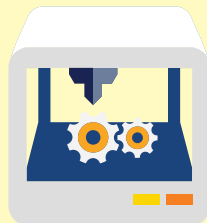
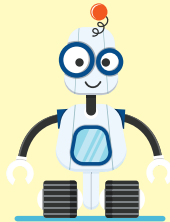
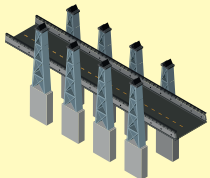
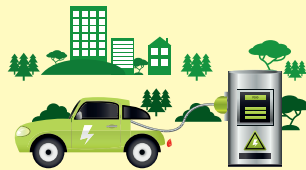
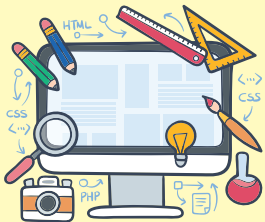




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PREFACE

Thakur College of Engineering and Technology (TCET) was established in the academic year 2001-02 with a clear objective of providing quality technical education in tune with international standards and contemporary global requirements. Currently, the institute runs nine UG, three PG and three Ph. D. programmes with a strength of 3650 students and 206 faculty members. In last twenty years of its existence, the institute has marked its presence at different levels and is recognized and awarded by different certifying and accrediting bodies of India. The efforts of TCET were conferred with autonomous status for 10 years from academic year 2019-20.

To continue on the journey of excellence, the Institute initiated organizing of annual Conference and Workshop in the year 2010 with the objective of providing a common platform to nurture young minds of the 21st century. The International Conference on Humanities, Sciences and Technical Education (ICHSTE) is one of the conferences under the banner of MULTICON-W which attracted various scholars in the field of humanities, sciences and technical education to propose their inputs which can work as a decisive step for developing futuristic education. ICHSTE has seen participation from various scholars at the international level. The Proceedings of ICHSTE contain 50 selected research papers. The Proceedings include research papers on basic engineering sciences, humanities, skill development and technical education. All the papers are scrutinized and reviewed at multiple levels to ensure quality. The Institute has taken due care to check the plagiarism level and confirm to recommendations from UGC with the help of Turnitin software. All the papers are kept in the format similar to IEEE paper format and reviewed by internal and external experts. While editing the Proceedings we faced a challenge of articles not compliant with the IEEE format. The institute level editors took the help of authors to improve the quality of the articles.

The organization of EWPPC under MULTICON-W 2031 is a team effort of TCET. I would like to take this opportunity to thank the Management of Thakur Education Group for their support, world class infrastructure and facilities. I am grateful to all the authors who have contributed research papers and the articles for this conference. I also wish to acknowledge the members of the Review Committee for carrying out the arduous task of the peer review process of the submitted research articles. Finally, I wish to thank all who are directly or indirectly involved in the compilation of the conference proceedings.

Convener

Mr. Rohitkumar Singh, Assistant Professor & Deputy FE Incharge

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The Essence of Biomimetics

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Abstract: Biomimetics is the field of science that seeks to understand and imitate biological systems to create new technologies and materials that can be used to solve human problems. The word "biomimetic" comes from the Greek words bios (life) and mimesis (imitation), and it encompasses a wide range of disciplines, including engineering, materials science, physics, and biology. Biomimetics aims to apply the principles and strategies that have evolved over millions of years in nature to solve human challenges, such as developing new medical treatments, designing more efficient vehicles, and creating sustainable materials. By studying how living organisms have adapted to their environments, scientists and engineers can gain insights into how to create new technologies that are more efficient, durable, and environmentally friendly.[7]

I. INTRODUCTION

Biomimetics, also known as biomimicry or biologically inspired design, is a field of study that looks to nature as a source of inspiration for human innovation. It involves using biological systems, structures, and processes to design new materials, products, and technologies.

Biomimetics has its roots in ancient times, with humans develop more efficient solar cells and batteries.

The benefits of biomimetics are numerous. By looking to nature for inspiration, designers and engineers can create products and technologies that are more efficient, sustainable, and environmentally friendly. They can also develop solutions to complex problems that might not be possible using traditional approaches. For example, the way ants work together to build complex structures has inspired the development of algorithms that can optimize supply chain logistics.[5]

Biomimetics also has the potential to help us understand and appreciate the natural world. By studying the way that organisms have evolved to solve complex problems, we can gain a deeper understanding of the interconnectedness of all living things and the importance of biodiversity.

However, there are also challenges associated with biomimetics. One of the biggest is the fact that natural systems are incredibly complex, and it can be difficult to fully understand how they work. In addition, there is a risk of overusing natural resources if we rely too heavily on biomimetic solutions. Finally, there is the danger of oversimplifying nature and failing to fully appreciate its complexity and beauty.[8]

observing and imitating natural phenomena such as bird flight and fish swimming. However, it wasn't until the 20th century that the concept of biomimetics began to be formally studied and developed.[5]

One of the earliest examples of biomimetics in modern times is the development of Velcro, which was inspired by the hooks and loops on the surface of burrs. In the 1950s and 60s, NASA scientists also began to look to nature for inspiration in developing new materials and designs for space exploration. For example, the shape of the Apollo capsules was inspired by the shape of a seed pod, while the reflective material used in space suits was based on the structure of moth eyes.[5]

Today, biomimetics is a rapidly growing field with applications in a wide range of industries, from architecture to medicine to energy production. For example, researchers are studying the way that geckos can climb walls and exploring how this could be used to create adhesives that don't leave residue behind. Biomimetics is used in medicine to develop new materials and structures for prosthetic limbs and to create new drugs based on natural compounds found in plants and animals. In energy production, researchers are looking at natural processes such as photosynthesis and the way that plants store energy to. Despite these challenges, biomimetics has the potential to be a powerful tool for innovation and problem-solving. By continuing to study and learn from the natural world, we can develop new technologies that are both more efficient and effective, sustainable, and in harmony with the world around us.

II. THESIS

Biomimetics, also known as biomimicry or biologically inspired design, is a scientific discipline that studies nature's models, systems, processes, and elements to create new technologies, products, and solutions that address human needs and challenges.[11]

The concept of biomimetics is rooted in the idea that nature has already found efficient and effective solutions to many problems that humans face. By studying and mimicking nature's designs and processes, we can create sustainable, innovative, and often superior solutions to engineering, design, and scientific challenges.

The term "biomimetics" was first coined by Otto Schmitt in the 1950s, but the concept has been around for centuries. For example, Leonardo da Vinci studied birds and bats to

develop his designs for flying machines. In modern times, biomimetics has become a burgeoning field of research and development, with applications in areas such as medicine, energy, materials science, and robotics.[4]

One of the key aspects of biomimetics is its interdisciplinary nature. Biomimetic researchers draw on knowledge and techniques from biology, engineering, physics, chemistry, and other fields to understand and replicate natural phenomena. It has several advantages over traditional design and engineering approaches. For one, natural systems have often been optimized over millions of years of evolution, resulting in highly efficient and effective solutions to complex problems. By studying these systems, we can learn from nature's design principles and apply them to our own designs.

Nature's systems are often highly efficient, using minimal resources and producing little waste. By mimicking these systems, we can create products and processes that have a smaller environmental impact than traditional designs.[4]

Examples of biomimetics abound in many fields. One notable example is Velcro, which was inspired by the way that burrs attach to animal fur. The tiny hooks on the burrs catch on the loops of the animal's fur, allowing the burrs to travel long distances. George de Mestral, the inventor of Velcro, realized that this same principle could be applied to fasteners and developed a product that uses hooks and loops to create a secure closure.

In the field of materials science, researchers are using biomimetics to develop new materials that have properties similar to those found in natural materials. Biomimetics is also being used in the field of robotics to create machines that can move and operate like animals.

In the field of medicine, biomimetics is being used to develop new treatments and technologies. For example, researchers are studying the way that animals such as salamanders and axolotls can regenerate limbs and other body parts. By understanding the biological mechanisms involved in this process, researchers hope to develop new treatments for any problems.[4]

One of the key benefits of biomimetics is that it allows for the development of more sustainable and environmentally friendly technologies. Nature's systems are often highly efficient, using minimal resources and producing little waste. By mimicking these systems, we can create products and processes that have a smaller environmental impact than traditional designs.

Overall, biomimetics offers a unique and powerful approach to problem-solving and innovation. By studying and imitating the natural world, humans can create more efficient, sustainable, and effective technologies and products that benefit both people and the planet.

1. TYPES OF BIOMIMETICS

There are several types of biomimetics, including:

1. Structural biomimetics:

Structural biomimetics is a field of biomimicry that focuses on using the structural design principles found in nature to

develop new materials and structures. It involves studying how living organisms have evolved to create efficient and effective structures and using that knowledge to design new materials and structures that can improve human technologies and processes.

For example: Researchers might study the structure of a seashell to learn how to create stronger and more durable materials for building construction. Or they might study the structure of a bird's wing to develop more efficient and streamlined airplane wings. And replicating the physical properties of natural materials, such as the strength and flexibility of spider silk or the lightweight and durable structure of bone.[3]

2. Functional Biomimetics:

Functional biomimetics refers to by studying and replicating the design principles and mechanisms found in nature, scientists and engineers can develop new materials and devices with advanced properties and functions.

Functional biomimetics has a wide range of applications in fields such as medicine, robotics, aeros

pace, and energy. For example, biomimetic materials that mimic the properties of bone or cartilage can be used to develop more effective joint replacements. Biomimetic robots can be used for search and rescue missions in hazardous environments, while biomimetic materials can be used to increase the efficiency of solar cells.

Examples of functional biomimetics include:

- A. Gecko-inspired adhesives that the sticky pads on the feet of geckos, which allow them to climb vertical surfaces.
- B. Artificial muscles mimic the structure and function of natural muscles, which can be used in robotics and prosthetics.
- C. Sharkskin-inspired materials that reduce drag and increase the efficiency of underwater vehicles.
- D. Biomimetic sensors mimic the sensory structures found in animals, which can be used for environmental monitoring and medical diagnostics.
- E. Lotus leaf-inspired materials that repel water and self-clean, which can be used in the development of water-repellent surfaces.[6]

3. Behavioral biomimetics:

Behavioral biomimetics is a field of study that involves applying principles from animal behavior and cognitive neuroscience to design intelligent and adaptive machines. The goal of behavioral biomimetics is to develop algorithms and technologies that can mimic the behavior of animals and humans in complex and dynamic environments.

One of the key principles of behavioral biomimetics is the idea that animals and humans have evolved to solve complex problems in a highly efficient and adaptive way. By studying the behavior of animals and the neural

mechanisms that underlie their behavior, researchers in behavioral biomimetics hope to gain insights into how to design machines that can adapt to changing environments and solve complex problems in real-time.

Behavioral biomimetics has applications in a wide range of fields, including robotics, artificial intelligence, and human-computer interaction. For example, researchers have used principles from animal behavior to design robots that can navigate complex environments, interact with humans in natural ways, and learn from their environment.

Overall, the field of behavioral biomimetics is still relatively new, and there is much research to be done to fully understand the complex interactions between behavior, cognition, and technology.[2]

4. Molecular biomimetics:

Molecular biomimetics is a field that seeks to design and synthesize new molecules, materials, and systems inspired by biological structures and processes. Biomimetics draws on the principles of natural selection and evolution to create new materials and devices that mimic the functional and structural features of living systems.

One area of focus in molecular biomimetics is the design of new drugs and therapeutic agents that mimic the activity of natural molecules in the body.

Here are some examples of molecular biomimetics:

- A. Artificial enzymes: Researchers have developed synthetic enzymes that mimic the catalytic activity of natural enzymes. These artificial enzymes can be used in industrial processes, drug discovery, and biotechnology.
- B. Synthetic ion channels: Ion channels are membrane proteins that regulate the flow of ions across cell membranes. Researchers have developed synthetic ion channels that can mimic the function of natural ion channels, and these synthetic channels have potential applications in drug delivery and medical devices.[12]
- C. Biomimetic membranes: Biomimetic membranes are synthetic membranes that mimic the structure and function of natural cell membranes. These membranes can be used in drug delivery, water purification, and other applications.
- D. Molecular motors: Molecular motors are proteins that convert chemical energy into mechanical work. Researchers have developed synthetic molecular motors that mimic the function of natural molecular motors, and these synthetic motors have potential applications in nanotechnology and drug delivery.
- E. Self-assembling materials: Many biological structures, such as proteins and DNA, can self-assemble into complex structures. Researchers have developed synthetic materials that can self-assemble into various structures, such as nanotubes and nanowires, and these materials have potential applications in electronics, energy

storage, and drug delivery.

- F. Synthetic antibodies: Antibodies are proteins that recognize and bind to specific targets, such as viruses and cancer cells. Researchers have developed synthetic antibodies that mimic the function of natural antibodies, and these synthetic antibodies have potential applications in medical diagnosis and therapy.
- G. Biomimetic sensors: Researchers have developed sensors that mimic the function of biological sensors, such as the sense of smell and taste. These biomimetic sensors have potential applications in environmental monitoring, food quality control, and medical diagnosis.[7]

5. Systematic biomimetics:

Systematic biomimetics involves the identification of biological systems and their unique features, the analysis of those features, and the development of materials or technologies that can replicate or improve upon those features.

To achieve this goal, systematic biomimetics often involves collaboration between biologists, engineers, and materials scientists. By working together, these experts can identify key features of biological systems that could be useful in engineering new materials or devices.

One example of a systematic biomimetic approach is the development of the Shinkansen bullet train in Japan, which was inspired by the kingfisher bird's beak.

The kingfisher is known for its ability to dive quickly and smoothly into the water without creating a splash. Researchers at JR Central, the company that operates the Shinkansen line, studied the shape of the kingfisher's beak and used it as a model to design the front of the train's nose.[3]

By mimicking the shape of the kingfisher's beak, engineers were able to create a train nose that is more aerodynamic, reducing air resistance and noise as the train travels at high speeds. This design not only improves the train's speed and efficiency but also reduces the amount of noise and vibration experienced by passengers.

By looking to nature for inspiration, researchers may be able to develop new and innovative solutions to some of the world's most pressing challenges.

Overall, biomimetics is a rapidly growing field with many opportunities to learn from and be inspired by nature.[17]

III. APPLICATION IN DAILY LIFE

This interdisciplinary field draws inspiration from nature to create more efficient and sustainable technologies, materials, and systems. Biomimetics has already produced a range of products and materials that have transformed industries, including Velcro, solar panels, and aerodynamic designs for airplanes.[18]

Here are the daily applications of biomimetics:

1. Clothing - The structure of spider silk has inspired the development of lightweight and durable fabrics for clothing. Spider silk is one of the strongest materials found in nature, and researchers have created synthetic spider silk that can be used to create fabrics for clothing, medical devices, and more.[14]
2. Air Conditioning - The way termites regulate the temperature in their mounds has inspired the development of more efficient air conditioning systems. Termites use a network of tunnels and ventilation systems to regulate the temperature in their mounds, and scientists have mimicked this design to create air conditioning systems that use less energy and are more sustainable.[14]
3. Efficient Lighting - Fireflies use bioluminescence to produce light, and researchers have used this design to create more efficient lighting systems. By mimicking the way fireflies produce light, scientists have developed lighting systems that use less energy and produce less heat.
4. Protective Coatings - The skin of sharks is covered in tiny, tooth-like scales called dermal denticles, which help reduce drag as they swim through water. Researchers have used this design to create coatings for boats and planes that reduce drag, increase speed, and improve fuel efficiency.
5. Robotics - The way animals move and navigate through their environments has inspired the development of robotics. For example, researchers have created robots that mimic the movements of snakes and fish to move through tight spaces or underwater environments.[13]
6. Solar Energy - The development of solar panels that mimic the way plants capture energy from the sun has revolutionized the renewable energy industry. Photosynthesis, the process by which plants convert sunlight into energy, inspired researchers to create solar cells that use light-sensitive materials to generate electricity.
7. Water Filtration - Many aquatic organisms, such as mollusks and sponges, have efficient filtration systems that remove contaminants from water. Scientists have used these designs to create water filtration systems that mimic the way these creatures clean water. This technology is already being used to provide clean drinking water in developing countries and disaster zones.[18]
8. Wind Turbines - The shape of bird wings has inspired the design of more efficient wind turbines. By mimicking the shape and structure of bird wings, engineers have developed wind turbines that generate more energy while being quieter and more durable.
9. Adhesives - The way geckos stick to surfaces has inspired the development of adhesives that are strong yet removable. Geckos use tiny hairs on their feet to stick to surfaces, and scientists have mimicked this design to create adhesives that can be used in a variety of applications, such as medical devices and industrial equipment.
10. Sustainable Materials - The use of sustainable materials, such as bamboo and mushrooms, has been inspired by nature. Bamboo is a fast-growing plant that is strong and lightweight and has been used to create furniture, flooring, and even bicycles. Mushrooms can be used to create a range of materials, from packaging to building materials.[19]
11. Transportation - The aerodynamic design of birds and fish has inspired the development of more efficient transportation systems. By mimicking the way these creatures move through their environments, engineers have developed more aerodynamic cars, trains, and even ships that use less fuel and emit fewer pollutants.
12. Energy Storage - The way plants store energy has inspired the development of more efficient energy storage systems.

IV. DRAWBACKS OF BIOMIMETICS

While biomimetics offers many benefits, there are also some disadvantages to consider:

- A. Limited Scope of Application: While biomimicry has produced many innovative solutions, it is not applicable to all human challenges. There are some areas where it is difficult to find natural models, and some problems that are unique to human systems.
- B. Complexity of Natural Systems: Natural systems are often complex, and it can be difficult to fully understand the mechanisms behind them. As a result, mimicking these systems can be challenging and time-consuming.
- C. Unpredictable Results: The complexity of natural systems can also lead to unpredictable results. It can be difficult to predict how a biomimetic design will behave in different environments or under different conditions.
- D. Ethical Considerations: While biomimicry is inspired by nature, it is important to consider the ethical implications of using natural models for human benefit. There are some cases where mimicking natural systems may be harmful to the environment or to the organisms themselves.[19]
- E. Intellectual Property Issues: As biomimicry becomes more popular, there may be issues related to intellectual property rights. If a biomimetic design is based on a natural model, it may be difficult to determine who owns the rights to that design.
- F. Cost: Biomimetic designs can be expensive to develop and implement, especially if they require specialized materials or technologies. This can limit their access to certain industries or organizations.
- G. Limitations in Adaptation: Natural systems evolve over time, but biomimetic designs may not be as adaptable.

This means that they may become outdated or less effective over time as conditions change.[11]

V. CONCLUSION

In conclusion, biomimetics is a fascinating and rapidly expanding field that has the potential to revolutionize many industries, from medicine to engineering to architecture. By studying and emulating the designs and processes found in nature, biomimetics has already led to numerous innovations and breakthroughs that have improved the way we live and work.[1]

One of the main benefits of biomimetics is its focus on sustainable solutions. Nature has spent millions of years perfecting efficient and environmentally-friendly designs and processes, and biomimetics seeks to harness this knowledge to create new technologies that are both effective and sustainable. For example, researchers have used the structure of leaves to develop more efficient solar cells, and the properties of spider silk to create stronger and more durable materials.[1]

Biomimetics has also made significant contributions to the field of medicine. By studying the structure and function of biological systems, researchers have developed new drugs, medical devices, and imaging technologies. For example, the invention of the artificial heart valve was inspired by the structure of the heart, and the development of the cochlear implant was based on the way the ear processes sound.[18]

In addition, biomimetics has the potential to address some of the biggest challenges facing humanity, such as climate change and resource depletion. By developing technologies that are inspired by nature, we can create more efficient and sustainable systems for energy production, waste management, and resource conservation.

However, there are also challenges and limitations to biomimetics. One of the biggest challenges is understanding nature's complex systems and processes and how they can be replicated in the lab. Nature is incredibly complex and diverse, and it can be difficult to identify the most relevant features for a given application. Additionally, there are ethical considerations to consider when studying and replicating biological systems, especially when it comes to animal testing and genetic modification.

Despite these challenges, the potential benefits of biomimetics are too great to ignore. As we continue to face increasingly complex problems, we need innovative solutions that can improve our lives while also protecting the planet. Biomimetics offers a promising avenue for achieving these goals, and it will be exciting to see what breakthroughs and discoveries emerge in the years to come.

In conclusion, biomimetics has already made significant contributions to science and technology, and it has the potential to transform many industries and address some of the biggest challenges facing humanity. By studying and emulating the designs and processes found in nature, we can create more efficient, sustainable, and effective solutions to complex problems. As we continue to explore the possibilities of biomimetics, we can look forward to a future that is not only innovative but also sustainable and

environmentally responsible.[18]

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This article provides an overview of biomimetics, focusing on how scientists are learning from nature to develop new materials, devices, and therapies in the fields of nanomedicine and Nanobiotechnology.

Nanotechnology Ethics and Social Implications

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Abstract—Nanotechnology includes the development of man-made or engineered particles and molecular structures that have dimensions in nanometer range [between 1 to 100 nm in at least one dimension.] It has vast field of usage in current world like medicine, food, fuel etc., with beyond imagination of future possibilities. But with such great power, the consequences are countless. Government is constantly trying to take legal actions to prevent misuse of this technology. In this paper we will understand the pros and cons of nanotechnology and how it affects our daily life.

Keywords— nanotechnology, nanoscale, nanites.

I. INTRODUCTION

Technology that manipulates atoms and molecules or makes use of their properties at that size is known as nanotechnology. "A discipline of engineering that deals with the design and manufacture of extremely small electronic circuits and mechanical devices built at the molecular level of matter" is nanotechnology, sometimes known as "molecular manufacturing." Given the physical constraints of matter, the objective of nanotechnology is to be able to control materials at the atomic level in order to create the smallest electromechanical devices conceivable.

II. INVENTIONS IN FIELD OF NANOTECHNOLOGY

This would result in nanomachines, also known as nanites, that may be employed as molecular assemblers and disassemblers to build, repair, or destroy any physical or biological objects, as well as nano-computers little larger than a bacterium.

Essentially, the goal of creating nanotechnology is to

create molecular tools that are comparable to those we now have for working with larger systems. Nanomachines will allow us to produce a wide range of things and push our engineering capabilities to the limits of the physical world, much like the construction equipment we use to build skyscrapers.

At an IBM research site in Switzerland, Gerd Binnig and Heinrich Rohrer created the scanning tunnel microscope. The STM won the inventors the physics Nobel Prize and made it possible for anyone to observe atoms for the first time. STM may be used to pick up and deposit atoms if the charge is chosen properly. The method enables individual atom manipulation.

This was advantageous for both physics and chemistry.

Substance synthesis and analysis became simple. Large batches of nanoparticles can be created using common chemical processes. One such instance of nanotechnology is sol-gel technology. Sol-gels are colloids, suspensions of small particles in liquids, that can be used to encapsulate extremely small particles and maintain their shape. This is absolutely necessary for the creation of safe sunscreen.[2]

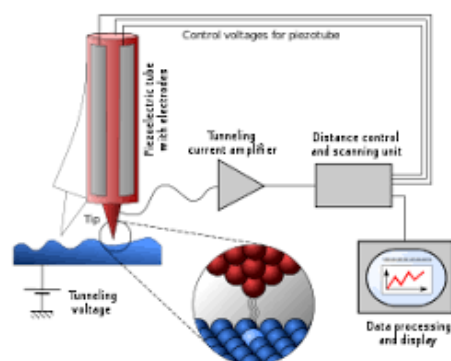


Figure 1- Scanning Tunneling Microscope

MEDICINE

Researchers produce customized nanoparticles, the dimensions of molecules that can deliver medication right to infected cells in your body. When it's perfected, this method should significantly lessen the damage treatment like chemotherapy does to the healthy cells.

➤ ELECTRONICS

Nanotechnology holds some answers for how we could increase the capabilities of electronic devices while reducing their weight and energy consumption.

➤ FOOD

Nanotechnology has a direct impact on several aspects of food science, from how it is grown to its packaging. Organizations are developing nanomaterials that will make a difference in the food taste and food safety and the health advantages that food provides.

➤ FUEL CELLS

Nanotechnology is being used to decrease the cost of catalysts used in fuel cells to generate hydrogen ions from a fuel like methanol and raise the membranes' effectiveness to separate hydrogen ions from other gasses like oxygen.

➤ SOLAR CELLS

Companies have manufactured nanotech solar cells that can be developed at a significantly lower cost than traditional solar cells.

➤ BATTERIES

Companies are developing batteries with nanomaterials. One such battery will be good as new after sitting on the shelf for many years. Another battery can be recharged notably faster than conventional batteries.

➤ SPACE

Nanotechnology is the key to making space-flight more functional. Improvements in nanomaterials build lightweight spacecraft and a cable for the space elevator possible. By reducing the amount of rocket fuel needed, these advances could reduce the cost of reaching orbit and traveling in space.

➤ FUELS

Nanotechnology can overcome the shortage of fossil fuels like diesel and gas by producing fuels from ordinary materials, raising the mileage of engines, and making the production of fuels from standard materials economical.

➤ BETTER AIR QUALITY

Nanotechnology can enhance the functionality of catalysts used to convert vapors escaping from industrial plants or cars into harmless gasses. That is because catalysts have a larger surface space combined with the reacting compounds than catalysts made from bigger particles. The larger surface area lets more chemicals interact with the catalyst simultaneously, which makes the catalyst more efficient.

➤ BETTER WATER QUALITY

Nanotechnology has been used to create solutions to three different issues in water quality. One difficulty is the discharge of industrial wastes, such as a cleaning solvent known as TCE, from groundwater. Nanoparticles may be used to convert the chemical via a contaminating chemical reaction to make it harmless. Researches have shown that this method can be used actively to reach scattered in underground ponds and at much-reduced cost than methods that require pumping the water out of the ground for treatment.

➤ CHEMICAL SENSORS

Nanotechnology can allow sensors to detect small quantities of chemical vapors. Different kinds of elements, such as carbon nanotubes, palladium nanoparticles, or zinc oxide nanowires, may be utilized in nanotechnology-based sensors. Due to the small nanotubes, nanowires, or nanoparticles, there are gas molecules enough to modify the electrical properties of the elements. This allows the detection of a low concentration of chemical vapors.

➤ SPORTING GOODS

If you're a golf or tennis fan, you'll be delighted to hear that even sporting goods have walked into the nano realm. Existing nanotechnology applications in the sports field include developing tennis racquets' strength, filling any defects in club shaft materials, and lowering the rate at which air leaks from tennis balls.

➤ FABRIC

Making composite fabric with fibers or nano-sized particles enables the growth of fabric properties without a notable increase in thickness, weight, or stiffness, as might have been the case with previously-used techniques.[5]

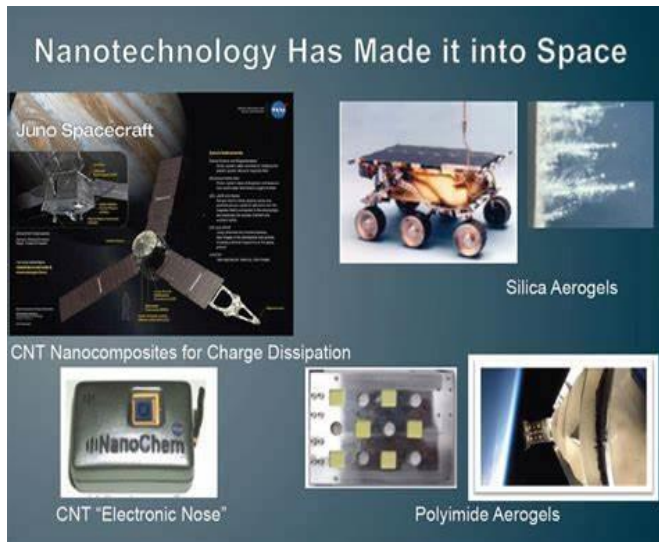


Figure 2- Future in Space Operation

NANOETHICS

Nano-ethics is the ethics of nanotechnology. Technology both helps and hurts. Yet, there is much potential for human condition improvement from nanotechnology. It can aid in cleansing the environment if applied effectively. Artificial photosynthesis was proposed by Dr. Braach-Maksvytis. Solar-powered devices can turn sunlight into usable energy while removing CO₂ from the environment. In the far future, nanobots will be able to move within blood vessels, removing plaque and attacking malignant cells inside. Also, it has the capacity to produce food and water at a low cost.

With the advantages, there are also significant potential risks. Concerns with nanotechnology include how to protect privacy in a world of nano-snooping gadgets, how much human experimentation is acceptable, and how to prevent risk of nanobots.

New regulations and protections have to be put in place to lessen privacy invasion as personal documents, like medical records, became computerized. It will get really simple to attach a nanoscale camera to anything, and nobody will know it. There will be a wide range of medical advantages to nanotechnology. New treatments and early detection will lengthen human life expectancy. There are further-off possibilities like cell repair tools that can be developed. It will be able to slow or even stop the ageing process and lengthen life spans if cell repair devices are developed.

Yet if humans can lengthen human life, population growth would become a bigger issue.

III. GOVERNANCE AND MORALITY

The following are some examples of government functions that touch on the ethical and value aspects of technology:

- A. Making decisions on what goals should be given priority and how resources should be distributed in order to achieve those goals is a part of science and technology policy and planning.
- B. Control of science and technology is designed to achieve something that is believed to be useful and that justifies any related expenses, which necessitates that some aims be valued more highly than others—i.e., it hinges on comparative value judgements. Allocating burdens and benefits is frequently

involved in regulation, as are the dimensions of authority, control, monitoring, and responsibility. These are all traits of ethical problems and choices.

- C. The government can encourage responsiveness to social and ethical issues related to technology, support study into these issues, and raise awareness of them (as many people think the Human Genome Project did). The social and ethical implications of technology can also be obscured (as many people believe is the case with genetically modified crops).[6]
- D. The goal of this typology is to clarify and facilitate discussion of the social and ethical concerns raised by advancing nanotechnologies.

IV. TYPOLOGY OF ETHICAL ISSUES

1. Social Context Issues:

When nanotechnologies interact with unfavorable aspects of the institutional or social contexts in which they are being used, social context difficulties result. Unfair access to health care, educational and technological disparities, a lack of adequate information security and privacy protection, flaws in the systems that protect intellectual property, unequal exposure to environmental dangers, and a lack of adequate consumer safety protection are a few examples of social context issues.

2. Morally Controversial Practices or Activities:

Morally contentious practices or activities are those that a majority of people believe should be illegal, and they are those that interact with or are instantiated by nanotechnology. Synthetic biology, the creation of artificial organisms, the development of biological weapons, stem cell research, and human genetic modification are a few examples of morally contentious practices and activities that nanoscale science and technology are, or are expected to be, involved in.

3. Techno cultural Issues:

The social systems and structures from which and into which nanotechnologies are evolving provide problematic aspects of the function of technology.

Techno culture problems include, for instance, an excessive reliance on technological fixes to manage problematic effects (rather than addressing the root causes of those effects), an overestimation of our ability to predict and control technologies (particularly within complex and dynamic biological systems), and technological mediation of our relationship with and experience of nature (and the resulting marginalization of natural values).

4. Problems with Living Forms:

Form of life issues result from the synergistic effects of nanotechnology on parts of the human condition that form the basis of social norms, behaviors, and institutions. For instance, if nanomedicine helps increase the average human life duration by even one to ten healthy years, standards of human flourishing will need to be reevaluated, and there may be significant effects on family structures and norms e.g. (Medicare)

5. Transformational Issues:

Nanotechnology has the potential to revolutionize various facets of the human condition, particularly when combined with other developing technologies like biotechnology, information technology, computer science, cognitive science, and robotics. This might be done by significantly changing the type of beings we are, reconfiguring how we interact with the world, or developing artificial intelligences that are self-aware and autonomous (i.e., artefactual persons). In such circumstances, it would be necessary to reconsider some salient component of our ethical landscape, such as what it means to be human, one's identity, or the moral standing of particular items.

V. COMPANIES WORKING ON THE ETHICAL ISSUES OF TECHNOLOGY

The ethical issues raised by nanotechnology are being worked on by more brilliant minds than mine. Below is a selection of these organizations and their missions:

1. An impartial group that researches the sociological and ethical effects of nanotechnology is called the Nano ethics Group. On relevant topics and activities, they include the public and work with research institutions and nanotech businesses. A nonprofit organization concerned about the substantial societal and environmental effects of cutting-edge nanotechnology is the Center for Responsible Nanotechnology (CRN).

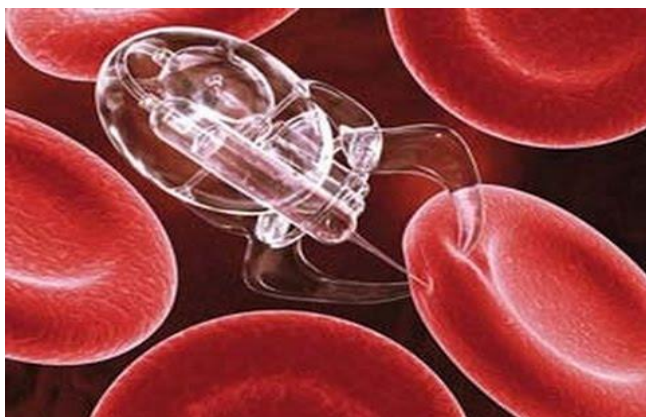


Figure 3 First Nanotechnology Medicine

2. The Latin American Nanotechnology and Society Network (ReLANS) intends to establish a venue for information sharing and debate that follows the process of Latin American nanotechnology development.
3. With the aim of analyzing and evaluating the political, economic, social, legal, ethical, and environmental implications of nanotechnologies that are domestically developed, and/or in collaboration with foreign centers and associations, as well as imported goods that include nanocomponents, ReLANS will forge connections with and

cooperation agreements with academic institutions, governments, and society.

4. In order to combat brain drain and all forms of poverty, including science and technical poverty, Focus Nanotechnology Africa Inc. (FONAI) was founded in 2006 as a 501c3 not-for-profit educational and scientific organization, with a focus on the US, Africa, and the Caribbean.
5. Also, there are a lot of research groups, like the Whitesides Research Group at Harvard University, that provide a big obstacle to employing first-world knowledge to advance the welfare of those in developing nations. The Whitesides team is actively tackling this kind of global issue by utilizing its strengths in biology, engineering, and materials science, concentrating on local energy generation and health diagnostics.



Figure 3 First Nanotechnology Medicine

1. Ethical implications

1. Nanotechnology will grant us more "god-like" abilities
2. It may help to resolve other moral dilemmas (e.g. assembling beef instead of slaughtering cows, constructing cells rather than getting them from reproduction, etc...)
3. Could result in covert surveillance, endangering the right to privacy
4. Should we owe it to other [countries] to use this technology to assist and provide for them?

Current usage

1. Sunscreen- Adding nanoparticles in sunscreen make them more powerful and effective. Titanium dioxide and zinc oxide are nanoparticles that are added. These particles make it light and effective against UV radiations.
2. Clothing- Silica can be added to the fabric either by incorporating it or spraying it on the fabric. It creates

a waterproof coating.

3. Computers- many electronic devices uses nanotechnology for small parts. Intel- a leading computer processor company, is making 10-nanometer chip using this technology.

2. Legal & Policy Concerns

1. As nanotechnology affects a wide range of industries, who should establish and enforce regulations for its research and development?

at international regulations for the secure advancement of nanotechnology are necessary? Who is able to enforce them, too?

2. The government now controls the majority of funding for nanotechnology research, which is principally provided by DARPA and the NSF. How can everyone's principles be in sync when nanotechnology is being created in so many diverse fields?

3. Consequences

With the earliest feasible action, it might block nanotechnology's general development and stop its widespread potential damages, but it would slow down present scientific advancements and might not stop renegade researchers, businesses, nations, or armies from developing it in the first place.

The second potential course of action might standardize R&D policies and practices and compel the research community to thoughtfully evaluate the potential negative effects of nanotechnology.

The third alternative course of action would reduce "accidents" using nanotechnology by stopping nanomachines' potentially lethal behavior.

4. Fairness and individual rights

Given that the second option is currently routinely carried out for emerging technologies and that the third option actively avoids designs that can result in catastrophic circumstances, these two options appear to be the most prudent ones to choose.

5. Common sense

The third alternative is a set of design rules that aim to prevent immoral or unintentional uses of nanotechnology, whereas the second and third options also seem to advance the greatest common good. This is because the second option involves encouraging ethics within the scientific community.

6. Final Choice

The continuation of nanotechnology research should be permitted, but with a non-governmental advisory board to oversee the research and assist in developing ethical standards and policies. In general, nanomachines shouldn't be

made to be all-purpose, self-replicating, or able to run on a plentiful natural substance. Additionally, radioactive isotopes should be used to tag complicated nanomachines so that they can be found if lost.

VI. CONCLUSION

Since that nanotechnology has already started to permeate many other sectors of research, it would be difficult to dismiss the potential advantages of the subject and to halt the advancement of related research. To ensure that the technology does not become too potentially dangerous, rules might be used in the development of nanotechnology. As with any new technology, it is impossible to thwart every well-funded outfit that might try to use it for evil. But, we should be able to advance nanotechnology safely and still enjoy its promised benefits provided the researchers in this field adopt an ethical set of principles and abide by them.

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Psychology Behind Addiction

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Abstract— Addiction is a complex phenomenon and the psychological dynamics driving it are multifaceted. The psychology of addiction is the study of psychological processes that contribute to the development, maintenance and treatment of addictive behaviours. This abstract provides a synopsis of the body of literature exploring the psychology behind addiction and examines the underlying mechanisms and motivations. Various models of addiction are discussed, such as the biopsychosocial model and the self-medication hypothesis. Additionally, the influence of family and social dynamics as well as psychological influences, such as cognitive distortions and comorbid conditions are considered. Finally, the implications of this research for addiction treatment and prevention are discussed.

Keywords— [1]Opioid, [2]Cannabis, [3]Cognitive, [4]Psychodynamic, [5]Biopsychology, [6] Multifaceted

I. INTRODUCTION

The psychology of addiction is the study of the psychological processes that lead to the development, maintenance, and treatment of addictive behaviors. Addiction is a complex and multifaceted phenomenon that can involve substances such as alcohol and drugs, as well as behaviors such as gambling, gaming, and social media use. The psychological factors that contribute to addiction can be biological, cognitive, emotional, and social in nature. Addiction can be described as a persistent desire to engage in a particular behavior or use a substance despite harmful consequences. These consequences can include physical health problems, social isolation, financial difficulties, and legal troubles. Addiction can also cause psychological distress, such as anxiety and depression. The psychology of addiction is important for developing effective prevention and treatment strategies. Various approaches, including behavioural therapies, cognitive therapies, and motivational interviewing, are used by mental health professionals to help individuals overcome addiction. The goal of treatment is to help individuals build resilience, develop coping skills, and identify risk factors that may lead to relapse. Overall, the psychology of addiction is a critical area of study that has important implications for public health and individual well-being.

II. CHARACTERISTIC

People who are addicted to drugs, alcohol, gambling, or shopping will always need more of the substance or behavior to get the same effects. This is because their tolerance will increase, meaning they will need to take more of the substance or behavior to get the same effect as before. As someone addicted to cigarettes progresses from smoking one or two cigarettes a day to smoking one pack a day, their body becomes more tolerant to the addictive substance. This is true for any addiction, such as [1] opioids, alcohol, gambling, and sex.

If someone suddenly stops using a substance or behaving in a way that is addictive, they will experience symptoms of withdrawal. These can include emotional and physical reactions, which can vary in severity based on a variety of factors.

Addiction is characterized by denial, rationalization, loss of will power, preoccupation, and craving. These symptoms can be seen in those addicted to a substance, behavior, or activity. Addiction can be difficult to overcome, but with the help of addiction treatment, individuals can start to recover.

III. ADDICTION & IT'S TYPES

A behavioural addiction is the compulsive use of a behavior or activity that leads to negative consequences, such as financial problems and social isolation.

- A. **Process addiction** is an addiction to engaging in activities that provide a natural reward, such as eating or sex. These activities can activate the same reward pathways in the brain as drugs and alcohol.
- B. **Tobacco addiction** is a serious problem that can involve compulsive use of tobacco products. This can lead to physical dependence and withdrawal symptoms.
- C. **Opioid addiction** can involve a compulsive use of prescription painkillers or heroin, which can lead to physical dependence and a high risk of overdose.
- D. **[2]Cannabis addiction** is a pattern of behavior in which someone becomes compulsively dependent on marijuana or other cannabis products. While cannabis is not usually considered highly addictive, some people can develop a dependency on it.
- E. Internet addiction is a condition in which people compulsively use the internet, including social media, online gaming, and other online activities. This can have a negative impact on daily life and social functioning.

IV. Statistical Analysis

Addiction	Males.	Females.	Non-Bi
Internet	18.57	17.29	18.54
Alcohol	4.59	4.15	5.43
Smoking	9.29	9.15	8.61
Drugs	1.63	1.77	2.13
Sex	7.62	4.86	5.65
Social Media	10.98	13.06	12.84
Shopping	12.86	14.92	13.42
Exercise	14.96	13.61	10.45
Gambling	14.02	12.92	11.70
Internet	19.52	20.63	22.27

IV. PSYCHOLOGY OF ADDICTION & IT'S TYPE

The psychology of addiction is a broad field that encompasses many different theoretical perspectives and approaches. The psychology of different types of addiction includes:

- A. **Behavioural psychology** is a field that focuses on the role of reinforcement and conditioning in addiction. It posits that addiction is a learned behavior that is reinforced by the pleasurable effects of addictive substances or behaviors.
- B. [3]**Cognitive psychology** is the study of how thoughts, beliefs, and attitudes impact addiction. It suggests that addiction is caused by cognitive biases and faulty thinking patterns.
- C. [4]**Psychodynamic psychology** is a field of psychology that focuses on the role of unconscious motivations and early life experiences in addiction. It believes that addiction is a result of unresolved psychological issues from the past.
- D. **Neuroscience** studies the brain's mechanisms behind addiction. It believes that addiction is caused by changes in the brain's reward system and other neural pathways.
- E. **Social psychology** is devoted to the study of how social factors such as peer pressure, family dynamics, and cultural norms can impact addiction. According to this field of study, addiction is influenced by the way that people interact with one another in their social contexts.
- F. **Positive psychology** is a field of study that focuses on the role of positive emotions, strengths, and virtues in addiction recovery. It believes that individuals can build resilience and cultivate positive coping skills to overcome addiction.
- G. Different approaches to psychology of addiction offer different perspectives on the nature of addiction and how to best prevent and treat it. By combining different perspectives, we can get a more complete understanding of addiction and create more effective interventions.

V. MODELS OF ADDICTION

There are various models that attempt to explain addiction, including:

- A. **model:** The disease model of addiction views addiction as a chronic, progressive, and relapsing brain disease. It suggests that addiction is caused

by a combination of genetic, environmental, and behavioural factors that affect the brain's reward system and the individual's ability to control their behavior.

- B. **Psychological model:** The psychological model of addiction focuses on the individual's emotional and psychological factors that contribute to addiction. It suggests that addiction is a result of unresolved emotional issues, trauma, or psychological disorders that drive the individual to seek relief through substance use.
- C. **Social learning model:** The social learning model of addiction suggests that addiction is a learned behavior that is acquired through exposure to social and environmental factors. It suggests that individuals learn to use substances as a way of coping with stress, peer pressure, or as a way of fitting in with a particular group.
- D. [5]**Biopsychosocial model:** The biopsychosocial model of addiction considers addiction as a complex interaction between biological, psychological, and social factors. It suggests that addiction is not caused by a single factor but rather by a combination of biological predispositions, psychological factors, and social influences.
- E. **Self-medication model:** The self-medication model of addiction proposes that individuals use substances to alleviate the symptoms of an underlying mental health disorder such as depression, anxiety, or post-traumatic stress disorder.
- F. **Positive reward model:** The positive reward model of addiction suggests that individuals continue to use substances because of the positive feelings they experience, such as pleasure or relief from pain. This model views addiction as a result of a positive reinforcement cycle that strengthens the individual's desire to use the substance.

It's important to note that there is ongoing debate in the scientific community about which model of addiction is most accurate. Each model has its strengths and weaknesses, and it's likely that addiction is a complex condition that involves a combination of these factors.

VI. CAUSES OF ADDICTION

There are several factors that can contribute to addiction, and these can vary from person to person. Here are some common examples:

Geneticsople may have a **genetic predisposition** to addiction. For example, studies have shown that certain genes may predispose people to addictions to substances such as alcohol, nicotine, or opioids.

- a) **Environmental** factors can have a role in addiction. For example, if a person has been exposed to substance abuse in their family often, then they may be more likely to develop an addiction.
- b) **Mental health conditions** can increase the risk of addiction, as some people may use substances to self-medicate and cope with their symptoms.
- c) **Peer pressure** can be a factor in influencing how young people behave. For example, teenagers may start using drugs or alcohol to fit in with their peers or to seem cool.
- d) **Trauma** can increase the risk of addiction, as some people may turn to substances as a way to cope with the emotional pain of trauma.

It's important to note that addiction is a complex issue, and multiple factors often contribute to it. Understanding these

factors can help us develop more effective strategies for prevention and treatment.

VII. PSYCHOLOGICAL THEORIES OF ADDICTION

There are several theories about addiction, each of which tries to explain why some people become addicted to certain things.

- A. **Behavioural addiction** theory suggests that addiction develops as a result of repeated behaviors that result in positive outcomes (such as pleasure or reduced anxiety). Over time, this behavior becomes reinforced, and people can become addicted to it.
- B. **Social learning** theory states that people are more likely to develop addiction if they see others engaging in addictive behaviors and if they receive positive reinforcement from those around them. For example, if someone grows up in a household where alcohol is frequently consumed, they may be more likely to develop an addiction to alcohol themselves. This theory suggests that addiction is related to irrational thoughts and beliefs that lead to feelings of powerlessness and distorted pleasure/pain perception. These thoughts can be reinforced over time and can become entrenched.
- C. The **psychodynamic** theory suggests that addiction is caused by unresolved conflicts and emotions. It suggests that people with addiction may be using substances or behaviors to cope with emotional issues or to fill a missing piece in their lives.
- D. The **Self-Medication** Theory suggests that people use substances or behaviors to cope with underlying mental health conditions or physical pain. It posits that individuals may be seeking relief from symptoms such as anxiety, depression, or chronic pain.

Addiction is a complex problem with multiple causes and mechanisms. Each of these psychological theories offers a different perspective on addiction, which can help inform effective prevention and treatment strategies.

VIII. EFFECTS OF ADDICTION

Use of addictive substances and behaviors can lead to changes in brain chemistry that can affect mood, cognition, and behavior. In the short term, addiction leads to feelings of joy and euphoria. It's possible, but in the long run it can cause a variety of adverse effects, including:

- A. **Substance** lead to a range of physical health problems, including liver damage, cardiovascular disease, respiratory problems, and infectious diseases.
- B. **Mental problems:** Addiction can also lead to a range of mental health problems, including anxiety, depression and other mood disorders.
- C. **Social problems:** Addiction can lead to social problems, including unemployment, financial problems, and strained relationships with friends and family.
- D. **Legal problems:** Drug use can also lead to legal problems, such as being arrested for drug possession or driving under the influence.

- E. Addiction can have a major impact on **mental health**. Addiction is a complex disorder that affects the brain and behavior, often co-occurring with other mental health conditions such as anxiety and depression.
- F. **Depression and anxiety** can be addictions in their own right. Addiction can lead to feelings of depression and anxiety, and in some cases, these mental health conditions may have been present before addiction started.
- G. Addiction can affect your **ability** to think clearly and remember things. It can also interfere with your focus and ability to make wise decisions.
- H. **Physical health problems:** Addiction can lead to a range of physical health problems, including liver disease, heart disease and cancer.
- I. **Social isolation** can lead to addiction and withdrawal from friends and family, which can further exacerbate mental health problems.

Financial Problems: Addiction can cause financial problems, which can lead to great stress and anxiety. Addiction can have a significant impact on families and communities, with addicts often experiencing strained relationships and difficulties meeting their obligations at work and in the community.

In general, addiction can have serious negative effects on individuals and those around them. Effective treatment and prevention efforts can help reduce the impact of addiction and promote healthier and more fulfilling lives for individuals and communities.

IX. TREATMENT

Behavioural therapies, medication-assisted treatment, and support services are commonly used to treat addiction. The approach that is used will depend on the individual's needs and circumstances. Some of the common addiction treatment approaches include:

- A. **Behavioural** can help people learn how to manage their thoughts and behaviors in order to cope better with underlying issues that may be contributing to their addiction.
- B. **Medications** can be used to manage withdrawal symptoms and reduce cravings for opioids or alcohol.
- C. **Support services** can provide individuals with the ongoing support they need to recover from addiction.
- D. **Inpatient or residential** treatment can provide intensive support and monitoring for those working towards recovery.
- E. **Dual diagnosis** treatment programs are designed to help people with addiction and mental health conditions, like depression or anxiety, together.

X. MEDICAL TREATMENT

- A. **Methadone** is a long-acting opioid that can be used to manage withdrawal symptoms and reduce cravings for opioids. Methadone is often used as part of medication-assisted treatment (MAT) for opioid addiction.
- B. **Buprenorphine** is a medication that can be used to manage withdrawal symptoms and reduce cravings for opioids. It is also used as part of MAT for opioid addiction.
- C. **Naltrexone** is a drug that blocks the effects of opioids in the brain, which can help reduce cravings for opioids or alcohol and prevent relapse.
- D. **Disulfiram** is a medication used to help people who are addicted to alcohol. It can make drinking very unpleasant, which may help to keep people from drinking.
- E. **Acamprosate** is a medication used to treat alcohol addiction. It can help to reduce cravings for alcohol and promote abstinence.

There is no one-size-fits-all approach to treating addiction, and different individuals will require different medications and combinations of treatments to achieve the best results. Treatment providers should work closely with individuals to develop a comprehensive treatment plan that takes into account their physical, mental, and social needs.

XI. PREVENTION

Prevention is key when it comes to addiction. By taking precautions, you can lower your risk of getting addicted in the first place. Some ways to do this are listed below.

Drug education can help you to avoid addiction and lead a healthy lifestyle. This includes learning about the physical and mental health effects of drug use, as well as ways to avoid or manage peer pressure when using drugs.

- A. Providing **healthy coping skill**, such as exercising, mindfulness, and social support, can help them better manage stress and other negative emotions without needing to turn to drugs or alcohol.
- B. **Addressing environmental factors** that contribute to drug use, such as poverty, social isolation, and a lack of access to resources, can help prevent people from becoming addicted to drugs. This may involve promoting policies that address these issues, such as increasing access to education and job opportunities.
- C. **Preventing addiction** from developing can be done by providing mental health services to those who are at risk. Doing this can help prevent addiction from taking hold.
- D. **Restricting access** to drugs and alcohol can help prevent people from becoming addicted. This can involve implementing policies such as making it harder to get prescription drugs, regulating the sale of alcohol and tobacco products, or raising the drinking age.

To help prevent addiction, we need to take a holistic approach that looks at the underlying factors that lead to drug use, like how people cope with stress, what kind of environment they live in, and how easy it is to get drugs. This can help reduce the chances of addiction happening in the first place, and the consequences that come with it.

XII. CONCLUSION

In conclusion, the psychology of addiction is a complex and [6]multifaceted phenomenon involving both environmental and biological factors. The development of addiction is influenced by a combination of genetic, psychological, and social factors, including a person's family history, mental health, and environmental stressors.

Addiction is a chronic brain disease that is characterized by compulsive drug seeking and use despite harmful consequences. The brain's reward system plays a crucial role in addiction, with repeated drug use leading to changes in brain function and the development of addiction.

Addiction can be treated with a combination of medications, behavioural therapy, and support services to help individuals manage cravings, avoid relapse, and lead healthy, fulfilling lives.

Preventing addiction requires education, early intervention, healthy coping mechanisms, environmental strategies, and support systems. By addressing risk factors, promoting protective factors, and providing education and support, we can help individuals make healthier choices and prevent addiction from taking hold.

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Carbon Capture and Storage

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Abstract –This paper assesses the role of carbon dioxide capture and storage (CCS) in addressing challenges in the energy transition in regions reliant on carbon-intensive industries for employment and as an economic base. Common understanding showed that for CCS to contribute to a just transition it has to (a) make a contribution to climate change imperatives(b) help to mitigate the economic and employment effects arising from declining or maturing industries; thus helping in tackling global warming.

Keywords—Carbon capture, Pre combustion system, Post combustion system, Oxyfuel, Transport of CO₂, Storage of captured carbon, Utilization of captured carbon

I. INTRODUCTION

CCS is a technology to prevent large quantities of carbon dioxide from being released into the atmosphere by capturing CO₂ and storing it so that it does not enter the atmosphere. Carbon Capture and Storage (CCS) is a way of reducing carbon emissions, which could be a key in helping to tackle global warming. CCS involves three steps which involve capturing the carbon dioxide (CO₂) which is emitted during industrial processes such as steel and cement production or when fossil fuels are burned in power plants. This carbon is then transported from where it was produced, via ship or in a pipeline, and stored in geological structures deep underground.

II. CAPTURING OF CARBON DIOXIDE

A. Pre combustion system

Pre-combustion capture refers to the removal of CO₂ from fossil fuels before combustion is completed. For example, in the gasification processes raw material (such as coal) is partially oxidized in steam and oxygen/air at high temperature and pressure to form synthesis gas. This syngas (common term for synthesis gas), is a mixture of hydrogen, carbon monoxide, CO₂, and smaller amounts of other gaseous components, such as methane. The syngas can then undergo the water-gas shift reaction to convert CO and water (H₂O) into H₂ and CO₂, to produce a gas mixture rich

in H₂ and CO₂. The CO₂ concentration in this mixture can range from 15 to 50%. The CO₂ can then be captured and

flue gas streams and is at low pressure, the shifted synthesis gas stream is rich in CO₂ and at higher pressure, which allows for easier removal before the H₂ is combusted. Due to

the more concentrated CO₂, pre-combustion capture typically is more efficient but the capital costs of the base gasification process are often more expensive than traditional pulverized coal(PC) power plants.

Currently, commercially available pre-combustion carbon capture technologies generally use physical or chemical adsorption processes, and will cost around \$60/tonne to capture CO₂ generated by an Integrated Gasification Combined Cycle (IGCC) power plant. The goal of DOE's research efforts is to bring this cost down to \$30 per tonne of CO₂. To achieve this goal, research is focused on three major separation technologies – advanced solvents, adsorbents, and membranes.

Pre-combustion capture studies are closely aligned with the gasification and advanced turbine programs to ensure successful integration of pre-combustion capture technologies into IGCC facilities. Advances in those programs will also help meet the goal of bringing down the pre-combustion capture costs to \$30 per tonne. Below is a pictorial representation of the pre combustion capture process of CO₂.

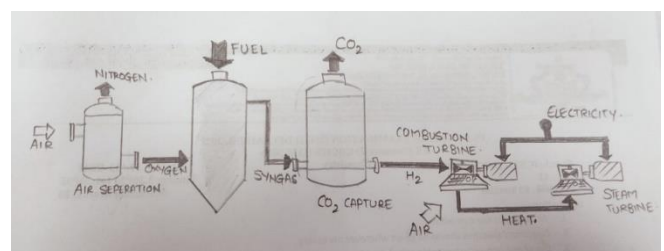


Fig 1: Pre combustion system

B. Post combustion system

Post-combustion CO₂ capture is primarily applicable to conventional natural gas and pulverized coal (PC) power is ultimately combusted.

Compared to post-combustion technology, which removes dilute CO₂ (~5 to 15% CO₂ concentration) from separated, transported, and later stored, and the H₂-rich fuel generation. In a typical PC power plant, fuel is burned in a CO₂ is present at dilute concentration (typically 13 to 15 volume percent for PC power plants and 3 to 4 percent for natural gas-fired plants) and at low pressure; thus, a large volume of gas has to be treated.

Trace impurities in the flue gas (e.g., particulate matter, sulphur dioxide [SO₂], nitrogen oxides [NO₂]) can degrade absorbers and reduce the effectiveness of some CO₂ capture processes.

CO₂ is captured at a low pressure. Compressing from atmospheric to pipeline pressure (approximately 2,000 psia) places a large auxiliary power load on the overall power plant system.

A post-combustion CO₂ capture absorption process is pictorially shown below.

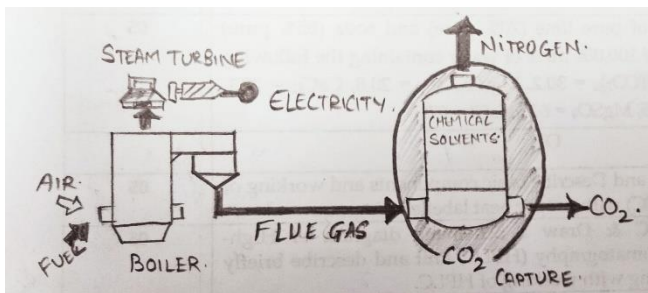


Fig 2: Post combustion system

These types of processes have been developed and deployed commercially in the chemical industries. However, their use in PC power plants has been restricted to slipstream applications, and to date, no definitive analysis exists as to the actual costs for a full-scale capture plant. A preliminary analysis conducted at NETL indicated that CO₂ capture via amine scrubbing and compression to 2,200 psia could raise the cost of electricity from a new supercritical PC power plant by 65 percent, from 5.0 cents/kilowatt hour (kWh) to 8.25 cents/kWh.

C. Oxy fuel combustion system

Oxy-combustion system uses a pure or enriched oxygen instead of air for combustion. This process removes nearly turbine to generate electricity. The boiler exhaust, or flue gas, consists mainly of nitrogen (N₂), and carbon dioxide. Separating CO₂ from this flue gas stream is a challenging process. boiler containing air to produce steam, which drives all the nitrogen from the air, resulting in a stream containing approximately 95% oxygen.

Therefore, the volume of flue gas, which is approximately 70% CO₂ by volume, which is approximately 75% less for oxy-fuel combustion than for air combustion. The lower gas volume also allows easier removal of the pollutants (sulphur oxide [SO_x], nitrogen oxide [NO_x], mercury, particulates) from the flue gas. Another benefit is

that because nitrogen is removed from the air, NO_x production is significantly reduced.

Oxy-combustion power production involves three major components: oxygen production, the oxy-combustion boiler, and CO₂ purification and compression.

Oxy-combustion systems can be configured differently with these components, resulting in different economic performances.

The components are shown in the following diagram.

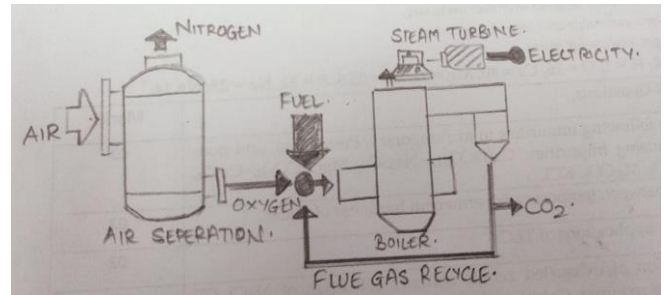


Fig 3: Oxy fuel combustion system

III. TRANSPORT OF CO₂

The safe and reliable transport of CO₂ from capture to storage is the second step in the carbon capture and storage (CCS) process. Transportation of CO₂ occurs daily in many parts of the world, but large-scale deployments require significant investment in transportation infrastructure.

- Specifications for transportation
 - No free water should be present.
 - Temperature should not exceed 48.9°C.
 - Minimum of 95% of CO₂ should be present.
 - Nitrogen content should not be more than 4%.
- Transportation system used:
 - A) Pipeline transportation system
 - B) Marine transportation system

A. Pipeline transportation system

Currently, CO₂ is primarily transported via pipelines, but transport by ship is also possible. Repurposing existing infrastructure, instead of building new pipelines, reduces both project risk and commercial burden.

Larger CCS deployments may require new and repurposed pipelines to connect sources to storage. Many inland facilities will also need to be connected to coastal hubs for CO₂ export or subsea storage.

Challenges include:

1. Fracture control.
2. Corrosion.
3. Flow assurance and operational issues.
4. Impurity control.
5. Managing risk of release and dispersion of CO₂.

B. Marine transportation system

- Case studies are carried out by assuming that the amount of captured CO₂ is 20,000 tons/day and the transport distance is widely changed from 200km to 12,000km.
- The cost of CO₂ marine transportation and the additional emissions of CO₂ from the system are assessed. Influences of parameters such as size and shape of the ship and CO₂ condition before liquefaction are investigated.
- In the case where CO₂ is captured in a chemical absorption process, the gaseous CO₂ at the entrance of the liquefaction process is saturated with moisture.
- Dehydration is, therefore, necessary at first to avoid freezing and/or hydrate generation. A spherical tank with skirt support is suitable for the large scale storage of pressurized liquefied gas.
- The design condition of the tank would be near the triple point of CO₂. Loading facilities from the storage tank to the ship would be the loading arm type and pumps would be situated at the port.
- Unloading depends on the receiving facilities in the CO₂ storage system; however the pumps in the cargo tanks of the ship would be used.

IV. STORAGE OF CAPTURED CARBON

CO₂ can be stored in two main ways:

- A. Deep geological storage
- B. Mineral storage

Other methods include:

- C. Enhanced oil recovery method

D. Saline aquifers

- E. Unmineable coal

A. Deep geological storage

- Storage in deep geological formations is also known as 'geo-sequestration'. In this technique, CO₂ is converted under high pressure to a liquid form known as 'supercritical CO₂'.
- Supercritical CO₂ behaves like a liquid and is injected directly into sedimentary rocks.
- Rocks may be found in old oil fields and gas fields or salt deposits ; that is rocks in which porous spaces are filled with salty water.
- Unmineable coal seams and some volcanic rocks can also be considered as storage sites. Various physical structures prevent CO₂ from reaching the surface. These include impermeable 'caprocks' and geochemical trapping mechanisms.

B. Mineral storage

When storing minerals, the trapped CO₂ reacts with the natural mineral iron (Fe), magnesium (Mg) and calcium (Ca). This is called "mineral carbonation" and occurs naturally when rocks weather over time. This mineral is very common and very stable. As a result, CO₂ is not reemitted into the atmosphere.

However, this carbonation reaction proceeds very slowly under normal conditions and its acceleration requires energy to raise the temperature and pressure to ideal levels.

C. Enhanced oil recovery

- Oil and gas reservoirs are thought to be suitable candidates for the geologic storage of carbon dioxide.
- Oil and gas reservoirs offer geologic storage potential as well as economic opportunity by injecting carbon dioxide to extract additional oil from developed sites.
- Carbon dioxide- Revenue from selling captured carbon dioxide to EOR operators could help defray the cost of capture technology at power plants and industrial facilities.

D. Saline aquifers

- Some deep rocks contain highly concentrated brine (salt water). It exists in rock cavities and acts like a giant sponge. These are known as "saline aquifers". The biggest advantage of CCS is it huge storage capacity and richness.
- A major disadvantage of saline aquifers is that relatively little is known about them compared to oil fields. However, current studies have shown that several CO₂ capture mechanism are anchored underground reducing the risk of leakage. Unlike storage in oil fields or coal seams, there are no useful by-products to offset the cost of storage.

- E. Unmineable coal • 'Unmineable' coal, which is coal that is too deep or difficult to mine, can be used for CO₂ storage. Coal absorbs CO₂ if it is permeable enough for CO₂ to penetrate. In this process, the coal releases previously absorbed methane (CH₄), which can be recovered and used later. This is called enhanced coal-bed methane or ECBM.

V. PRODUCTS MADE FROM CAPTURED CARBON

Company	Product	Amount of carbon used
Air company	Alcohol	1.5 kg of CO ₂ / litre
Aether	Diamonds	20 tons of CO ₂ / diamond
Clean O ₂	Soap	6-8 tons / year

VI. RESULTS AND DISCUSSION

CCS is key to ensuring sustainable development and growth especially in India for the production of clean products and energy. India's dependency on the fossil based Energy Resources is likely to continue in future, hence CCS policy is needed.

As India has updated its NDC targets for achieving 50% of its total installed capacity from non fossil based energy sources, 45% reduction in emission intensity by 2030 and taking steps towards achieving Net Zero by 2070, Carbon capture and Storage becomes an important reduction strategy. CCS provides a wide variety of opportunities to convert the captured CO₂ to different value-added products like green urea, food and beverage form, building materials (concrete and aggregates), chemicals (methanol and ethanol), polymers (including bio-plastics) and enhanced oil recovery (EOR) with wide market opportunities in India, thus contributing substantially to a circular economy.

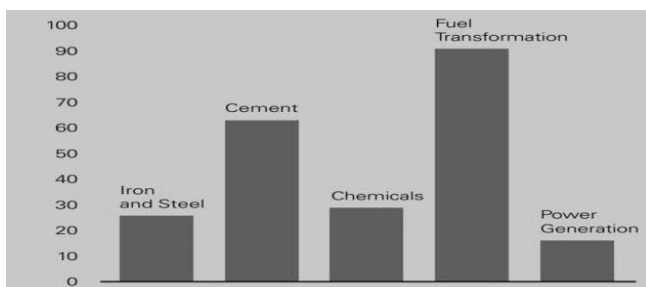


Fig 4: *Uses of captured carbon in various areas*

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Deep Learning in Industry and Market Trends

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Abstract-

The field of artificial intelligence and machine learning has seen astounding growth in recent years. With advancements in technology and increased interest in the constructive operation of AI and ML, there has been a rise in exploration and evolution in these sectors. Deep Learning, a subdivision of machine learning, has been at the cutting edge of this expansion and has seen widespread adoption across numerous businesses. The objective of this research paper is to analyze the current market trends and expansion in the deep learning industry, with a focus on the United States of America, India, and the international market. The study also features some of the considerable players in the AI, ML, and Deep Learning fields, such as Google, Microsoft and OpenAI. The offering of outstanding individuals is also explored. The role of communication technologies, such as DSRC, LTE, and 5th Generation Mobile Networks, in self-driving cars are explained. The paper will provide an analysis of the key players in the industry and growth figures, and an assessment of the future chances of the industry from an investor's point of view. This research paper aims to provide valuable insights into the current state of the deep learning market and its future possibility.

In conclusion, this study brings a thorough overview of the deep learning in industry and market trends, offering intuition into the modern state of the field and the potential for further advancement. This study will be useful for individuals and institutions seeking to invest in the field of deep learning and its utilization.

Index Terms-

- ❖ Deep learning in industry & innovation trends.
- ❖ Industry adoption of deep learning & market trends
- ❖ Deep learning Market analysis & applications in various sectors
- ❖ Deep Learning market size and growth projections
- ❖ Investment opportunities in AI

Objective -

The objective of the Research Paper is to give a brief overview and a broader picture of Deep Learning in Industry and Market Trends to People, Investors and Deep Learning community in layman terms. The goal is to explain types of deep learning, its application, its uses in industry and global market trends. This research paper will help to convince investors and institutions to invest in the Deep Learning sector. This research paper aims to

provide valuable insights into the current state of the deep learning market and its future possibility.

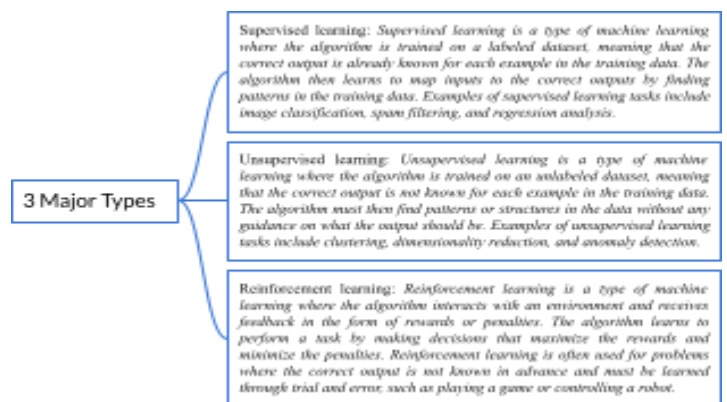
I. INTRODUCTION

Deep Learning is the Subset of Machine Learning, Which Attempts to Simulate behavior of Human Brain Through Artificial Neural Network. Deep learning drives many artificial intelligence (AI) operations and services that improve automation, operating analytic and physical tasks without human intervention. Deep learning algorithms use multiple layers of artificial neurons to perform hierarchical feature extraction and opinion making. This allows them to automatically learn and improve from experience without being absolutely programmed.

In deep learning, the neural network processes big data through multiple hidden layers of algorithms, each of which documents and abstracts increasingly complicated faces from the data. This action helps the network to learn and make predictions on basis of probability about new, undiscovered data.

The main feature and asset of deep learning is its capability to automatically learn and advance itself from a large bulk of data, making it applicable for assignments that include recognizing patterns and making predictions..

Three main categories of machine learning algorithms.:



A Deep Neural Network (DNN) is a type of Artificial Neural Network (ANN) that has numerous hidden layers between the

input layer and the output layer. The additional hidden layers allow the network to analyze more complicated samples of the data, which empower it to perform more complex tasks.

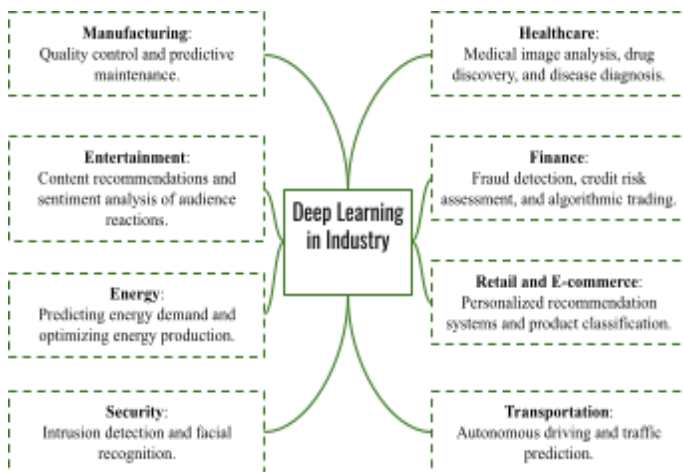
In summary, a Deep Neural Network is a type ANN that has multiple hidden layers, allowing it to learn more complex representations of the data and perform more sophisticated tasks.

Deep learning has a wide range of utilization in numerous fields, some of the most notable ones are:

- ❖ **Computer Vision:** Deep learning is used for tasks such as image grouping, object tracking, linguistic segmentation, and image formation.
- ❖ **Speech realization:** Deep learning is used for assignments such as speech-to-text changeover, voice recognition, and language rendering.
- ❖ **Natural Language Processing (NLP):** Deep learning is used for tasks such as sentiment analysis, machine translation, query answering, and text formation.
- ❖ **Recommender Systems:** Deep learning is used for custom-made recommendation systems in business such as e-commerce, browsing, and social media.
- ❖ **Robotics:** Deep learning is used for tasks such as object recognition, hurdle avoidance, and opinion constructing in self-governing systems.
- ❖ **Gaming:** Deep learning is used for tasks such as game playing and opinion constructing in video games.

II. BRIEF OVERVIEW AND CURRENT SCENARIO

Deep Learning in Various Industries: The below chart explains The Importance of Deep Learning in Various Industries



Self-driving cars

Self-driving cars use Deep Neural Networks (DNNs) in several ways to enable autonomous driving.

- ❖ **Perception:** One of the main challenges in self-driving

cars is perception, which involves detecting and interpreting objects in the environment. DNNs are used for object detection and classification, such as detecting other vehicles, pedestrians, traffic signs, and road markings. The DNNs process input from cameras, lidar, and other sensors to produce a high-level understanding of the scene.

- ❖ **Path Planning:** Once the car has a perception of the environment, it must decide on a safe and efficient path to follow. DNNs are used to plan the trajectory of the car, taking into account the location and movement of other objects in the environment.
- ❖ **Control:** Finally, the car must control its movements to follow the planned path. DNNs are used to control the car's actuators, such as the steering, throttle, and brakes, to ensure that the car moves smoothly and safely along the planned trajectory.

Hence, self-driving cars use DNNs for perception, path planning, and control to enable autonomous driving. The DNNs process input from sensors and make decisions that allow the car to safely navigate the environment and reach its destination.

Example - Tesla Cars:

Tesla Cars uses a combination of sensors to detect adjacent cars, the speed of adjacent cars, highway markings, and traffic signals. Dedicated Short Range Communications (DSRC), Vehicular Ad Hoc Networks (VANETs), Long Term Evolution (LTE), and 5th Generation Mobile Networks (5G) are communication technologies that are being used to support self-driving cars.

1. **Cameras:** Tesla's self-driving cars are equipped with multiple cameras that capture images of the environment from different angles. The cameras are used to detect adjacent cars, traffic signals, and road markings, and are often combined with computer vision algorithms to extract high-level information from the images.
2. **Radar:** Tesla's cars are also equipped with radar sensors that use radio waves to detect the presence of nearby objects. The radar is able to detect objects that are obscured by other vehicles or by weather conditions, and provides information about the speed and range of adjacent cars.
3. **Lidar:** Some self-driving cars, including some Tesla vehicles, are equipped with lidar sensors that use laser light to create a 3D map of the environment. The lidar sensors provide detailed information about the location and shape of nearby objects, and are particularly useful for detecting small objects and objects at close range.
4. **GPS:** Tesla's cars are equipped with GPS receivers that provide information about the car's location and speed. The GPS is used to determine the car's position on the road and to track the movement of adjacent cars.
5. **Dedicated Short Range Communications (DSRC):** DSRC is a wireless communication technology that is specifically designed for use in vehicles. It allows

vehicles to communicate with each other and with road-side infrastructure, such as traffic lights and road signs, to support the development of cooperative and autonomous driving.

6. Vehicular Ad Hoc Networks (VANETs): VANETs are a type of mobile ad hoc network that is specifically designed for use in vehicles. They allow vehicles to communicate with each other directly, without the need for a fixed infrastructure. This can support the development of cooperative and autonomous driving, by allowing vehicles to share information about the road environment and to coordinate their movements.
7. Long Term Evolution (LTE): LTE is a mobile communication technology that is widely used for voice and data communications. In the context of self-driving cars, LTE can be used to support the communication between the car and a central control center, or between the car and the cloud. This can allow the car to receive real-time updates and to upload data about its environment and driving conditions.
8. 5th Generation Mobile Networks (5G): 5G is the upcoming generation mobile communication technology that is being made to back the expanding requirement for high-speed data communications. In the context of self-driving cars, 5G can support the communication between the car and the cloud, and can allow the car to receive actual time updates and to upload and download data about its surroundings and driving conditions.

In summary, self-driving cars like Tesla use a combination of cameras, radar, lidar, DSRC, VANETs, LTE, and 5G are communication technologies that are being used to support self-driving cars. They allow vehicles to communicate with each other and with road-side infrastructure, to receive real-time updates and to upload data about their environment and driving conditions, which can support the development of cooperative and autonomous driving.

Global Companies in this Sector:

There are many players globally that are working in the sector of Artificial Intelligence, Machine Learning and Deep Learning. Here are some of the major players in this space as follows:

- Google: Google is superior in AI and ML, with a target on creating cutting edge tools/technologies in these sectors. Google's DeepMind and Google Brain are among the leading research institutions in the world of DL.
- Amazon: Amazon is heavily invested in AI and ML, using these technologies to improve its products and services and to stay ahead of its competitors. Amazon's AI services, such as Amazon SageMaker and Amazon Rekognition, are widely used by businesses and developers.
- Microsoft: Microsoft has a strong presence in AI and ML, with a focus on developing solutions for enterprise customers. Microsoft's Azure AI services and Cortana AI assistant are among its key offerings in this space.
- Meta: Meta is investing heavily in AI and ML, using these technologies to improve its products and services, such as its Facebook, Instagram, and its virtual reality platform, Oculus and Metaverse.
- IBM: IBM is a leader in AI and ML, with a focus on

developing solutions for enterprise customers. IBM's Watson platform is among the company's key offerings in this space.

- Baidu: Baidu is a Chinese technology giant that is heavily invested in AI and ML, with a focus on developing cutting-edge technologies in these fields. Baidu's DeepVoice and DuerOS are among its key offerings in this space. Baidu has created its own Chat GPT-like AI model which generates text based on given data. This model is currently in the Development and Testing phase.
- Alibaba: Alibaba is a Chinese e-commerce giant that is heavily invested in AI and ML, using these technologies to improve its products and services and to stay ahead of its competitors. Alibaba's AI platform, Alibaba Cloud, is widely used by businesses and developers. Alibaba has created its own Chat GPT-like AI model which generates text based on given data. This model is currently in the Development and Testing phase.
- DeepMind: DeepMind is an artificial intelligence company founded in September 2010 and acquired by Google in 2015. One of DeepMind's most notable achievements is AlphaGo, an artificial intelligence program that defeated the world champion in the game of Go, an ancient Chinese board game. DeepMind is considered one of the leading companies in the field of AI and has made significant contributions to the advancement of the field. Its work in the development of AlphaGo and its continued research in various areas of AI have positioned DeepMind as a key player in the industry and have helped to shape the future of AI.

There are many prominent individuals in the field of Artificial Intelligence, Machine Learning, and Deep Learning who have made significant contributions to the development and advancement of these technologies. Here are a few of the most well-known:

- I. Geoffrey Hinton: Hinton is a computer science professor at the University of Toronto and a researcher at Google Brain. He is widely regarded as the "Godfather of Deep Learning" and has made numerous breakthroughs in the field, including the development of deep neural networks and the creation of the backpropagation algorithm.
- II. Yann LeCun: LeCun is a computer scientist and researcher who is best known for his work in the field of deep learning, particularly in the development of convolutional neural networks (CNNs). He is currently the Director of AI Research at Facebook.
- III. Andrew Ng: Ng is a computer science researcher and entrepreneur who has made huge contributions to the fields of machine learning and deep learning. He is best recognized for his work developing popular device learning algorithms known as support Vector Machines and principal component evaluation.
- IV. Ian Goodfellow: Goodfellow is a computer scientist

➤ and researcher who is best known for his work in the field of deep learning, particularly in the development of Generative Adversarial Networks (GANs). He is currently a Research Scientist at Google Brain.

- V. **Fei-Fei Li:** Li is a computer science educator at Stanford University and the director of the “Human-Centered AI Institute”. She is finest known for her effort in the area of computer vision and has made various improvements in the evolution of deep learning algorithms for image classification and object understanding.
- VI. **Yoshua Bengio:** Bengio is a computer science professor at the University of Montreal and a researcher at Mila, Quebec AI Institute. He is a leading expert in the field of deep learning and has made significant contributions to the development of language models and other deep learning algorithms.
- VII. **Ilya Sutskever** is a co-founder and Chief Scientist at Open-AI and is one of the most influential figures. He is widely recognized as one of the founders in the sector of AI and Deep Learning.

These individuals, among others, have made significant contributions to the development and advancement of AI, ML, and deep learning, and their work has helped to shape the field and make these technologies more accessible and useful to the wider public.

Open AI- Microsoft Deal:

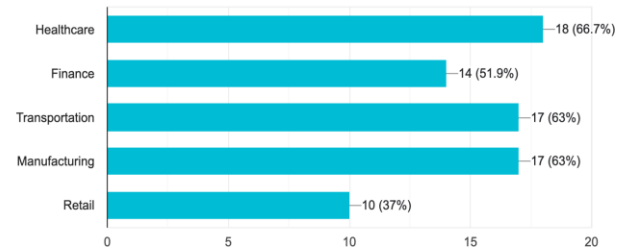
Microsoft has currently done a deal with Open AI company. Rumors of this deal suggested Microsoft may receive 75 percent of OpenAI’s profits until it secures its investment return and a 49 percent stake in the company.

Eventual Agendas of Open AI & Microsoft:

1. Microsoft and Open AI will work together to build numerous supercomputing systems mechanized by Azure, which will be used to train all of Open-AI’s models. Azure’s unique architecture design will be essential in delivering best in class performance and scale for Open-AI’s AI training and reasoning assignment.
2. Open-AI partnered with Microsoft to deploy Open AI’s technology through our API and the Azure OpenAI Service—enabling enterprise and developers to build on top of GPT, DALL·E, and Codex. They also worked together to build OpenAI’s technology into apps like GitHub Copilot and Microsoft Designer.
3. Open-AI’s Chat-GPT was trained on 2021 and before data, with collaboration with Microsoft now Chat-GPT can access search engine data and website crawling techniques so that this model can be trained on the latest dataset and can produce better results.
4. Microsoft is planning to create Bing chat which can generate results by combination of technique of Chat GPT and Bing search engine

In which industries do you think deep learning can have the biggest impact?

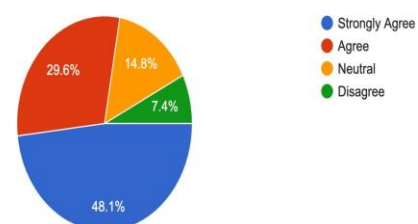
27 responses



Open AI's - Chat-GPT		Google's - BARD	
I.	Chat GPT was launched in 30 november 2022	I.	BARD was announced on 06 Feb 2022
II.	Chat GPT (Chat Generative Pre-trained Transformer) is based on Google's Open Source Project - Transformer (A Novel Neural Network Architecture for Language Understanding)	II.	BARD is mechanized by LaMDA (Language Model for Dialogue Applications)
III.	Chat GPT is trained on data before 2021	III.	Google BARD would most likely have the access of the internet to gather new data and generate information on the basis of it.
IV.	Chat GPT is most likely to get integrate with Microsoft Azure platform under a name of Azure OpenAI Service,	IV.	BARD would use google's supercomputer and servers to crawl through data available on internet
V.	Chat GPT will use Microsoft's Bing search engine to crawl through website data to generate results on new data.	V.	BARD will use Google Search Engine to generate results.

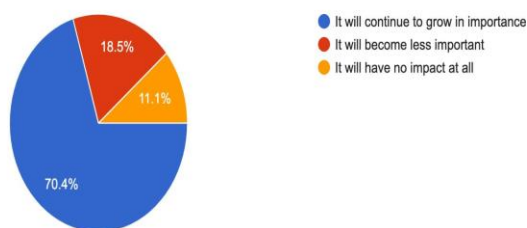
Will Artificial Intelligence, Machine Learning & Deep Learning would be used globally in various industry?

27 responses



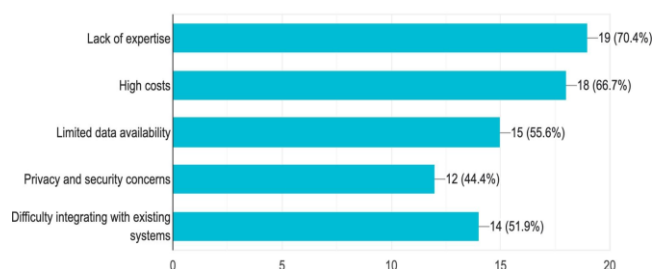
What do you think the future holds for deep learning in industry and market?

27 responses



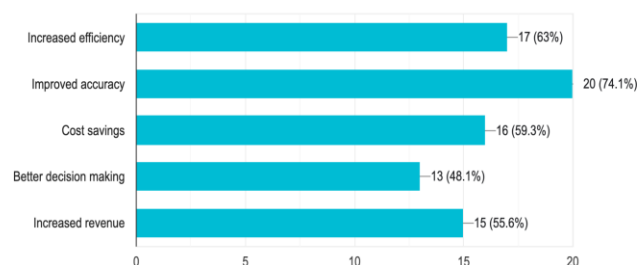
What do you think are the biggest challenges in adopting deep learning in industry and market?

27 responses



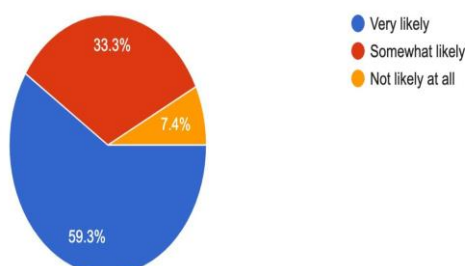
What do you think are the biggest benefits of using deep learning in industry and market?

27 responses



How likely are you to invest in deep learning for your business in the next 1-2 years?

27 responses



Peoples View:

Deep learning has gained widespread recognition among the general public due to its ability to solve complex problems and provide intelligent solutions in areas such as image recognition, natural language processing, and self-driving cars. Many people view deep learning as a key technology that will shape the future and have a significant impact on our lives.

ndustries View:

Deep learning is widely adopted in various industries, including healthcare, finance, retail, and transportation. Companies in these industries are investing in deep learning to improve their products and services and to stay ahead of their competitors. Industry experts believe that deep learning has the potential to revolutionize many industries and to bring about significant improvements in efficiency and productivity.

nvestor's Perspective:

The deep learning market is growing rapidly, as organizations across industries are adopting AI and machine learning technologies to automate tasks and improve decision making. This growth is reflected in the size of the deep learning market, estimated at billions of dollars worldwide.

In India, the deep learning market has been growing at a rapid pace, with the market size estimated to be around US\$1 billion as of 2021. This growth is due to the increasing adoption of deep learning technologies by various industries, such as retail, healthcare, and finance, among others.

The United States of America has a large and mature deep learning market, predicted to be worth around US\$20 billion as of 2021. The growth of the market in the US is compelled by the presence of leading technology companies and research institutions, as well as the high demand for AI and machine learning solutions across various industries.

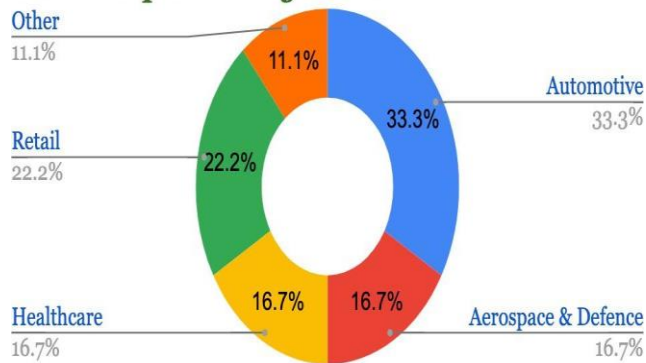
The global deep learning market is estimated to be worth approximately \$100 billion by 2021, at a compound annual growth rate (CAGR) of approximately 40%. This growth is driven by the growing adoption of deep learning technologies by organizations across industries and continued advances in artificial intelligence and machine learning.

The AI and ML market has seen significant growth in recent years and is expected to continue growing in the future. The global AI market size is estimated at USD 19.47 billion in 2020 and is expected to reach USD 266.2 billion by 2025, growing at a CAGR of 52.7% over the forecast period (2020-2025).

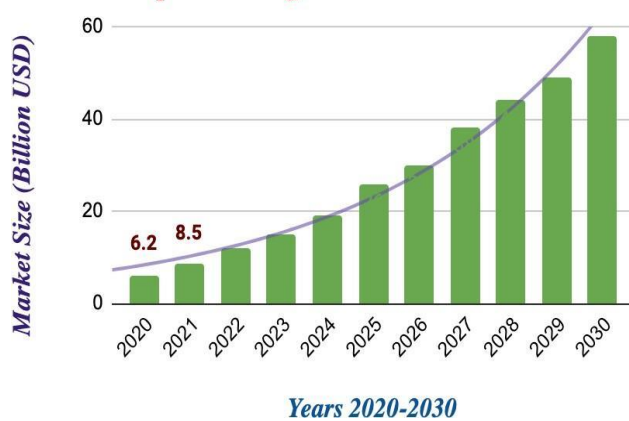
In the United States, the AI market size was estimated to be around \$13.9 billion in 2020 and is expected to reach \$57.2 billion in 2025.

the US AI market.

Gloal Deep Learning Market



U. S. A Deep Learning Market



In India, the AI market size was estimated to be around \$1.5 billion in 2020 and is expected to reach \$5.5 billion by 2025, growing at a CAGR of 28.5%. TATA Elxsi Wipro, L&T Infotech-Mindtree, L&T Technology & Services and Infosys are among the leading AI service providers in India.

Investors view deep learning as a promising area for investment due to its potential for high returns and its widespread adoption in various industries. Many investors are investing in startups that are developing deep learning solutions and in companies that are using deep learning to improve their products and services. The investment community believes that deep learning has the potential to generate significant returns in the long term.

In summary, people's, industry, and investors' opinions on deep learning and its applications are generally positive and optimistic. Deep learning is widely recognized as a key technology that will shape the future and have a significant impact on our lives, and is attracting significant investment from

investors and companies across various industries.

III. CONCLUSION

The field of deep learning, a sub-area of machine learning, has seen a surge of interest in recent years because of its potential to resolve complicated issues and offer rather accurate predictions. This study gives a complete analysis of the current state of the deep learning industry and market tendencies. This study discusses distinctive types of deep learning, which includes convolutional neural networks, recurrent neural networks, generative opposed networks, and extra. Deep learning applications consisting of photograph and speech recognition, self-driving automobiles, and robotics are also discussed.

The study also highlights some of the major players in the Artificial Intelligence, Machine Learning, and Deep Learning fields, such as Google's Deep Mind, Google's BARD and OpenAI. The contribution of prominent individuals, such as Ilya Sutskever of OpenAI, is also explored. The role of communication technologies, such as Dedicated Short Range Communications, Long-Term Evolution, and 5th Generation Mobile Networks, in self-driving cars is discussed.

The study takes into account the opinions and perspectives of individuals, industry experts, and investors on the potential and limitations of deep learning and its applications.

In conclusion, this study provides a thorough overview of the deep learning industry and market trends, offering insights into the current state of the field and the potential for further development. This study will be useful for individuals and organizations seeking to invest in the field of deep learning and its applications.

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- [9] Survey Questionnaires & Response

MATRICES BY PYTHON PROGRAMMING IN DATA SCIENCE AND APPLICATIONS

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Abstract— Mathematics is one of the main pillars of data science. In mathematics, matrix is a fundamental tool in data science, providing a way to represent and manipulate large and complex data sets. Matrices have various applications in data science which can be executed by operating linear algebra with the help of python libraries in data science. In this paper, we will outline the python libraries for matrix manipulation and describe the applications of matrices in data science.

Keywords— Matrices, Linear Algebra, Data Science, Python

I. INTRODUCTION

In mathematics, a matrix is a rectangular array of numbers or other mathematical objects, such as complex numbers, polynomials, or functions. Matrices can be added, subtracted, multiplied, and divided, and can be manipulated using various matrix operations, such as transposition, inversion, and determinant calculation. Matrices are widely used in many areas of mathematics, science, engineering, and computer science, including linear algebra, graph theory, statistics, and data analysis. Matrices are a fundamental tool in data science, providing a way to represent and manipulate large and complex data sets. In data science, matrices are used to represent data tables, with each row representing an observation or sample, and each column representing a variable or feature. Matrices are typically represented and manipulated using various programming languages and libraries, such as Python's NumPy, R's Matrix, and MATLAB's matrix functions. These libraries provide tools for performing various matrix operations, such as matrix multiplication, matrix inversion, and matrix factorization. Data scientists can use matrices in a wide range of applications, such as image and signal processing, natural language processing, and network analysis, among others.

WHY PYTHON?

Easy to Learn and Use: Python has a simple syntax that is easy to read and understand, making it a great language for beginners. Its structure is straightforward and intuitive, and it has a vast library of documentation and tutorials available online, which makes it easy to learn and use.

Versatile: Python can be used for a wide range of applications,

including web development, data science, artificial intelligence, machine learning, and scientific computing, among others. It is a versatile language that can be used in almost any field.

Large Standard Library: Python has a vast standard library that contains a wide range of tools and functions, making it easier to write complex applications. The standard library includes modules for string operations, file I/O, regular expressions, and many other tasks.

Open-Source and Free: Python is an open-source language, which means that it is free to use and distribute. This makes it an excellent choice for developers who are just starting or working on a tight budget.

Cross-Platform Support: Python is a cross-platform language, which means that it can be used on different operating systems, including Windows, Linux, and macOS.

Community Support: Python has a large and active community of developers, which means that there is a vast pool of resources available online. This includes documentation, forums, tutorials, and libraries, which makes it easy to get help and support when needed.

PYTHON LIBRARIES

1)NumPy: Python wasn't made to carry out mathematical operations. However the growing popularity of Python among the technical, scientific, and research sectors compelled its creators to produce a package containing a high level implementation of arrays. Large, multi-dimensional arrays and matrices are supported by NumPy, a library for the Python programming language, along with a substantial number of high-level mathematical operations that may be performed on these arrays.

For example: Initialization: `import numpy as np`

This command imports numpy library with an object np. This object can be used whenever we have to use the numpy functionalities, methods etc. To create an array: `a = np.array([4, 5, 6])`

This code creates an array object and inserts 4, 5, 6 numbers to variable a.

2)Pandas: The Pandas library is a highly effective tool for handling and manipulating data; its data frames and series serve as the foundation for data analysis. Data frames are

multidimensional arrays, whereas series are one-dimensional arrays similar to lists in Python. We can load and read any kind of data, including JSON and Excel files, using pandas.

Initialization: `import pandas as pd`

This command imports pandas library with object `pd`.

Reading a file: `Df=pd.read("filename")`

Read function in pandas library loads all the files into the data frame.

3)matplotlib: The most widely used library for data visualisation is matplotlib. It offers numerous functions, approaches, and visual graphs for plotting the data points on the graph and performing analyses. It offers a variety of graphs to study the data, including stream plots, contouring and pseudo-color images, histograms, pathways, and many subplots. It is compatible with many different platforms and data visualisation programmes. Complete control over data representation is provided. Any complex data can be represented in a graph to get insights once the x and y axes have been setup.

Initialization: `Import matplotlib.pyplot as plt`

This code imports matplotlib library to the working environment.

4)Skit-Learn: To create and construct models, this library was developed to work with the scipy and numpy libraries. It uses a variety of algorithms based on statistics and probability. The original data set can be divided into the desired train/test dataset ratio using this library. The model is trained using a subset of the original dataset called the training dataset, and it is then tested using the test dataset to gauge the model's quality and accuracy. Moreover, the Skit-Learn Library offers a range of supervised, unsupervised, and reinforcement learning techniques. With this library, data items can be categorized and grouped.

5)Nltk library: The initials nltk stand for natural language tool kit library. As suggested by the name, this library is used to create NLP modules. It is intended to make English more understandable in machine learning models. The three main procedures that must be carried out on the dataset before training an NLP model are tokenization, stemming, and lemmatization. The NLTK library has numerous built-in methods and functions that can be utilised immediately by just utilising the values in the dataset.

APPLICATIONS OF MATRICES IN DATA SCIENCE

1)Linear algebra:

In linear algebra, matrices are a strong tool with a wide range of applications. Some of the main applications of matrices in linear algebra include solving systems of linear equations, linear transformations, eigenvalues and eigenvectors, determinants and orthogonal matrices.

Solving systems of linear equations: Systems of linear equations can be represented as matrices, and their solutions can be found by applying the methods of matrix algebra. For instance, the Gaussian elimination approach entails converting a matrix into its reduced row echelon form so that the system of equations' solutions can then be ascertained.

Linear transformations: Matrix representations of linear transformations between vector spaces are available. The transformation that an A matrix represents takes an x vector and translates it to an Ax matrix. As a result, matrix algebra can be used to examine linear transformations.

Eigenvalues and eigenvectors: The eigenvalues and eigenvectors of a linear transformation can be discovered using matrices. These are crucial ideas in linear algebra, and there are many uses for them in disciplines including physics, engineering, and computer science.

Determinants: A determinant, or scalar value, is a property of matrices that can be used to determine an object's invertibility. This is significant because systems of linear equations with

invertible matrices have unique solutions.

Orthogonal matrices: Matrix representations of orthogonal transformations, which maintain the length and angle of vectors, are known as orthogonal matrices. In areas like computer graphics, where they are utilised to rotate and transform images, orthogonal matrices are widely used.

2)Dimensionality reduction and data compression:

In dimensionality reduction, the process of lowering the number of features or variables in a dataset while keeping the most crucial data, matrices are crucial. Principal Component Analysis (PCA), one of the most widely used techniques for dimensionality reduction, involves identifying a collection of variables that are linearly uncorrelated and are referred to as principle components since they account for the majority of the variance in the data. This technique makes significant use of matrices. In particular, the data is shown as a matrix, where each row represents a data point or observation and each column a variable. Afterwards, this matrix is normalised, giving each variable a mean value of 0 and a variance value of 1. The Singular Value Decomposition method is then used to separate the standardised data matrix into its eigenvectors and eigenvalues (SVD).The primary components of the data are represented by the eigenvectors, and the variance explained by each component is represented by the eigenvalues. The first k eigenvectors are used to generate a new matrix with k columns in place of the original matrix's number of columns. The eigenvectors are sorted in decreasing order of their corresponding eigenvalues. The reduced dimensionality matrix is the name of this new matrix. The reduced dimensionality matrix can be applied to a number of applications, including as grouping, classification, and visualisation. The computational difficulty of these tasks is decreased by lowering the number of variables in the data, making it simpler to interpret the outcomes. In order to locate the most crucial information in the data while reducing its complexity, matrices are widely utilised in dimensionality reduction techniques like PCA.

3)Machine learning:

A fundamental idea in machine learning, matrices have numerous and varied applications. Data is usually represented as matrices in machine learning, where they are used to organise the data, modify it, and carry out mathematical operations like matrix multiplication and dot products. Machine learning heavily relies on optimization, and matrices are frequently used in optimization approaches. For instance, gradient descent requires incrementally updating a weight matrix to reduce a cost function. A well-liked machine learning method called neural networks models the connections between neurons using matrices. The forward and backward passes of a neural network include matrix operations, and the weights and biases are represented as matrices.

4)Image processing:

The subject area of image processing, which is devoted to the analysis and manipulation of digital images, makes extensive use of matrices. Digital images can be represented as matrices of pixel values, with each pixel standing in for a specific place in the image and having a value that reflects the pixel's colour or intensity. These pixel values are represented and altered using matrices. The technique of altering an image with a filter or kernel is known as image filtering. A new image is created by convolving a tiny matrix called the kernel with the image matrix. Convolution is a technique for extracting certain features from an image or for enhancing its sharpness or smoothness by conducting dot products between the kernel and a piece of the picture. As part of Singular Value Decomposition (SVD), which divides an image matrix into three matrices that each reflect a low-rank approximation of the original matrix, matrices are employed in image compression techniques. This method is used to shrink an image while keeping all of its important details. The division of a picture into various regions

or segments is known as image segmentation. These segments are represented as matrices, which can be adjusted or further examined. Convolutional neural networks (CNN) and other machine learning techniques are used for segmenting, classifying, and recognising images. The forward and backward passes in CNNs entail matrix operations, and the weights and biases of the network are represented as matrices.

5) Natural language processing:

In the study of natural language processing (NLP), which aims to give computers the ability to comprehend and produce human language, matrices play a key role. In NLP applications like language modelling, sentiment analysis, and text classification, word embeddings are a means to represent words as vectors of integers. Word embeddings are frequently made using matrices, where the columns represent the properties of the embedding vector and the rows represent specific words. Predicting the probability of a word sequence in a language is called language modelling. In language modelling, matrices are used to indicate the possibilities of each word in a sequence given the words that have come before. These matrices can be used to produce text or assess the effectiveness of language models. Finding the sentiment or emotion expressed in a text is a method known as sentiment analysis. In sentiment analysis, matrices are used to represent the text's characteristics, such as the frequency of specific words or phrases, and to train machine learning models to forecast the text's sentiment. The process of labelling or categorising a text involves text categorization. In order to train machine learning models to predict the category of the text, matrices are used in text classification to represent the properties of the text, such as the frequency of specific words or phrases.

6) Recommender systems:

In order to construct recommendation systems that offer consumers individualised recommendations based on their tastes and behaviour, matrices are a crucial component. User-item interactions are frequently represented in recommendation systems as a matrix, where each row represents a user and each column represents an item. The entries in the matrix depict how the user and the object interacted, for as through a rating or a purchase. The process of matrix factorization, which is widely used in recommendation systems, involves splitting the user-item interaction matrix into two or more matrices that represent the users' and the objects' latent properties. A user's interaction with something they haven't yet interacted with can be predicted using these latent traits. Using the preferences of other users who share their interests, collaborative filtering is a technique used in recommendation systems to find products that are likely to be of interest to a user. Finding user or item similarity, which can be represented using matrices, is the goal of this technique. The use of neural networks and other machine learning techniques in recommendation systems is also possible. In these situations, the input data, as well as the weights and biases of the neural network, are represented as matrices.

CONCLUSION

In conclusion, matrices are a powerful tool in data science, used in variety of range applications like linear algebra, dimensionality reduction, data compression, machine learning, image processing, natural language processing and recommended systems. Matrices are impactful in these applications if we apply certain operations like transposition, inversion, and determinant calculation. These operations can be executed using some of the most popular python libraries which used in performing data science operations such as

Numpy, Pandas, matplotlib library, skit-learn library and Nltk library.

A. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named "Heading 1", "Heading 2", "Heading 3", and "Heading 4" are prescribed

ACKNOWLEDGEMENT

I would like to thank our teachers and professors who gave us a chance to work on this project. We are very grateful that they provided valuable suggestions for the betterment of the project, which we greatly appreciate them for doing so. I would like to convey our sincere gratitude to my mentor Dr. Vinita Agarwal for her considerable support. Furthermore, I want to extend special thanks towards TCET because without their resources then none of what is seen now could have been possible in terms of creative or intellectual development. Last but not least, everyone involved in this deserves recognition such as family members and friends.

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Carbon Capturing Titans

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Abstract— Carbon capturing titans are large-scale systems designed to capture carbon dioxide (CO₂) from two types of sources -natural and artificial, and store it underground in order to reduce greenhouse gas emissions and mitigate the impacts of climate change. This can be divided into two main categories: natural carbon capturing titans and artificial carbon capturing titans. Natural carbon capturing titans utilize natural processes. These include plants and animals that capture or store carbon within themselves. On the other hand, Artificial carbon capturing titans use man-made technologies, such as chemical processes to capture and sequester CO₂.

This paper provides a review of the current state in the creation and deployment of both natural and artificial carbon capturing titans. The paper includes an overview of the various technologies that are being used, the economic and technical challenges posed by CSS (Carbon Capture and Storage) and CCU (Carbon Capture and Utilization), and the potential benefits and limitations of this approach to mitigate greenhouse gas emissions. The study also throws light on the need of combining natural and manmade carbon capture systems for maximum efficiency in mitigating the impacts of climate change

Keywords— artificial, natural, sequester, Carbon Capture and Storage, Carbon Capture and Utilization, limitations.

I. INTRODUCTION

To prevent dangerous global warming, it has become necessary to reverse the trend in global greenhouse gases and ensure that they reach net zero by mid-century. Although energy is the main driver of economic growth, the majority of global emissions come from. of energy use. That is why it is necessary that the global energy system is decarbonized. In 2015, world leaders agreed in Paris, due to the increasing global emissions, to continue efforts to keep the increase of global average temperatures well below 2⁰ C above pre-industrial levels, and then to limit the temperature at degrees. Rise 1.5⁰ C compared to pre-industrial times. Governments, business organizations and individuals play a major role in achieving this goal. The main methods of achieving net zero emissions include removing carbon dioxide from the atmosphere through reforestation, better weathering of minerals or direct capture of carbon dioxide from the air. Emissions trading and reducing emissions through energy efficiency and the use of renewable energy sources represent some of the main approaches. To achieve the goal of zero emissions, there must be political change at all levels, technological development must be adapted to international

climate goals, and the behavior of companies and individuals must be changed to protect the environment [1]. However, net-zero emissions can be achieved mainly in three ways:

- (1) Emissions compensation: is the reduction or avoidance of emissions of carbon dioxide or other greenhouse gases in one sector to compensate for emissions elsewhere. This goal can be achieved by investing in energy efficiency, renewable energy or other low emission technologies [2].
- (2) Carbon sequestration: This refers to the removal of carbon dioxide from the atmosphere and long-term storage to mitigate the effects of global warming. Carbon sequestration occurs both naturally and through artificial processes [3].

CO₂ is removed from the atmosphere naturally through biological, chemical and physical processes and mainly in green plants and trees, in soil as organic debris, in geological formations, infinity and in oceans. This is the process by which nature reached an equilibrium in the CO₂ atmosphere that optimally supports life. However, several artificial methods have been developed to achieve a similar goal, such as: It is estimated that improved farming practices can capture and remove from the atmosphere approximately 600 megatons of CO₂ equivalent (MtCO₂e) per year. equivalent to about 10% of the emissions of in 1990 [3].

- (3) Reduce emissions: This means minimizing emissions of carbon dioxide and other greenhouse gases by adapting industrial, agricultural and other processes, such as the use of renewable energy sources such as solar and wind energy, and energy efficiency. emission reduction processes. Although both fossil fuels and non-fossil fuel-based energy sources produce emissions, non-fossil fuel-based energy source produce significantly lower emissions [4-5].

II. OBJECTIVE

Unprecedented changes in the climate system and significant increase of the surface temperature have been reported in the past decades [12]. Carbon dioxide (CO₂), methane (CH₄) and

nitrous oxide (N₂O), also known as greenhouse gases, have been releasing in the atmosphere for decades. They are recognized nowadays as the major factors behind the undesirable climate change. Burning fossil fuels for power generation, industrial processes and transportations have led to the huge increase of CO₂ concentration in the atmosphere while agricultural activities and deforestation are the main cause of increase in the concentration of CH₄ and N₂O [13].

Many studies were carried out in the past decade to reduce the increasing concentration of CO₂ in the atmosphere where several approaches such as reduction of energy consumption, swapping to fuel with shorter carbon chains, and capturing and storage of CO₂ have been proposed [14]. It was then appeared that the carbon capture and storage (CCS) technology can be a promising approach to save the climate by injecting CO₂ into geological formations [14–16]. In fact, if implemented successfully, the CCS can reduce the concentrations of CO₂ to 50 ppm by 2100 [13]. The concept of CCS was introduced in 1977, when it was suggested that CO₂ could be captured from the coal power plant and injected into suitable geological formations [17]. The International Energy Agency has claimed that this technology has the capability to reduce 17% of global CO₂ emission by 2050, and as such the CCS must be part of the policy in every single country worldwide to mitigate the severe effect of global warming [14]. A total number of 800 sedimentary basins across the continents have been determined as a suitable geological site for CO₂ storage [18].

In recent years, many CCS projects such as CO₂ SINK, In-Salah, RECO₂POL, Sleipner and Otway have been launched in different countries [12–19]. Among them, Sleipner and In-Salah are the most advanced CCS projects. Sleipner in Norway was started in 1996 to inject CO₂ into saline groundwater with a capacity of 0.9 million tons per year (Mt/yr). In-Salah, an industrial-scale CCS demonstration project in Algeria, was initiated to test the feasibility of CCS for reintroducing CO₂ to an aquifer with a capacity of 1.2 Mt/yr [26]. CO₂ SINK, on the other hand, is a research project developed and demonstrated in Ketzin, Germany, managed by Shell to introduce/control CO₂ into deep salty water in the ground. RECO₂POL (Reduction of CO₂ Emissions by CO₂ Storage in Coal Beds of the Silesian Coal Basin in Poland) is a pilot project of Enhanced Recovery of Coal Bed Methane (ECBM) known as the first demonstration project for economic analysis and technical feasibility. CO₂ storage in coal seams [27]. However, several CCS projects have been implemented in recent decades, and there are currently 22 major CCS projects worldwide.

III. THEORY

A. Carbon Emissions Problem

Burning fossil fuels for energy leads to the emission of carbon dioxide. The amount of carbon emissions trapped in our atmosphere causes global warming. Global emissions of carbon dioxide by fossil fuel is increasing 2.7% annually over the past decades.

B. Sources

Power plants, oil refineries, biogas sweetening as well as production of ammonia, ethylene oxide, cement and iron and steel are the main industrial sources of CO₂ [6]. So, to reduce the emission we came over the idea of CCS (Carbon Capture and Storage) and CCU (Carbon Capture and utilization). In CCS the carbon is captured and stored while in CCU the carbon is captured and utilized. CCS is technology that allows to even capture more than 90% of CO₂. The main thing

is to capture the carbon, the captured carbon is not pure it contains impurities which helps in corrosion and may react with other things and form corrosive material. These. So for separation we have 3 methods:

- i. Post conversion
- ii. pre conversion
- iii. Gas fuel combustion
- iv. Amine Scrubbing

Post conversion:

In the carbon producing areas this system is installed in this the carbon is captured after the fuel combustion because of these we can retrofit in the existing plants this can capture 90 % carbon. The purity is most compared to others and the energy penalty is up to 30%.

Pre conversion:

In this process the carbon is captured before combustion and it can't retrofit in existing plants. This process can only be applied for power plants and limited industrial plants. This can capture 90% carbon also the energy penalty is almost less than post conversion about 20% but it can't be retrofitted in existing plants and it is very expensive.

Gas fuel combustion:

The capture of CO₂ takes place after the fuel is burnt with pure oxygen instead of air. This process can be involved in power plants and industrial plants which occurs combustion in this less amount of nitrogen oxide is emitted and no need of extra chemical process and capture 100% carbon but it has very high capital investment and to retrofit in old existing plants it is very expensive and difficult.

Amine Scrubbing:

This method calls for running exhaust through a column filled with an alkaline amine solution. The compounds in the alkaline amine solution will bind the CO₂. Now, to release the carbon dioxide from the amine solution we heat it, so that we can compress it and later store it.

But this requires energy, which means burning fossil fuels and releasing carbon dioxide. So, it's not a fool proof method. Already existing CCS technologies capture tens of millions of tons of CO₂ each year but it is not enough. We need more CCS facilities to reduce emissions and we also need to capture the already existing CO₂ that is already in the environment. This is where Carbon Dioxide Removal (CDR) comes into play.

IV. THE PROBLEM WITH CARBON DIOXIDE REMOVAL (CDR):

CO₂ makes a very small percentage of the earth's atmosphere and there aren't any existing technologies that are efficient enough to suck out large quantities of CO₂ from the atmosphere. Even if there existed a CDR technology that was 100% efficient, we would need to remember that earth has a natural Carbon Cycle where the ocean and lands are releasing carbon dioxide continuously, and even if we were to get rid of the atmospheric carbon dioxide, that shift in the equilibrium itself would pull out a lot of carbon dioxide from the ocean. A few technologies exist to remove CO₂ from the atmosphere:

- i). Restoring "Blue Carbon" Marine Ecosystem.
- ii). Deploying Kelp into the oceans.

iii). Direct air capture.

V. OVERVIEW OF THE CCS AND CCU TECHNOLOGIES

CCS (Carbon Capture and Storage):

Once captured, CO₂ is compressed and shipped or pipeline to be stored either in the ground, ocean or as a mineral carbonate [7,8]. CO₂ storage in geological formations is at present probably one of the most promising options Ocean storages relies on the principle that the ocean bed has a huge capacity to store injected CO₂ at great Depths. Yet, ocean storage has never been tested on the large scale Even though it has been studied for over 25 years [7,8].

The main concerns with CO₂ storage are its possible leaks and the related damage that a concentrated CO₂ stream would cause if It escaped into the environment. The annual leakage rates reported in the literature range from 0.00001% to 1%, depending on the Permeability of the geological structure and its faults or defects [7].

CCU (Carbon Capture and Utilization):

As an alternative to storage, captured CO₂ can be utilized in the following ways-

Direct utilization of CO₂:

several industries utilize CO₂ directly. For example, in the food And drink industry, CO₂ is commonly used as a carbonating agent, Preservative, [9].

Enhanced oil and coal-bed methane recovery:

CO₂ Injected under supercritical conditions, it mixes well with The oil to decrease its viscosity, thus helping to increase the Extraction yields [10]. Under special conditions, the injected CO₂ could Remain stored underground, similar to geological storage.

Conversion of CO₂ into chemicals and fuels:

Carboxylation Reactions where the CO₂ molecule is used as a precursor for Organic compounds such as carbonates, acrylates and polymers, or reduction reactions where the C55O bonds are broken to Produce chemicals such as methane, methanol, syngas, urea and Formic acid [6]. Furthermore, CO₂ can be used as a Feedstock to produce fuels, for example, in the Fischer–Tropsch Process [11]. Consequently, CO₂ is released into the atmosphere Before the benefits of the capture can be realise. For that reason, Future research efforts should focus on the synthesis of materials and products with longer lifespans.

Mineral carbonation:

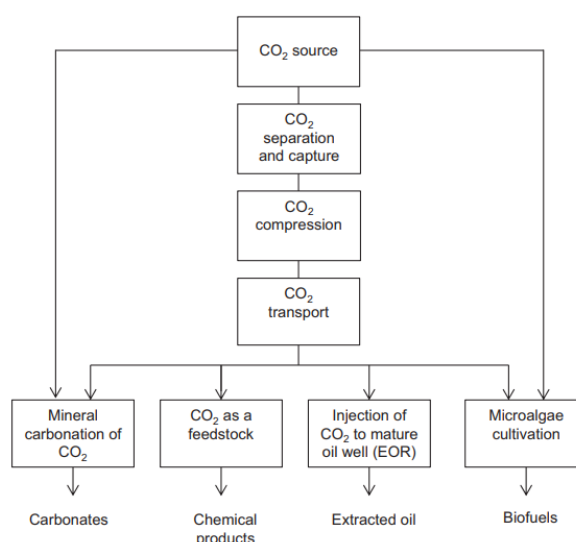
Mineral carbonation is a chemical process In which CO₂ reacts with a metal oxide to form carbonates The main advantage of mineral carbonation is the formation of stable carbonates capable of storing CO₂ for long periods (decades to centuries) [6], without the risk

of CO₂ leakage as In CCS [7,8].

Biofuels from microalgae:

CO₂ can be used to cultivate Microalgae used for the production of biofuels [10,11]. Micro-Algae have the ability to fix CO₂ directly from waste streams such as flue gas as well as using nitrogen from the gas as a nutrient [6]

But those options which merely delay the Emissions of CO₂ rather than eliminate them permanently. Although from an economic perspective, CCU would appear to Be a better option than CCS, the potential of CCU is still limited as the current global Demand of chemicals and other products does not have the Capacity to sink enough CO₂ emissions issue For CCU is that the ‘storage’ time of CO₂ is limited by the short Lifespans of the chemicals and fuels produced. While CCS overcomes this problem through long-term Storage, there is a risk of CO₂ leakage which could potentially Cause more damage than if



dilute emissions were to continue Unabated.

Fig.1 Various ways to utilize CO₂ [28]

IV. RESULT AND DISCUSSION

Comparing with existing literatur ,the most relevant assumptions for the quantitative assessment are majorly three

- (i) the heat supply technology,
 - (ii) the energy penalties (electricity and heat) of DAC, and
 - (iii) the energy consumption or penalties of water electrolysis.
- It has become very important to focus on the effects of CCS and CCU routes therefore these 3 steps are taken forward.
- 1) Heat supply: Heat pumps are used here to supply heat. Firstly H₂ is produced starting from carbon free electricity through water electrolysis and then burnt in boilers to give heat. The conversion of electricity to heat gives lower efficiency. The CO₂ regeneration is carried out through natural gas based oxy-fuel combustion, while in the DAC technology considered here and in Sutter et al.
 - 2) Energy penalties of DAC: The data which is different than those used in this work are found in paper by Gonzalez-Garay et al. Again. This is because they consider the technology presented by Keith et al.,64 which features (i) a higher electricity consumption and (ii) a lower heat consumption, with heat required at higher temperature. Since overall results in higher values of the total electricity consumption for the

Summary of LCA studies for CCS technologies [19,26,28,29,37,40,61–65].

Study	Scope	Carbon capture method	Storage option	Functional unit	LCA impacts ^a
Khoo and Tan [37]	Comparative LCA of different CCS technologies applied to a coal-fired power plant in the US, from cradle to grave	Post-combustion via chemical absorption, membrane and cryogenic separation, and pressure swing adsorption	Ocean and geological storage	1 MWh of electricity	GWP, AP
Viebahn et al. [29]	Comparative LCA of CCS and renewable energy technologies applied to PC, CCGT and IGCC power plants in Germany, from cradle to grave	Post-combustion via MEA Pre-combustion via rectisol and oxy-fuel combustion	Geological storage in a depleted gas field	1 kWh of electricity	GWP, AP, POCP, EP
Koornneef et al. [61]	LCA of three different PC power plants in The Netherlands with and without CCS, from cradle to grave	Post-combustion via MEA	Geological storage	1 kWh of electricity	GWP, AP, ADP, ODP, HTP, FAETP, MAETP, TETP, POCP, EP GWP
Odeh and Cockerill [28]	LCA of a PC, CCGT and IGCC power plants in the UK with and without CCS from cradle to grave	Post-combustion via MEA and pre-combustion via selexol	Geological storage in a depleted gas field	1 kWh of electricity	GWP, AP, POCP, EP
Pehnt and Henkel [26]	Comparative LCA of different CCS technologies applied to lignite PC and IGCC power plants in Germany, from cradle to grave	Post-combustion via MEA and pre-combustion via selexol Oxy-fuel combustion	Geological storage in a depleted gas field	1 kWh of electricity	GWP, AP, POCP, EP
Korre et al. [40]	LCA of several PC power plants with and without CCS, from cradle to grave	Post-combustion via MEA, PZ, KS-1 ^b	Not specified	1 MWh of electricity	GWP, AP, ADP, HTP, FAETP, POCP, EP GWP, EP
Modahl et al. [62]	LCA of four CCGT power plants in Norway with and without CCS, from cradle to grave	Post-combustion via MEA	Ocean storage below the sea bed	1 TWh of electricity	GWP, AP, HTP, POCP, EP
Schreiber et al. [63]	LCA of a coal-based power plant in Germany with and without CCS, from cradle to grave	Post-combustion via MEA	Not specified	1 kWh of electricity	GWP, AP, HTP, POCP, EP
Nie et al. [64]	Comparative LCA of different types of CCS in a PC power plant, from cradle to grave	Post-combustion via MEA and oxy-fuel combustion	Geological storage in a saline aquifer	1 MWh of electricity	GWP, AP, ADP, ODP, HTP, MAETP, TETP, POCP, EP
Singh et al. [65]	LCA of a CCGT power plant with and without CCS, from cradle to grave	Post-combustion via MEA	Geological storage in a saline aquifer	1 kWh of electricity	GWP, AP, HTP, FAETP, MAETP, TEPT
Singh et al. [19]	Comparative LCA of different CCS technologies in CCGT and IGCC power plants, from cradle to grave	Post-combustion via MEA, pre-combustion via selexol and oxy-fuel combustion	Ocean storage below the sea bed	1 kWh of electricity	GWP, AP, HTP, FAETP, MAETP, TEPT

^a ADP, abiotic depletion potential; AP, acidification potential; EP, eutrophication potential; FAETP, fresh water aquatic ecotoxicity potential; GWP, global warming potential; HTP, human toxicity potential; MAETP, marine aquatic ecotoxicity potential; ODP, ozone depletion potential; POCP, photochemical ozone creation potential; TETP, terrestrial ecotoxicity potential.

^b PZ, piperazine and potassium carbonate; KS-1, hindered amine.

based are on DAC.

3) Energy penalty of water electrolysis: This data are found in the paper by Gonzalez-Garay et al. The conservative value for this is 52.3 MWh/tH₂ (64% LHV efficiency), if we use 47.6 MWh/tH₂ (70% LHV efficiency) which is a rather optimistic value. This shows high electricity consumption. For the CCU routes only 10% is obtained from the total electricity consumption which has been reduced. The values of electrolysis efficiency is mostly similar to thermodynamic limit (around 80% LHV).

A. Life cycle environmental impacts of CCS and CCU:

This section reviews and analyses LCA studies for different CCS and CCU options. Overall, 27 studies were found in the literature, of which 11 focused on CCS and 16 on CCU. Environmental impacts of both CCS and CCU are explained in the further section.

B. Environmental Impacts of CCS:

Over the past decade, several studies have evaluated the life cycle environmental impacts of CCS technologies. These are listed in Table below, the goal and scope varied in different studies. For different CCS technologies applied to fossil-fuel based power plants, also compared the environmental performance of CCS against those from renewable energy technologies such as wind and solar thermal. The rest of the studies assessed the environmental impacts of power plants with and without CCS technologies

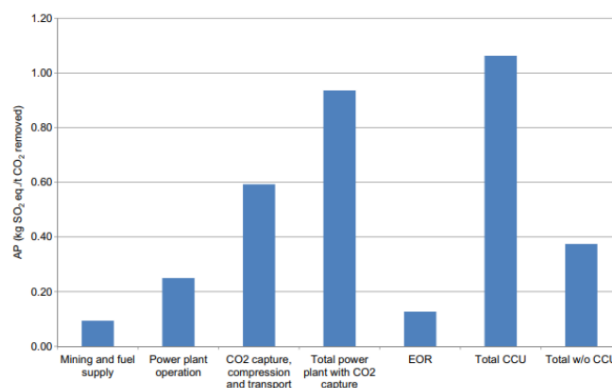
The GWP for the PC, CCGT and IGCC plants are compared in the above graph, these indicate that the greatest GWP

combustion in PC and IGCC plants and the lowest by post-combustion capture in CCGT plants (63%).

Fig.2 studies conducted for CCS technologies[28]

The above graph shows the contribution to global warming of different life cycle stages for PC, IGCC and CCGT power plants with CCS. As can be observed from Fig. above, fuel supply and CO₂ emissions from power plants are the main contributors to the GWP in the life cycle of CCS, contributing on average 53% and 28%, respectively. The GWP from CO₂ capture is only significant for CCGT power plants, adding between 5% and 31%.

Hertwich et al. [12] also found that the EOR increases the AP by almost three times compared to the system without CCU (Fig. 20). This is mainly because of the ammonia emissions from the CO₂ capture plant, which contribute 56% to the total AP. This is twice as high as the AP from the acid emissions at the power plant, which contribute 23% to the total; the EOR activities add a further 12%.



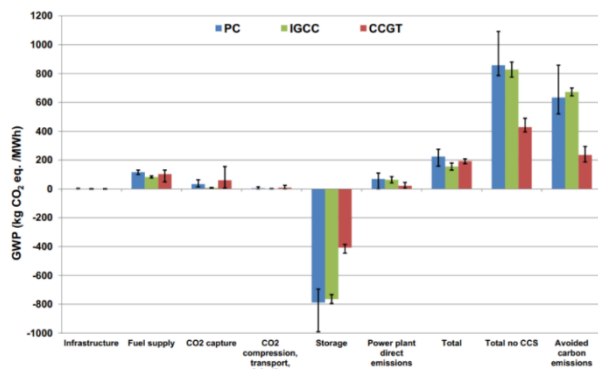


Fig.3 contribution of PC, IGCC and CCGT [28]

Comparison Of CCS And CCU:

Fig.4 Study for CCU [28]

This section compares the environmental impacts of different CCS and CCU technologies discussed in Sections 3.1 and 3.2, respectively. To enable the comparison, the functional unit is defined as “1 ton of CO₂ removed” and the original results have been recalculated accordingly as detailed in Supplementary

Table 3
Summary of LCA studies of CCU.

Study	Scope	Ca
Mineral carbonation		Pt
Khoo et al. [6]	LCA of a CCGT plant in Singapore with carbon capture and mineral carbonation (with and without heat recovery), considering mining and shipment of serpentine from two different locations in Australia	ca
Khoo et al. [68]	LCA of a CCGT plant in Singapore with and without carbon capture and two mineral carbonation processes, considering mining and shipment of serpentine from Australia	Pt
Nduagu et al. [38]	LCA of coal power plant in Canada including coal and serpentine mining and transport, carbon capture, transport and mineralisation	ca
Production of chemicals		Rt
Aresta and Galatola [66]	Comparative LCA of the synthesis of dimethylcarbonate (DMC) via conventional route with phosgene and an alternative route using captured CO ₂ as a feedstock (urea-based synthesis)	st
Enhanced oil recovery		
Jaramillo et al. [67]	LCA of five IGCC plants in the US with carbon capture, compression, transport and use for EOR, including crude oil refining and combustion of refined products	Pre-combustion capture via selexsol
Hertwich et al. [12]	LCA of a 832 MW CCGT plant in Norway with carbon capture, compression, transport and use for EOR	Injection into oil field for EOR
Diesel production from microalgae		
Lardon et al. [55]	Cradle to gate LCA of biodiesel produced from microalgae (<i>Chlorella vulgaris</i>) in an open raceway pond in France	Total production of electricity over the projected lifetime
Brentner et al. [51]	Comparative cradle to gate LCA of biodiesel produced from microalgae (<i>Scenedesmus dimorphus</i>) through various methods available in the US	Production of 1 MWh of electricity; extraction of 1 m ³ of oil
Campbell et al. [60]	Comparative LCA of biodiesel production from microalgae in open raceway ponds with canola biodiesel and ultra-low sulphur diesel in Australia	GWP, AP
Clarens et al. [69]	Cradle to gate LCA of biodiesel produced from microalgae (<i>Phaeodactylum</i> sp. and <i>Tetraselmis</i> sp.) in an open pond in the US	GWP, AP, EP, ADP, ODP, HTP, MAETP, POCP, land competition and ionising radiation
Shirvani et al. [57]	Cradle to gate LCA of biodiesel produced from microalgae (<i>Chlorella vulgaris</i>) in an open raceway pond in various countries. The results were compared with fossil diesel	GWP, EP, energy, land requirement, water use
Borkowski et al. [59]	Cradle to gate LCA of biodiesel and renewable diesel produced from microalgae in open ponds located in Phoenix, AZ, USA. The study looked at different allocation scenarios for waste	GWP
Passell et al. [54]	Cradle to gate LCA of biodiesel produced from microalgae (<i>Nannochloropsis</i> sp. and <i>Nannochloropsis</i> sp.) in an open pond in Israel. The results were compared with other types of diesel	GWP, POCP, energy, water use, SO ₂ and NO _x emissions
Soratana et al. [56]	Cradle to gate LCA of biodiesel produced from microalgae (<i>Chlorella vulgaris</i>) in a flat-plate photobioreactor in the USA. The results were compared with other types of diesel	GWP, EP, POCP
Zalmes and Khanna [58]	Cradle to gate LCA of biodiesel produced from microalgae in open raceway ponds in the US. Multiple production pathways considered	GWP, energy
Stephenson et al. [70]	Cradle to gate LCA of biodiesel production from microalgae (<i>Chlorella vulgaris</i>) in open raceway ponds and tubular bioreactor in the UK	GWP

As indicated in Fig. 24, the average GWP in the CCS studies is significantly lower than for the CCU options. The worst CCU option appears to be the production of chemicals, specifically DMC from waste CO₂, which Almost two tons of DMC need to be produced in order to remove one ton of CO₂, requiring large quantities of reactants such as ammonia and naphtha, which increases the impact relative to CCS [66]. However, as there is only one rather dated study of the production of chemicals from CO₂ and is specific to DMC only, in the absence of other data these findings cannot be corroborated or extrapolated to other types of chemical. This indicates a research gap in terms of LCA studies related to CCU via production of chemicals. The second worst option is biodiesel production with the average GWP four times higher than for CCS. However, the GWP for this option varies significantly depending on the technologies and process conditions assumed (for details, see Section 3.2) so that at the lower range biodiesel has a lower GWP than the lowest value CO₂ removed. The former refers to biodiesel from microalgae cultivated in open raceway ponds and the latter to CCS using pre-combustion via selexol coupled with IGCC and ocean storage below the sea bed.

VI. RESULTS:

- Results show that the GWP from power plants can be reduced by 63-82% per unit of electricity generated, depending on the CO₂ capture alternative.
- The average GWP for pulverized coal (PC) power plants without CCS is 876 kg CO₂ eq./MWh while for the post conversion capture via MEA the average value is 203 kg CO₂ eq. and for oxy-fuel combustion it is 154 kg CO₂ eq.
- The equivalent average values for CCS at CCGT power plants are estimated at 120 kg CO₂ eq./MWh for oxy-combustion and 173 kg for post conversion, compared to 471 kg CO₂ eq./MWh without CCS.

VII. CONCLUSION

In conclusion both natural and artificial carbon capturing titans play a major role in mitigating the effects of climate change. India's per capita energy consumption and carbon dioxide emissions are significantly lower compared to other countries. It needs to expand its energy supply to ensure universal access to modern energy and sustain economic growth through decarboxylation. India's growing dependence on foreign energy sources has important political implications for the country's energy security. and its coal-centric energy source and increasing carbon dioxide emissions pose serious challenges to India's sustainable development [29]. Hence it is clear that CCS and CCU have a key role to play in reducing global carbon emissions and addressing the challenges of climate change. The successful implementation of these technologies will require a range of policy and regulatory measures, as well as continued research and development efforts to improve their efficiency, affordability, and scalability. However, there are still some uncertainties regarding the long-term effectiveness and safety of CCS technology. Many policies are in the works for the future scope of artificial carbon sequestration. Nonetheless, CCS and CCU technologies are not the silver bullet and should be followed parallel to geological sequestration. The field of carbon Capture and Storage and Carbon Capture and Utilization is a promising solution to reaching our target of net zero emissions.

VIII. ACKNOWLEDGMENT

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FUTURE OF EDUCATION SYSTEM

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Abstract—Education is to development of a country as foundation is to a building. Education is a necessity and its quality defines the direction of a country's progress. The following paper defines how the present education system is not up to the mark it could be and what the present generation, the Gen-Z, feel about it. The paper also presents a model of Education System that can be followed to ensure a better result as compared to the present System.

I. INTRODUCTION

The Education System is the foundation of a country's Economy. The stronger a country's education, the stronger will be its economy. A well-educated population is more likely to improve the economy than an illiterate population. However, the responsibility of our current education system lies on the shoulders of underpaid and overworked teachers who try their best yet are unable to fulfill their duties. A better Education System can be implemented slowly and steadily. The latest presented budget is working towards the goal by setting aside the highest ever budget for education, ₹1.12 lakh crore, an increase of 8.2% over the previous budget.

Higher education in India has experienced phenomenal expansion since independence. India has produced scientists, engineers, technologists, doctors, teachers and managers who are in great demand all over the world. Now it is one of the top ten countries in our industrial and technological capacity, because of the significant contribution of manpower and tools provided by higher education, especially, technical education. Methods of higher education also have to be appropriate to the needs of four pillars of education, learning to learn, learning to do, learning to be and learning to become. (Ganihar &Bhat 2006) Student centered education and the employment of dynamic method of education will require from teachers new attitudes and skills (Saravanakumar &Mohan 2008) Methods of teaching through lectures will have to be supplemented with the methods that will lay stress on self-study, personal consultation between teachers and students and informative sessions of seminars and workshops. In engineering Indian society, knowledge creation, exchange, networking and highest utilization have become most vital for the advancement of nature. India needs to make the Proceeding of the Social Sciences Research ICSSR 2014 (e-ISBN 978-967-11768-7-0). 9-10 June 2014, Kota Kinabalu, Sabah, Malaysia. Organized by <http://WorldConferences.net> 485 system of education innovative and futuristic in order to respond to the changing demands of the modern society. India has already entered into the era of knowledge

explosion. It has proved its tremendous potential by its performance in nuclear and space domains. In the coming few decades will be heralded by space craft, satellites, internets and others offshoots of scientific enquires. The recent development in communication technologies have helped to cross the barriers of time and distance. Borders have become porous and the sky open. The success story of the post independent India turns out bleak when the question of quality is raised. Higher education has been finding it difficult to meet the challenges of unplanned expansion, educated unemployment, uneven growth, commercialization of education, financial crises, teacher burnout and the digital divide of quantity versus quality, equity versus excellence, and creativity versus conformity which are posing continuous threats to higher education. The student of today learning a specific content of information will find to his amazement that he is not prepared to face the life which he has to live for the next five decades because the knowledge furnished with, has become outdated long back. The Report of National Commission of Excellence in Education (1983) in the United States warns that the "educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens the very future of a nation and a people". In the context of multinational entering into the field of education, quality assurance has become a necessity. India will have to decide on what knowledge and /or skills would be most helpful to prepare students for adjustments to continuing change. The impact of continued change will be visible in the content of the curriculum, its form and the process of decision making that shapes it.[1]

The present education system focuses on a few career-goals that a student can pursue but a lot of career options are unavailable because of stigma attached with non-conventional career-options. Even for the mainstream options, students do not get to choose what they want to study until they reach at least class 8, or in some cases, class 10. This means an art-oriented child has to learn the mainstream subjects and concepts that do not help him, and which he is unable to comprehend until he is 15.

A few subjects are important for all and must be taught to all, but subjects that do not interest a child are taught to him because that is what a full curriculum is. Students who have more grasp of the subjects taught mainstream do not have any issues and score great scores, but a student with a different mindset, oriented towards commerce, or any other stream for that matter, are unable to grasp the same topics and score average scores.

The Education System can be greatly improved by simply inculcating other subjects since primary levels and letting a

student choose their subjects term-wise from a younger age.

The Government had suggested a new model in 2020, which received great criticism from the entire country due to its different nature as compared to the present curriculum. The Education policy of 2020 wanted to focus on individual growth by focusing on various languages, but would make it difficult for some students who might not enjoy a course that forced them to learn more languages than necessary. A few states have accepted this policy into their curriculum and they are studying according to the new policy.

II. National Policy On Education

The National Policy on Education (NPE) is a policy formulated by the Government of India to promote and regulate education in India. The policy covers elementary education to higher education in both rural and urban India.

Since the country's independence in 1947, the Indian government sponsored a variety of programs to address the problems of illiteracy in both rural and urban India. Maulana Abul Kalam Azad, India's first Minister of Education, envisaged strong central government control over education throughout the country, with a uniform educational system. The Union government established the University Education Commission (1948–1949), the Secondary Education Commission (1952–1953), University Grants Commission and the Kothari Commission (1964–66) to develop proposals to modernize India's education system. The Resolution on Scientific Policy was adopted by the government of Jawaharlal Nehru, India's first Prime Minister. The Nehru government sponsored the development of high-quality scientific education institutions such as the Indian Institutes of Technology. In 1961, the Union government formed the National Council of Educational Research and Training (NCERT) as an autonomous organization that would advise both the Union and state governments on formulating and implementing education policies.[2]

The National Education Policy of India 2020 (NEP 2020)[3], which was started by the Union Cabinet of India on 29 July 2020, outlines the vision of new education system of India. The new policy replaces the previous National Policy on Education, 1986. The policy is a comprehensive framework for elementary education to higher education as well as vocational training in both rural and urban India. The policy aims to transform India's education system by 2030. The NEP 2020 enacts numerous changes in India's education policy. It aims to increase state expenditure on education from around 3% to 6% of the GDP as soon as possible. The National Education Policy 2020 has 'emphasized' on the use of mother tongue or local language as the medium of instruction till Class 5 while, recommending its continuance till Class 8 and beyond. The "10 + 2" structure will be replaced with "5+3+3+4" model.

- **Foundational Stage:** This is further subdivided into two parts: 3 years of preschool or anganwadi, followed by classes 1 and 2 in primary school. This will cover children of ages 3–8 years. The focus of studies will be in activity-based learning.
- **Preparatory Stage:** Classes 3 to 5, which will cover the ages of 8–10 years. It will gradually introduce subjects like speaking, reading, writing, physical education, languages, art, science and mathematics.
- **Middle Stage:** Classes 6 to 8, covering children between ages 11 and 13. It will introduce students to the more abstract concepts in subjects of mathematics, sciences, social sciences, arts and humanities.

- **Secondary Stage:** Classes 9 to 12, covering the ages of 14–18 years. It is again subdivided into two parts: classes 9 and 10 covering the first phase while classes 11 and 12 covering the second phase. These 4 years of study are intended to inculcate multidisciplinary study, coupled with depth and critical thinking. Multiple options of subjects will be provided.

III. PROPOSED MODEL

Against the present model, the Government has suggested higher funding to various educational fields and non-conventional career options are now given recognition, yet the number of students pursuing the conventional, main-stream options are more as compared to the non-conventional options. Students are still forced to score good in the conventional subjects at a younger age and options that make a difference are introduced at a later age.

Let us look at another model, where a student aged 6 is given options to select his/her subjects for the next term, a period of 3 months. Each term, he/she needs to select a different set of subjects. As he/she selects the subjects for the term, all the students who have selected the same subjects are grouped and taught by a group of teachers fluent in the subjects. Another teacher(s) is appointed in each class and their job is to make sure each student is able to comprehend what is taught. A student who is unable to understand the topics taught is helped by the secondary teacher to understand better.

At the end of a year, each student has learnt about the full set of subjects but at their own pace. Previously, they have already learnt the basics like the alphabets and the numbers. Following this, class 2 onwards, the students all have a few subjects like general mathematics, basic science (each child must learn about their health, first-aid, etc.) and each child can select his/her own subjects. The next 3–4 years, the students are taught their subjects of choice and may change their options without much difficulty. A group of teachers of the new subject can tutor a changing student and help him/her settle in.

At class 5 level, the students are tested to check their understanding of the topics. Students who score between 40–70% are retaught the topics as a revision and allowed to continue. Reteaching basically would include the subject teachers giving the students a quick recap of what was taught throughout the course, which would act like a refresher and make it easier for the students to understand further topics. Students who score between 25–40% are retaught and re-evaluated. The reteaching here is more of a detailed recap as compared to the revision for better scoring students, this would be a surety that the students would be able to get higher scores in the re-exams and also retain the information for the future. If their scores are still low, they are given an option to change their subject. Students below 25% are insisted upon to change their subjects. They can still continue the subject but may need to take a drop-year to revisit the curriculum. If they decide to change their subject, the new subject should be something of their interest yet easier than the first subject.

Each student, whether one who scores poorly, or one who gets full marks, is allowed to change their subject up until class 8. Post class 8, students have different course options, each having a different timeline, and a student can select any option in their subject. The opportunity to change the subjects whenever desired ensures that a student who selected a subject under peer or family pressure would change his/her subject easily and not regret it later. If a student desires to change their subject post class 8, they can do so but with some

difficulty as they may need to take a drop year to catch up on all the course-work.

In this model, as a student can select his/her own subject, the probability of a student not understanding is low. The students would select a subject they love, and hence would enjoy education rather than counting it as a daily-chore. A student who enjoys his/her education would be loving of his career too and would be a great asset to whatever organization he/she works with.

IV. CONCLUSION

The proposed model allows a student to select his/her own path and thus makes studying a fun activity rather than a chore. Students can enjoy studying, do homework daily without the interference of their parents, the parents would not have to force their children to study. This model allows a child to select a subject at age 7, a very young age some would say, but they are allowed to change their subjects till they appear for class 8 tests. They can change subjects easily, they would be taught by their teachers and receive video lectures and notes to refer. Post this, they can still change their subjects, but may need to take a year to learn it all and continue the education a year later. This model thus may be the new change that we need.

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Mathematics and the Strange World of Fractional Dimensions

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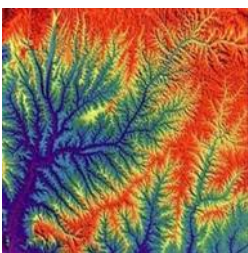
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Abstract— Brief introduction on fractals, the fractional geometry. Real world application. Importance of scaling in dimensions. Mathematics including $f(z)=z^2$

,Minkowski–Bouligand dimension, Mandelbrot and filled Julia set, Application in computer graphics, hidden sequences.

I. INTRODUCTION

We have learned since our childhood that dimensions are and have always been in the form of whole numbers, for example, a point has 0 dimensions, a line has 1 dimension while a plane has 2 dimensions, and a cube, for example, has 3 dimensions. But can we have dimensions in fractions? All the above cases are about real-world geometry, but the fractional dimension, on the other hand, exists in a complex system where we deal with complex numbers and complex planes. These fractional dimensions are also called as fractals (a word coined by American-French-Polish mathematician Benoit Mandelbrot).



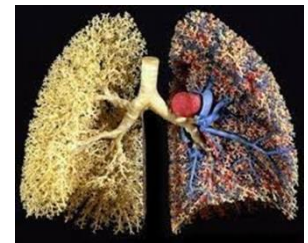
Fractals are never-ending patterns or geometric shapes containing detailed structures that repeat themselves at different scales. It is the base behind the unpredictable movements of a chaotic world. It can also be defined as the spatial patterns of nature which are so irregular or fragmented, that it is impossible to describe with the principle of classical geometry. We can even say that anything that we see that is too random to appear can be a fractal.

It originated from the Latin adjective "fractus" which means "irregular or fragmented". So it is a mathematical object such that when you zoom in or zoom out it will look

similar. They are and always have been related to the world of disorder, a universe of motion and not the static one.

The real-world application of fractals are as follows:

1. In astronomy, the structure of the universe can be seen as fractal at all scales.
2. In nature, we can see fractals almost everywhere, in the branches and roots of trees, the patterns on some fishes and shells, cauliflower, the feet skin of geckos, patterns of soil erosion, weather pattern, branches in leaf
3. It has great use in computer science to process images like converting them into jpeg or gif file formats, to enlarge pictures. In meta verse/gaming to smoothen the 3d graphics, and also to make game maps.
4. It is used widely in fluid mechanics in the study of turbulence, chaos, wind flow, and flame stimulation.
5. For telecommunication, fractal antennas (antenna shapes in fractal form) is used to produce and receive a wide range of frequency in very less space.
6. An important application of fractals is in surface physics. We use them to increase the surface area so that the roughness of the surface can be increased.
7. One recent research had also been conducted where it is found that our human brains and our consciousness work on this very format of fractals.
8. It can also be seen in the market trends in the field of economics.

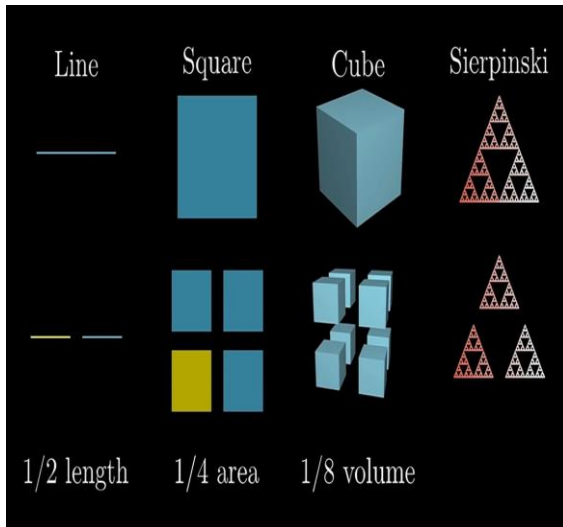


Based on similarity fractals are divided into two categories:

1. Perfectly self-similar
2. Not self-similar.

II. Scaling in Fractional Dimension

A fractal dimension is an index for characterizing fractal patterns or sets by quantifying their complexity as a ratio of the change in detail to the change in scale. Several types of fractal dimensions can be measured theoretically and empirically. In practice, however, fractal dimensions can be determined using



techniques that approximate scaling and detail from limits estimated from regression lines over log vs log plots of size vs scale.

Here we are dealing with perfectly self-similar shapes as it gives us a nice clear-cut way to compare masses. For example, a line can be broken up into 2 lines which are just a perfect copy of the original which is scaled down by 1/2. Similarly, a square can be broken down into four smaller squares each of which is a perfect copy of the original, just scaled down by 1/2. Similarly, a cube can be broken down into eight smaller cubes, where each one is again scaled down by 1/2. When we look at a perfectly self-similar fractal shape like the one of the Sierpinski triangle, we see a characteristic that it's made up of 3 smaller copies of itself, and the length of the side of one of those smaller copies is one-half the side length of the original triangle. When we measure (here it is the measure of its mass if all of them are made up of some metal) the above things/shapes change as we scale them, we would say that the smaller line is one-half the length of the original line, the smaller square is one-quarter the area of the original square, the small cube is one-eighth the volume of the original cube.

I. PREPARE YOUR PAPER BEFORE STYLING

Therefore, for line, the scaling factor = 1/2, and the mass scaling factor = 1/2; for square, the scaling factor = 1/2 and mass scaling factor = 1/4 = 1/2² for the cube, scaling factor = 1/2 and mass scaling factor = 1/8 = 1/2³, for Sierpinski triangle, scaling factor = 1/2 and mass scaling factor = (1/3)^D. The exponent here in the mass scaling factor (s(M)) of the shape is the dimension of the shape.

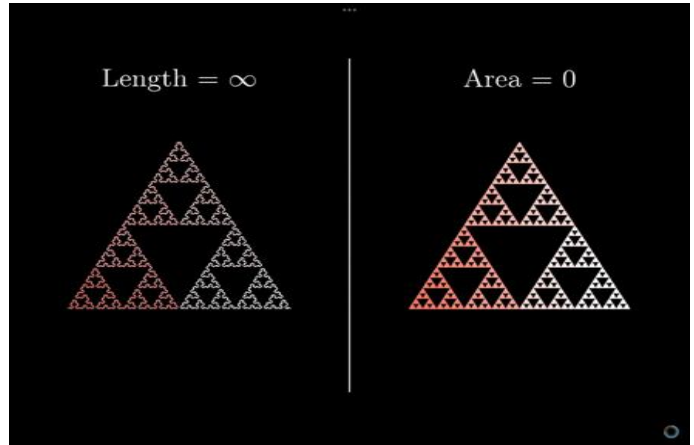
So for the Sierpinski triangle,

$$\therefore (1/2)^D = (1/3)$$

$$\rightarrow 2D = 3$$

$$\rightarrow D = \log_2(3) = 1.585$$

Thus we can say that the Sierpinski triangle is not 1 dimensional, even though you could define a curve that passes through all its points, and nor is it two-dimensional, even though it lives in the plane. We cannot define its length nor can we describe its area, as its length would turn out to be infinite, and its area turns out to be zero.



Let's look at another self-similar curve, the Van Koch curve. It is composed of 4 smaller identical copies of itself, each of which is a copy of the original scaled down by 1/3 and the mass by a factor of 1/4.

So scaling factor = 1/3 mass scaling factor = 1/4

$$\therefore (1/3)^D = (1/4)$$

$$\rightarrow D = \log_3(4) = 1.262$$

Therefore, we can speculate a formula, $s(L)^D = s(M)$

OR

$$D = [\ln(s(M))]/[\ln s(L)]$$

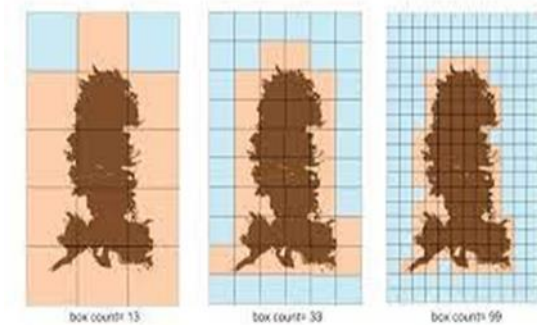
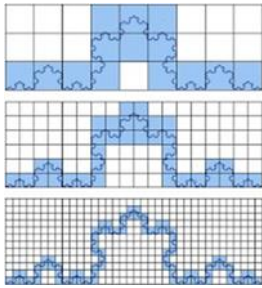
where, $s(L)$ = length scaling factor $s(M)$ = mass scaling factor

D = dimension

The above method is used for perfectly self-similar fractals.

Minkowski–Bouligand dimension (Box Counting dimension):

It is a way of determining the fractal dimension of a set A in a space R_n , or more generally in a metric space (X, d) . For example, let's assume a plane is covered with the grid and highlight all of the grid squares that are touching the fractal A . Now count how many squares are there. We also know that no. of grids should be proportional to their area. A clever way to verify this empirically is to scale up that fractal by some factor, for example to a factor of 2, and now count how many grid squares touch this new scaled-up version. We find that the no. of boxes touching has now increased approximately in proportion to the square of the scaling factor, which in this case means about four times as many boxes. So now, when we plot the scaling factor compared to the number of boxes that the scaled fractal touches, the graph shows a perfect parabola since the no. of boxes touched is roughly proportional to the square.



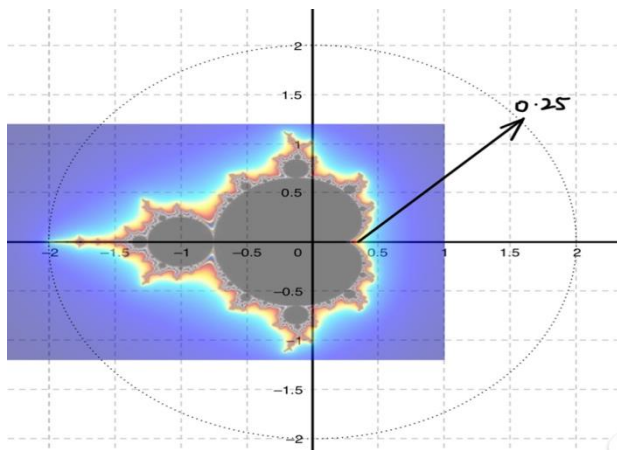
For the Sierpinski triangle, the data of curve of number of box touched vs scaling factor graph will resemble $y=x^{1.585}$, i.e, $f(x)=cx^{1.585}$.

The above can be formulated as such that, $\dim_{\text{box}}(A) = \lim_{D \rightarrow 0} \frac{\ln s(MD)}{\ln 1/D}$.

The above method can be used for both perfectly self-similar and not self-similar fractals.

Mandelbrot Set:

M the Mandelbrot set is the set of complex numbers c .



Let's take a complex number z , and let the following function be associated with this complex no.,

$$f_c(z) = z^2 + c \quad (1)$$

for equation (1), when we observe its behavior of 0 under iteration for $c=1$, $f_1(z) = z^2 + 1$

$$f_1(0) = 0^2 + 1 = 1 \quad f_1(1) = 1^2 + 1 = 2 \quad f_1(2) = 2^2 + 1 = 5 \quad f_1(5) = 5^2 + 1 = 26$$

.....

\therefore the series follows: 1, 2, 5, 26, 677 case 1

for equation (1), when we observe its behavior of 0 under iteration for $c=-1$, $f_{-1}(z) = z^2 - 1$

$$2 - 1$$

$$f_{-1}(0) = 0^2 - 1 = -1$$

$$f_{-1}(-1) = (-1)^2 - 1 = 0$$

$$f_{-1}(0) = 0^2 - 1 = -1$$

$$f_{-1}(-1) = (-1)^2 - 1 = 0$$

.....

\therefore the series follows: -1, 0, -1, 0, -1, 0 case 2

So we have 2 options for the size (the distance ($r = \text{mod}(a+ib)$) of iteration in the complex plain, from the point ($a+ib$) to 0) for $f_c(z) = z^2 + c$:

→ (case 1) the distance from 0 of the sequence gets arbitrarily large, that is the iterates go to infinity, that is the size of the no goes to infinity, so we can say that it blows up.

→ (case 2) the distance, or, the size is bounded, (here the distance never gets larger than 2), the iterates alternate between -1 and 0. so we can say that these don't blow up

-for a number to be in the Mandelbrot set it must be less than or equal to 2

-the last dot on positive x-axis (real axis) is 0.25

Some properties of the Mandelbrot set are as follows:

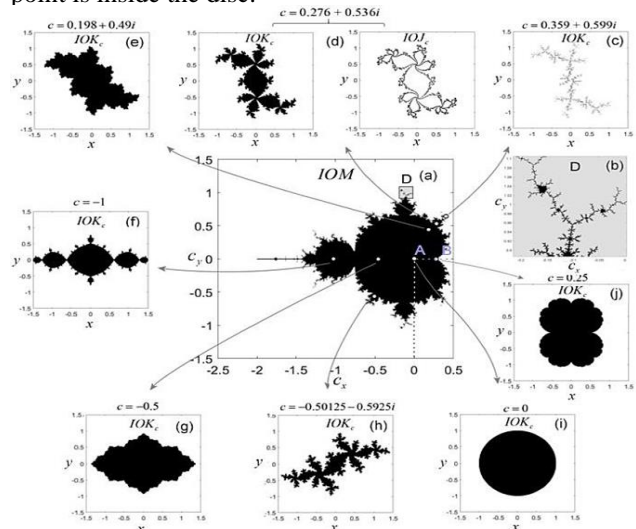
1. The graph of Mandelbrot set M is symmetric with respect to the real axis as the set contains complex numbers. therefore the conjugate of that complex number c also belongs to M .
2. The set always lies in the interior area of the circle $\text{mod}(z)=2$, thus we can say the Mandelbrot set is bounded.
3. It has the property of self-similarity to some extent.
4. The Mandelbrot set intersects with the x-axis, here the real axis, at intervals $[-2, 1/4]$

Filled Julia set:

This set is similar to the Mandelbrot set but here we are fixing the polynomial. It is the set of complex numbers z so that under iteration by the function ($f_c(z) = z^2 + c$) such that, the values don't go till infinity, that is the values don't blow up. this is not just for 0 but is done for any value of complex number.

For example, if $c=0$, $f_0(z) = z^2$. When seen on a complex plain graph, the equation we got turns out to be exactly the disc of radius 1, center at zero. If the point is outside the disc, it will blow up, but if the point is inside the disc, it won't blowup, it

will be bounded under iteration by squaring the map when the point is inside the disc.



Application of fractals in computer graphics :

Fractals are often used in computer graphics to create complex and lifelike images. One of the most popular applications of fractals in computer graphics is the practice of fractal geometry,

which involves the repetition of geometric shapes at different scales to produce patterns that mimic natural objects.

Some specific examples of fractals' applications in computer graphics are as follows:

1. **Terrain Generation:** Fractal techniques can be used to create realistic landscape models for video games and other virtual environments. The complicated contours and shapes of mountains, valleys, and other natural landscapes can be replicated using fractals. Recurring patterns are called fractals.
2. **Textures and Patterns:** By utilizing fractal algorithms, textures and patterns with intricate and aesthetically beautiful designs can be produced. The backdrops of

websites and mobile apps, as well as fabrics and wallpaper, can all be decorated with these designs.

3. **Fractal Art:** Fractals are commonly used in digital art. By constructing intricate forms and patterns using mathematical formulas, artists can produce sophisticated and visually pleasing works of art that resemble natural phenomena such as trees, clouds, and snowflakes.

4. **Image Compression:** Fractals can be used in image reduction to reduce the size of digital photographs without compromising quality. Using fractal-based algorithms, unnecessary information can be found and removed from images while still maintaining their overall structure and aesthetic appeal.

As a means for effectively and elegantly modeling complex forms and patterns, fractals play a significant role in computer graphics. Let's go into detail about a few applications.

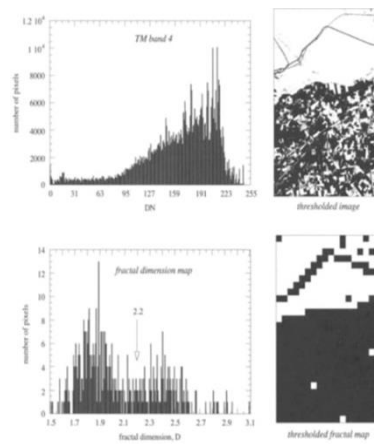
- **Fractal Art**

> Digital artists that use fractal geometry to produce detailed and visually beautiful artworks are known as fractal artists. Computer software is frequently used to make fractal art, which is composed of intricate patterns and shapes that repeat at various scales.

> Fractal artists are digital artists that employ fractal geometry to create intricate and aesthetically pleasing works of art. Fractal art, which consists of intricate patterns and shapes that repeat at various scales, is typically created using computer software.

> Fractal art can be found in animations, still images, and even virtual reality experiences. Some of the key characteristics of fractal art include the following:

1. **Self-Similarity:** One of the most obvious features of fractal art is its selfsimilarity. Because the same patterns and shapes are duplicated at different scales, it appears as though there are no bounds to their complexity.
2. **Complexity:** Very intricate patterns are a prominent feature of fractal art, making it difficult to replicate them using traditional artistic techniques. Its complexity is a result of the complex mathematical formulae used to produce pictures.

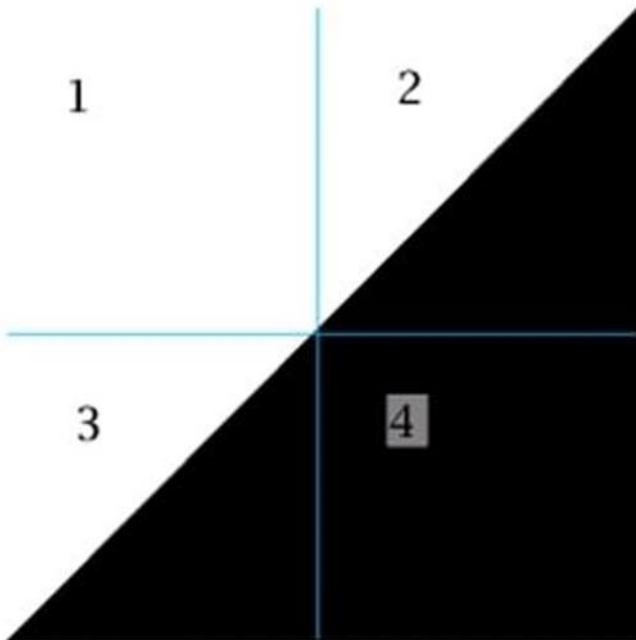


1. **Color:** Fractal art usually employs a wide range of hues and colors each pattern and form uniquely. These colors may be chosen by the artist or produced by the software.
2. **Abstraction:** Fractal art typically demonstrates abstraction, meaning it doesn't necessarily reflect a specific object or scenario. Because of its intricate patterns and shapes, fractal art is meant to be admired.
3. **Technology:** Fractal art is a relatively new form of art that has been feasible thanks to developments in digital technology. Because fractal art can be created by artists with the aid of powerful computers and specialized software, it is more intricate and detailed than traditional art genres.



Fractal art is a distinctive and visually captivating digital art that is steadily gaining popularity among creators and art enthusiasts.

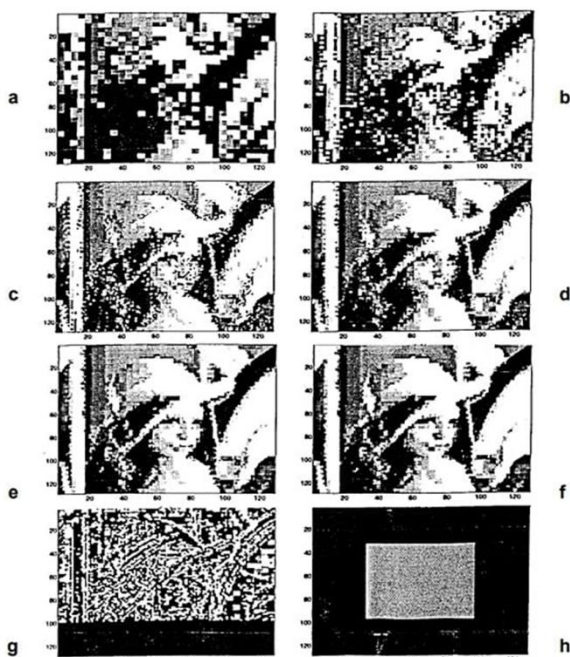
- **Image Compression :** Fractal image compression is a technique for reducing the size of digital images that uses the concepts of fractal geometry. This method can be used to efficiently compress images of recurring patterns in landscapes, clouds, or other natural environments. The underlying idea behind fractal image compression is finding similarities between different components of a picture and utilizing mathematical formulas to convey these similarities. As a result, rather than being preserved as a large collection of pixels, the image can instead be saved as a set of mathematical equations. After the image has been decompressed, the software uses the formulas to recreate it.



The following are the basic steps in fractal image compression:

1. Separate the image into blocks, each of which is a smaller section. The blocks are then scrutinized to seek recurrent patterns.
2. Match the Blocks: In this game, matching similar blocks results in the creation of a formula that explains how the blocks relate to one another.
3. Encode the Formulas: The mathematical formulas are encoded, compressed, and then stored.
4. Decompression: To display the image, the encrypted compressed data is decrypted and the image is recreated using mathematical formulae.

4x4 decoding using square



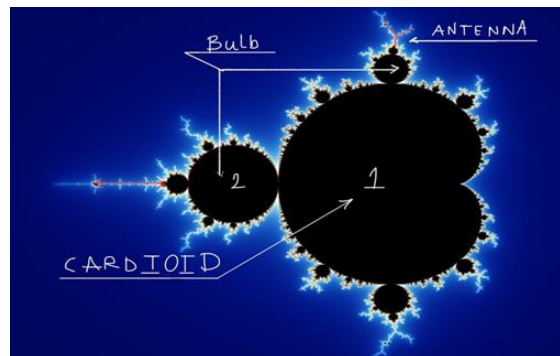
Hidden Fibonacci Sequence in Mandelbrot set:

The Fibonacci sequence is the sequence where we take the previous two numbers and add them together to get the next number.

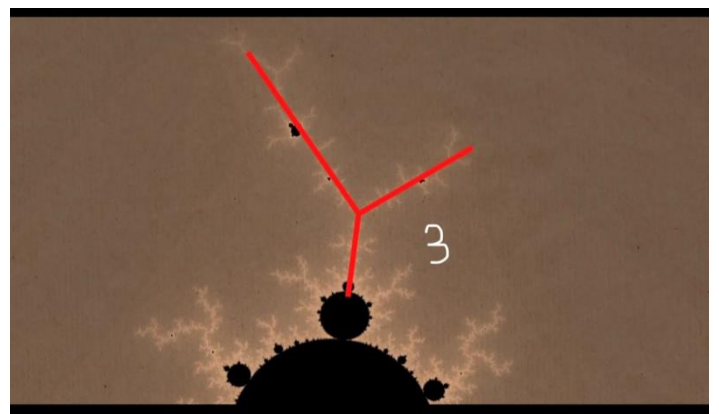
So the series is 1,1,2,3,5,8,13,.....

Here we are considering a certain type of dynamical system, when in Mandelbrot set to function at $c=-1$, we get $fc(z)=z^2-1$, and we know the series -1, 0, -1, 0,.....

When we see an image of the Mandelbrot set, we see the little components coming off of the main piece (cardioid with number 1) called hyperbolic components. When we assign numbers to these components, the number is going to be the number of branches called an antenna.



For the above image, there are 2 directions where we can go, so this component will have number 2.



Here this component had 3 antennae, so we can go in 3 directions, so this component will have a number 3.

6. Hidden series •
<https://www.numberphile.com/videos/fibonacci-and-mandelbrot>
• <http://fractalfoundation.org/OFC/OFC-11-4.html>
• <https://www.sciencedirect.com/science/article/pii/S0019357714000871>
• https://en.wikipedia.org/wiki/Mandelbrot_set
• <https://arxiv.org/pdf/1708.07429.pdf#:~:text=Pascal's%20triangle%20is%20a%20well,is%20considered%20modulo%20prime%20powers.>
• <http://mathtourist.blogspot.com/2020/08/fractals-in-pascals-triangle.html>
• <https://fractalfoundation.org/resources/fractivities/pascals-sierpinski-triangle>

Cognitive Engineering- The Multidisciplinary Endeavour

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Abstract— Cognitive engineering is a multidisciplinary field that focuses on designing and improving systems, products, and technologies that are intuitive, efficient, and safe to use by humans. It draws on principles and methods from cognitive psychology, engineering, computer science, and human factors to develop products and systems that are well-matched to the cognitive abilities and limitations of users. The goal of cognitive engineering is to enhance human performance and productivity, reduce errors and accidents, and optimize the user experience. This abstract provides an overview of the field of cognitive engineering and highlights its key principles, methods, and applications.

Keywords—*component, formatting, style, styling, insert (key words)*

I. INTRODUCTION

This template, modified in MS Word 2007 and saved as a "Word 97-2003 Document" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow. Cognitive engineering is a field that aims to improve the design of systems and products so that they are more intuitive, efficient, and safe for human use. It combines knowledge and methods from cognitive psychology, engineering, computer science, and human factors to create systems that are optimized for human performance and user experience. The goal of cognitive engineering is to make products and systems that are well-matched to human cognitive abilities and limitations, reducing the potential for errors, accidents, and user frustration.

The concept of cognitive engineering emerged from the recognition that human factors are critical to the design and use of technology. The rapid development of technology has brought with it new challenges related to the usability and safety of products and systems. Poorly designed systems can lead to accidents, errors, and inefficiencies, causing significant harm to users and organizations. It seeks to address these challenges by understanding the cognitive

processes that underlie human performance and designing systems that support those processes.

Cognitive engineering has a broad range of applications, including the design of complex systems such as aviation and transportation systems, medical devices, and military equipment. It is also used in the development of user interfaces for software applications and websites, and in the design of consumer products such as home appliances and automobiles.

In this context, the present paper provides an overview of the principles, methods, and applications of cognitive engineering. It highlights the importance of designing systems that are well-matched to human cognitive abilities, and it presents examples of successful applications of cognitive engineering in various fields.

II. THESIS

One of the key theories in cognitive engineering is the theory of mental models. According to this theory, people develop mental representations, or models, of the systems or processes they interact with. These mental models are used to make predictions about the behavior of the system and guide decision-making. For example when driving a car, a person develops a mental model of the car's controls and behavior that

allows them to anticipate the car's movements and respond appropriately. In cognitive engineering, designers use this theory to develop systems that are more intuitive and easier to learn and use by designing interfaces that match users' mental models.

An important theory in cognitive engineering is the theory of attention. This theory posits that attention is a limited resource that must be allocated strategically to achieve goals efficiently. Designers use this theory to

develop systems that minimize attentional demands and make it easier for users to focus on important information and tasks. For example, interfaces can be designed to highlight important information or to reduce distractions, allowing users to focus on the task at hand.

Theory of affordances is also relevant to cognitive engineering. According to this theory, people perceive the possible actions that can be taken with an object or system based on its physical properties. Designers use this theory to create systems that are more intuitive and easier to use by making the physical properties of the system correspond to the actions that users want to take. For example, a door handle that is shaped like a bar suggests that the user should push, while a handle that is shaped like a lever suggests that the user should pull.

In addition to these theories, cognitive engineering also draws on principles from decision-making theory, problem-solving theory, and learning theory. For example, decision-making theory suggests that people often use heuristics, or mental shortcuts, to make decisions quickly and efficiently. Designers can use this theory to create interfaces that make it easier for users to make decisions by providing clear options and reducing cognitive load. Problem-solving theory can help designers identify and resolve problems in the design process by providing a framework for breaking down complex problems into smaller components. Learning theory can inform the development of training programs and interfaces that are optimized for learning and retention.[3]

One of the key challenges in cognitive engineering is designing for diverse user groups. Users may have different mental models, attentional capacities, and affordance perceptions based on their prior experience and background. To address this challenge, cognitive engineering researchers and practitioners use a variety of methods to understand and model user behavior, including task analysis, cognitive task analysis, and usability testing. These methods allow designers to develop systems that are tailored to the needs and capabilities of specific user groups.

Another challenge in cognitive engineering is designing complex and dynamic systems. Many systems, such as air traffic control systems, involve multiple agents and require coordination and communication between different components. Cognitive engineering researchers and practitioners use a variety of methods to model and understand these complex systems, including agent-based modeling and network analysis. These methods allow designers to develop systems that are resilient and adaptable in the face of unexpected events or failures.

III. CATEGORY OF COGNITIVE ENGINEERING

Cognitive engineering is a multidisciplinary field that encompasses several types oapproaches and methods.

Here are some of the main types of cognitive engineering:

- o Cognitive task analysis:

Cognitive task analysis (CTA) is a method for analyzing the mental processes and strategies involved in completing a specific task. CTA is used to understand how individuals perceive, think, and reason about a task, and how they use their knowledge and skills to perform the task successfully.

CTA typically involves a structured approach that includes the following steps:

1. Identify the task to be analyzed: The first step is to select a task that is of interest or concern. This could be any task, from assembling a product to solving a complex problem.

2. Gather information about the task: This involves collecting information about the task, such as the steps involved, the resources required, and the expected outcome.

3. Identify the cognitive processes involved: This step involves identifying the cognitive processes that are required to complete the task successfully, such as perception, attention, memory, decision-making, problem-solving, and reasoning.

4. Identify the knowledge and skills required: This step involves identifying the knowledge and skills required to perform each cognitive process, such as domain-specific knowledge, procedural knowledge, and metacognitive skills.

5. Develop a model of the task: This step involves developing a model of the task that captures the cognitive processes, knowledge, and skills required to perform the task successfully.

CTA can be used to improve training, design more effective tools and technologies, and identify and prevent errors in complex tasks. It is often used in fields such as aviation, medicine, and engineering, where tasks can be complex and require a high level of cognitive processing.[10]

- o Human-computer interaction:

Human-computer interaction (HCI) is a field of study focused on the design, evaluation, and implementation of interactive computing systems for human use.

HCI research and design can involve a variety of technologies and interfaces, including desktop and mobile devices, virtual and augmented reality, voice and gesture-based interfaces, and more. The goal of HCI is to create interfaces that are easy to use, efficient, and enjoyable for users.

Some key areas of study within HCI include user interface design, usability testing, user experience (UX) design, accessibility, cognitive psychology, and human factors engineering. HCI researchers and designers may work in industry, academia, or government, and may collaborate with a variety of stakeholders, including software developers, product managers, and end-users.

Overall, the goal of HCI is to create technology that improves people's lives by enabling them to interact with digital systems in natural, intuitive, and satisfying ways .

- o Cognitive modeling:

Cognitive modeling is the process of creating a computational model that simulates the cognitive processes that underlie a particular task or behavior.

It involves specifying the steps or stages that people go through in performing a task, and the representations and processes that underlie these steps. The model can be formalized using mathematical or computational techniques, such as neural networks or Bayesian models.

Cognitive modeling can help researchers test hypotheses about how the brain processes information and makes decisions, and can provide insights into the underlying mechanisms of cognitive processes. It can also be used to develop and test interventions for cognitive disorders, such as attention deficit hyperactivity disorder (ADHD) and Alzheimer's disease.

- o Ecological interface design:

Ecological interface design (EID) is an approach to designing interfaces between humans and complex systems, such as industrial processes or transportation systems. It is based on the principle that interfaces should be designed to support the natural cognitive and perceptual abilities of humans, rather than requiring them to learn complex and unfamiliar ways of interacting with technology.

EID involves analyzing the demands and constraints of the system being controlled, as well as the cognitive and perceptual capabilities of the operators who will interact with the interface. Based on this analysis, the interface is designed to present information and controls in a way that is intuitive and easy to understand, and that supports [6]

the operator's decision-making and problem-solving abilities.

EID has been used in a variety of applications, including aviation, nuclear power, and transportation systems. It has been shown to improve operator performance, reduce errors, and increase efficiency and safety.

Overall, EID is a powerful approach to interface design that takes into account the complex interplay between humans and technology. It has the potential to improve the usability and safety of complex systems and is an

important tool for designers and engineers working in a wide range of industries.

- o Distributed cognition:

Distributed cognition is a theory in cognitive science that suggests that cognition is not just limited to the individual mind, but is distributed across multiple individuals, tools, and artifacts. It is the idea that cognition is not just happening inside the brain but is distributed across the environment and the people around us.

In distributed cognition, the focus is on understanding how people think and solve problems in real-world situations that involve complex systems and tools. It emphasizes the role of artifacts and technology in supporting and enhancing human cognition.

The theory of distributed cognition proposes that cognitive processes are distributed across multiple agents or actors, such as people, objects, and tools, and that the interactions between them are critical for understanding cognitive processes. It is a way of looking at the world that takes into account the complex relationships between people, technology, and the environment.

For example, consider a team of engineers working on a complex design project. The team members rely on each other's expertise and knowledge, as well as various tools and software, to complete the project successfully. The distributed cognition perspective would suggest that the cognitive processes involved in completing the project are distributed across the team members and their tools, rather than being confined to individual minds.

Overall, distributed cognition provides a framework for understanding how cognitive processes are embedded in the larger socio-technical systems in which they occur.

4. POSITIVE ASPECTS OF COGNITIVE CONTRIVE

The goal of cognitive engineering is to optimize the interaction between humans and technology, to improve efficiency, safety, usability, and user experience. In this, we will discuss the advantages of cognitive engineering in greater detail.

- o Improved Usability:

One of the most significant advantages of cognitive engineering is improved usability. Cognitive engineering takes into account the cognitive processes involved in using technology or systems and uses this information to design interfaces and user experiences that are more intuitive and easier to use. This can lead to increased efficiency, productivity, and satisfaction.

For example, a cognitive engineer might use knowledge of human memory and attention to design an interface that prioritizes important information and minimizes distractions. This can make it easier for users to find and process the information they need, leading to improved task performance.[6]

- o Increased Safety:

Cognitive engineering can also help increase safety by identifying potential hazards or errors in the design of technology or systems and developing solutions to mitigate these risks. This is especially important in domains where safety is critical, such as aviation, healthcare, and transportation.

For example, a cognitive engineer might use knowledge of human error and decision-making to design a cockpit interface that provides pilots with the information they need to make safe and informed decisions. This can reduce the risk of accidents caused by human error.

- o Better Decision Making:

Another advantage of cognitive engineering is better decision-making. By providing information in a format that is easier for humans to process, cognitive engineering can support better decision-making in complex and dynamic environments.

For example, a cognitive engineer might use knowledge of human visual perception and attention to design a dashboard interface that highlights the most important information and alerts drivers to potential hazards. This can improve the driver's situational awareness and help them make safer and more informed decisions.[

- o Enhanced Learning:

Cognitive engineering can also enhance learning by designing systems that support cognitive processes such as attention, memory, and problem-solving. This can lead to more effective and efficient training and education.

For example, a cognitive engineer might use knowledge of human memory and learning to design a computer-based training program that uses spaced repetition and other techniques to help learners retain information more effectively. This can lead to better learning outcomes and increased knowledge retention.

- o Increased Automation:

Finally, cognitive engineering can increase automation by designing systems that can perform routine or dangerous tasks, freeing humans to focus on more complex and strategic tasks. This can improve efficiency, reduce costs, and improve safety.

For example, a cognitive engineer might use knowledge of human motor skills and perception to design a robotic system that can perform tasks that are dangerous or difficult for humans to perform, such as working in hazardous environments or assembling complex machinery.

5. IMPLEMENTATION IN DAILY LIFE

In everyday life, cognitive engineering can be seen in various forms, such as in the design of appliances, technology, and transportation systems. In this essay, we will explore a few examples of cognitive engineering in daily life, including smart home appliances, user interfaces in technology, and transportation systems.

- o Smart Home Appliances

Smart home appliances are examples of cognitive engineering in everyday life. They are designed to be intuitive, easy to use and to provide helpful features that enhance users' experience. For instance, a smart refrigerator can monitor the food inside and send alerts when the food is about to expire, or when it is running low on specific items. This feature reduces cognitive load by helping users keep track of their food inventory and reminding them when they need to restock. Smart home thermostats are also great examples of cognitive engineering. They can automatically adjust the temperature based on users' routines and preferences, thereby eliminating the need for users to remember to adjust the temperature manually.[13]

Smart home appliances are also designed to be easy to use, with intuitive interfaces and features. For instance, a smart TV can suggest shows or movies based on the user's viewing history, making it easier for them to find content that they like.

The remote control is also designed to be simple and easy to use, with large buttons and clear labeling. Smart speakers, such as Amazon Echo or Google Home, use natural language processing to understand voice commands, making them easy to use for people who are not tech-savvy.

o User Interfaces in Technology

User interfaces in technology are also examples of cognitive engineering in daily life. They are designed to be intuitive, easy to use and to reduce cognitive load by providing users with the information they need to complete a task. For instance, smartphones have intuitive interfaces that allow users to navigate through apps and settings quickly. The apps are also designed to be visually appealing and easy to understand, with clear labeling and icons.[13]

Another example of cognitive engineering in user interfaces is seen in web design. Websites are designed to be easy to navigate, with clear menus and links that lead users to the information they need. They also use design elements, such as color, to draw attention to important information, making it easier for users to find what they are looking for. The text is also designed to be easy to read, with appropriate font sizes and spacing.[11]

o Transportation Systems

Transportation systems are also designed using cognitive engineering principles. For instance, airports are designed to be easy to navigate, with clear signs and directions that lead travelers to their gates or baggage claim areas. The seating areas are also designed to be comfortable, with charging ports and Wi-Fi access to reduce cognitive load and anxiety.

In public transportation, cognitive engineering is seen in the design of ticket machines and interfaces. The machines are designed to be easy to use, with clear instructions and visual cues that guide users through the process of purchasing tickets. The interfaces are also designed to be intuitive, with touchscreens and large buttons that make it easy for users to select their destination and purchase the correct fare.

In automotive design, cognitive engineering is seen in the design of dashboards and interfaces. The dashboard is designed to be easy to read, with large and clear gauges that provide information about speed, fuel level, and other essential information. The interfaces are also designed to be intuitive, with touchscreens and voice commands that allow drivers to control music, navigation, and other features without taking their eyes off the road.[13]

6. DRAWBACKS OF COGNITIVE CONTRIVE

While cognitive engineering has many advantages, such as reducing cognitive load and improving user experience, it also has several disadvantages that should be considered. In this essay, we will explore some of the disadvantages of cognitive engineering.[1]

o Over-reliance on Technology

One of the main disadvantages of cognitive engineering is the over-reliance on technology. As technology becomes more advanced and ubiquitous, people may become too dependent on it, which can have negative consequences. For instance, if a smart home appliance breaks down or malfunctions, users may not know how to perform basic tasks without it, such as cooking or cleaning. This over-reliance on technology can lead to a loss of essential skills and abilities, such as problem-solving and critical thinking, which can have long-term consequences for individuals and society.[1]

o Privacy and Security Concerns

Another disadvantage of cognitive engineering is privacy and security concerns. Many smart devices and systems collect and store personal data, such as users' location, preferences, and browsing history. This data can be vulnerable to cyber-

attacks, and users may not be aware of how their data is being used or shared. This lack of transparency and control over personal data can lead to privacy concerns, and users may feel uncomfortable with the idea of being constantly monitored.

o Health and Safety Risks

Cognitive engineering can also pose health and safety risks. For instance, using a smartphone or computer for extended periods can lead to eye strain, headaches, and other physical discomforts. Similarly, the overuse of smart home appliances can lead to a sedentary lifestyle, which can increase the risk of obesity and other health problems. In transportation systems, over-reliance on automation can lead to complacency and reduced situational awareness, which can increase the risk of accidents.

o Cost and Accessibility

Another disadvantage of cognitive engineering is the cost and accessibility of technology. Many smart devices and systems are expensive, which can make them inaccessible to people with lower incomes or living in developing countries. This can create a digital divide, where some people have access to advanced technology and others do not. This can have long-term consequences for education, employment, and economic growth.

o Social and Psychological Impacts

Cognitive engineering can also have social and psychological impacts. For instance, social media and other online platforms can create echo chambers, where people are exposed only to information that confirms their biases and beliefs. This can lead to a lack of diversity of thought and a reduced willingness to consider alternative perspectives. Similarly, the use of smart devices and systems can lead to a loss of interpersonal skills, as people may rely on technology to communicate instead of face-to-face interactions.[1]

o Ethical Concerns

Finally, cognitive engineering raises ethical concerns, particularly in the areas of automation and artificial intelligence. As machines become more advanced and capable of performing complex tasks, questions arise about their role in society and the potential impact on employment and human well-being. There are also concerns about the potential misuse of AI, such as in the creation of autonomous weapons or the perpetuation of bias and discrimination.

IV. CONCLUSION

The benefits of cognitive engineering are clear, but it is important to continue researching and refining cognitive engineering principles to optimize the benefits and mitigate the potential risks.

Cognitive engineering has the potential to transform the way we interact with technology, and as technology continues to evolve, the importance of cognitive engineering will only increase. By designing systems that are optimized for human performance, cognitive engineering can improve the usability, efficiency, and safety of technology across a wide range of domains.[12]

However, as with any technology, cognitive engineering is not without its risks. It is important to consider the potential negative consequences of cognitive engineering, such as the standardization of human behaviour and the potential for over-reliance on technology.

As a society, we must approach cognitive engineering with caution and continue to research and refine cognitive engineering principles to optimize the benefits and mitigate the potential risks. This will require collaboration across multiple disciplines, including cognitive psychology, human factors engineering, and computer science.

Ultimately, the success of cognitive engineering will depend on

our ability to balance the benefits and risks and use this technology to enhance human performance and improve the quality of life for individuals across a range of domains. As we continue to develop and refine cognitive engineering principles, it is important to remember that technology is a tool that should be designed to serve the needs of humanity, rather than the other way around.

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EUTHANASIA: Dilemma Between Assisted Suicide and Murder

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ABSTRACT: A wormhole is a hypothetical space-time passage that could provide shortcuts for long journeys across the universe. Wormholes are predicted by general relativity theory, though creating, or discovering one would be extremely difficult. Teleportation, on the other hand, is the concept of instantly transporting a person or object from one location to another without the need for physical travel. For many years, it has been a popular concept in science fiction, and while it is not yet possible, scientists are making progress in the field. Both wormholes and teleportation have the potential for faster-than-light travel, but there are significant differences between the two. Wormholes are a theoretical concept, while teleportation is being investigated as a potential quantum physics application. Wormholes are thought to be capable of connecting two very distant points in the universe, whereas teleportation could be used to travel between two relatively close points.

Keywords: wormholes, hypothetical, space-time, general relativity theory, faster than light travel, quantum physics application, physical travel.

I. INTRODUCTION

"The idea that we might be able to travel through a wormhole and emerge in another part of the universe, or even in a different time, is mind-blowing. It challenges everything we think we know about space and time." - Stephen Hawking

Wormholes and teleportation are intriguing concepts that call our understanding of space and time into question. A wormhole is a fictitious space-time tunnel that could connect two points in the universe, allowing for faster-than-light travel and communication. Teleportation, on the other hand, is the physical movement of matter or information from one location to another. Both ideas remain purely theoretical, with no experimental evidence to support them. Recent advances in quantum mechanics and theoretical physics, on the other hand, have reignited interest in these concepts, implying that they may have practical applications in space exploration and communication. Theoretical frameworks such as **ER=EPR**, which proposes that wormholes and entanglement are two different manifestations of the same physical phenomenon, are being studied to better understand these concepts. While practical implementation of these ideas is still a long way off, the possibility of wormholes and teleportation challenge our

current understanding of the universe and opens up an exciting new line of research.

ER = Einstein-Rosen bridges

EPR = Einstein-Podolsky-Rosen

II. DEFINITION

i) Wormhole:

A wormhole is a hypothetical space-time passage that could provide shortcuts for long journeys across the universe. Wormholes are predicted by general relativity theory, but it is very difficult to create or discover one. Teleportation refers to the ability to move a person or object from one location to another without the need for physical travel. Meanwhile, teleportation is also known as instant travel. For many years, it has been a popular concept in science fiction, but it is not yet possible to create or teleport through a wormhole. Wormholes and teleportation both have the potential for faster-than-light travel, but there are significant differences between the two. Wormholes are a theoretical concept, while teleportation is being investigated as a potential quantum physics application. If teleportation were to be successfully developed, it could be used to travel between two relatively close points in space.

Types:

1. Traversable wormholes:

Traversable wormholes are hypothetical structures that could be used for travel. They allow matter and energy to pass through, allowing them to serve as shortcuts between two distant points in space. A traversable wormhole requires exotic matter, which has a negative energy density, to keep the throat of the wormhole stable and prevent it from collapsing.

- **Morris-Thorne wormholes** are the first proposed by physicists Michael Morris and Kip Thorne. They are theoretical structures that connect two separate regions of space-time. They require exotic matter to keep the throat of the wormhole stable and prevent it from collapsing.

The properties of Morris-Thorne wormholes are: -

- They are **extremely stable** and can transport large amounts of matter through them.
- They also have the potential to connect different parts of the universe. Morris-Thorne wormholes are **two-way passages** that allow matter and energy to flow in both directions. They could be used for

interstellar travel or for faster-than-light communication.

- c) **Exotic matter** is necessary to keep Morris-Thorne wormholes stable. It has a low energy density, which is a mysterious form of matter that has not yet been observed in the universe. The properties and behaviour of exotic matter are still being studied.
- d) The Morris-Thorne wormhole has a **short lifespan** and is prone to collapsing. Its lifespan is limited to fractions of a second, making its practical use for travel or communication very challenging.
- e) The **causality principle** says that an event's cause must always precede it. So, using a wormhole to travel back in time could create paradoxes, such as the grandfather paradox.

Overall, Morris-Thorne wormholes are a fascinating theoretical concept in physics, but many technical challenges must be overcome to bring them to life. The properties of exotic matter and the stability of the mouth of a wormhole remain major areas of research and debate in theoretical physics.

2. Non-traversable wormholes:

Non-traversable wormholes are believed to exist naturally in space, but they cannot be used for travel or communication. They are formed due to gravitational forces and are extremely unstable. Their lifespan is extremely short, and they collapse almost immediately after forming.

- **Schwarzschild wormholes** are a type of impassable wormhole, meaning they cannot be used for travel or communication. They are formed due to the gravitational field of a black hole, and are named after the physicist Karl Schwarzschild, who was the first to study the properties of black holes.

The properties of Schwarzschild wormholes are: -

- a) Schwarzschild wormholes are **one-way passages**, meaning that matter and energy can only travel in one direction. Anything that enters the wormhole will be trapped inside the black hole and cannot exit the other end.
- b) Space-time can be curved by a massive **gravitational field**, resulting in a wormhole. This wormhole can be seen as a funnel-like structure, extending from the black hole's event horizon to the other end of the wormhole.
- c) **Gravitational lensing** is a phenomenon caused by the existence of Schwarzschild wormholes. These wormholes cause the light passing through them to be distorted, creating an image of objects that is magnified and distorted.
- d) **Tidal forces** near the event horizon are so strong that they can stretch and deform matter into thin, elongated shapes, known as spaghettification.

- **Ellis wormholes** these are formed due to the presence of cosmic strings, which are hypothetical one-dimensional topological defects in the fabric of space-time.

The properties of Ellis wormholes are: -

- a) Ellis wormholes are **two-way passages**, meaning matter and energy can flow through them in either direction. They can be used to travel from one end to the other, potentially enabling interstellar travel or faster-than-light communications.
- b) **Exotic matter** is necessary to keep Ellis wormholes stable. It has a low energy density, which is a type of matter that has not been seen in

the universe yet. The properties and behaviour of exotic matter are still being studied.

- c) **Unique Geometry** Ellis wormholes have a unique geometry that differs from other types of wormholes. They have a spherical neck connecting two regions of flat spacetime, which differs from the funnel-like shape of Schwarzschild wormholes or the toroidal shape of Morris-Thorne wormholes.
- d) There is some debate over whether or not Ellis wormholes are **singularity-free**, but if they are, this could make them a safer and more stable option for travel and communication than other types of wormholes.

Overall, Ellis wormholes are an intriguing theoretical concept in physics, and their unique geometry and lack of singularity make them a promising candidate for practical use in the future. However, as with other types of wormholes, the properties and behaviour of exotic matter remain a major area of research and debate in the field of theoretical physics.

ii) Teleportation:

Teleportation is the process of transferring an object or a set of properties from one location to another without physically moving it through the space in between. It is a common theme in science fiction, but it is also a real concept in physics. There are two main forms of teleportation: quantum teleportation and classical teleportation.

- **Quantum teleportation** is a method of transferring quantum information from one quantum system to another over long distances. This relies on a quantum phenomenon called entanglement, which allows for correlated properties between two particles. Because entanglement can be maintained over large distances, quantum teleportation could potentially allow for secure and instant communication or quantum computing over long distances.

- a) **Standard quantum teleportation** uses entangled particles to transfer quantum information between two locations. It has been successfully demonstrated in experiments but is limited by the need for a pre-existing entangled state.
- b) **Entanglement swapping** allows for the creation of new entangled states without a pre-existing entangled state, but it is limited by the need for multiple pairs of entangled particles and the difficulty of maintaining entanglement over long distances.
- c) **Quantum teleportation** using non-local measurements uses measurements that allow for the transfer of quantum information without the need for entanglement. However, this method is limited by the difficulty of making non-local measurements and the fact that it can only transfer quantum information.

- **Classical teleportation**, on the other hand, is a method of transferring classical information from one location to another. It does not rely on quantum entanglement, but instead on the principles of classical information theory. In classical teleportation, a sender first prepares a classical message, such as a string of bits, and then encodes the message into a set of quantum states. Classical teleportation is mainly used for transferring classical information, such as data or text, rather than physical objects.

- a) **Classical teleportation using entanglement** is limited by the fact that it can only transfer classical information and is not suitable for transferring physical objects.
- b) **Classical Teleportation using Classical Channel and EPR Pairs** This method involves using classical channels and EPR pairs to transfer classical information between two locations. The sender and receiver share EPR pairs, and the sender encodes the information into a classical channel using a process known as quantum error correction. The receiver can then decode the information using the shared EPR pairs. While this method can be used to transfer larger amounts of classical information than other methods, it is limited by the fact that it requires the use of quantum error correction codes, which can be complex and difficult to implement.

III. THEORETICAL BASIS

i) Wormhole:

General relativity predicts the existence of wormholes, structures in spacetime that connect two distant regions. Physically, the existence of wormholes requires the presence of exotic matter that has a negative energy density and violates classical energy conditions. Exotic matter is a theoretical concept that has not yet been observed in nature but is required by the mathematics of general relativity to stabilize the structure of a wormhole and prevent it from collapsing under its own gravitational pull. The properties of exotic matter have not been sufficiently studied, and its existence remains the subject of ongoing research. The study of wormholes has also been extended to the field of quantum gravity, which attempts to reconcile general relativity with quantum mechanics. One of the challenges in understanding quantum gravity is to develop a theory that can describe the behaviour of spacetime on small scales, such as the Planck length. Some theories of quantum gravity predict the existence of wormholes on this scale and suggest that they may play a role in the structure of spacetime at the quantum level. Albert Einstein and Nathan Rosen were two of the most prominent physicists of their time who explored the possibility of wormholes and their properties. In 1935, they proposed the existence of a special type of wormhole known as the "Einstein-Rosen bridge", also known as the "ER bridge". Their work was based on their previous development of general relativity. They noticed that the equations of general relativity allow for a structure in spacetime that allows matter to pass through a tunnel that effectively connects two distant points in spacetime. This structure was later called a "wormhole". Einstein and Rosen introduced the concept of an ER bridge describing a wormhole connecting two black holes. They argued that matter falling into one black hole would exit through another black hole, effectively "teleporting" across the bridge. They also showed that the existence of an ER bridge requires the presence of an exotic substance to stabilize the structure. Later, other notable scientists such as John Archibald Wheeler and Kip Thorne expanded on the work of Einstein and Rosen to study the properties of wormholes in more detail. Wheeler coined the term "wormhole" to describe a hypothetical structure that could be used for time travel. Thorne developed the idea of wormholes and their properties and showed that the presence of exotic matter is necessary to keep them stable.

ii) Teleportation:

The concept of teleportation rests on the principles of quantum mechanics, which predicts that particles can exist in a state known as "superposition", in which they exist in multiple possible states simultaneously. This process involves the use of entanglement, in which two particles become correlated in such a way that the state of one particle can be inferred from the state of the other particle. Quantum teleportation is a process that allows the transfer of the state of one particle to another particle, even if they are located far apart from each other. Classical teleportation, on the other hand, is a concept that has been explored in science fiction but has no scientific basis in current theories of physics. While it is possible to transmit classical information using various communication technologies, such as the internet, the transfer of physical objects from one location to another is not currently possible using known physical principles. Charles Bennett and Gilles Brassard are two significant scientists who worked on quantum teleportation, a technology that allows objects to be transported across great distances without having to be physically present.

In 1993, Bennett and Brassard developed the first protocol for quantum key distribution, which is a method of securely transmitting information using quantum mechanics. This protocol, known as BB84, uses entanglement to establish a shared secret key between two parties. This key can be used to encrypt and decrypt messages. Bennett and his team also made significant contributions to the field of quantum teleportation, particularly in the development of the first experimental demonstration of quantum teleportation in 1997. This breakthrough was achieved using entanglement to transfer the state of a single photon from one location to another. Brassard also made significant contributions to the field of quantum teleportation, including the development of protocols for the teleportation of quantum states that are more efficient and reliable than previous methods.

Charles Bennett and Gilles Brassard have made significant contributions to the fields of quantum teleportation, quantum cryptography, and quantum information theory. Their work has helped pave the way for future research in these areas.

IV. APPLICATION

There are many reasons why wormholes and teleportation could be useful. For example, they could be used to travel to different parts of the world quickly, or to escape dangerous situations.

Space travel can involve using wormholes or teleportation to travel between different places in space. This could significantly reduce the time it would take to travel to other stars or even galaxies.

Quantum teleportation could create a secure **communication** network that uses particles that are entangled. This would have a lot of important implications, such as being able to use banks and other services securely, protecting national security, and protecting personal privacy.

Time travel is a theory that is still being explored but could be possible if we understand the basic laws of physics.

There are some things that you can do with wormholes and teleportation that are really cool, but there are some things that are still not possible yet.

- a) If you try to use a wormhole to enter or create it, it might not be stable, so it could collapse or create a black hole.

- b) Creating a wormhole would be very difficult, and it would require a lot of energy to keep it open.
- c) Teleportation is a process of destroying the original object or particle in order to move it elsewhere. This raises questions about whether the original object is really being moved or whether a copy is being created.
- d) Teleportation requires using specially prepared quantum systems. Sometimes, different types of particles won't work for teleportation because they don't have the right properties.

Quantum teleportation is a way to send information securely over a network, but it is vulnerable to attack. Scientists are still working on understanding the mathematical and physical theories behind wormholes and teleportation, and are developing methods to create and keep wormholes stable, in order to perform quantum teleportation with increasingly complex systems. So far, the practical applications of quantum teleportation are limited, but ongoing research is expanding our understanding of the technology. This could have far-reaching implications for space exploration, communication, and technology in the future. The stability of wormholes is a major challenge, and it's not clear if they can be created or sustained. Creating and maintaining a wormhole would require a lot of energy, and it may be hard to study these strange phenomena.

There are many challenges to teleportation, the most significant of which is the destruction of the original object or particle. Additionally, not all particles can be used for teleportation, and the process requires the use of specially prepared quantum systems. While quantum teleportation has the potential to create a secure communication network, it is vulnerable to a variety of attacks. However, ongoing research is expanding our understanding of these concepts and could have far-reaching implications for the future of space exploration, communication, and technology. In particular, advances in quantum teleportation could lead to the development of secure communication networks and new forms of cryptography, while the discovery of stable wormholes could revolutionize space travel and allow us to explore the universe in ways that are currently unimaginable.

V. ETHICAL CONSIDERATIONS

There are many ethical considerations to take into account when developing these new technologies. For example, if teleportation is used to transport people across vast distances, it could create new social and economic inequalities. Alternatively, the ability to manipulate time or create alternate realities could create new power dynamics, which could further divide people.

With the possibility of wormholes and teleportation, our understanding of the nature of reality and our place within it has come into question. Is the universe one big, interconnected reality, or are there multiple universes that we cannot see or access? If time travel is possible, does this

mean that the future is predetermined, or that we have the power to alter it? These are all deep philosophical questions that require significant thought.

In conclusion, the potential applications of wormholes and teleportation raise significant questions about ethics and philosophy that must be addressed as we explore these technologies. It is important to approach these questions with a spirit of curiosity and inquiry, while also taking into account the potential risks and unintended consequences of these technologies. Ultimately, our exploration of these concepts could have far-reaching implications for our understanding of the universe and our place within it.

VI. CONCLUSION

To sum up, the notion of wormholes and teleportation have been investigated in both science fiction and scientific study. Wormholes are assumed structures in spacetime that may be able to enable faster-than-light movement and time travel, while teleportation is the ability to transfer matter over long distances in a flash. Both of these concepts evoke tremendous ethical and philosophical queries with regard to their potential uses, such as in space exploration, communication, and time travel.

At the moment, the study of wormholes and teleportation is in its initial stages, and a great deal of work needs to be done to apprehend the physical and mathematical principles that lie behind these notions. Though some advances have been made in constructing theoretical models and experimental techniques for teleportation, there are still numerous technical and practical issues that must be dealt with prior to these technologies becoming a reality. Further research is necessary.

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IS QUANTUM TELEPORTATION POSSIBLE USING QUANTUM ENTANGLEMENT

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Abstract: “Quantum teleportation and entanglement are two fundamental concepts in the field of quantum mechanics that have revolutionized the way we think about information and communication. Entanglement refers to the phenomenon where two particles can become connected in such a way that the state of one particle is affected the state of the other, even though if they are at large distances. By entangling two particles and then measuring the state of one of them, the state of the other particle can be inferred and reconstructed using the shared Qubit. This process enables the transfer of quantum information without the need for a physical transfer of matter. The implications of quantum teleportation and entanglement are far-reaching, with potential applications in areas such as cryptography, computing, and even teleportation of physical objects. However, the intricacies of these concepts and their implementation present significant challenges, both in theory and practice, that must be overcome for their full potential to be realized.







Bit	v/s	Qbit	
	= (1)		= (1)
	= (0)		= (0)
	= not define		= (0)+(1)

Fig.1: Bit and Qbit properties

Keywords: Quantum, entanglement, teleportation, bits, Qubit.

I. Introduction

Bits are a classical way for transferring data in a computer i.e., 1 & 0 fixed value of the bits. But Qubit (quantum bits) can have the orientation in any direction (superposition) either up or down... till the point we observe them.... once we observed that its value will be fixed. This property of the quantum particle can only be measured and calculated with the help of the quantum computer since speed is 100 million times faster than the classic computers.

It can produce approximately 2.5 exabytes of data in a single day.

“1 Gigabyte is the size of the earth and 1 Exabyte is the size of the Sun”

1 exabyte (EB)

= 10^{18} bytes

= $1,000^6$ bytes

= 1000000000000000000 bytes

= 1000000000000 Megabyte

= 1000000000 Gigabyte

II. Quantum teleportation

In this teleportation, the quantum particle (photon, electron, positron) is moved from one position to the other but keep it in mind not the macroscopic object (ball, human, car). In these two entangled particles are used. These two particles can be at an infinite distance and when we observe one property it gets defined as the property of the other entangled particle at the same time irrespective of the distance between them (i.e., the speed of data transfer is faster than the speed of light.)

Quantum teleportation application fields:

Quantum communication: Quantum can be used as a new mode of transmitting quantum information over a long distance, securely without any interference and physical transmission of the particle.

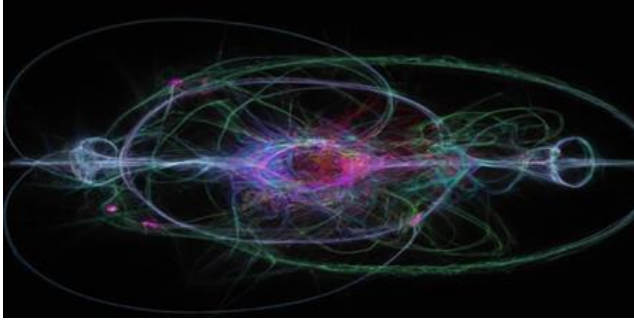


Fig.2 Two entangled particles

Quantum computing: Quantum teleportation can be used to transmit Qubit in the super quantum computer.

Physics field: To elevate the level of the study of physics because it will provide insight into the deep study of the nature of quantum mechanics and properties of entanglement a key aspect of quantum mechanics because certain types of calculations are more efficient than classical computers, making them useful for solving problems in cryptography, optimization, and simulation. "The properties of our equation are inconsistent with fundamental unitary of quantum mechanics," admitted Qureshi. "However, in the kind of experiments in which this unitary has been tested till now, the differences between our theory and usual quantum mechanics are negligible, and the modified dynamics is unitary for all practical purposes."

Quantum cryptography: Quantum teleportation can be used as means of transmitting encryption of the keys in form of a quantum keys system resulting in a more advanced and secure communication channel.



Fig. 3: Quantum cryptography

III. Quantum entanglement

Quantum entanglement is a phenomenon in which two or more quantum systems act connected in such a way that the properties of one system are relative to the properties of the other, even when the systems are separated by large distances. Let's say two particles one on earth and one on the end of the galaxy still exchange information. Two or more quantum systems become interconnected in such a way that the properties of one system are dependent on the properties of the other, even when the systems are separated by large distances. This is a phenomenon of quantum mechanics and this one is

considered a fundamental aspect of the quantum world. Einstein famously referred to this act as "spooky action at a distance".

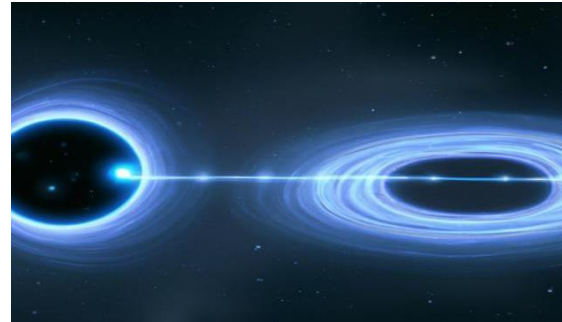


Fig. 4: Entangled particle inside the two black holes at a large distance

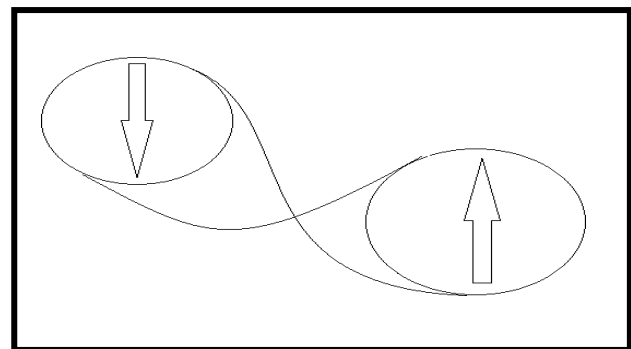


Fig.5: Two entangled particles depicting opposite spin directions.

Quantum entanglement application filed:

Quantum Communication: Entanglement can be used to transmit information securely through quantum key distribution (QKD) techniques, which provide unconditional security.

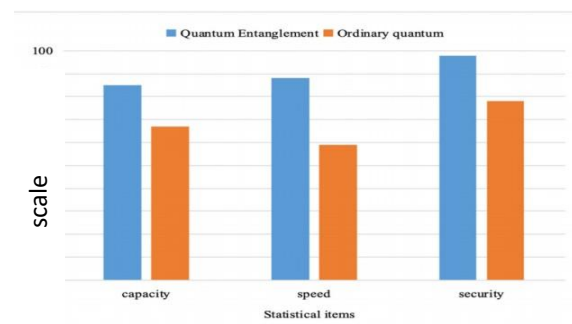


Fig.6: Graph comparing between the Quantum Entanglement and Ordinary Quantum particle

Quantum Sensing: Entangled particles can be used to make highly precise measurements, such as those in gravitational wave detectors or atomic clocks.

Quantum Computing: Entangled Qubit can be used to perform advanced and heavy calculations.

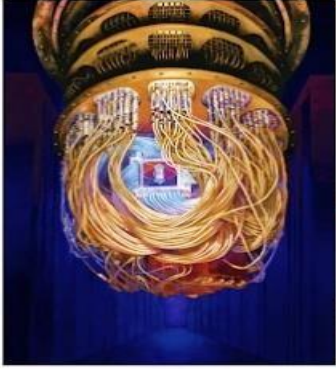


Fig. 6: Quantum computer

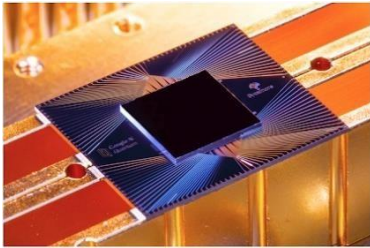


Fig. 7: Quantum chip

Quantum Simulation: By using entangled particles, researchers can simulate complex quantum systems that are difficult to study experimentally. These are just a few examples, but the field of quantum entanglement is rapidly advancing and new applications are being discovered all the time. Entanglement has numerous uses in quantum information science. With the use of entanglement, many impractical tasks can be achieved.

Some of the important applications of quantum entanglement are quantum teleportation and super dense coding.

Entanglement is considered to be necessary for the complete deployment of quantum computing.

Quantum entanglement is used in a few protocols of quantum cryptography.

However, under the standard assumption, entanglement is not required to confirm the security of quantum key distribution.

IV. Scope

Quantum teleportation possible: Quantum teleportation is a phenomenon in which the quantum state of a particle can be transferred instantaneously to a distant particle without physically transporting the original particle. This process is based on the principles of quantum entanglement and quantum mechanics.

In practice, quantum teleportation has been demonstrated with a variety of systems, including individual atoms, ions, and photons. The method typically involves creating an entangled pair of particles and then using one particle from the pair as a "teleportation channel" to transfer the quantum state of a second particle to a distant location. However, it is important to note that the teleportation of actual physical objects (i.e., macroscopic objects) is still not possible due to the technical

challenges and the fact that it would violate the laws of physics as we know it.

V. Relation

Quantum teleportation and quantum entanglement relation: Quantum teleportation and quantum entanglement are related in that they both involve the principles of quantum mechanics and the concept of entangled particles. A pair of particles must first be entangled for quantum teleportation to take place. Entanglement creates a strong correlation between the properties of the two particles, such that the state of one particle becomes dependent on the state of the other particle, even when separated by large distances. When a measurement is made on one particle of an entangled pair, the state of the other particle becomes regardless of the distance between the two. In quantum teleportation, this instantaneous correlation between the states of the entangled particles is used to transfer the quantum state of a particle to a distant location.

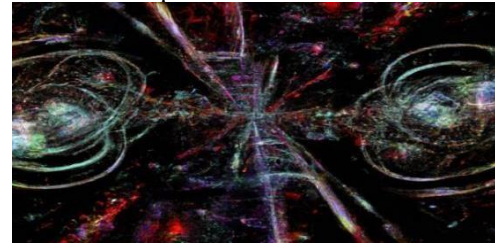


Fig. 8: quantum particle teleportation

The process starts by creating an entangled pair of particles, then using one particle from the pair as a "teleportation channel" to transfer the quantum state of a second particle to a distant location. The second particle is then measured, and the result of that measurement is used to instantaneously determine the state of the particle at a distant location, effectively "teleportation" the state of the particle.

In summary, 'quantum entanglement is a necessary condition for quantum teleportation to occur, as it creates the strong correlation between the properties of the two particles that allows the state of one particle to be transferred to another.'

VI. Feasibility

Quantum teleportation isn't possible for a macroscopic particle: Since it is perfectly organized and compact, however, the diameter of a nucleus containing the entire human genome measures no more than 6 μm . On top of all that, the DNA manages to encode data for 20,000 to 25,000 proteins in only 4 letters. A diploid genome can store 1.5 gigabytes of data converted to digital media. We have 37.2 trillion cells in our body, So the total data size will be: 5 gigabytes*37.2 trillion cells

$$= 5368709120 * 37,200,000,000,000 =$$

$$19,97,15,97,92,64000,000,000,000 \text{ bytes} = 18599999999992$$

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so it's next to impossible to crack this system to make a super quantum computer that can beat this complexity.

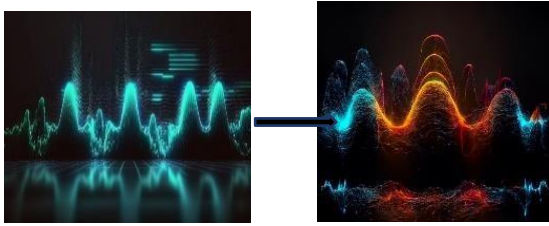


Fig. 9 :Depicts the input of a wave and the output of a wave

If there is a slight mistake in this then the result of the teleportation outcome for the macroscopic object will be unimaginable that's why quantum teleportation isn't possible. But in Japan's group of tardigrades, a multicellular organism quantum teleportation is through the system.

These are just a few examples of the many scientists who have made important contributions to the field of quantum entanglement and quantum teleportation. Many more scientists are working on these topics, in various countries, institutions, and collaboration.

VII. Result & discussion:

Quantum entanglement and teleportation have been studied extensively in recent decades, with significant progress made in understanding the underlying principles and developing practical applications. Experimental demonstrations of quantum entanglement have been performed with various types of particles, including photons, atoms, and ions, with the ability to entangle particles over increasingly larger distances. The process of quantum teleportation has also been experimentally demonstrated using photons, with high levels of accuracy achieved in transmitting quantum states over distances of several kilometers. In addition, researchers have explored the potential for quantum teleportation to be used in a variety of practical applications, including secure communication, distributed computing, and quantum cryptography.

One of the most significant implications of quantum entanglement and teleportation is their potential to enable highly secure communication. By using entangled particles, it is possible to create unbreakable codes for sending messages, as any attempt to intercept or eavesdrop on the transmission would alter the entangled state of the particles, making the message unreadable. This has led to research on the development of quantum key distribution systems, which use entangled particles to generate and share secret keys for encrypting and decrypting messages.

Another potential application of quantum teleportation is in the field of quantum computing. By using entangled particles and quantum teleportation, it may be possible to perform computations on remote quantum computers without physically transferring information between them. This could enable distributed quantum computing, where multiple quantum computers are connected via entangled particles and work together to perform complex calculations.

In conclusion, research on quantum entanglement and teleportation has produced promising results and opened up new avenues for exploring the potential of quantum mechanics in various applications. While there are still many challenges to overcome, the potential benefits of these concepts are significant and warrant continued research in this field.

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Reduction of NOx Emissions

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Abstract NOx emissions are pollutant gases, including nitrogen oxides, that are released into the atmosphere and contribute to air pollution. These emissions come from multiple sources, including automobiles, industrial processes, and even natural sources. Reducing NOx emissions is necessary to protect public health and the environment, and fortunately, there are a number of ways to accomplish this. One of the major sources of NOx emissions is automobiles. In recent years, automotive manufacturers have made significant improvements in the amount of NOx emissions released by vehicles. This has been accomplished through the use of catalytic converters, which trap NOx-emitting pollutants before they are released into the atmosphere. Additionally, the use of cleaner-burning fuels and the development of hybrid electric and other zero-emission vehicles have helped to reduce NOx emissions from cars and other vehicles.

I. INTRODUCTION

Nitrogen oxides (NOx) are a very interesting and important family of air polluting chemical compounds. This bulletin explains why NOx are important air pollutants and how NOx are formed and react in the atmosphere. This bulletin also discusses the principles on which all NOx control and pollution prevention technologies are based; available NOx technologies for various combustion sources; and performance and cost of NOx technologies. NOx emissions (NO and NO₂) are a significant source of pollution in the atmosphere. They have a wide range of negative consequences for the environment and human health. The main effects of NOx on the environment include acidification of rain, photochemical smog, greenhouse effect, and ozone depletion. Most of the dangerous effects on health is respiratory tract disorders [1]. Although many sources such as agriculture, thermal plants, and industry have been considered as contributors to NOx emissions, the transport sector especially diesel-powered vehicles are the main contributor of NOx emissions. NOx

is principally produced by a high-temperature endothermic reaction between nitrogen and oxygen in the fuel-air mixture. Around 40% of total NOx emissions come from road transport, while diesel-powered cars account for 85% of NOx emissions from the transportation sector. The challenge for vehicle makers and researchers has been to minimize NOx emissions from diesel engines without sacrificing engine performance. To obtain optimal conversion rates in NOx emissions, numerous research and technological advancements have been made. Emissions after they have been directed to the methods for decreasing NOx emissions include exhaust gas recirculation (EGR), electronically controlled fuel injection, engine modification, increased injection time, water spray in the combustion chamber, improved fuel characteristics, and the use of fuel additives [2]. After-treatment technologies including the use of lean NOx trap (LNT) catalysts and the selective catalytic reduction (SCR) systems, which were developed to reduce NOx emissions and are widely used in diesel engines, are the subject of this research. Diatomic molecular nitrogen (N₂) is a relatively inert gas that makes up about 80% of the atmosphere. However, the chemical element nitrogen (N), as a single atom, can be reactive and have ionization levels (referred to as valence states) from plus one to plus five. Thus nitrogen can form several different oxides. Using the Niels Bohr model of the atom, valence state relates to the number of electrons which are either deficient (positive valence) or surplus (negative valence) in the ion when compared with the neutral molecule. NOx conversion efficiency was studied using NiCO₂O₄ as a catalyst at two different engines with various loading conditions. Furthermore, using a basic physical mixing strategy is a cost-effective and practical option that can be quickly implemented in the industry. This catalyst reduces additional fuel expenses and carbon dioxide emissions by operating at low temperatures without the use of an external reductant. As a result, it provides enormous economic and environmental benefits. SCR (selective catalytic reduction) of NOx emissions is a common technique nowadays. With a reductant and catalyst in an SCR system, NOx emissions from diesel engines can be reduced significantly. The most common reductant and catalyst used to reduce NOx emissions at high exhaust gas temperatures are ammonia (NH₃) and V₂O₅ WO₃/TiO₂. However, conversion

efficiency remains low at low exhaust gas temperatures below 250° C, and NH₃ builds up on the exhaust line and catalyst surfaces. This phenomenon, known as NH₃ slip, has a significant detrimental impact on SCR conversion efficiency and can lead to catalyst degradation. Many catalysts, such as Cu zeolites or Mn oxides, have been created with superior low-temperature SCR activity; however, they are all ineffective in most off-gas circumstances because the active sites are substantially destroyed by sulfur dioxide poisoning. Yu et al. created a CuSSZ-13 zeolite-metal oxide hybrid catalyst that has improved SO₂ tolerance by preferring producing Zn sulfate over Cu sulfate. Unfortunately, commercialization in the field is problematic due to the sophisticated catalyst preparation procedure and the requirement for a very high temperature (650°C) to regenerate inactive catalysts[3]

RESULT AND DISCUSSION

Nitrogen oxides (NO_x) are a group of gases that are produced during the combustion of fossil fuels, including in vehicles and power plants. NO_x emissions contribute to air pollution and can have negative impacts on human health and the environment. Therefore, reducing NO_x emissions is an important goal for many industries. There are several ways to reduce NO_x emissions. One approach is to improve the efficiency of combustion processes so that less fuel is needed to produce the same amount of energy. This can be achieved through better combustion chamber design, optimization of fuel-air mixture, and use of advanced combustion technologies such as lean burn and selective catalytic reduction (SCR). Another way to reduce NO_x emissions is to use alternative fuels, such as biofuels, hydrogen, or electricity. These fuels have different combustion properties than fossil fuels, and they can help to lower NO_x emissions. For example, hydrogen and electricity can be used in fuel cells to generate electricity with no emissions other than water vapor[4]. There have been many studies on the reduction of NO_x emissions in different industries. For example, in the automotive industry, improvements in engine design, the use of SCR systems, and the use of alternative fuels have all been effective in reducing NO_x emissions from vehicles. Similarly, in the power generation industry, the use of low-NO_x burners and SCR systems has been effective in reducing NO_x emissions from power plants. The reduction of NO_x emissions is important for both human health and the environment. NO_x emissions contribute to the formation of smog and can cause respiratory problems in humans. In addition, NO_x emissions can lead to acid rain, which can have negative impacts on plants and animals.

There are several ways to lower NO_x emissions from various industries, such as the automotive and power generation industries[5]. These ways include improving combustion efficiency, optimizing fuel-air mixture, and using advanced combustion technologies, such as lean burn and selective catalytic reduction (SCR). Additionally, using alternative fuels, such as biofuels, hydrogen, or electricity, can also help reduce NO_x emissions. Studies have shown that these methods have been effective in reducing NO_x emissions from vehicles and power plants. In the automotive industry, improvements in engine design, the use of SCR systems, and the use of alternative fuels have all been effective in reducing NO_x emissions from vehicles. Similarly, in the power generation industry, the use of low-NO_x burners and SCR systems has been effective in reducing NO_x emissions from power plants. Reducing NO_x emissions is crucial for human health and the environment. NO_x emissions contribute to the formation of smog and can cause respiratory problems in humans. In addition, NO_x

emissions can lead to acid rain, which can have negative impacts on plants and animals. Overall, reducing NO_x emissions is an important goal for many industries, and there are several effective methods to achieve this goal. By adopting these methods, industries can contribute to a cleaner and healthier environment while also improving their operational efficiency[6].

II. CONCLUSION

1. NO_x emissions (NO and NO₂) are a significant source of pollution in the atmosphere. They have a wide range of negative consequences for the environment and human health. The main effects of NO_x on the environment include acidification of rain, photochemical smog, greenhouse effect, and ozone depletion, while the most severe effect of NO_x on health is respiratory tract disorders.
2. Around 40% of total NO_x emissions come from road transport, while diesel-powered cars account for 85% of NO_x emissions from the transportation sector.
3. Elevated levels of nitrogen dioxide can cause damage to the human respiratory tract and increase a person's vulnerability to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease.
4. NO_x enzymes modulate the disease progression amyotrophic lateral sclerosis (ALS).
5. Most NO_x emissions are generated globally from domestic and industrial sources. The most common sources are power generation stations, Turbines, Automobiles etc.
6. The Environmental Protection Agency (EPA) has long recognized the negative effects of these airborne pollutants and fixed emission levels for all industrial processes. To help meet the NO_x Control Regulations set by the EPA, NO_x abatement technologies can reduce the level of waste gases produced by burning fossil fuels. Outlined below are some of the most useful NO_x emission control methods available like natural gas burning, Fuel gas treatment, Excess air control etc.

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WORMHOLES: A SHORTCUT TO IMPOSSIBLE

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ABSTRACT: A wormhole is a hypothetical space-time passage that could provide shortcuts for long journeys across the universe. Wormholes are predicted by general relativity theory, though creating, or discovering one would be extremely difficult. Teleportation, on the other hand, is the concept of instantly transporting a person or object from one location to another without the need for physical travel. For many years, it has been a popular concept in science fiction, and while it is not yet possible, scientists are making progress in the field. Both wormholes and teleportation have the potential for faster-than-light travel, but there are significant differences between the two. Wormholes are a theoretical concept, while teleportation is being investigated as a potential quantum physics application. Wormholes are thought to be capable of connecting two very distant points in the universe, whereas teleportation could be used to travel between two relatively close points.

Keywords: wormholes, hypothetical, space-time, general relativity theory, faster than light travel, quantum physics application, physical travel.

I. INTRODUCTION

"The idea that we might be able to travel through a wormhole and emerge in another part of the universe, or even in a different time, is mind-blowing. It challenges everything we think we know about space and time." - Stephen Hawking

Wormholes and teleportation are intriguing concepts that call our understanding of space and time into question. A wormhole is a fictitious space-time tunnel that could connect two points in the universe, allowing for faster-than-light travel and communication. Teleportation, on the other hand, is the physical movement of matter or information from one location to another. Both ideas remain purely theoretical, with no experimental evidence to support them. Recent advances in quantum mechanics and theoretical physics, on the other hand, have reignited interest in these concepts, implying that they may have practical applications in space exploration and communication. Theoretical frameworks such as **ER=EPR**, which proposes that wormholes and entanglement are two different manifestations of the same physical phenomenon, are being studied to better

understand these concepts. While practical implementation of these ideas is still a long way off, the possibility of wormholes and teleportation challenge our

current understanding of the universe and opens up an exciting new line of research.

ER = Einstein-Rosen bridges
EPR = Einstein-Podolsky-Rosen

II. DEFINITION

i) Wormhole:

A wormhole is a hypothetical space-time passage that could provide shortcuts for long journeys across the universe. Wormholes are predicted by general relativity theory, but it is very difficult to create or discover one. Teleportation refers to the ability to move a person or object from one location to another without the need for physical travel. Meanwhile, teleportation is also known as instant travel. For many years, it has been a popular concept in science fiction, but it is not yet possible to create or teleport through a wormhole. Wormholes and teleportation both have the potential for faster-than-light travel, but there are significant differences between the two. Wormholes are a theoretical concept, while teleportation is being investigated as a potential quantum physics application. If teleportation were to be successfully developed, it could be used to travel between two relatively close points in space.

Types:

3. Traversable wormholes:

Traversable wormholes are hypothetical structures that could be used for travel. They allow matter and energy to pass through, allowing them to serve as shortcuts between two distant points in space. A traversable wormhole requires exotic matter, which has a negative energy density, to keep the throat of the wormhole stable and prevent it from collapsing.

- **Morris-Thorne wormholes** are the first proposed by physicists Michael Morris and Kip Thorne. They are theoretical structures that connect two separate regions of space-time. They require exotic matter to keep the throat of the wormhole stable and prevent it from collapsing.

The properties of Morris-Thorne wormholes are: -

- f) They are **extremely stable** and can transport large amounts of matter through them.
- g) They also have the potential to connect different parts of the universe. Morris-Thorne wormholes are **two-way passages** that allow matter and energy to flow in both directions. They could be used for interstellar travel or for faster-than-light communication.
- h) **Exotic matter** is necessary to keep Morris-Thorne wormholes stable. It has a low energy density, which is a mysterious form of matter that has not yet been observed in the universe. The properties and behaviour of exotic matter are still being studied.
- i) The Morris-Thorne wormhole has a **short lifespan** and is prone to collapsing. Its lifespan is limited to fractions of a second, making its practical use for travel or communication very challenging.
- j) The **causality principle** says that an event's cause must always precede it. So, using a wormhole to travel back in time could create paradoxes, such as the grandfather paradox.

Overall, Morris-Thorne wormholes are a fascinating theoretical concept in physics, but many technical challenges must be overcome to bring them to life. The properties of exotic matter and the stability of the mouth of a wormhole remain major areas of research and debate in theoretical physics.

4. Non-traversable wormholes:

Non-traversable wormholes are believed to exist naturally in space, but they cannot be used for travel or communication. They are formed due to gravitational forces and are extremely unstable. Their lifespan is extremely short, and they collapse almost immediately after forming.

- **Schwarzschild wormholes** are a type of impassable wormhole, meaning they cannot be used for travel or communication. They are formed due to the gravitational field of a black hole, and are named after the physicist Karl Schwarzschild, who was the first to study the properties of black holes.

The properties of Schwarzschild wormholes are: -

- e) Schwarzschild wormholes are **one-way passages**, meaning that matter and energy can only travel in one direction. Anything that enters the wormhole will be trapped inside the black hole and cannot exit the other end.
- f) Space-time can be curved by a massive **gravitational field**, resulting in a wormhole. This wormhole can be seen as a funnel-like structure, extending from the black hole's event horizon to the other end of the wormhole.
- g) **Gravitational lensing** is a phenomenon caused by the existence of Schwarzschild wormholes. These wormholes cause the light passing through them to be distorted, creating an image of objects that is magnified and distorted.
- h) **Tidal forces** near the event horizon are so strong that they can stretch and deform matter into thin, elongated shapes, known as spaghettification.

- **Ellis wormholes** these are formed due to the presence of cosmic strings, which are hypothetical one-dimensional topological defects in the fabric of space-time.

The properties of Ellis wormholes are: -

- e) Ellis wormholes are **two-way passages**, meaning matter and energy can flow through them in either direction. They can be used to travel from one end to the other, potentially enabling interstellar travel or faster-than-light communications.
- f) **Exotic matter** is necessary to keep Ellis wormholes stable. It has a low energy density, which is a type of matter that has not been seen in the universe yet. The properties and behaviour of exotic matter are still being studied.
- g) **Unique Geometry** Ellis wormholes have a unique geometry that differs from other types of wormholes. They have a spherical neck connecting two regions of flat spacetime, which differs from the funnel-like shape of Schwarzschild wormholes or the toroidal shape of Morris-Thorne wormholes.
- h) There is some debate over whether or not Ellis wormholes are **singularity-free**, but if they are, this could make them a safer and more stable option for travel and communication than other types of wormholes.

Overall, Ellis wormholes are an intriguing theoretical concept in physics, and their unique geometry and lack of singularity make them a promising candidate for practical use in the future. However, as with other types of wormholes, the properties and behaviour of exotic matter remain a major area of research and debate in the field of theoretical physics.

ii) Teleportation:

Teleportation is the process of transferring an object or a set of properties from one location to another without physically moving it through the space in between. It is a common theme in science fiction, but it is also a real concept in physics. There are two main forms of teleportation: quantum teleportation and classical teleportation.

- **Quantum teleportation** is a method of transferring quantum information from one quantum system to another over long distances. This relies on a quantum phenomenon called entanglement, which allows for correlated properties between two particles. Because entanglement can be maintained over large distances, quantum teleportation could potentially allow for secure and instant communication or quantum computing over long distances.

- d) **Standard quantum teleportation** uses entangled particles to transfer quantum information between two locations. It has been successfully demonstrated in experiments but is limited by the need for a pre-existing entangled state.
- e) **Entanglement swapping** allows for the creation of new entangled states without a pre-existing entangled state, but it is limited by the need for multiple pairs of entangled particles and the difficulty of maintaining entanglement over long distances.
- f) **Quantum teleportation** using non-local measurements uses measurements that allow for the transfer of quantum information without the need for entanglement. However, this method is limited by the difficulty of making non-local measurements and the fact that it can only transfer quantum information.

- **Classical teleportation**, on the other hand, is a method of transferring classical information from one location to another. It does not rely on quantum entanglement, but instead on the principles of classical information theory. In

classical teleportation, a sender first prepares a classical message, such as a string of bits, and then encodes the message into a set of quantum states. Classical teleportation is mainly used for transferring classical information, such as data or text, rather than physical objects.

- e) **Classical teleportation using entanglement** is Creating a wormhole would be very difficult, and it would require a lot of energy to keep it open.
- f) Teleportation is a process of destroying the original object or particle in order to move it elsewhere. This raises questions about whether the original object is really being moved or whether a copy is being created.
- g) Teleportation requires using specially prepared quantum systems. Sometimes, different types of particles won't work for teleportation because they don't have the right properties.

Quantum teleportation is a way to send information securely over a network, but it is vulnerable to attack. Scientists are still working on understanding the mathematical and physical theories behind wormholes and teleportation, and are developing methods to create and keep wormholes stable, in order to perform quantum teleportation with increasingly complex systems. So far, the practical applications of quantum teleportation are limited, but ongoing research is expanding our understanding of the technology. This could have far-reaching implications for space exploration, communication, and technology in the future.

The stability of wormholes is a major challenge, and it's not clear if they can be created or sustained. Creating and maintaining a wormhole would require a lot of energy, and it may be hard to study these strange phenomena.

There are many challenges to teleportation, the most significant of which is the destruction of the original object or particle. Additionally, not all particles can be used for teleportation, and the process requires the use of specially prepared quantum systems. While quantum teleportation has the potential to create a secure communication network, it is vulnerable to a variety of attacks. However, ongoing research is expanding our understanding of these concepts and could have far-reaching implications for the future of space exploration, communication, and technology. In particular, advances in quantum teleportation could lead to the development of secure communication networks and new forms of cryptography, while the discovery of stable wormholes could revolutionize space travel and allow us to explore the universe in ways that are currently unimaginable.

V. ETHICAL CONSIDERATIONS

There are many ethical considerations to take into account when developing these new technologies. For example, if teleportation is used to transport people across vast distances, it could create new social and economic inequalities. Alternatively, the ability to manipulate time or create alternate realities could create new power dynamics, which could further divide people.

With the possibility of wormholes and teleportation, our understanding of the nature of reality and our place within it has come into question. Is the universe one big, interconnected reality, or are there multiple universes that we cannot see or access? If time travel is possible, does this mean that the future is predetermined, or that we have the

power to alter it? These are all deep philosophical questions that require significant thought.

- c) In conclusion, the potential applications of wormholes and teleportation raise significant questions about ethics and philosophy that must be addressed as we explore these technologies. It is important to approach these questions limited by the fact that it can only transfer classical information and is not suitable for transferring physical objects.
- d) **Classical Teleportation using Classical Channel and EPR Pairs** This method involves using classical channels and EPR pairs to transfer classical information between two locations. The sender and receiver share EPR pairs, and the sender encodes the information into a classical channel using a process known as quantum error correction. The receiver can then decode the information using the shared EPR pairs. While this method can be used to transfer larger amounts of classical information than other methods, it is limited by the fact that it requires the use of quantum error correction codes, which can be complex and difficult to implement.

III. THEORETICAL BASIS

iii) Wormhole:

General relativity predicts the existence of wormholes, structures in spacetime that connect two distant regions. Physically, the existence of wormholes requires the presence of exotic matter that has a negative energy density and violates classical energy conditions. Exotic matter is a theoretical concept that has not yet been observed in nature but is required by the mathematics of general relativity to stabilize the structure of a wormhole and prevent it from collapsing under its own gravitational pull. The properties of exotic matter have not been sufficiently studied, and its existence remains the subject of ongoing research. The study of wormholes has also been extended to the field of quantum gravity, which attempts to reconcile general relativity with quantum mechanics. One of the challenges in understanding quantum gravity is to develop a theory that can describe the behaviour of spacetime on small scales, such as the Planck length. Some theories of quantum gravity predict the existence of wormholes on this scale and suggest that they may play a role in the structure of spacetime at the quantum level. Albert Einstein and Nathan Rosen were two of the most prominent physicists of their time who explored the possibility of wormholes and their properties. In 1935, they proposed the existence of a special type of wormhole known as the "Einstein-Rosen bridge", also known as the "ER bridge". Their work was based on their previous development of general relativity. They noticed that the equations of general relativity allow for a structure in spacetime that allows matter to pass through a tunnel that effectively connects two distant points in spacetime. This structure was later called a "wormhole". Einstein and Rosen introduced the concept of an ER bridge describing a wormhole connecting two black holes. They argued that matter falling into one black hole would exit through another black hole, effectively "teleporting" across the bridge. They also showed that the existence of an ER bridge requires the presence of an exotic substance to stabilize the structure. Later, other notable scientists such as John Archibald Wheeler and Kip Thorne expanded on the work of Einstein and Rosen to study the properties of wormholes in more detail. Wheeler coined the term "wormhole" to describe a hypothetical structure that could be used for time travel. Thorne developed the idea of wormholes and their

properties and showed that the presence of exotic matter is necessary to keep them stable.

- iv) Teleportation:
- v) account the potential risks and unintended consequences of these technologies. Ultimately, our exploration of these concepts could have far-reaching implications for our understanding of the universe and our place within it.
- vi)
- vii) **VI. CONCLUSION**
- viii)
- ix) To sum up, the notion of wormholes and teleportation have been investigated in both science fiction and scientific study. Wormholes are assumed structures in spacetime that may be able to enable faster-than-light movement and time travel, while teleportation is the ability to transfer matter over long distances in a flash. Both of these concepts evoke tremendous ethical and philosophical queries with regard to their potential uses, such as in space exploration, communication, and time travel.
- x) At the moment, the study of wormholes and teleportation is in its initial stages, and a great deal of work needs to be done to apprehend the physical and mathematical principles that lie behind these notions. Though some advances have been made in constructing theoretical models and experimental techniques for teleportation, there are still numerous technical and practical issues that must be dealt with prior to these technologies becoming a reality. Further research is necessary.
- xi)
- xii)

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- xxiv)
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- xxvi) with a spirit of curiosity and inquiry, while also taking into

Designing of college bag to address various flaws in existing designs

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2. Comfort:

The bag should be designed to be comfortable to carry. To reduce

ABSTRACT: A college bag is a tool that every student uses on a daily basis to transport stationery and personal belongings. The bag's usage and convenience are influenced by its materials, styles, and features. Several designs were offered over time to improve on the existing college bag designs. A college bag's design is vital for students to consider because it can have a big impact on their comfort and convenience throughout the day. Students confront issues such as bag handling in congested places, shoulder ache, poor bag quality, and oil leaks from lunch boxes. Aside from that, the bags are uncomfortable to wear for long periods of time and cause back and shoulder pain. The use of latex foam near the shoulders and paddings can help to reduce the stress imposed by bags on the body. This document also offers various remedies to the difficulties, such as the use of Velcro pockets, double stitching in specific spots, and oil insulating material. It makes proposals for new bag designs in the future. Earphone slot can be attached to the bags for upcoming generation bags. Aside from this, more adjustments are suggested here to improve convenience of bags

Keywords: wormholes, hypothetical, space-time, general relativity theory, faster than light travel, quantum physics application, physical travel.

I. INTRODUCTION

Creating a college backpack may be both a difficult and enjoyable. College bags are a must-have accessory for students who need to transport their books, laptops, and other daily necessities. A well-designed college backpack should be both utilitarian and trendy, as well as aesthetically pleasing.

When creating a college backpack, keep the following points in mind:

1. Purpose: The first step is to determine the bag's intended use. It should be able to transport laptop computers, books, or both. Knowing the purpose will aid in deciding the bag's size, shape, and general design.

tension on the shoulders

and back, the weight of the bag should be spread equally. To provide extra comfort, the straps should be adjustable and padded.

3. Material: The bag's material should be strong and long-lasting. It should be able to tolerate daily wear and tear. Canvas, leather, and nylon are popular materials for college bags.

4. Compartments: To accommodate various objects, the bag should contain many compartments. It should feature a laptop compartment, a book compartment, and additional pockets for small goods such as phones, pens, and keys.

5. Design and Style: The bag's design and style should be aesthetically appealing and complement the student's own style. It should be available in a variety of colors and designs to appeal to a wide range of tastes.

THEORETICAL BACKGROUND:

Creating a college bag is a multifaceted undertaking that combines elements of industrial design, fashion design, and functionality.

The following steps are considered while creating designs:

Define the issue, do the back research, specify requirements, analyze data, evaluate solutions, choose solutions, make changes in design, develop prototype, test solution, solution meeting requirements, review new data and communicate results. The final product should be practical, comfortable, aesthetically pleasing, and represent the college or university's brand. It should be convenient to use and should be a improvised version of other designs. The weight of bag, shoulder pain, leakage of oil from lunch box compartment to other compartments, discomfort, handling of bags, poor quality and many more such problems are the reason behind the need of better designs.



OBJECTIVE:

This paper explains the importance of structure of backpack which helps not only in the reduction of stress but also helps to accommodate more things which are required for students. It states about the need of more convenient bags which are easy to carry and handle. Aside for this, the bags should be able to match with the upcoming generation's needs and requirements. Also it should be pleasing to look at with a good fashion design. The problems and solutions are explained here with some suggestions in the existing designs of college bag.

EXISTING DESIGN:



PROBLEMS OF EXISTING DESIGNS:

- **Handling-** In crowded places like in bus it becomes difficult to take out money or other small objects
- **Shoulder pain-** Causes too much stress on shoulders
- **Low quality-** After a period of time stitches get worn out
- **Oil leakage-** Oil gets leak from lunch box to other compartments
- **Bottles compartment-** Bottles often fell from bags due to rush in crowded places like bus.

SOLUTIONS:

- **Velcro pockets-** A pocket with the Velcro opening can be put at the back of the bag which would make it easy to remove small objects while wearing the bag itself, since our hands can reach that far.
- **Latex foam-** Latex foam can be placed in shoulder straps. It gives comfort and has cushioning properties. It also promotes natural spine alignment.
- **Double stitching-** Double stitching will improve the shelf life of bag and will make it more durable. Its cost-effective too.
- **Oil insulation cloth-** Oil insulation cloth materials can be used in tiffin compartment to prevent oil from leaking into other compartments.
- **Bottles compartment-** This compartment can be replaced by Velcro pockets instead of open elastic column attached at the side panel.

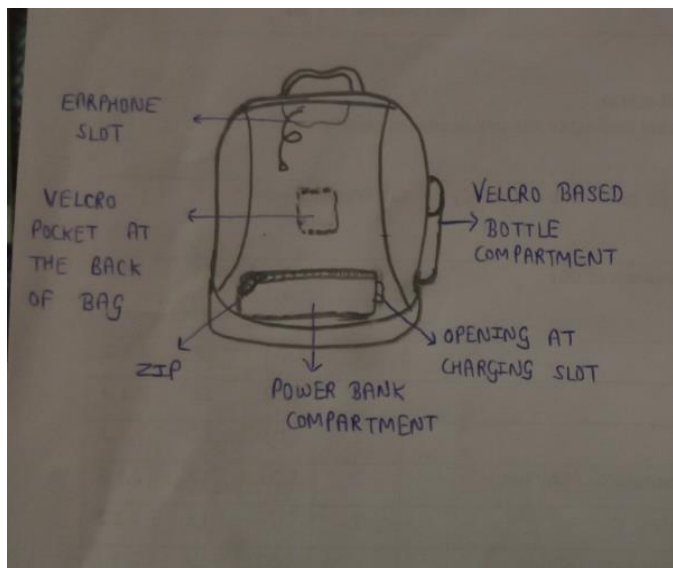
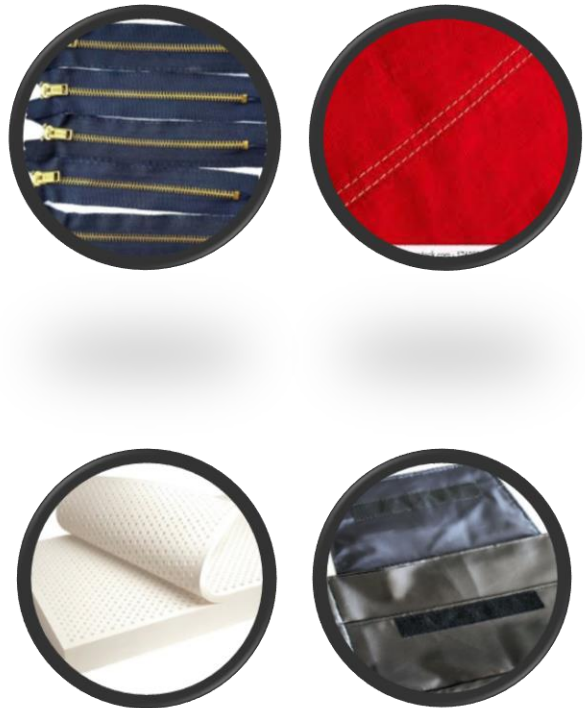
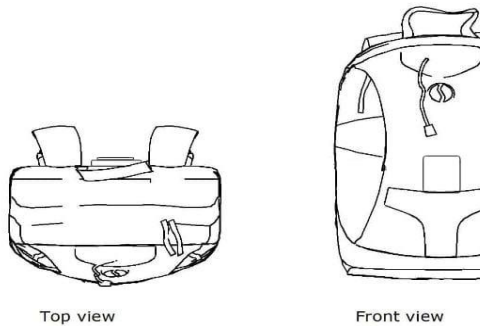
Latex foam is light-weight material with cushioning properties. It should be applied near shoulder areas where more stress is generated due to weight of bags. For the rest neoprene should be used which is cheap. Double stitching should be applied in selected areas of bags where more pressure is generated due to weight of bags.

This method where selected areas are provided with selected solutions will help to decrease the overall price of the bag.

FEATURED DESIGN:

1. For the new generation daily routine, a earphone jack slot can be added near the neck of the bag. It would minimize the handling of earphone or headphone wires. Also it would look appealing and matching the standards of fashion.
2. Because students typically spend a significant amount of time in educational institutions, a separate powerbank can be included with the backpacks to facilitate the student's daily routine. A compartment of the size of a powerbank would be added to the lower section of the front panel, with an opening near the charging slot. This would allow students to conveniently charge their devices while travelling. It would be stable and safe in that compartment because it is the same size as the powerbank.

NEW DESIGN :



Since we would use latex foam in selected area, small to medium-sized bags (such as laptop bags or backpacks) that use latex foam as a cushioning material can cost anywhere from Rs. 1,000 to Rs. 3,000.

For power banks with a battery capacity of 10,000 mAh, the price can range from Rs. 500 to Rs. 1,500 and for power banks with a battery capacity of 20,000 mAh, the price can range from Rs. 1,500 to Rs. 3,500.

Therefore if powerbank is provided with the bags along with latex foam , it would cost around Rs.1,500 to Rs.4,500.

MATERIALS:

- Velcro
- Nylon thread
- Scissors/Cutter
- Sewing machine
- Elastic material
- Zipper chains
- Neoprene
- Oil insulating materials like polyester or nylon
- Cloth material
- Latex foam
- Glue

Aside from these, some machines are used to perform their respective processes.

CONCLUSION:

After evaluating the shortcomings in existing college bag designs and discussing alternative remedies, it is evident that this sector has a lot of space for improvement. Durability, quality, storage, lightweight materials, and total bag cost are all potential areas for improvement. Thus, a new college bag design might considerably improve the student experience and daily living for college students by addressing these shortcomings in present college bag designs and introducing solutions that promote organisation, comfort, and sustainability. Also, as per analysis, bags with latex foam would cost around Rs.1,000 to Rs.3,000 and if powerbank is also supplied with it then it would cost around Rs.1,500 to Rs.4,500.

ACKNOWLEDGEMENT:

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LIE DETECTOR MACHINE

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Abstract— Lie Detector is crucial in many areas, such as airport security, police investigations, counter- terrorism, etc. The goal of lie detection is the discovery of a truth that is known to one person and concealed from others. One technique to detect lies is through the identification of facial micro-expressions. which are brief, involuntary expressions shown on the face of humans when they are trying to conceal or repress emotions. Manual measurement of micro-expressions is hard labour, time consuming, and inaccurate. The Design and Development of a Lie Detection System using Facial Micro-Expressions. Modern polygraphy measures blood pressure, breathing, and skin conductance. Alternative metrics such as voice stress analysis and functional magnetic resonance imaging are as yet unproven. The control question test uses relevant, control, and irrelevant questions. A larger response to the relevant questions is considered evidence of deception. The guilty knowledge test uses concealed information questions and irrelevant questions..

I. INTRODUCTION (HEADING 1)

A lie detector machine, also known as a polygraph, is a device used to measure physiological responses to determine whether a person is telling the truth or lying. The machine measures several physiological indicators, including blood pressure, respiration, and perspiration, while a person is asked a series of questions. The premise is that lying creates physiological changes that can be detected by the machine. The polygraph typically consists of several sensors that are attached to the person being tested. These sensors measure changes in the body that occur when a person lies, such as an increase in heart rate or perspiration. The polygraph examiner will ask a series of questions, both relevant and irrelevant, and then analyze the changes in the physiological responses to determine whether the person is telling the truth or lying.. A polygraph was used in police interrogation and investigation since 1924, the polygraph is still a controversial topic among psychologists and is not judicially acceptable. It is important to note that the use of polygraph machines is controversial, and their accuracy is not 100% reliable. Some experts argue that the machine can be fooled, and that the results can be affected by factors such as anxiety or fear, rather than deception. Despite these criticisms, polygraph tests continue to be used in certain situations, such as criminal investigations and employment screenings.

II. HISTORY OF THE LIE DETECTOR MACHINE

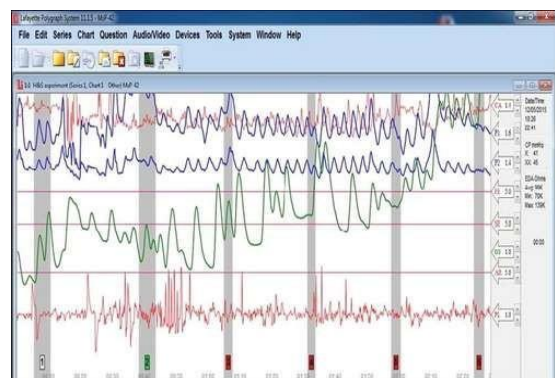
Since the beginning of time man has been looking for an efficient way to flush out the lie. Various innovative techniques were tried. Some were ridiculous, other cruel, but

they were all based on the assumption that some physiological reaction occurred when a person was confronted with specific event under investigation and that this reaction would have a detectable external manifestation. In 1730, the British novelist Daniel Defoe in his essay "An Effectual Scheme to the immediate preventing and suppression of street robberies all the other disorders of the night" advance a theory that the pulse of a suspicious person can reveal that person can reveal that the person is lying. The first lie detector machine was created in 1921, when a California-based policeman and physiologist John A. Larson devised an apparatus to simultaneously measure continuous changes in blood pressure, heart rate and respiration rate in order to aid in the detection of deception. The lie detector machine made its official entry into computer age around 1993 when statisticians of the Johns Hopkins University Applied Physics Laboratory in Maryland completed a software called PolyScore, which used sophisticated mathematical algorithm to analyze the polygraph data in order to estimate a probability level of lying or sincerity of a subject.

III. POLGRAPH TECHNOLOGY

Modern polygraphs no longer use pens attached to tambours to write in ink onto a roll of paper driven by clockwork in the way the original Keeler polygraph models used to work. Modern polygraphs produce digital outputs that go directly from the measuring instruments into a computer with the appropriate polygraph software.

1. Digital polygraph output.



They are cardiovascular activity (red line, Figure 1), respiratory activity (blue line, Figure 1) and electrodermal activity (green line, Figure 1) which is also known as GSR. Increases in heart rate and blood pressure are brought on by the sympathetic nervous system releasing the postganglionic neurotransmitter norepinephrine, while a decrease in heart

rate and blood pressure is brought on by the parasympathetic nervous system releasing postganglionic acetylcholine. Pressure-sensitive receptors, baroreceptors, play a central role in activating the appropriate system when blood pressure suddenly drops or rises, thus maintaining the basal blood pressure required for sustained life. Cardiovascular activity is, however, modulated by a range of other factors beyond this basic mechanism. Perceived threats, increased physical or mental activity, the anticipation of a threat or activity, and effectively any form of specific or general arousal can affect heart rate, blood pressure and other cardiovascular processes in a range of ways. They can differ subtly or radically amongst individuals (especially for those with active mental illnesses or anxiety disorders) and even for the same individual under different circumstances. This has obvious implications for polygraph practitioners, who employ techniques that assume certain patterns of cardiovascular activity to be characteristic of certain psychological states (e.g. deceptiveness) across individuals and situations. Respiratory activity is even more problematic in this regard as it is affected by both the autonomic and the central nervous system. In the autonomic nervous system, breath intakes are initiated in the medulla and pons by the spontaneous firing of neurons, and then modified based on carbon dioxide and oxygen concentrations in the blood, as respectively detected by central and peripheral chemoreceptors, while stretch receptors monitoring lung inflation modulate respiration further. The central nervous system allows an individual to easily bring respiratory activity under voluntary control, which represents a problem for polygraph examiners due to the fact that both heart rate and GSR can be affected by changes in breathing, e.g. a sharp intake of breath reliably produces an electrodermal response (EDRs) due to respiratory sinus arrhythmia. Electrodermal activity has long been regarded the most sensitive and reliable of the three channels of the polygraph. The electrical resistance and conductance of the skin is largely determined by the activity of the sweat-producing eccrine glands, which are controlled by the sympathetic nervous system. However, due to eccrine glands having acetylcholine as their postganglionic neurotransmitter, they are not affected by epinephrine (commonly known as adrenaline) or norepinephrine level fluctuations in the blood, like cardiovascular and respiratory activity are (Stern, Ray, & Quigley, Citation2001). While this does make the GSR channel less prone to being affected by extraneous factors, it in no way eliminates the inherent problems associated with any attempt to infer psychological states based on peripheral nervous system activity. Furthermore, the frequency with which EDRs occur spontaneously, in the absence of an apparent stimulus, has been found to differ amongst individuals (Waid & Orne, Citation1982; Waid, Wilson, & Orne, Citation1981). A large variety of traditional analogue and modern digitized polygraph models are available to purchase from different companies. Most polygraphs can be used with a combination of different tools that measure the three main channels, with certain models also allowing for the use of additional devices that measure movement, voice pitch and other physiological data that the examiner might find relevant (Geddes, Citation2002). For the polygraph measurement of cardiovascular activity, the standard tool is the sphygmomanometer arm cuff, similar to those used in medical practice (Turner & van Schalkwyk, Citation2008), which also comes in wrist cuff and finger cuff varieties. An alternative to using cuffs, which function by measuring changes in pressure, are photoelectric plethysmographs,

which are clipped to a finger or ear. They work by sending infrared light (7000 to 9000 Å) into the tissue, where it is scattered by red blood cells, and photo-sensors measure the light that is reflected or passed through the tissue segment where the monitor is placed. The amount of light that reaches the photo-sensors is directly related to the amount of blood through which it passed before reaching the sensor; and thus changes in blood volume can be measured without relying on pressure cuffs (Challoner & Ramsay, Citation1974). Whether either form of measurement is superior for the purposes of detecting heart rate variability or the difference of the maximum and minimum amplitudes has yet to be established. Respiration is measured using pneumatic rubber bellows, which are fastened around the thorax and abdomen with a connecting chain so that the changes in thoracic and abdominal circumference concurrent with inhalation and exhalation expand the bellows, causing their internal pressure to change, which can be monitored with a pressure transducer (Isshiki & Snidecor, Citation1965). This method of measuring respiratory activity is generally considered to have a relatively low frequency response, but this is not thought to be inherently detrimental to polygraph examinations (Baken & Orlikoff, Citation2000). One available alternative are piezoelectric respiration transducers, which replace the pneumatic rubber bellows with belts that include stretch-sensors, which function based on the property of certain materials, such as crystals, to build up electrical charges (piezoelectricity) when exposed to mechanical stress (Bhaskar, Subramani, & Ojha, Citation2013). In either case, the acquired measurements of thoracic and abdominal breathing are usually combined (either on paper or by a digitized polygraph) to create a single composite measure of respiration line length for the examiner (Kircher & Raskin, Citation2002). Lastly, electrodermal activity is measured either in terms of skin conductance, skin resistance or a combination of both depending on the company that produced the polygraph. Skin conductance is generally considered to be the more efficient and reliable, as measuring changes in resistance magnitude from basal activity level has inherent problems associated with it (Dawson, Schell, & Filion, Citation2000). To measure conductance, two electrodes are attached to the examinee's palm or fingers and a small current is applied in order to measure factors such as conductance level, changes in conductance level, frequency of spontaneous responses, event-related response amplitude, latency, rise time and half recovery time (Dollins, Krapohl, & Dutton, Citation2000). See Figure 2 for an example of the polygraph measuring equipment most commonly used.

Figure 2. Polygraph equipment



In addition to the three channels mentioned above, a range of other compatible tools can also be utilized. The most widely used to these are 'activity sensors', which can include headsets, seat pads, arm-rest pads, foot-rest pads and special

chairs designed to be used in conjunction with said activity sensors (see Figure 3 for an example of the standard polygraph equipment attached to an examinee).

Figure 3. Polygraph equipment attached to an examinee



These chairs are designed to detect examinee movement; be it large, small or confined to specific muscles, such as the jaw's masseter muscle. The main reason why examiners may wish to monitor movement is that movement can affect the monitoring of the three main channels by affecting equipment or the examinee's physiology. This is particularly relevant when it comes to the matter of countermeasures.

Polygraph methodologies

This review will focus on the two dominant polygraph methodologies, the CQT and the CIT. Both methodologies use the same polygraph apparatus, and share one fundamental premise, namely that certain psychological processes result in physiological cues that can be measured and interpreted with the polygraph for the purpose of aiding in the detection of deception. The CQT aims to detect deception by measuring the physiological arousal patterns that result from the emotional states that the production of deception is argued to evoke, i.e. fear/stress. This line of reasoning is generally supported by the emotional deception detection approach developed by American psychologist Paul Ekman. Ekman (Citation2009) argues that deceptive individuals will likely experience different emotions than someone who was telling the truth would, and that the strength of this emotion is correlated to the likelihood of deceptive cues being leaked. The fear and stress associated with getting caught are the most commonly cited examples of such an emotion and are argued to result in deception cues such as gaze aversion, increased movement (e.g. fidgeting), speech errors and – in line with the CQT – increased heart rate and perspiration. These matters are, however, more complex, as Ekman's approach does not consider deception to be invariably fear inducing or stressful, maintaining that deceptive individuals may well experience a range of other emotional states, such as 'Duping Delight', which describes the pleasure associated with meeting the challenge of a successful deception (Ekman, Citation1981). This exemplifies the main theoretical caveat of the CQT, in that it is heavily reliant upon evoking the appropriate fear/stress within a deceptive examinee. As will be discussed later, CQT examiners sometimes employ additional strategies to attempt to ensure that deceptive examinees experience the

appropriate emotional states; however, this does not resolve the issue in its entirety. In contrast, the CIT does not rely upon the measurement of physiological signs of emotion, but rather on the physiological signs of what is referred to as an Orienting Response, or a 'What is it?' reflex, which describes an individual's spontaneous reaction to novel or significant changes in its environment (Lang, Bradley, & Cuthbert, Citation1990; Sokolov, Citation1963). The detection of deception through the Orienting Response with the CIT is not affected by the same problems associated with CQT, which we will see. In addition to the basic theoretical concerns related to the inference of deception via the measurement of physiological cues, it must be noted that the flaws in common polygraph research methodologies have been a frequent and long-running source of debate (NRC, Citation2003, p. 128). In order to accurately capture the relevant issues and adequately discuss them in the context of current research, a separate review paper is required

Future scope

In the future, lie detector machines may continue to be used in certain applications, but their scope and usefulness may be limited. Here are some potential scenarios:

Legal system: Lie detectors could be used as a supplemental tool in legal cases, but they are unlikely to replace other forms of evidence or testimony. This is because their accuracy and reliability are not considered sufficient to prove guilt or innocence beyond a reasonable doubt.

Employment screening: Employers may continue to use lie detectors in certain situations, such as screening employees for positions that require high levels of trust and security clearance. However, this practice is already controversial and may be restricted in some jurisdictions.

Psychiatric treatment: Lie detectors could be used as a tool in psychiatric treatment to help patients with conditions such as compulsive lying or pathological deception. However, this would likely be a niche application and not widely used.

Personal use: In the future, individuals may be able to purchase and use lie detector machines for personal use, such as to test the honesty of romantic partners or business associates. However, the accuracy and reliability of these devices would need to be improved significantly before they could be used with any confidence.

Brain Imaging: Advances in brain imaging technology, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), may enable more accurate detection of deception by measuring changes in brain activity.

Artificial Intelligence: The use of artificial intelligence (AI) and machine learning algorithms may enhance the accuracy and reliability of lie detector tests by analyzing patterns in physiological data.

Wearable Devices: The development of wearable devices that can continuously monitor physiological responses may make it easier to detect changes in a person's physiology that could indicate deception

Voice Analysis: Advances in voice analysis technology may enable more accurate detection of deception by analyzing changes in tone, pitch, and other vocal characteristics.

Overall, the future scope of lie detector machines is uncertain, but they are unlikely to become a primary tool for determining truthfulness or guilt. Instead, they may continue to be used in limited and specialized applications where their limitations are understood and accepted

However, it's important to note that lie detection technology is not foolproof, and there are ethical concerns surrounding the use of such technology. As such, it's important to approach these advancements with caution and continue to prioritize the protection of individual rights and privacy.

Conclusion

The quality of polygraph research has improved considerably over the past three decades. In its current state, the polygraph can already serve as a viable investigative tool to investigators, and its value is likely to increase as research continues to improve and address its current shortcomings. The CIT holds the greatest potential in this regard as its limitation lies mostly in its applicability in practice, which – as demonstrated by the Japanese NPC – is in not an insurmountable hurdle. It appears unlikely that the proponents of the CQT will be able to reconcile the theoretical flaws of their technique in the foreseeable future, but its long history and general usefulness in practice are likely to preserve its popularity with the law enforcement agencies employing it. While it may not be possible to improve the polygraph to the level where it can truly be thought of as ‘The Lie Detector’, it does appear to hold the potential of becoming one of the most effective tools for the purpose of aiding investigators in the detection of deception. The polygraph suffered as a result of its own initial fame and overt optimism regarding what it could do. The greatest benefit of the polygraph within an investigative setting has not yet been realized, but there is plenty to suggest, from the research that has taken place, that its use for assisting the investigative process through, for instance, identifying persons of interest primarily, is not too far away.

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Python - The Most Popular Programming Language

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Abstract—Python is a suitable language for both learning and programming in the real world. Python is a powerful, high-level, object-oriented programming language developed by Guido van Rossum. In this document, we will first introduce you to the properties and functions of Python programming. This paper also discusses the reasons. Recently, python is the most popular programming language which is supported by research conducted through articles from various popular websites. This paper covers the features and key features of the Python language, the types of programming supported by Python, and their users and applications

I. INTRODUCTION

There's an intriguing story behind giving the name "Python" to the programming language. At the time of development of python, the inventor was reading the script "Monty Python's Flying Circus" (a BBC comedy series). While reading this book he got an idea to name the programming language as "Python" to have a short and unique name. In this paper, we're going to introduce the characteristics of Python. Python is a dynamic, interpreted (bytecode- collected) language. There are no type declarations of variables, parameters, functions, or styles in the source code. This makes the code short and flexible, and you lose compiling- time type checking of the source code. The most important point in Python being it supports multiple programming paradigms, including object-oriented, imperative, and functional programming or procedural styles. Python interpreters are available for numerous operating systems.

II. THEORY:

1. Properties:

Python is a programming language that is dynamically and implicitly typed, meaning that variables do not need to be declared beforehand. The variables are case sensitive, so variables with different capitalization are considered different. To find out how an object works, we can use the following function :

```
help(object)
```

The "dir(object)" command can be used to list all the methods available for a specific object, and the "object.doc" can be used to access the object's document string. Unlike other programming languages, Python does not require a specific character to terminate statements. Blocks are defined using indentation, with the start of a block indicated by an indentation and the end indicated by a de-dent. Statements requiring indentation end with a colon. Single-line comments can be added using the "#" sign. Multi- line

comments require multi-line strings. The assignment operator "=" is used to assign values, and equality is tested using "==". Values can be incremented or decremented using the operators "+=" or "-=" with the amount on the right-hand side. This can be done with strings and other data types. Multiple variables can be assigned on a single line.

2. Data Types :

Python has various built-in data types, including:

- Numbers: integers, floating-point numbers, and complex numbers
- Boolean: True or False
- Strings: ordered sequences of characters
- Lists: ordered sequences of items
- Tuples: ordered, immutable sequences of items
- Sets: unordered collections of unique elements
- Dictionaries: unordered collections of key-value pairs

3. Data structures:

Python has three main data structures: dictionaries, tuples, and lists. Sets can also be found in the sets library, which has been available in all versions of Python since 2.5. Lists are similar to one- dimensional arrays but can contain lists of other lists. Dictionaries function as associative arrays or hash tables, while tuples are one-dimensional arrays. Python arrays can be of any type and their indexes always start at zero. Negative indexes begin counting from the end of the array, with -1 being the last item. Variables can also be assigned to functions. For example: To access ranges of arrays, the colon can be used. If the start index is left empty, the first item is assumed, while the end index is assumed to be the last item. Negative indexes count from the last item, so -1 represents the final item. Here is an example:

By adding a third parameter, the Python code can step in increments of N items rather than one. In the example above, the first item is returned, followed by the third item, so items 0 and 2 in zero-indexing.

4. Strings:

In Python, strings are used to represent textual data. They are defined as a sequence of characters enclosed in either single quotes ('...') or double quotes ("..."). For example
a = "hello"

Strings are immutable, which means that once they are created, their contents cannot be changed. We can access individual characters in a string using indexing, with the first character

having index 0. Strings have several built-in methods that can be used to manipulate and analyze them, such as upper(), lower(), strip(), split(), replace(), and find().

5. Flow control statements:

In Python, flow control statements are used to control the order in which statements are executed in a program. There are three types of flow control statements:

a. Conditional statements: Conditional statements are used to execute different code blocks depending on a certain condition. Some of these are listed below:

(i) $a == b$ (equals)

(ii) $a != b$ (not equals)

b. Loops: Loops are used to execute a block of code repeatedly until a certain condition is met. There are two main types of loops in Python: the "for" loop and the "while" loop.

c. Function calls: Function calls are used to execute a block of code that has been defined elsewhere in the program. In Python, functions are defined using the "def" keyword, and can take parameters as input and return values as output. The basic syntax of calling a function is:

def function_name():

6. Classes:

Classes are a fundamental concept in object-oriented programming, and they are used in Python to define new types of objects. A class is a blueprint for creating objects, which are instances of the class.

In Python, a class is defined using the class keyword followed by the class name, and the class definition includes a series of methods (functions) that define the behaviour of the objects created from the class.

III. IMPORTANT FINDINGS:

1) Game Development:

Python is a versatile programming language that can be used for a wide range of applications, including game development. While game development is often associated with languages such as C++ and Java, Python can offer advantages in terms of ease of use and rapid development. Python game development is typically done using game engines or libraries. Some popular options for game engines that support Python include:

- a. Pyglet.
- b. Arcade
- c. Rabbyt
- d. Pymunk
- e. Pybox 2D
- f. Panda 3D

2) Image Processing:

It works like a signal processing where we take the input as an image and the output can be an image or characteristic features associated with this image. Python is a popular

programming language for image processing due to its ease of use, readability, and the availability of several powerful libraries for image processing. Some popular libraries for image processing in Python include:

- a. Scikit image.
- b. Open cv-python
- c. Mahotas
- d. Cairo

3) Data Science:

Python is a popular programming language for data science due to its powerful libraries and tools for data manipulation, analysis, and visualization. Some of the most popular libraries for data science in Python include:

- a. Matplotlib
- b. Pandas
- c. NumPy
- d. SciPy
- e. Flask

4) Machine Learning:

Python is used for machine learning due to its extensive libraries and tools for data manipulation, preprocessing, and modeling. Some of the most popular libraries for machine learning in Python include:

- a. Keras
- b. Shogun
- c. XG Boost
- d. Scikit-learn
- e. TensorFlow

5) Deep Learning:

In deep learning, Python is used due to the availability of powerful libraries and frameworks for building and training deep neural networks. Some of the most popular libraries for deep learning in Python include:

- a. Apache MxNet
- b. Caffe
- c. Fastai
- d. CNTK
- e. TF Learn

6) Speech Recognition

Speech recognition is the process of converting spoken words into text. In Python, there are several libraries available for speech recognition, such as:

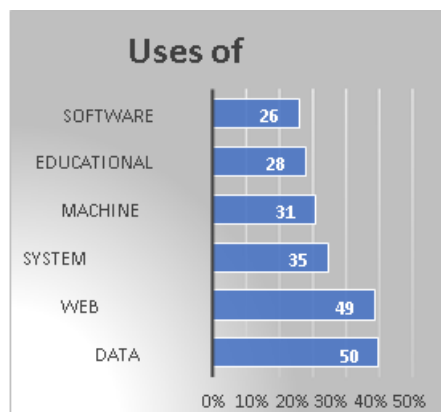
- a. SpeechRecognition
- b. pocketsphinx

7) Cloud Computing:

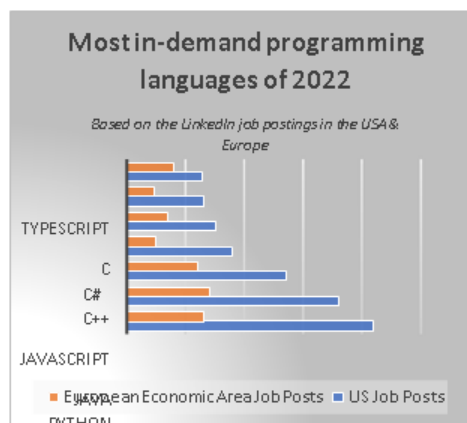
Cloud computing is the delivery of computing resources such as servers, storage, databases, networking, software, analytics, and more, over the internet. Python is a popular programming language for cloud computing due to its simplicity and versatility.

- a. Apache Libcloud
- b. google-api-python client

IV. RESULT AND DISCUSSION :



Based on the graph depicted above, it is evident that Python has attained significant adoption across multiple domains in contemporary times. These domains include web development, data science, game development, software testing, and machine learning and many more



After analyzing the largest number of job listings on LinkedIn in the United States and Europe, CodingNomads determined that Python was the most in-demand programming language. Java came in second place, while the rest of the top 10 consisted of JavaScript, C++, C#, C, TypeScript, PHP, Perl, and Ruby.

V. CONCLUSION:

In conclusion, Python is a powerful programming language with a wide range of applications in various fields, including web development, data analysis, machine learning, and scientific computing. Its simple syntax, ease of use, and strong community support make it a popular choice for beginners and experts alike. Python's vast library of modules

and packages offers developers a wealth of pre-built tools and functions to help them accomplish complex tasks more efficiently. Python's flexibility and versatility also make it a popular choice for prototyping and rapid application development. Overall, Python's popularity and continued growth in usage demonstrate its importance and relevance in the modern programming landscape. With ongoing development and innovation, Python is expected to remain a leading programming language for years to come.

VI. FUTURE SCOPE :

Python has a bright future and is expected to continue its upward trend in popularity and usage in the coming years. Here are some reasons :

1. Increased adoption in machine learning and artificial intelligence: Python's ease of use, extensive libraries, and powerful frameworks like TensorFlow and PyTorch make it a popular choice for machine learning and AI development.

2. Growing demand for data analysis and visualization: Python's data science and visualization libraries, such as Pandas, NumPy, and Matplotlib, have made it a go-to language for data analysis and visualization. As data-driven decision-making continues to grow in importance, Python's relevance in this field will only increase.

3. Cross-platform support: Python's cross-platform support means that developers can write code once and

run it on multiple platforms, making it a cost-effective and efficient option for building applications.

4. Increased popularity in web development: Python's frameworks, such as Django and Flask, have made it a popular choice for building web applications. With the continued growth of web-based technologies, Python's relevance in this field is expected to increase.

5. Continued support from the community: Python's strong community support, including active development and maintenance, makes it a reliable and secure option for building applications.

Overall, Python's future looks bright, with growing adoption across a range of industries and applications, continued development of libraries and frameworks, and strong community support.

VII. ACKNOWLEDGEMENT :

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Chaos and Bifurcations in Nonlinear Systems: A Comprehensive Review of the Logistic Map, Eigen Plane, and Lorenz Model

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Abstract— This paper explores various mathematical tools used to analyze the nature of dynamical systems (logistic map, bifurcation diagram, Lorenz attractor) and provides further insights.

Keywords—(Logistic map, bifurcation diagram, Eigen plane, Lorenz Model)

I. DYNAMICAL SYSTEMS

The dynamics of the situation are the characteristics that simulate growth, which is defined as the change in the situation through time. For a dynamic system, the change in setting or growth is brought about by a rule which decides how the change is brought in the situation. Dynamical systems[2] help determine the behavior of a system and also characterize it over long the long term

A. Discreet-time systems

In discreet time dynamical systems, measurements are given at a specific time sequence. a rule helps us determine the measurement at time $n+1$ (1), which can help determine the growth of the function by iteration (2). The state of the function at time n determines the state uniquely at time $n+1$

$$x_{n+1} = f(x_n)$$

$$x_n = f(f(\dots f(x_0)\dots))$$

given an initial state x_0 the values obtained on iteration of the function is then termed as the orbit of x_0

$$\{x_0, x_1, x_2, \dots, x_{n+1}\}$$

B. Lyapunov Exponents:

Lyapunov exponents[1] are a scalar quantity that gives us insights about the rate of separation of trajectories in a non dynamical system , negative Lyapunov exponent tends to indicate stability while the positive exponent value is

associated with chaos and instability .let x_0 and y_0 be two initial states such that $x_0 - y_0 = d_0$ obeying the rule $x_{n+1} = f(x_n)$

$$f'(x_i) = \frac{f(y_i) - f(x_i)}{d_i} \text{ \& \; } f'(x_i) = \frac{d_{i+1}}{d_i} \text{ so we can say that}$$

$$\frac{d_n}{d_0} = \frac{y_n - x_n}{y_0 - x_0} \text{ and further state} \\ \frac{d_n}{d_0} = \frac{y_1 - x_1}{y_0 - x_0} \times \frac{y_2 - x_2}{y_1 - x_1} \dots \times \frac{y_n - x_n}{y_{n-1} - x_{n-1}} \text{ which can be then written}$$

$$\text{as} \\ \therefore \frac{|d_n|}{|d_0|} = \prod_{i=0}^{n-1} |f'(x_i)|$$

$$f'(x_1) \times f'(x_2) \dots f'(x_n) = g_n^n \text{ (gn is geometric mean)}$$

$$g_n^n = \prod_{i=0}^{n-1} |f'(x_i)| \text{ which is } g_n^n = \frac{|d_n|}{|d_0|} \text{ and } \ln g_n = \frac{1}{n} \ln \frac{|d_n|}{|d_0|}$$

$$\Lambda = \lim_{n \rightarrow \infty} \ln g_n \text{ (Lyapunov exponent being } \Lambda)$$

$$\Lambda = \lim_{n \rightarrow \infty} \ln \frac{1}{n} \ln \frac{|d_n|}{|d_0|} \therefore \Lambda = \lim_{n \rightarrow \infty} \sum_{i=0}^{n-1} \frac{1}{n} \ln |f'(x_i)| \therefore \frac{|d_n|}{|d_0|} = e^{\Lambda n}$$

C. fixed points and their stability:

$f(x^*) = x^*$ is the condition for stability for a discreet-time dynamical system . where one can say $X_n = x^* + \varepsilon_n$ and if $(f(x^*) - \frac{\varepsilon_1}{\varepsilon_0}) > 1$ it is said to be a fixed stable point and if $(f(x^*) - \frac{\varepsilon_1}{\varepsilon_0}) < 1$ it is a fixed unstable point.

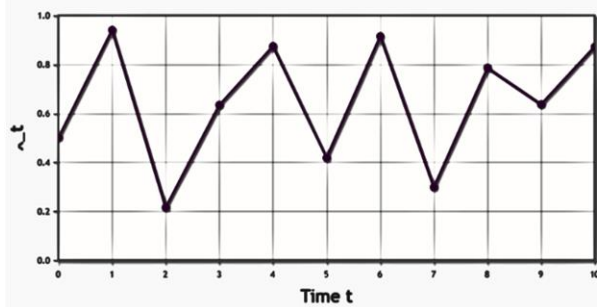
D. Logistic Map :

The logistic map[1] is used to predict population models given their initial or present state by employing the model $x_{n+1} =$

$rx_n(1 - x_n)$, defined for $x \in [0, 1]$ where r is a parameter defined over the interval $r \in [0, 4]$. fixed points for the logistic map are $x=0$, $x=1-(1/r)$ (only when $r>1$) subject of constraint to the domain of x .

Lyapunov Exponent for the logistic map can be given by $\Lambda = \lim_{n \rightarrow \infty} \sum_{i=0}^{n-1} \frac{1}{n} \ln |r(1 - 2x_i)|$. A series time plot for $r=3.75684$, with 10 iterations and $x_0=0.5$ as the initial state

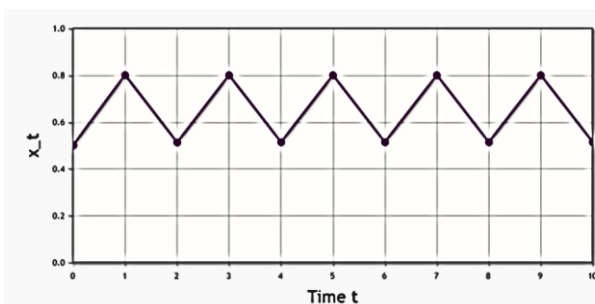
$x_0 = 0.5$	$-\infty$
$x_1 = 0.93921$	1.19395
$x_2 = 0.214495$	0.763229
$x_3 = 0.632979$	-0.000840905
$x_4 = 0.872777$	1.02995
$x_5 = 0.417151 \rightarrow f'(x) = r(1 - 2x_n) \rightarrow$	-0.474007
$x_6 = 0.913423$	1.13344
$x_7 = 0.297096$	0.421702
$x_8 = 0.784541$	0.759848
$x_9 = 0.635043$	0.0145614
$x_{10} = 0.870698$	1.02436



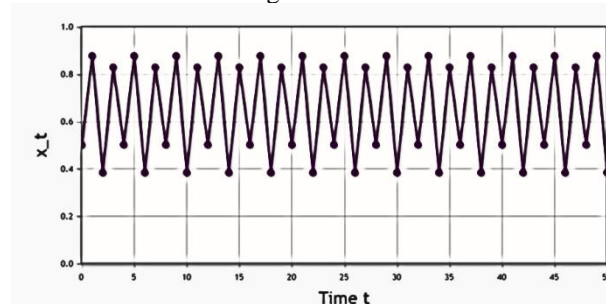
the average value (Λ) neglecting the first value x_0 we get 0.586619. however this is just an approximation as the required iterations are ∞ but in our case only 10 iterations have been considered. however the value obtained by 10^6 iterations is found out to be 0.385205.

The positive value of lyapunov exponent indicates chaotic behaviour of the system with the chosen set of initial value which can be further observed in the fig. where small regions of periodicity is found but no long term convergence is to be seen

It is observed that 2 stable fixed points at $r=3.2$. which can be seen in figure below,



and at $r=3.5$ the period becomes 4 i.e 4 stable fixed points are observed shown in fig below

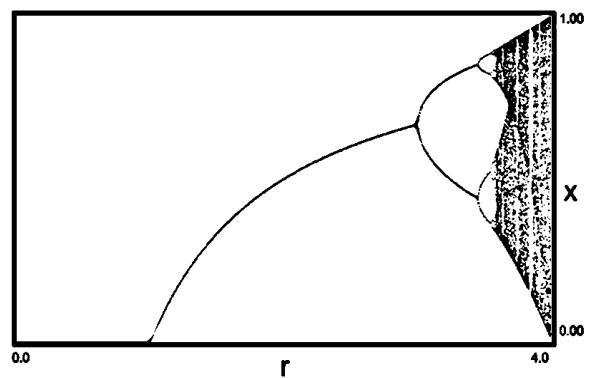


E. Bifurcation Diagrams:

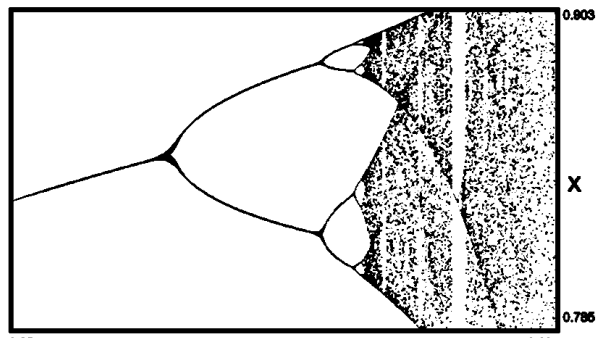
A bifurcation diagram[5] illustrates how a system behaves in relation to a control parameter. It illustrates how changes in the control parameter can cause the system to switch from one type of behavior to another by displaying the qualitative behaviour of a dynamic system when the control parameter is altered. The behaviour of complex systems is widely investigated using bifurcation diagrams, which also help to determine the critical values of control parameters that lead to qualitative shifts in the system's behavior. The x-axis of a bifurcation diagram normally represents the control parameter, and the y-axis the system state. Typically the diagram depicts how the system's state changes when that of the control parameter is changed

Period doubling bifurcation takes place at $r = 3$, the trajectory converges to a cycle of period 2 while $3 < r < 3.544$ and the system turns chaotic at $r=3.5699$

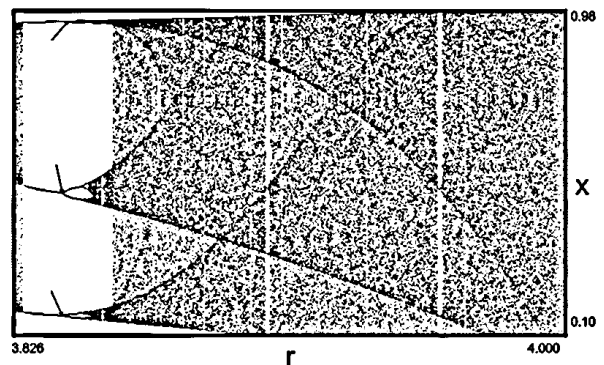
$r \in [0, 4]$



$r \in [3.35, 3.69]$



$r \in [3.826, 4.00]$



The factor by which distance between bifurcation points decrease as the control parameter increases for the logistic equation is known as the Feigenbaum constant

$\delta = \lim_{n \rightarrow \infty} \frac{r_n - r_{n-1}}{r_{n+1} - r_n} = 4.669\ 201609 \dots$ There are periodic windows that can be observed between $3.35 < r < 4$. one such periodic window can be observed at $A=3.826\dots$ near this value the orbit of A is nearly 3 which is interrupted at 3.852. this change from periodic to chaotic orbit is termed as intermittency

F. Eigen plane :

Consider the set of equations

$$\dot{x} = \sigma x - \omega y$$

$$y = \omega \dot{x} - \sigma y$$

Linear approximation[4] of non-linear function $\dot{x} = Jx$

Where $J = \begin{bmatrix} \sigma & -\omega \\ \omega & \sigma \end{bmatrix}$ and associated eigen values are

$$\lambda = \sigma \pm j\omega, \therefore \begin{bmatrix} -j\omega & -\omega \\ \omega & -j \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \text{ where } v_1, v_2 \text{ are eigen vectors.}$$

$$\begin{bmatrix} -j\omega v_1 & -\omega v_2 \\ \omega v_1 & -j\omega v_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \therefore v_1 = jv_2, v_2 = 1.$$

Hence the associated vector can be represented as $\begin{bmatrix} j \\ 1 \end{bmatrix}$ hence

one solution for the given set of equations is

$$x(t) = e^{(\sigma t \begin{bmatrix} -\sin \omega t \\ \cos \omega t \end{bmatrix} + j \begin{bmatrix} \cos \omega t \\ \sin \omega t \end{bmatrix})}$$

which can be written as $x(t) = C_1 e^{\sigma t \begin{bmatrix} -\sin \omega t \\ \cos \omega t \end{bmatrix}} + C_2 e^{\sigma t \begin{bmatrix} \cos \omega t \\ \sin \omega t \end{bmatrix}}$, and since eigen vectors are homogenous, the plane passing through the vectors is known as eigen plane, the eigen values help further determine the exponential growth rate error of the trajectories on the plane

G. One Dimensional Continuous-time Dynamical systems

LORENZ ATTRACTOR: It's a very simplified mathematical model developed to understand atmospheric dynamics and predict weather.

The Lorenz Equations are as follows: -

$$\dot{x} = \frac{dx}{dt} = \sigma(y - x) \quad \dots (1.1)$$

$$\dot{y} = \frac{dy}{dt} = x(\rho - z) - y \quad \dots (1.2)$$

$$\dot{z} = \frac{dz}{dt} = xy - bz \quad \dots (1.3)$$

The equilibrium points in the vector field space defined by the set of given equations are

$$A = (\sqrt{b(\rho - 1)}, \sqrt{b(\rho - 1)}, \rho - 1)$$

$$B = (-\sqrt{b(\rho - 1)}, -\sqrt{b(\rho - 1)}, \rho - 1)$$

$$C = (0, 0, 0)$$

Considering $\sigma = -\frac{8}{3}, \rho = 10$

For Point C the eigenvalues obtained after linearizing the space near the equilibrium point considering $\rho = 1$ are $\lambda_1 = -\frac{8}{3}, \lambda_2 = -11, \lambda_3 = 0$ indicating it's a critical state. we get to further see that point C is stable for $\rho < 1$, critical at $\rho = 1$, and unstable at $\rho > 1$. Point A and B come into existence in the vector field space defined by the set of equations at $\rho = 1$. Points A and B are symmetric in the space. Point A and B are stable for $\rho < 24.73$ and exhibit chaos at > 23.73 .

For $\sigma = -\frac{8}{3}, \rho = 10$

The eigen values[3] and eigen vectors for point A (A is symmetric to B) would be $\lambda_1 \approx -12.4757$, $\lambda_2 \approx -0.595497 + 6.17416 i$

$$\lambda_3 \approx -0.595497 - 6.17416 i$$

and

$$v_1 \approx (-2.66104, 0.658787, 1),$$

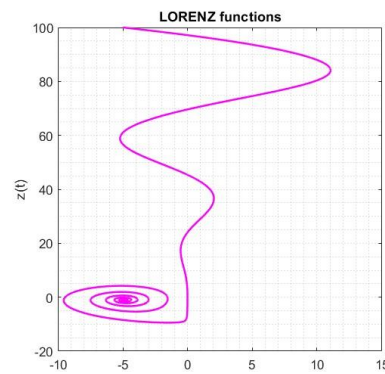
$$v_2 \approx (0.385502 + 0.526826 i, 0.0372741 + 0.733469 i, 1),$$

$$v_3 \approx (0.385502 - 0.526826 i, 0.0372741 - 0.733469 i, 1)$$

There is one real negative eigenvalue associated with this and two complex conjugate eigenvalues associated. the set of eigenvectors consists of complex conjugate values. so there will be a stable direction associated with the real eigenvalue so an initial condition growth will exponentially decay along that direction. the coefficient's of real and imaginary parts of the eigenvectors are also vectors in the field space, forming an Eigen plane and any perturbation along the direction of the plane will also decay exponentially to the stable equilibrium point which is A and B in our case. the theoretical analysis can be seen in the given illustration

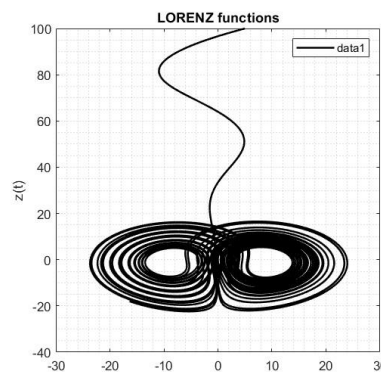
Hence, the behavior is chaotic. the initial condition will

Initial condition (-5,-5,100)

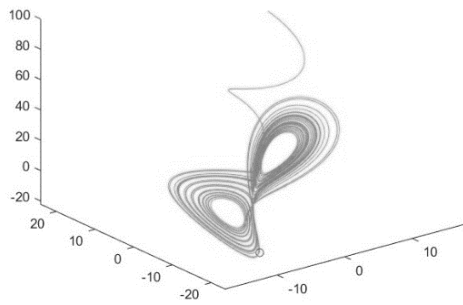


decay down exponential along the stable direction associated with the negative real eigen value, but will exhibit chaos on the Eigen plane. We need to take into consideration the symmetry between point A and B, their stability and the Eigen planes co-inciding with one another, hence we get a Lorenz attractor

Initial condition (5,5,100)



Strange Attractors : if we take two trajectories of the Lorenz system that do not start from very similar initial conditions. we observe that trajectories are indeed very different and very unpredictable but they accumulate on a same butterfly like object. this accumulation does not seem to have any dependence on the initial condition. So to put it one can say that the trajectories of the chaotic system remain confined while also being non periodic at the very same instant.



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Exploring the Potential of Blockchain Technology

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Abstract— If you've read about science and digital transformation, you've probably seen a lot of the buzz around blockchain. Despite the hype, we believe that once a few dental issues are resolved, blockchain technology will revolutionize many industries, just like the Internet. Blockchain technology has emerged as a solution to several long-standing issues in traditional centralized systems, such as lack of transparency, data security, and trust. In this paper, I look at the very real advantages blockchain technology can bring to our life and society, and how it is going to revolutionize our modern world.

Keywords— Blockchain technology, Decentralized, immutable, Consensus, Transaction, Cryptographic, Supply chain management, Finance, Identity, Data sharing, Privacy, Voting System, Healthcare

I. INTRODUCTION

Blockchain science is an extremely precise database engine that helps the true alternative of data in organization networks. Blockchain databases for businesses exhibit information in blocks that are linked to every other. Because chains frequently by the way of a neighborhood can be deleted or modified, the records are organized chronologically. As a result, you can use your data from blockchain science to create an immutable ledger that tracks orders, payments, invoices, and a range of transactions. The machine has built-in mechanisms to supply up unauthorized transactions and make certain consistency in the collective illustration of these transactions.

II. IMPORTANCE OF BLOCKCHAIN

Traditional database applied sciences currently have several challenges for recording financial transactions. For instance, reflect consideration of the sale of a property. Once the cash is exchanged, possession of the property is transferred to the buyer. Individually, both the purchaser and the seller can file the financial transactions, however, neither furnish can be trusted. The dealer can accept the situation and declare they have no longer bought the cash even though they have, and the patron can equally argue that they have paid the cash even if they haven't. To hold away from manageable criminal issues, a relied-on 1/3 birthday social gathering has to supervise and validate transactions. The presence of this central authority no longer complicates the transaction alternatively addition creates a single difficulty of vulnerability. If the central database used is compromised, every party might additionally moreover pick to suffer. Blockchain mitigates such troubles using the use of developing a decentralized, tamper-proof

laptop to file transactions. In the property transaction scenario, blockchain creates one ledger for the consumer and the seller. All transactions ought to be authorized with the resource of every activity and are robotically up to date in both of their ledgers in authentic time. Any corruption in historical transactions will corrupt the total ledger. These residences of blockchain technological grasp have led to its use in larger than a few sectors, consisting of the introduction of digital foreign cash like Bitcoin.

III. WHAT MAKES BLOCKCHAIN DIFFERENT

A. Decentralization

Decentralization in blockchain refers to transferring management and desire-making from a centralized entity (individual, organization, or group) to a dispensed network. Decentralized blockchain networks use transparency to decrease the opt for having confidence among participants. These networks, in addition, deter people from exerting authority or manipulating particular structures that degrade the typical standard overall performance of the network.

B. Immutability

Immutability capability is something that cannot be modified or altered. No participant can tamper with a transaction once anyone has recorded it in the shared ledger. If a transaction record includes an error, you ought to add a new transaction to reverse the mistake, and each transaction is seen on the network.

C. Consensus

The blockchain device establishes guidelines regarding the consent of individuals to report transactions.

IV. A BRIEF OVERVIEW OF THE WORKING OF BLOCKCHAIN TECHNOLOGY, IN THE FOLLOWING STEPS

A. Record the transaction

A blockchain transaction suggests the movement of physical or digital belongings from one birthday celebration to another in the blockchain network. It is recorded as a records block and can include details like these:

- a) Who was involved in the transaction?
- b) What came about for the duration of the transaction?
- c) When did the transaction occur?
- d) Where did the transaction occur?

e) *Why did the transaction occur?*

Exp

f) *How is plenty of the asset exchanged?*

g) *How many pre-conditions had been met at some stage in the transaction?*

B. Gain Consensus

Most distributed blockchain community participants must agree that the recorded transaction is valid. Depending on the type of network, guidelines for settlement can fluctuate however are commonly set up at the beginning of the network.

C. Linking

Link the blocks Once the people have reached a consensus, transactions on the blockchain are written into blocks equivalent to the pages of a ledger book. Along with the transactions, a cryptographic hash is also appended to the new block. The hash acts as a chain that hyperlinks the blocks together. If the contents of the block are deliberately or unintentionally modified, the hash change changes, imparting a way to detect information tampering. Thus, the blocks and chains hyperlink securely, and you can't edit them. Each additional block strengthens the verification of the previous block and hence the complete blockchain. This is like stacking timber blocks to make a tower. You can completely stack blocks on top, and if you take away a block from the middle of the tower, the complete tower breaks.

D. Share the ledger The system distribute the latest copy of the central ledger to all participants.

V. WIDE APPLICATIONS

A. Supply Chain Management

- Provenance tracking: Blockchain technology can allow the tracking of products and materials for the duration of the provide chain, imparting visibility into their origin, journey, and manufacturing methods. This can help to ensure the authenticity of merchandise and limit the hazard of counterfeiting or fraud.
- Supply chain Finance: Blockchain technology can facilitate provide chain finance by using imparting an invulnerable and transparent platform for financing and payment transactions between suppliers and buyers.
- Quality assurance: Blockchain science can be used to music and verify high-quality merchandise for the duration of the supply chain, from raw substances to finished products. This can help to reduce the threat of defects and recalls, and enhance patron satisfaction.
- Compliance and sustainability: Blockchain technological know-how can allow higher compliance and sustainability monitoring with the aid of offering a transparent and immutable record of environmental and social practices throughout the provide chain.
- Streamlining processes: Blockchain technological know-how can allow the automation of furnish chain processes, such as stock administration and order

fulfillment, through growing self-executing smart contracts.

B. Identity Management

- Self-sovereign identity: Blockchain science can allow the introduction of self-sovereign identities, where men and women control their personal information and can share it selectively with others. This can help to minimize the chance of identity theft and enhance privacy.
- Identity verification: Blockchain technology can allow impenetrable and transparent identification verification, by means of growing a decentralized community of trusted identification providers. This can assist to limit the danger of fraud and make sure that solely verified people can get admission to sure services or information.
- Digital identity: Blockchain technology can enable the advent of digital identities that are linked to real-world identities, such as government-issued IDs or biometric data. This can help to enable secure and environment-friendly digital transactions, except for compromising on privacy or security.
- Authentication: Blockchain science can allow secure and transparent authentication of individuals, with the aid of the use of public and private key cryptography to verify identity. This can assist to minimize the danger of unauthorized get right of entry and improve security.
- Data sharing: Blockchain science can enable impervious and selective sharing of private data, by means of giving individuals control over who can get the right of entry to their statistics and how it is used. This can assist to minimize the threat of statistics breaches and make sure that private data is used ethically and responsibly.

C. Voting System

- Transparency: Blockchain science can allow extended transparency in the vote-casting process, by growing a decentralized and public ledger of all votes. This can help to make sure that all votes are counted exactly and transparently.
- Security: Blockchain science can beautify the protection of the vote-casting process, by way of the usage of cryptography to make sure that votes are encrypted and can't be tampered with. This can aid to limit the danger of fraud or manipulation.
- Anonymity: Blockchain technological know-how can permit greater anonymity in the vote-casting process, with the useful resource of the usage of encryption to make certain that votes cannot be traced again to character voters. This can assist to defend voter privacy and minimize the risk of coercion or intimidation.
- Accessibility: Blockchain science can enable greater accessibility in the vote-casting process, by way of enabling far-off and online vote-casting that is impenetrable and tamper-proof. This can assist to

enhance voter turnout and make certain that all eligible voters can participate.

- Efficiency: Blockchain science can enable greater effectivity in the balloting process, via automating the counting and verification of votes. This can assist to limit the time and price of the voting process, and enable real-time reporting of results.

D. Healthcare

- Medical records management: Blockchain can be used to manage and securely store electronic medical records (EMRs) and personal health records (PHRs) in a decentralized manner. Patients can control their records and authorize access to their doctors and other healthcare providers. Blockchain can help to reduce data breaches, improve data accuracy, and enhance data interoperability.
- Clinical trials and research: Blockchain can be used to securely store clinical trial data and facilitate data sharing among researchers. This can help to increase transparency, reduce fraud, and accelerate drug development processes. Drug supply chain management. Blockchain can be used to track and trace the movement of drugs in the supply chain, from the manufacturer to the pharmacy, ensuring that drugs are genuine and not counterfeit. This can help to reduce drug diversion, improve patient safety, and increase the efficiency of drug recalls.
- Telemedicine and remote patient monitoring: Blockchain can be used to facilitate secure and private telemedicine consultations and remote patient monitoring. It can enable patients to maintain control of their data and allow healthcare providers to access the data they need to provide care.
- Medical billing and payments: Blockchain can be used to streamline medical billing and payment processes, reducing the risk of fraudulent billing and reducing the need for intermediaries.

VI. CONCLUSION

Blockchain technology is a modern science that has the viable to transform a large variety of industries and use cases. Its decentralized and tamper-proof nature makes it ideal for functions that require transparency, security, and trust. By providing a transparent and impenetrable ledger that can be accessed by way of all parties worried in a transaction or process, blockchain science can help to decrease costs, enlarge efficiency, and enhance trust. However, blockchain technological expertise is not a silver bullet, and there are some challenges to be addressed, such as scalability, interoperability, and regulatory frameworks. Additionally, science is exceptionally new, and there is a choice for greater search for and development to recognize its potential. Despite these challenges, the achievable advantages of blockchain science are significant, and many corporations and groups are already exploring its features in a range of industries. As the technology continues to evolve and mature, we can count on seeing even greater thrilling and progressive functions of blockchain technology in the future.

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A Review of the Battery Thermal Management System for Electric Vehicles

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Abstract— These days cars have become an essential part of one's life, whether be it for commercial use or personal use. Price of gasoline is rapidly rising and pollution is at its peak, to overcome this problem car manufacturers have introduced electric vehicles in the market. Electric vehicles are nothing but battery operated vehicles. These vehicles contribute a lot in preventing pollution and is also pocket friendly for the buyers out there. The main component of EVs is its battery pack, also known as the heart of the car. A battery management system is a major part of the vehicle that's plays an important role in ensuring performance, safety and lifespan of the battery. BTMS is a device responsible for managing or dissipation of heat generated during the electrochemical processes or reactions taking place inside the cell and making sure the battery operates efficiently and smoothly. The complete research on the BTMS of EVs is covered in this review.

Keyword- Battery packs, BTMS, EV

INTRODUCTION

Now a days vehicles electrification technologies have been vigorously developed to reduce global greenhouse emissions. A battery thermal management system plays a important role in ensuring the performance, safety and lifespan of the batteries. [1]. BTMS is a device responsible for managing/ dissipation of the heat generated during the electrochemical processes occurring in the cells, allowing the battery to operate safely and efficiently. The main objective of BTMS is to prevent accelerated battery deterioration by managing the heat by its component so that it operates under optimum temperature conditions. A battery can safely operate between -40 to 60 degrees and the operating range of the battery pack is preferred between 15- 35 degrees. BTMS is the component of the EASE OF USE

Battery pack responsible ensuring that the cells operate under the optimum temperature conditions specified by the manufacturer. The main function of BTMS is to keep the batteries cool in hot environment or to keep the batteries hot in cool environment for it to work safely and efficiently. In the recent years heating pipes have received a lot of recognition and attention in the BTMS field because of its ability to perform efficiently in different climate conditions and adverse conditions. It is compact in size and has high thermal conductivity and efficiency. They are extremely reliable and is also used in aerospace industries. It has a long life span of 15 years and its potential is quite promising. Study, researches and Rnd projects are being performed by the experts for more.

The BTMS is equipped with four essential functions :

- 1) Cooling
- 2) Heating
- 3) Ventilation
- 4) Insulation

1. HEAT GENERATION AND BATTERY FAILURE

The heating of the battery pack and its failure depends on the following factors:

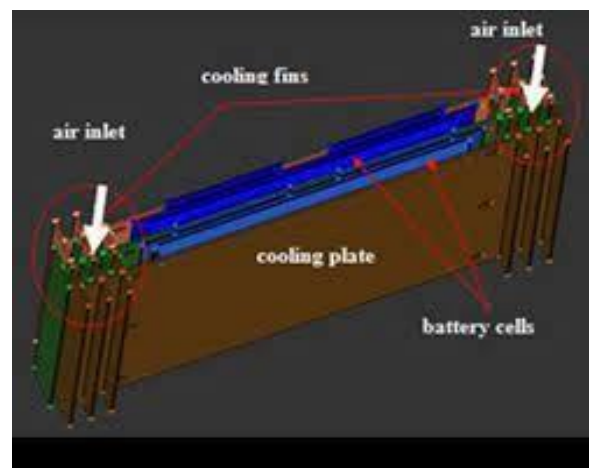
- i) Poor Battery management system, charging defects:- If theres a voltage drop in the battery and the BMS is not detecting then it may harm the battery.
- ii) External short circuits: Incorrect battery usage or both the terminals of the battery comes in contact with each other .
- iii) Over Charging: Generation of heat takes place inside the batteries which may result in explosions or causing fire, even slight overcharging may reduce the cell discharge capacity.
- iv) Mechanical damage: Any external damage for example car accident may puncture the battery which can cause over heating.

2. Types of cooling systems for the batteries in EVs

There are four types of cooling systems used to keep the battery packs cool :-

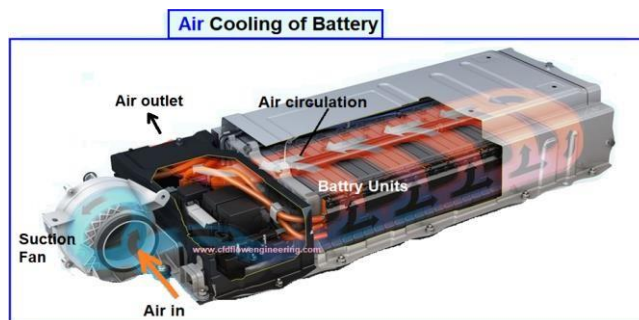
- i) Fin cooling: Increase the surface area to increase the rate of heat transfer.

Figure 1. Fin cooling systems in battery pack

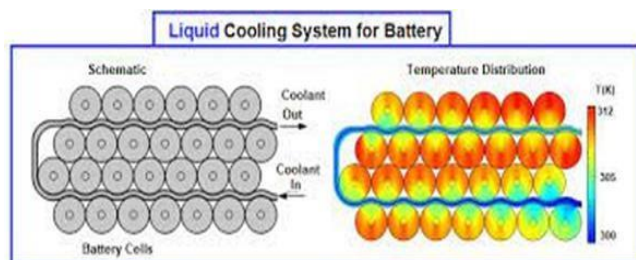


- ii) Air cooling: Air cooling uses the principle of convection to transfer heat away from the battery pack

Figure 2. Air cooling system of a Battery pack



iii) liquid cooling: Liquid cooling is the most popular cooling technology. It uses a liquid coolant such as water, a refrigerant, or ethylene glycol to cool the battery. The liquid goes through tubes, cold plates, or other components that surround the cells and carry heat to another location, such as a radiator or a heat exchanger



iv) Phase change material (PCM): Phase Change Material. PCM refers to a substance that could absorb or release latent heat to keep the temperature as almost constant.

3. Existing Battery Thermal Management system

The most commonly used BTMS is the liquid cooling system which provides a compact design and a high cooling performance. The mainly used coolant in the cooling system is water due to its easy obtainability and low cost, but the possibility of an electric short is a huge problem in this system. So to overcome this indirect refrigeration system is used by many dominant electric vehicles manufacturers. The liquid cooling system has always been fixated at the development of the physical design of the cooling plate and its channels and also by targeting the parameters like; coolant pressure drop and cell temperature we can achieve the best design for a liquid cooling system.

4. Opportunities for Advancement

The advancement in the batteries can be achieved by refining the design of the electrode and the battery capacity by reviewing the design, size, and all types of materials used for construction of the battery. By reducing the internal resistance of the electrodes it is possible to decrease the amount of heat generated and therefore increasing the cell capacity and lifespan. Electrode size included as a key factor in the overall design of the entire system.

5. CONCLUSION

The rapid usage of the EV is going to surge in the near future as sustainable transport is concerned and due to which the need for development of an efficient batteries are priority. The thermal losses of the batteries are main challenges to development better BTMS. The range and the work load of the EV is going to increase. This research paper gives report of numerous BTMS and opportunities for future work are highlighted.

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Missing Pieces in the Puzzle of Universe

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Abstract— Dark matter is a hypothetical form of matter that does not emit or reflect light, and its gravitational effects on the visible matter in galaxy clusters suggest the existence of a new type of weakly interacting massive particle (WIMP). Dark energy is a mysterious substance that pervades space and causes the expansion of the universe to accelerate. It has been proposed as an alternative explanation to Albert Einstein's theory of general relativity and is often referred to as a "cosmological constant". The CRESST Experiment was designed to detect the recoil of dark matter particles after they collide with atoms in an ultra-cold gas. The Xenon experiment, which first observed the cosmic background radiation and dark matter, has been used to detect dark energy.

Keywords— Dark Matter, Experiments and Gravity

I. INTRODUCTION

The Universe is made up of dark matter and dark energy. Dark matter is a hypothetical construct that scientists have created to explain gravity's inability to hold on to objects in the universe. The presence of dark matter has been determined through several observations and its existence is backed by scientific evidence, while there's no proof of its existence, nor evidence that it can be detected yet. Dark energy on the other hand is a mysterious construct that scientists have created to explain why the universe is expanding at an accelerating rate despite its gravity still being able to pull on objects in space. The presence of dark energy has been observed but there's not enough evidence yet for this mysterious substance to exist.

Multiple Theories on Dark Matter

A. Being an Empty Space:

Which states that it might be an empty space which means it's not a thing but it's also not nothing, it means it has its own energy and which generates more and more space which leads to faster and expanding universe.

B. Energy Fluid:

Maybe dark energy is an unknown kind of dynamic energy fluid or field which permeates the entire universe but somehow has an adverse effect on normal energy and matter.

II. PREHISTORY:

One of modern astronomy's great unsolved mysteries is dark matter. It is composed of matter that, if at all, interacts weakly with light but drives much of the gravitational interactions between galaxies. It has a century-long history and has been refined and improved as we have learned more about our Universe. Dark matter can be traced back to the 1600s, when Isaac Newton proposed his theory of universal gravity. Pierre Laplace proposed that some objects may be massive enough to trap any light they emit, and by the 1800s, Urbain Le Verrier and John Couch Adams predicted the presence of Neptune using gravitational anomalies in Uranus' motion.

- "In the early 1900s, physicists and astronomers started looking at galaxies' spectra to calculate a galactic rotation curve, a measure of the velocity of stars relative to their distance from the galactic centre. Neither radio measurements nor the Milky Way's rotation curves demonstrated any radial feature."
- For centuries, dark matter was an invisible, nebulous force within our universe. But as scientists dug deeper into the dynamics of galaxies and stars, they started to suspect that something else might be at work in this mysterious universe of ours.



If dark matter is "fuzzy," it would affect how the first stars formed. (Image credit: AntonioSolano via Getty Images)

- Dark Matter has been a mystery for astronomers and physicists, with little consensus on what it is. All stars, planets, galaxies, and asteroids are held together by gravity. But what is gravity? According to classical Newtonian physics, gravity is a property of mass. This, therefore, makes any object having mass have gravity; its gravitational force is what holds the object together. The earth doesn't have mass (weight or volume), so we don't experience its gravitational force; this is what makes it so difficult to study gravity from space. However, one can observe objects around us that do hold us to the earth; it's called radiation Pressure [1].
- History of Dark Matter is one of the earliest attempts to understand the nature of dark matter and how it interacts with magnetic fields in our universe. The book was written by an amateur astronomer living in Australia who once remembered that gravitational lensing only works through massive objects. He went on to find some better evidence for these massive objects, which he called magnetic monopoles, before eventually writing this book explaining why these monopoles are probably real.
- In a letter that was published in 1844, he claimed that the proper motion of the stars Sirius and Procyon could only be explained by the existence of faint companion stars that gravitationally pulled on the observed stars: "If we were to regard Procyon and Sirius as double stars, their change of motion would not surprise us [19].
- Merely two years later, in 1846, the French astronomer Urbain Le Verrier and the English astronomer John Couch Adams hypothesized the possibility of a new planet to explain several recurring abnormalities in Uranus' motion. Dark "nebulae" or dark clouds were also suggested as forms of dark matter in the century [6].
- Others posited the possibility of unobservable matter existing in our universe. For instance, Philolaus of Pythagoras proposed the presence of Antichthon, or counter-earth, a celestial body that revolves on the opposite side of the Earth's "centrefire" (Kragh, 2006).
- John Michell, who is famous for developing the torsion balance to measure gravity, realized in 1783 that if the light is subject to the laws of gravity as he believed it should be, then massive objects may exist whose gravitational pull is so strong that even light would not be able to escape it [9].
- The great Pierre Simon Laplace articulated this idea a decade later, and it is usually considered the first reference to what is now known as black holes. They were formerly categorized as black cavities, but this explanation is exceedingly implausible, particularly considering the nebular masses' gaseous composition having been discovered [8].
- Astronomers began to detect that stars were not equally spaced in the sky as soon as astronomical photography was developed [5].
- When black areas in dense stellar fields were noticed, the question of whether they were dark because there weren't many stars in them or because there was absorbing material in their line of sight emerged [4].
- W. H. Wesley, who served as the Royal Astronomical Society's assistant secretary for 47 years, suggested an intriguing solution that involved crude modelling of how the Milky Way's stars are arranged [6].
- The atomists, most notably Leucippus and Democritus, who lived in the fifth century BCE, were persuaded that all matter was formed of the same fundamental, indivisible building pieces, known as atoms and that both the number of atoms and the vast space in which they were housed was infinite. Moreover, Epicurus (341–270 BCE) implied in his "Letter to Herodotus" that there were an endless number of other realms, "some like this world, others unlike it [6]."



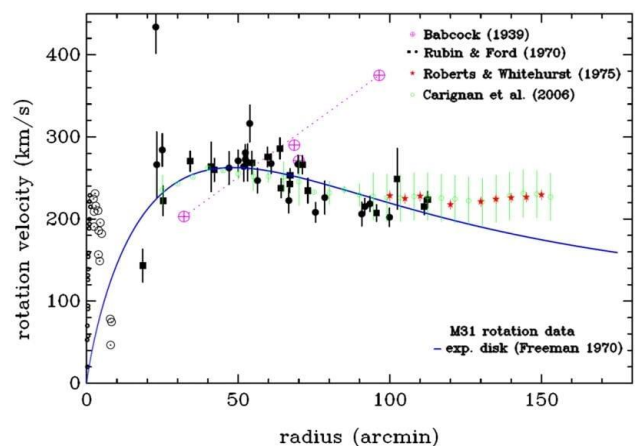
III. GALACTIC CLUSTERS

Zwicky was the first to use the virial theorem to calculate the mass of a galaxy cluster, estimating Coma's total mass to be the product of 800 observed galaxies and an average mass of 109 solar masses. He then calculated the average kinetic energy and velocity dispersion and estimated the physical size of the system to be around 106 light-years. He discovered that 800 galaxies with 109 solar masses should have a velocity dispersion of 80 km/s in a sphere of 106 light years, whereas the observed average velocity dispersion along the line of sight was around 1000 km/s [10]. In 1937, Zwicky published a new article in astrophysical journal and extended more about coma clusters. He returned to the viral theorem to determine the mass of galaxies, this time assuming the coma contains about 1000 galaxies within a radius of 2×10^6 light years. The velocity dispersion was observed to be of 700 km/s. This caused a substantial high amount of mass to light ratio of about 500. Zwicky's work relied on hubbles relationship between redshift and distance [12]. Another finding on mass clusters was published by Sinclair Smith in 1936 regarding Virgo cluster. Assuming the outer galaxies were performing circular motion around the Virgo cluster, Smith calculated the total mass for the cluster, and it was about 10^{14} M (solar mass). Then divided by observed galaxies in the cluster 500, the average mass of Galaxy was 2×10^{11} M. [12] Just like Zwicky, Smith also considered this high value obtained to be a problem.

IV. GALACTIC ROTATIONAL CURVES

A crucial part in the finding of dark matter was performed by the rotation curves of galaxies, or the circular velocity profile of the stars and gas in a galaxy as a function of their distance from the galactic center. It is feasible to determine the mass distribution of galaxies from their rotation curves with a few fair simplifications. In the past, it was the discovery of roughly "flat" rotation curves at extremely far galactocentric distances that most persuaded the scientific community that galaxies' outermost regions contain significant amounts of dark matter. Many people utilized Andromeda's recorded rotational velocity to compute its mass and debate how it compares to the solar neighborhood's measured figure for the ratio of mass to light.[1]

Horace Babcock provided the rotation curve of M31 out to 100 arc min, or roughly 20 kpcsr, from its center in his 1939 Ph.D. dissertation [11]. It's interesting that he discovered extremely high values for the circular velocity at huge radii; in fact, they are so high that they conflict with current data. He computed the galaxy's mass distribution by simulating M31 as



a sphere encircled by a flattened ellipsoid, realizing that the galaxy's reported increasing rotation curve at high radii suggested the presence of significant material in its outer regions. A new 25 m radio telescope was built at DwingelooS, the Netherlands, and it was finished in 1955. Van de Hulst, Jean Jacques Raimond, and Hugo van Woerden published M31's first radio rotation curve just two years later, expanding observations out to 2 degrees from the galaxy's core (van de Hulst, Raimond, and van Woerden, 1957). Despite noting that "nothing as yet can be asserted regarding the ratio in the innermost and outermost sections" of M31, they concluded that a constant mass-to-light ratio gave a sufficient explanation of the findings [13]. The clever "timing argument," also known as Franz Kahn and LodewijkWoltjer's The technique was put out in 1959 to calculate the combined mass of M31 and The Milky Way.

V. Baryonic Dark Matter

Baryons:

Quarks: Fundamental Constituents of Matter.

Basic Composite of particle made up of particles called hadrons.

Hadrons: They are most stable form of neutron and proton mixed compound.

So, baryons (subatomic particle): Both neutrons and Proton
This states that 3 quarks are its composition.

Baryonic Matter:

The baryons make baryonic matter.

They are existential matter of 5% of universe that we know.

A. Gravitational Micro lensing

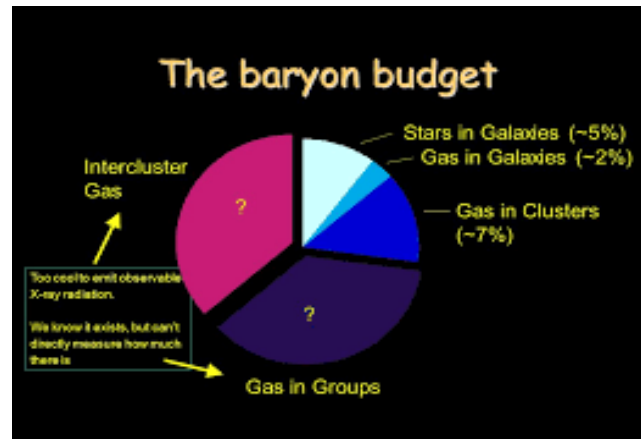


The possibility that light could be deflected by gravity has been studied since Newton, and Einstein made the correct prediction in 1915. An early test of general relativity was conducted during the solar eclipse of 1919, and Arthur Eddington's results were seen as persuasive. In 1924, Orest Chwolson proposed that a massive body could deflect light from a distant source in such a way that would lead to the appearance of multiple images or a ring. Einstein himself published a paper in 1936 but concluded that due to the precise alignment required, there was no great chance of observing this phenomenon. The modern theory of gravitational lensing was developed in the 1960s, with contributions from Klimov, Liebes, and Refsdal, and the first observation of a lensed quasar by Walsh, Carswell, and Weymann in 1979 [1].

Chang and Refsdal (1979) showed that individual stars could act as lenses, leading to potentially observable variations over time scales of months. Paczynski (1986) proposed that this phenomenon of gravitational microlensing could be used to

search for compact objects in the "dark halo" of the Milky Way.[17] proposed a strategy to simultaneously monitor large numbers of stars in a nearby galaxy to detect variations in their brightness. The MACHO, EROS, and OGLE Collaborations set out to conduct large microlensing surveys to test the hypothesis that the Milky Way's dark halo consisted of MACHOs. Although the first claim of a microlensing event was reported by Irwin et al. (1989), the implications of microlensing surveys for dark matter only began to take shape a few years later.[1]

B. The Universe's baryon budget



Alpher, Bethe, and Gamow (1948) proposed that all nuclear species (both light and heavy) may have been produced in the early Universe through the process of neutron capture. However, there were technical flaws with the calculations presented in these early papers, such as not accounting for Coulomb barriers and the lack of stable nuclei with atomic numbers in the range of 5-8. After accounting for these issues, Alpher, along with Robert Herman and James Follin, correctly predicted the abundance of helium and reported in 1953 that the heavier elements could not be accounted for by this mechanism. Stellar nucleosynthesis remained the predominant theory throughout the 1950s and into the 1960s, but it was becoming increasingly clear that stellar nucleosynthesis could not generate enough helium to accommodate the observed abundance. The discovery of the cosmic microwave background in 1965 led to increased interest in big bang nucleosynthesis and made it possible to further refine the predictions for the light element abundances. In 1973, a paper by Hubert Reeves, Jean Audouze, William Fowler, and David Schramm focused on the production of deuterium in the early universe.

VI. Modified Gravity

Modified Gravity, also known as Modified Newtonian Dynamics (MOND), is an alternative theory of gravity that is based on the application of Einstein's gravitational field equations to the dynamics of bodies. The modified theory includes several hypotheses, some being new such as the acceleration of free-falling objects caused by the loss or absorption of gravitational energy, and others being common extensions to Einstein's theory, such as the existence of Dark Matter [1].

VII. Dark Matter Particle

Dark matter is a difficult concept to explain. It is not a singular

particle, nor can it be considered an "anti-substance." Dark matter does not produce light, nor does it interact with electromagnetic radiation such as radio waves or gamma rays. It does seem to play a key role in the formation of galaxies, but astronomers have theorized that outer regions of galaxies could attract additional particles (such as black holes) that are invisible to us but may account for some of the mass we see there.

AXION

The Axion is a hypothetical particle that arises from the Peccei-Quinn theory. It is a neutral, massless, spinless scalar boson whose existence has been suggested by physicist it rotates like an ordinary electron and has a charge equal to that of an electron. The Axion has been proposed as a possible candidate for dark matter, the substance making up 90 percent of the universe's mass. [2] AXION theory is the most compelling and controversial theory to date. It is based on the observation that all matter possesses a potential energy field which can attract or repel other particles, depending on their mass and distance from each other [1].

WIMPS

The Weakly Interacting Massive Particle (WIMP) is a hypothetical particle that has been the leading candidate for dark matter for decades. The theory predicts the existence of WIMPs with masses like those of the top quark, but hundreds or thousands of times smaller [2].

VIII. Hunt For Dark Matter

Axion Experiment

There has been an active experimental program for searching dark matter axions, most in the form of the axion dark matter experiment (ADMX). The experiment makes use of photon-photon axion coupling this way experiment converts dark matter axions in strong and static magnetic field into a signal of almost monochromatic microwave photons. The probability of this happening was first suggested by Sikivie in 1983. In 2003, Axion dark matter experiment collaborations reported results that constrained realistic axion dark matter models but in a range of 1.9 - 3.3 μ eV. With anticipated upgrades Axion dark matter experiment is expected to be sensitive to higher range of masses.

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Use Of Matrix In Robotics

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Abstract— *Matrices has always been an important part of technology and robotics starting from encryption, decryption, to multiple complex arbitrary calculations of robots. Here we will be discussing multiple methods used in working of different types of robots.*

Keywords— *End Effectors, Servos, Reference Frame, Gripper, Joint angles, Revolute joint.*

II. INTRODUCTION

Matrices a concept with which we all can have a fair understanding and one of the most interesting topic to deal with. In today's era robots have established a quite dominant role in almost every sector of human life. Countless experiments and simulations are in progress across the world in order to have the most efficient and precise output generating robotic devices. But how and exactly what experiments are performed? What core fundamentals are required?

Matrices comes as an important integral part of the working which helps to design the movements of humanoid robots and robotics in general. This will be a deep dive into the core of how matrix is formed for a specific task with some complex yet intriguing methods including topics like inversion, homogenous transformation, forward kinematics.

This work is going to provide an adequate understanding of the mathematical principles, methodology, real life applications, pros and cons, future scope etc.

III. METHODS & WORKING:

A) *Homogenous transformation method*- To understand this concept, imagine a person standing beside a table. A phone is kept on a table & it starts ringing. Person picks up phone & takes it to his ears to start a conversation. Now in this case, phone had moved from table to the ears of the standing person. To achieve this, the phone had travelled a specific distance & had undergone a specific rotation in a 3D space to reach to ears of standing person. Person in this case can be compared to a robot & his hand as the robotic arms. It had controlled the movement of phone in a 3D space. The 3D frame of phone can be treated as object. It had undergone the transformation in a 3D space from its

basic/reference (earlier) position to reach to destination or target position. This was controlled by person's hand (robotic arm). Term "Transformation" here means rotation & displacement of an object from 1 position to other in a 3D space. Question can be - How this transformation took place? Answer is 1) Wrist joint of a person had provided the required rotation (angle) to phone. 2) Shoulder joint of person had provided required displacement (distance) to phone.

Key to find the relationship (3D output position of End Effector in space with respect to the input angles of joints) is special kind of Matrix called Homogeneous Transformation Matrix. It is responsible for controlling mobility, determining and controlling sequence of positions and transformations of robot and robotic parts. Thus, it is an important concept of forward kinematics.

Basically, HTM Acts on a Reference frame or a reference vector of an object. By applying HTM on reference frame, we get the next/subsequent position and orientation of that reference frame which can actually be a robot or a robot component. Transformation indicates rotation or displacement or both; necessary to move the object to a specific position in a 3D space.

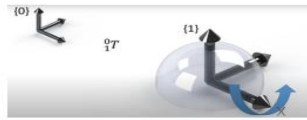
HTM is nothing but a 4×4 matrix which represents transformation of 1 object/frame wrt to another object/frame.

It is formed by combining the rotation matrix (3×3) and the displacement vector (3×1) into a single matrix.

{0} – Reference Frame OR Base Frame

{1} – Object Frame.

Below Transformation Matrix is to get frame 1 from frame 0.



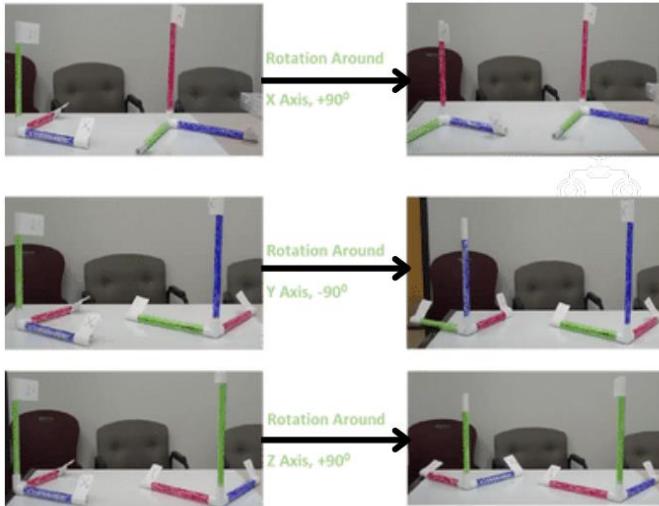
$${}^0_1T = \begin{bmatrix} r_{11} & r_{12} & r_{13} & d_1 \\ r_{21} & r_{22} & r_{23} & d_2 \\ r_{31} & r_{32} & r_{33} & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- **Blue Part** – Rotation Matrix (3*3)
- **Gray Part** – Constant Part
- **Green Part** – Displacement Matrix (3*1)

B) Rotation Matrix-

It is a 3*3 matrix which is an integral part of transformation matrix which represents the rotation of one frame wrt to other along the coordinate axis. Here,

- $\theta = +90^\circ$ for X&Z Axis.
- $\theta = -90^\circ$ for Y Axis.

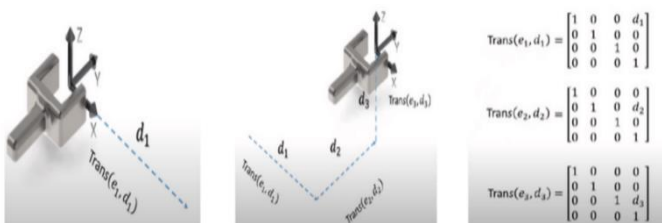


C) DISPLACEMENT MATRIX/ VECTOR-

It is a 3*1 matrix which is an integral part of transformation matrix which represents displacement of 1 frame wrt to other along the coordinate axis. Here,

- D1- Displacement along X-Axis.
- D2- Displacement along Y-Axis.
- D3- Displacement along Z-Axis.

- e1 = X-Axis.
- e2 = X-Axis.
- e3 = X-Axis.



D) Forward Kinematics

Forward kinematics is a method used in robotics to determine the position and orientation of a robot's end effector, such as its gripper, based on the values of its joint angles. Matrices are often used to represent the transformation of a robot's end effector from its base frame to its current pose in space.

To use matrices for forward kinematics, we start by defining a coordinate frame for each joint of the robot. We can represent the position and orientation of each joint frame with a homogeneous transformation matrix, denoted as T_i , where i is the joint number.

Each T_i matrix describes the transformation from the previous joint frame to the current joint frame. The matrix typically includes a rotation component (R_i) that describes the orientation of the joint frame, and a translation component (p_i) that describes the position of the joint frame relative to the previous joint frame.

To compute the position and orientation of the end effector, we can multiply all the T_i matrices together, starting from the base frame and moving towards the end effector. The resulting matrix, denoted as T_{0n} , represents the transformation from the base frame to the end effector frame.

To extract the position and orientation of the end effector from T_{0n} , we can use the following formulas:

The position of the end effector is given by the translation component of T_{0n} , denoted as $p_n = T_{0n}[0:3, 3]$.

The orientation of the end effector can be represented as a 3x3 rotation matrix, denoted as $R_n = T_{0n}[0:3, 0:3]$.

In summary, forward kinematics in robotics with matrices involves defining joint frames with transformation matrices, multiplying these matrices together to compute the end effector's transformation matrix, and then extracting the position and orientation of the end effector from this matrix using appropriate formulas.

Here is an example of forward kinematics in 2d:

let's consider an example of a simple 2-link robot arm with revolute joints, where the first joint rotates about the z-axis and the second joint rotates about the y-axis. We will use matrices to perform forward kinematics and determine the position and orientation of the end effector.

We can start by defining coordinate frames for each joint. The first joint frame is located at the base of the robot and its z-axis points upward. The second joint frame is located at the end of the first link and its y-axis points in the direction of the second link.

We can represent the position and orientation of each joint frame using homogeneous transformation matrices, denoted as T_1 and T_2 . The T_1 matrix represents the transformation from the base frame to the first joint frame, and the T_2 matrix represents the transformation from the first joint frame to the end effector frame.

Let's assume the following parameters for our robot:

- The length of the first link is 1 meter.
- The length of the second link is 0.5 meters.
- The joint angles are given by $\theta_1 = 45$ degrees and $\theta_2 = 30$ degrees.

We can calculate the transformation matrices for each joint as follows:

$$T_1 = \begin{bmatrix} \cos(\theta_1) & -\sin(\theta_1) & 0 & 0 \\ \sin(\theta_1) & \cos(\theta_1) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_2 = \begin{bmatrix} \cos(\theta_2) & 0 & \sin(\theta_2) & 0 \\ 0 & 1 & 0 & 1 \\ -\sin(\theta_2) & 0 & \cos(\theta_2) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

[Note that the matrices include a rotation component and a translation component, where the translation component is determined by the length of the link.]

To calculate the position and orientation of the end effector, we can multiply the two transformation matrices together: $T_{0n} = T_1 * T_2$. This gives us the transformation from the base frame to the end effector frame.

We can then extract the position and orientation of the end effector from T_{0n} as follows:

The position of the end effector is given by the translation component of T_{0n} , denoted as $p_n = T_{0n}[0:3, 3] = [0.77, 1.35, 0.35]$. The orientation of the end effector can be represented as a 3x3 rotation matrix, denoted as $R_n = T_{0n}[0:3, 0:3] = [-0.33, 0.93, 0; 0.6, 0.21, 0.77; 0.72, 0.29, -0.62]$.

These values represent the position and orientation of the end effector of the robot arm given the joint angles of $\theta_1 = 45$ degrees and $\theta_2 = 30$ degrees.

Now, here is an example of forward transformation in 3d

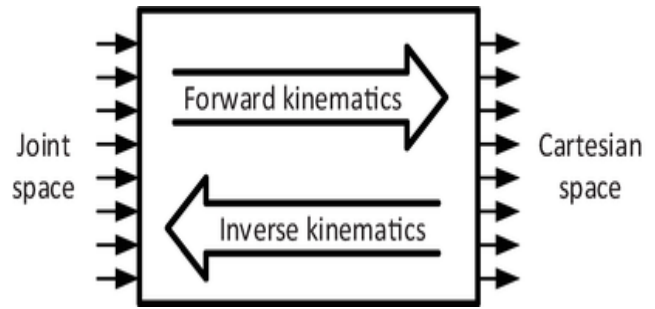
Forward kinematics in 3D involves determining the position and orientation of a robot's end effector in a 3-dimensional space, based on the values of its joint angles.

In 3D, we typically use transformation matrices to represent the position and orientation of a robot's end effector relative to its base frame. Each transformation matrix corresponds to a particular joint of the robot, and describes the position and orientation of that joint relative to the previous joint.

We can represent the transformation matrix for each joint using a homogeneous transformation matrix, denoted as T_i , where i is the joint number. Each T_i matrix includes a 3x3 rotation matrix, R_i , that describes the orientation of the joint, and a 3x1 translation vector, p_i , that describes the position of the joint relative to the previous joint.

To compute the position and orientation of the end effector, we can multiply all the T_i matrices together, starting from the base frame and moving towards the end effector. The resulting matrix, denoted as T_{0n} , represents the transformation from the base frame to the end effector frame.

To extract the position and orientation of the end effector from T_{0n} , we can use the following formulas:



The position of the end effector is given by the translation component of T_{0n} , denoted as

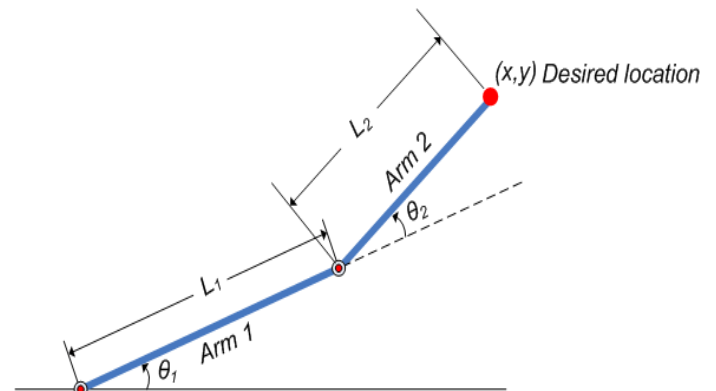
$$p_n = T_{0n}[0:3, 3].$$

The orientation of the end effector can be represented as a 3x3 rotation matrix, denoted as

$$R_n = T_{0n}[0:3, 0:3].$$

In 3D, we often use different coordinate systems, such as Cartesian or cylindrical, to describe the joint angles and the position and orientation of the end effector. In addition, different types of joints, such as revolute, prismatic, or spherical, may require different approaches to compute the transformation matrices.

Overall, forward kinematics in 3D involves using transformation matrices to represent the position and orientation of each joint, multiplying these matrices together to compute the transformation from the base frame to the end effector frame, and then extracting the position and orientation of the end effector from this matrix using



appropriate formulas.

E) Inverse Kinematics

Inverse kinematics involves the use of kinematic equations to predict the movement of a robotic component at a desired or given location. If a target location is set for the end effector, the joint parameters are determined using inverse kinematics.

Inverse kinematics works in reverse to forward kinematics.

A closed-form expression cannot be used to solve inverse kinematic, unlike in forward kinematics. Hence, there may be infinite solutions, finite solutions or no solutions for an inverse kinematic problem.

There are two methods for solving inverse kinematic problems: analytical and numerical

In the analytical method, the eqn;

$$X_D = f(q)$$

[X_D refers to the desired value, q refers to the robot's configuration(angle)]

Is inverted using symbolic manipulations into a closed form expression mathematically.

In the numerical approach, a sequence of configurations q_0 ,

$q_1, q_2 \dots$ are calculated if initial q_0 is given, such that error

$$|X_D - f(q)| \text{ approaches } 0.$$

F) Use of Jacobian matrix

Jacobian matrices relate the joint velocities to the cartesian velocities in a robot manipulator. Jacobian matrix is referred by J

$$\text{Hence, } J = \frac{\partial X_D}{\partial q} = \frac{\partial X_D}{\partial t} \cdot \frac{\partial t}{\partial q}$$

$$\frac{\partial X_D}{\partial q} = J \frac{\partial q}{\partial t}$$

$$v = J \dot{q} \quad [v = \text{target velocity, } q = \text{joint velocity represented by } \dot{q} = [\dot{\theta}_1, \dot{\theta}_2, \dots]^T]$$

Using inverse of Jacobian matrix, joint velocity can be calculated if target velocity is given

IV. CONCLUSION

Matrices play a crucial role in robotics, particularly in the areas of kinematics, dynamics, and control. They allow for efficient and accurate representation of the spatial relationships between different parts of a robot, as well as its motion and forces.

In kinematics, matrices are used to describe the relationship between different coordinate frames, which allows for precise control of a robot's movement. In dynamics, matrices are used to represent the forces and torques that act on a robot, which is essential for predicting its motion and stability.

Matrices are also important in control, where they are used to design controllers that can stabilize a robot and track desired trajectories. Moreover, the use of matrix algebra in robotics has led to the development of powerful computational tools and algorithms that make it easier to design and control complex robotic systems.

In conclusion, matrices are an essential tool in robotics, providing a powerful and efficient way to represent and manipulate the spatial relationships, motion, and forces of a robot. Their use has revolutionized the field of robotics, enabling the development of increasingly complex and capable robotic systems.

V. DEFINITIONS

- End effector- It is a device located at end of the robotic arm, designed to interact with environment.
- Servos- It is a precise and powerful way of converting rotational motion into linear motion.
- Reference Frame- It consists of an abstract coordinate system and the set of physical reference points that uniquely fix the coordinate system and standardize measurements within that frame.
- Gripper- It is a tool primarily used for testing and increasing the strength of the hands.
- Joint angles- The angle between the two segments on either side of the joint
- Revolute angles- A revolute joint is a one-degree-of-freedom kinematic pair used frequently in mechanisms and machines.

ACKNOWLEDGMENT

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Secondly, I would also like to thank all my teammates for such a great teamwork & cooperation.

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Blue-Eyed Innovations: Harnessing the Power of Technology

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Abstract— The goal of blue eyes technology is to create a connection between the user and the system by detecting all of the user's behavior and their physical state of mind. With the use of this technology, we may deduce an individual's emotional condition from their facial expression. Basically, this technology identifies bodily and physiological activity and extracts

Keywords—Blue eyes, Bluetooth, emotion computing, , sensory ability, Data Acquisition Unit, Emotion Mouse, artificial intelligence, speech recognition, SUITOR, Magic Pointing

I. INTRODUCTION

The phrase BLUE stands for Bluetooth and Eyes refers to our eye moment. Hence, in summary the computers equipped with Blue Eye technology monitors a human's eye movement and analyses its emotions over a Bluetooth connection. The monitoring's and recognitions such visual attention monitoring, psychological monitoring, gesture recognition, face recognition, voice recognition, eye recognition etc. are seen and linked through Bluetooth

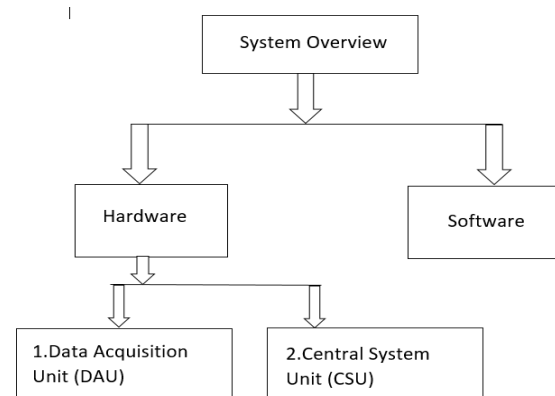
network and will be send to the machines. This is how the machines might grasp human sentiments. The fundamental purpose behind this work is to provide the computer human potentials. Blue eyes technology transcends the limits of people like: weariness, mental illness, laziness etc.

In the present day people merely spare most of the time in front of computers, laptops, mobile phones etc. Hence, by giving human power or talents to computer, the machine may naturally communicate with people. Imagine a pleasant future! where humans join forces with computers. The computer can comprehend the demands of user and behave important data using various kinds of sensors. By leveraging the emotion sense system of the Blues eyes innovation, it has positive benefit in the surveillance of a patient's wellness. Physicians may also collect physiological

data from patients, such as heart rate and blood pressure, heart beat, and body temperature, with the use of this technology. By using this technology, we can raise the bar for society and provide people in need of good healthcare.

II. SOFTWARE

The software incorporated in a Blue-Eyes gadget continually checks the circumstances of the surroundings.



As the circumstances change, the programmer does real-time analysis of the incoming information and activates multiple processes depending on the acquired data. The connection manager controls wireless connectivity between the Data Acquisition Unit and the Central System Unit. The physiological conditions of the user obtained by the sensors are examined by the data analysis module. The Visualization module functions as a UI for the supervisors and enables

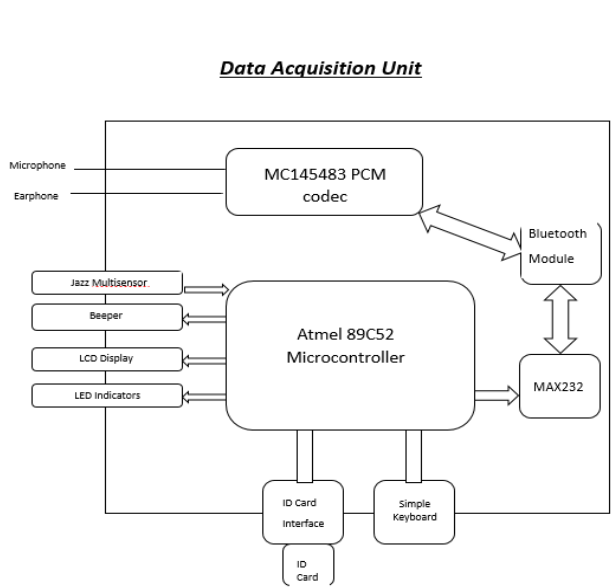
Blue-Eyed Innovations

them to observe the physiological state of the user with a preview of the audio-visual feeds. This software provides an overview of the selected video

source and related sound stream monitoring by the operational operators to act as intimate companions with human beings. This software also provides an overview of the selected video source as well as accompanying sound stream monitoring of the physiological condition of the operating operator. On the arrival of the warning messages, the supervisor is alerted instantly each time. Researchers are working to increase the capability of computers so that they can be communicated with as humans, identify human things, and listen to guess, talk, and even listen to human thoughts. It aspires to develop virtual robots with visual and sensory capabilities similar to those of humans. The role of the operator is to observe all the physiological states, warnings, and video and audio data gathered. Physiological data are shown using a number of custom-built GUI features.

III. HARDWARE

Data Acquisition Unit (DAU): The Blue Eyes System's Data Acquisition Unit (DAU) is one of its component parts. The primary duty is to gather physiological data from the sensor and transmit it to the processing unit. The Data Acquisition Kit includes a number of Atmel 89C52 Microcontroller hardware modules, Bluetooth core functionality (based on ROK101008), a small LCD display (HD44780), an I2C EEPROM, a multisensory interface (Jazz), indicators (including a beeper and an LED), six AA batteries, and voltage monitoring capabilities.



Central System Unit (CSU):

This piece of equipment provides a wireless connection per second for the central network system. A Bluetooth module and a voice data transmission PCM codec are both included in the kit. To connect to a computer, the module needs a parallel, serial, or USB connection. Audio data may be accessed by using regular mini-jack connectors.

IV. EMOTION COMPUTING

A. Theory

The key to making a computer system adaptable is emotion discovery. Rosalind Picard outlined the benefits of feelings for computers in 1997. Giving the computer the capacity to feel emotions and giving it

the capability to express those emotions are the two abecedarian factors of emotion computing. Druggies connected to bias can record measures similar to physiological data and emotional status, such as pressure, palpitation, heart rate, skin temperature, etc., by touching a mouse that has bedded detectors like a GSR detector, heart rate detector, pressure detector, and temperature detector. This is in agreement with Paul Ekman's exploration of facial expressions. The party's personality is also calculated. Using Ekman's findings as a base:

Surprise: The eyebrows are overly lifted and twisted.

Happiness: The eyes are observed to be unstrained and relaxed.

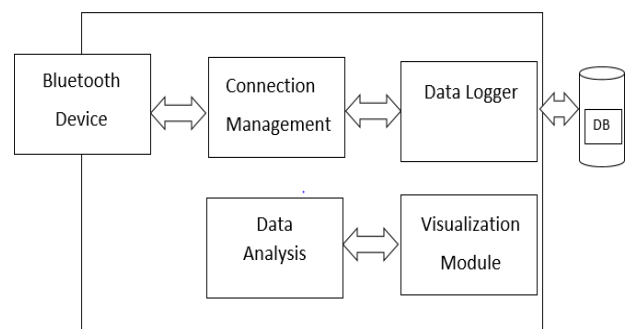
Sadness: The eyebrows come together, with the inner corners raised and the external corners lowered; the eyes look lustrous, wrathfulness. The forepart is pulled down and inward; the sclera isn't seen in the eyes.

Emotional Sensors

1. For Hand-Emotion Mouse

The computer in Blue Eyes has the capacity to detect subtle changes in a person's emotional state. As an example, a user may type quickly or slowly depending on his or her emotional state, such as whether they are furious, sad, or happy. With the use of Blue Eyes technology, computers are now able to recognize these subtle emotional shifts in people just by touching the keyboard or mouse. Based on these emotional states, the computers begin to react to the users. To do this, smart gadgets like the "Emotion Mouse" may be used. As a user interacts with a computer, the Emotion Mouse is designed to assess and understand their emotions, such as disgust, surprise, fear, rage, happiness, and sorrow. The Emotion Mouse's main function is to quickly and easily gather physical and physiological information about the user

Central System/Unit



2. For Eyes-Expression Glasses

Expression Glasses provides "appliance-based" wearable technology that can be used in facial recognition systems. These eyewear devices track facial muscle movements and use pattern recognition to discern important emotions like interest or perplexity. Such spectacles have been studied, and

a model has been created. The device allows for anonymity, compactness, and user control by using piezoelectric sensors concealed in a visor extension. Several continuing developments in applied technologies include the effort to understand the client's benefits only by looking at the client PC interface to understand what the person is passionate about at a certain moment. The computer might scan related websites and forecast the user's outcomes, for instance, by extracting the user's mood from the sort of page they access or browse.



3. Manual and Gaze Input Cascading (*Magic Pointing*)

A unique way for managing "eye gaze" for man-machine interfaces is introduced via eye gaze monitoring techniques. The techniques of classical eye-gaze monitoring have a number of drawbacks. MAGIC-Manual and Gaze Input Cascaded, or Manual Acquisition with Gaze Started, is an alternative method. Such challenging procedures are avoided by using the cursor. Magic pointing uses "eye gaze" to point the cursor to the location of the target, particularly to the area where the user was focusing under inconsistent and real lightning conditions. A webcam is used to instantly interpret the user's glints and pupils. This reduces the amplitude of cursor motion required for selecting the target. The users then have the absolute right to reach the target by moving their hand close to it or by choosing to ignore it and look for a different one. The two Magic Pointing techniques are common and flexible in terms of cursor positioning and target recognition. They are planned, evaluated, and carried out using an eye tracking device. In magic pointing, the target item is selected using a variety of techniques, including continuous staring and eye blinking. In certain cases, if a user does not continually gaze at a given target for a predetermined threshold value, the target will not be picked. As a result, there is a chance of making poor decisions. Each time a new item is

encountered, move the cursor to it.

4. Artificial Intelligent Speech Identification

A voice recognition system's environment is essential to its operation. The location of the microphone, the sort of noise, the volume of the noise, the pace and manner of the user's

speech, and the kind of vocabulary used by the user and recognized by the system are a few factors that might affect the quality of speech recognition. While communicating with the computer, the user speaks through a filtered microphone. The likelihood of proper identification rises with the number of filters. The ADC processes the words after converting the analogue signal to digital form using the filter's output. Every single word is converted to its binary form and stored in Memory. The binary input pattern is compared with the templates after the computer performs the searching process. Then, the user's input is scanned and compared to the internally stored words. Pattern matching is designed to discover the optimum fit due to numerous variations in pitch, loudness, time gap, frequency difference, etc. If a best match is discovered, either further action is taken or the word is decoded and presented on the screen.

5. Simple User Interest Tracker (*SUITOR*)

According to Myron Flickner, manager of Almaden's USER division, the foundation of IBM's Blue Eyes research project is the question, "Can we use nonverbal cues to produce more effective user interfaces?" Simple User Interest Tracker (*SUITOR*), a novel approach for computers to decipher human perceptual and sensory abilities, was created by Flickner and his associates for monitoring human eye movement and gaze-tracking technologies.

By evaluating and deciphering the website that the user is seeing, the *SUITOR* makes it simple to get extra information on the desktop. *SUITOR* may more accurately deliver the user's subject of interest by determining the user's eyes' point of attention on the PC screen. It is the fundamental idea of a smart system that tracks what the user is doing, reading, and typing in order to react to the user when the latter requests any type of data. When a user establishes an eye connection with a suitor equipped with blue eyes, the suitor automatically detects the user's region of concentration and begins searching there.

V. FUTURE APPLICATIONS

- ❖ This technology makes it possible to operate
- ❖ Security systems in situations where continual human monitoring is needed.
- ❖ Blue eyes may help in medical diagnosis. When running the system and keeping an eye on the varied actions of the experts and others in a sizable medical office, it may measure the human pulse.
- ❖ Banks and merchants may exploit consumer emotions for smart marketing.
- ❖ Instead of just using their hands, pilots may speak orders into the computer via microphones.
- ❖ Appliances in the home, including

Blue-Eyed Innovations

- ❖ Refrigerators, TVs, and ovens, may function while we are speaking to them.
- ❖ Blue Eyes will be useful in educational programs since it will enable computers to recognize the emotional state of pupils (anger, sadness, etc.) and

communicate the information appropriately.

- ❖ It may be used in lie detector exams to use facial recognition to find thieves.
- ❖ A vehicle equipped with a smart computer system might determine when a driver seemed to be drowsy and advise them to pull over to the side of the road, or it could recognize when a stressed-out bike rider was ready to erupt and warn him to slow down.

VI. CONCLUSION

Because technology is advancing, society will soon see people using it and seeing it used frequently in routine home tasks. The "Blue Eyes" technology allows computers to become so clever and sophisticated that they behave like people. With the help of user-friendly services and more sensitive computer equipment, blue-eye technology opens the way for a simpler way of life. It is a highly sophisticated system that guards against potential risks brought on by human faults such as weariness, supervision, fatigue, etc.

Patients' health conditions may be remotely monitored with the use of IoT and Blue Eyes technology. Health care professionals, doctors, and hospitals retrieve and evaluate the health data produced by this system for use in patient diagnostics and therapy.

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MATHEMATICAL STUDY OF CHAOS: APPLICATIONS OF CHAOS THEORY IN DIFFERENT DISCIPLINES

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Abstract— In this review paper we have explored chaos theory and importance of its mathematical analysis in different scientific areas of research.

Keywords— Chaos , strange Attractor, Lyapunov Exponents, parameter adaptation, Lorenz attractor

I. INTRODUCTION

Chaos theory[1] investigates how nonlinear dynamical systems behave during space-time span. It is defined by the sensitive dependence on initial conditions (SDIC), which means that even a slight variation in the initial conditions have a significant impact on how various events unfold in the future [2]. Chaos typically has a negative connotation that suggests unpleasant or confusion.

In short, chaos embodies three important principles:
extreme sensitivity to initial conditions
cause and effect are not proportional
nonlinearity

Poincare [3] first introduced the idea of SDIC, which is now known as the butterfly effect according to Lorenz's foundation from the 1960s and 1970s [4]. The importance of chaotic systems lies in the fact that they highlight the limits of predictability in our world. The concept of SDIC limits the ability to make predictions.

When a butterfly flies , a tornado in Texas could be sparked by a butterfly flapping its wings somewhere in the Amazon valley, according to the widely accepted theory known as the "Butterfly Effect." The inspiration for the concept came from a remarkable discovery made by Edward Lorenz, a professor of meteorology at MIT, fifty years ago. [5]
Edward Lorenz, a meteorologist and mathematician at the Massachusetts Institute of Technology, was enthusiastic about studying the weather. Lorenz saw a chance to combine math

with meteorology with the advancement of computers. In order to account for variations in temperature, pressure, wind speed, and other weather-related factors, he set out to develop a set of differential equations. The weather was finally simplified by Lorenz to a set of 12 differential equations.

In the winter of 1961, Lorenz wanted to review a batch of data that had come from his model on a particular day. Instead of starting over from the beginning, he made the time-saving decision to resume the run somewhere in the middle. He used data printouts to enter the conditions at a point around the middle of the prior run and then restarted the model calculation. He discovered a truly odd and unexpected finding. The data from the second run should have been an exact match to the data from the first run. After initially matching, the runs gradually began to diverge, and within a few "model" months, the second run swiftly lost all similarities to the first run. [6,7]. He was able to use his algorithm to regulate a weather system's beginning circumstances based on 12 differential equations. His programme could operate for a very long time without halting and could execute up to 60 calculations per second. When Lorenz entered data, his programme result forecast weather and atmospheric information.

II. THE LORENZ ATTRACTOR

Its a very simplified mathematical model developed to understand atmospheric dynamics to predict weather.

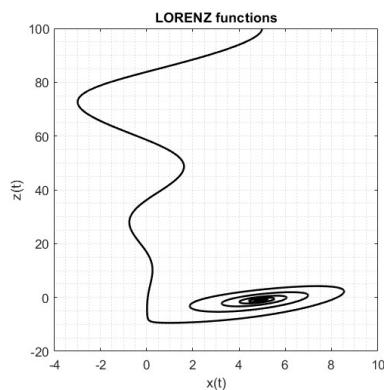
The Lorenz Equations are as follows: -

$$\dot{x} = \frac{dx}{dt} = \sigma(y - x) \quad \dots (1.1)$$

$$\dot{y} = \frac{dy}{dt} = x(\rho - z) - y \dots (1.2)$$

$$\dot{z} = \frac{dz}{dt} = xy - bz \quad \dots (1.3)$$

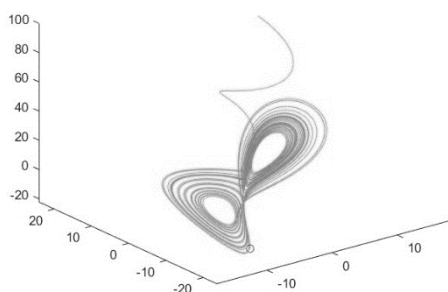
Here , σ, β and ρ are control parameters ,



Two points with very similar initial conditions after time t have very different trajectories indicating sensitive dependence on initial conditions; however, these values are confined to a set called as a limiting set, which has self-similar properties. Known as Lorenz attractor.

If we take two trajectories of the Lorenz system that do not start from very similar initial conditions, we observe that trajectories are indeed very different and very unpredictable but they accumulate on a same butterfly like object.

this accumulation does not seem to have any dependence on the initial condition. The trajectory seems to be attracted to this object, hence referred to as Lorenz attractor or a strange attractor; instead of predicting the growth of the trajectory from a given starting initial condition, we will instead try to describe the attractor, the internal dynamics of the attractor.



III. CHAOS CONTROL AND SYNCHRONIZATION

Long time ago chaotic systems were thought of as unpredictable and uncontrollable; unpredictable, as sensitive dependence on initial condition produces change of the original motion that grows exponentially fast; uncontrollable, because small disturbances produces other chaotic states but not to any stable or regular motion.

Chaos control aims to enhance Chaos, when it is beneficial or suppress Chaos, when it is harmful. In general speaking we can say that chaos control aims to stabilize a chaotic attractor either to a periodic orbit or to an equilibrium point.

First time chaos control came into existence by the work of Ott, Grebogi and Yorke [8]. OGY proposed that Chaos can be controlled to unstable periodic orbits or fixed points by using small perturbation.

The most popular scheme for Chaos control was

adaptive control, which was introduced to control nonlinear systems in the presence of parameter uncertainties. Huberman

and Lumer [9] introduced this scheme where a system which is perturbed away from a stable fixed point (X_s^*) is brought back to the fixed point by introducing changes in the parameter μ such that $\mu_{n+1} = \mu_n + \epsilon(X_n - X_s^*)$

Controlling chaos found applications in different areas.

The most fruitful application of Chaos control was found in the field of communication. Hayes and their group showed theoretically [10] and experimentally [11] how this idea could be used for chaotic communication.

The word synchronizations taken from the greek word (sync+chronous) i.e. occurring at the same time. In other words we can say that it is the co-ordination of events to operate a system in unison. For example in a musical instrument say orchestra, where all the parts operating at the same time maintains synchrony.

Synchronization of Chaos [12] bokaletti refers to a process wherein two or many chaotic systems (either equivalent or nonequivalent) adjust a given property of their motion to a common behavior due to coupling or forcing (periodic or noisy).

IV. APPLICATION OF CHAOS IN DIFFERENT RESEARCH AREAS

A. CHAOS CONTROL AND SYNCHRONIZATION IN SECURE TRANSMISSION OF SIGNALS

One of the important applications of Chaos is 'chaos based secure communication'. Chaotic variables are random-like and broadband. This makes them a good candidate as carriers of secure messages. Many techniques of chaos control and synchronization are proposed [13] for secure transmission of digital signals. Adaptive parameter synchronization [14] was explored using chaotic synchronization.

In this scheme slave, system is modified by a control system, which does not depend on the parameter of the master system. The parameter of the slave system is made to evolve according to an adaptation law. The control system and the adaptation law are so chosen that the differences between the corresponding variables and between the parameters of the two systems are governed by a linear time independent system whose eigenvalues have negative real part [15].

This ensures that the slave system synchronizes with the master system and the parameter R' of the slave system converges to the parameter R of the master system. This rapid convergence of R' to R is used for secure communication of digital signals, binary as well as decimal, by using the parameter R to code the signal.

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B. THE APPLICATION OF CHAOS IN COVID-19 ANALYSIS

The most recent application of chaos was explored in COVID19 infection analysis [16]. Lyapunov Exponent (LLE) to examine the existence of chaotic behaviour in the COVID-19 time series data, to predict the outcome of new daily instances of infection till 2023. Forecasting shows that certain countries' infections are decreasing while others are increasing.

Unidirectional Payload Launching and Intercepting system

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Abstract— Unidirectional Payload Launching and intercepting system is a technological concept which can be used in the future to transport cargo in zero/minimal gravity environment. This technology was thought of keeping in mind its uses in space mining.

Keywords— UPLIS, Faraday's law, Lenz's law, ring jump experiment, Space mining.

I. INTRODUCTION

Space mining is the concept of extracting valuable resources from space objects, including asteroids, comets, and the Moon. These objects are rich in materials such as water, minerals, and metals, which could be used to support future space exploration and settlement [1]. One of the main motivations behind space mining is the concept of in-situ resource utilization (ISRU), which is the ability to use local resources to support human activities in space. ISRU is seen as a key enabler for sustainable long-term human exploration and settlement in space, as it reduces the need to launch large amounts of supplies from Earth, which is expensive and logistically challenging [2][3].

Now for instance, if this mined material is needed to be transported to a nearby space colony or even a far-off place, it can be done using Unidirectional Payload Launching and Intercepting System or UPLIS. UPLIS is basically a launching and intercepting device, which can launch a payload from its origin to the desired location. On the final position there is another UPLIS device which will intercept this payload, it will then reposition itself in its orbit and then launch it to another destination. By using this relay-system a payload can be transferred from one location to another

II. PHENOMENON

UPLIS is based on basic laws of physics. A basic ring jump experiment can very well explain this phenomenon [4]. The ring jump experiment is a classic demonstration of electromagnetic induction that utilizes the principles of Faraday's law and Lenz's law. In the experiment, a conducting ring is placed on a flat surface, and a powerful magnet is held above the ring without touching it [4]. As the magnet is moved downwards towards the ring, a changing magnetic field is created, inducing a current in the ring in accordance with Faraday's law [4][5]. The induced current creates a magnetic field that opposes the changing magnetic field of the

magnet, as per Lenz's law. This interaction between the magnetic fields causes the ring to jump up. The ring falls back down when the magnet is moved away from the ring, and the process repeats, creating a bouncing effect.

Faraday's Law:

Faraday's law of electromagnetic induction states that the magnitude of the electromotive force (EMF) induced in a circuit is proportional to the rate of change of the magnetic flux through the circuit. Mathematically, this is expressed as:

$$EMF = d\Phi/dt \quad (1)$$

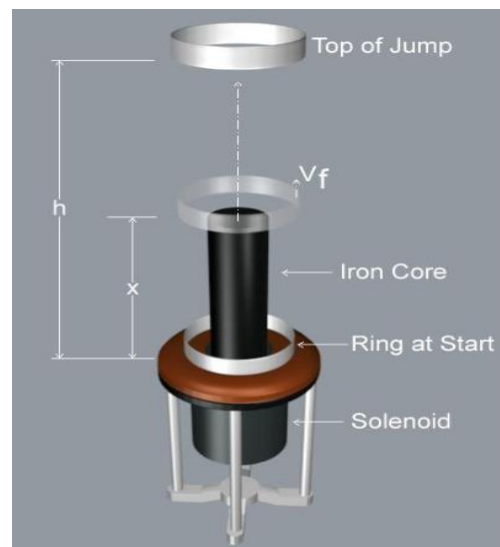
where EMF is the induced electromotive force, Φ is the magnetic flux through the circuit, and $d\Phi/dt$ represents the rate of change magnetic flux over time [6].

Lenz's Law:

Lenz's law is a consequence of the law of conservation of energy and states that the direction of the induced current in a circuit is such that it opposes the change that produced it. Mathematically, this is expressed as:

$$E = -d\Phi/dt \quad (2)$$

where E is the induced electromotive force, Φ is the magnetic flux through the circuit, and $d\Phi/dt$ represents the rate of change of magnetic flux over time. The negative sign in the equation represents the fact that the induced current opposes the change that produced it [5].



Ring jump experiment, using Faraday's law and Lenz's law, ref: Jeffery, Rondo N. and Farhang Amiri. "The Phase Shift in the Jumping Ring." *The Physics Teacher* 46 (2008): 350-357.]

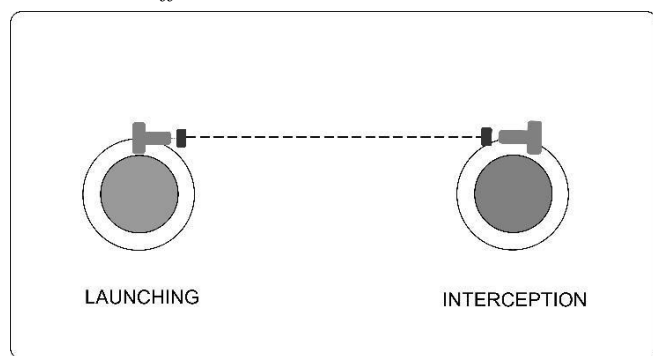
III. TECHNOLOGICAL CONCEPT

UPLIS, or Unidirectional Payload Launching and Intercepting System will be a device that can be launched from earth and assembled in space. Another method can be using a 3D printer, which can be launched in space and the printer will produce the entire UPLIS unit in space.

An UPLIS unit needs to be in orbit of any celestial body, be it a planet, a moon, an asteroid or a meteor. The cargo will be loaded in front for an UPLIS, and due to electromagnetic effect, it will be launched into a particular direction.

Another UPLIS unit is placed in orbit in another location, mostly the targeted location, where it will intercept the cargo and depending if that is the final location, the UPLIS will start to reroute to transport the cargo to another relay point. If that location is final, the cargo will be safely moved further for processing. Regarding the power supply, if the UPLIS is in range of a star, solar power can be used for transportation and if not, nuclear energy can also be used. If this transportation method is to be used in the solar system, our sun will be more than enough to power UPLIS.

Authors and Affiliations



[UPLIS launching and intercepting cargo]

IV. CURRENT TECHNOLOGY

Currently, the technology that is used for transportation of cargo in space are:

1. Space shuttle: Spacecraft are vehicles designed to travel through space. They can be used to transport cargo, crew, or a combination of both. Examples of spacecraft used for in-space cargo transportation include the Cygnus spacecraft, the Automated Transfer Vehicles (ATVs), the H-II Transfer Vehicle (HTV), the Progress spacecraft, and the Dragon spacecraft developed by SpaceX [7].

2. Space Tugs: Space tugs are vehicles designed to move cargo between different locations in space. They can be used to transport cargo to and from the ISS, as well as to move cargo to and from the Moon or other destinations in deep space. Some examples of space tug concepts include the Space Infrastructure Servicing (SIS) vehicle, which is being developed by NASA, and the Advanced Common Evolvable Interoperable Spacecraft (ACEIS), which is being developed

by the Defense Advanced Research Projects Agency (DARPA) [8].

3. Mass Drivers: Mass drivers are a proposed type of electromagnetic launcher that could be used to launch cargo from the surface of the Moon or other planetary bodies into space. The idea is to use a linear motor to accelerate cargo to high speeds, allowing it to escape the planet's gravity without the need for a rocket. Mass drivers are still a concept and have not yet been developed for use in space, but they have the potential to significantly reduce the cost and complexity of launching cargo into space from other planetary bodies [5][9].

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Battery Upgradation in Electric Vehicles

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Abstract— A significant possibility for lowering greenhouse gas emissions is the usage of electric automobiles. Electric cars not only lessen reliance on fossil fuels but also lessen the effects of ozone-depleting compounds and encourage the widespread use of renewable energy sources. Electric vehicle production and network modelling continue to change and are limited despite extensive study on the qualities and traits of electric vehicles as well as the makeup of their charging infrastructure. Adequate storage technologies are needed to allow a transition to renewable energy sources from fossil fuels. Common Lithium-ion batteries are widely used but are limited by availability of materials, price and safety. This paper shows the early-stage research on new advanced batteries and published discoveries so far. Because of the needed follow up research, techniques are presented as well as ways to evaluate and compare future results.

I. INTRODUCTION

Electric vehicles are becoming very popular these days there are several reasons why it is gaining huge attention. And one such reason is because they create less pollution than the cars that work on petrol or diesel. these cars are environment friendly. An electric car is a car powered by an electric motor and batteries rather than a petrol engine. while we drive an electric car or even see it the only thing that strikes us with its true nature is that it is almost silent. Over last few decades many companies that manufacture vehicles have shifted to manufacturing electric vehicles. Society is constantly evolving and upgrading and people are becoming more aware of the environment which is reflected in the purchasing patterns of cars. As previously mentioned, electric vehicles tend to be seen as an environment friendly alternative to conventional cars which becomes apparent in the statistics that show us how the market is growing. As the environment has worsened over the last few years the attitude towards green products has changed and people are looking for ways to make their daily lives “greener” and better. However, it is still a controversial topic and the general attitude towards them is dispersed which can be seen in the national benchmark report on consumer views on EVs. Transport electrification and modernisation has started a virtuous self-reinforcing circle. Use of EV has triggered the battery technology and cost reductions which provides significant economic-development opportunities for the companies and countries intercepting the battery and EV value chains.



II. REVIEW OF LITERATURE

A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet Popa, Mohammad Nurunnabi Mollah and Eklas Hossain] [Academic Editor: Sergio Saponara Received: 8 May 2017; Accepted: 21 July 2017; Published: 17 August 2017]

The information in the review paper is focused upon the energy sources in electric vehicles, the charging techniques of the battery and its process about charging and discharging, the control procedures related to operation of electric vehicles. Limitations are cited which focuses on the use of machine algorithms, it's complexity, and multiple steps related to vehicles energy charging and cooling system.

The hurdles related to battery management is issued which effect the efficiency of the power unit. Optimization methods have been also discussed which are about monitoring the systems with robust mechanism which include sensors which actively track the units, and control units which analysis it and then operate throughout the provided information.

[Review article]

Overview of batteries and battery management for electric vehicles Wei Liu ,Tobias Placke, K.T. Chau, Department of Electrical and Electronic Engineering, The University of Hong Kong, Pokfulam, Hong Kong Special Administrative Region of China, MEET Battery Research Center, University of Münster, Corrensstraße 46, 48149 Münster, Germany.

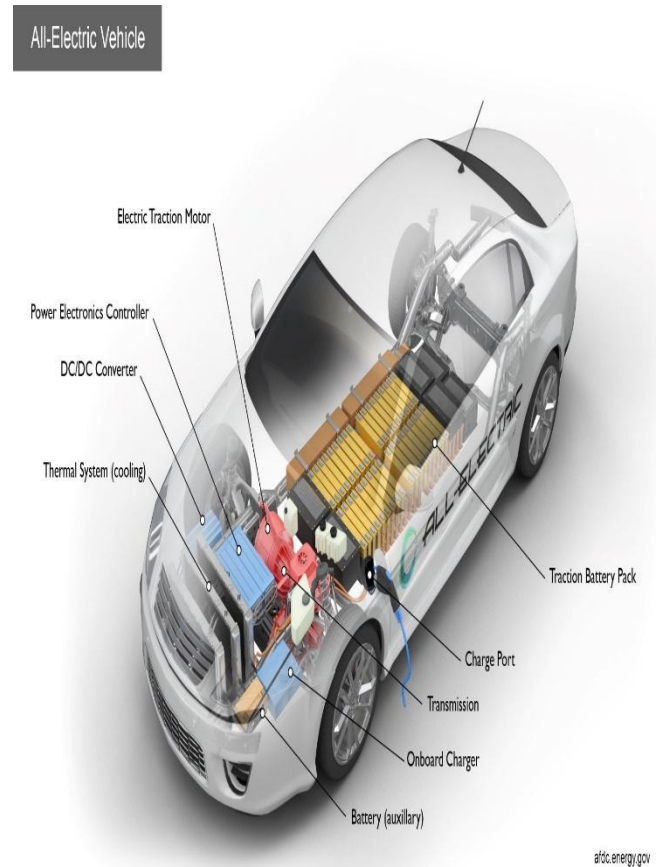
This review paper is focused upon the battery and the power units management system, it's process which include

topics stretching from battery production to integrating the small batteries together in small parts for better battery performance and better management system. The effective making of the smaller sized battery modules into larger usable units and later integrating them to the battery pack and vehicle, about how it helps to reduce operation temperature and helps to maintain the required operating frequency throughout all units. It also talks about adapting one type of power station for different types of vehicles and increasing the power transfer to different types of vehicle units without affecting the composition of battery and without much heating.

2. III. METHODOLOGY

1. A. Overall Working of an Electric Vehicle:

A vehicle works on an engine. The special thing about electric vehicle is that it works on electric motor. Hence the electric energy replaces the fuel. The electric vehicles work on the principle of transformation of electric energy into mechanical energy, which is then used to obtain kinetic energy enabling motion in the electric vehicle. The engine of the vehicle is replaced by an electric motor and the fuel tank is replaced by the battery pack in the electric vehicle. The flow of electrical energy to the motor is controlled by Power Electronics Controller. And the electric motor gets energy from the controller which regulates the amount of power based on the usage of the accelerator pedal. When you place the vehicle in gear and press the accelerator pedal, the power is converted from DC battery to AC by an inverter for the electric motor. The accelerator pedal sends the signal to the controller which adjusts the vehicle speed by changing the frequency of AC power from inverter to motor. The amount of current required to run the motor varies depending on the input on the accelerator pedal. Once the motor receives power, the rotors start spinning and produce mechanical energy. In this way the electrical energy from the battery is converted to mechanical energy. The mechanical energy produced by the motor starts rotating the gears or transmission. The wheels of the vehicle start moving as a result of this mechanical energy which the transmission transfers to the wheels, which propels the vehicle forward.



2. 1. Gear in electric vehicle:

Electric vehicles have just one gear. As the Electric motors deliver power instantly, the process of building up torque through revving as in internal combustion engines is unnecessary. And as there is just one gear regulating the electric motor, the Electric vehicles don't even have a reverse gear. This is because an electric motor can turn clockwise or anti-clockwise. The direction in which the motor is rotating, determines if the car will move forward, or back. And the direction in which the motor is rotating can be reversed by just giving an electrical input via the drive selector switch. Hence, all-electric vehicles have a simpler arrangement of gears and hence Electric vehicles are like automatic car they have forward and rewards mode.

2. Braking system in electric vehicles:

In an Electric Vehicle, the moment the vehicle stops accelerating, a regenerative braking system covers the loss of energy due to deceleration and transfers the energy back to the motor. The motor now acts as the generator to recharge the battery. Regenerative braking in Electric Vehicle is a mechanism that slows down a moving vehicle or object by converting its kinetic energy into a form that can be stored until needed. Hence Regenerative braking is a energy recovery mechanism.

3. B. Battery in Electric Vehicles:

These factors determine battery performance. Batteries are energy storing power units in cars, so the main properties are :

1. Battery density:

It is the parameter which show content of energy in battery. There are two ways to define. Gravimetric and volumetric: Gravimetric energy density is

also called specific energy and is defined as energy contained in per kg weight. Volumetric says about content in per unit volume. If Battery has higher gravimetric energy density it means it will store more energy in low space. Less weight battery occupy less space so energy density also is necessary to determine design of vehicles.

2. Power Density:

Power density says about how much energy is supplied in what time. More power density battery can supply high volume of energy so the vehicle can accelerate quickly and the energy demands are met quickly.



Figure 14. Battery Pack of Chevrolet Bolt [67]

3.State of Charge:

SoC say about the charge available in the battery at a given time, it tells about whether battery is charged, discharged. Similar to fuel meter in diesel and petrol vehicles, in electric vehicles state of charge show the available energy in the car, SoC estimation helps to determine remaining kilometers available for car to travel.

4. State of Health:

With time the performance of batteries decrease. And so the storing capacity decreases, this parameters show that how much battery has deteriorated from its original capacity, this depends on various other parameters which include ambient temperature, Charging current, depth of discharge. But these batteries do not turn completely useless and can be used for other purpose at homes.

5. State Discharge:

When a battery is kept idle without connecting to any circuit, it discharges with time this phenomenon is called self-discharge, this affects the performance, if the self-discharge is high, the battery will always give less output as compared to the input energy provided , these depend on various factors like state if charge, battery chemistry, cell design, depth of discharge, ambient temperature.

6. Battery Efficiency:

Similar to other power equipment batteries also have efficiency, it helps to determine how much energy can be abstracted by the used battery after supplying energy to it, during charging and discharging the batteries various energy conversion processes are involved. These involve conversion of chemical energy to electrical energy and

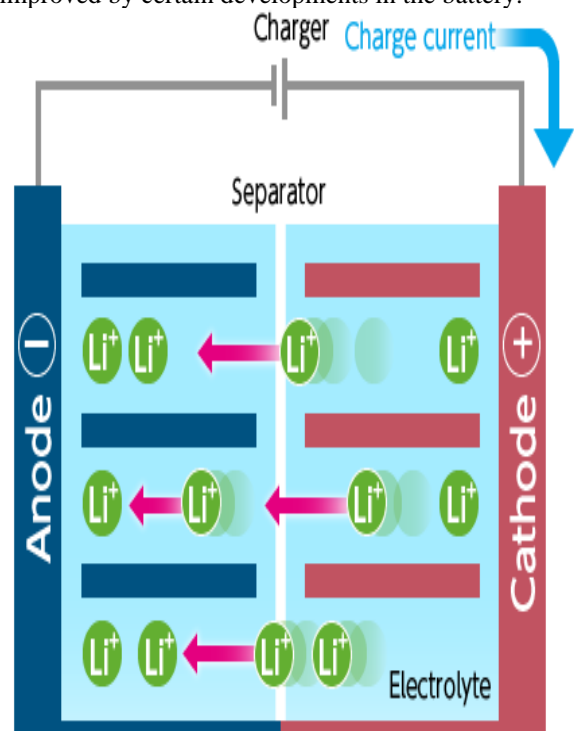
from electrical energy to chemical energy, these processes are not completely efficient and there are some energy lost. So the energy drawn firm the battery is mostly less than the energy provide to the battery and it decreases the efficiency of battery.

7. C Rate:

The c rate is the charging discharging rate in which the battery will fully charge or fully discharge in 1 hour. For a 1 kWh battery the c rate is rate at which the 1 kWh battery will either get charged completely or discharge completely in 1 hour time, 2C means the battery can charge 2 kWh energy in 1 hour, so battery will take half time to charge completely, so if battery is charged at c rate it will charge completely in 1 hour and at 2C rate it will take half time.

3. IV. DESCRIPTION OF METHOD USED:

Currently li ion batteries are being used in electric cars. No doubt li ion batteries are at the core of the electric vehicles production they offer great energy density as compared to many other battries. li ion batteries are also ideal for use in electric vehicles because they can be recharged many times which is essential for electric vehicles that require extensive charge/recharge cycles over their useful life. But there are some drawbacks which can be improved by certain developments in the battery.



A. WORKING OF Li-ion BATTERIES:

The fundamental lithium-ion battery makes use of the chemical properties of its constituent parts. The lithium in these batteries is a metal that is eager to lose an electron, creating lithium-ions, from which the battery gets its name. The cathode, which is the positive electrode in these batteries, is made of a metal oxide (cobalt is a common choice). In addition, the anode, a negative electrode in these batteries, is frequently comprised of graphite, which enables lithium to intercalate between it.

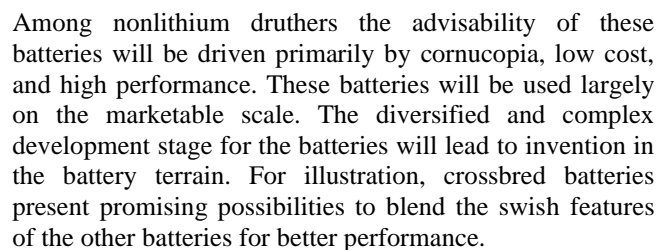
A flow of electrons into the anode is created when you charge a lithium-ion battery because the charger pushes electrons out of the cathode. The lithium-ions leave the cathode and travel back to the anode, reversing the complete chemical process that took place while the battery was draining. The battery is once again ready to use after the charging process is finished.

- 1) It only has a two- to three-year shelf life after manufacture.
- 2) It is susceptible to extreme temperatures.
- 3) The battery cannot be recharged once it has been totally discharged.
- 4) The "separator" has the potential to catch fire if it sustains damage.

Now a day's Li- ion batteries are preferred for energy storehouse in electric vehicles but there are problems that are being faced with the help of these batteries as they're expensive, short – lived, or indeed explosive in certain situations.

So, for these reasons we came up with a new battery which stores 4x times energy as that from Li- ion batteries. These batteries are more stable, barring the pitfall of catching fire and offering a truly high energy viscosity. Also, in place of lithium essence we used essence similar as sodium, iron which are better druthers for use in batteries. We used Sulphur batteries which provides advanced energy density. With this we achieved the result for all the four aspects of batteries as it's of low cost, it gets fluently fabricated, and have inconceivable mechanical and chemical stability. We set up a new form of oxysulphide glass electrolyte That has the implicit to satisfy all the conditions contemporaneously. These batteries that we created have a distinct microstructure, performing in an entirely homogeneous glass structure. This allows the electrolyte to form a unresistant face at the interface between the substance and electrolyte. This element is essential for reversible plating and stripping of essence this is the miracle that's delicate to achieve so far. These batteries allow the development of safe, low cost, Energy thick, and long continuance batteries.

We can replace the existing semi permeable membrane, which allows the going of electrons in charge discharge process, with some other material and modify it in such a way that the semi permeable membrane which is already in use can be made to trap lithium polysulphides during the process. Currently suggestions are to use phosphorus and activated carbon, but it takes high space and so the size of battery increases.



The demand for these batteries is expected to grow worldwide for full commercialization in the marketplace as it has a lifespan of nearly 15 years and has efficiency around 85%.

Mrs. Archana Kulkarni. We offer our sincere appreciation for the learning opportunities provided by her. My completion of this project could not have been accomplished without the support of my classmates, Mayank, Sudeep and Aishwarya. My heartfelt thanks.

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Design of NBC (Nuclear, Biological, Chemical) Suit using Radio Luminescence Material

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Abstract— Radio luminescence is when light is produced by interactions with radiation particles, such as α or β particles, and cosmic rays or photons, such as X-rays or γ rays. We are going to use this principle to build a protective suit for nuclear technicians and scientists who work in nuclear power plants. We will integrate strips of Radio luminescence made up of tritium or Strontium Aluminate as they will absorb radiation particles and cosmic rays or photons and will emit light which will indicate the user about the presence of any radiation particles or cosmic photons around them. This will reduce the use of Geiger counter (also referred to as a Geiger-Müller counter) as it's difficult to carry to different places for detecting and measuring ionizing radiation. We have addressed this issue in order to reduce accidents and dead cases due to radiations. Also, non-nuclear technicians can also use this suit in order to protect themselves from radiations as it's easy to use them compared to using a Geiger counter. We can develop a solid state strip of tritium by incorporating tritium into inorganic or organic materials which will improve the safety of the suit by two ways: a) Tritium will be contained in a chemical structure rather than as a gas in a glass container. b) No gamma rays will be emitted by Tritium when it decays. Also, we can use Strontium Aluminate as it emits a large amount of light in response to a miniature amount of radiation and is chemically inert which connotes that it will not react with surrounding substances and makes it suitable for using it in a nuclear radiated environment. Gamma rays are the most dangerous external hazard for humans. Gamma rays can penetrate human skin and result in ionizations that detriment tissue and DNA, which will affect normal cell replicative function and impact rates of apoptosis. It will also cause detriment to genetic material which can result in transformation of healthy cells to cancers, impaired cellular function, and cell loss. [19] The strips of Tritium or Strontium Aluminate will alert the user about the presence of gamma radiation in the surrounding. By this we can save more than 23 million lives of nuclear technicians and non-nuclear technicians.

Keywords— Radio luminescence, Tritium, Strontium Aluminate, radiation, Ionizing, Gamma, DNA

I. INTRODUCTION

Luminescence occurs when a material absorbs energy, its atoms move to a higher and more energetic state. Atoms in higher orbitals are energetic and unstable due to the natural tendency of an atom to seek out lower energy configuration, the atom undergoes another transition back to its more stable, less energetic ground state. By this process Luminescent materials convert the energy which has been absorbed into light energy.

There are different types of luminescence materials such as:

- Photoluminescence : which emit photons when light is incident on an object with luminescence such as watches
- Bioluminescence : which emit light when the chemical reactions occur within living organisms such as fireflies, glow-worms and phytoplankton
- Electroluminescence: which emit light when an electrical current passes through the object such as Light Emitting Diodes (LEDs), Television Set and computer monitors.
- Radio luminescence : which emit light the object interacts with radiation particles, such as α or β particles, and cosmic rays or photons, such as X-rays or γ rays
- Chemiluminescence: which emit light via chemical reactions for example glow sticks
- Triboluminescence : which emit light by tearing, ripping, scraping, striking, rubbing or alternating crystals
- Thermo luminescence: which emit light when photons are emitted from a hot object [18]

I. NUCLEAR POWER PLANT ACCIDENTS

In the past there were several mortalities due to nuclear power plant accidents. An example is the SL-1 accident which happened in the year 1961, the Three Mile Island accident which happened in the year 1979, in 1986 there was the Chernobyl disaster [1], the Fukushima nuclear disaster which happened in the year 2011, and recently in the year 2019 there was a radiation accident at the State Central Navy Testing Range at Nyonoksa, near Severodvinsk, Russia. Due to the Chernobyl accident, there is an increased risk of developing thyroid cancer due to penetration of radiation into the human skin and resulting ionizations that detriment tissue and DNA for the people living near Chernobyl as they were exposed to Iodine-131 radiation. Radiation exposure not only results in transgenerational effects due to mutation of DNA but it also passed on to their

future offspring, increasing cancer risk in those offspring. According to the data, nearly 5 million residents received an accumulated whole-body average dose of around 0.01 grays (Gy), which were located near Chernobyl.[1][3] According to several reports, a high dose of radiation was received by approximately 600 non- nuclear technicians working in a power plant and they endured from radiation sickness. According to research, a person who is expose to more than 6 grays (Gy) of radiation became morbid immediately and departed. There is a hope of survival for those who are exposed to less than 4 grays (Gy) of radiation. Ample of people who work as clean-up crew were exposed to 0.14 Gy in 1986 to 0.04 Gy in 1989. [1][3]

II. DISCOVERY OF RADIO LUMINESCENCE MATERIAL

Around 20th century, the radioactivity was identified and detected, and the important application of radio luminescence has been in radio luminescent paint, used on watches, compass dials, gun sights, Aircraft instrument , and other application to permit them to be see in the dark. The radiation particles were released by constant radioactive decay from the isotope's atoms and these particles collide with phosphor molecules, which results into emission of light. The first application of radio luminescence was in luminous paint made up of radium, a natural radioisotope. In the year 1908, luminous paint made up of radium and copper-doped zinc sulphide molecules and were used to coat watch faces and dials and emitting greenish glow. Ernest Rutherford used ZnS: Ag coated spintharoscope screens for identifying and detecting the atomic nucleus. Around 1950s clock made up of radium were incident to ultraviolet light to boost its luminescence. Radio luminescent light sources usually made up of a radioactive substance commingle with phosphor.

III. RADIO LUMINESCENT ELEMENTS

There are different elements who emit light when the object interacts with radiation particles, such as α or β particles, and cosmic rays or photons, such as X-rays or γ rays. They are Radium, Promethium, Strontium Aluminate, and Tritium. Radium's are one of the earliest radio luminescent materials, it was commonly used in dial clocks and a variety of quack products. Unlike radium, promethium is only a diminutive amount of energy beta-emitter and does not breakdown the phosphor lattice and the brightness of the material breakdown slowly. Tritium are the latest generation of the radio luminescent material. It's a radioactive isotope of hydrogen that have a half-life of 12.32 years and discharge small energies of beta particles.

IV. SUITABLE RADIO LUMINESCENT ELEMENTS WHICH CAN USE FOR THE STRIPS OF THE PROTECTIVE SUIT

The only possible substance which can be used for the strips of the protective suit are Tritium and Strontium Aluminate. We cannot use radium Due to its radiation hazard and it releases radon gas which is also harmful for the human skin. Similar we cannot use Promethium due to its short half-life of 2.62 years. We can use Tritium because not only it has half-life of 12.32 years but also beta particles discharged by tritium cannot pierce through the glass tube and even if they could, they will not able to penetrate through a human skin.

V. PROPERTIES OF TRITIUM

Tritium being isotope of Hydrogen so it has same chemistry as that of hydrogen, except that tritium is radioactive. There are several forms of tritium, the most common being T2 and TH (gases) and tritiated water (THO or T2 O). Tritiated water is the most prevalent form of tritium in the environment (THO). There are several forms of tritium, the most common being T2 and TH (gases) and tritiated water (THO or T2 O). [4]

Tritium has a high specific activity, radiolysis occurs. Tritium can be retained to a solid structure by reacting it with binder or phosphor. We can develop a solid state strips of tritium by incorporating tritium into inorganic or organic materials which will improve the safety of suit by two ways:

1. Tritium will be contained in a chemical structure rather than as a gas in a glass container
2. No gamma rays will emitted by Tritium when it decays. Gamma rays are the deadly and precarious external hazard for humans. Gamma rays can penetrates human skin and can cause ionizations that damage tissue and DNA, which will affect normal cell replicative function and impact rates of apoptosis. It will also cause detriment to genetic material which can result into transformation of healthy cells to cancers, impaired cellular function, and cell loss. Not only Tritium will emit gamma rays but it will also alert the user about the presence of gamma radiation in the surrounding. [4]

VI. HOW TRITIUM WILL DETECT RADIATION?

Tritium can detect gamma and beta particles through the process of scintillation. When a gamma or beta particle passes through a scintillation material, it excites the atoms in the material and causes them to emit light a low-level of light in the blue-green part of the visible spectrum. This light is known as scintillation light and is produced by virtue of the interaction between the gamma or beta particles and the scintillation material.

The exact colour of the light emitted by tritium can vary depending on the type of scintillation material used and the properties of the tritium. In general, tritium scintillation materials tend to emit light in the blue-green part of the visible spectrum, with a peak emission around 510-530 nanometres. This light is then detected by a photomultiplier tube, which amplifies the signal and produces a measurable output

VII. HAZARDS OF TRITIUM

If there is leakage of Tritium gas into the environment it will eventually form THO. Tritiated water is the greater hazard to health and safety as it can absorbed by the body by several paths such as ingestion, inhalation, injection, or percutaneous absorption. If the tritium is released indoors, it easily convert to a THO molecules from gas phase and the rate of conversion depends on the factors related to ventilation such as temperature, humidity, catalytic

surfaces, electric discharges from electrical equipment, etc. So once the suit is been used, its advice to return it to recycle or dispose or to destroy it. [4]

VIII. PROPERTIES OF STRONTIUM ALUMINATE

Strontium Aluminate is a type of phosphor with the chemical formula SrAl_2O_4 . It has several properties that make it useful for various applications:

- **Brightness:** Strontium aluminate is a highly efficient phosphor, meaning that it emits copious amount of light in response to a miniature amount of radiation. This makes it useful in applications such as exit signs and glow-in-the-dark paints, where brightness is important.
- **Long Persistence:** Strontium aluminate has a long persistence, meaning that it continues to emit light for a long time after the origin of radiation has been removed. This property is particularly useful in exit signs and glow-in-the-dark paints, where the phosphor needs to maintain the emission light even after the power has been turned off.
- **Stability:** Strontium aluminate is a stable material, meaning that it does not easily degrade or break down over time. This makes it useful in exit signs, where the phosphor needs to remain functional for many years.
- **Chemically Inert:** Strontium aluminate is a chemically inert material, meaning that it is unresponsive with other materials or substances. This makes it useful in applications such as glow-in-the-dark paints, where it needs to be mixed with other materials without reacting with them.
- **Colour:** The colour of the light emitted by strontium aluminate can be controlled by changing the size of the crystals used in the phosphor. This allows for the creation of phosphors that emit light in different colours, making it useful for a variety of applications.[7]

IX. HOW STRONTIUM ALUMINATE WILL DETECT RADIATION?

When gamma or beta rays penetrate the strontium aluminate phosphor, they ionize the electrons in the material, causing them to become excited and move to

higher energy states. As these electrons return to their ground state, they release light energy.

The light emitted is in the visible spectrum, making it useful for applications such as exit signs, glow-in-the-dark paints, and clock dials. The radio luminescence of strontium aluminate is due to the presence of strontium ions in the material, which act as the active centres for light emission. The energy released by these ions is dependent on the energy of the gamma rays and the size of the strontium aluminate crystals.

X. HAZARDS OF STRONTIUM ALUMINATE

Though Strontium aluminate considered to be a safe material, there are some potential hazards associated to it.

Strontium aluminate is a source of ionizing radiation, meaning that it can produce high-energy particles that can damage living tissues and increase the risk of cancer. [21] However, the quantity of radiation emitted by strontium aluminate is typically very low, and the risk of exposure can be reduced by handling the material properly and avoiding unnecessary exposure.

Strontium aluminate is a fine powder that can be easily generated as dust, which can be inhaled and cause respiratory irritation. To avoid this hazard, it is essential to handle strontium aluminate in an air-conditioned and blowy environment and to use protective equipment such as masks and gloves if necessary.

XI. CONCLUSION

We can attach strips of solid tritium or Strontium Aluminate on NBC (nuclear, biological, chemical) suit. The strips of solid tritium should be circle in order to cover maximum area and using less tritium. This will be both cost effective and will cover maximum area of the suit. Usage of Geiger counter wasn't effective because it was used by the nuclear technicians and not by common people. Also it covers less area and restrict a person as it locate and determine the radiation in a particular direction and not detecting radiation 360 degree, we can be detected if the users are working protective suited with Radio Luminescent strips. By this we can save more than 23 million lives of nuclear technicians and non- nuclear technicians.

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Figure SEQ Figure *ARABIC
INBC (nuclear, biological,
chemical) suit

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Designing a Power Nest with a Maglev Windmill and other Energy Sources

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Abstract—Power consumption in India has risen by 13.31 percent annually. India is the second most populated country in the world. Conventional methods of energy generation are depleting day by day. Power nest is a hybrid system which combines the energy of sun and wind. It is entirely based on renewable source of energy and does not emit CO₂ which helps in sustainable development of world. By combining the sun and wind energy the total output is increased by 6-10x more than what they in dividually produced. The Vertical-Axis Wind Turbine (VAWT) with Maglev is used over the conventional horizontal axis wind turbine and due to which the efficiency is increased around 30 percent and at the same time the operational cost has been reduced by 45 percent over the ordinary wind turbine. As VAWT does not produce friction the maintenance cost is very less. The major advantage of this system is that it is fitted on the rooftop and its lifespan is also more than the conventional energy sources. We will use Neodymium Iron Boron (NdFeB) magnets because they have a much stronger magnetic field with the highest BH Max of any permanent magnet available today and they are cheaper than Samarium Cobalt (SmCo) magnets. There will slits to reduce to area through which the wind will escape and thus the velocity of the wind will increase and, this concept is based on the Venturi effect. We will be going to use Bi-facial Solar panel arrangement which will increase the number of solar panels used and also the Maglev Vertical-Axis Wind Turbine (MVAWT) will cool which will not only boost the power production but also increase the efficiency of the power nest by 15-25 percent. In order to increase surface area and capture more wind, we will also increase the number of blades on the rotor side of the vertical axis maglev wind turbine (MVAWT). In addition to producing more power at low wind speeds, it will also be quieter and produce less noise.

Keywords— *Power Nest, Maglev Vertical-Axis Wind Turbine, Bi-facial Solar panel, Venturi effect.*

INTRODUCTION

India is one of the most populated country in the entire world and due to this rapidly increasing population energy consumption has increased enormously. As per the recent reports that are published by various news agencies, power

consumption in India rose by 13.31% annually [2]. The total power consumption in India has increased upto 127.39 billion units as of September 2022[1]. To meet the increasing energy demands various renewable and non-renewable energy sources are used. Traditional energy producing technologies are diminishing day by day, contributing to increased pollution and CO₂ emissions. This has triggered threat to environment and biodiversity because of which sustainable energy development has become need of an hour.

Renewable energy sources are those which are unlimited and never runs out. Solar energy, wind energy, tidal energy, and so on are some examples. Till now we were producing energy from sun and wind separately but What will happen if we combine solar energy and wind energy together?

In this paper we aim to present POWER NEST technology which is renewable energy source and has gained popularity over the recent years. Power nest is a hybrid system which combines the energy of sun and wind[22]. Benefits of combining solar panels with small Turbines with a form of installation called "POWER NEST". Power nests are specifically designed to blend in existing architecture of the sournding. Power Nest is integrated with small Maglev vertical axis wind turbines (MVAWT), funnels, and solar panels into what IBIS refers to as a modern "Kinetic Sculpture" to maximise the amount of electricity a single roof can produce[4]. It requires a flat roof on a building with a minimum of five floors or more attempting to harness wind energy within the area. Turbines and funnels are located beneath a raised platform of bifacial solar pannels, which create extra energy above and below while being cooled by air in each "Nest". This system produces 6-10x more energy than rooftop solar panel alone can generate[4]. PowerNEST's clever wind and solar combination gathers more energy in a wider range of weather situations than other on-site systems. Lowering the monthly electric cost is just the start of achieving energy independence through the power of nature

This technology uses many advance and morden concept to increase the efficency such as:

A. *Maglev vertical axis wind turbines(MVAWT)*

This is one of the special kind of wind turbine. The middle shaft rod is where this turbine is fastened. Magnetic bearings(permanent magnets) are used in place of the mechanical ball bearings in this[5][7]. The method relies on the straight forward magnetic levitation phenomena.

• **Magnetic Suspension/Levitation**

Magnetic levitation is the phenomenon of an object floating in midair when its magnetic field is strong enough to repel other magnets[6]. The two magnets are positioned so that their polarities are similar that they resist one another and defy gravity. The capacity and strength of the magnet, as well as the weight of the system to be handled by the magnets, are the key determinants of the opposition provided by the magnets to the objects. This technology is already used in rails, and because to its efficiency and dependability, it is very popular right now.

Benefits of Magnetic Suspension/Levitation

- ✓ The efficiency is boosted since there is less friction because the two magnets repel one another and keep a set distance between them.
- ✓ Because there is less friction, there is less noise, less maintenance, no lubrication, less power loss, etc. in the system.

1) Power Generation

When building a generator, it is critical to understand the fundamental laws that govern its operation. A nearby changing magnetic field is required to produce a voltage in a wire. The induced voltage is affected not only by the size of field density, but also by the coil area. Flux (Φ) is the relationship between area and field density. The generator design determines how this flux varies over time [10]. The axial flux generator generates electricity by utilising the changing magnetic flux. Using Faraday's law of induction, the voltage produced by each coil may be computed [9].

$$v(t) = L \frac{di}{dt} \quad P = vi = Li \frac{di}{dt}$$

$$W = \int P dt = \int Li \frac{di}{dt} dt = \frac{Li^2}{2}$$

$$W = \int F dt = \frac{1}{2} Li^2 \quad R_m = \frac{1}{\mu_0 A}$$

Inductance is given by

$$L = \frac{N^2}{R_m}$$

$$W = \frac{1}{2} Li^2 = \frac{(Ni)^2 \mu_0}{2 \cdot 2X} = \frac{(Ni)^2}{4} \mu_0 A (X^{-1})$$

$$F = \frac{dW}{dx} = \frac{(Ni)^2}{4} A (X^{-2})$$

$$F = \frac{(Ni)^2}{4X^2} \mu_0^2 A^2 \frac{1}{A \mu_0}$$

where

$$\varphi = \frac{Ni}{R_m} = \frac{Ni}{2X} \mu_0 A$$

$$V = -N \left(\frac{d\varphi}{dt} \right)$$

2) Induced E.M.F

It is necessary to describe the components that produce an electromotive force or voltage in order to describe how an axial flux generator is constructed. A time produces an induced EMF. Magnetic field variations. Michael Faraday conducted tests using a straightforward transformer and steady currents in an effort to generate a voltage from a magnetic field. He found that a time-varying magnetic field could induce a voltage while a constant magnetic field would not. This was a significant advancement in the field of electromagnetic induction, which is essential to the construction of a generator. We can be inventive in the ways we produce electricity because of the relative motion of a magnetic field that creates a voltage [12].

3) Magnetic Flux

When a coil is placed in a magnetic field perpendicular to the field, the magnetic flux is at its strongest. When creating an axial flux generator, it is best to maintain the coils perpendicular to the field formed by the permanent magnets. Frequently, a winding rotates inside a magnetic field in conventional motors. The number of windings is increased so that each winding is aligned with the field at nearly 90 degrees. In our design, the magnetic field itself changes with time, not the angle between the coil and the magnetic field. According to Faraday's law of induction, the induced electromotive force is equal to the change in magnetic flux over time. $V = -d\varphi/dt$

Here, two magnets are positioned so that the force of attraction from their complementary polarity maintains them apart. The magnets are strategically positioned to maintain the separation between the two components, which reduces friction and boosts performance.

4) Magnet Selection

In market two types of magnets are present, they are temporary magnet and permanent magnet. cNeodymium iron boron permanent magnet (Nd-Fe-B) suits best for magnetic levitation in windmill because even at the room temperature it exhibits highest properties of all magnetic materials. It has very high magnetic attraction properties therby providing high magnetic flux densities, and resistant to demagnetization[12]. This properties of permanent magnets are very important because it has to levitate heavy load and rotate at very high speed which exhibit a high force in downward direction.

The blades and stator base are held by the shaft. Axial flux is generated by the base's windings, which are coupled in series with one another. Permanent magnets mounted on the base of the rotor begin revolving when wind strikes the turbine blades. As a result, the winding that is attached to the stator is cut by a magnet with a magnetic field, which induces emf in the winding. The power from the generator is kept in the battery in the form of DC, which is easily used for either direct use in a DC application, or it can be converted to AC power by an inverter and used in AC applications.

5) Benefits of using Maglev

- ✓ Cleaning and maintenance becomes easier.
- ✓ Since there is no friction in this mechanism, there is no need for lubrication or maintenance.
- ✓ It doesn't require Yaw mechanism for its operation and it can generate power with low wind speed as 1.5m/s to high as 60m/s.
- ✓ 30% more output is produced than conventional turbine model and also it reduces operational cost by 45% for the same and this reduces the vibrations up to 30%.
- ✓ Because it does not require a location specification, it can be easily set up anywhere, reducing the need for a long transmission line.

6) Drawbacks of using Maglev

- ✓ Maglev wind turbines have some drawbacks, such as higher installation costs than conventional wind turbines.
- ✓ Other basic type of problems that occurs in almost all electrical systems like voltage disturbance, variation in frequency, etc affects system output.
- ✓ This turbine's height is both an advantage, and a drawback also as it becomes difficult to utilize wind at higher altitude.

B. Venturi effect

The Venturi effect is simply the drop in wind pressure when it passes through a confined section [16]. When slits with an inclination are added to the structure so that the area through which the wind will escape will reduce and thus the velocity of the wind is increased [17].

1) Benefits of using Venturi effect

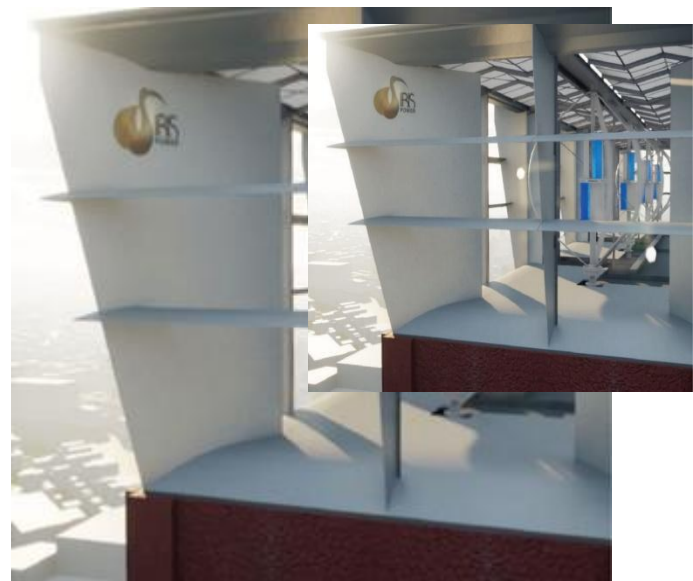
- ✓ This increases the velocity of wind which hits the MVAWT by 140-160% [18].
- ✓ As the pressure of wind is reduced due to this effect, the blades of the MVAWT does not get destroyed due to high wind pressure.
- ✓ This even makes the design Bird and Bat friendly.

2) Bi-facial Solar panel arrangement

This configuration is formed by positioning a pair of two solar panel modules at an acute angle (45 degree), which results in the creation of a semi-triangular roof over the MVAWT in a continuous arrangement of rows and columns.

3) Benefits of using Bi-facial Solar panel arrangement

- ✓ Covers a bit more than the entire area of the roof or the ground available.
- ✓ It allows them to better capture sunlight throughout the day.

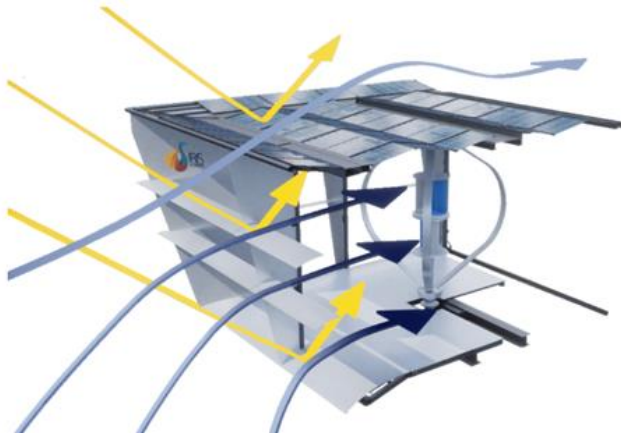


- ✓ The number of the solar panels used in the structure gets increased, thus the amount of energy generated is also increased.
- ✓ The wind below the setup of Bi-facial Solar panel arrangement which is used by the MVAWT cools down the temperature of the Solar panel system, thus there is boost in efficiency of the panels by 15-25% [20].

Fig -1. PowerNest design [4]

4) Advantages of 'POWER NEST'

- ✓ Electricity costs are decreased or eliminated, and renewable energy is produced on-site, right where



it is needed.

Fig-2. venturi effect acting in the system [4]

- ✓ It is totally based on renewable source of energy and helps in sustainable energy development.
- ✓ Can be simply constructed and installed in one day, Include a management system that is ready to use.
- ✓ It is adaptable to any building which has flat rooftop.
- ✓ Capture maximum energy in every climate, Upgrade existing buildings to renewables.
- ✓ Batteries with large capacity is not required in this system for energy storage.

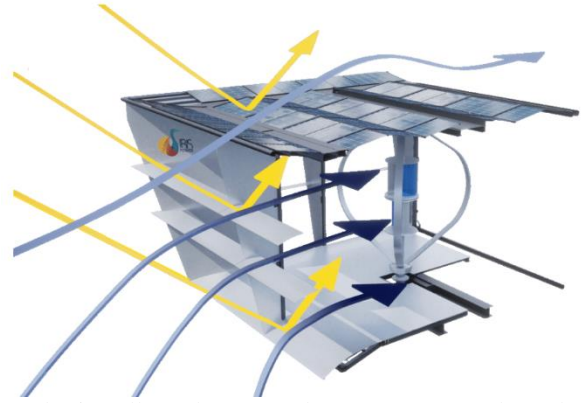
5) Drawbacks of 'POWER NEST'

- ✓ Initial installation is costly.
- ✓ System requires maintenance on monthly basis.
- ✓ Heavy weight of the whole system can damage the base structure.

FUTURE SCOPE

We can also use another model which will be similar to previous as explained above and, it will make use of Neodymium Iron Boron (NdFeB) magnets **because they** have a much stronger magnetic field –with the highest BH Max of any permanent magnet available today –and they are cheaper than Samarium Cobalt (SmCo) **magnets**. Two ring type neodymium (Nd-Fe-B) magnets at the shaft, by which the required levitation between the rotor and the base is obtained. We will also place them on alternate poles, one after the other, along the rotor's periphery to increase stability and avoid damage during strong gales. It will also increase the magnetic flux to increase power production. We will increase the number of blades on the rotor side of the vertical axis maglev wind turbine to increase surface

area and capture more wind (MVAWT). In addition to producing more power at low wind speeds, it will also be quieter and produce less noise. This design will be heavier than compare to previous one which was explained above,



so it can be install on the strong base structure such as the upper surface of the Airports, Bus terminal buildings etc. Due to the influence of the topography and high air pressure, higher altitudes tend to have stronger winds than lower altitudes, hence this design can also be installed on the ground in areas that are close to mountain ranges or at higher elevations. This concept will allow for the operation-free delivery of power to faraway locations.

CONCLUSION

“Sustainability is no longer about doing less harm, it’s about doing more good” -Jochen Zeitz. We discussed the rapidly growing technology POWER NEST in this paper. It is entirely based on renewable source of energy and does not emit CO₂ which helps in sustainable development of world. By combining the sun and wind energy the total output is increased by 6-10x more than what they in dividually produced[4]. The VAWT with Maglev equipped in it is preferred over the conventional horizontal axis wind turbine as the efficiency is increased around 30% and at the same time the operational cost has been reduced by 45% over the ordinary wind turbine. As VAWT does not produce friction the maintenance cost has also reduced. The major advantage of this system is that it is fitted on the rooftop and its lifespan is also more than the conventional energy sources.

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FOOD ITEM RECOMMENDATION, PREDICTION MODEL ALONG WITH FOOD ORDER MANAGEMENT AND DATA ANALYTICS.

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Abstract— Data science powered by artificial intelligence and machine learning is a rapidly growing field that has the potential to transform various industries. In this research paper, we have leveraged this technology to develop a recommendation and prediction model that can assist kitchen staff in hotels or canteens in making informed decisions about food preparation and purchasing.[9][10]

Our model uses past data to recommend food items that can be prepared during free time when there are no orders, increasing productivity and reducing food waste. Additionally, the model predicts the demand for specific food items on any given day, enabling staff to purchase the right amount of ingredients and avoid stockouts or excess inventory.[10]

The effectiveness of our model was evaluated using real-world data from our college canteen, and the results demonstrate its potential to improve operational efficiency and reduce costs. The model's ability to adapt to changing patterns in customer behavior makes it a valuable tool for food service establishments seeking to stay competitive in an increasingly dynamic market.

Overall, this research highlights the power of data science and machine learning to revolutionize the food industry, and the potential benefits it can bring to businesses and consumers alike.[2][3]

Keywords— data modelling, data management, artificial intelligence, machine learning, business analytics, probability modelling, food item prediction, food item recommendation, predictive analytics, data pre-processing, collaborative filtering, content based filtering, customer behaviour, data base management.

I. INTRODUCTION

Data science has become an essential component in the success of businesses in today's competitive world. With the increasing availability of data, companies are seeking ways to leverage this information to make more informed decisions and gain a competitive edge. Data science is a rapidly evolving field that focuses on the extraction of knowledge and insights from large, complex data sets. It uses various statistical and machine learning techniques to analyze and model data, ultimately providing organizations with valuable insights to improve decision-making and drive business growth.[9][10]

In this research paper, a novel data science model that uses data science techniques to provide recommendations and

predictions for the food industry is proposed. Specifically, this model focusses on a recommendation and prediction for hotels, restaurants, and canteens that can help optimize their daily operations.[9]

The model presented in this research paper is designed to provide recommendations for food items that can be cooked during free hours in a canteen or restaurant based on past data. By analyzing historical data, the model can identify food items that are frequently ordered and can be prepared during periods of low customer demand, helping to reduce waste and optimize kitchen operations. In addition, the model provides predictions for food items that are likely to be popular on a given day based on probabilities calculated from historical data, allowing for better inventory management and greater profitability.

The development of this model was made possible through the use of advanced data management, artificial intelligence, and machine learning techniques. These techniques allowed us to build a powerful recommendation and prediction engine that can be used to improve decision-making in the food industry. By leveraging data science and business analytics, companies can optimize their operations, reduce waste, and increase profitability.

In this research paper, a detailed description of the working of the model is explained. The results of the model are also presented, including its accuracy and the benefits it can provide to the food industry. Ultimately, this research paper aims to demonstrate the power of data science and its ability to revolutionize the way businesses operate in the food industry.[1][2][3]

II. METHODS

The food recommendation and prediction model was developed using a combination of Python programming language and SQL database management system. The following libraries and tools were used in the development of the model:

Pandas: Used for data preprocessing and manipulation.

Matplotlib: Used for data visualization.

Tkinter: Used to create a graphical user interface (GUI) for the model.

Tkcalendar: Used to provide a calendar widget for date selection in the GUI.

Numpy: Used for numerical computations and operations on arrays.

MySQL Connector: Used to connect to the MySQL database and perform operations on the data stored in the database.

PIL (Python Imaging Library): Used to process and display images in the GUI.[5][6][7][8]

The food recommendation and prediction model was developed using a three-layer architecture, consisting of a GUI layer, a logic layer, and a database layer. The GUI layer was developed using Tkinter, which provides a user-friendly interface for inputting data and displaying results. The logic layer was developed using Python, which performs the calculations and operations necessary for the recommendation and prediction of food items. The database layer was developed using SQL, which stores and retrieves data from the MySQL database.

The food data was collected from various sources and was preprocessed using Pandas. The data was then stored in the MySQL database, where it was manipulated and analyzed to generate recommendations and predictions. The results were visualized using Matplotlib and displayed in the GUI. The model was trained on a dataset of food items, including information about the food items, such as date, time of purchase and quantity of purchase. The model was then tested on a separate dataset to evaluate its performance.[6]

III. METHODOLOGY

In this model first the data is stored in the database at the counter/reception where the name of the item, quantity purchased, total money, date and time are stored. for the recommendation system the past data is fetched and only the items sold on the same hour in the past same days (i.e. Monday, Tuesday, etc) is selected and then they are sorted based on their quantity sold and then the top 5 food items are displayed that can be cooked in the free hour to reduce the waiting time of customers. For the prediction system, the probability of food items is calculated for the day selected based on the data of the selected day and then the probabilities of the past same days are also calculated and then their mean is taken and then this data is converted into

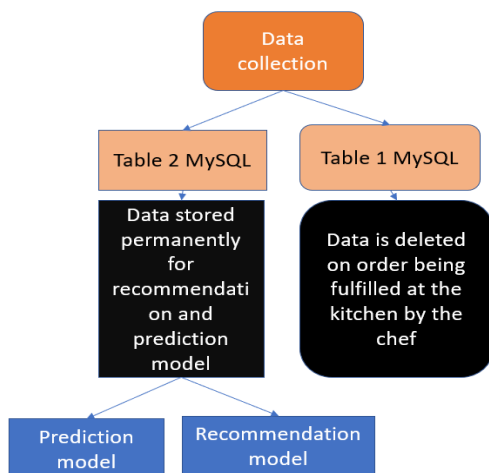


Fig. 1. Data collection [author's own work]

visual representation and tabular form so that the items can be purchased according for cooking for a particular day this will maximize the profit and minimize the loss.[4]

IV. APPLICATION OVERVIEW

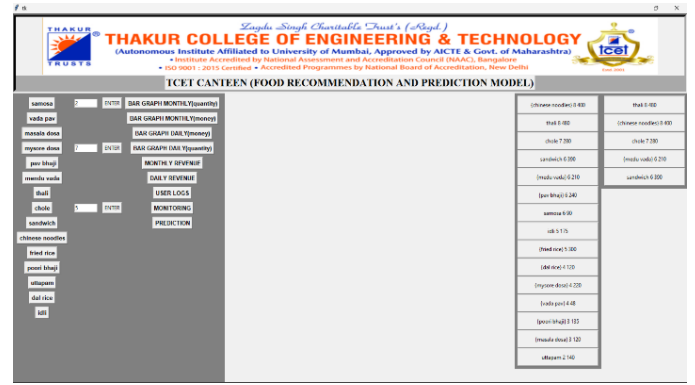


Fig. 2. Application overview [author's own work]

1. In the above picture of the application, there are 4 columns, the left most is for entering the orders
 - Whenever an item along with its quantity is entered its total cost is calculated in the backend and is stored in the database along with the data and time.
 - While storing the data, the data is stored in two tables, where one table is for storing the current orders pending and the next for permanent storage for data analysis, recommendation system and prediction system
2. The second column is for performing various operations and analysis whose working is explained in the later part of the paper
3. The third column shows the current orders
If an item is cooked by the chef, then chef can click that item and then that item will be removed from this column in the application and will be deleted from the first table in the database.
4. The fourth table depicts the recommendation model whose working is explained in the coming part of the paper.

V. WORKING OF THE RECOMMENDATION MODEL

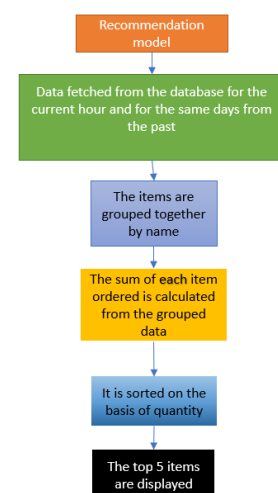


Fig. 3. Flowchart of recommendation model [author's own work]

1. The data is fetched from the database for the current hour slot based on the past same days.
2. Suppose if the day is Monday and the time is 12:20 then all the data for the time slot 12-13 pm

and for all the past Mondays will be fetched from database.

- Here the data is fetched only for the same days because people usually follow the same trend for same days, since there is high probability for a person to eat the same food item on particular days like a student of a college might usually eat a particular food item in Monday and another on Tuesday and follow this trend. So for good accuracy in prediction, the data is fetched only for those days.
- The second reason for this is timing, usually in colleges, there is fixed time table and hence majority of people usually come in recess time and hence the recommendation system here would be very accurate since along with the same days it is fetching and computing data for the Same time slot like if the current time is 2:35, then the data will be fetched for the time slot 2:00 to 3:00. This would give precise recommendations with a very less variation.
- Then the items will be grouped together, i.e., there might be many orders for the same item then their sum will be calculated.
- the food items will then be sorted based on their quantities. And only the top five food items will be displayed.
- As it can be noticed, the recommendation model sorts the items based on quantity and also displays the total amount which it sums to.

sandwich 94 6110
samosa 87 1305
{poori bhaji} 75 3375
{vada pav} 70 840
thali 69 4140

Fig. 4. Recommendation column of application [author's own work]

VI. WORKING OF THE PREDICTION MODEL

- first the date in input from the calendar displayed

February		2023				
Mon	Tue	Wed	Thu	Fri	Sat	Sun
5	30	31	1	2	3	4
6	6	7	8	9	10	11
7	13	14	15	16	17	18
8	20	21	22	23	24	25
9	27	28	1	2	3	4
10	6	7	8	9	10	11
Retrieve Date						

Fig. 5. Calendar for accepting the date [author's own work]

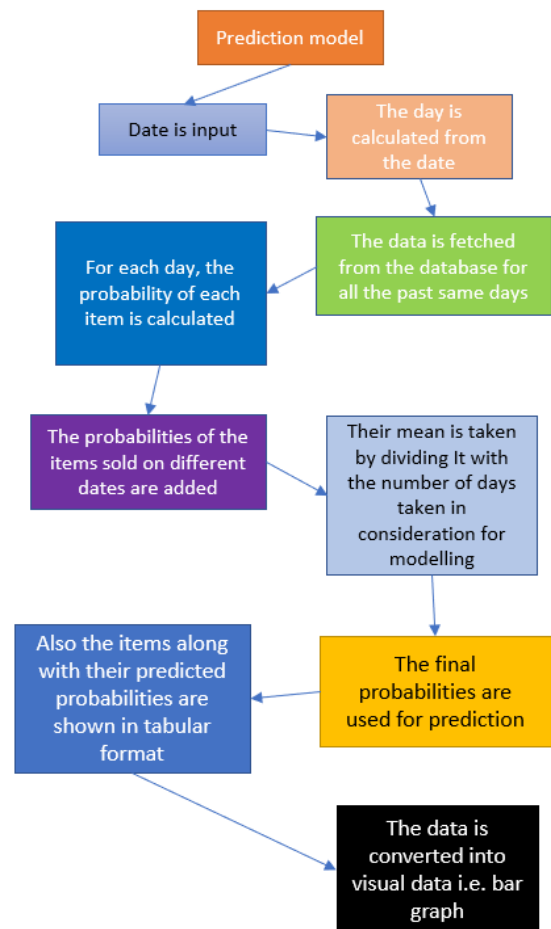


Fig. 6. Flowchart of prediction model [author's own work]

- then the data is fetched from the database for the given date and the probability of each item is calculated as shown below

$$\frac{\sum \text{quantity of an item}}{\sum \text{quantities of all items sold}}$$

- the probabilities of all the items are calculated in the same way [10]
- then the probabilities of all the items for the past same days is also calculated by fetching the data from the database for the past same days and then the mean is taken for the probabilities of each item as shown below

$$\frac{\sum \text{probabilities of an item}}{\sum \text{number of days data is fetched from past}}$$

- in this way the average probability of each item is calculated for the same days in the past (here day means Monday, Tuesday, etc) [10]
- This can be understood as suppose the day chosen is Monday, Then the data is retrieved for Monday, then the items with the same name are grouped together and the total number of items sold for each item is calculated. Then the sum of the items sold is calculated and the probability of each item is calculated by dividing with the sum. The same procedure is followed for all the past Mondays. Then for each item suppose it is 'samosa' then the probability of samosa is added for all the Mondays

and then it is divided by the number of Mondays for which the data is manipulated, this is done to increase the accuracy of the prediction system since if we directly add the quantities sold for a particular item for all the days and then find the probabilities then it would be very inaccurate since there might be days where due to some events etc the sale of items were decreased but this will not affect the prediction if we directly find the sum and find the probability therefore first we have to find the probability of an item separately for each day and then take its mean this would be more accurate. This could be better understood by the below graphical explanation.

7. this data is then displayed on the application and also its visual representation is displayed i.e., it is converted into a bar graph as shown below

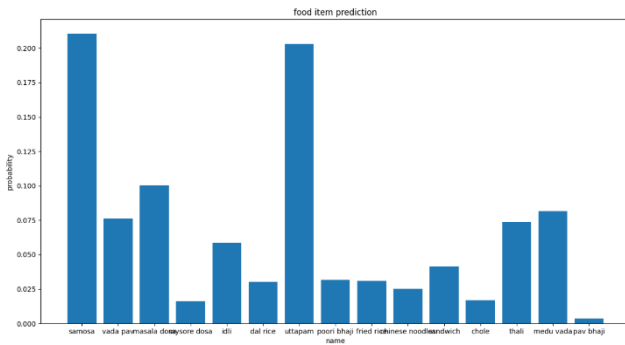


Fig. 7. Prediction graph [author's own work]

name	probability
samosa	0.210481
vada pav	0.0761721
masala dosa	0.100148
mysore dosa	0.016213
idli	0.0586453
dal rice	0.0300533
uttapam	0.20299
poori bhaji	0.031635
fried rice	0.0308374
chinese noodles	0.025308
sandwich	0.0415208
chole	0.0170038
thali	0.0737993
medu vada	0.0816346
pav bhaji	0.00355894

Fig. 8. Prediction table with probabilities [author's own work]

VII. DATA ANALYSIS

There are also several options in the application which can be very useful for data analysis

A. User Logs

This will show the history of purchases for the selected date which will be inputted from the displayed calendar upon clicking the user logs button

name	quantity	date	time	money
pav bhaji	2	2023-02-11	16:47:18	80
mysore dosa	23	2023-02-11	16:47:17	1265
masala dosa	43	2023-02-11	16:47:17	1720
medu vada	38	2023-02-11	16:47:17	1190
sandwich	87	2023-02-11	16:47:16	5635
thali	85	2023-02-11	16:47:16	3900
chole	36	2023-02-11	16:47:15	1360
chinese noodles	47	2023-02-11	16:47:14	2350
fried rice	28	2023-02-11	16:47:14	1680
poori bhaji	75	2023-02-11	16:47:14	3775
uttapam	53	2023-02-11	16:47:13	3710
dal rice	89	2023-02-11	16:47:13	2070
idli	66	2023-02-11	16:47:13	2340
vada pav	45	2023-02-11	16:47:11	780
samosa	87	2023-02-11	16:47:11	1365
medu vada	5	2023-02-11	16:46:57	165
masala dosa	6	2023-02-11	16:46:35	240
mysore dosa	2	2023-02-11	16:46:25	110
thali	4	2023-02-11	16:46:34	240
sandwich	7	2023-02-11	16:46:34	415
chinese noodles	5	2023-02-11	16:46:33	250
vada pav	5	2023-02-11	16:46:22	80
thali	7	2023-02-11	15:48:40	420
mysore dosa	8	2023-02-11	15:48:01	440
vada pav	9	2023-02-11	15:48:01	150
pav bhaji	7	2023-02-11	12:58:52	280
medu vada	5	2023-02-11	12:58:51	175
chole	9	2023-02-11	12:58:51	360
sandwich	11	2023-02-11	12:58:50	715
chinese noodles	12	2023-02-11	12:58:50	600
fried rice	3	2023-02-11	12:58:50	180
poori bhaji	5	2023-02-11	12:58:49	225
uttapam	3	2023-02-11	12:58:49	150
dal rice	7	2023-02-11	12:58:48	210
idli	6	2023-02-11	12:58:48	210
mysore dosa	8	2023-02-11	12:58:47	480
masala dosa	3	2023-02-11	12:58:46	120
vada pav	4	2023-02-11	12:58:46	80
samosa	6	2023-02-11	12:58:46	90

Fig. 9. User logs windows [author's own work]

B. Monitoring

- a. This will first display the user logs for the selected date

name	quantity	date	time	money
pav bhaji	2	2023-02-11	16:47:18	80
mysore dosa	23	2023-02-11	16:47:17	1265
masala dosa	43	2023-02-11	16:47:17	1720
medu vada	38	2023-02-11	16:47:17	1190
sandwich	87	2023-02-11	16:47:16	5635
thali	85	2023-02-11	16:47:16	3900
chole	36	2023-02-11	16:47:15	1360
chinese noodles	47	2023-02-11	16:47:14	2350
fried rice	28	2023-02-11	16:47:14	1680
poori bhaji	75	2023-02-11	16:47:14	3775
uttapam	53	2023-02-11	16:47:13	3710
dal rice	89	2023-02-11	16:47:13	2070
idli	66	2023-02-11	16:47:13	2340
vada pav	45	2023-02-11	16:47:11	780
samosa	87	2023-02-11	16:47:11	1365
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sandwich	7	2023-02-11	16:46:34	415
chinese noodles	5	2023-02-11	16:46:33	250
vada pav	5	2023-02-11	16:46:22	80
thali	7	2023-02-11	15:48:40	420
mysore dosa	8	2023-02-11	15:48:01	440
vada pav	9	2023-02-11	15:48:01	150
pav bhaji	7	2023-02-11	12:58:52	280
medu vada	5	2023-02-11	12:58:51	175
chole	9	2023-02-11	12:58:51	360
sandwich	11	2023-02-11	12:58:50	715
chinese noodles	12	2023-02-11	12:58:50	600
fried rice	3	2023-02-11	12:58:50	180
poori bhaji	5	2023-02-11	12:58:49	225
uttapam	3	2023-02-11	12:58:49	150
dal rice	7	2023-02-11	12:58:48	210
idli	6	2023-02-11	12:58:48	210
mysore dosa	8	2023-02-11	12:58:47	480
masala dosa	3	2023-02-11	12:58:46	120
vada pav	4	2023-02-11	12:58:46	80
samosa	6	2023-02-11	12:58:46	90

Fig. 10. User logs window [author's own work]

- b. Then it will display the bar graph of items sold that day

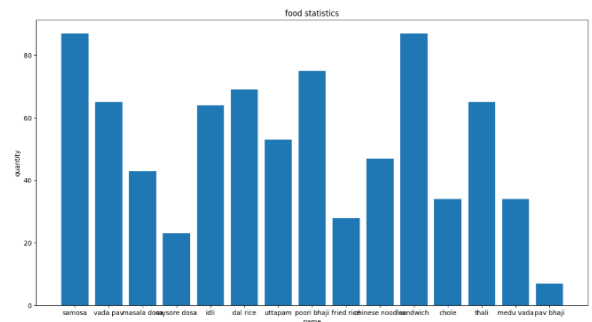


Fig. 11. Bar graph (item quantity vs name of item) [author's own work]

- c. Then it will show the total revenue earned that day

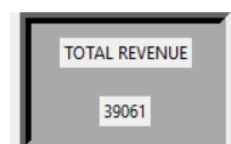


Fig. 12. Application overview [author's own work]

3.

C. Monthly Revenue

This will display the total monthly revenue of that month



Fig. 13. Application overview [author's own work]

D. Monthly Analysis (Money)

This will show the monthly statistics of the items sold that month in terms of money

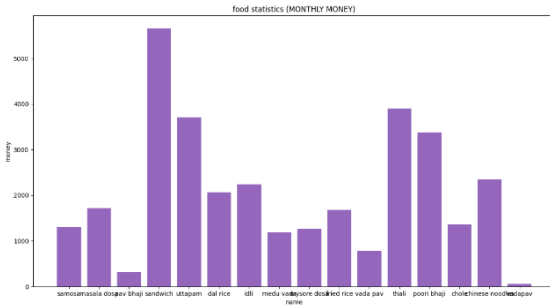


Fig. 14. Bar graph (money vs name of item) [author's own work]

E. Monthly Analysis (Quantity)

This will show the monthly statistics of the items sold that month in terms of quantity

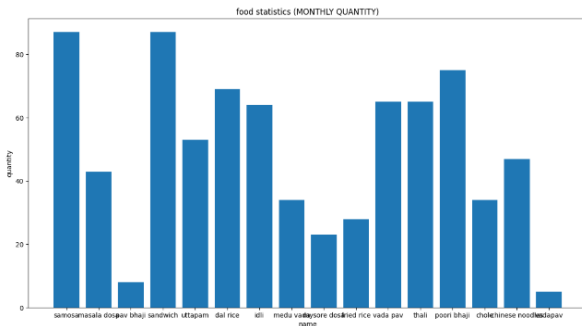


Fig. 15. Bar graph (item quantity vs name of item) [author's own work]

F. Daily Analysis (Quantity)

This will show the analysis of items sold that day in terms of quantity

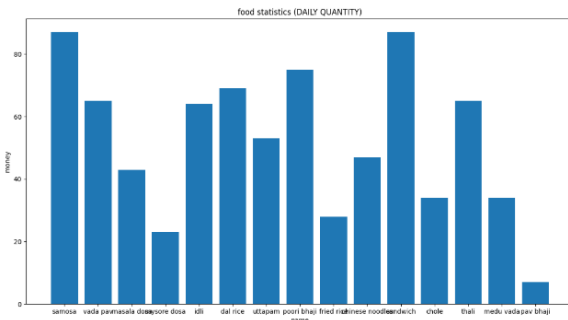


Fig. 16. Bar graph (item quantity vs name of item) [author's own work]

4.
5.
6.

G. Daily Analysis (Money)

This will show the analysis of items sold that day in terms of money

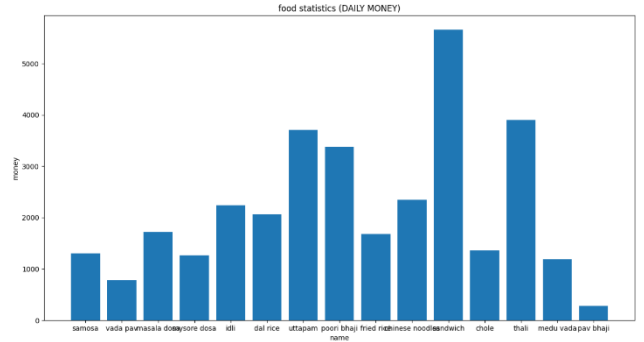


Fig. 17. Bar graph (money vs name of item) [author's own work]

VIII. ADVANTAGES OF THE PROPOSED MODEL

1. Reduced Cooked food wastage: The food recommendation model can help to reduce cooked food wastage by providing accurate predictions of food demand. This can help hotel and canteen operators to plan for the appropriate quantities of food to be prepared, reducing the risk of over-preparing food that may go to waste.
2. Reduced Food material wastage: The prediction model can help to reduce food material wastage by providing accurate predictions of food demand. This can help hotel and canteen operators to plan for the appropriate quantities of food materials to be purchased, reducing the risk of over-purchasing food materials that may go to waste.
3. Crowd management: The recommendation model can help to manage crowds in hotels and canteens by providing accurate predictions of food demands and hence fulfilling the order as soon as it is ordered. This can help operators to plan for staffing and seating arrangements, reducing wait times and improving customer experience.
4. Customer health and hygiene: if the food materials are ordered on guess work, then there might be high chances for materials to be left unused and if they are used for cooking after many days of storage then they can affect the health of the customers. This problem can be solved using the prediction model proposed.
5. Profitability: The prediction model can help hotel and canteen operators to improve their profits by providing accurate predictions of food demand. This can help operators to make informed decisions about which foods to include on their menus and to plan for the appropriate quantities of food to be prepared.
6. Pricing: the products can be priced accordingly based on the data analysis provided in the created application.
7. Menu changes: the menu items can be changed, i.e., if some food items are sold rarely then those can be removed from the menu using the data analysis techniques provided in the application.

IX. FUTURE DIRECTIONS

- 1) Expanding the dataset to include more food-related data such as nutritional information, ingredient lists, or customer reviews for more personalized recommendations and predictions.[1]
- 2) Experimenting with different machine learning algorithms, such as neural networks or decision trees, to improve the accuracy of the model.[2]
- 3) Developing a personalized recommendation system by incorporating user feedback and using techniques such as collaborative filtering or content-based filtering.[5]
- 4) Collecting feedback from users through surveys or feedback forms embedded in the GUI to continually improve the model.[4]
- 5) Optimizing preprocessing techniques, such as data cleaning or feature engineering, to further improve the accuracy and efficiency of the model.[7]
- 6) Testing the model on a larger and more diverse dataset to ensure its robustness and generalizability.[8]
- 7) Integrating the food recommendation and prediction model with other tools or systems, such as inventory management software or customer relationship management systems, for even more valuable insights and optimization of overall business operations.[6]

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XI. CONCLUSION

It can be concluded that profit for any hotel/canteen/etc can be maximized and the loss can be minimized with the use of the application and the recommendation and prediction model. Acknowledgment

The prediction model created can be utilized for purchasing the materials for cooking the food according to the prediction which will minimize the loss of money due to rotting of unused materials due to improper guess work

The recommendation model will reduce the waiting time of customers and will reduce the crowd and will lead to better overall space management in the hotel/canteen since the chef can cook the food based on recommendation in the free time.

In this study, we presented a food recommendation and prediction model that was developed using a combination of Python programming language, SQL database management system, and Tkinter graphical user interface

library. The model was designed to provide recommendations and predictions based on a user's food preferences and past food consumption patterns.

The results showed that the model was able to provide accurate recommendations and predictions based on the food data. The use of probabilities and the calculation of their mean improved the accuracy of the predictions made by the model. The graphical user interface provided by Tkinter was user-friendly and made it easy for users to input data and view results.

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Green Chemistry: A Pathway to Future Development

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Abstract— Green Chemistry is a method of chemical synthesis and processing that reduces or eliminates the use and production of hazardous substances during, design, manufacture and use of product. Green chemistry avoids contamination by utilizing environmentally harmless processes and innovative products, which are “benign by design.” Through the various dominant trends of green chemistry, including biocatalysts, renewable feedstock’s, new synthetic pathways, the dual aims of economic benefit and environmental protection could be achieved. This paper focuses the promotion and development of future sustainable ways of life in which guiding principles and trends of green chemistry are observed not only for their basic benefits to the environment or health but also to advance new technologies/sciences, generations, and jobs. Foremost among the essential changes is the demands of shifting the energy production and chemical fabrication from a fossil resource to a renewable biomass or bioenergy feedstock.

Keywords— Green chemistry, Hazardous substances, innovative products, chemical fabrication, renewable biomass.

I. INTRODUCTION

The principles of green chemistry include designing processes and products to reduce or eliminate the generation of hazardous substances, using renewable resources and catalysts in place of toxic or hazardous chemicals, and using solvents and reaction conditions that are safer, more energy-efficient, and more environmentally friendly. The design and use of chemical processes and products with reduced danger to the environment and to human health is known as "green chemistry," [1,2] and it is an essential part of sustainable chemistry. Chemical innovations create new environmental issues and undesirable unforeseen side effects, necessitating the development of 'greener' chemical goods. Green chemistry investigates pollution prevention at the molecular level. Because of the importance of Chemistry in our society today and the ramifications it can have on our environment, it is an extremely significant topic of Chemistry. Certainly the area of environmentally benign solvents has been one of the leading research areas of Green Chemistry with great advances seen in aqueous catalysis [3] and the use of supercritical fluids [4] in chemical reactions. Green Chemistry investigates bio plastics, biodegradable oils, and renewable resources as a safer alternative to harmful chemicals. It also guides creating more efficient reactions with fewer harmful reagents and less hazardous waste. Moreover it also emphasizes developing catalyst that reduces energy consumption and decrease environmental impact. They are exclusively used chemicals and chemical processes that do not have negative consequences for the environment. Green chemistry is a philosophy of chemical research and engineering that encourages the design of products and processes that minimize the use and generation of hazardous substances. Developed by Paul Anastas and John

Warner in 1998, following list outlines a framework for making a greener chemical, process, or product. Prevention: It is preferable to prevent waste than to treat or clean it up after it has occurred.

- 1) Atom Economy: Synthetic methods should be designed to maximize incorporation of all materials used in the process into the final product.
- 2) Less Hazardous Chemical Synthesis: synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
- 3) Designing Safer Chemicals: Chemical products should be designed to preserve efficacy of function while reducing toxicity.
- 4) Safer Solvents and Auxiliaries: The use of auxiliary substances should be made unnecessary wherever possible and, innocuous when used.
- 5) Design for Energy Efficiency: Energy requirements should be recognized for their environmental and economic impacts and should be minimized.
- 6) Use of Renewable Feedstocks: A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
- 7) Reduce Derivatives: Unnecessary derivatization should be minimized or avoided, if possible, because such steps require additional reagents and can generate waste.
- 8) Catalysis: Catalysts do not interfere with the reaction and can be used again and again.
- 9) Design for Degradation: Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
- 10) Real-time Analysis for Pollution Prevention: Analytical methods must be further developed to enable real-time, in-process monitoring and control before the creation of hazardous chemicals.
- 11) Inherently Safer Chemistry for Accident Prevention: Substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires. [5]

II. RESULT AND DISCUSSION

Apart from these twelve principles of green chemistry, its horizon can be further expanded taking into consideration few other important aspects viz. location and designing of plants. The Bhopal Gas catastrophe is one example, in which thousands of people died because of methyl isocyanate gas leakage [6]. To avoid such dangerous events, it is necessary to decide on the proper location of the plant if there is even the slightest doubt about the poisonous nature of the reactants as well as the products.

The second part is the design and manufacture of chemical facilities. The finest example is the production of triethylene glycol (TEG), which is utilized as a dehydrating agent to remove moisture from natural gases produced in the petroleum industry [7,8]. Ethylene gas is a dangerous substance to handle, and its conversion into TEG necessitates extremely high temperature and pressure conditions. As a result, planning and fabricating reactors becomes a key aspect in maintaining such circumstances. Although a catalyst in the form of silver oxide is currently utilized in this process, there is still room for improvement in terms of reducing the requirements for high pressure and temperature conditions.

A lot of work has already been done in the subject of green chemistry. People are well aware of the harmful nature of the compounds used in various industries, for instance, diesel was once employed as a lubricant in drilling fluids used to carry out drilling operations in the petroleum sectors. Diesel used in drilling fluids had to be discontinued due to the advancement of offshore drilling technology and its negative impact on marine life. As a result, water base extreme pressure lubricants were developed as an alternative for diesel oil. More investigation was conducted in this area, and employing polymers [9,10], a modified, non-toxic drilling fluid was created, nearly replacing the need of lubricants.

III. CONCLUSION

All of the previously mentioned information reflects on the advancements, necessity, and use of green chemistry in today's society. Green chemistry has the potential to make a significant positive impact on the health of our planet and the well-being of people and communities. It demonstrates the significance of putting it into practice and expanding it in as many ways as is practical to have a greener and eco-friendlier environment around living things. Pollution in its different forms affects the entire world. According to the proverb "Prevention is better than cure," we should avoid producing pollutants in the form of chemicals, thus it is obvious that green chemistry has applications throughout the entire process.

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CHATGPT: Advancing Conversational AI through Deep Learning

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Abstract— This article explores that ChatGPT is a large language model developed by OpenAI that is capable of generating human-like responses to a wide range of inputs. It is built using state-of-the-art natural language processing techniques and is trained on a vast corpus of text data. ChatGPT has demonstrated impressive performance on a variety of language tasks, including question answering, machine translation, and text generation. One of the key features of ChatGPT is its ability to adapt to the user's input, producing responses that are tailored to the specific context of the conversation.

Keywords— Chat gpt, Artificial intelligence, chatbox, advancement, conversational, human

I. INTRODUCTION

A. Background on Language Models and their Applications

ChatGPT is a huge language version advanced with the aid of OpenAI, that's a part of a own family of fashions referred to as Generative Pre-trained Transformers (GPT). These fashions are trained the usage of unsupervised studying techniques on big quantities of text statistics, letting them analyse the underlying structure of language and generate coherent and natural language output.

The GPT fashions were broadly used in various herbal language processing (NLP) responsibilities, which includes language translation, text summarization, and question-answering. They have also been used to generate human-like responses in conversational agents, chatbots, and virtual assistants.

One of the important benefits of the GPT models is their potential to generate human-like language output, which has made them especially beneficial in growing conversational dealers which can have interaction with human beings in a herbal and intuitive way. For example, GPT fashions were used to increase chatbots for customer service, non-public assistants, and social robots. Some other application of GPT fashions is in language generation for creative purposes, consisting of generating text for storytelling, poetry, and song writing. Those models have additionally been used to generate synthetic facts for education other device learning fashions, including image reputation and speech recognition.

B. Overview of ChatGPT and its Significance

ChatGPT is a selected implementation of the GPT family of fashions, designed particularly for producing herbal and human-like textual content responses in conversational settings. It's been trained on big quantities of text records

from a wide variety of assets, together with books, articles, and on-line conversations.

ChatGPT has enormous significance in the development of conversational retailers, chatbots, and other virtual assistants. Its ability to generate natural and intuitive language output has made it a popular desire for businesses and developers looking to create extra state-of-the-art and engaging chatbots and digital assistants. ChatGPT can assist corporations automate customer service, offer customized pointers, and enhance engagement with users.

Additionally, ChatGPT has substantial capacity for use in innovative programs, including generating textual content for storytelling, poetry, and song writing. Its potential to generate coherent and contextually appropriate responses makes it an effective tool for writers and artists seeking to increase new and innovative kinds of innovative expression.

Universal, ChatGPT and the wider own family of GPT fashions have substantially superior the latest in herbal language processing and have enabled the development of greater state-of-the-art and superior conversational dealers and NLP applications.

II. TECHNICAL DETAILS OF CHATGPT

A. Architecture of the Model

The structure of ChatGPT, like different GPT models, is based totally at the transformer structure brought within the paper "interest Is All You want" through Vaswani et al. The transformer architecture has revolutionized herbal language processing through changing traditional recurrent neural network (RNN) and convolutional neural network (CNN) fashions with attention mechanisms that can capture lengthy-variety dependencies in the enter collection.

The structure of ChatGPT can be damaged down into numerous key components:

- **Tokenization:** The input text is first tokenized into individual tokens or sub words. That is performed the use of a manner known as byte pair encoding (BPE) which encodes common word sequences as a single token.

- **Positional Encoding:** The input tokens are then
- ChatGPT

transformed into a non-stop vector area the usage of a method referred to as positional encoding.

- **Transformer Layers:** The heart of the structure is a chain of transformer layers, every of which consists of a multi-head interest mechanism and a feedforward neural network.
- **Output Layer:** The output layer is a totally related layer that maps the output of the very last transformer layer to the output vocabulary. The output vocabulary consists of all feasible tokens that the version can generate as a response to the input collection.
- **Education:** The model is trained using a self-supervised mastering technique referred to as masked language modelling. At some point of schooling, a sure percent of enter tokens are masked out, and the model is tasked with predicting the lacking tokens. This forces the version to examine a deep expertise of language structure and the relationships between specific tokens inside the input collection.

B. Training Data and Process

The education records and process of ChatGPT are key to its achievement in generating human-like and contextually appropriate responses. ChatGPT is educated the use of a massive corpus of text records, that can come from a huge range of resources together with books, articles, and online conversations.

The education manner of ChatGPT may be damaged down into numerous steps:

Facts Pre-processing: The training records is pre-processed to cast off any unwanted characters, inclusive of punctuation marks and special characters, and to convert the textual content into a standardized format.

- **Tokenization:** The pre-processed textual content is then tokenized into individual words or sub words the usage of a process referred to as byte pair encoding (BPE). BPE is a data compression approach that represents not unusual sequences of characters as a unmarried token. This facilitates the version to handle uncommon words and out-of-vocabulary (OOV) words more effectively.
- **Education:** The version is then skilled using a technique referred to as unsupervised studying. In unsupervised learning, the version is educated to expect the following phrase or sub word in a sequence based totally at the previous words or sub words.
- **Exceptional-tuning:** After schooling on the massive corpus of textual content data, the version is quality-tuned on a smaller corpus of information this is unique to the challenge handy. This best-tuning procedure allows the version to adapt to the specific nuances and vocabulary of the mission and to generate extra contextually appropriate responses.

C. Evaluations and Benchmarking Results

ChatGPT has been evaluated and benchmarked the use of

various metrics and datasets to assess its overall performance

in natural language technology obligations. Right here are some of the evaluation and benchmarking results of ChatGPT:

- **The Pile:** The Pile is a diverse series of text facts used for benchmarking huge-scale language models. ChatGPT was evaluated at the Pile and completed state-of-the-art performance in numerous tasks, such as sentiment evaluation, paraphrase detection, and common-sense reasoning.
- **GLUE:** the general Language knowledge evaluation (GLUE) benchmark is a group of nine natural language information duties, consisting of sentence finishing touch, sentiment evaluation, and herbal language inference. ChatGPT has accomplished modern day performance on the GLUE benchmark, surpassing human performance on numerous responsibilities.
- **SuperGLUE:** SuperGLUE is a greater challenging benchmark for natural language information that consists of extra complicated tasks inclusive of coreference resolution and logical reasoning. ChatGPT has accomplished aggressive overall performance at the SuperGLUE benchmark, demonstrating its ability to address greater complex language obligations.
- **Conversational AI:** ChatGPT has also been evaluated in conversational AI obligations, where it has tested the potential to generate contextually appropriate and coherent responses to a huge variety of prompts. In a human evaluation of open-area chatbots, ChatGPT changed into ranked because the most engaging and human-like chatbot, surpassing many different contemporary models.

III. USE CASES AND APPLICATIONS OF CHATGPT

A. Natural Language Processing

ChatGPT is a potent tool that may be used to further Natural Language Processing (NLP) research and applications. NLP is a fast-expanding area with many applications in a variety of fields.

Researchers may create models that properly categorise text into different categories, such as news articles, social media postings, or consumer comments, for instance, by training ChatGPT on enormous amounts of text data. By automating the process of classifying and organising massive volumes of text data, businesses may free up resources for more worthwhile activities.

Additionally, named entity recognition, which entails locating and extracting entities like persons, businesses, and locations from text input, is another task that ChatGPT may be trained to execute. This can be helpful for many NLP applications, including sentiment analysis and event extraction, as well as for data-driven decision making in various domains, such as marketing, finance, and government.

Sentiment analysis, which includes identifying the sentiment or emotion represented in a text, is one of ChatGPT's key NLP applications. Organizations may, for instance, swiftly and reliably ascertain the general mood of their consumers by training ChatGPT on customer input, giving them invaluable insights into client opinions and preferences.

B. Conversational AI

One of the most well-known applications of ChatGPT is conversational AI, which entails the creation of conversational agents like chatbots and voice assistants that can communicate with people in a friendly and engaging way. ChatGPT is especially well-suited for this kind of application because it can produce text answers that seem like they were written by a person.

ChatGPT is a chatbot that can be trained to identify user input and produce pertinent real-time answers. For instance, a chatbot created using ChatGPT might help clients in a customer service context by responding to queries, giving information about products, and addressing difficulties. To offer consumers simple and accessible service, the chatbot may also be embedded into websites, messaging applications, and social networking platforms.

ChatGPT is a useful technique for creating speech-controlled devices like smart speakers and in-car entertainment systems since it can be used to create spoken replies to user inquiries in the context of voice assistants. In order to give consumers a more natural and intuitive method to interact with their devices, voice assistants created with ChatGPT can be combined with other technologies such as speech recognition and natural language processing.

C. Information Retrieval and Question Answering

ChatGPT is a useful tool for both information retrieval and question answering because to its natural language processing capabilities. It can aid in searching through sizable databases and text collections to discover pertinent information because of its capacity to comprehend the subtleties of natural language. For instance, ChatGPT may be used in the e-commerce sector to assist clients in finding certain items by analysing natural language queries and comparing them to pertinent products in a database. ChatGPT may aid clients in customer service or technical support environments by looking through knowledge bases to discover pertinent articles or support cases.

Moreover, ChatGPT may be utilised for question-answering, allowing it to accept natural language inquiries and deliver answers that are correct and coherent. This can be helpful in a variety of contexts, including educational ones where students can ask questions in regular language and receive thorough and precise responses via ChatGPT. By searching through legal databases and summarising pertinent material, ChatGPT may be used by attorneys and legal researchers to obtain answers to complicated legal queries rapidly.

IV. LIMITATIONS AND FUTURE WORK

A. Challenges in deployment and scalability

The difficulty of deploying and scaling the model in production contexts is one of the main difficulties connected with employing ChatGPT in NLP applications. Due to ChatGPT's complexity and high processing overhead, scaling it for more extensive applications can be difficult. However, some businesses may find it difficult to implement the concept since it demands specific technological know-how.

It can be difficult to implement ChatGPT for a number of reasons. First off, running the model uses a lot of resources, including a lot of memory and processing power. To use ChatGPT efficiently, companies must have access to

high-performance computer resources. The model's complexity can also make it challenging to implement and integrate with current systems, which can further impede adoption.

Another issue with employing ChatGPT in NLP applications is scalability. Scaling the model to handle greater amounts of data and requests may be necessary when firms gather more data and the number of users rises. Given the model's resource requirements, this could be challenging. In order to grow ChatGPT successfully, businesses might need to spend money on specialist hardware or cloud-based solutions.

B. Limitations in language understanding and generalization

ChatGPT, like other language models, also has limitations in language understanding and generalization. Some of these limitations include:

Out-of-distribution generalization: ChatGPT and other language models are often trained on large amounts of data from a specific distribution, which means they can struggle with generalizing to new, out-of-distribution data. This can lead to poor performance on tasks that require generalization, such as question answering or summarization.

Limited common-sense reasoning: While ChatGPT can generate coherent and contextually appropriate responses to open-ended prompts, it often lacks common sense reasoning abilities that humans take for granted. This means that it can sometimes provide nonsensical or contradictory responses when presented with novel situations.

Sensitivity to adversarial attacks: Language models like ChatGPT are vulnerable to adversarial attacks, which involve making small modifications to input text to deceive the model into producing incorrect or harmful outputs. Adversarial attacks can cause language models to generate inappropriate or offensive responses or to fail in their intended task.

Bias and fairness issues: Language models trained on large amounts of text data can also exhibit biases that are present in the training data. These biases can manifest in the form of stereotypical or discriminatory language, and can have harmful effects on individuals or groups. Ensuring fairness and reducing biases in language models is an important area of ongoing research.

C. Potential for improvement and future research directions

There is also significant potential for improvement and future research directions specifically for ChatGPT. Some potential areas of improvement and research include:

- **Fine-tuning for specific domains:** While ChatGPT is a powerful general-purpose language model, it may not perform as well on specific tasks in certain domains. Future research could explore ways to fine-tune the model on specific domains, such as healthcare or finance, to improve its performance in those areas.
- **Multi-task learning:** Multi-task learning is a promising research direction that involves training a single model to perform multiple tasks simultaneously. This could improve ChatGPT's performance on tasks that require knowledge from multiple domains.
- **Model compression:** ChatGPT is a large model, which can make it difficult to deploy in resource-constrained environments. Future research.

ChatGPT

could explore ways to compress the model, making it more lightweight and efficient, without sacrificing performance

- Hybrid models: Another potential direction for future research is the development of hybrid models that combine different types of models, such as rule-based and machine learning models. This could help address some of the limitations of ChatGPT, such as its inability to reason and infer, while maintaining its strengths in language generation.

V. CONCLUSION

A. Summary of the technical review

As an AI language model, ChatGPT is a powerful tool for natural language processing tasks such as text classification, language translation, and question-answering.

ChatGPT is built using the Transformer architecture, which allows it to learn long-range dependencies and capture the context of a sentence more effectively than earlier language models. The model is trained on a massive corpus of text data using unsupervised learning, which enables it to generate high-quality, coherent responses to a wide variety of input prompts.

In terms of performance, ChatGPT has achieved state-of-the-art results on a range of benchmark language tasks, such as language modelling and machine translation. Its ability to generate human-like responses to open-ended prompts has also made it a popular tool for chatbot development.

While ChatGPT has many strengths, it also has some limitations. For example, the model may occasionally produce responses that are irrelevant, contradictory, or offensive. This is due to its lack of understanding of cultural or ethical norms, as well as the potential biases present in the training data.

B. Impact of ChatGPT on the field of NLP

ChatGPT has had a significant impact on the field of natural language processing (NLP) since its introduction in 2018. Some of the key impacts are:

- Improved performance on language tasks: ChatGPT has achieved state-of-the-art results on many NLP benchmarks, including language modelling, machine translation, and question answering. Its ability to generate coherent and contextually appropriate responses to open-ended prompts has also made it a popular tool for developing chatbots and other conversational agents.
- Advancement of Transformer architecture: ChatGPT's success has contributed to the increased use of the Transformer architecture in NLP. The Transformer's ability to capture long-range dependencies and the context of a sentence has led to significant improvements in language modelling and other language tasks.
- Exploration of unsupervised learning: ChatGPT's training using unsupervised learning has opened up new avenues for research in NLP. It has shown that large amounts of text data can be used to train a language model without the need for explicit

annotations, which has the potential to reduce the cost and time required for training.

- Potential for applications in industry: ChatGPT's ability to generate human-like responses has made it a promising tool for applications such as customer service chatbots and personal assistants. It has also been used in the development of chatbots for mental health support and other healthcare applications.

C. Implications for future research and development in conversational AI.

The success of ChatGPT has opened up many avenues for future research and development in conversational AI. Some of the key areas of focus include:

- Exploring larger and more diverse training datasets: One area of ongoing research is the use of larger and more diverse training datasets to improve the performance and robustness of language models. This includes efforts to address biases in the training data and to incorporate multiple languages and dialects.
- Incorporating external knowledge sources: Many current language models, including ChatGPT, rely solely on large amounts of text data for training. Future research will likely explore ways to incorporate external knowledge sources, such as structured knowledge graphs or external databases, to enhance the models' understanding of the world.
- Improving model interpretability and explainability: As conversational AI becomes more prevalent in industry and society, the need for model interpretability and explainability will become increasingly important. Future research will focus on developing methods for explaining how language models make decisions and how they can be audited for biases and ethical concerns.
- Addressing ethical concerns and biases: The development of conversational AI must be accompanied by efforts to address the ethical concerns and potential biases associated with these technologies. Ongoing research will explore ways to mitigate these risks, such as developing methods for detecting and mitigating biased responses and ensuring that conversational AI is used in ways that align with ethical and moral values.
- Advancing multimodal conversational AI: As conversational AI becomes more sophisticated, there will likely be a greater focus on developing multimodal models that can understand and generate responses based on multiple input modalities, such as text, images, and audio.

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ChatGPT

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The Analysis of Liquid Rocket Fuels

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Abstract— Liquids are desirable as propulsion media in modern rocket techniques and have been utilized since the beginning of modern rocketry. It has been proved recently that liquid biofuels from agricultural available lands can provide safe and convenient energy for rockets. Mostly because of their reasonably high density. That allows to reduce the weight of the tanks, resulting in a high propellant structure mass ratio. Liquid rockets have been built to use cryogenic liquid fuels (such as liquid hydrogen) or liquid mixture of hydrocarbons that can be stored at room temperature (ethanol, petrochemical fuels; RP-1 or syntin). Liquid biofuels such as biodiesel or Bio-SPK (Synthetic Paraffinic Kerosene) may offer potential possibilities similar, or even superior, to traditional RP-1. Brief comparison and potential performance analysis of liquid biofuels in comparison to petrochemical ones is presented in the paper.

Keywords— Propulsion media, Rocketry, Cryogenic liquid fuels, Biofuels, Petrochemical

I. INTRODUCTION

A liquid-propellant rocket or liquid rocket utilizes a rocket engine that uses liquid propellants. Liquids are desirable because they have a reasonably high density and high specific impulse. This allows the volume of the propellant tanks to be relatively low. It is also possible to use lightweight centrifugal turbopumps to pump the rocket propellant from the tanks into the combustion chamber, which means that the propellants can be kept under low pressure. This permits the use of low-mass propellant tanks that do not need to resist the high pressures needed to store significant amounts of gases, resulting in a low mass ratio for the rocket.

The fuel that will power the core (or the middle unit of the lower part) of the GSLV Mk-III, the rocket to be used in the Chandrayaan-2 mission is UDMH (Unsymmetrical Dimethyl Hydrazine).

- The Indian Space Research Organisation (ISRO) is using the highly toxic and corrosive fuel UDMH (Unsymmetrical Dimethyl Hydrazine), along with the oxidizer nitrogen Tetroxide. This is called a “dirty combination”.
- Elsewhere in the world, space programmes have moved to a cleaner and greener fuel — liquid methane or kerosene.
- GSLV Mk III is designed to carry 4 ton class of satellites into Geosynchronous Transfer Orbit (GTO) or about 10 tons to Low Earth Orbit (LEO), which is about twice the capability of GSLV Mk II.

II. PROPELLANT USED IN ROCKET

The propellant is the chemical mixture burned to produce thrust in rockets and consists of a fuel and an oxidizer.

- Fuel is a substance that burns when combined with oxidizer for propulsion.
- The oxidizer is an agent that releases oxygen for combination with a fuel. The ratio of oxidizer to fuel is called the mixture ratio.

Propellants are classified according to their state - liquid, solid, or hybrid.

Liquid Propellants: In a liquid propellant rocket, the fuel and oxidizer are stored in separate tanks and are fed through a system of pipes, valves, and turbopumps to a combustion chamber where they are combined and burned to produce thrust.

Advantages: Liquid propellant engines are more complex than their solid propellant counterparts, however, they offer several advantages. By controlling the flow of propellant to the combustion chamber, the engine can be throttled, stopped, or restarted.

Disadvantages: The main difficulties with liquid propellants are with oxidizers. Storable oxidizers, such as nitric acid and nitrogen tetroxide are extremely toxic and highly reactive, while cryogenic propellants being stored at low temperature and can also have reactivity/toxicity issues.

Liquid propellants used in rocketry can be classified into three types: petroleum, cryogens, and hypergolic.

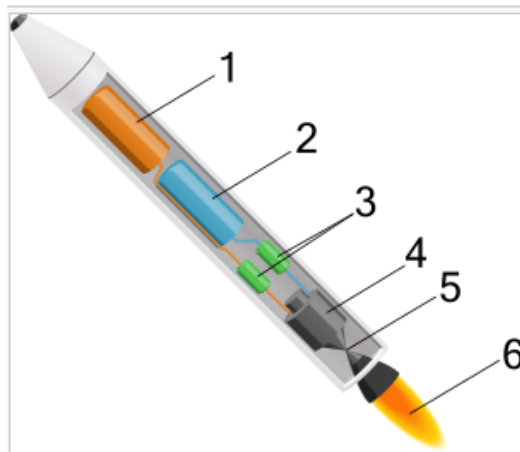
- Petroleum fuels are those refined from crude oil and are a mixture of complex hydrocarbons, i.e. organic compounds containing only carbon and hydrogen.

The Analysis of Liquid Rocket Fuels

The petroleum used as rocket fuel is a type of highly refined kerosene.

- Cryogenic propellants are liquefied gases stored at very low temperatures, most frequently liquid hydrogen (LH₂) as the fuel and liquid oxygen (LO₂ or LOX) as the oxidizer. Hydrogen remains liquid at temperatures of -253 oC (-423 oF) and oxygen remains in a liquid state at temperatures of -183 oC (-297 oF).

- Hypergolic propellants and oxidizers that ignite spontaneously on contact with each other and require no ignition source. The easy start and restart capability of hypergolic make them ideal for spacecraft maneuvering systems. Since hypergolic remain liquid at normal temperatures, they do not pose the storage problems like cryogenic propellants. Hypergolic are highly toxic and must be handled with extreme care. Hypergolic fuels commonly include hydrazine, monomethylhydrazine (MMH) and unsymmetrical dimethylhydrazine (UDMH).



A simplified diagram of a liquid-propellant rocket.

1. Liquid rocket fuel.
2. Oxidizer.
3. Pumps carry the fuel and oxidizer.
4. The combustion chamber mixes and burns the two liquids.
5. The gas put off by the reaction passes through the "throat", which aligns all the gases produced in the right direction.
6. Exhaust exits the rocket.

III. METHODOLOGY

On this slide, we show a schematic of a liquid rocket engine. Liquid rocket engines are used on the Space Shuttle to place humans in orbit, on many un-manned missiles to place satellites in orbit, and on several high speed research aircraft following World War II. In a liquid rocket, stored fuel and stored oxidizer are pumped into a combustion chamber where they are mixed and burned. The combustion produces great amounts of exhaust gas at high temperature and pressure. The hot exhaust is passed through a nozzle which accelerates the flow. Thrust is produced according to Newton's third law of motion.

The amount of thrust produced by the rocket depends on the mass flow rate through the engine, the exit velocity of the

exhaust, and the pressure at the nozzle exit. All of these variables depend on the design of the nozzle. The smallest cross-sectional area of the nozzle is called the throat of the nozzle. The hot exhaust flow is choked at the throat, which means that the Mach number is equal to 1.0 in the throat and the mass flow rate \dot{m} is determined by the throat area. The area ratio from the throat to the exit A_e sets the exit velocity V_e and the exit pressure p_e . You can explore the design and operation of a rocket nozzle with our interactive nozzle simulator program which runs on your browser.

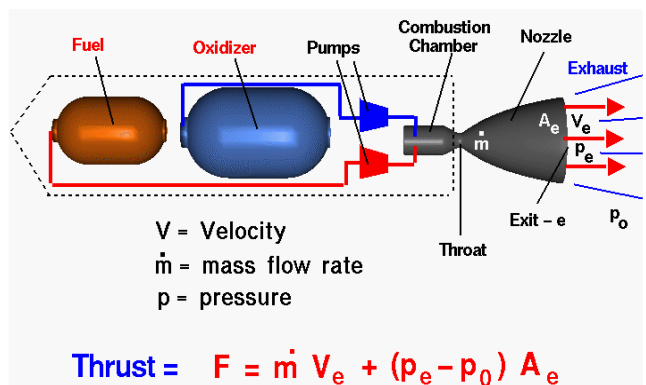
The exit pressure is only equal to free stream pressure at some design condition. We must, therefore, use the longer version of the generalized thrust equation to describe the thrust of the system. If the free stream pressure is given by p_0 , the thrust F equation becomes:

$$F = \dot{m} V_e + (p_e - p_0) A_e$$

Notice that there is no free stream mass times free stream velocity term in the thrust equation because no external air is brought on board. Since the oxidizer is carried on board the rocket, rockets can generate thrust in a vacuum where there is no other source of oxygen. That's why a rocket will work in space, where there is no surrounding air, and a gas turbine or propeller will not work. Turbine engines and propellers rely on the atmosphere to provide air as the working fluid for propulsion and oxygen in the air as oxidizer for combustion.

The thrust equation shown above works for both liquid and solid rocket engines. There is also an efficiency parameter called the specific impulse which works for both types of rockets and greatly simplifies the performance analysis for rockets.

The details of how to mix and burn the fuel and oxidizer, without blowing out the flame, are very complex. It DOES take a rocket scientist to figure it out!



IV. DESCRIPTION OF METHOD USED

A. What is Rocket Fuel Made of?

After watching a rocket launch, you may wonder what the Rocket Launch, you may wonder what the rocket fuel is made of? There are actually two kinds of fuel used in rockets. The fuel can be divided into liquid fuel and solid fuel.

With Solid fuel, there must be both fuel and an oxidizer to make a Solid fuel rocket go. An oxidizer is a chemical that is needed to make fuel burn. Since space has no atmosphere, rockets have to carry both their own fuel and their own oxidizers. The most common fuel in solid fuel rockets is Al. In order to make the Al burn, these solid fuel rockets use Ammonium Perchlorate as the oxidizer, or to make Al burn. In order to work together, the Al and the ammonium

The Analysis of Liquid Rocket Fuels

perchlorate are held together by another compound called a binder. When mixed all together, the fuel has a slightly rubbery consistency. This rubbery substance is then packaged into a casing. As the fuel burns, the heat and energy cause the inside of the rocket to heat up. Water vapors and gases then shoot out of the rocket to heat up. Water vapors and gases then shoot out of rocket, causing the rocket to be thrust, or pushed, upwards into the sky. You will find that many boosters, not the main engines, on rockets use solid fuel. This is because this fuel is short-lived and burns very quickly.

The Main engines are more likely to be propelled by liquid fuel. Liquid fuel engines are composed of liquid oxygen and liquid H. The liquid H is the fuel and liquid O is the oxidizer helps the fuel Burn. The H needs to be in liquid form, not gas form, in order to have a smaller tank on the rocket. Gases are lightweight, so it would take a larger tank to hold H gas than it would be to hold Liquid H. The Liquid H and O are released into an engine where they begin. To begin to combine to make water. Just like the solid fuel, the Water vapor creates the energy and steam. The steam is released to make the rocket go upwards.

To get a rocket from the ground into space, rockets need both solid fuel and liquid fuel. You would think that rockets could just carry liquid fuel because liquid fuel is more efficient and gives more push when burned. However, having only liquid fuel would require a huge tank of fuel. Instead, rockets are boosted off the ground by solid fuel. The boosters are dropped off the rocket to make it lighter, and then the liquid fuel is burned to allow the rocket to keep moving upward in space.

Therefore, rocket fuel can be categorized into solid or liquid fuels. Rocket engines and boosters carry both fuel and an oxidizer. For solid fuel, the components are Al and ammonium perchlorate. For liquid fuel, the components are liquid hydrogen and liquid oxygen. When combined, the fuels release water, which allows the rocket to leave the ground.



V. FUTURE SCOPE AND DEVELOPMENT

Space travel is heating up—and so are rocket fuel emissions. These companies are developing cleaner alternatives to protect earth first. Despite challenges with

supercooled liquid hydrogen leading up to the Nov. 16 launch, the mission successfully utilized the universe's lightest and most abundant element to produce enough energy to power four engines with 2 million pounds of thrust. The other main by-product was water vapor. That's good for planet earth, especially when compared with rocket launches that rely on a popular alternative: kerosene-based propellant.

In the case of SpaceX, a single Falcon 9 flight emits

about 336 tons of carbon dioxide—the equivalent of a car traveling around the world 70 times—according to John Cumbers, a former NASA synthetic biologist and CEO of SynBioBeta.

Burning liquid hydrogen is far from perfect: Producing it is usually a fossil-fuel-intensive process. But green hydrogen projects are attempting to improve its sustainability through the use of renewables.

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Assessment of Therapeutic Footwear Use in Diabetic Patients

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Abstract—This dissertation aims to discover the new technical therapeutic shoes which involves with some designs of an existed as well as involvement of some Advanced insoles, Cushioning sole, Air pockets, Non-binding design with seam free protective interior and PPG chip. These soles and insoles helps the patients to make their feet comfortably movable as well as it prevents from bacteria and skin diseases. Photoplethysmography (PPG) Chip is a simple optical technique used to detect the volumetric changes in blood in peripheral circulation. This chip has been inserted at the top of the feet with certain inclination which does not make the victim feel uncomfortable as well as does not make any harm to the device. Since swelling occurs due to rapid changes of volume of blood inside the body, this device can detect the changes of volume of blood and notified through your mobile.

Keywords—Therapeutic footwear, Diabetic foot, Photoplethysmographic (PPG) Chip, Orthopedic shoes

I. INTRODUCTION

A serious health problem in people with Diabetes Mellitus (DM) is foot ulceration, since an initially simple injury can lead to functional losses and culminate in limb amputation or even death. Every year, more than 1 million people with diabetes lose at least part of their leg because of diabetes complications. This translates into the estimation that every 20 s a lower limb is lost to diabetes somewhere in the world. Several factors are involved in the development of foot ulcers in people with diabetes such as neuropathy, peripheral vascular disease, limiting joint movements, trophic skin disorders and abnormal distribution of mechanical forces in the feet. Among them, the most important etiological factor is peripheral diabetic neuropathy.

With the absence of pain and sensitivity, the patient continues walking, which impairs healing and corroborates the worsening of the lesion.

II. RESULT AND DISCUSSION

Our design is different from normal orthopedic footwear. We have included all the materials used in normal diabetic shoes but we have upgraded our shoes with three air pockets for reducing stress of joint. We have used advanced insole and a cushion sole. we have used non binding design with seam free protective interior. Besides this we have introduced a small 2cm PPG chip. The sensed PPG chip can be connected to mobile through bluetooth and can alert the person about the swelling. Photoplethysmography (PPG) is a simple optical technique used to detect volumetric changes in blood. It is a low cost and non-invasive method that makes calculation at the surface of the skin. PPG makes uses of low-intensity infrared light. When light travels through biological tissues it is absorbed by bones, skin and

both venous and arterial blood. Since light is more strongly absorbed by blood than the surrounding tissues, the changes in blood flow can be identified by PPG sensors as changes in the intensity of light. The voltage signal from PPG is proportional to the volume of blood flowing through the blood vessels. Even small changes in blood volume can be identified using this method, hence it cannot be used to quantify the amount of blood.

Manufacturing process of this shoes can be done by some procedures. Digital images of the outer surface of a patient's foot and an impression of the patient's sole are formed. From said digital images, a model in three dimensions of the patient's foot is reconstructed. By calculation in a data processing unit, this model being defined by data that can be used to control a machine tool. From said data, a block of material is machined to manufacture a shape corresponding to the three-dimensional model.

One or more heat-formable sheets are applied to said shape to form a sole or orthopedic shoe. It digitizes in the data processing unit to build a pattern for the manufacture of the sole or the orthopedic shoe. A manufacturing method, wherein a footprint of the patient's foot is formed by means of a cushion deformable containing polystyrene beads and connected to a vacuum pump.

Soles of orthopedic shoes are manufactured using the process molding, plaster strips are wrapped around the foot of the patient. Polyurethane is dried in plaster mold to get a positive corresponding volume of it.

For the footwear we can mold plastazote easily by heating it for 1-3 minutes at 230- 250 degree F. Plastazote footwear are meant for people with light to healthy people performing moderate levels of activity in their everyday life. We use latex foam, a porous substance, very common material for any diabetic shoe manufacturing. It is prepared from synthetic or natural latex with ingredients being whipped froth. The resulting product contains roughly 85 percent air and 15 percent rubber and can be molded and vulcanized.

Advantages of this diabetic shoes can be such like It provide better motion control. It promote circulation. It prevent skin breakdown. It prevent the formation of calluses. It reduce the occurrence of foot problems in high-pressure

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areas of the foot. We will be notified before the swelling as any change in blood flow will be captured by the device. Disadvantages of this diabetic shoes can be such like Your intrinsic foot muscles are working less because your foot is

being supported by the insole. PPG sensors are influenced by many factors including touch force and temperature. So if force or pressure is high and we might get wrong ppg readings. It is not cost effective.

The incidence of diabetic foot ulcers and lower extremity amputations remains very high and unacceptable. The high risk of ulcer formation and subsequent amputation is closely related to difficulties in obtaining adequate devices to prevent and/or treat them, especially in the long term. Due to their complexity of use, available weight devices are underused by healthcare professionals and patients with very poor adherence to therapy, which has led to the development of “smart” footwear based on continuous measurement and continuous and automatic adaptation of the foot and insole need it.

III. CONCLUSION

Therapeutic footwear is used to reduce the pressure applied by the patients, it is being more efficient than a common diabetic footwear. This technique can contribute to the prevention of injuries associated with diabetic foot. Advanced insole and air pockets were more effective than the traditional insoles to prevent from foot ulcers in high-risk people.

The development of this shoe is the best evaluation with height predictive values, specificity, sensitivity and reliability are crucial points of the diabetic study. Future research could facilitate the best instruments to be used in medical trials in the health and research area to contribute to treatments in these areas.

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Microprocessor Trends and Challenges in the Era of Artificial Intelligence

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Abstract—As artificial intelligence (AI) workloads become more prevalent, microprocessors are facing new design, performance, and energy efficiency requirements. In this paper, we examine the trends and challenges associated with running AI workloads on microprocessors. We first discuss the need for specialized microprocessor architectures to support AI workloads, including GPUs, TPUs, and neuromorphic processors. We then consider power management challenges, such as thermal constraints and power consumption, associated with running AI workloads on microprocessors. Next, we examine the security implications of running AI workloads on microprocessors, including potential vulnerabilities in hardware and software. We also explore the role of memory and storage in supporting AI workloads on microprocessors, as well as emerging trends in AI microprocessor design, such as in-memory processing. Finally, we discuss the potential for future developments in AI microprocessor design and consider the Implications of these trends and challenges for the broader field of AI.

Keywords—microprocessor, artificial intelligence, AI workloads, specialized microprocessor architectures, GPUs, TPUs, neuromorphic processors, power management.

I. INTRODUCTION

Microprocessors are the central processing units (CPUs) of modern computing systems, responsible for executing instructions and performing calculations. Over the past several decades, microprocessors have undergone significant advances in terms of performance, energy efficiency, and capabilities. These advances have enabled a wide range of applications, from personal computers and mobile devices to high-performance computing clusters. Microprocessor are the core components of any electronic device ranging from the compact smart watches to the complex huge spacecrafts and satellites.

II. ARCHITECTURE OF MICROPROCESSORS

The microprocessor is a single IC package in which several useful functions are integrated and fabricated on a single silicon semiconductor chip. Its architecture consists of a central processing unit, memory modules, a system bus, and an input/output unit. The system bus connects the

various units to facilitate the exchange of Information. The Central processing unit consists of one or more arithmetic logic units (ALU), registers, and a control unit. Based on the registers also the generations of the microprocessor can be classified.

A microprocessor consists of general-purpose and a special type of register to execute instructions and to store the address or data while running the program. The ALU computes all arithmetic as well as logic operations on data and specifies the size of microprocessors like 16 bit or 32 bit.

The Memory unit holds the program as well as data and is divided into a processor, primary and secondary memory. The Input and output unit interfaces the I/O peripheral devices to the microprocessor for accepting and sending information [2]. However, there are some special purpose microprocessors that includes-

A. Graphics Processing Units (GPUs)

GPUs are specialized microprocessors designed to handle the computational demands of rendering and displaying graphics, but they can also be used to accelerate other compute-intensive workloads, including AI workloads. Compared to traditional CPUs, GPUs are designed to perform many calculations simultaneously, making them well-suited for parallelizable workloads such as deep learning. In particular, the parallelism and high memory bandwidth of GPUs can accelerate matrix multiplication, a key operation in many deep learning algorithms. Nvidia is a major manufacturer of GPUs, and their CUDA programming language is widely used for programming GPU-based systems.



Fig 1.1. GGPU [9]

B. Tensor Processing Units (TPUs)

TPUs are a type of microprocessor developed by Google specifically for running AI workloads. TPUs are designed to accelerate the training and inference stages of deep learning

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models, and are particularly well-suited for models built using TensorFlow, Google's open-source machine learning framework. TPUs feature a dedicated matrix multiplication unit that can perform many matrix operations simultaneously, as well as a high-bandwidth memory architecture that supports large-scale model training. TPUs are available for use on Google Cloud Platform [5].



Fig 1.2. T.P.U. [9]

C. Neuromorphic Processors

Neuromorphic processors are a type of microprocessor designed to emulate the structure and function of biological neurons. These processors are based on the concept of spiking neural networks, which use asynchronous spikes of electrical activity to perform computations. Neuromorphic processors are well-suited for low-power, real-time processing of sensory data, such as image and audio recognition. One example of a neuromorphic processor is the TrueNorth chip developed by IBM, which features 1 million programmable neurons and 256 million programmable synapses [1].

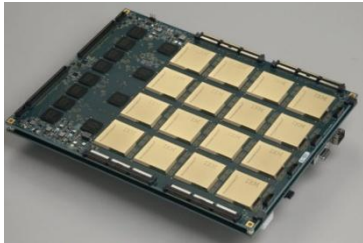


Fig 1.3. Neuromorphic processor [9]

III. POWER MANAGEMENT CHALLENGES

Running AI workloads on microprocessors poses a significant challenge for power management, as these workloads often require high levels of computational resources and consume large amounts of power. This can lead to increased energy costs, decreased battery life for portable devices, and increased heat generation, which can degrade performance and reliability.

One of the primary power management challenges in running AI workloads on microprocessors is balancing performance and power consumption.

High-performance processors often consume more power, while low-power processors may not have the necessary computational resources to efficiently execute AI workloads. Another power management challenge in running AI workloads on microprocessors is managing thermal effects. High levels of power consumption can lead to increased heat generation, which can cause thermal throttling and reduce performance. This requires designers to carefully manage the thermal characteristics of the microprocessor, using techniques such as power-aware

thermal management and advanced cooling systems to dissipate heat and maintain performance. Overall, power

management is a significant challenge in running AI workloads on microprocessors, requiring designers to carefully balance performance, power consumption, and thermal effects to optimize the performance and reliability of the system [4].

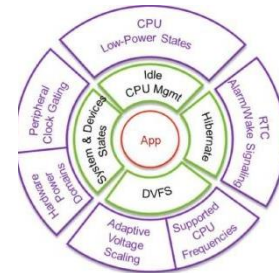


Fig. 2. Power management [9]

IV. SECURITY IMPLICATIONS

Running AI workloads on microprocessors can have significant security implications, as these workloads often involve sensitive data and complex algorithms that can be vulnerable to attack. In particular, AI workloads can be vulnerable to attacks such as data poisoning, model inversion, and adversarial attacks, which can compromise the integrity and confidentiality of the data and undermine the accuracy and reliability of the algorithms. One of the primary security implications of running AI workloads on microprocessors is the risk of data poisoning attacks. Data poisoning attacks involve injecting malicious data into the training data used to develop AI models, which can undermine the accuracy and reliability of the model and compromise the integrity of the data. This requires designers to carefully evaluate the quality and integrity of the data used to train AI models, often using techniques such as data validation and data cleansing to identify and remove potentially malicious data. To address the security implications of running AI workloads on microprocessors, there are several security measures that can be taken:

- **Data validation and cleansing:** Designers should carefully evaluate the quality and integrity of the data used to train AI models, and use techniques such as data validation and data cleansing to identify and remove potentially malicious data.
- **Differential privacy:** Differential privacy is a technique that adds statistical noise to the data to protect sensitive information, while preserving the overall accuracy of the data.
- **Model encryption:** Model encryption involves encrypting the AI model to protect against unauthorized access and ensure the confidentiality of the model.
- **Input validation:** Input validation involves verifying the integrity and authenticity of the input data to an AI model to protect against adversarial attacks.
- **Adversarial training:** Adversarial training involves training an AI model with deliberately manipulated data to improve the model's robustness against adversarial attacks.
- **Access controls:** Access controls can be used to restrict access to sensitive data and AI models to authorized personnel only, thereby reducing the risk of unauthorized access and data breaches.

By implementing these security measures, designers can
Microprocessor Trends and Challenges in the Era of AI

protect against the security implications of running AI workloads on microprocessors, and ensure the integrity, confidentiality, and accuracy of the data and algorithms used in AI systems [3].

V. MEMORY AND STORAGE LIMITATIONS

The role of memory and storage is crucial in supporting AI workloads on microprocessors. As AI models require massive amounts of data to be processed and stored, the memory and storage architecture of the microprocessor must be designed to handle the high data throughput and storage requirements of these workloads.

In particular, the following factors play a critical role in supporting AI workloads on microprocessors:

- **Memory bandwidth:** High memory bandwidth is required to support the large data transfers between the processor and memory required for AI workloads.
- **Memory capacity:** Large memory capacity is needed to store the data used for training and running AI models.
- **Memory access latencies:** Low memory access latencies are essential to reduce the time taken to access data and avoid bottlenecks in the processing pipeline.
- **Storage capacity:** The storage capacity must be large enough to store the massive amounts of data required for training and running AI workloads.
- **Storage access speed:** High storage access speeds are needed to reduce the time taken to read and write data to the storage.

To support AI workloads on microprocessors, memory and storage solutions such as High-Bandwidth Memory (HBM), Graphics Double Data Rate (GDDR), and Solid-State Drives (SSDs) are commonly used. These solutions offer high bandwidth, large capacity, and low access latencies, enabling microprocessors to handle the massive data throughput and storage requirements of AI work system.

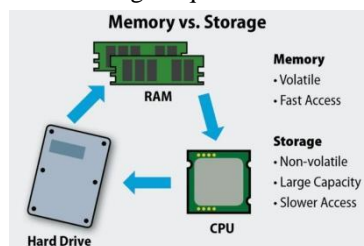


Fig 3. Memory management [9]

VI. TRENDS IN MICROPROCESSOR DESIGN

There are several emerging trends in microprocessor design that are expected to shape the future of AI computing:

- **Increased focus on energy efficiency:** As AI workloads become more complex and data-intensive, there is a growing need for microprocessors that can deliver high performance while minimizing energy consumption.
- **Neuromorphic computing:** Neuromorphic computing is an emerging area of AI microprocessor design that seeks to replicate the functionality of the human brain

by using spiking neural networks.

- **Edge computing:** Edge computing involves bringing AI computing capabilities closer to the source of data, such as at the edge of the network or on the device itself. This trend is driving the development of low-power, high-performance microprocessors that can support AI workloads at the edge.
- **Quantum computing:** While still in its early stages, quantum computing is an emerging trend in AI microprocessor design that has the potential to significantly accelerate the training and inference of AI models.

These emerging trends are expected to drive innovation in AI microprocessor design and lead to the development of more efficient, powerful, and specialized microprocessors that can support the growing demands of AI computing [6].



Fig 4. Quantum processor [9]

VII. FUTURE SCOPE/DEVELOPMENT

Emerging technologies such as quantum computing, photonics, and other novel materials have the potential to revolutionize AI microprocessor design by providing new ways to process and store data. For example, quantum computing can perform certain types of computations exponentially faster than classical computers, making it a promising technology for accelerating the training of AI models.

Photonics, which involves using light to transmit and process information, is also being explored as a potential alternative to traditional electronic microprocessors. Photonics-based microprocessors can achieve higher speeds and bandwidths than their electronic counterparts, making them well-suited for processing large amounts of data in parallel.

Other novel materials, such as carbon nanotubes and graphene, are also being studied as potential alternatives to traditional silicon-based microprocessors. These materials offer advantages such as higher conductivity and better thermal performance, making them attractive options for high-performance AI computing.

In addition to these emerging technologies, trends in the broader field of AI, such as explainable AI and ethical AI, are also having an impact on microprocessor design. Explainable AI, which involves making AI models more transparent and interpretable, is driving the development of new types of microprocessors that are optimized for explainability.

Overall, the implications of emerging technologies and

trends in the broader field of AI for microprocessor design are significant, and are expected to shape the future of AI computing in important ways [7].

A. Graphene Over Silicon

Microprocessor Trends and Challenges in the Era of AI

Graphene is a two-dimensional material consisting of a single layer of carbon atoms arranged in a hexagonal lattice. It is an allotrope of carbon. It is the thinnest material known to exist and is considered a "miracle material" due to its exceptional strength, flexibility, and conductivity.

Graphene has several advantages over silicon for making microprocessors:

- High electron mobility: Graphene has extremely high electron mobility, which means that it allows electrons to move very quickly through the material. This property makes graphene-based transistors much faster than their silicon-based counterparts.
- Low power consumption: Graphene-based transistors also consume less power than silicon-based transistors. This is because graphene has very low resistance, which means that it generates less heat when current flows through it. This is a key advantage for microprocessors, which can generate a lot of heat and consume a lot of power.
- Scalability: Graphene-based transistors can be made much smaller than silicon-based transistors, which makes them more scalable. This means that they can potentially pack more transistors into a smaller space, leading to more powerful microprocessors.
- Flexibility: Graphene is a very flexible material, which means that it can be used to create flexible and wearable devices. This is a potential advantage for microprocessors used in such applications.

VIII. OTHER NOVEL MATERIAL

Several other novel materials being explored for use in microprocessors, including:

- Carbon nanotubes: Similar to graphene, carbon nanotubes have high electron mobility and low power consumption. They also have a unique cylindrical shape that could be useful in designing new types of transistors and circuits.
- Gallium nitride (GaN): GaN is a semiconductor material that has several advantages over silicon, including higher electron mobility and higher breakdown voltage. These properties make GaN transistors more efficient and capable of handling higher voltages and currents.
- 2D materials: In addition to graphene, there are several other two-dimensional (2D) materials that are being explored for use in microprocessors. These materials include molybdenum disulfide (MoS₂), tungsten diselenide (WSe₂), and black phosphorus, among others.
- Organic materials: Organic materials, such as polymers and small molecules, are being explored for use in flexible and low-cost electronics. While they currently have lower performance than inorganic materials like silicon, they have potential for use in certain applications where flexibility and low cost are more important than high performance.

Overall, there is a lot of research being done on novel

materials for use in microprocessor design, and it is likely that we will see new materials and designs emerge in the coming years [8].

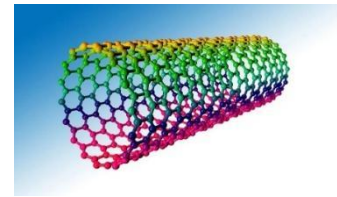


Fig 5.1. Carbon Nanotubes [9]

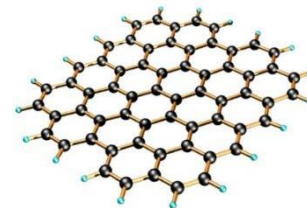


Fig 5.2. Graphene [9]

IX. CONCLUSION

The field of microprocessor design and usage is rapidly evolving to meet the demands of the artificial intelligence era. Specialized microprocessor architectures such as GPUs, TPUs, and neuromorphic processors have enabled the acceleration of AI workloads and improved performance. However, power management, security, memory and storage limitations, and the need for more efficient and specialized designs remain significant challenges. Emerging technologies like quantum computing, photonics, and novel materials such as graphene hold great potential for improving microprocessor performance and enabling new applications, but their integration poses new challenges.

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RFID Smart Lock

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Abstract:

In recent years, Radio Frequency Identification (RFID) technology has gained a lot of popularity due to its ease of use and flexibility in various applications. One of its common applications is in smart locks, which provide a high level of security and convenience. In this research paper, we present the design and implementation of an RFID smart lock system using Arduino Uno. We describe the hardware and software components of the system and present the results of our experiments. Our experiments demonstrate that the proposed RFID smart lock system provides a reliable and secure method of access control.

Introduction:

The use of traditional keys for access control has become outdated and inconvenient, leading to the development of smart locks. Smart locks offer a higher level of security and convenience, enabling users to control access to their premises remotely. The RFID technology, in particular, provides an easy and reliable method of access control.

The RFID smart lock system is a combination of hardware and software components. The hardware includes the RFID reader, microcontroller, motor, and

power supply, while the software comprises the Arduino sketch and mobile application. In this research paper, we present the design and implementation of an RFID smart lock system using Arduino Uno.

Hardware Design:



The RFID smart lock system consists of several hardware components, including the RFID reader, microcontroller, motor, and power supply. The RFID reader is responsible for detecting the RFID tags and sending the data to the microcontroller. The microcontroller processes the data and controls the motor to unlock or lock the door. The power supply provides the necessary voltage to power the system.

The RFID reader used in this project is the MFRC522, which communicates with the microcontroller using SPI. The microcontroller used is the Arduino Uno, which is a widely used microcontroller for

various projects. The motor used is a standard DC motor, which rotates the lock mechanism to unlock or lock the door. The power supply used is a 5V DC adapter.

Software Design:

The software components of the RFID smart lock system include the Arduino sketch and mobile application. The Arduino sketch is responsible for reading the data from the RFID reader, processing the data, and controlling the motor. The mobile application is responsible for providing the user interface to the system, enabling users to control access to their premises.

The Arduino sketch is written in the Arduino IDE and consists of several functions, including the setup and loop functions. The setup function initializes the RFID reader and motor, while the loop function reads the data from the RFID reader and processes it. The mobile application is developed using the MIT App Inventor, which provides a simple and easy-to-use interface for developing Android applications.

Code:

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>

#define SS_PIN 10
#define RST_PIN 9

#define SERVO_PIN 3
Servo myservo;

#define ACCESS_DELAY 2000
#define DENIED_DELAY 1000
MFRC522 mfrc522(SS_PIN, RST_PIN);
// Create MFRC522 instance.

void setup()
{
```

```
    Serial.begin(9600); // Initiate a serial
communication
    SPI.begin();        // Initiate SPI bus
    mfrc522.PCD_Init(); // Initiate
MFRC522

    myservo.attach(SERVO_PIN);
    myservo.write( 70 );
    delay(7500);
    myservo.write( 0 );
    Serial.println("Put your card to the
reader...");
    Serial.println();

}
void loop()
{
    // Look for new cards
    if ( !
mfrc522.PICC_IsNewCardPresent())
    {
        return;
    }
    // Select one of the cards
    if ( ! mfrc522.PICC_ReadCardSerial())
    {
        return;
    }
    //Show UID on serial monitor
    Serial.print("UID tag :");
    String content= "";
    byte letter;
    for (byte i = 0; i < mfrc522.uid.size; i++)
    {
        Serial.print(mfrc522.uid.uidByte[i] <
0x10 ? " 0" : " ");
        Serial.print(mfrc522.uid.uidByte[i],
HEX);
        content.concat(String(mfrc522.uid.uidB
yte[i] < 0x10 ? " 0" : " "));
        content.concat(String(mfrc522.uid.uidB
yte[i], HEX));
    }
    Serial.println();
    Serial.print("Message : ");
    content.toUpperCase();
    if (content.substring(1) == "69 C8 E2
2A") //change here the UID of the card
    {
        Serial.println("Authorized access");
```



```

    Serial.println();
    myservo.write( 70 );
    delay(7500);
    myservo.write( 0 );

}

else {
    Serial.println(" Access denied");

    delay(DENIED_DELAY);

}
}

```

Results:

The RFID smart lock system was tested in a laboratory environment, and the results demonstrated that the system provides a reliable and secure method of access control. The system was tested with several RFID tags, and the system was able to detect and respond appropriately. The motor was able to lock and unlock the door, providing a high level of security.

Conclusion:

In this research paper, we presented the design and implementation of an RFID smart lock system using Arduino Uno. The system provides a reliable and secure method of access control, enabling users to control access to their premises remotely. The system can be further improved by adding features such as facial recognition and voice recognition, which can enhance the security of the system. The proposed RFID smart lock system can be used in various applications, including homes, offices, and other commercial buildings.

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Future of Windmills: Maglev Windmill

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Abstract: “The Maglev windmill is a promising innovation in the field of wind energy generation, designed to maximize the efficiency and sustainability of wind turbines. Unlike traditional wind turbines, which use mechanical bearings to support the rotating blades, the Maglev windmill employs magnetic levitation technology to suspend the blades in mid-air, eliminating friction and reducing wear and tear on the system. This novel approach to wind energy production has numerous advantages, including increased energy output, improved reliability, reduced maintenance costs, and a longer lifespan. One of the key benefits of the Maglev windmill is its ability to generate more energy than conventional wind turbines. By eliminating the friction and drag caused by mechanical bearings, the Maglev windmill can capture more wind energy and convert it into electricity. This increased efficiency makes it an attractive option for both onshore and offshore wind energy installations, where space and accessibility are often at a premium. Another advantage of the Maglev windmill is its enhanced reliability. Without the need for mechanical bearings, there is less potential for component failure, reducing the risk of downtime and lost productivity. Additionally, the lack of physical contact between the blades and other parts of the windmill results in reduced noise and vibration, making it a more pleasant and sustainable energy source for communities.

Keywords: Levitation, magnetic field, harness, turbine, generator.

I. Introduction

Maglev wind turbines is a new type of wind turbine technology that uses magnetic levitation (Maglev) to harness wind power. This technology allows the generator to float, placing it in more advantageous

locations and avoiding the noise and vibration associated with traditional wind turbines. The technology also enables the turbine to be more efficient as it can capture more of the wind energy available. In this resource will discuss the Maglev

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wind turbines, the current state of the technology, future scope and how it can be improved.

II. Objective

The objective of a Maglev windmill is to generate clean and efficient energy from the wind. The design of a Maglev windmill is based on the principle of magnetic levitation, which uses magnets to lift and propel the wind turbine blades. This design eliminates the need for traditional wind turbine blades, which are prone to wear and tear due to friction. Additionally, the use of magnetic levitation also allows for more efficient energy production as the rotor is not hindered by friction. The result is a windmill that can generate more electricity than traditional wind turbines and with less maintenance. This technology has the potential to provide a more efficient, cost-effective and environmentally friendly way of generating electricity than traditional wind turbines. It also has the potential to reduce the amount of noise and vibration produced by wind turbines. The idea is that Maglev bearings can significantly improve the efficiency of a wind farm. Granted that a Maglev bearing may have lower noise and longer life. Despite this, the viral spread rapidly, and it still hangs on many websites and has penetrated Wikipedia and various reports. Some more "sensible" comments admit that the increased efficiency of the Maglev turbine will show up at low wind speeds. As it is written, it is the truth, nothing but the truth. But it can give the impression that the turbine will supply energy even in light breezes. This means that when there is a light breeze, the energy captured by the turbine is so small that it is comparable to the energy lost in conventional bearings. If, for example, half of the captured energy falls on overcoming the resistance of the bearings, then by removing this resistance, the energy supplied by the turbine would suddenly double. Of course, this means that instead of the amount of energy "nothing" we get "twice". However, if we don't want to take any energy from the turbine and are content with it moving (for example to scare the birds), reducing the resistance of the bearings makes sense. I made

something like this for exactly this purpose. The Power of Wind As mentioned earlier the effective functioning of a wind turbine is depend on the wind availability in an area and if the amount of power it has is sufficient enough to keep the blades in constant rotation. When the wind is blowing the energy available is kinetic due to the motion of the wind so the power of the wind is related to the kinetic energy.

We know:

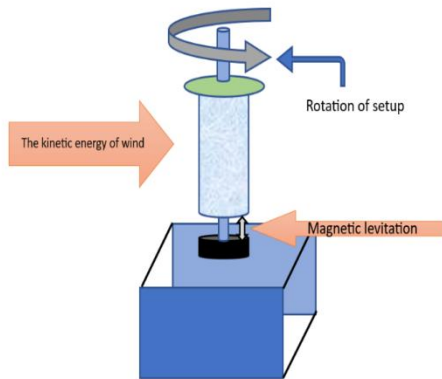


Figure 1: Maglev windmill working

$$K_e = \frac{1}{2} m v^2$$

The volume of air passing in unit time through an area A, with speed V is AV and its mass M is equal to the Volume V multiplied by its density ρ so:

$$M = \rho A v$$

$$\text{So } K_e = \frac{1}{2} (\rho A) v^2$$

$$K_e = \frac{1}{2} \rho A v^3$$

To convert the energy to kilowatts, a non-dimensional proportionality constant k is introduced where $k = 2.14 \times 10^{-3}$

$$\text{power in kW (P)} = 2.14 A V^3 \times 10^{-3} \text{ slugs/ft}^3$$

area(a)=area swept by the blades of the turbine

velocity(v)=wind speed

III. PRINCIPLE

The basic working principle of a wind turbine is when air moves quickly, in the form of wind, the kinetic energy is captured by the turbine blades. The blades start to rotate and spin a shaft that leads from the hub of the rotor to a generator and produce electricity.

The high-speed shaft drives the generator to produce electricity. The low speed shaft of wind turbine is connected to shaft of high speed drives through gears to increase their rotational speed during operation. Using the effects of magnetic repulsion, spiral shaped wind turbine

blades will be fitted on a rod for stability during rotation and suspended on magnets as a replacement for ball bearings which are normally used on conventional wind turbines.

The energy that can be extracted from the wind is directly proportional to the cube of the wind speed. We can then calculate the power converted from the wind into rotational energy in the turbine

using the equation.

$$P_{\text{available}} = 0.5 \rho A v^3 C_p$$

Where,

$P_{\text{available}}$ = output available in watts

ρ = density of air

A = Area swept by the blade

V = velocity of the blade

C_p = power coefficient of blade (Betz limit)

$$C_{p \text{ max}} = 0.59$$

IV. Design of Maglev

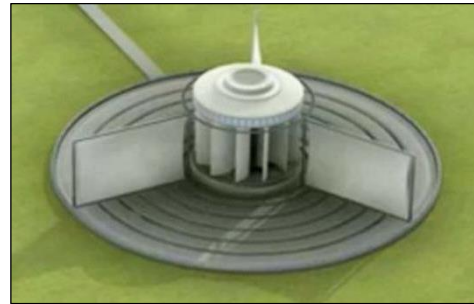
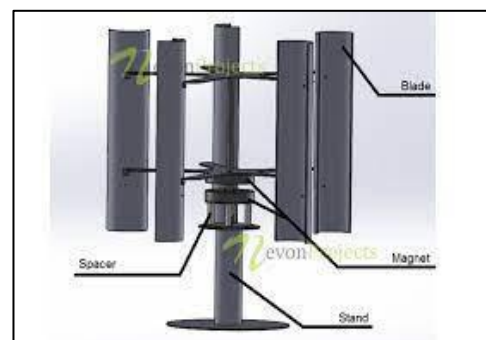


Figure 3. Maglev design

V. Components

- Neodymium Magnets or Normal magnets
- Blades
- Supporting frame
- Copper wire
- Wooden plank



- Shaft

Figure 2. parts of Maglev windmill

VI. Features of Maglev

The main advantage of Maglev windmills is their efficiency. Maglev technology has been shown to reduce the friction between the rotating parts, allowing for greater power output. This increase in efficiency translates to more energy produced for the same amount of wind. Additionally, the use of magnets in the blades helps to reduce noise pollution and vibration, making Maglev windmills more friendly to their environment. The use of Maglev technology also reduces the cost of maintenance and operation.

High Efficiency: Maglev wind turbines are designed to produce more power with less wind, resulting in higher energy output. **Increased Reliability:** Maglev wind turbines have fewer moving parts than traditional turbines, resulting in fewer maintenance problems. **Lower Noise Pollution:** Maglev turbines are quieter than traditional turbines and generate less noise pollution.

Low Carbon Footprint: Maglev turbines are more efficient and generate fewer carbon emissions, making them an environmentally friendly option.

Low Maintenance: Maglev wind turbines have fewer moving parts than traditional wind turbines and require less maintenance, reducing both time and cost.

Safer: Maglev wind turbines are safer than traditional wind turbines because they do not have any blades which can cause harm.

Durability: Maglev wind turbines are much more durable than traditional wind turbines, allowing them to withstand strong winds and storms. **Advantages** The main advantage of Maglev wind turbines is that they can be placed in more advantageous locations. By using magnetic levitation, the generator can float, allowing it to be placed in areas that are less windy than traditional wind turbines. This means that the turbine can capture more of the available wind energy, leading to higher efficiency. Maglev wind turbines are also less noisy and less prone to vibration than traditional turbines. This means that they can be placed in locations that are closer to residential areas, leading to more efficient energy production

VII. Shortcoming

High Initial Cost: The initial cost of installing a Maglev windmill is quite high due to the complexity of the technology. This makes it a difficult investment to justify when compared to more traditional wind turbines.

Comfort: Maglev windmills generate a high-pitched whirring sound due to the magnetic

levitation system, which can be annoying for people living nearby.

Maintenance: The maintenance of a Maglev windmill is much more difficult than other types of turbines. It requires more expertise and specialized tools to ensure that it is running at its peak efficiency.

Reliability: Maglev windmills are relatively new technology and there is very limited data on how reliable they are in the long run.

Expensive: The construction of a Maglev windmill requires a lot of money, as it requires costly magnets and special components. Additionally, the technology is still in its early stages, so it is not yet commercially available. This cost can be a barrier to the widespread adoption of the technology. Another disadvantage is that the technology is still relatively untested. Maglev wind turbines have only recently been developed and are yet to be proven in large-scale applications. While there has been some progress in its development, the technology is still not ready for widespread adoption. Several prototypes have been developed and tested, but they are yet to be deployed in large-scale applications. **Improvements** To make Maglev wind turbines more viable, several improvements can be made. First, the cost of the technology needs to be reduced so that it can be more widely adopted. This could be achieved through the development of more efficient designs and/or the use of cheaper materials. Second, more large-scale tests need to be conducted to prove the technology's effectiveness. This could be achieved through the construction of demonstration projects that test the technology in different conditions.

The technology needs to be optimized for the specific conditions of a given location. This could be done by collecting data on the local wind conditions and using this data to design a turbine that is optimized for that particular location.

VIII. Conclusion:

Maglev wind turbines are a promising new technology that could revolutionize the way we generate wind energy. While the technology is still in its early stages, there are several ways in which it can be improved. By reducing costs, conducting more large-scale tests, and optimizing the technology for specific conditions, Maglev wind turbines can become a viable alternative to traditional wind turbines. Advanced implementation of Maglev windmills Advanced implementations of Maglev windmills could include the use of advanced materials and technologies to maximize the efficiency of the system. This could include the use of lightweight and durable materials such as carbon fibre composites and advanced lubricants to reduce

Additionally, advanced aerodynamic designs could be used to increase efficiency of the turbine blades, while advanced control algorithms could be used to ensure the blades are always optimally oriented to the wind. In addition to the use of more advanced materials and technologies, the research could be conducted into ways to optimize the placement of wind turbines to maximize the efficiency of the Maglev system. This could involve optimizing the spacing between turbines, as well as positioning them in areas of high wind resources to capture more energy. Finally, the research could be conducted into ways to store the energy generated by the Maglev wind turbines, such as through the use of batteries or other energy storage systems.

IX. Future Scope

The future scope of Maglev windmill technology is very promising. Maglev windmills have the potential to generate more power than traditional wind turbines, due to the increased efficiency of the magnetic levitation system. They also have the potential to be scaled up to much larger sizes, since the magnetic force increases with the size of the Maglev rotor. This could lead to increased wind energy production in areas with higher wind speeds and better wind resources. Additionally, Maglev windmills could be used to generate electricity in remote areas, since they do not require a large foundation or other infrastructure. Furthermore, they could be installed in areas with more challenging terrain, such as mountains. Finally, Maglev windmills are more reliable than traditional wind turbines and require less maintenance. In the future, Maglev windmills could become a major source of renewable energy, providing an efficient and cost-effective way to generate electricity. As technology continues to advance, the possibilities become even more exciting. Some potential avenues of research and development include:

Increasing the efficiency of Maglev wind turbines by utilizing advanced aerodynamic principles. Utilizing the excess energy created by the turbines to power other renewable energy sources, such as solar or geothermal. Developing a more affordable and efficient Maglev wind turbine system. Developing a more efficient way to store the energy created by the turbines. Developing a way to integrate Maglev wind turbines into existing power grids. Developing a way to reduce the noise created by the turbines. Investigating the potential for using Maglev wind turbines to generate electricity in remote areas. Investigating the potential for using Maglev wind turbines in offshore applications. Investigating the potential for using Maglev wind turbines to generate power in urban areas. Investigating the potential for using Maglev wind turbines to generate power in areas with strong ocean currents.

X. Result & Discussion:

The Maglev windmill is a revolutionary technology that offers a number of benefits over traditional wind turbines. In this section, we will discuss some of the results and potential benefits of using Maglev windmills for wind energy production. One of the primary advantages of Maglev windmills is their increased energy output compared to conventional wind turbines. Several studies have shown that Maglev windmills can generate up to 20-30% more energy than traditional wind turbines, primarily due to the absence of friction between the moving parts. This increased energy output can translate into significant cost savings for wind energy projects, as well as a greater supply of clean energy for homes and businesses. In addition to their increased energy output, Maglev windmills also offer improved reliability and longevity compared to traditional wind turbines. Because there are no mechanical bearings to wear down or fail, Maglev windmills have a longer lifespan and require less maintenance than traditional wind turbines. They are also less likely to experience downtime due to mechanical failure, reducing the risk of lost productivity and revenue. Another advantage of Maglev windmills is their reduced noise and vibration levels. Because there is no physical contact between the blades and the other parts of the windmill, the noise and vibration levels are significantly lower than those of traditional wind turbines. This can be especially important in areas where noise pollution is a concern, such as residential neighborhoods or areas near wildlife habitats. One potential limitation of Maglev windmills is their higher initial cost compared to traditional wind turbines. However, as the technology continues to improve and become more widely adopted, the cost is expected to decrease. Additionally, the increased energy output and reduced maintenance costs of Maglev windmills can help to offset their higher initial investment. Overall, the Maglev windmill represents an exciting development in wind energy technology, offering increased efficiency, reliability, and sustainability for wind energy projects. While there are still some challenges to overcome, the potential benefits of this technology make it an attractive option for wind energy projects around the world.

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SOLAR POND

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ABSTRACT: There are many methods to trap solar energy, but an effective one was by using solar pond. Solar pond is an unnaturally constructed pond in which large temperature can be maintained in the lower convective zone by the way of higher salt concentration and by preventing natural convection so these ponds are called —Salt Gradient Solar Pond. They are large-scale energy collectors with integral heat storage for supplying thermal energy. In recent years the usage of solar ponds are in an increasing manner due to more temperature can be obtained with minimal loss and have been constructed of varying in size from a few hundred to a few thousand square meters of surface area.

Keywords: Halocline, upper-convecting zone, non-convecting zone, lower-convecting zone, desalination, brine, internal heat exchange.

INTRODUCTION

A solar pond, any large human-made body of salt water that collects and stores solar energy, thereby providing a sustainable source of heat and power. Although research on the practical applications of solar ponds did not begin until the late 1940s, a natural lake particularly well-suited for use as a solar pond was discovered in the Transylvania region of eastern Europe in the early 1900s. Since that time, interest in solar pond development has expanded throughout the world. Today, notable solar ponds can be found in Israel, India, and the United States (in El Paso, Texas). However, many solar pond projects have been abandoned because of the high cost of solar pond production and maintenance compared with that of facilities for gas and fossil fuels. Still, interest in the solar pond as a source of sustainable energy

continues worldwide. Solar pond is a pool of saltwater which collects and stores solar thermal energy. The saltwater naturally forms a vertical salinity gradient also known as a "halocline", in which low-salinity water floats on top of high-salinity water. The layers of salt solutions increase in concentration (and therefore density) with depth. Below a certain depth, the solution has a uniformly high salt concentration.

TYPES OF SOLAR POND: CONVECTING AND NON CONVECTING

Solar ponds are of two types: non-convecting and convecting. The more common non-convecting solar pond reduces heat loss by preventing convection (the transfer of heat from one place to another by the movement of fluids) with the addition of a concentration of 20–30

percent salt to the bottom level (lower convective zone) of the pond. When saturated with high amounts of salt in the form of concentrated brine, the temperature of the bottom level rises to about 100 °C (212 °F) as heat from the Sun is trapped. The middle level (non-convective zone) receives a lower amount of salt than the bottom level. Because it is lighter than the bottom level but heavier than the top level, the water in the middle level is unable to rise or sink. The middle level, therefore, halts convection currents and acts as an insulator, trapping sunlight in the bottom level. In the top level (upper convective zone), where there is little salt, the water remains cold. Fresh water is added to that level, and saline water is drained. Finally, heat from the bottom level is transferred to pipes circulating through the pond to extract thermal energy. In contrast to the non-convecting pond, convecting solar ponds trap heat by stopping evaporation rather than by stopping convection. The structure consists of a large bag of water with a blackened bottom, foam insulation below the bag, and two layers of plastic or glass glazing on top of the bag; the design allows convection but prevents evaporation. The Sun heats the water during the day. Then, at night, hot water is pumped into heat-storage tanks. Heat generated by solar ponds has many applications and can cut down on the use of fossil fuels. The heat extracted from the pond enables the production of chemicals, food, textiles, and other industrial products. Heat from the pond can also be used to warm greenhouses, swimming pools, and livestock buildings. The heat can be converted to electricity through the use of the organic Rankine cycle engine, a relatively efficient and economical means of solar energy conversion, which is especially useful in remote locations. The solar pond can purify water for municipal water systems through

desalination and can serve as a receptacle for brine disposal resulting from the extraction of crude oil from ocean drilling. The use of a solar pond has several benefits. Since it has built-in thermal energy storage, it can be used all year, day and night, regardless

of weather. The solar pond is especially attractive as an alternative to fossil fuel technologies in rural areas in less-developed countries where large ponds can be built. Energy from a solar pond is more cost-effective than energy from the flat-plate solar water-heating systems that are commonly used in homes. Since the pond provides heat energy without burning fuel, it does not contribute to air pollution and conserves traditional energy resources.

UCZ-upper convective zone

An upper convective zone or the surface zone consists of crystal clear pure water which performs as a solar radiation absorber or receiver where it transmits the radiations which are falling on it. The very shallow top layer of fresh or slightly salty water has the same salinity throughout its entire depth and thus convection takes place.

NCZ – non-convective zone

Middle layers of pond occupy the half depth of pond and having salt concentration much higher than the above layer. The salinity presents in the pond divide the NCZ and UCZ. Central layers ranging from slightly saltier at its upper boundary to very salty at its lower boundary is non-convecting because of its salt gradient. This stable middle layer serves partially as heat storage, but more importantly as insulation for the lower storage layer. The major center of attention to the non-convective zone is to maintain interior stability. It can't function as an inside unchanging salinity gradient and as part of the least necessity or increase moving back to avoid any gravitational overturn. This zone will perform as insulating zone, so that small amount of energy will be lost when the solar rays penetrate from the surface to the gradient zone and stores in heat storage

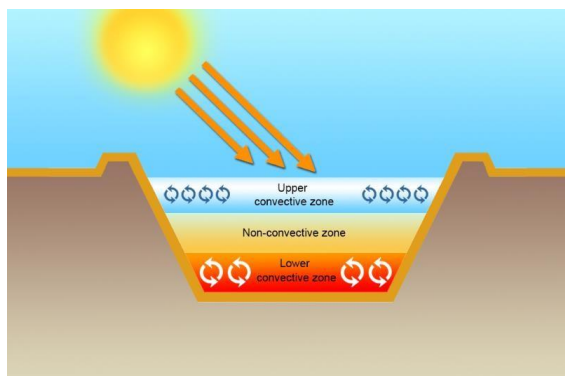
zone. NCZ is the vital zone for the functional of a solar pond.

LCZ – lower convective zone

The highly saline bottom storage layer is also a storage layer due to the relatively strong absorption of solar energy at the bottom of the pond. Lower convective zone has high salt concentration and acts as a storage zone. Heat storage zone is normally where the heat is stored and when it is needed it can be extracted. Temperature stored in the pond can be obtained by extracting the brine solution from the pond or by passing spiral tubes inside the pond. For the operation and maintenance of solar ponds, periodic observations of basic parameters are necessary in order to monitor and predict the pond performance. Data recording for temperature and solar radiation was done.

SOLAR POND WORKING

The concept of a solar pond is derived from the observation that in some naturally occurring lakes, a significant temperature rises of about 40 degrees Celsius to 50 degrees Celsius. This is because of the fact that there is a natural salt concentration gradient in these lakes, whereby the water at the bottom remains denser even when it is hotter than the water at the top. Thus convection does not occur and heat is lost from the hot water only by conduction. The salt concentration gradient in such lakes is maintained naturally because of the presence of salt deposits at the bottom of the lakes, which approximates to saturation concentrations because of fresh water streams which flow across the top.



The schematic diagram of solar pond is shown in above figure. The top layer remains at ambient temperature while the bottom layer attains a maximum steady state temperature of about 60 degree celsius to 85 degree celsius. As stated earlier it combines the functions of heat collection with long term storage and can provide sufficient heat for the entire year. Typically it is about two or three meters deep with a thick liner that is durable and made of plastic placed at the bottom. Materials used for the liner include low density polyethylene (LDPE), high density polyethylene (HDPE), woven polyester yarn (XB-5). Salts are dissolved in the water, the concentration varying from 20 to 30 percent at the bottom to almost zero at the top. Left to itself the concentration gradient will disappear over a period of time because of upward diffusion of the salt. Fresh water is added at the top of the pond in order to maintain the concentration gradient, while slightly saline water is run off. Simultaneously, concentrated brine is added at the bottom of the pond. The amount of salt required for this purpose is about 50 g/m² – day, which is large quantity when considered on an annual basis. Hence the normal practice is to recycle the salt by evaporating the saline water runoff from the surface in an adjacent evaporation pond. In order to extract the energy stored, hot water is removed continuously from the bottom passed through a heat exchanger and returned to the bottom. Alternatively, heat is extracted by water flowing through a heat exchanger coil submerged at the bottom. Because of movement and mixing of the fluid both at the top and the bottom, the solar pond is characterized by 3 zones such as a surface convective zone, a non-convective concentration gradient zone and a lower convective zone. The upper convective zone or surface convective zone (SCZ) usually has a small thickness around 10 to 20 cm. It has a low uniform concentration, which is close to zero, as well as a fairly uniform temperature which is close to the ambient air temperature. Both temperature and concentration increases with the depth in this zone. It serves principally as an insulating layer and reduces heat losses in the upward direction. Some of the heat

collection also takes place in this zone and it serves also as part of the thermal storage. The lower convective zone (LCZ) is comparable in thickness to the non convective zone. It serves as the main heat collection as well as thermal storage medium. The lower convective zone is often referred to as storage zone or as the bottom layer. Typically the temperature in the lower convective zone of a well designed large pond operating in India might fluctuate cyclically between a maximum value of 85 degree celsius to 95 degree celsius in summer and a minimum of 50 degree celsius to 60 degree celsius in winter. The annual collection efficiency generally ranges between 15 and 25 per cent. These values are lower than those obtained for a flat plate collector. Nevertheless, solar ponds are more cost effective since their cost per square meter is much less than that of a liquid flat plate collector system. This is particularly true when the area is of the order of 1000 m² or more. The site selected for the construction of a solar pond should have the following features: • It should be close to the point where thermal energy from the pond is to be utilized. • It should be close to the source of water for flushing the surface mixed- layer of the pond. • The thermal conductivity of the soil where is pond is constructed should not be too high. • The water table should not be too close to the surface.

FACTORS AFFECTING PERFORMANCE

Water turbidity: The particles present in solar pond prohibits the penetration of light in the water is called turbidity as time progresses, the water in a solar pond starts becoming hazy and unclear due to microbial growth, and accumulation of dirt, debris, and other foreign matter. This reduction in water clarity, i.e.,

growth in turbidity strongly affects the solar radiation absorption in the pond.

Water clarity: The thermal performance of a solar pond largely depends on the nature of the absorption of solar radiation in the layers of the ponds. The water in the pond needs to be as clear as possible so that the maximum amount of solar radiation reaches the storage zone at the bottom. More the water is clear the more radiation water will absorb. Water should be clearer to perform well

Algae formation: A common problem encountered in salinity-gradient solar ponds is the growth of various types of algae and bacterial populations, which affects the brine clarity and hence reduces thermal performance. Algae and bacterial populations are enhanced by the presence of organic nutrient such as nitrogen and phosphorus. The main factor affecting a solar pond 's performance in terms of its ability to collect heat energy is heat loss, and among these loss factors, the major thermal loss occurs due to surface layer evaporation. As the upper layer is appreciably shallow, the heat loss due to conduction is limited, and thus it can be neglected, while the evaporation, convection and radiation effects can be greatly reduced by covering the solar pond.

Fouling and corrosion: Fouling and corrosion are inherent problems in solar ponds. Fouling may be caused by the falling of wind-blown material such as dirt and leaves as well as by the growth of algae or bacteria in the body of the pond. Heavy wind-blown debris normally settles to the pond bottom, where its effect on pond performance is not significant. The material of low-specific gravity is usually confined to the convective layer at the pond surface and can be removed by filtering and skimming the layer biological growth can be checked by adding a biocide such as copper sulfate with salt at the time of filling the pond. A hot and saline environment is usually the cause of corrosion, which is often encountered in feed water pumps and heat exchangers. Careful material selection can help. Bronze, ceramic,

stainless steel, and plastics (polypropylene) are well suited for saline and hot water.

IMPROVING PERFORMANCE

Effect of Covering the Top Surface of the Pond

Evaporation is one of the significant challenges in efficient working of solar ponds. A large part of the heat is lost to the environment through evaporation. Ruskowitz, Suarez, Tyler and Childress [22], experimented with floating hemispheres, floating discs, and a continuous cover over a solar pond. It was found that when a floating disc covers the solar pond with 88% surface, the evaporation rate decreased from 4.8 to 2.5 mm/day whereas the temperature increased by 7 °C, i.e. from 34 °C to 43 °C. The heat content also increased by 41 MJ, i.e. from 179 MJ to 220 MJ. Suppression of evaporation also resulted in a reduction in the heat lost to the surroundings and increase in the heat content of the LCZ, which improved the efficiency of the solar pond. This also resulted in a reduction in heat loss from LCZ to NCZ and hence, a higher temperature was obtained in LCZ and NCZ. Further, by suppressing the evaporation in the solar pond, it can be operated in locations where the availability of water is less

Effect of Polyethylene Film placed between NCZ and LCZ A polyethylene film having a thickness of 100 μm was placed between LCZ and NCZ. The film being impervious would prevent diffusion between LCZ and NCZ and thus maintain a salinity gradient for a longer duration. It was observed that the temperature of the LCZ i.e. heat storage zone was considerably higher for the solar pond with polyethylene film just above LCZ as compared with the case having no separating polyethylene film. The efficiency of the solar pond with polyethylene film above LCZ was found to be 69% while that for the conventional solar pond was about

52% [21]. The rate of rising of the temperature of LCZ, i.e. heat storage zone, was also considerably higher for the solar pond with separating polyethylene film as compared with the solar pond without any polyethylene film.

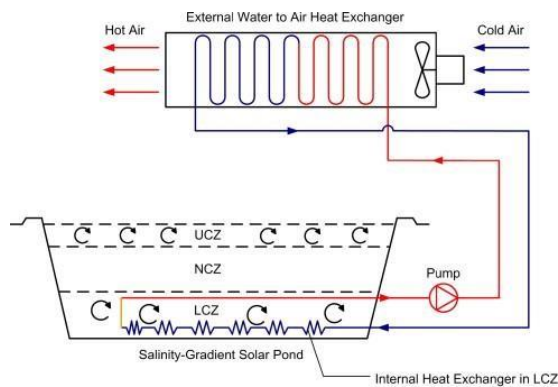
The pond was covered with plastic sheet before the strong rainfall came. After the rainfall, the rainwater was pumped out of the sheet to a container and then added the chemicals for the treatments, including sedimentation, filtration and clarification. The treated rainwater was then injected to the surface of the pond. Thus, the dust mixed in rainwater and wind was stopped out of the pond.

HEAT EXTRACTION METHODS

A solar pond's heat must be immediately removed when the lower layer temperature reaches just over 100°C. The optimum heat extraction rate is achieved when the solar irradiation, heat energy input into a solar pond is nearly equal to the heat energy extracted from the pond. Extraction may be accomplished using an in-pond heat exchanger located in this lower zone or by pumping hot brine from the upper region of LCZ through an external heat exchanger, where heat is transferred to a separate working fluid and hence delivered to the application.

Submerged Heat Exchanger:

This internal method for the extraction of heat is designed such that the thermal energy can be deployed for multiple uses. The process involves circulating water, glycol or any required fluid through pipes into an internal heat exchanger, which is placed at the bottom of the solar pond. The heated liquid is then passed on to an external heat exchanger placed at a distance which then provides heat to an attached application. The choice of pipe material has an impact on the efficiency of this system. For the case of using metallic pipes, the intensity of the natural convection process would directly influence the rate at which heat can be extracted.



On the other hand, plastic pipes have a higher resistance towards heat extraction amount. This choice of material is driven by both efficiency and cost considerations and thus is implemented accordingly. This method experiences temperature stratification. Temperature stratification is a natural phenomenon where a less dense layer of fluid overlays a denser, colder layer of fluid. Temperature stratification takes place at the bottom of the LCZ due to natural heat transfer through convectional currents. The cooler fluid moves towards the bottom and the warmer to the top of the layer, resulting in stratification. This lower-temperature fluid at the bottom also results in lowering any ground heat losses. Another advantage of this method is that it can be free of any metallic corrosion problems if a plastic component is used.

Brine Withdrawal Method: This method involves pumping hot brine directly from the storage zone by using an extraction diffuser. The brine, once its heat energy has been extracted, is then returned to the bottom of the pond by using a return diffuser. This is considered more effective than other method, and hence it is practiced more often. The advantage of using this circulation method is that it reduces ground heat losses, as this method ensures that the cooler brine is always at the bottom.

APPLICATIONS : There are many specific applications of solar pond for

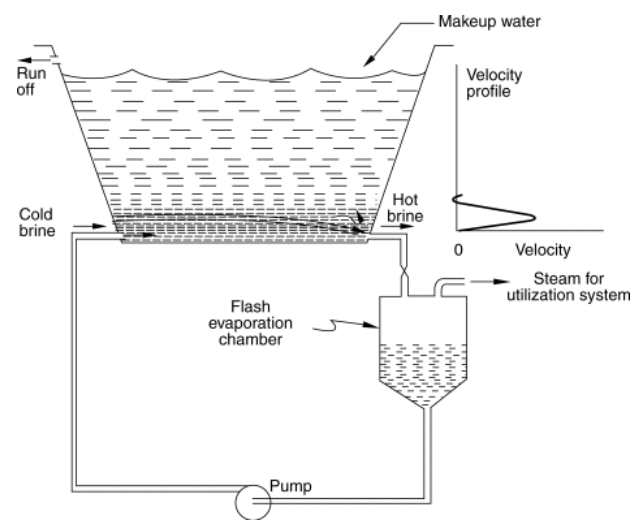
differences purposes such as :

- heat to industrialized process
- electricity power production
- commercial or farming crop drying
- desalination
- greenhouse heating
- Space heating and absorption cooling systems
- Heating animal housing and drying crops on farms
- Aquaculture

Conclusion: Solar pond is one of the most important and promising of sustainable energy sources. It can use as a technology to convert the solar landing beams to useful renewable energy and can be employed for water desalination, power generation, heating, and many other applications. Simple energy balance technique is generally and successfully used to model the overall performance of the solar pond. The summary of the literatures showed ability of the solar pond in various industrial applications. However, in comparison with the simplicity, cost effectiveness and environmental friendly operation, the solar pond deems as one of the most useful energy resources especially in remote areas.

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NON-NEWTONIAN FLUIDS AND GASES

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Abstract— The main purpose of this research was to help the society. During the year 2021, a total number of 4,12,432 road accidents have been reported in the country, claiming 1,53,972 lives and causing injuries to 3,84,448 persons. Unfortunately, the worst affected age group in Road accidents is 18-45 years, which accounts for about 67 percent of total accidental deaths Globally, falls are a major public health problem. An estimated 684 000 fatal falls occur each year, making it the second leading cause of unintentional injury death, after road traffic injuries. 2020, 42,114 people died in falls at home and at work. Construction workers are most at risk for fatal falls from height more than seven times the rate of other industries . To prevent this fall and protect life we are presenting this paper.

An incompressible fluid where the inertial terms are nullified or neglected is termed as non - Newtonian fluids . The fluid exhibits the idea of if applied force is high then the reaction force is high and the total force is being nullified . Here we now come upon an idea of why not a gas can exhibit such properties and such gas which is incompressible can be used for many purposes . We are going to be using such idea and we are going to develop the gas . Since every problem has a solution in world, similarly solution of road accidents and falling from buildings or construction side is NON- NEWTONIAN FLUID GAS . We can use this gas as safety product as putting this gas at lower level of building or construction side so that if person fall from building there we be only small injuries only but life will be safe. Similarly we can use this gas in vehicles . Just like airbag we can put a device on vehicle with sensor and when there is accidental condition arrives this gas will release and will behave as a partially solid gas . And chance of life loss will be decrease .

"Truth is one but the learned ones call it by many names"

INTRODUCTION

The objective of this paper is to introduce and to illustrate the frequent and wide occurrence of non-

Newtonian fluid behavior in a diverse range of applications, both in nature and in technology. Starting with the definition of a non-Newtonian fluid, different types of non-Newtonian characteristics are briefly described. Representative examples of materials (foams, suspensions, polymer solutions and melts), which, under appropriate circumstances, display shear-thinning, shear-thickening, viscos-plastic, time-dependent and viscoelastic behavior are presented. Each type of non-Newtonian fluid behavior has been illustrated via experimental data on real materials. This is followed by a short discussion on how to engineer non-Newtonian flow characteristics of a product for its satisfactory end manipulating its microstructure by controlling physio-chemical aspects of the system. And applying the knowledge to prepare a gas which can be used in many lifesaving operations. Finally, we touch upon the ultimate question about the role of non-Newtonian characteristics on the analysis and modelling of the processes of pragmatic engineering significance and defining the properties of the gas.

RESULTS AND DISCUSSION

Classification of fluids are broadly done mainly in two types that is Newtonian and Non Newtonian fluids these are on the basis of whether the fluid follows the Newton's law of viscosity which states that the shear stress produced in the fluid is directly proportional to the shear strain produced by the shear force. Using this law many calculations are done for the Newtonian fluids but the major thing depends on viscosity .

Melissa C. Brindise, said that Optical imaging is commonly used to investigate biological flows and cardiovascular disease using compliant silicone polydimethylsiloxane (PDMS) Sylgard 184 geometries. However, selecting the working fluid with blood density and viscosity, and PDMS index of refraction

(RI) for such experiments is challenging. Currently, water–glycerol is commonly used and sodium iodide (NaI) is often added to increase the index of refraction without changing fluid viscosity. But the resulting fluid density is well above blood. Moreover, NaI is expensive, has safety and material discoloration concerns, and has been reported to affect non-Newtonian fluid behavior. Here, we present a new blood-analog alternative based on urea. Urea is approximately 5–15 times less expensive than NaI, safe and easy to handle, optically clear, and causes no discoloration. Water–glycerol–urea solutions, unlike those with NaI, simultaneously matched the density and viscosity of blood and RI of PDMS. Water–xylitol and water–xylitol–urea solutions are also possible blood-analog solutions. Xanthan gum (XG)–water–glycerol non-Newtonian solutions maintained similar viscoelastic properties throughout the range of weight

percent (about 15–25%) of urea and NaI used here. The results showed that the XG weight percent affected viscoelastic properties more than the weight percent of urea or NaI tested in this study. Overall, we demonstrate urea is useful for PDMS blood-analog experiments and should also be considered as an inexpensive additive, and an alternative to NaI. A.B. Metzner, R. H. Feehs, Hector Lopez Ramos, R. E. Otto, said that Viscous fluids are frequently agitated by multiple impellers and in vessels only slightly larger than the impeller. This paper presents data for both Newtonian and non-Newtonian fluids agitated under such conditions. The large decreases in power requirements (at a given level of mixing rate in the non-Newtonian system) which are possible by use of low tank diameter, impeller diameter ratios and/or two impellers, have been quantitatively studied. The types of impellers used in the non-Newtonian work and the ranges of conditions over which power requirement correlations were developed.

The results generally confirm an approach developed earlier, for the broader ranges of variables listed above. For the non-Newtonian fluids of primary interest in this study, that is purely viscous materials having flow behavior indexes of less than unity (pseudoplastics, Bingham plastics), the prediction of power requirements has been developed to nearly the same level of perfection as for Newtonian.

Gilroy Harrison, A. John Barlow researched that Experimental methods for the measurement of dynamic shear properties at high frequencies usually involve the generation and propagation of a shear wave into the liquid. In principle, the shear modulus components can be determined from measurements of the velocity and attenuation of the shear wave. The practical and theoretical developments in the study of light scattered from the naturally occurring orientational fluctuations of anisotropic molecules in

liquids have complemented and extended the existing frequency range. The shear impedance of a liquid may be determined from measurements of the complex reflection coefficient for shear waves at a solid–liquid interface. It is found that reflection of shear wave's incident to an impedance discontinuity gives rise to both longitudinal and shears waves, but by polarizing the shear wave so that the particle motion is parallel to the interface, the conversion to longitudinal is avoided.

Bastian E. Rapp *Dilatant* showed that *fluids* are also referred to as *shear-thickening fluids*. The viscosity of these fluids will grow with increasing shear rate. For these fluids, the exponent Eq. 9.4 is $n > 1$. Typical examples of dilatant fluids are thick suspensions of particles in a liquid. If a shear rate is applied to these particles, they need to reorder in order to reduce the influence of the shear rate. By doing so, the overall shear force can be reduced. If the shear rate applied is small, the particles have enough time to reorder. However, if a high shear rate is applied, the particles do not have the required time to reorganize and a significant shear force is built up. A good example of a dilatant fluid is a suspension of corn starch in water. If such a suspension is compressed quickly by hand, the suspension will turn almost solid. If releasing the pressure, the suspension will flow freely again.

Stephen Hall *Pseudo-plastic fluids* are also referred to as *shear-thinning fluids*. The viscosity of these fluids will decrease with increasing shear rate. Therefore, for these fluids, the exponent Eq. 9.4 is $n < 1$. Typical examples for pseudo-plastic fluids are polymer solutions and similar solutions of high molecular weight substances. At low shear rates, these liquids will experience the formation of shear stress. The shear stress results in the reordering of the molecules in order to reduce the overall stress. This induction of a higher degree of order in the fluid reduces the shear stress and leads to the observed nonproportionality between the shear rate and the shear force. shear-thinning fluids, where the flow behavior index is less than about 0.3, a cavern forms around the impeller.

Outside the cavern, little or no mixing occurs and the fluid remains stagnant. With turbine impellers, the height to diameter ratio of the cavern ranges from about 0.4 to 0.6.

David B. Braun researched that the material is an elastic solid for shear stress less than a critical value. Once the critical shear stress (or "yield stress") is exceeded, the material flows in such a way that the shear rate, $\partial u/\partial y$ (as defined in the article on viscosity), is directly proportional to the amount by which the applied shear stress exceeds the yield stress. Bingham Plastic fluid (in blue), stress can be applied but it will not flow until a certain value, the yield stress, is reached. Beyond this point the flow rate increases steadily with increasing shear stress. This is roughly the way in which Bingham presented his observation, in an experimental study of paints.^[3] These properties allow a Bingham plastic to

have a textured surface with peaks and ridges instead of a featureless surface like a [Newtonian fluid](#).

Bingham plastic requires two parameters, the **yield stress** and the slope of the line, known as the **plastic viscosity**.

Continuum it is a concept where the void spaces and gaps between the molecules or atoms or particles, the concept is useful when we need to measure the physical properties and to interpret some calculations based on those properties. If suppose the temperature being a physical property is measured from a void then the reading will be wrong and the whole set of calculations will be wrong. Hence continuum becomes an important concept. Now, Properties of Gas: Gas must be heavier than air: IF gas is lighter than air there are high chances that gas will spread into surrounding. This will decrease efficiency of the gas and it will also increase in cost of operation as amount of gas needed will be more

object is directly proportional to velocity of object. Gas should be non Hazardous: The gas which we use in the following operation it should be non toxic and it should not affect and surrounding area.

Gas should be non carcinogenic it the main reason behind this to prevent harm to citizen living in locality. Gas should be less reactive: Our gas should less reactive as if gas react with surrounding. IT can form product which can have Newtonian nature which will oppose our desired property. So, we should select the gas which will less reactive. State of gas change should change with respect to applied force not the temperature. If pressure is more than it will more act like a semi solid or liquid. Different type of non newtonian fluid are Dilant, pseudoplastic, Rheopetic, and Thixotropic. out of These we should use either Dilant and rheopetic as there viscosity increase with increasing shear stress. Out of which rheopetic is time dependent and and dilant is non dependent. So, we can use dilant for the following application.

CONCLUSION

The properties of Non Newtonian and Newtonian fluids and applying the knowledge for new definition of fluids and how gases are included in the fluids mechanics. using the Non Newtonian properties and some additional properties in creation of the gas This needs very much properties and characteristics to be inculcated together and used for a precise preparation of the gas.

The properties of the gas should be as follows; It should be a NON – NEWTONIAN FLUID. It should be heavier than gas. It should be non toxic. It should

clubbing all the above information one can interpret that there can be new definition of fluid which is” FLUID IS A SUBSTANCE WHICH DEFORMS CONTINUOUSLY UNDER THE ACTION OF VERY SMALL SHEAR STRESS. “ By this definition of a fluid we can say that gases are also fluids and hence they come under the fluids We can now say that a gas that exhibits the above properties and which comes under the non Newtonian fluids can be created. The gas must create an opposing reaction force which is equal in magnitude to the applied force and which can be balance out the force. This is only possible when the gas created is heavier than the air and the gas must be the non Newtonian type of fluid and it must be non toxic and must be easy to prepare than that of the gas will be heavier. Since, the gas will slow down the falling person or object if its quantity is less than it will not decrease properly. Which, will cause larger impact and cause increase in chances of death as force on falling be stable enough to not to react and disperse in air.

Pros- Non-Newtonian fluid gas are a part of several different applications in daily life. We can use it in construction side as safety measures just like net is there on ground floor. We can use it on heavy way for reducing accidents. At the time of accident When two vehicles comes too close then the gas will behave as partial solid and will repel each other. This gas came be useful for research work also.

Cons- If the gas is toxic then it will affect human as well as nature. The maintenance cost of this gas is high since at constant interval of time we need to release the gas continuously. If the quantity of gases from which the desire gas is created should be in perfect ratio otherwise the required properties of gas will not able to created.

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Maglev Sneakers

*Note: Sub-titles are not captured in Xplore and should not be used

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Abstract— *Maglev sneakers and platforms are a type of footwear and flat surface that use magnetic forces to create a levitating effect, without any physical contact with the ground. This technology is often used in trains and other forms of transportation to achieve high speeds and reduce friction. Maglev technology has the potential to transform transportation and the way we move objects, but it is still in its early stages of development. Technical and practical challenges need to be addressed before maglev sneakers and platforms can become practical for everyday use. Despite this, maglev sneakers and platforms offer a glimpse into the possibilities of this technology and its potential impact on various industries.*

Keywords— Maglev Technology, Magnetic Forces, Potential Impact, Transportation

I. INTRODUCTION

Maglev sneakers are designed for transportation through shoes that uses two pairs of electromagnets. In the case of maglev sneakers, the magnetic levitation technology is used to eliminate the amount of friction between the shoe and the ground, creating a smoother and more efficient movement. 'maglev' is an acronym that stands for magnetic levitation. It refers to a technology that uses magnetic fields to levitate and propel objects. Maglev sneakers are a relatively new technology that combines the principles of magnetic levitation that uses magnetic fields to levitate and propel objects, such as trains, without the use of wheels or other physical contact with the ground. The concept of maglev dates back to the early 20th century, but it wasn't until the 1960s and 1970s that practical applications of the technology began to emerge. In addition to transportation, maglev technology is also being explored for other applications, such as maglev elevators and even space launch systems. While maglev technology is still in its early stages, it has the potential to revolutionize the way we move and travel in the future.

II. LITERATURE SURVEY

Maglev, or magnetic levitation, is a topic of active research in several fields, including transportation, engineering, and materials science. Here are a few examples of recent literature on maglev: "a review of magnetic levitation systems for transportation," by matthew j. Bares and christopher d. Rahn, in the proceedings of the institution of mechanical engineers, part c: journal of mechanical engineering science. This review paper provides an overview of the history and current state of maglev technology for transportation, including an analysis of the advantages and disadvantages of various systems.

The first cuprate superconductor was found in 1986 in inorganic state by ibm reasearchers george bednorz and karl alex muller. The critical temperature that was found in the reasearch was 35k at start and the previous highest record of critical temperature of a superconductor was 23k. Gednorz and muller continued their research and found many other publication of cuprates by changing its molecular formula.

"design and development of a maglev propulsion system for underwater vehicles," by a. Kumar and a. Das, in the journal of marine science and engineering. This paper describes the design and development of a maglev propulsion system for underwater vehicles, with a focus on improving efficiency and reducing noise.

III. POTENTIAL APPLICATION

- Diseases like mnd, arthritis, paralysis could be assisted
- Overcoming drawbacks of vfx animations to give us the realistic effects.
- Commercialization of the product for recreation activites like amusement parks and rides.
- Could be also useful for research purposes, particularly in the field of engineering, material science and biomechanics. Researchers could use maglev sneakers as a platform to study the effects of magnetic levitation on the human body, such as the biomechanics of walking and running in a low-impact environment
- Could be revolutionary in the field of science on a long run.

IV. THEORY

Proposed work

In the world of nuclear life, humans have been facing drastical issues in terms of losing their limbs through accidents or diseases. According to the world health organization, an estimated 250 million people worldwide are affected by some form of lower limb disability, with the majority of cases resulting from musculoskeletal conditions, such as arthritis, or neurological conditions. With the help of maglev sneakers one could re enhance their way of living to limited extent at presently and can perform any other household activities that a normal person could.

Film industries are mostly criticised for having less realistic vfx animation for the different genres. With the help of maglev sneakers we could overcome the drawbacks and give the entertainment field a new direction.

With the addition of a maglev zone into amusement and trampoline parks one could experience a different taste of technology promoting the boon of science to mankind.

Modelling/simulation

Maglev works on the principle of **superconductivity**, the **meisner effect**. Henceforth the material that we would be using for the development of the base of the sneakers would be consisting of the base material cuprate. Cuprate has one of the highest critical temperature which would allow superconductivity at a higher efficiency. to maintain its critical temperature, small tubes consisting liquid helium would be introduced. the current source to be unleashed to the cuprate could be from a battery to avail it's portability. For the initial stages wired shoes could be used. addition of guideway and levitating coils which are installed on the platform would help the shoes to maintain the balance and stable levitation. Additionally, we would be various types sensors in the control system like temperature sensors to monitor the temperature of the shoe and the magnetic levitation system to ensure that they are operating within safe limits. after the completion of the formation of sneakers, we would move on to the platform that would be made of conductive materials like aluminium help to create repulsive principle of magnetization. repulsive platforms would typically be made of aluminum (and possibly copper). The shoes electromagnets are located above the platform (or beside); resulting in an upward force. hence we are ready for witnessing the boon of superconductivity.

Interpretation of key equations:

Maglev sneakers

Maglev sneakers use magnetic fields to levitate the wearer, reducing the impact of each step and providing a more comfortable and energy-efficient way of walking or running. The key equation used to describe the force involved in maglev sneakers is given by:

$$F = (b^2 * a * x) / (2 * \mu_0)$$

Where f is the force of levitation, b is the magnetic field strength, a is the area of the magnetic field, x is the magnetic susceptibility of the material, and μ_0 is the permeability of free space.

This equation relates the force of levitation to the strength and area of the magnetic field and the magnetic properties of the material used in the sneakers. By controlling the magnetic field, the force of levitation can be adjusted to provide the right amount of support for the wearer.

Maglev platform

Maglev platforms use magnetic fields to levitate and propel sneakers. The key equations used to describe the operation of maglev platforms are related to the forces involved in levitation and propulsion.

The force of levitation in a maglev platform is described by the equation:

$$F = (b^2 * a * x) / (2 * \mu_0)$$

Which is the same equation used for maglev sneakers. The force of propulsion, on the other hand, is described by the equation:

$$F = (i * l * b)$$

Where f is the force of propulsion, i is the current flowing through the electromagnets, l is the length of the electromagnets, and b is the magnetic field strength.

This equation relates the force of propulsion to the current flowing through the electromagnets and the length and strength of the magnetic field. By adjusting the current and the length of the electromagnets, the force of propulsion can be controlled to provide the right amount of speed for the sneakers.

Critical magnetic field (hc):

The key equation used to describe critical magnetic field in maglev sneakers is given by:

$$H_c(t) = H_c(0) [1 - (t^2/t_c^2)]$$

Where $h_c(t)$ is critical magnetic field at any temperature. $H_c(0)$ is critical magnetic field at degree k . T_c is critical temperature when $h=0$.

V. FUTURE SCOPE

The concept of maglev sneakers has the potential for several future applications in the footwear industry. Overall, the future scope for maglev sneakers is promising, and there may be several potential applications for this technology in the footwear industry and beyond. However, it may take some time for this technology to be fully developed and integrated into everyday life. For now, it is just limited to sneakers but in the coming future it can provide us with many useful forms.

VI. CONCLUSION

Maglev sneakers are a concept of shoes that use magnetic levitation technology to create a floating effect between the sole of the shoe and the ground. While various prototypes and concepts have been developed, there are currently no commercially available maglev sneakers that are widely available on the market. The practicality and cost of producing such shoes are some of the main challenges in developing maglev sneakers. However, ongoing research and development in this area indicate that the idea of maglev sneakers continues to be of interest to many people, and there might be a potential. To become a viable footwear option in the future.

VII. ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to ms. Ela agarkar mam for being our mentor and giving us an opportunity for presenting on this topic.

VIII. REFERENCES

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A. Figures and Tables

a) *Positioning Figures and Tables:* Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

TABLE I. TABLE TYPE STYLES			
Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
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^a Sample of a Table footnote. (Table footnote)

Fig. 1. Example of a figure caption. (figure caption)

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

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REFERENCES

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Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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To have non-visible rules on your frame, use the MSWord “Format” pull-down menu, select Text Box > Colors and Lines to choose No Fill and No Line.

Plastic Drawing Sheet Container

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Abstract—A sheet container's design focuses and prioritizes storage of any sheets and convenience of its use. The main objective of a sheet container is to provide a storage space for larger drawing sheets which cannot be carried by conventional methods. It also focuses on protection of the sheets inside from any mechanical forces leading to damage of sheets. It also protects the sheets from any water related accidents. Its aim is to provide portability as well, therefore it has a nylon strap attached to it, so that it can be carried on the shoulder while traveling. The key feature that has been added to a normal sheet container, is the provision of an extra compartment inside a container. There will be another hollow tube present inside the container for you to separate and segregate your work sheets. This design focuses on the more systematic and structured working of a sheet container. It also caters to the requirement of time management.

Keywords—Plastic Sheet Container, Plastic Molding, Blow Molding

I. INTRODUCTION

A plastic cylinder container known as a "Sheet Container" is used to store and transport documents, blueprints, posters, paper rolls, scrolls, maps, drawing papers, architect papers, and other materials while protecting them from light and minimal water. It serves as a secure haven for your work.

Its sturdy plastic construction makes it an affordable storage option for all of your crucial documents. Also, it offers an extensible length mechanism with a handy lock and unlock system that allows length adjustments anywhere, enabling storage of any type of artwork. The design of a sheet container concentrates on and puts convenience of use and storage of any sheets first. The container is portable due to its lightweight and compact dimensions, which makes carrying it simple.

It also provides versatile functions such as a Great storage facility and transporting chart holders for anything that needs to be rolled and not folded for engineering students, art students, architects, designer, artist, etc.[3]

SPECIFICATIONS:

This adjustable sheet holder has a 30 outer diameter and can be adjusted between 47cm and 70cm. The inner compartment has a radius of 17. Total length of 150 including the cap.[4]

II. PROBLEM STATEMENT

Loose lock and unlock mechanism, Poor extendibility features, No provision of compartments, Managing various kinds of sheets is difficult, Very tricky to handle too many sheets, Removal of sheets from container is difficult, Accessibility is an issue.

III. MANUFACTURING & MATERIALS

The main material used for packaging is currently plastic. They are used for a range of packaging and containers, such as blow bottles, sheet-mold containers, and flexible packaging. Plastics are a relative newcomer to the realm of packaging whether compared to glass, metal, or paper. Cellophane film was first utilized for flexible packaging, and multi-layered film packaging is now being commonly employed.

The first consumer packs in supermarkets were made using sheet-mold containers. Blow bottles were once used as containers for liquid seasonings and edible oil, but they are currently primarily used as containers for beverages. The gas-barrier feature is seen to be the most crucial of the several functionalities required of packing materials. Among the many functions needed for packaging materials, the gas-barrier property is seen to be the most important function. Recently, many kinds of gas-barrier materials and gas-barrier technologies are being developed for application in plastic packaging. Since packaging materials become waste after use, the 3Rs (Reduce, Reuse, Recycle) philosophy is being taken into consideration with the design of these forms of packaging. Made from durable plastic making it an economical storage for any of your important documents.[1]

The process we used in the manufacturing is Blow Molding

BLOW MOLDING:

A manufacturing method for creating hollow plastic components is blow molding. Glass bottles and other hollow objects can also be formed using this technique.

Extrusion blow molding, injection blow molding, and injection stretch blow molding are the three primary

types of blow molding.

PROCESS OF BLOW MOLDING:

The first step in the blow molding process is to warm the plastic to soften it. The parison is a plastic tube with a hole in one end that allows compressed air to pass through.

After that, air is blown into the clamped-in plastic workpiece in the mold. The plastic is inflated by air pressure and then molds to the mold. The item is released from the mold once the plastic has cooled and solidified. Cooling is aided by water passages within the mold.

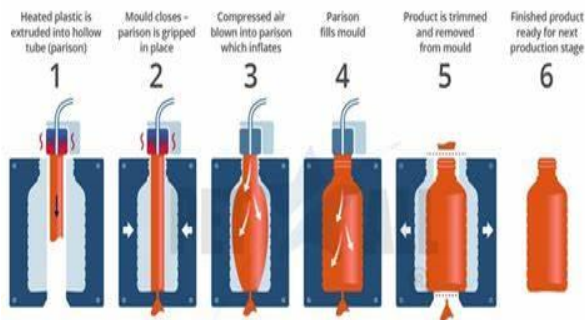


Figure 1

IV. RESULT & FEATURED DESIGN

This particular sheet container model emphasizes the importance of having a reliable, practical storage system. In contrast to what a typical conventional sheet container has to offer, this model focuses on the requirement of enveloping sheets in an organized manner. The inclusion of an additional compartment inside a container is the main improvement over a typical sheet container. You can separate and organize your work sheets using the additional hollow tube that is included inside the container. This design focuses on the sheet container's more organized and methodical operation. Also, it meets the need for time management.

When there are too many papers, students frequently struggle to manage them. They may effectively organize their time with the aid of this sheet container. Students might potentially save a tonne of time by being able to distinguish between their completed sheets and incomplete sheets in this way.

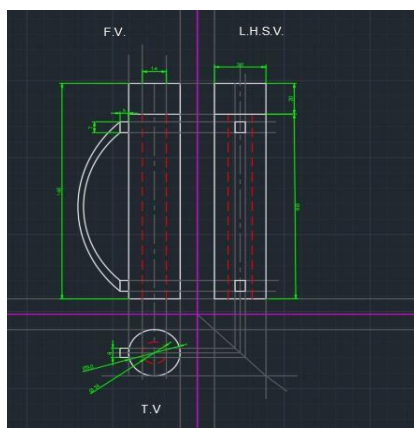


Figure 2: Featured Design

By Author — Akshita Chunchu

ADVANTAGES:

A sheet container is a piece of equipment that we engineering students utilize on a daily basis. Due to its significant significance in our learning process and study habit, such a device is great for being portable and convenient. As was already discussed, the current model has some shortcomings that make pupils uncomfortable when utilizing it. We developed this new model that gives improved facilities and replaces the old model because it is a regularly utilized learning tool. It's challenging to keep the sheets organized because they are constantly rolled up and packed tightly inside the container.

In our new featured model, the ability to distinguish between entire and incomplete sheets is a useful feature, which can facilitate the students' better management of their worksheets. The addition of compartments for various sheets enhances time management, which is crucial in the current environment.

V. CONCLUSION

Many kinds of vital documents, sketches, posters, and maps, among other things, are stored and carried in this durable drawing sheet holder. It is watertight and secures all the components within thanks to the sturdy plastic material it is composed of. All types of sheet sizes can be stored inside the sheet holder since it can be stretched from 19 inches to a maximum of 29 inches. Given the changes described above, we arrive at a new iteration of the sheet container that concentrates on the ordered operation of a typical sheet container.

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Nanofiltration Systems for Air Pollution

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Abstract— *Environmental pollution is a hot issue in today's world and it is the main cause of toxic chemicals including air pollution. At present, the contaminations such as CO, chlorofluorocarbons, unpredictable natural and inorganic mixes, hydrocarbons, and nitrogen oxides are containing in the air. This review is focused on the air pollutants, types, dominant sources, and consequently their possible impacts on human life. The status of air qualities shows in different cities of India during the Covid-19 lockdown and has been summaries introduction of nanotechnology, property of nanoparticles, and use of nanotechnology in environmental issues in this review. A comprehensive study on the development of the various nanomaterials and their applications for environmental remediation has been reviewed.*

Key Word: *Nanomaterial, control of air pollution, photocatalyst*

1. INTRODUCTION

Air pollution refers to the release of pollutants into the air—pollutants which are detrimental to human health and the planet as a whole. According to the World Health Organization (WHO), each year air pollution is responsible for nearly seven million deaths around the globe. Nine out of ten human beings currently breathe air that exceeds the WHO's guideline limits for pollutants, with those living in low- and middle-income countries suffering the most.

In recent years, there has been an increase in innovative technologies capable of retaining fine soot particles, including micro-organisms. The recent progresses in nanotechnology and its vital role to encompass the imperative demand to monitor and treat the emerging hazardous waste with lower cost, less energy, as well as higher efficiency.

Environmental pollution is very important issues of the world in today. The numerous type of environmental pollutants categorized are air pollution, water pollution, land pollution, noise pollution, light pollution and plastic pollution. In this paper, I have discussed air pollution. Air pollution is a mixture of solid particles and toxic gas suspended in air. There are some main major source of air pollution as

portable/Mobile source (released by motor vehicles, planes, trains, and various engines.), stationary source (fuel burning power source expending power plants, petroleum oil refineries, petrochemical plants, of human health as human beings with heart or lung disease, poisonous impact through absorption into the blood (e.g. Pd, Cd, Zn), allergic or hypersensitivity effect (e.g. a few woods, flour grains, chemicals), bacterial and fungal infection (from live organism), fibrosis (e.g. Asbestos, quartz), cancer (e.g. Asbestos as naturally occurring silicate minerals, chromates salt Cr_2O_3 , irritation of mucous membranes layers (e.g. Acid and alkalis), exacerbation of asthma and unexpected death. Due to pollution the temperature of the earth and seas change the climate cause as global warming and as a result of the excess over the atmosphere with greenhouse poisonous gases [1]. Fig 1.1 show the air pollutant emission sources examples power plants, dust, diffused sources, diesel generator sets, transport, industries, brick kilns etc The observing data for the world driving megacities include, 100 nations distributed in April 2018 by WHO for the time of 2011 and 2016. In NCT Delhi (National Capital Territory of Delhi (NCT)), PM_{2.5} is recorded exceptionally high and it is a long way past as possible according to National Ambient Air Quality System (NAAQS) and National Encompassing Air Quality Norms (NEAQN) [2]. COVID-19 is a profoundly infectious distinguished in Wuhan, China in December 2019. The infection of COVID -19, an across the nation lockdown is forced in India

from spring 24th for three weeks up to 14th of April up to 3rd May, the 3rd period of lockdown be reached out till 17 May 2020 with the classification of environment into 3 zones for example Red, Orange, and Green. Simply following four days of starting lockdown instance as indicated by the official information from the Central Pollution Control Board (CPCB). Air quality decrease by the five significant contaminations (PM₁₀, O₃, SO₂, NO₂ and CO) air qualities in COVID-19 lockdowns. The survey of the effect of COVID-19 lockdown going on the air. For instance, considering the offers of family produced vehicle have

extended by in any event 15%/year, the vehicle request is relished upon upward to rise as much as 200% somewhere in the range of 2015 and 2030, the automobile amounts are likely going to increment by 10.5%/year, even as power age be required to increment by 11.1% /year.

2. RESULT AND DISCUSSION

Air pollution control with the help of nanotechnology

Nanotechnology presents environmental advantages in air pollution control. They can be mostly divided into four classes

- a. Remediation and treatment,
- b. Air Pollution prevention with the help of nanotechnology
- c. Environmentally friendly materials (environmentally materials)
- d. Detection and sensing.

2.1 Remediation and treatment

There are three type of nanotechnology is individual utilized to treat as well as reduce the diverse air pollutant

2.1.1 Adsorption by nano-adsorptive materials

Nanoscience and nanotechnology hypothesized that the current issues with climate quality utilize the nanoscale adsorbents, known as nano adsorbents. Materials focused to the nanoscale can all at once show a mixture of properties, occurring a micro scale, attributable to two affects [8]: (A) The first involve the surface impact, which can exist clarify via (i) have regularly surface particles evaluate inner atoms, (ii) have considerably an increasingly free energy surface presented (this increased surface area and surface particles result increase of surface energy related with the particles), and

(iii) the fact that rate of chemical reaction increase with developing increase the surface area of a material. (B) the volume impacts, which may be a direct (i) a lower wavelength (higher frequency and higher energy), (ii) a blue shift of particles for optical absorption spectra, (iii) super paramagnetic to occur while the molecule be smaller than the magnetic field in a material, and (iv) the course to, in a free electron model, average energy spacing increases expansions same as the measure of particles is decreased and this improves the catalytic material properties of nanoparticles.

3. AIR REMEDIATION USING NANO SIZE SEMICONDUCTOR PHOTOCATALYST

Some material such as titanium dioxide (TiO_2), zinc oxide (ZnO), iron (III) oxide (Fe_2O_3) and tungsten oxide (WO_3) serve as a photocatalyst. In relation to the environment and water remediation, photocatalysts are able to oxidize organic pollutants into nontoxic materials.

Using the principle of a semiconductor, organic molecules can be oxidized by light. At a sufficient level of light, the charge transfer process will occur from the valence band to the conduction band causing the surrounding substances to be oxidized. Through the development of nanotechnology, semiconductor photocatalysts are modified in terms of reactivity and selectivity. In addition to the use of (TiO_2),

which already commonly used in industry, ZnO photocatalysts are currently being developed as well. As a concept, ZnO is expected to have two functions, namely to detect and remediate contaminants. During laboratory experiments, a ZnO photocatalyst was successfully used to detect and eliminate 4-chlorocatechol.

4. FEATURES OF PHOTOCATALYST METHOD

There are many features of this method but this method creates more effect because it purifies most types of air pollution such as heavy metal in air, harmful gases like CO , nitrogen oxides, including NO_x and VOCs. It also mineralizes 100% harmful gases to H_2O and CO_2 . The main problem with most air filtration method is not being environmentally friendly but this method is very nature friendly and causes no extra pollution.

5. REMOVAL OF VOLATILE ORGANIC COMPOUNDS

In addition to nitrogen oxides and sulfur oxides, many chemicals are formed by atmospheric reactions, such as soot, nitrous acid, polyaromatic compounds and volatile organic compounds (VOCs). Clean air regulations have become increasingly stringent as those particles are potentially damaging to human health. Most modern air purification systems are based on photocatalysts, adsorbents such as activated carbon or ozonolysis. However, conventional systems are not very good at getting rid of organic pollutants at room temperature. Japanese researchers have now developed a new material that is very effective for removing VOCs, nitrogen and sulfur oxides from air at room temperature. It involves highly porous manganese oxide with gold nanoparticles that are grown into it.

To prove the effectiveness of this catalyst, Sinha and Suzuki the major researcher from Korea has performed tests using three major components of organic indoor air pollutants: acetaldehyde, toluene and hexane. The results showed that all three pollutants in the air were very effectively removed and degraded by this catalyst compared with the conventional catalyst systems. One reason for the success is porous manganese oxide which has a much larger surface area than all previously known compounds. This large surface area causes better adsorption of volatile molecules. In addition, the adsorbed pollutants are decomposed effectively. Degradation on the surface is very effective because of the presence of free radicals. The presence of gold nanoparticles helps to reduce the barrier of radical formation that is usually very high. This process has opened the possibility for other Nano-metal components to be applied.

6. CURRENT APPLICATION

It has long been understood that long-term exposure to particulate matter and heavy metal pollution is a significant leading factor in causing health problems in the form of heart conditions, lung cancer and other problems. In urban areas, particulate sizes are typically in the range of 100–300 nm in diameter while heavy metals could be found in various ranges of concentration. In addition, heavy metals cannot be broken down by microorganisms (i.e. they are not biodegradable). A high degree of difficulty in the recovery of heavy-metal-contaminated land raises pressure in developing onsite sensors that can detect heavy metal ions before their concentration reaches dangerous levels. Nano filters could be applied to automobile tailpipes and factory smokestacks to separate out contaminants and prevent them from entering the atmosphere. In addition, Nano sensors have been developed to sense toxic gas leaks at extremely low

concentrations.

7. RISK OF NANOTECHNOLOGY

Although nanotechnology offers a broad range of potential uses and rapid advances, this technology may also have unintended effects on human health and the environment. Materials that are harmless in bulk forms can become highly toxic at the nanoscale, for example, if they enter and build up in drinking water supplies and the food chain, and do not biodegrade. The inhalation of airborne nanoparticles and the impact upon lung disease is a specific concern, with recent studies showing a similar response by the human body to some forms of CNTs as to asbestos particles, if inhaled in sufficient quantities. These concerns are exacerbated by the current poor understanding of the fate and behaviour of nanoparticles in humans and the environment. However, it is very early in the development of this technology, and the amount of testing has been relatively limited. The understanding of toxicity and potential health risks associated with nanomaterials is extremely limited.

Scientific authorities acknowledge this as a massive challenge, since monitoring the huge volume of diverse nanoparticles being produced and used and their consequent impact is very difficult to track. This strengthens our case for an increase in the amount and type of testing to assess whether these theoretical risks are real, and to monitor their behaviour in the environment.

The major kinetic investigations are concerned with the reactions whose rates can be measured without the use of instrumental methods [8]. During recent years, due to development of new electronic techniques, a sound deal of efforts has been devoted to study the reactions that are very difficult to study by conventional methods. In general there are two kinds of problems that arise in any kinetic investigations, first is the establishment of the relationship between the velocity and various factors such as concentration, solvent, catalyst, ionic strength, temperature etc. and the second is to arrive at interpretations of the empirical laws in terms of reaction mechanisms. There are two key factors that decide the productivity of the reaction, Thermodynamics which explains the extent of reaction whereas the kinetic provides the information about the mechanism of the reaction.

Radhey S. Verma and co-workers [9] studied the rate of oxidation of various amino acids in aqueous sulphuric acid and perchloric acid solutions. It has been observed that the order of the reaction is two for a given concentration of listed acids. Various hypotheses for the mechanism of acid catalysis have been studied and found that Brunett's hypothesis worked excellent. The remarkable observation was that the amino acids with an even number of atoms in carbon chain are more easily oxidized in acidic media than those with odd number of atoms in carbon chain, which was in good agreement with the view of Pokrovskaya. S.K. Joshi et al. [10] have been examined the kinetics of oxidation of amino acids such as Glycine, Alanine and Valine by Manganese (III) acetate in aqueous sulphuric acid medium. The rate law equation have been derived which shown that the reaction was first order in substrate, second order in Mn(III) and inverse first order in sulphuric acid. The inverse dependence on the concentration of sulphuric acid might be resulted from formation of protonated species of

the substrate which is non-reactive in oxidation process.

Rao et al. [11] has investigated the kinetics of oxidation of glycine, alanine, serine, threonine, aspartic acid, glutamic acid by permanganate in the presence and absence of silver ion. The order of the reaction was found to be one with respect to substrate and oxidant. The silver ion was responsible for catalyzing these reactions. B. Thimme Gowda and Mahesh Shetty [12] had employed twelve sodium salts of N-Chloroarylsulphonamide as oxidants for investigating the mechanism of two amino acids i.e. aspartic acid and glutamic acid. The reaction was found to follow second order kinetics in oxidant, fractional order in amino acid and shown the inverse dependence of concentration of hydrogen ions. In these entire Cl^+ ion was an effective oxidizing species. From the study it has been observed that introduction of electron-withdrawing group enhance the ease of Cl^+ ions which further increases the oxidizing strength of the employed substrates.

Shanu Mathur et al. [13] has studied the kinetics of oxidation of Lysine with Chromium(VI) in perchloric acid medium. The order of reaction with respect to lysine was less than one and for chromium (VI) it was found to be one. It was also observed that increase in concentration of acid accelerates the rate of reaction. The final oxidation products were identified as chromium (III) and 5-aminopentaldehyde. Dhan Raj, Manju Bala Yadav & Vijay Devra [14] studied the oxidation of serine by cerium(IV) in presence of Mn(III) as a catalyst. From the study it has been observed that formerly rate of reaction was slow in acidic media but when catalyst was introduced the reaction rate increased significantly. $\text{Ce}(\text{SO}_4)_2$ was found to be a reactive species. S. Parimala Vijayanthi & N. Mathiyalagan [15] has carried out the oxidation of various amino acids by novel oxidant N-chloropyrazinamide (NCPZA) in acetic acid medium in presence of hydrochloric acid. The study revealed that the reaction was first order in novel oxidant and H^+ and Cl^- . The order with respect to amino acid was zero. One significant observation was noted that on addition of novel oxidant the rate of reaction retarded.

T. Sumathi et al. [16] have been investigated kinetic and mechanistic study of oxidation of L-methionine and N-acetyl L-methionine by Cerium (IV) in sulfuric acid medium. The sulfoxide forms of the substrate were found to be major oxidation products. Increase in concentration of acidic medium did not have any effect on the reaction rate. Under inert atmospheric condition polymerization process initiated which shown the generation of the free radicals. C.S. Chidan Kumar [8] and other investigated the kinetics of Mn(III)-Ala reactions in acid solutions. The stoichiometry in the reaction was found to be 2:1. It has been also investigated that the reaction was proceeds through the formation of transition state and the state was rigid and reaction was entropy controlled. K. Vivekanandam & R. Lakshmi Narayanan [17] has worked on the oxidative decarboxylation and deamination of essential amino acids by Nicotinium Dichromate (NDC) in perchloric acid medium. The reaction was found to be temperature dependent and follow pseudo-first order kinetics. B. L. Hiranand others [6] has found that the final oxidation product was aldehyde when oxidation of phenylalanine was carried out by PCC in DMF-water mixture in the presence of perchloric acid. The reaction was found to be first order

in all respect and also it followed the Michelis-Menten mechanism. M.Sundar et al[18]. has studied the oxidation of lysine by oxone in a buffered medium concluded the non-existence of autocatalysis. Due to this further formation of Schiff base was discarded.

8. CONCLUSION

Nanotechnology has been developed to achieve the purpose of maintaining environmental sustainability. In this case, environmental sustainability is not limited to human environmental issues, but also human health problems. Technologies that have been developed include technologies which can enhance and improve the conventional technological capabilities and new technologies which replace the conventional technologies. The application of nanotechnology in the environmental field is not limited to the conditions where environmental contamination has occurred. Nanotechnology can also be applied to prevent the creation of pollution. Although nanotechnology has many applications in the fields of environmental technology, it needs to be studied further to assess its risk.

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Evolution Of Animation, Computer Graphics And Game Science

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A. Traditional animation

Traditional animation (classical animation, cel animation, or hand-drawn animation) is an animation technique in which each frame is drawn by hand. The technique was the dominant form of animation in cinema until computer animation. Sometimes referred to as cel animation -cel is short for celluloid which is a transparent sheet on which objects are drawn-, traditional animation is a technique where each frame is drawn by hand. It's also called classical or hand-drawn animation.

A. 2D animation

2D animation occurs when we combine different pictures of different heights and widths together, which creates an illusion of movement in a two-dimensional world without any depth. Now you might ask why we call this 2D animation. That's because width and height are the only two variables and dimensional elements.

There are various ways of breaking down 2D animation styles, but in the most basic way, it all comes down to two subcategories: traditional and modern animation.

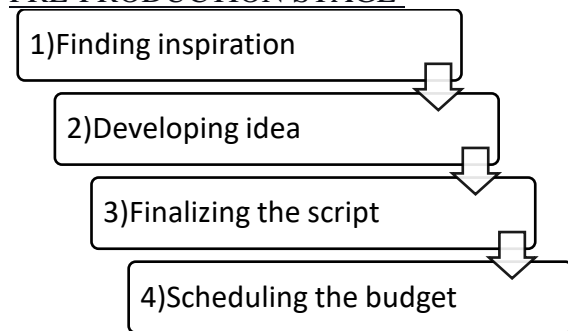
B. Modern animation

Unlike the traditional method, modern 2D animation is all about computers and their ability to take things further when it comes to creating animation. Along with that, different 2D animation software is developed which gives the option of creating characters and backgrounds and animating them together.

2D ANIMATION is made by step by step process:

The THREE major steps are: PRE-PRODUCTION, PRODUCTION AND POST-PRODUCTION

PRE-PRODUCTION STAGE



I. PRODUCTION STAGE

A) Designing

1) Character design:- character design is an important aspect to attract an audience when it comes to ideas everyone contributes every animator takes a pencil and a piece of paper and starts sketching different designs of the character again and again

2) Location designing:- animators have to design the background of the movie even if it's just the bedroom of the main character, a school class, Or a whole village

B) Storyboard:- Storyboards are sketches similar to comic books that follow the action of the script and show how the characters will move in every scene. To plan the storyboard, animators use a bar sheet to organize the scenes. A bar sheet (or exposure sheet) is a table that contains the breakdown of the action, dialogue, and sound of every sequence.

カセット	シーン	内容	セリフ
008		※暗いエンブリオの周りにだけぼっと光っているお尻を出したサリアを抱えて所蔵しているエンブリオ。壁にサリアの小さなモニター出てる	エンブリオ「準備は整った.....が」 ()
		サリアのお尻を叩くサリア (数秒 T.U)	SE「バーン」 サリア「あうっ！」 (3+1)
009		エンブリオ	()
		暫くたしそくに竹刀と見てはるく。	エンブリオ「.....アンジュが居ないとは」 (3+6)
010		サリア お尻を叩いてくっとなる。	サリア「.....」 (4+6)

Storyboard

C) Concept art:- In doing concept art, We develop the style, tone, colour, and overall artistic approach to each and every sequence.

Concept art will not be in any part of the movie, it just helps the animators to get inspired and know how the movie will finally look. Everything has to be designed, from the major characters to the smallest of props. They make thousands and thousands of drawings, paintings, blueprints, sculptures, and models to design everything.



Concept art of MUZAN from DEMON SLAYER

D) Animating :- This is when animation truly begins. All the storyboards and the planning are done, so now it's time to let the animators do the magic. Animators are divided into two groups, the key animators (or main animators) and the inbetweeners.

Key animators :- Every character is assigned to one main animator, usually, the one who designed them, that will draw all the scenes where the mentioned character appears. Key animators draw the frames that have the essential poses of the characters without taking into account the fluidness of the movement.



Key animation

Tweening artists:- The inbetweeners are the animators that receive the mainframes the key animator has created and fill them with more frames to make the movement flow and look real. The average number of frames a second has to contain is 24 f/s.

They have to keep in mind that the characters must do simple human things like breathing and blinking, etc. They have to give them the feeling of having flesh and bones. Tweening is also a difficult process because everything has to look the same, unified.

To see if there are any mistakes in their animation, they put all the drawings together in a videotape called a pencil test. It is a preliminary version of the final animated scene, and sometimes they even add the dialogue to see if the lip-sync is done correctly.

II. POST PRODUCTION

1) Inking and Coloring:- All the animated scenes are taken into the inking department, this is where they used celluloid and outline the drawing into a cel, depending on if they are doing it traditionally or digitally.

2) Background:- The background is the set where the action of each animated sequence takes place.



Background design

3) Visual effects:- visual effects are computerized effects, and these effects are needed some time to animate background characters. Lighting, the speed of movement, and the atmosphere of the scenes are all under visual effects. The animation industry all got the opportunity to show their skills in the field of GAMES AND GRAPHICS.

III. GAME SCIENCE AND GRAPHICS

The first game that was developed to play was BERTIE THE BRAIN

Which was a tic tac toe game, it was played on a 13-foot tall screen, there was no graphics as such just a static screen. Also, a major thing to highlight is that 70% of the information humans get is from vision. Humans process what they see. The first gaming pc was developed in 1950 called NIMROD. The game SPACE WARS was developed on a PDP-1 microcomputer in 1962.

Let's take a look at the Graphical elements of computer games: There are various graphical elements but some of them are considered which are:

- 1) Dimensionality
- 2) Perspective
- 3) Color
- 4) Presentation
- 5) Realism

IV. DIMENSIONALITY

The dimensionality is nothing but the dimension of your game and the view of the game. 2D, and 3D graphics are used to make games

Before 1992 all the games developed were devoid of three-dimensional view only 2d graphics were there.

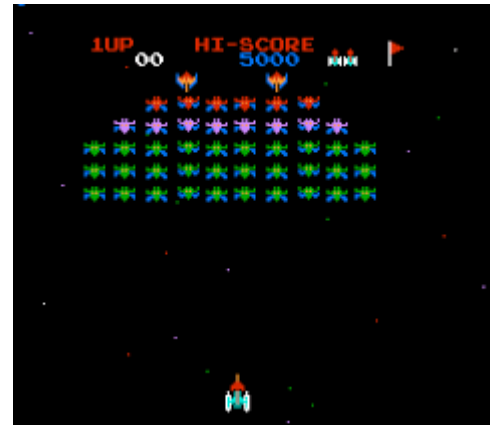
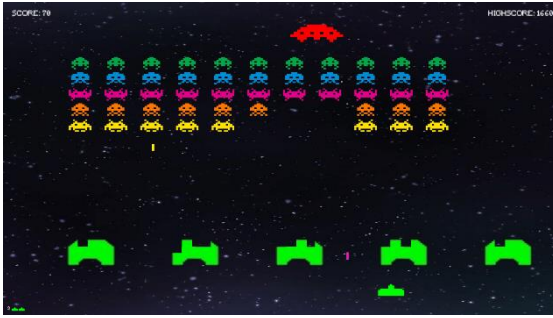
Space wars is an example of a game that had 2d graphics. Later on, 2.5D or pseudo-3D graphics were introduced. This type of graphic was achieved due to PARALLAX SCROLLING.

This technique is nothing but arranging the layers in such a way that the 2d game appears to be in 3d but it is not in 3d.

Eg) Sonic the hedgehog



Sonic the Hedgehog



Paper title

Galaxian game first game with colours

V. PERSPECTIVE

It is actually the positioning of the camera in the games. First or third-person games developed using a 3d engine usually use the accustomed perspective camera, while some genres like strategy and RPG games use an isometric view. Some games use the cartoonish style and it is made like a comic book.



First person game view



Third person view

VI. COLOR

It plays an important role in establishing an environment. It also helps to establish a good mood and convey certain emotions. In 1979 a game named GALAXIAN was introduced and it was the first game that had colors like RGB (RED, GREEN, and BLUE). It also affects the atmosphere of the game.

VII. PRESENTATION

It means how the visuals of the game are utilized. It allows the player to get fully involved in the virtual world's goings-on and become a part of it while they are interacting with it

The assets are modeled in software like Maya or 3ds Max, then if they have animation, they would be animated in the same software.

You can add your good-looking model to the scene (the world/level). In order to see your model, you need to add lights, just like in real life. And you need to add a camera (your player's eyes, or vision). Your camera is what you apply most of your visual effects to, like color saturation, film grain, fade to black, etc.

VIII. REALISM

Realism is defined as whether the game is looking like a real-world or not. The famous example is of the shaders used in Minecraft, and mods used in GTA V game.

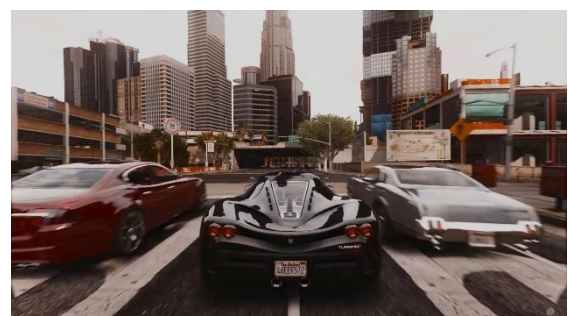
A realistic look is given by the developer also, he designs the way in such a way that it coincides with the real-world behavior of animals, plants, and humans.

There are several aspects that contribute to the perception of realism like realistic sound, realistic character animation, or the believable behavior of objects and characters (which is controlled by the physics engine or the AI engine)

Today's games strive more toward realism. The engine used the sound of ripples, etc.

In 2020 Epic Games launched the UNREAL ENGINE 5. It contained the NANITE feature which allows highly detailed photographic source material

Its actually hard to develop a game of that level but today game engine has made it possible



Gta V with shaders



Minecraft with realistic shaders



Microsoft Flight Simulator

IX. FUTURE OF GAME SCIENCE, GRAPHICS, AND ANIMATION

The future of animation, game science, and graphics is vast. For years VIRTUAL REALITY has been seen as the ultimate future of video games. All games are striving towards total immersion in a digital world. Some developers are planning to make a virtual world where people can live their entire lives, have meetings, etc. Video game streaming is also becoming popular nowadays, cloud gaming is blooming like a flower it's like on any computer u can stream and play the game of your choice. Mark Zuckerberg has thought about creating a metaverse and he started working towards it. Quality animators with a knack for creativity can go for jobs as graphic designing, game developer, 3D models, keyframe animators, etc. Animators can also do freelancing. Recent animation studios UFOTABLE and old one TOEI animation are booming today due to the quality of animation they are producing, the visuals, and the sound design. Nvidia is also trying to level up graphics by using its graphics card, its latest graphics card is RTX 4090 which is costly but very effective. Various jobs are also there in the field of video games. Also, there is a game named Microsoft flight simulator which encompasses all the real-world features including the scenery, time, landscape, roads, sound, etc. this game proves that the future of games is very bright and beautiful.



RTX 4090

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Sixth Sense Technology

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Abstract:-*Sixth Sense Technology refers to a wearable device that enhances the physical world around us with digital information and communication. It serves as an interface between the human and technological worlds. The technology is based on gestural and natural user interfaces, which enable people to interact with digital content through hand gestures, body movements, and voice commands. The device typically consists of a small projector, a camera, and a set of sensors that work together to sense the user's gestures and surroundings. The projector projects digital information onto any surface, and the camera tracks the user's movements, allowing the device to display information in real-time based on the user's context and interaction. The Sixth Sense can recognize objects in the user's environment and display relevant information related to those objects in real time. Sixth Sense Technology offers a new and innovative way of interacting with the world, enabling people to the physical and digital world and gain access to a lot of information and communication in real-time.*

Keywords:-

WUW (Wear your World)- A short name given to the 6th Sense device.

ESP-Extra sensory perception

PDA- Personal Digital Assistant

Gizmo- Additional devices

I. INTRODUCTION

Our five senses—sight, sound, smell, taste, and touch—are used to communicate. But just as the name suggests this technology brings forward an additional sense making it our 6th sense.

A sixth sense is an ESP (extra sensory perception) that envisions a more advanced future without the use of technology like mobile phones, televisions, etc. to link the physical and digital worlds. We can interact with world and use devices simultaneously without any interruption.



He was the one who first used the sixth sense technology, wearing a projector and camera device around his neck. But later on, an Indian men Mr. Pranav Mistry who was a media lab student at that time. He used and implemented the 6th sense device and did some great change to it and name it as “WUW” (Wear your World).

WUW which is a computer-vision based wearable device that helps to interact with the physical world around us with the digital information while using the hand naturally and device will sense gestures of the hand and take it as an input. WUW consists a projector, smart device, camera, colour markers on hand.

II. WHAT IS SIXTH SENSE?

The Sixth Sense is a wearable gesture interface that enables us to engage with the digital information in the physical environment using simple hand gestures. based on the virtual reality idea.

Real world items are combined with the digital world using sixth sense technology. The amazing sixth sense technology is a mixture of many sophisticated technologies. What makes it great is that it brilliantly integrates all of these technologies into one portable and affordable product.

It combines technologies such as hand gesture recognition, image capture, image processing and manipulation, and more. It imposes the digital world on the real world.

Just as the senses allow us to perceive information about the environment in different ways, the senses are also oriented toward information perception. The sixth sense has more to do with understanding information than the senses we can use.

And today, in addition to the physical world from which we receive information, there is also a digital world that has become part of our lives. This digital world is now just as important to us as the physical world. And with the help of the internet, the digital world can be expanded many times over the physical world.

God gave us no reason to interact with the digital world, so we created the digital world: smartphones, tablets, computers, laptops, PDAs, music players, and other devices. These gadgets allow you to communicate with the digital world around you.

However, we cannot directly interact with the digital world because we are human and our physical bodies are not designed for it. For example, press a key to make a call. Enter search text and more.

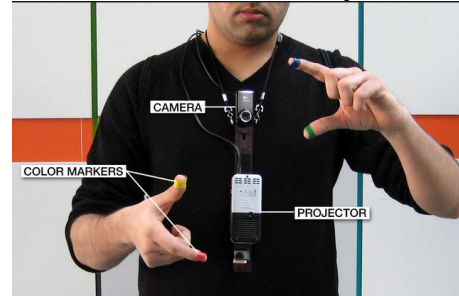
The sixth sense of technology is to interact with the digital world in the most efficient and direct way. Therefore, it would be wrong to conclude that sixth sense technology is one of the gateways between the digital and real worlds. Prior to Wear Ur World (WuW), direct interaction was possible through other methods such as voice recognition software, touch recognition, and so on.

III. CONSTRUCTION AND WORKING

A typical Sixth Sense technology system includes a camera, a small projector, and a mobile device such as a smartphone. The camera captures images of the user's hand gestures, while the projector projects digital information onto physical surfaces. The mobile device processes and stores the digital information and communicates with the camera and projector to control and display the information.

The construction of a Sixth Sense technology system involves integrating hardware and software components. The camera and projector are connected to a microcontroller, which communicates with the mobile device wirelessly.

The microcontroller uses software to interpret the camera input and recognize the user's hand gestures, and sends commands to the projector to display the appropriate digital information. The mobile device handles the processing and storage of the digital information and communicates with the microcontroller to control the system.



The Sixth Sense technology has the potential to revolutionize the way people interact with technology by allowing them to access and manipulate information in real-time using natural hand movements, without relying on traditional input devices such as keyboards, mice, or touchscreens. It could also make it easier to interact with digital information in public spaces, such as while giving a presentation or navigating a museum.

IV. ADVANTAGES

6th sense technology is an innovative approach that enables users to interact with the digital world in a more intuitive and natural way. Some of the advantages of 6th sense technology include:

1. Portability: The 6th sense device is small and wearable, making it highly portable and easy to use on the go.

2. Gesture-based interaction: With 6th sense technology, users can interact with digital devices and content through natural gestures, such as pointing or waving.

3. Real-time data access: 6th sense technology allows users to access real-time data and information on the go, without the need for a traditional computer or smartphone.

4. No physical interface required: Unlike traditional devices, 6th sense technology does not require a physical interface, such as a keyboard or mouse, to interact with digital content.

5. Interactive projection: 6th sense technology can project digital content onto any surface, such as a wall or a table, creating an interactive and immersive experience.

6. Seamless integration: 6th sense technology can seamlessly integrate with other digital devices, such as smartphones, tablets, and computers, allowing for a more connected experience.

7. Enhanced learning: 6th sense technology can be used to enhance learning, by providing users with interactive and immersive learning experiences.

8. Improved healthcare: 6th sense technology can be used in healthcare to improve patient outcomes, by providing doctors and healthcare providers with real-time access to patient data and medical information.

9. Increased productivity: 6th sense technology can help increase productivity, by allowing users to quickly access and interact with information and data in real-time.

10. Cost-effective: 6th sense technology is relatively low-cost, making it accessible to a wider range of users and industries.

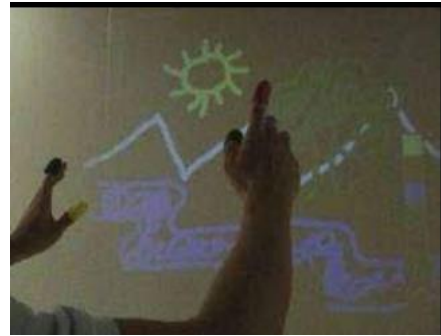
V. APPLICATIONS

Some potential applications for Sixth Sense technology:

1. **Augmented Reality Gaming:** Using Sixth Sense technology to create interactive games that combine the physical and digital worlds, such as games that involve moving and interacting with virtual objects in real space.



2. **Education:** Sixth Sense technology can be used to enhance traditional education methods by providing students with interactive and immersive learning experiences. For example, it can be used to display 3D models of objects, translate foreign languages, or provide additional information on a subject in real-time.



3. **Healthcare:** Sixth Sense technology has the potential to revolutionize healthcare by allowing for more accurate and efficient diagnosis and treatment. It can be used to track vital signs, display patient information in real-time, and provide doctors with access to the latest medical research and diagnostic tools.



4. **Retail:** Sixth Sense technology can be used to provide customers with personalized shopping experiences, by using augmented reality to display product information, reviews, and comparisons. It can also be used to improve inventory management and logistics. By using the fingers the user can capture photos hence, no need to carry an additional gizmo. The box created by the fingers act as frame for capturing photo.
5. **Entertainment:** Sixth Sense technology can be used to create interactive installations and exhibitions that blur the boundaries between the physical and digital worlds.

It can be used to create interactive art installations, music performances, or even immersive theatre experiences.



These are just a few examples of the many potential applications of Sixth Sense technology. As the technology continues to develop, we can expect to see it being used in a wide range of industries and fields. Pranav Mistry said “This prototype needs some serious engineering & programming.

VI. WHY CHOOSE SIXTH SENSE TECHNOLOGY?

People make decisions after receiving information from their senses. However, the information we collect is not enough to make good decisions. However, much of the information to help you make the right decision is available online.

Information can be collected by connecting devices such as computers and mobile phones, but it is limited to the screen and there is no direct interaction between the tangible physical world and the intangible digital world. This sixth sense technology gives us the freedom to interact with the digital world through hand gestures.

This technology has wide applications in artificial intelligence. This methodology can aid in the synthesis of bots that can interact with humans. Several applications were implemented on the Sixth Sense prototype to demonstrate the usefulness, viability and flexibility of the system.

VII. FUTURE ENHANCEMENTS

The concept of Sixth Sense technology has great potential for future enhancements, enabling it to become an even more versatile and capable technology. Some of the possible future improvements and advancements for this technology include:

1. **Improved accuracy:** Currently, Sixth Sense technology relies on computer vision algorithms to recognize hand gestures. Machine learning algorithms can be used to improve gesture recognition accuracy and enable recognition of a wider range of hand gestures.
2. **Expanded functionality:** The scope of Sixth Sense technology could be expanded to include other digital devices beyond smartphones, such as smart home appliances, virtual reality headsets, and autonomous vehicles.
3. **Miniaturization:** The various components of a Sixth Sense system could be reduced in size and

integrated into wearable devices like smartwatches, smart glasses, or even smart clothing.

4. **Haptic feedback:** Incorporating haptic feedback, like vibrations or pressure, could enhance the user's experience by providing physical feedback during interactions with digital information.

5. **Multi-user interaction:** Future enhancements could make it possible for multiple users to interact with the same Sixth Sense technology system at once, enabling collaboration on projects and the sharing of information.

6. **Integration with artificial intelligence:** By integrating Sixth Sense technology with artificial intelligence (AI) systems, it would be possible to provide context-aware information and personalized recommendations based on a user's behaviour and preferences.

Overall, these enhancements and advancements would enable Sixth Sense technology to become an even more sophisticated and pervasive form of human-computer interaction, with a range of potential use cases beyond its current capabilities.

VIII. CONCLUSION

In conclusion, Sixth Sense technology is an exciting concept that has the potential to revolutionize the way we interact with the world around us. It is a wearable gesture interface that enriches the physical world around us with digital information, and allows us to interact with this information using natural hand gestures.

By combining technologies such as hand gesture recognition, image capture, image processing, and more, Sixth Sense technology creates a unique and immersive experience that blends the physical and digital worlds in new and exciting ways. The applications for this technology are numerous, ranging from education and healthcare to entertainment and retail.

While there are still many challenges to be overcome in developing Sixth Sense technology, such as improving accuracy and reducing costs, the potential benefits of this technology are clear. As the technology continues to evolve and improve, we expect to see more and more exciting applications of Sixth Sense technology in the years to come.

ACKNOWLEDGMENT

We would like to express our special gratitude towards our teachers for their guidance and support in completing the project. We would like to express gratitude towards the college to provide the required facilities for the completion of the project. It would have been impossible without the kind support and help of many individuals. I would also like to thank my friends who helped me in finishing

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A Brief Introduction to Cold Fusion

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Abstract— Cold fusion is a proposed type of nuclear reaction that occurs at or near room temperature, in contrast to the high temperatures required for traditional nuclear fusion. Despite initial claims of success in the late 1980s, subsequent experiments were unable to reproduce the results, and cold fusion remains a controversial and largely unproven concept. Nonetheless, researchers continue to explore the phenomenon and its potential applications, which could include a nearly limitless source of clean energy.

Keywords—Excess heat, electrolysis, heavy water, critics

I. INTRODUCTION

Cold fusion is a scientific concept that has generated considerable controversy and interest since its initial announcement in 1989. The idea behind cold fusion is that nuclear fusion reactions, which typically require extreme temperatures and pressures to occur, could potentially take place at or near room temperature. If proven true, this would be a major breakthrough in the field of nuclear energy, offering a nearly limitless source of clean, sustainable power.

The first claims of cold fusion were made by electrochemists Martin Fleischmann and Stanley Pons, who reported observing excess heat and the production of helium in a laboratory experiment involving palladium electrodes immersed in heavy water. The announcement generated enormous media attention and excitement, with some predicting a revolution in energy production.

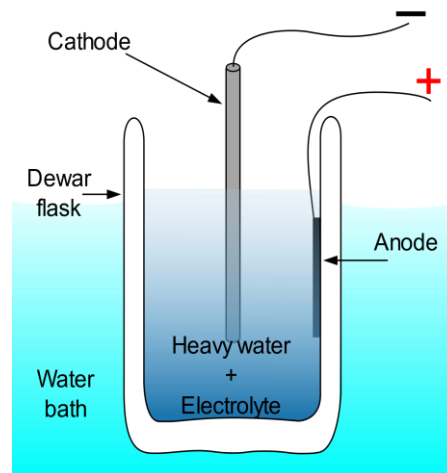
However, subsequent attempts to reproduce the results were largely unsuccessful, and many scientists were unable to find evidence of the phenomenon. The scientific community became divided on the validity of cold fusion, and it has remained a controversial topic ever since.

Despite the challenges in replicating the original results, many researchers have continued to investigate the concept of cold fusion, seeking to understand the underlying physics and to develop new techniques for generating and controlling fusion reactions at low temperatures. This research has potential implications not only for energy production but also for fields such as nuclear physics, materials science, and solid-state chemistry.

II. FLEISHMANN-PONS EXPERIMENT

Martin Fleischmann of the University of Southampton and Stanley Pons of the University of Utah hypothesized that the high compression ratio and mobility of deuterium that could be achieved within palladium metal using electrolysis might result in nuclear fusion to investigate, they conducted electrolysis experiments using a palladium cathode and heavy water within a calorimeter, an insulated vessel designed to measure process heat. Current was applied continuously for

many weeks, with the heavy water being renewed at intervals. Some deuterium was thought to be accumulating within the cathode, but most was allowed to bubble out of the cell, joining oxygen produced at the anode. For most of the time, the power input to the cell was equal to the calculated power leaving the cell within measurement accuracy, and the cell temperature was stable at around 30 °C. But then, at some point (in some of the experiments), the temperature rose suddenly to about 50 °C without changes in the input power.



These high temperature phases would last for two days or more and would repeat several times in any given experiment once they had occurred. The calculated power leaving the cell was significantly higher than the input power during these high temperature phases. Eventually the high temperature phases would no longer occur within a particular cell.

Result Of Experiment

In 1989, Fleischmann and Pons reported that they had observed excess heat production and the presence of nuclear reaction by-products such as tritium and helium-4, which they attributed to nuclear fusion occurring within the palladium cathode. However, their findings were met with skepticism and controversy, as other researchers were unable to reproduce their results.

Subsequent investigations and studies over the years have produced mixed results, with some researchers reporting evidence of anomalous heat and nuclear reaction products similar to those reported by Fleischmann and Pons, while others have not been able to replicate their results. As a result, the scientific community remains divided on the question of whether cold fusion is a valid phenomenon.

To date, there is no widely accepted report that definitively confirms or refutes the findings of the Fleischmann-Pons experiment.

III. CRITICISM

The Fleischmann-Pons experiment, also known as the "cold fusion" experiment, has been the subject of significant criticism and controversy. Some of the main criticisms include:

Excess heat and energy production

An excess heat observation is based on an energy balance. Various sources of energy input and output are continuously measured. Under normal conditions, the energy input can be matched to the energy output to within experimental error. In experiments such as those run by Fleischmann and Pons, an electrolysis cell operating steadily at one temperature transitions to operating at a higher temperature with no increase in applied current. If the higher temperatures were real, and not an experimental artifact, the energy balance would show an unaccounted term. In the Fleischmann and Pons experiments, the rate of inferred excess heat generation was in the range of 10–20% of total input, though this could not be reliably replicated by most researchers. Researcher Nathan Lewis discovered that the excess heat in Fleischmann and Pons's original paper was not measured, but estimated from measurements that didn't have any excess heat.

Unable to produce excess heat or neutrons, and with positive experiments being plagued by errors and giving disparate results, most researchers declared that heat production was not a real effect and ceased working on the experiments. In 1993, after their original report, Fleischmann reported "heat-after-death" experiments where excess heat was measured after the electric current supplied to the electrolytic cell was turned off. This type of report has also become part of subsequent cold fusion claims.

Setup of Experiment

Cold fusion setups utilize an input power source (to ostensibly provide activation energy), a platinum group electrode, a deuterium or hydrogen source, a calorimeter, and, at times, detectors to look for by-products such as helium or neutrons. Critics have variously taken issue with each of these aspects and have asserted that there has not yet been a consistent reproduction of claimed cold fusion results in either energy output or by-products. Some cold fusion researchers who claim that they can consistently measure an excess heat effect have argued that the apparent lack of reproducibility might be attributable to a lack of quality control in the electrode metal or the amount of hydrogen or deuterium loaded in the system. Critics have further taken issue with what they describe as mistakes or errors of interpretation that cold fusion researchers have made in calorimetry analyses and energy budgets.

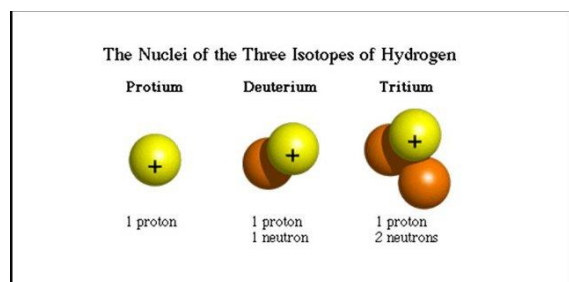


Fig.2: Hydrogen isotopes Protium, Deuterium, and Tritium.

Protium H is the familiar hydrogen found in water; in seawater, 1 out of every 6400 hydrogen atoms is deuterium.

Misinterpretation of data

Some research groups initially reported that they had replicated the Fleischmann and Pons results but later retracted their reports and offered an alternative explanation for their original positive results. A group at Georgia Tech found problems with their neutron detector, and Texas A&M discovered bad wiring in their thermometers. These retractions, combined with negative results from some famous laboratories, led most scientists to conclude, as early as 1989, that no positive result should be attributed to cold fusion.

Reproducibility

In 1989, after Fleischmann and Pons had made their claims, many research groups tried to reproduce the Fleischmann-Pons experiment, without success. A few other research groups, however, reported successful reproductions of cold fusion during this time. In July 1989, an Indian group from the Bhabha Atomic Research Centre (P. K. Iyengar and M. Srinivasan) and in October 1989, John Bockris' group from Texas A&M University reported on the creation of tritium. In December 1990, Professor Richard Oriana of the University of Minnesota reported excess heat.

Groups that did report successes found that some of their cells were producing the effect, while other cells that were built exactly the same and used the same materials were not producing the effect. Researchers that continued to work on the topic have claimed that over the years many successful replications have been made, but still have problems getting reliable replications. Reproducibility is one of the main principles of the scientific method, and its lack led most physicists to believe that the few positive reports could be attributed to experimental error. The DOE 2004 report said among its conclusions and recommendations:

"Ordinarily, new scientific discoveries are claimed to be consistent and reproducible; as a result, if the experiments are not complicated, the discovery can usually be confirmed or disproved in a few months. The claims of cold fusion, however, are unusual in that even the strongest proponents of cold fusion assert that the experiments, for unknown reasons, are not consistent and reproducible at the present time. (...) Internal inconsistencies and lack of predictability and reproducibility remain serious concerns. (...) The Panel recommends that the cold fusion research efforts in the area of heat production focus primarily on confirming or disproving reports of excess heat."

IV. CONCLUSION

The concept of cold fusion, which involves achieving nuclear fusion at room temperature, remains a subject of ongoing research and debate in the scientific community. Despite the initial excitement surrounding the Fleischmann-Pons experiment in 1989, subsequent studies have yielded mixed results, with some researchers reporting evidence of anomalous heat and nuclear reaction products, while others have been unable to replicate these findings.

There are still many questions about the feasibility of cold fusion as a means of producing energy, including the technical challenges of achieving and controlling the fusion process, and the potential risks and environmental impact of using nuclear technology for energy production. Additionally, the lack of reproducibility and scientific consensus on the validity of cold fusion as a phenomenon has made it a controversial topic in the scientific community.

V. ACKNOWLEDGMENT

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Hyperventilation Wrist-Band

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Abstract: Hyperventilation is a Medical Condition of Rapid & Deep Breathing. It is Not a Disease but Rather a Symptom For Another Condition like Lung Diseases, Diabetes or the Result of Emotional Distress caused by Fear, Panic or Stress. People Suffering From Hyperventilation can have Psychological Issues as Well as Panic Attacks. Therefore, as to Provide the Patient with Help to Counter these Attacks by Himself with the Help of Artificial Intelligence We Propose a Revolutionary Service based Product that Not only Keeps Track of the Patient's Health & Safety, but Also Provides a Calculated Response & Alarm System that Takes Necessary Actions in a Medical Situation. This System Aims to Provide Personal Medical Attention & Better & Quicker Reaction Mechanism to Prevent Major Mishaps. This Product System Works with Medical Disciplines by Using Machine Learning Algorithms.

Keywords: Hyperventilation, Health & Safety Tracking, Medical Reaction Mechanism, Machine Learning Algorithms

1. INTRODUCTION

Hyperventilation is a condition in which a person breathes rapidly and deeply, leading to a decrease in the amount of carbon dioxide in the blood. Hyperventilation can be caused by a variety of factors, including anxiety, panic attacks, high altitudes, fever, asthma, and certain medications. According to Richard E. Brashear, it is also common in people with chronic obstructive pulmonary disease (COPD) and other lung conditions^[1]. This can cause a range of symptoms, including light-headedness, dizziness, tingling sensations in the hands and feet, and even fainting. Anticipating these symptoms in advance would greatly facilitate the acquisition of critical information by doctors for the purpose of diagnosing and treating patients. This can be Done with the Help of Machine Learning. **Machine learning Algorithms** can play an important role in anticipating and predicting hyperventilation symptoms, especially in high-risk patients.

C language is a popular programming language known for its speed, efficiency, and low-level memory access. It has several applications in the field of medicine, including the development of medical equipment, data analysis, signal processing, and simulation of biological systems. Its low-level memory access makes it suitable for developing operating systems and embedded systems used in medical devices. Sir P. Bankhead illustrate how C programming applied in healthcare, notably in identifying Symptoms, can deliver better and more refined patient outcomes using scalable and dynamic applications^[2]. C language coding libraries like OpenCV and ImageMagick are used in image processing and computer vision applications in healthcare. The Hyperventilation Wrist Band is also Based on Machine Learning Algorithms Made Using C-Language.

This Product is to be Used by Patients Suffering From Intermittent Anxiety Attacks. The Application System within the Band will Keep Track of the Medical Data of the Patient like Heart-Rate, Breathing, Blood- Pressure, etc. & Will Update this Data to The Main Hospital System. On a Regular Basis. Also the Application Will Always be Connected to the Main System As to Provide the Necessary Reaction Mechanism for a Medical Emergency which Consists of AI Generated Voice Commands, Automatic Notifying & Live Updates to the Main System, Live Call-Connect to a Medical Professional & a AI Controlled Morphine Injector For Worst Case Scenario in the Future Scope. Main Objective of the Product is to Provide a Better & Quicker Response to a Medical Emergency to Avoid Any Medical Calamities.

2. DESIGN

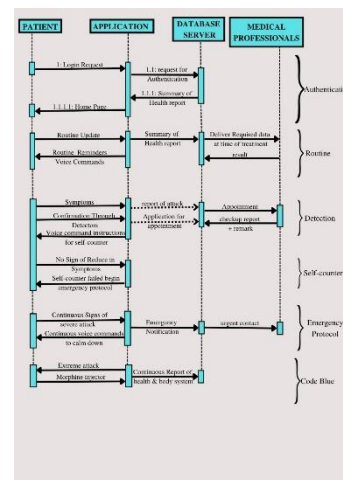


Fig.: Sequence Diagram for Application Architecture

2.1. The Application Architecture

The **Hyperventilation Wrist Band** is designed similarly to smart-watches or fit-bands, has an artificial intelligent system powered by machine learning algorithms using C-language. With real-time data analysis and pattern identification, the wristband provides a general sense of a patient's health. The wristband is connected to the main database through a wireless network, where it stores all its inputs. This allows patients to be connected with the main system, which in turn connects them with doctors and medical professionals working in the hospital. The wristband is interactive and can be controlled through voice commands and calls, making it an efficient and easy-to-use system for patients and medical professionals alike.

It Consists of Variety of Sensors For Taking Data Inputs from the Patient like **Photoplethysmographic Sensor**^[3] based on Photoplethysmography (PPG) which is a non-invasive technique that is commonly used in medical and fitness monitoring devices such as pulse oximeters, smart watches, and fitness trackers to measure blood volume changes in tissues. It works by shining a light onto the skin and measuring the amount of light that is absorbed by the underlying blood vessels. It can also be used to measure a variety of physiological parameters, including heart rate, blood oxygen saturation (SpO₂), and respiratory rate. It is a simple and non-invasive method that provides continuous monitoring of these parameters, making it a valuable tool in Detection of Hyperventilation.

The Band Also has a **Muscle Spasm Detection**^[4] System. According to a Japanese Case Study Conducted by Shutaro Nakaaki, Muscle spasms in the wrist are involuntary contractions of the muscles that control movement of the wrist and fingers. Symptoms of muscle spasms in the wrist may include sudden contractions of the muscles, pain, weakness, and difficulty moving the wrist and fingers. The spasms may be brief and intermittent, or they may persist for extended periods of time. This is Another Prime Symptom of Hyperventilation Attacks.

Thermographic Sensors^[5] are also one of the Important Sensors Present in the Wrist-Band According to Dr. Seung Jun Ryu, When a person experiences a sudden rush of adrenaline, their blood vessels constrict, reducing blood flow to the skin and causing the skin temperature to drop in the affected areas. Conversely, when a person is anxious or stressed, their blood vessels may dilate, increasing blood flow to the skin and causing the skin temperature to rise in the affected areas. Hence Thermographic Sensors Can Detect a Spike in Adrenaline Secretion which is Observed During Panic Attacks.

2.2. Detection & Working System

The Hyperventilation Wrist Band has Two Artificial Intelligence Based Working Systems which are Routine System & Reaction Mechanism.

System 1: Routine

The first system is a **Routine system** that is always active and

keeps track of the patient's regular health readings. These include heart rate, blood pressure, breathing rate, and physical activity, and they are updated to the main server. The system is AI-generated and features voice alarms for regular medical activities like, **"Sir, It's Time to Take Your Afternoon Medicine."** Or **"Congratulations! You've Completed Your Daily Quota of 2000 Steps"**. The goal of this system is to **familiarize** the patient with the voice and the system in general, so they are comfortable with its use. The system stores a general dataset of regular health readings,

allowing it to take action in the future based on these readings. The patient's regular health readings are analyzed by the system to detect any potential issues or changes, and alerts are sent to medical professionals when necessary. Additionally, the system provides the patient with **real-time feedback** on their health, including tips and recommendations for improvement. This system is an essential part of the overall healthcare solution, providing patients with regular monitoring and support, and enabling medical professionals to detect and address **potential health issues** before they become serious problems.

The Second System is Called as Reaction Mechanism which is as Follows:

System 2: Reaction Mechanism

Part 1: Detection

- The Second System is Not Always Live, But it Turns On By Detecting the Symptoms of a Coming **Panic Attack**.
- The frequency of hyperventilation panic attacks can vary greatly from person to person. Some individuals may experience them only once or twice in their lifetime, while others may experience them frequently, even several times a day.
- These Attacks can Cause Great **Mental Strain**, Psychological & Medical Stress on a Patient.
- But These Attacks Can be Predicted Just Seconds Before.. But No Medical System is Capable Enough to Give Personal Attention to Every Patient.. Hence the Only Option that Can Detect & Provide Necessary Action On Time is Artificial Intelligence.
- The System Detects the Following Symptoms:
 - Sudden Increase in Breathing Rate
 - Increase in Heart Rate & High Variance in Blood-Pressure
 - Muscle Spasms in the Wrists
 - High Spike in Adrenaline Secretion
- After Enough Rectification of the Symptoms the Second System then is Turned on Live.

Part 2 : Counter by Patient - using AI Voice Commands

- System Starts Artificially Generated **Voice Commands** To Try to Calm the Patient Down. These Commands generally provide the Manual Procedure of Counter an Attack like:
 - "Your Blood Procedure & Breathing Rate has Increased. You are Experiencing a Panic Attack.. Please Calm Down & Try to Get a Control on Your Breathing."
- The Regular Interactions with the AI System Using Voice Commands Makes Patients Familiar with the Voice.. And the Voice Attempts to Provide an Psychological Support & Procedure to Proceed in a Panic Situation for the objective to Calm Down the Patient & Gain Control Over his Breathing & Counter this Attack by Himself.
- If the Patient Successfully Manages to Calm Down. The System then Creates a Report Consisting of the Summary of Attack & Patient's Health Details Before & Now & Submits

it to the Database & Notifies the Medical Professionals Within the Hospitals for an Appointment.

Part 3 : Emergency Protocol

Medical Professionals Nearby For Immediate Rush-in & Treatment of the Patient.

- If the Patient is unable to Calm themselves Down & is Showing Continuous Signs of Severe Attack, The System Runs an **Emergency Protocol**.

The Protocol will First Give an **Immediate Notification** to the Main Server which is Connected by Part 4 : Code Blue

- 'Code Blue' is an Emergency Term used in Hospitals to Indicate a patient is in a **Severe Medical Emergency** and requires Immediate Medical Attention.
- In Such Situations, SSRI Injector is Commanded Remotely by Medical Surveillance System Can be used to Calm Down a Severe Attack.
- SSRIs, or **Selective Serotonin Reuptake Inhibitors**^[6], are a class of Antidepressant Medications that work by increasing the levels of the neurotransmitter serotonin in the brain. Serotonin is a chemical messenger that helps to regulate mood, appetite, and sleep, among other functions. By blocking the reuptake of serotonin, SSRIs can help to alleviate symptoms of depression, anxiety.
- The Wrist Band is Provided with a Injector in the Volar Wrist Region. When Triggered is Carefully injected into the Arteries.
- This is Only & Only Used as a **Last Preference** As These Are Some Serious Medical Situations & are Need to be Dealt with only By Medical Experts.

2.3. Addressing the Emerging Challenges

Artificial intelligence (AI) is becoming increasingly important in healthcare as it has the potential to improve patient outcomes, reduce costs, and streamline operations. However, the use of AI in healthcare also presents some challenges. One of the primary challenges is ensuring the accuracy and efficiency of AI algorithms. AI can get stuck in some **Boundary Cases**, which can cause fluctuations within the programs. In addition, AI works on a prediction basis from the analysis of previous data, but sometimes it can misinterpret the situation or command, leading to inaccurate decision-making.

Another challenge is the Variation in the Analysis of AI from patient to patient, leading to slight variances in **decision-making** efficiency. This variation can be attributed to differences in patients' characteristics or the quality of the data used for analysis. Furthermore, the use of AI in healthcare is often limited to narrow spectrum objectives. While this allows AI to excel in its area of focus, it can also result in monotony and a lack of adaptability to changing circumstances.

3. ADVANTAGES

The hyperventilation wristband is a **revolutionary medical device** that aims to provide personalized attention to patients suffering from hyperventilation. Hyperventilation is not a disease, but rather a symptom of many serious medical conditions, including lung diseases, diabetic ketoacidosis, and emotional distress and anxiety. Successfully countering these attacks can increase the morale of patients, which has a direct relation with the secretion of dopamine, a neurotransmitter in our body, alongside the secretion of serotonin, which performs various functions involving the **relaxation of the mind**.

The wristband provides interactive and continuous updates to the patient regarding their health, with the aid of artificial intelligence. The ability of the wristband to conduct a remote procedure under medical supervision is a leap of medical science using AI technology. The wristband is adaptable according to the patient's needs and **budget-conscious**, productive, and healthy without misusing valuable resources.

Overall, the hyperventilation wristband aims to provide a personalized and revolutionary medical service experience with a whole new level of positive approach, pleasing each and every

patient. With the wristband, patients can relax their minds, while receiving continuous updates and personalized attention, making it an essential device for healthcare professionals to effectively treat patients suffering from hyperventilation.

. FURTHER WORK AND FUTURE SCOPE

AI-powered medical applications have been playing a critical role in healthcare in recent years, and their potential for the future is immense. In particular, the use of wearable bands in hospitals can greatly enhance medical services and provide a more systematic approach to patient care. These bands can track vital signs continuously and send alerts to healthcare providers in case of any anomalies. This can greatly reduce the risk of medical errors and help medical professionals make better-informed decisions, leading to improved patient outcomes.

The development of these wearable bands for remote applications can have a tremendous impact on healthcare. Patients with less severe symptoms can use the product outside of the hospital, enabling continuous monitoring of their vital signs in real-time. This technology can lead to early detection and intervention, which can prevent the development of more severe health issues. Remote monitoring can also help reduce the burden on hospitals and healthcare providers by preventing unnecessary hospitalizations and enabling patients to manage their conditions from the comfort of their homes.

The potential for wearable bands in healthcare extends beyond the narrow scope of hyperventilation. The use of machine learning algorithms can further improve the accuracy and efficiency of these applications, leading to better-informed diagnoses and treatment options. Machine learning algorithms can analyze vast amounts of patient data, enabling healthcare providers to identify patterns and correlations that might not be visible to the human eye. This can lead to improved precision medicine and personalized treatment options for patients.

The overall impact of wearable bands on the country's health system is highly positive. This technology can greatly improve the quality of medical services while reducing costs and improving patient outcomes. In addition, the use of these wearable bands can help democratize access to healthcare by enabling patients to monitor their health outside of the hospital, irrespective of their location or socioeconomic status.

4. CONCLUSION

Hyperventilation Wristband Application will drastically change the face of the Medical Service System as the Patients will be Provided with AI Support & Surveillance Through Which they Can Counter over Hyperventilation to Avoid Any Medical Complications In Future which would promote a better standard of living. The future of wearable bands in healthcare is highly promising. With further research and development, this technology can revolutionize the way medical services are delivered, leading to improved patient outcomes and reduced healthcare costs. As such, the scope for future work in the field of medical technology is vast and highly promising. We Hope it can Inspire More Research Works on AI in Medical Systems.

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Impact of Social Media on Current Generation

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Abstract—This research examined the relations of social media addiction to college students’ mental health and academic performance, researched the role of self-esteem as a mediator for the relations, and further tested the effectiveness of an intervention in lowering social media addiction and its adverse outcomes. In Study 1, we used a survey method with a sample of college students (N = 232) and found that social media addiction was negatively associated with the student’s mental health and academic performance and that the relation between social media addiction and mental health was regulated by self-esteem. In Study 2, we developed and tested a two-stage self-help intervention program. We chose a sample of college students (N = 38) who met criteria for social media addiction to receive the intervention. Results reflected that the intervention was effective in reducing the student’s social media addiction and improving their mental health and academic efficiency. The current studies showed original findings that contribute to the empirical database on social media addiction and that have important theoretical and practical implications.

Keywords—Social media addiction; mental health; academic performance; self-esteem; intervention

I. INTRODUCTION

Human beings have fundamental needs to fulfill and to relate, for which interpersonal communication is the key [1]. In recent years, with the development of information technology, generally with the rapid proliferation of Internet-based social media (e.g., Facebook, WeChat, or Instagram), the methods of interpersonal communication have adversely changed (Smith & Anderson, 2018; Stone, & Wang, 2018) [2]. The ubiquitous social media platforms and the easy access to the Internet bring about the potential for social media addiction, namely, the irrational and more use of social media to the extent that it interferes with other aspects of everyday life [3]. Social media addiction has been found to be related with a host of emotional, relational, health, and performance problems. Understanding the causes, consequences, and remedies of social media addiction is thus of paramount importance. In the recent research, we examined the relations of social media addiction to college students; mental health and academic performance and the role of self-esteem as a mediator for the relations. We further tested the effectiveness of an intervention in reducing social media addiction and its potential drastic outcomes

II. RESULT AND DISCUSSION

SOCIAL MEDIA USE BY TWEENS AND TEENS:
Engaging in various forms of social media is a routine activity that research has shown to benefit children and

adolescents by enhancing communication, social connection, and even technical skills.¹ Social media sites such as Facebook and Myspace offer multiple daily opportunities for connecting with friends, classmates, and people with shared interests. During the last 5 years, the number of preadolescents and adolescents using such sites has increased dramatically. According to a recent poll, 22% of teenagers log on to their favorite social media site more than 10 times a day, and more than half of adolescents log on to a social media site more than once a day.² Seventy-five percent of teenagers now own cellphones, and 25% use them for social media, 54% use them for texting, and 24% use them for instant messaging.³ Thus, a large part of this generation’s social and emotional development is occurring while on the Internet and on cellphones. Because of their limited capacity for self-regulation and susceptibility to peer pressure, children and adolescents are at some risk as they navigate and experiment with social media. Recent research indicates that there are frequent online expressions of offline behaviors, such as bullying, clique-forming, and sexual experimentation,^[4] that have introduced problems such as cyber bullying,^[5] privacy issues, and “sexting.”^[6] Other problems that merit awareness include Internet addiction and concurrent sleep deprivation.^[7] Many parents today use technology incredibly well and feel comfortable and capable with the programs and online venues that their children and adolescents are using. Nevertheless, some parents may find it difficult to relate to their digitally savvy youngsters online for several reasons. Such parents may lack a basic understanding of these new forms of socialization, which are integral to their children’s lives. They frequently do not have the technical abilities or time needed to keep pace with their children in the ever-changing Internet landscape.^[8] In addition, these parents often lack a basic understanding that kids’ online lives are an extension of their offline lives. The end result is often acknowledged and technical skill gap between parents and youth, which creates a disconnect in how these parents and youth participate in online world together.

BENEFITS OF CHILDREN AND ADOLESCENTS USING SOCIAL MEDIA:

Social media sites allow teens to complete online many of the tasks that are necessary to them offline: staying connected with friends and family, making new friends, sharing pictures, and sharing ideas. Social media participation also can give adolescents deeper benefits that extend into their self, community, and the world ^[9]

SOCIALISATION AND COMMUNICATION:

1. Freedom for community engagement through

raising money for charity and volunteering for events, including political and philanthropic events [10]

2. Enhancement of individual and group creativity through development and sharing of artistic and musical endeavors;
3. Growth of ideas from the writing of blogs, making podcasts, making videos, and gaming sites;
4. Expansion of one's online connections through shared interest to include others from many diverse backgrounds (such communication is an important step for all adolescents and affords the opportunity for respect, tolerance, and increased discourse about personal and global issues); and
5. Fostering of someone's individual identity and unique social skills.

ENHANCED LEARNING OPPORTUNITIES:

Middle and high school students are using social media to be in contact with one another on homework and school projects [11]. For example, What Sapp and other same social media programs allow students to gather outside of class and chances to collaborate and share ideas about projects. Some institutes successfully use blogs as teaching, which has the benefit of skills in English, written expression, and creativity in students.

RISKS OF YOUTH USING SOCIAL MEDIA:

Using social media becomes a disadvantage to adolescents more often than most adults realize. Most risks fall into the following categories: peer-to-peer; false content; lack of knowledge of online privacy issues; and influences of third-party advertising groups [12].

CYBERBULLING AND ONLINE HARRASMENT:

Cyberbullying is deliberately using digital media to communicate wrong, embarrassing, or contrary information about another person. It is the most common online risk for all teens and is a peer-to-peer risk. Although "online harassment" is often used with the term "cyber bullying," it is actually, a different entity. Current information suggest that online harassment is not as common as offline harassment, and participation in social networking sites does not put most children at risk of online harassment. On the other hand, cyberbullying is quite common, can occur to any teen or young person online, and can cause psychosocial outcomes including depression, anxiety, severe isolation, and, suicide [13]

SEXTING:

Sexting can be defined as "sending, receiving, or forwarding sexually explicit messages, photographs, or images via cell phone, computer, or other digital devices. "Many of these images become distributed rapidly via cellphones or the Internet. This phenomenon does occur among the teen population; a recent survey revealed that 20% of teens have sent or posted nude or seminude photographs or videos of themselves. Some teens who have engaged in sexting have been threatened or charged with felony child pornography charges, although some states have started characterizing such behaviors as juvenile-law

misdeemeanors.² Additional consequences include school suspension for perpetrators and emotional distress with accompanying mental health conditions for victims. In many circumstances, however, the sexting incident is not shared beyond a small peer group or a couple and is not found to be distressing at all [14]

FACEBOOK DEPRESSION:

Researchers have proposed a new phenomenon called "Facebook depression," defined as depression that develops when preteens and teens spend a great deal of time on social media sites, such as Facebook, and then begin to exhibit classic symptoms of depression.²²⁻²⁷ Acceptance by and contact with peers is an important element of adolescent life. The intensity of the online world is thought to be a factor that may trigger depression in some adolescents. As with offline depression, preadolescents and adolescents who suffer from Facebook depression are at risk for social isolation and sometimes turn to risky Internet sites and blogs for "help" that may promote substance abuse, unsafe sexual practices, or aggressive or self-destructive behaviors [15]

PRIVACY CONCERNS AND THE DIGITAL FOOTPRINT:

The main risk to teens and adolescents online today is risks from each other, risks of not using technology properly, lack of privacy, sharing too much information, or posting false information about themselves or others. These types of behavior put their private information at-risk. When Internet users visit various Web sites, they can leave behind trails of which sites they have visited. This collective, ongoing record of one's Web activity is called the "digital footprint." One of the biggest threats to young people on social media sites is to their digital footprint. Teens and adolescents who lack an awareness of privacy issues often post inappropriate messages, photos, and videos without understanding that "what goes online stays online." As a result, future jobs and college acceptance may be put into jeopardy by inexperienced and rash clicks of the mouse. Indiscriminate Internet activity also can make children and teenagers easier for fraudsters to target [16]

INFLUENCE OF ADVERTISEMENTS ON BUYING:

Many social media sites display multiple advertisements such as banner ads, behavior ads (ads that target people on the basis of their Web-browsing behavior), and demographic-based ads (ads that target people on the basis of a specific factor such as age, gender, education, marital status, etc.) that influence not only the buying tendencies of teens and adolescents but also their views of what is normal. It is necessary for parents to be aware of the behavioral ads, because they are common on social media sites and operate by gathering information on the person using a site and then targeting that person's profile to influence purchasing decisions. Such powerful influences start as soon as children begin to go online. Many online platforms are now prohibiting ads on sites where children and adolescents are participating. It is important to aware parents, children, and adolescents about this practice so that children can develop into media-literate consumers and understand how advertisements can easily trap them [17].

III. CONCLUSION

Social interaction brings entertainment for everyone

irrespective of their age, gender, caste, and colour. It makes globalization a reality but the threats should be checked. Social media clearly portrays both positive and negative effects on everyone. It is the decision of an individual to decide what to inculcate from it. Hence, it can be said that social media is a blessing to humanity if used wisely and also a weapon of destruction if misuse.

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Toxic Effects of Drugs on Brain

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Abstract—Adolescence is a very crucial stage of the human development. Many essential changes take place, both physically and mentally. Adolescents are more vulnerable in falling prey to substance use compared to adulthood. Substance use at this stage can affect the brain development in many ways which can lead to several other disorders. Some of these disorders may not prevail at earlier stage, but on prolonged use, they can become harmful. Some of the disorders tend to become long term, while some of them reverse on practicing abstinence. Substances like alcohol, marijuana and cannabis can affect the neural development of the gray and white matter, which are important for the developing brain. This paper aims at the review of few research papers to analyze the toxic effects of drugs on brain.

I. INTRODUCTION

A substance which can chemically cause changes in the functioning of the human body, be it physically or mentally is known as a drug. Drugs can be categorized into two categories, pharmaceutical drugs and psychoactive drugs. Pharmaceutical drugs are mostly administered to treat and cure diseases by creating a biological effect. These drugs were earlier obtained traditionally from medicinal plants, but now modern technology has made it possible to create them using organic synthesis. Psychoactive drugs can be classified as the types of drugs which can affect the psychological functioning and processing of the human body. This type of drug creates changes in the Central Nervous System also known as CNS causing alteration in the perception, moods and consciousness. Psychoactive drugs are classified into various types such as stimulants, depressants, anti-depressants, anxiolytics, antipsychotics and hallucinogens. Drugs can be consumed in a variety of ways such as, inhalation, ingestion, smoking, injection, absorption, and dissolution into the tongue.^[1]

Research shows that about 14.6% of the population of India in the age group 10-75 years consumes alcohol, which is also considered as a drug. It is also seen that 2.83% of that population consumes cannabis and 2.1% consumes opioids. It is estimated that about 1.48 crore teenagers in the age group of 10-17 years are the victims of drug abuse and about 27.71 crore people in the age group of 18-75 years consume the drugs.^[2]

Usage of drugs for a prolonged time can cause addiction to the substance which in turn can affect behavioural and physiological changes in the body. It has been scientifically proven that the addictive behaviour due to prolonged use is because of the key neurobiological connection it shares with the brain. It has been observed that there is an intense involvement of brain pathways of reward and reinforcement that affects motivation, which also includes the neurotransmitter dopamine, which is an essential neurological hormone. But it can be noted that the changes can be reversed after the consumption of the substance is stopped.^[3]

Exposure to drugs and addictive behaviour towards them during adolescence can be caused by various factors which include peer influence as well as risk taking behaviour. Family disputes and parental rejection can also lead to consumption of drugs. Poor academic performance can also lead to taking up drugs as stress relievers. Insufficient parental monitoring and sometimes usage of drugs by parents can cause the young ones to take up the usage of drugs. Addiction to drugs can also be caused by daily usage of medicine which contains small amounts of psychoactive drugs.^{[2][3]}

Sl.	Name of the substance	Prevalence of use w.r.t. survey 2018
		Age Group 10-75 years
1.	Alcohol	14.6%
2.	Cannabis	2.83%
3.	Opiates/ Opioids	2.1%

Sl.	Name of the Substance	Estimated no. of users (age 10-17 years)	Estimated no. of users (age 18-75 years)
1.	Alcohol	30,00,000	15,01,16,000
2.	Cannabis	20,00,000	2,90,18,000
3.	Opioids	40,00,000	1,86,44,000
4.	Sedatives	20,00,000	1,05,80,000
5.	Inhalants	30,00,000	51,25,000
6.	Cocaine	2,00,000	9,40,000
7.	Amphetamines Type Stimulants (ATS)	4,00,000	15,47,000
8.	Hallucinogens	2,00,000	11,01,000

II. EFFECTS OF DRUGS ON BRAINS

The adolescence stage is a crucial developmental stage as there is significant neurological development and the use of substances and drugs like alcohol and marijuana at this stage is quite dangerous and alarming. Even though the overall brain volume does not change at this stage, there are large number of changes in the volume of the gray and white matter regions of the brain. During the adolescence stage and the early adulthood stages, there is a decrease in the amount of the gray matter which is presumed to be happening because of synaptic pruning, change in the extracellular matrix and encroachment on the gray matter by the white matter. Opposite to the decrease of the gray matter, the white matter increases linearly at this stage. The respective decrease and increase of the gray and white matters are connected to better information processing which is essential for the complex cognitive abilities. Also, there is an imbalance in the development of the brain, because the prefrontal and cognitive control areas mature after the mesolimbic and reward systems. These difference in the non-linear development of the two neural systems causes adolescents to tend towards usage of alcohols and drugs. There are high chances the brain might get affected due to the potential effects of alcohols and drugs at this essential stage.^[4]

During the adolescence, many cognitive factors and neural features can cause the youth to get exposure to substantial drugs like alcohol and marijuana. Inhibition, a type of functioning or ability to resist a pre-potent response which can result in a more stable and goal-directed response, can become a key cognitive feature which can help in regulating substance use. A study done to examine the neuro-cognitive functioning in 175 substance-naïve 12-14 year old adolescents. They were monitored and checked for substance use each year until they turned 18 years. It was observed that 105 of them took up the use of alcohol and marijuana. It can be noted that the youths in this test were, on average from upper-middle class families in wealthy neighbourhoods and the findings can be more prominent in the youths who can have higher environmental and genetic risk factors, including disorders like depression and ADHD.^[4]

Educational progress is one of the most crucial task of the adolescence. But the use of alcohols and drugs in 12-14 year olds predict that educational progress gets lower at later stages. In a study of 234 healthy adolescents, it was observed that over the course of 4 years, those detected with intense alcohol and marijuana use showed deteriorated verbal memory, psychomotor speed and visuospatial functioning compared to the non-consumers. The same was observed in a long study done on youth of 16 years of age. It was observed that on reaching early adulthood stage (~25 years), those who consumed alcohols or drugs showed poor verbal and learning memory, working memory and attention after a span of 10 years. It was also found out that much heavier use and withdrawal symptoms over course of time showed worse cognitive working, which portrayed a relationship which was dose dependent between substance use and cognitive functioning. Heavy marijuana consumers showed worsening performance on multiple cognitive domains as compared to the youths who did not consume them. It was also seen that poor processing speed and executive functioning was related to early marijuana use by the age of 19. This hinted at the fact that use and consumption of marijuana at an early stage can cause lot of harm to the brain as compared to use and consumption at the later stage. Regular and prolonged use can also cause severe and major toxic effects. During a recent study, it was seen that abstinence from marijuana resulted in an improved verbal memory along with better psycho-motor task performance when compared to the ones who still were under the influence of marijuana.^[4]

The trajectories of gray and white matter volume were differentiated between 75 youths who started drinking at the adolescence stage and 59 youths who were non-using controls. It was seen that the heavy drinkers portrayed abnormal neurodevelopmental trajectories as compared to the non-using controls. It was also observed that there was an accelerated decrease in the volume of the gray matter and attenuated increase in the volume of the white matter. It appears that heavy drinking can cause interference and affect the normal development trajectories of the gray and white matter maturation during the adolescence stage. It can be noted that there is a need of a larger and in-depth study to get a better view of the dose-dependent effect of alcohol and marijuana on neural development.^[4]

Recent studies have shown how the cortical thinning during the developmental stage can be affected and altered by the use of alcohol and marijuana. In a 3 years long study related to the use of marijuana, it was seen that heavy marijuana users who also consumed alcohol showed development of thicker cortical, particularly in the parietal and frontal lobes. It can be seen that both the heavy alcohol and marijuana users showed decreased gray matter levels over adolescence compared to the normal levels, the alcohol users showed abnormal increased decline. Again, there could be many more factors like use of other substances, genetics, etc. to these findings and not just marijuana and alcohol. More in-depth and larger studies are needed for a more clear and firm results.^[4]

Heavy use of cannabis has been quite often associated to higher cases of mental illness and cognitive impairment, particularly among the adolescents. From studies, it is evident that regular and heavy use of cannabis during the adolescence stage, results in higher and serious negative outcomes as compared to the use in adulthood stage. The endocannabinoid system in the human brain plays an important role in its development. It can be said that prolonged and regular use in the adolescence stage can result in a normative neuro-maturational functions that occur at this stage. Synaptic pruning and white matter development can be identified as the two main processes that can be highly affected by the use of cannabis at the adolescence stage.^[5]

Even though cannabinoids show a range of properties that are neuro-protective, there are enough amount of evidences that prove that the main component found in *Cannabis Sativa*, delta-9-tetrahydrocannabinol(THC), has harmful effects on the brain. It has been found through the studies that adolescent cannabis users have a higher risk of developing adverse psychological outcomes such as psychotic symptoms and neurocognitive impairments. Epidemiological studies have shown that those who have high and regular cannabis usage, have a higher number of psychotic symptoms and also more depression and anxiety as compared to irregular and non-users. On the other hand, clinical studies have shown that impairments in memory and learning exist beyond the period of acute intoxication. Problems in other important functions such as decision-making, processing speed and attention have also been observed. Some long-term studies have also indicated that heavy usage of cannabis can have higher chances of leading to later psychosis and even depression.^[5]

From animal models, it has been evident that neuroprotective and neurogenic properties have been exhibited by some cannabinoids, there is very less evidence that it is the same in the case of humans, especially with THC. A recent interview conducted with Lorenzetti et al. (2014), working on the structural consequences of cannabis use, gave information that there are rising evidences that structural alterations in medial temporal regions of the brain are associated with the heavy use, even if though it appears that many parts of the brain appear unaffected due to it. It has been found that adolescent cannabis users are at a higher risk for adverse outcomes which include more persistent cognitive impairments and also psychotic symptoms with increased risks. Although during adolescence, regular use of cannabis might not always be harmful, it has been suggested by studies that during this stage can result in an increased risk of adverse outcome. Moreover, it has been said that use of cannabis during the adolescence stage can prove to be harmful because of the crucial involvement of the endocannabinoid system in the brain and also on the associated processes of synaptic pruning and white matter development. The studies that have examined the structural consequences of the exposure of cannabinoids in adolescence, even though less in numbers, show that early use of cannabis can have adverse effects on the morphology of the brain in selected individuals.^[5]

Studies have found that acute exposure to cannabis tends to affect a wide range of functions of the Central Nervous System(CNS), with variable subjective effects, which include euphoria and relaxation, perceptual distortions, increased sensory perception as well as effects like dizziness, hunger and anxiety. A review done on studies that were done to examine brain function during acute cannabis intoxication found that there was an increase in the regional cerebral blood flow(rCBF), throughout the cortex, especially in the frontal, limbic, paralimbic and cerebellar regions. Many studies indicate that this is because of the subjective feelings of intoxication. It has been also observed in studies, that there are both positive and negative psychological consequences, which is because of the differential effects of THC and cannabidiol. Human studies have also portrayed that the adverse effects of THC can be blocked by cannabidiol, even though the studies which provide evidences to these effects might have limited relevance to the typical usage patterns of recreational cannabis users. It has been found that acute administration of

cannabinoids can impair a variety of cognitive functions such as attention, executive functions, learning, short-term and working memory. More stronger effects have been seen in studies which were done to examine short-term episodic and working memory. It was seen that cannabinoids can impair consolidation, encoding and retrieval of both verbal and non-verbal information. There was also impairment seen in the performance on the tasks that assessed attentional processes that include, sustained, selective, focused and divided attention. Few studies have shown that during acute intoxication, there was altered inhibitory and decision making process, but it has to be noted that these studies have not been consistent. It has also been found that intravenous administration of THC induces schizophrenia-like transitory difference, in the studies examining the rCBF, in regard to the imaging data, which introduces the chances that due to residual effects, recent use or withdrawal, there might be some effects. In this regard, it can be noted that there is proof that after a prolonged period of abstinence, normalization of function in some regions might be preceded by initial decreases in activity. Similarly, Schreiner and Dunn(2012), found a range of residual neurocognitive deficits in users under abstinence, but on excluding studies that had examined participants before 25 days of abstinence from their analysis, it was seen that there was no significant residual effects on any aspects of neurocognitive performance. Yucet et al. (2012) reported that a subgroup of patients with first episode of psychosis, who had used cannabis heavily from adolescence, did not show usual profile of individuals with schizophrenia.^[5]

Even though structural findings from the human studies aren't as firm as the animal studies, evidence of structural brain abnormalities in the medial temporal, prefrontal and cerebellar regions, was found among heavy cannabis users. Although parahippocampal alterations were not observed in individuals with less exposure to cannabis, the ones with high frequency use showed the parahippocampal alterations. Also, more recent studies that was done on hippocampal alterations in cannabis users with and without schizophrenia, found that the abnormalities in the hippocampal morphology were related to the use patterns of cannabis and also with the symptoms of psychosis. Even though the studies point towards a potential relation between higher exposure to cannabis and morphological alterations in hippocampal and parahippocampal regions, due to mixed findings, there is a need for more research and studies to get a more clear picture.^[5]

A small number of studies have used Diffusion Tensor Imaging(DTI) to assess the integrity of white matter in the adult cannabis users. DTI involves mapping the diffusion of water molecules in brain tissue and is used to examine the patterns of anatomical connectivity and white matter microstructure. Findings, even though less in number, have supported the fact that heavy use of cannabis in adults is related to structural integrity and coherence of white matter tracts, including the ones within the frontal regions, the hippocampus and the corpus callosum. These studies prove the fact exposure during adolescence can be more harmful than adulthood. Also, it has been consistently evident from studies in adults that demonstrate, an earlier age of onset is correlated with more cognitive impairment and more pronounced morphological alterations.^[5]

III. RESULTS AND DISCUSSION

From the recent studies, the relationship between the adolescent brain and substance use has been clear along with analysis about the pre-existing studies on the vulnerabilities of them. It can be noted that there is a need of more detailed studies and research to characterize substance-specific concerns and also what type of developmental process and cognitive domains might provide more response to efforts made for prevention and treatment. Most of the research and work done has include predominately Caucasian youth which belong to the upper middle class families but do not

positive and negative symptoms in healthy individuals. Even though dose-response relationships were shown by memory and attention effects, they were inconsistent across a range of tests. Currently, only heartbeat and subjective effects can be considered as reliable biomarkers of intoxication caused due to cannabis.^[5]

Many studies have shown that abstinent users show alternate patterns of the brain activation during cognitive tasks when compared to healthy individuals, even though having no difference in the performance of tasks. However, it is not clear that how long do these effects continue to show after abstinence. There has been a noticeable

include the youths who already have co-occurring psychological disorders. More samples have to be examined to note the generalization in the results. There are many factors that might contribute to the findings and should be noted in the future which include gender, sleep habits, genetics, age at which the substance is being used and interactive & combined efforts of different substances. Also more diverse sample sizes are required to understand how the neural development might differ on use of cocaine, opioids, hallucinogens and amphetamines. It is important to note that current marijuana studies generally use crude measures of quantifying marijuana use for eg. the number of days marijuana was used in the past month or year. Also it is important to have better quantity and frequency of data when examining about substance use, because some of the existing studies have been done on variety of self-report questionnaires that makes the ability to understand the dose-dependent relationships less strong.^{[4][5]}

IV. CONCLUSION

Even though epidemiological and clinical studies have proved the relation of substance use with psychiatric illness and cognitive impairment, the process behind these relationships are still not clear and hence there needs to be reasonable consistency in measures that assess cognitive findings so that the ability to improve findings about the process increases. Also, more emerging work and research has helped analyze and characterize time limited and potentially persisting effects of substances use on the adolescent brain, which might also help with the rehabilitation and treatment efforts. Together, with intervention programmes at early stage which aim to reduce the regular and prolonged use in adolescence, efforts taken to reduce the exposure to substances during this stage of development can prove to be very crucial in an aim to minimize long-term harm to the brain.^{[4][5]}

ACKNOWLEDGMENT

The efforts put into understanding and summarizing the research papers and to write a review on them has been supported by respected guide, Dr. Kiran Sanap from the ES&H Department.

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Road Safety: IoT Based Vehicle Speed Control System

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Abstract—Smart city means having a quality and sustainable life in the modern city. Road safety becomes an important part of smart city in the modern world. Internet of Things has been on the rise lately with a very great future scope. Utilising the benefits of IoT in the betterment of road safety and rules can prove to be of great victory towards the challenges faced in an enhanced traffic and road management system. One of the major challenges of this is the problem of over-speeding which has been prevalent for quite a long time now with many deaths and injuries due to it. Existing technology of speed radar guns haven't proved to be of a concrete and reliable solution. Now, it is aimed to use the IoT devices like Arduino to develop a speed control system which can function wirelessly and can also reduce the human effort required in the use of the speed radar guns. It is expected that the new system can reduce over-speeding cases by a large number.

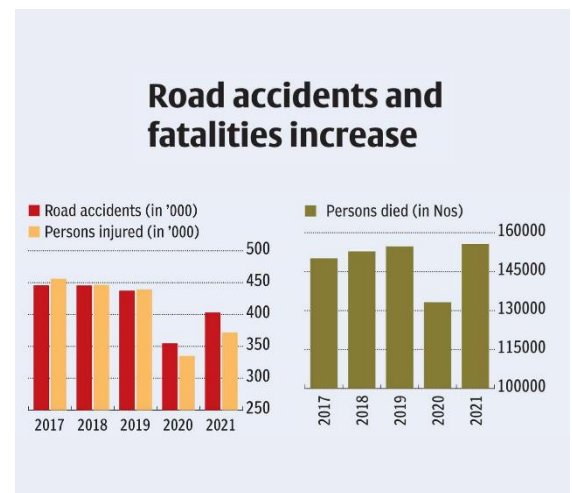
I. INTRODUCTION

Over-speeding has been a very major cause of most of the road related accidents in the previous years, with majority of them resulting in deaths. Over-speeding formed a major part of the traffic rule violation connected to accident deaths (69.3%) and injuries (73.4%) in the year 2020. A total of 2,65,343 road accidents took place in India during the year 2020 due to over-speeding, which caused 91,239 deaths.^[1] The National Crime Record Bureau (NCRB) provided data on the Accidental Deaths in India (2021) which shows that the road accident cases have increased from 3,54,796 in 2020 to 4,03,116 in 2021. The deaths have increased by 16.8 per cent (from 1,33,201 in 2020 to 1,55,622 in 2021). Also, it was seen that the rate of death per thousand vehicles increased to 0.53 in 2021 from 0.45 in 2020.

A detailed analysis reveals that majority of the road accidents were because of over-speeding, recording 2,40,828 out of 4,03,116 cases (59.7%) and thus causing 87,050 deaths and 2,28,274 injuries.^[2]

It can be observed from the above data that there is a lack of following of the road safety rules and laws by the people as declared by the Ministry of Road Transport & Highways^[4] and the National Road Safety Board^[3]. The MRTH have taken many steps to overcome the problem of over-speeding and punishing the offenders by the means of radar detectors which they use. But it can be seen that there

is no decrease in the number of over-speeding cases, rather they are still increasing. There needs to be an introduction of a system in the vehicles which can control the speed wirelessly of the cars by putting speed limit or speed barrier of the required limit. With the use of this system, the



number of over-speeding cases can be reduced by a great number thus reducing the deaths caused due to it.

II. CURRENT TRENDS

Currently the method followed by the Traffic Police for detection of over-speeding is by using the radar gun which is also known as the speed gun.^{[5][6]} The radar gun works on the principle of Doppler Effect. It is the most and widely used method currently for the detection of a vehicle's speed.

The gun emits or transmits a specific amount of frequency wave. This wave is aimed at the target vehicle. The wave then travels and reflects from the vehicle giving a variation in the reflected frequency. The variation in the frequency is calculated mathematically to determine the speed of the vehicle.^{[7][8]}



Let's take an example:

A specific radar gun emits a wave of frequency 34.7 GHz which is equal to 34,700,000,000 Hz.

After travelling a distance, the wave reflects back from the targeted vehicle and records a frequency of 34,700,006,713 Hz.

So according to the data collected from above,
 $f_0 = 34,700,000,000$ Hz and $f_r = 34,700,006,713$ Hz

The formula to calculate the speed of the vehicle is,

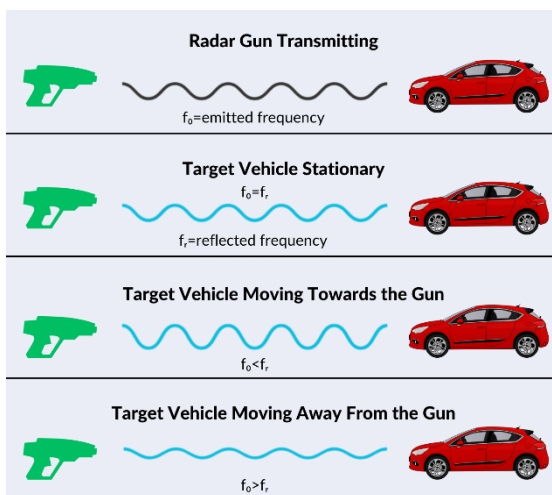
$$v = \frac{\Delta f}{f} \times \frac{c}{2}$$

Where $f = f_0, f_r$ and $c = 6.71 \times 10^8$

On calculating, $f = 6,713$ Hz

Putting the values in the formula and solving it,
 $v = 65$ mph which is close to 105 kmh.

The speed of a vehicle can be found out in this way using a radar gun.^{[5][6]}



Even though this method is very useful in determining the speed of a vehicle, this does not solve the problem of over-speeding as it has no control over the speed of the vehicle and drivers neglect the offense of it by paying the fine. They still over-speed which is dangerous to both the driver

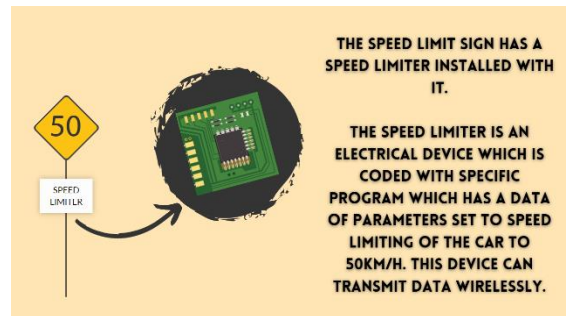
as well as other motorists and pedestrians. Also, the system is not efficient enough to provide a control to the Traffic Police over the over-speeding vehicles.

III. PROPOSED MODEL

The method and system in this section aims at enhancing the road and traffic safety in a newly upgraded way. There might be human efforts initially in the application of the system, but later on the efforts would be totally reduced to almost low. The implementation of the proposed system requires to be carried out on a wide scale.

With technologies like Internet of Things(IoT) on a rise with rapid growth, the technology of it can be utilised to a large extent to improve the road safety and security and tackle the problem of over speeding. The proposed system aims at developing two electronic devices, one receiver and one transmitter, which work on the fundamentals of IoT.^[14]

Transmitter: The transmitter is enabled with the function of transmitting information and coded data in it wirelessly via Bluetooth or Wi-Fi to another device, that is the receiver. The transmitter is coded with the data and information



about controlling the speed of a vehicle's engine/motor to which the receiver is connected to.

Let's take an example:

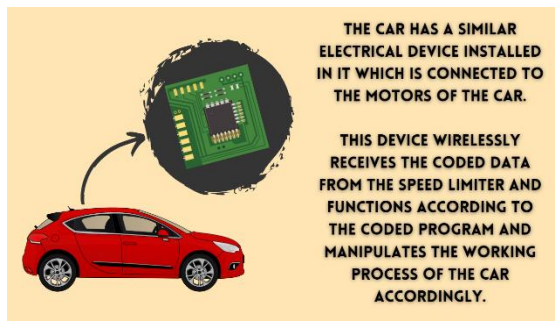
In a zone of suppose 500 m, the speed limit sign indicates a speed limit of 50 kmh. It is aimed to make the vehicles passing that zone to stay under the speed of 50 kmh for that whole 500 m range and not exceed the limit. The transmitter is coded with the data which says that the speed should not exceed 50 kmh restricting it to the given speed limit and for the given range of area of the limit.

This coded transmitter is then installed at a suitable place, it can either be on a building or somewhere around it or the speed limit post.

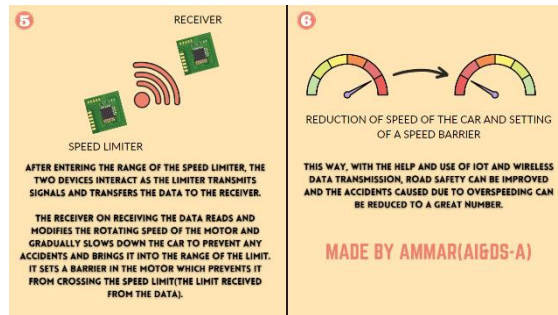
Receiver: The receiver is built with the function of receiving the coded information wirelessly from the transmitter and modify the working of the vehicle according to the data. It is connected to the engine^[10] or the motor^[12] of the vehicle from where the coded input is supplied to and the speed of the vehicle gets restricted to the given speed limit. The speed of the vehicle cannot exceed the limit because the receiver does not allow the engine or the motor to generate speed and torque more than that.^{[9][10]}

Let's take the same example as above to continue and to understand the working of the system:

A vehicle is fitted with the receiver which is further connected to the generation or transmission system of the vehicle.^[10]



When this vehicle enters the speed limit zone of 500m, the



IV. RESULT AND DISCUSSION

The current approach to tackle the problem of over-speeding is by the use of speed radar guns. But this method is not really the best solution as the radar guns are not very efficient because of many factors^[13] and also, after detection of an over-speeding vehicle, the Traffic Police generates a challan which is then sent to the offender. This is a huge gap towards the goal of a better and enhanced road safety, and hence the proposed model bridges that gap by providing an enhanced speed control and speed restriction technology which can reduce the amount of over-speeding cases and deaths related to it by a large amount. The system uses the modern technology of Internet of Things(IoT) to aim at solving the problem. With simple use of transmitters and receivers the solution to it can be achieved.^[14] Even though, initial implementation of the proposed model system requires lots of man-force, the later stages of it don't require much efforts as the whole process would be automated and the control over the problem of over-speeding would be easily obtained without any system gaps.

V. FUTURE SCOPE

With increasing number of vehicles on the roads day by day, cases of road related accidents are also increasing with the recent rise of 16.8% seen from the year 2020 to 2021. Over-speeding forms a major part of the road accidents with almost 60% of the cases.^[2] With the focus to have a better and enhanced road safety, there needs to be a concrete solution to the prevailing problem. Even with the

transmitter which is continuously emitting signals, interacts with the receiver installed in the vehicle. As the speed limit of that particular zone was 50 km/hr, the receiver receives the data accordingly which tells it to restrict the speed to 50 kmh. The receiver processes the data to the engine or the motor and hence limits the speed of the vehicle.^[10] It sets a barrier in the motor which prevents it from crossing the speed limit. Any attempts to over-speed cannot be made due to this proposed system.



existence and use of radar guns, there has been a rise in the number of road safety law violations. The proposed model system aims at replacing the speed radar guns and having a better and enhanced speed control system. It is anticipated that the proposed system can have a positive impact and can be a big upgrade and boost to the road safety system.

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The Future of Contract Management: A Study of Smart Contracts

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Abstract—In this research paper, we aim to provide a comprehensive overview of the concept of smart contracts and their current and potential use cases. We will also examine the challenges and limitations of the technology and explore the future prospects for the development and adoption of smart contracts. The findings of this research will provide valuable insights for individuals and organizations looking to implement smart contracts in their operations.

I. INTRODUCTION

A smart contract is a computer program or a transaction protocol that is intended to automatically execute, control, or document events and actions according to the terms of a contract or an agreement. The objectives of smart contract is to reduce the need for trusted intermediators, arbitration costs, fraud losses, as well as the reduction of malicious and accidental exceptions. Smart contracts are commonly associated with cryptocurrencies, and the smart contracts introduced by Ethereum (open source blockchain) are generally considered a fundamental building block for decentralized finance (DeFi) and NFT applications. A smart contract is not to be confused with a smart legal contract, which refers to a traditional, natural-language, legally-binding agreement that has selected terms expressed and implemented in machine-readable code.

II. HISTORY

Smart contracts were first proposed in 1994 by Nick Szabo, an American computer scientist who invented a virtual currency called "Bit Gold" in 1998, 10 years before Bitcoin was introduced. Szabo defined smart contracts as computerized transaction protocols that execute the terms of a contract. He wanted to extend the functionality of electronic transaction methods, such as POS (point of sale), to the digital realm. In his paper, Szabo also proposed the execution of a contract for synthetic assets, such as derivatives and bonds. Szabo wrote, "These new securities are formed by combining securities (such as bonds) and derivatives (options and futures) in a wide variety of ways. Very complex term structures for payments can now be built into standardized contracts and traded with low transaction costs, due to computerized analysis of these

complex term structures. Many of Szabo's predictions in the paper came true in ways preceding blockchain technology. For example, derivatives trading is now mostly conducted through computer networks using complex term structures.

III. FUNCTIONALITY

Smart contracts allow for the automation of processes without the need for intermediaries or third parties. This can reduce the time and costs associated with executing contracts.

1. **Self-execution:** Smart contracts are designed to self-execute when certain predetermined conditions are met. This eliminates the need for manual execution and reduces the potential for errors or fraud.
2. **Immutable and tamperproof:** Once a smart contract is deployed to a blockchain, it cannot be altered or deleted. This ensures that the terms of the contract are immutable and tamper-proof.
3. **Decentralization:** Smart contracts are executed on a decentralized network, such as a blockchain. This eliminates the need for a central authority or intermediary which can reduce the potential for corruption or manipulation.
4. **Transparency:** Smart contracts are transparent and all parties can see the terms of the contract and the transactions executed on the blockchain.
5. **Programmability:** Smart contracts are programmable, which means they can be customized to suit specific needs or conditions, thus making them flexible and adaptable to a wide range of use cases.
6. **Security:** Smart contracts are secured by cryptography and run on a blockchain, which is a highly secure network. This makes them less vulnerable to hacking or other security breaches.
7. **Interoperability:** Smart contracts can be designed to interact with other smart contracts or external systems, allowing for greater interoperability between different platforms and networks.
8. **Cost savings:** By eliminating the need for intermediaries and reducing the potential for errors

and fraud, smart contracts can result in significant cost savings for businesses and individuals.

9. **Trustless transactions:** Smart contracts enable trustless transactions, where parties can transact with each other without the need for trust. This is because the terms of the contract are encoded in the smart contract, and the contract will self-execute when the conditions are met.

IV. PLATFORM

A smart contract platform is a framework for building contracts on a blockchain. These platforms do the work of completing the conditions of contract if it is met. The platforms which provide the facility for smart contract are:

1. **TRON:** Tron is a blockchain based digital platform that hosts entertainment applications. It is a blockchain based decentralised digital platform with its own cryptocurrency, called TRX. It is dedicated to building an infrastructure for a truly decentralised internet.
2. **EOS:** EOS is a blockchain protocol based on cryptocurrency EOS. It aims to eliminate transaction fees and conduct millions of transactions per second. It was launched in 2017. Thus, the transaction speed is increased with the aid of this platform.
3. **Ethereum:** Ethereum is a smart contract platform that provides facilities like global payments, digital money etc. It is designed for the creation and deployment of smart contract. Ethereum enables the smart contracts and applications built on its blockchain to run smoothly without fraud, downtime or third-party interference.
4. **NEO:** NEO is used to establish ownership and management roles in the blockchain. NEO Gas is used to do transaction on its blockchain. It uses smart contracts to manage and secure digital identities. It has large active community of users.

These are some platforms that are widely used and trusted by users for smart contracts. Every platform has some pros and cons. The choice of these platforms depends on the requirement from the users.

V. FUTURE TRENDS

There is an increase in the use of smart contracts and will be growing as it is very secured and encrypted. It is including the involvement of new technologies. There is no involvement of middleman who provides the function of sharing the information. Smart contracts are completely based on blockchain. The coding of the programs of smart contracts are done in "if...else" format. The concept of smart contract was begun by the use of blockchain in cryptocurrency.

The functionality of smart contracts can be increased. The factors that can increase the future of smart contracts are:

1. **Sophisticated smart contract:** Smart contracts can be smarter. Currently the code is done to do a certain task based on if else condition. This can be developed more so that we can negotiate on the

cost of certain products. The blockchain is programmable and it can be programmed in such way.

2. **Regulation:** As the use of smart contracts becomes widespread, there will be likely increased scrutiny and new regulation that govern their use.
3. **Predictions in supply:** One major issue that supply chains face on a continuous basis is all unknowns that can happen. There can be downfall or shortage of a certain product. With the use of artificial intelligence, we can make these predictions more easily.
4. **Security:** Security is a major reason why people will opt for smart contract. Smart contracts are highly secured and it will become more secure in the coming future.

Thus, in conclusion, the future of smart contract is bright and promising. It is characterised by continuous growth.

VI. ADVANTAGES

1. **Transparency:** Smart contract is written in the form of code and store. In block chain. In block chain, once a block chain is created by all parts there will be no change after create the block chain. If we need to change in smart contract, we have to require the consent of all parties.
2. **Removal of Intermediaries & cost effectiveness:** Removing the third parties for execution, smart contract reduced the risk of manipulation. Cost saves from the removal of intermediary in relationship and peer-to-peer transacting.
3. **Security:** Smart contract is a piece of code which can be readily reused for similar operation with minimal changes as per requirement. It provides the advantage of using an already tested place of code to build upon.
4. **Trust:** Once a smart contract has been engaged to complete a transaction, it will complete exactly how it was coded to and no parties can interfere or change the result of it once it has been executed. This means we can trust Smart Contracts even when we cannot trust our fellow citizens.

VII. DISADVANTAGES

1. **Complexity:** The smart contract written in the form of code and the code is very complex.
2. **Limited functionalities:** The smart contract has limited functionalities. The function of smart contract is to simplify business & trade between both anonymous and identified parties.
3. **Lack of legal recognition:** In smart contract "*The code is law*", there can be no legal disputes over the term of the agreement.
4. **Immutable code:** Smart contract are immutable, verifiable, and autonomous pieces of code that can be deployed and run-on block chain network like Ethereum.

VIII. CONCLUSION

Smart contracts are self-executing agreements with the terms of the agreement directly written into code. They have the potential to revolutionize the way we conduct transactions and exchange value, by offering a secure, transparent, and automated alternative to traditional contract systems. Smart contracts have a wide range of potential use cases, including in finance, supply chain management, real estate, and many others.

There are some challenges associated with the use of smart contracts like security risks, scalability issues, and regulatory challenges

Overall, smart contracts represent a significant opportunity for organizations and individuals to improve the efficiency and security of their transactions, and their impact will continue to be felt in a growing number of industries and applications. It is important for stakeholders to stay informed about the developments in this field, and to be prepared for the changes and opportunities that they may bring.

ACKNOWLEDGMENT

The efforts put into understanding and summarizing the research papers and to write a review on them has been

supported by respected guide, Ms. Ritika Tiwari from the ES&H Department.

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Green Cloud Computing

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Abstract— Over the last few decades, advancements and transformations have taken place in information and communication technology. They have transformed computing into the 5th generation, after water, electricity, gas, telephones, and many more. Today, more companies and organisations are migrating their computation workloads to the cloud, and modern cloud computing platforms are becoming increasingly large-scale and distributed. With such a large-scale cloud computing system, the companies can provide services that are cost-effective and reliable. Also, they invite the opportunities for efficiency of energy and also count of carbon footprint would be lowered for the whole society. Every small development means a lot. Keeping this in mind, we have all been actively pursuing forms of cloud computing that would be more sustainable; green cloud computing's main motive is to reduce energy consumption and cut down carbon emissions accordingly.

Keywords—computing, efficiency, opportunities, footprint, sustainable.

I. INTRODUCTION

Green cloud computing refers to designing, creating and using cloud-based services in such a way that carbon emissions are reduced and also sustainability is offered to the environment. It basically aims the approaches and practices of using technological and other IT based services that would be environment friendly.

Although the word was not invented until the early 1950s, the idea of cloud computing has been around since then. In order to handle user requests, the cloud needs thousands of data centres, and running these centres requires a significant amount of power for cooling and other operations. Green cloud computing works to reduce power usage, which helps to address these problems as they progressively worsen each year. To reduce this expense, numerous strategies and methods are applied. One research topic, among others, focuses on lowering the energy consumption of computer servers, while another emphasises dynamic cluster servers. Configuration to balance loads and use properly in order to reduce overall power consumption.[1]

As part of a push to implement green cloud computing, all major public cloud providers, including Microsoft, AWS, and Google, have integrated renewable energy resources for operating their data centres.

II. CHARACTERISTICS

Green cloud computing characteristics the construction of a model is necessary because the field of green cloud computing is still considerably underdeveloped. In this approach, the main concepts of cloud computing and how it may be made profitable while maintaining environmental sustainability should be emphasised. In this sense, the study

has created a framework for the development of cloud computing in the future. According to the model above, the developing field of green cloud computing has a few characteristics. These qualities include virtualization, consolidation, multi-tenancy, energy efficiency, and environmental friendliness. Virtualization and multi-tenancy are two of these traits that are crucial but aren't yet covered in this work.

The idea of virtualization is to use the same abstraction process across several virtual computers. This would fall under the umbrella of "green cloud computing" and entail the use of several computers to perform shared activities, which would ultimately result in a decrease in energy usage per computer and an increase in efficiency. Similar to this, multi-tenancy is a phenomenon where cloud services are made available to numerous tenants of the same category in order to avoid additional or minimal expenditure and energy used by a single tenant. Although there are a number of advantages to this technology, particularly those related to energy efficiency, there is an immediate risk to the renters' privacy. Consequently, there is opportunity for the multi-tenancy features of Green Cloud Computing to expand further.

Consolidation, which is defined as "the process of installing different data centres and associated data processing applications on a single server utilising virtualization technology," is the final characteristic shown in the workflow diagram. In general, it refers to the process of implementing green cloud computing and making it compatible with environmental sustainability. These procedures mostly have to do with the application, network, and security upon which cloud computing logic is based.[2]

III. APPROACHES

Using green clouds provides a range of options to mitigate the environmental impact of cloud computing. There are several alternative methods and methods put forth to achieve "green cloud computing." There are primarily three methods: the first is hardware optimization, which entails reducing energy use and making it economically efficient; the second is software optimization, which entails creating methods to increase programme, storage, and energy efficiency; and the third and final method is network optimization.

Virtualization—It is a strategy that is frequently utilised in green cloud computing. There are other forms of virtualization, but server virtualization is one of the most prevalent because servers are a cloud data center's most crucial component. This strategy assigns numerous VMs (virtual machines) to a single server. A software

programme can be used to accomplish this. Consolidating tasks, cutting back on energy use (power consumption), and reducing the cost of hardware and operational costs all contribute to cost reduction. A running virtual machine can be moved from one host to another via virtualization, and distributed power management is also made possible.

Green Scheduler-Which servers should be turned on and off is decided by the green scheduler, or green scheduling algorithm. The server will automatically turn on as the load increases and off as the load decreases. Servers should be turned on before they are required because they take some time to fully load. Moreover, servers shouldn't be loaded past their capacity. This causes the data center's energy and power consumption to decrease. Also, because there are always the necessary number of servers C) Energy-efficient, network-aware scheduling algorithm for datacentres.

This algorithm assists in cutting costs, and by reducing overall energy use, data centres can reduce their operating costs. Based on the load and many factors present at the data centre, it chooses the resources that are most appropriate for carrying out a specific task or solving a problem. Also, a deadline-based model is used to manage the workload with the goal of completing each activity within a predetermined window of time. Hence, it improves workload efficiency by avoiding network congestion and component (server) overload. However, there has been a little increase in the number of active servers. Running, it helps to lessen the stress that is placed on the servers at any given moment.

Energy-efficient, network-aware scheduling algorithm for datacentres-This algorithm assists in cutting costs, and by reducing overall energy use, data centres can reduce their operating costs. Based on the load and many factors present at the data centre, it chooses the resources that are most appropriate for carrying out a specific task or solving a problem. Also, a deadline-based model is used to manage the workload with the goal of completing each activity within a predetermined window of time. Hence, it improves workload efficiency by avoiding network congestion and component (server) overload. However, there has been a little increase in the number of active servers.

Nano data Centers-It is a distributed computing platform. They speak of several smaller-sized data centres than the typical data centres, which are few and have vast sizes. The development of nanodata centres contributes to a 30% reduction in energy consumption. They are dispersed and connected all over the planet. They are transportable and suitable for usage everywhere, even in isolated areas or for short-term purposes. With a faster response time, they aid in lowering downtime.

TOE Model-The Technological Organization Environment, or TOE. It is valid for both technology and non-technological as-variables include organisational and environmental aspects. It consists of organisational, environmental, and technical elements. The organisational factor is the organisation of policies and protocols for ensuring green cloud computing along with knowledge of the most recent and cutting-edge green cloud computing hardware. The technical factor refers to the technical side such as implementation and design of cloud data centre.

The environmental factor also entails educating cloud service providers on the norms and regulations of sustainable and green computing. By utilizing technology, the TOE model seeks to improve efficiency while simultaneously lowering carbon emissions.[3]

IV. CHALLENGES AND ISSUES

There are winners and losers in the competition that is environmental protection research. All efforts are worthwhile and capable of producing fruitful results. The future generation and society as a whole come out on top. Green ICT is essential in this industry and presents both problems and solutions regarding the environment. Green cloud computing is an important aspect of this subject. The study spent a significant amount of time discussing cloud computing security and service quality.

Both requirements for environmental preservation and consumer satisfaction must be included in this quality. Designing a green cloud presents both technological and non-technological issues. Some of the technological features of green cloud computing include software design, virtualization techniques, and thermal-aware management techniques.

Software design is crucial to green cloud computing. Apps can assist with energy efficiency and resource management. Software components must be able to communicate properly. The typology must be dynamic; according to server demand, resources should be automatically added or removed. Some of the unresolved issues include the dynamic allocation of resources and energy, the reduction of job execution costs and times, and the reduction of energy usage. There are two difficulties: international legislation vary from country to country, and international regulations are centred on cloud security issues. A few of them have passed and put into effect strong environmental regulations.

Besides environmental issues, economic needs are also a concern because energy prices and IT's electrical requirements are both rising. Since green computing will be based on efficiency going forward rather than consumption reduction, future plans for green IT should include efficient services and workable energy-saving solutions. While doing research on green computing, I came to know that it has addressed some issues and still more research is to be done on these topics. One of the trends in green technology is green cloud computing. People all over the world may now access data and services thanks to the cloud computing initiative. People all over the world may now access data and services thanks to the cloud computing initiative. The effectiveness of the cloud computing data centre has been evaluated using a variety of indicators discovered by professionals.[4]

V. GREEN CLOUD FUTURE TRENDS

Efficiency in Energy: There is a need to build power optimization and management approaches to enable power management with multi-core CPUs because today's clouds are designed with multi-core CPUs. The data centre, which consists of a collection of data storage components and data management software, is another significant energy-consuming component of the cloud. The research

difficulties in this field include developing an effective power consumption monitoring system, a dynamic power management system, and intelligent power supply decision-making systems. With the speed at which IT is developing today, we want a thorough and perceptive method to deal with challenges related to energy optimization at every level of the cloud architecture.

Virtualization: Prior research has focused on developing an effective cloud virtualization technique, but there are still certain high-end optimization-related constraints with this technology. An essential research problem is developing brand-new approaches using cutting-edge technologies to optimise the entire virtualization process. Some significant research problems in virtualization include automated optimal VM creation with ample resources and dynamic resource allocation & sharing capabilities without impacting cloud performance. Although multi-tenancy is a fundamental aspect of green clouds, it is currently plagued by privacy and security issues. Future research will focus on designing safe multi-tenant architectures and privacy-preserving secure access to multi-tenant modules.

Consolidation: Future research problems in this field include the design of intelligence support for VM consolidation, multi-aspect-based threshold value computation, resource leveraging, and server downtime management.

Environment: friendly design of tools, such as carbon emission calculators to assess the impact of clouds on nature, is the main focus of this subject. A thorough methodology must be developed in order to rate the clouds according to various Green Cloud Computing criteria.[5]

VI. CONCLUSION

Today's entrepreneurs must concurrently confront the obstacles of sustainable development, which forces them to take an active role in areas other than only the economic one. Computers and accompanying infrastructure (such as data centres) are not only expensive to maintain but also harmful to the environment due to carbon emissions. Green computing decreases the negative effects of ICT on sustainability in light of today's greater environmental awareness. This strategy benefits the environment since it makes use of power management techniques, gets rid of electronic trash, and uses less electricity. The report summarised some of the beneficial practises and offered suggestions for the most efficient application of the most recent technologies. Green computing entails making greater use of previously available computing resources by putting cutting-edge concepts like green clouds into effect,

as well as building, using, and disposing of computers in a way that is environmentally friendly. Cloud providers need to dramatically boost the usage of renewable energy sources while reducing the electricity consumption of clouds, rather than just looking for financial incentives like cost minimization. Green ICT sustainability tackles issues like using renewable energy sources to power data centres, reducing electronic waste, designing hardware, middleware, and software that is energy-efficient, running multiple operating systems via virtualization, and informing customers to encourage them to make green decisions.[6]

The observed shortcomings in server optimization and load balancing methods lead to the use of virtual infrastructure that is more energy-efficient and to the development of green cloud computing. Intelligent management advice enables us to achieve true cloud computing that is environmentally friendly. The user's requirements within the SLA are matched by the optimization, threshold values are attained, and the throughput in the cloud has improved.[7]

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Location Plan

