30 SEPTEMBER 2023

VOLUME 16

ARTIFICIAL INTELLIGENCE
THE BRUSHSTROKE OF INNOVATION

CHAT GPT
WITHIN THE BYTES OF THE DIGITAL REALM

POTENTIA

Department of Electrical and Electronics Engineering
Thangal Kunju Musaliar College of Engineering, Kollam

THANGAL KUNJU MUSALIAR

Founder and Visionary

DR. T A SHAHUL HAMEED
PRINCIPAL
TKM COLLEGE OF ENGINEERIG

MESSAGE FROM PRINCIPAL

It gives me great pleasure to know that the department of Electrical and Electronics Engineering is once again releasing its technical magazine, Potentia, even if it has come after a break of two years. The changes during this period have only heightened the importance of science, innovation, development and better technical education. Potentia will provide us a glimpse of these areas and will certainly help inculcate these values in the institution.

While the college was conferred with autonomous status in 2022, the Electrical department attained approval for the new course B.Tech Electrical and Computer Engineering. The magazine is being released after these great milestones, and is bound to be bigger and bolder. I wish the Electrical and Electronics Engineering department all success for Potentia.

“THAT'S NO SMALL FEET”

DR. SABEENA BEEVI K
HEAD OF THE DEPARTMENT

MESSAGE FROM HOD

YOU DID IT!

POTENTIA has served as a platform for showcasing the innovative ideas, research endeavors, and technical prowess of our department. I am particularly delighted to note that the theme of the current edition revolves around the "Evolution of Artificial Intelligence and Chat GPT." This theme resonates deeply with the rapid advancements and transformative impacts of artificial intelligence in today's technological landscape. The choice of this theme reflects our department's commitment to staying at the forefront of emerging technologies and trends.

The articles featured in POTENTIA are a testament to the collective efforts of our students, faculty, and staff. The dedication and enthusiasm displayed by each contributor in sharing their insights and experiences are truly commendable. It is through such collaborative endeavors that we continue to uphold the standards of excellence and innovation that define our department. Furthermore, I am excited to announce that our department is expanding with the addition of one more UG course in Electrical and Computer Engineering. This expansion reflects our commitment to providing comprehensive education and preparing our students for the challenges of tomorrow's technological landscape.

As we delve into the pages of POTENTIA, I encourage each of you to explore the diverse perspectives and cutting-edge research showcased within its contents. Once again, I extend my heartfelt appreciation to the Editorial Board, contributors, and everyone involved in the publication of POTENTIA. May this magazine serve as a source of inspiration and knowledge.

Wishing you all an insightful and enriching reading experience.

BAIJU R. NAINA
ASSOCIATE PROFESSOR
DEPT. OF EEE

"Hats off to you, my dear students"

MESSAGE FROM STAFF EDITOR

It is with great pride that I write the message to our technical magazine "POTENTIA '23". I am gratified to see the 16th volume of the technical magazine "POTENTIA '23" brought out by our beloved, unassuming EEE 19-23 batch students. Hats off to you, my dear students.

POTENTIA '23 covers a balanced collection of technical articles, department activities, academic achievements, co-curricular activities and many more. This magazine is designed to provide a broad range of information focussing on application of existing technology, research, practical explanation and developments in latest trends and state of the art techniques. Through this magazine the Department wants to share its growth, insights and achievements with our alumni, our current and future students, and all other stakeholders.

I express my heartfelt gratitude to our respected principal Dr T.A. Shahul Hameed and our beloved Head of the department Dr. Sabeena Beevi for their reaffirming unconditional support rendered at all times that assures peak performance without any compromises.

I would like to thank profusely all the authors as well as our editors and editorial board for their contribution to POTENTIA '23. I hope that you will all greatly enjoy reading this publication, and we look forward to your feedback.

Last and in no way least, I thank all faculty members and students for their wonderful response and enthusiastic participation without whom this magazine would not have been possible.

Happy reading!

Balabhaskar
E8B
EDITOR

Farhana Shajil
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E8A
EDITOR

Manaal Babu Adam
E8B
Layout & Design

UNLOCKING THE CURRENTS OF INNOVATION

MESSAGE FROM STUDENT EDITORIAL TEAM

Dear Readers,

We are thrilled to welcome you to the 16th volume of POTENTIA, our esteemed Electrical and Electronics Engineering department magazine. It brings us immense joy to present this edition, as it marks our first release since the pandemic's challenging times. Our theme for this volume, "Evolution of Artificial Intelligence and Chat GPT," delves into the captivating world of AI and the remarkable advancements we've witnessed. As technology enthusiasts, we aim to unravel the intricacies of AI's evolution and its synergy with the remarkable Chat GPT model.

We extend our heartfelt gratitude to every student who contributed their insightful articles to make this edition a reality. Your dedication and enthusiasm continue to inspire us.

We also want to express our profound appreciation to our esteemed faculty members and our ever-supportive Head of the Department for their unwavering guidance and encouragement throughout this journey.

As we turn the pages of POTENTIA, we invite you to embark on an enlightening exploration of the electrical engineering landscape and the fascinating realm of AI. Thank you for being a part of our journey, and we hope you find this volume as enlightening and engaging as we did in curating it.

Happy reading!

Warm regards,

Your Student Editorial Team

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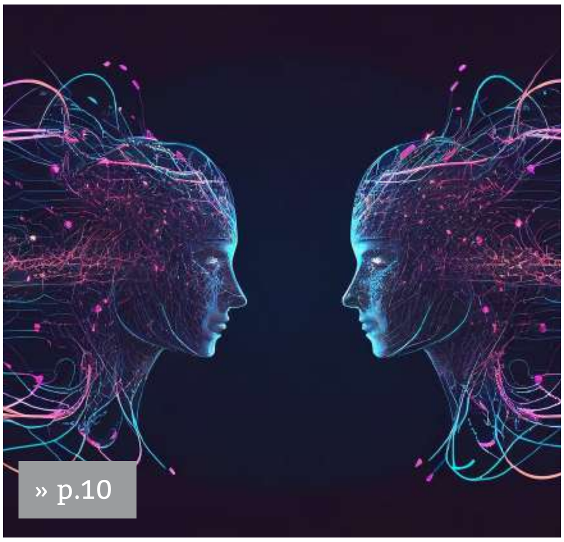
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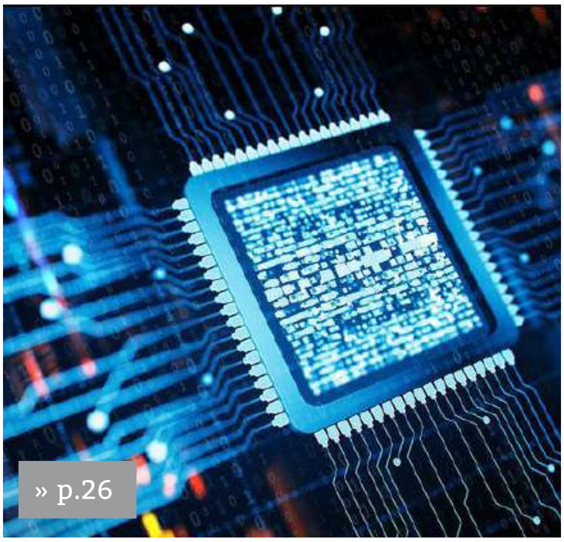
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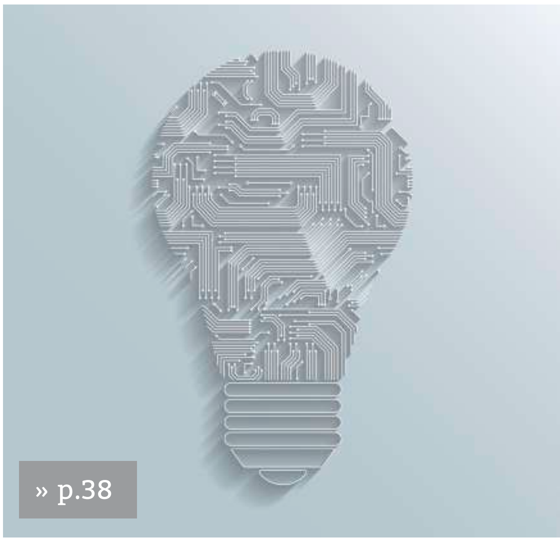
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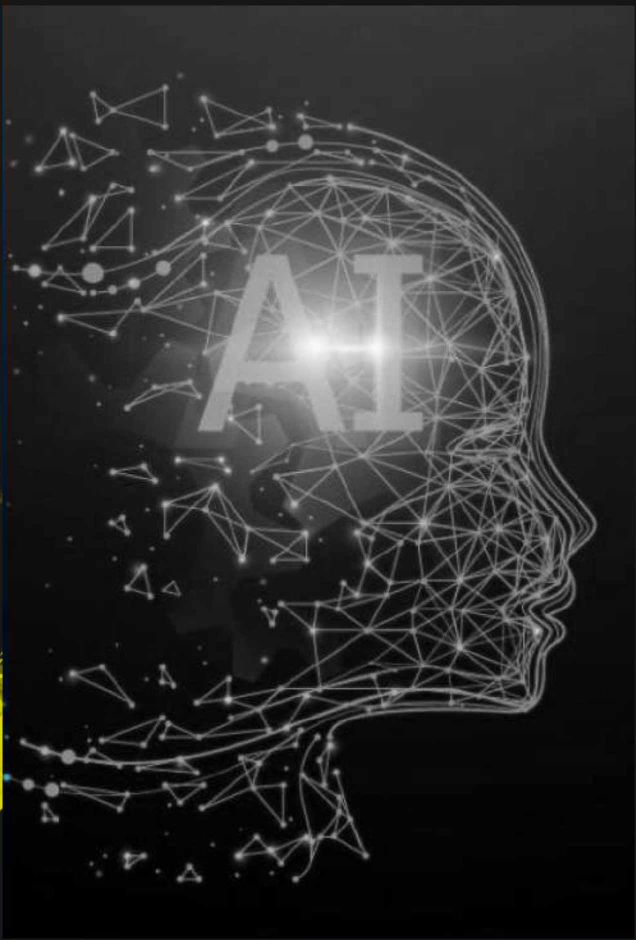
ARTIFICIAL INTELLIGENCE

-Farhana SHAJIL, E8A



The beginning of life and its offsprings and its evolution throughout the decades led to the creation of things that were once considered impossible. The youth turned out to be smarter with every passing generation. The world became smarter and creative. Artificial Intelligence is a popular term that we have been hearing for many years now and it is one of the biggest innovations that has been introduced. As the name suggests, it is an intelligence developed by machines without any human intervention. They are programmed to think and act like humans and are most often successful in problem solving and other related skills like that of an adult individual. Artificial intelligence has gained major influence all over the world to the effect that a world without it is unimaginable. With the help of AI, a machine is able to gain experience, learn from it, adapt to new inputs and perform accordingly based on the scenarios or situation posed in front of it. The advancement in technology has led to the creation of popular applications like expert systems, language processing, speech recognition and machine vision.

THE HISTORY OF AI AND ITS EVOLUTION THROUGHOUT THE YEARS

Even though it may seem as though Artificial Intelligence has become mainstream a few years back, its beginning was marked in the early 1900's. Being aware of the history of AI is important to understand its present scenario, and possibly predict the milestones it could cover in the upcoming future. In 1943, the first ever work on AI, 'a model of AI neurons' was proposed by Warren McCulloch and

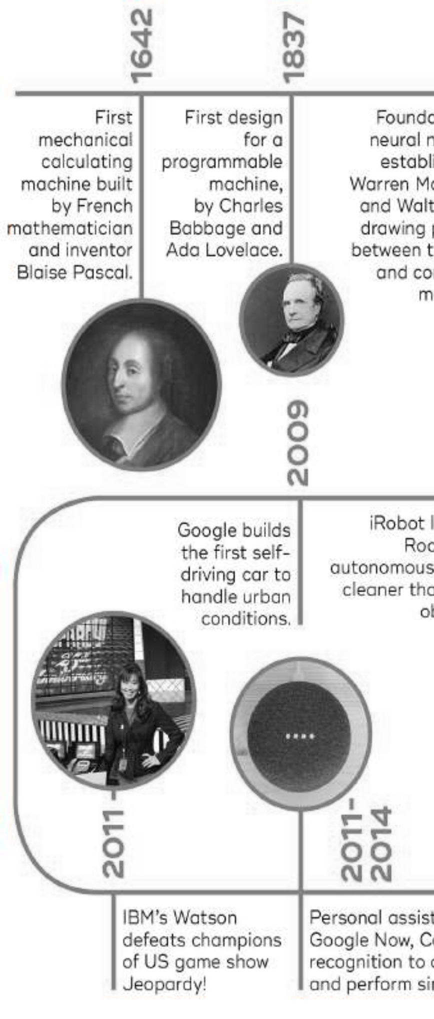
Walter Pits. In 1949, Hebbian learning, a rule on modifying the connection strength between neurons was proposed by Donald Hebb. In 1950, Alan Turing publishes “Computing Machinery and Intelligence” in which he proposed a test. The test checks the machine’s ability to exhibit intelligent behaviour equivalent to human intelligence which is called a Turing test. In 1955, the first artificial intelligence program which was named as ‘Logic Theorist’ created by Allen Newell and Herbert A. Simon was published. This program had proved 38 of 52 Mathematics theorems. In 1956, AI was coined as an academic field hence marking its official birth all across the world. The golden years-Early enthusiasm was from 1956 to 1974. In 1966, the researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA. In 1972, the first intelligent humanoid robot was built in Japan which was named as WABOT-1. The first AI winter was between 1974 and 1980. AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches. During AI winters, the interest of publicity on artificial intelligence was decreased. A boom of AI was observed between 1980 to 1987. In 1980, AI came back with an ‘Expert System’ that were programmed to emulate the decision-making ability of a human expert. In 1980, the first national conference of the American Association of Artificial Intelligence was held at Stanford University.

The Emergence of Intelligent Agents

The years between 1993-2011 marked the start of budding intelligent agents. In the year 1997, Gary Kasparov the world chess champion was defeated by IBM Deep Blue becoming the first computer ever to beat a world chess champion. In 2002, AI founds its way to homes with the invention of the vacuum cleaner “Roomba”. In 2006, AI began its entry into the business world when Companies like Facebook, Twitter, and Netflix started implementing them.

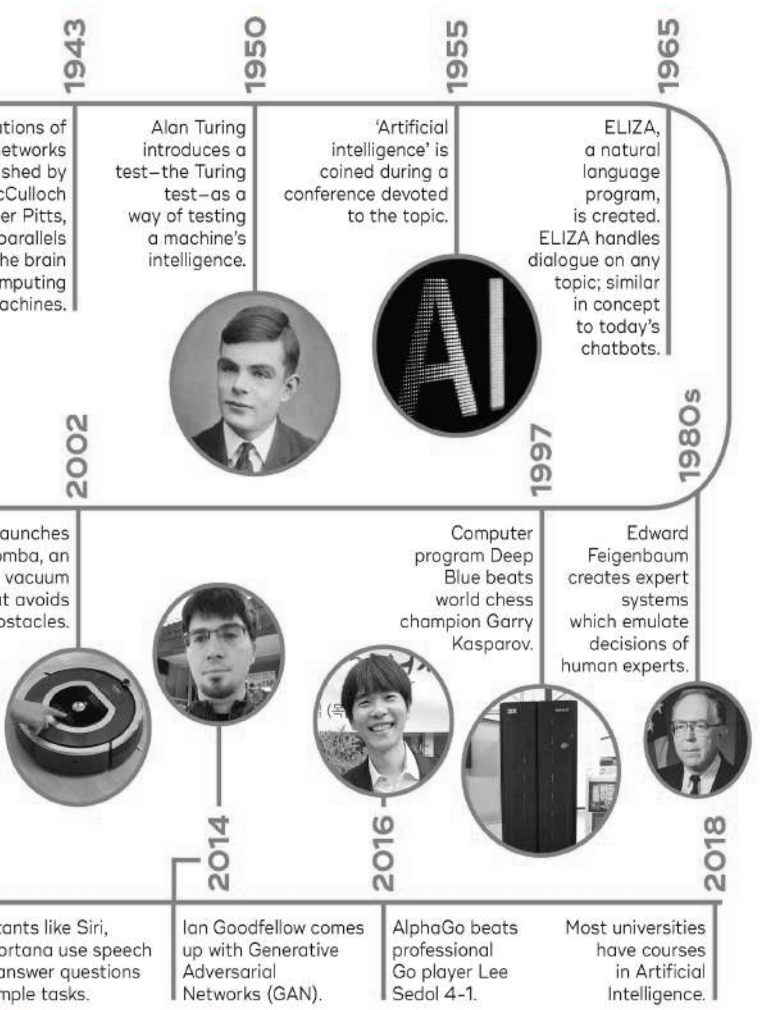
Deep ... BIG Da...

In 2011, IBM’s Watson ...
to solve complex questi...
that it could understan...
questions. In 2012, G...
‘Google now’, which ...
form of a prediction...
won a competition in ...
‘Project Debater’ of IBM...
against two master de...
demonstrated an AI pr...
off tasks like taking a h...
on the other side not e...
machine.



Learning,
ata and AI

n won jeopardy, a quiz show, where it had ions as well as riddles. Watson had proved nd natural language and can solve tricky oogle launched an Android app feature provided information to the user in the n. In 2014, Chatbot 'Eugene Goostman' the infamous 'Turing test'. In 2018, the M took part on debates with complex topics ebaters and also performed well. Google ogram 'Duplex', a virtual assistant pulling airdresser appointment on call, and a lady even noticing that she was talking with a

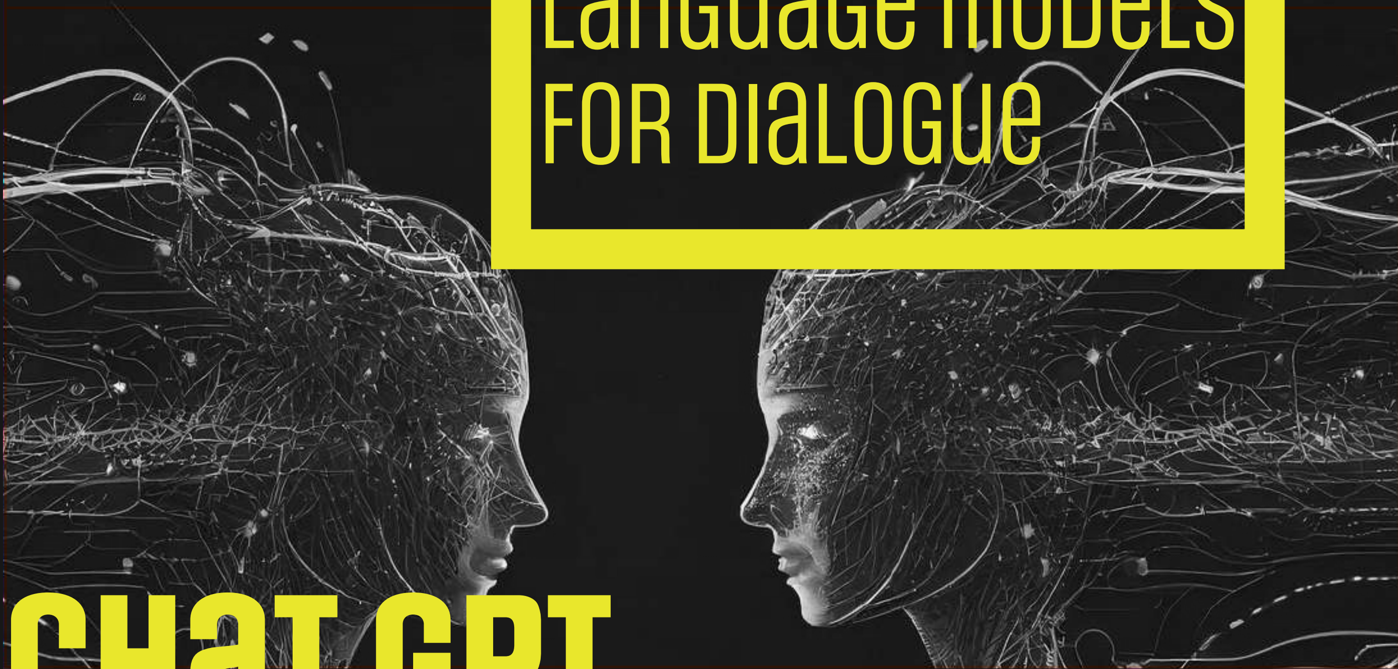


APPLICATIONS OF ARTIFICIAL INTELLIGENCE

The iconic rise of AI is evident through the variety of applications that has come forth through its support. AI is the basic groundwork for these applications across various industries ranging from healthcare to finance to transportation.

Some applications that has majorly influenced the dependence of human beings on AI are mentioned here. Natural Language Processing(NLP) is a branch of AI which provides computers the means to understand spoken words and text that is similar to the ways in which humans communicate. This was developed to ensure better and clear communication. Human language is known for its diversity and complexity with countless number of languages spoken all over the world, with its grammar , syntax and dialects that distinguishes it from one another, humans express themselves in infinite ways. The communication between computers and human beings has become easier and helps in faster completion of tasks . NLP is important because it helps resolve ambiguity in language and adds useful numeric structure to the data for many downstream applications, such as speech recognition or text analytics. Robotics is a branch in AI which contributes to the creation of intelligent robots or machines.it is a combination of electrical , mechanical and computer science engineering. It is considered to be an entity of artificial intelligence, robot machines are similar to human beings especially when associated with AI helping in becoming more smarter and efficient.

OPTIMIZING LANGUAGE MODELS FOR DIALOGUE

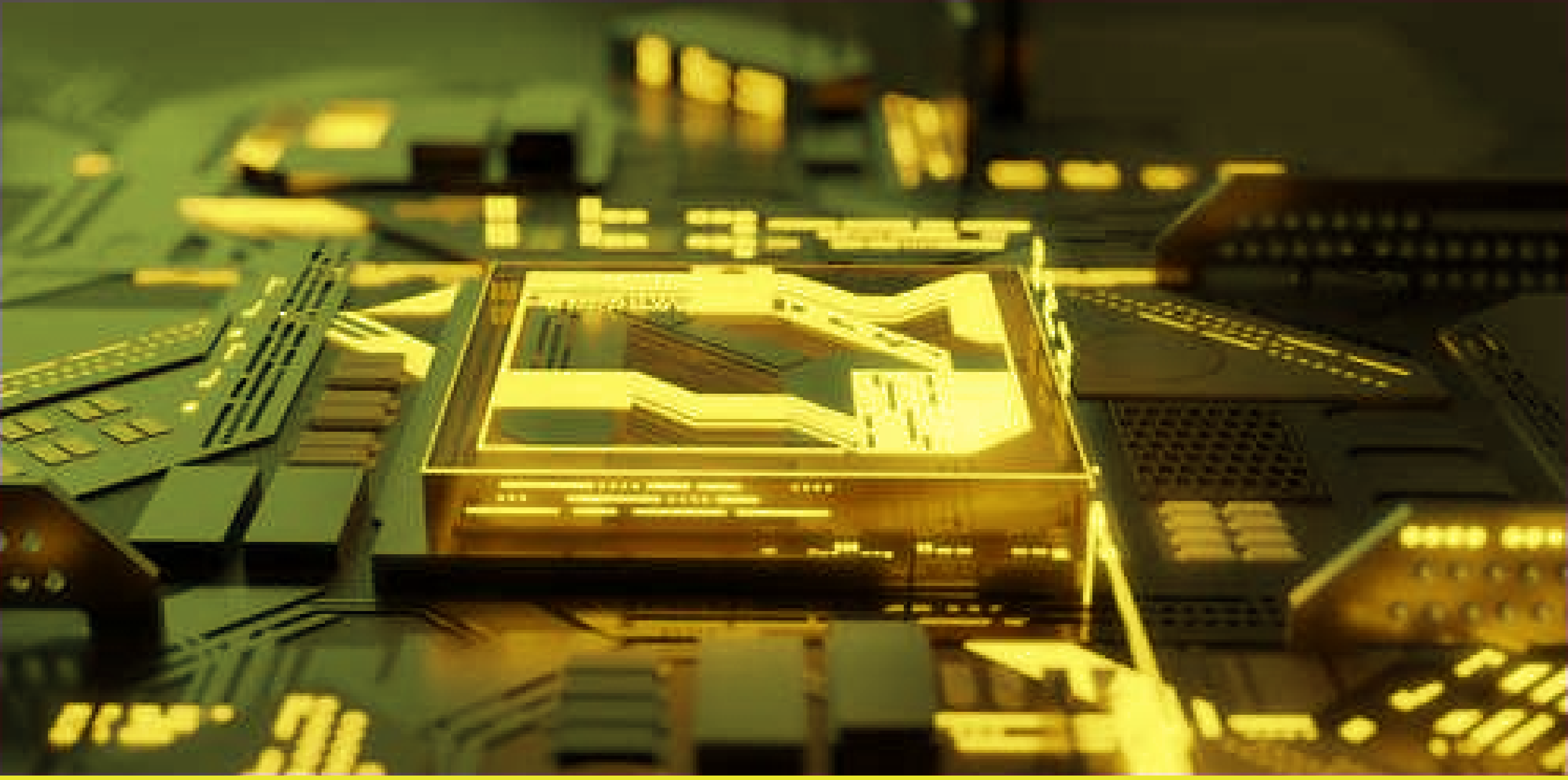


CHAT GPT

The main attraction to this article is another incredible application of AI that has blown our minds , that is 'Chat GPT' a variant of the GPT (Generative Pre-training Transformer) which is a quite recent development. Despite it being just a few months old, the number of people using it and depending on chat GPT is actually quite huge. It is an AI chatbot developed by Open AI. It is built and functions based on a language model that enables the interaction between the user and the chatbot in the simplest way possible. The tasks given to it varies from writing essays, drafting business plans and even generating codes, emails , reports etc. The idea behind Chat GPT may not be new due to the existence of similar applications like Siri, Alexa, Olivia etc. However the performance of Chat GPT in comparison to these is astounding as it generates answers spontaneously. The evolution evolution of AI and its applications have been so vast, its no wonder that popular multinational companies are vying for a chance to get their hands on it. Companies like Amazon Web Services (AWS), Google Cloud, Microsoft and Nvidia benefits from their outstanding capabilities. In fact MicroSoft is already on the move with adding ChatGPT onto the Azure Open AI Service giving customers access to a fine tuned version of GPT. Microsoft already invested $1 billion in OpenAI in 2019 to become its 'preferred partner' in the aim of commercialising new AI tech and to plan an additional $10 billion investment. Microsoft has begun embedding OpenAI technology into its products, such as GitHub Copilot, the service that uses AI to turn natural language prompts into coding suggestions for programmers Business companies see chat GPT as a boon to enhance customer experience. For example, Salesforce, Air India, Duolingo, and others use ChatGPT-powered tools in their businesses. Even though initially many companies were hesitant on using it, it had proved its worth by bringing better results. Snapchat is known for its wide variety of unique filters and messaging options. It is also jumping onto the AI bandwagon. The company has introduced a ChatGPT-powered AI chatbot named 'My AI' which is currently available only to Snapchat.

CHAT GPT- A NEAR TERM THREAT TO GOOGLE SEARCH?

The rapid rise in popularity of Chat GPT, despite its official release only a few months ago, has ignited discussions about whether it could potentially dominate the digital landscape. Given that Google and Microsoft Edge serve as default servers on a significant portion of computer systems worldwide, concerns are mounting as Chat GPT gains traction, suggesting it might even challenge Google's supremacy. The looming question is: could Chat GPT actually surpass Google? ChatGPT undeniably presents a 'near-term threat' to Google, posing potential risks to the search giant's market share and revenue streams tied to search-related services. As the trend of using Chat GPT continues to grow, Google is not resting on its laurels. It has introduced its own AI Bot, 'Bard', which has been met with excitement and curiosity, although its full capabilities are yet to be revealed. This move by Google indicates the tech giant's intention to stay competitive with both Microsoft and Chat GPT. However, many users and experts remain skeptical about the possibility of Chat GPT overtaking Google in the near future. This skepticism arises from the fundamental differences between the two platforms. Chat GPT is primarily a language processing model, while Google is a multifaceted search engine that offers an extensive array of products and services beyond just text-based interactions. The current design and purpose of Chat GPT do not inherently position it as a Google replacement. Yet, the history of artificial intelligence is marked by continuous advancements that have turned seemingly far-fetched ideas into reality. AI has evolved significantly over the past few decades, and Chat GPT stands as one of its notable achievements. The potential for Chat GPT to evolve and expand its scope cannot be underestimated.



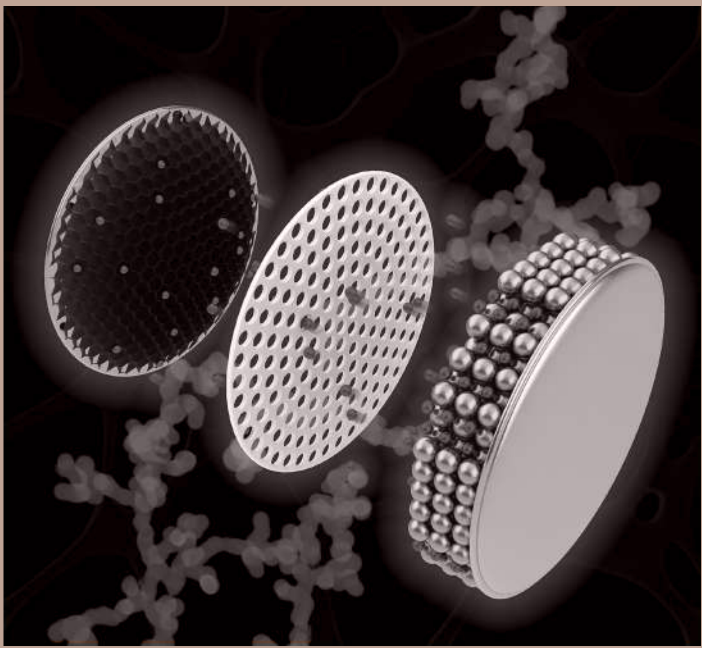
Quantum Computers - The Need of the Hour

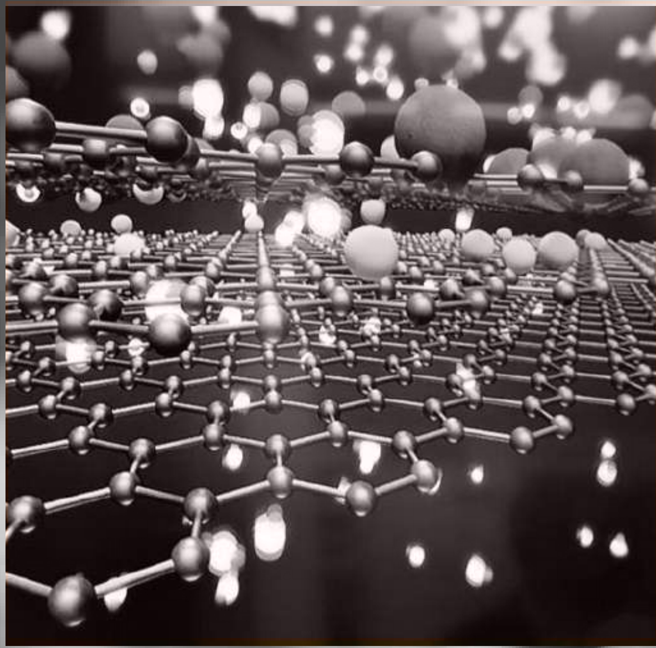
-Megha B. Pradeep, E2A

In the latest century quantum computing has begun to spread its feet to various fields. Advancements in the study of quantum physics has laid the foundation for quantum computing. Quantum physics that deals with particles like electrons and photons which can exist simultaneously in numerous states can be used to represent information in case of quantum computing. With the application of quantum computing the possibilities of performing extremely complex calculations with high efficiency and accuracy than regular computers. Quantum computers are those computers which operates on the basis of principles of quantum physics. Unlike the classical computers and supercomputers which uses classic bits that can represent either zero or one, quantum computers rely on quantum bits or qubits which can represent both states concomitantly. This makes them much more powerful and effective than classical computers. A quantum computer that has been built by Google is about 158 million times faster than the world's fastest supercomputer. Burgeoning in quantum computing can result in various changes in fields like artificial intelligence, financial modelling and weather forecasting and climate change. With quantum computing capacity there will be infinitely smarter AI systems due highly improved machine learning algorithms. There will be wide application in data security and advanced encryptions. Quantum computing allows to create new encryption techniques that can withstand quantum assaults. It is envisioned that quantum computers will be able to stimulate complex molecular interactions which can speed up drug discovery and predict its effects on patients. It could also increase the effectiveness of gene editing techniques. Quantum computers are the need of future but reaching quantum practicality is quite tough. In order to commercialise quantum computers there will be a requirement of millions of high-quality qubits. The challenges that are faced includes the fragile nature of qubits. Loss of data may occur due to qubits' short lifetimes, variation in temperature and external interferences. Addressing these challenges can increase the scalability of quantum computing systems. Advancement in quantum computers could eventually solve the many of the world's intractable problems.

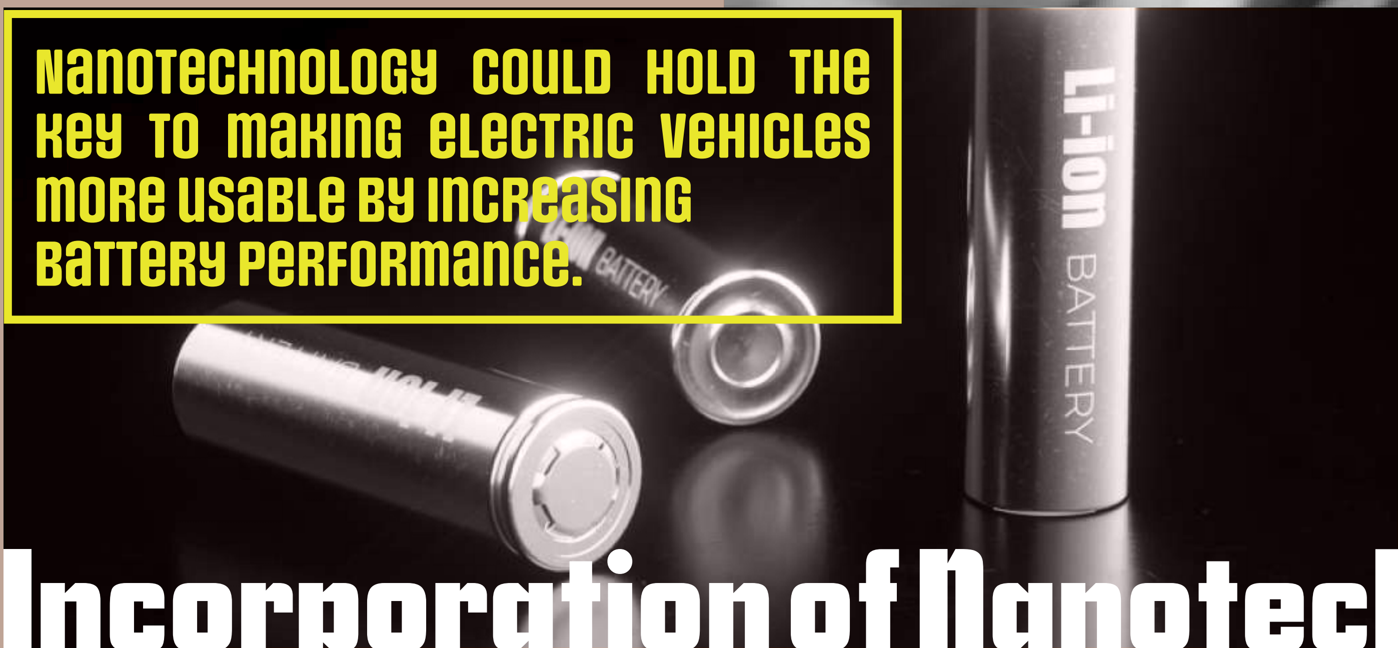
Will Artificial Technology Take Over Creative Jobs?

AI has largely evolved over this decade, from a simple machine learning model that could detect patterns with the help of trained data has now become so advanced that it is quite remarkable. Technologies like deep fakes, chatgpt, DALL E, soundful are so powerful that it can create useful information that is new and original from analysing and combining existing results and producing an output from that. Chatgpt is a chatbot made by Open AI with implements machine learning, and natural language processing. DALL-E is also an Open AI project which implements deep learning and machine learning to understand human text and convert that information into useful original images. Soundful can create tracks from user input. But the true fear arises when we doubt that these technologies may replace creative jobs. Creative jobs include jobs like musicians, artists, etc. AI will improve itself even more during the next 10 years and this can lead to some sectors of jobs being lost to AI. Jobs that require heavy manual labour like agriculture and manufacturing will be automated with maximum precision. Creative tasks can be replaced but they will survive. Art, design and music have a certain type of originality and flavour to them. Each artist has his own ideas, flavour and taste. This helps in producing art. Although these modern technologies can recreate human creativity. But as humans, we have that inner creative spark that helps us to invent, create and produce complex and original art. This trait can never be replaced.





NANOTECHNOLOGY COULD HOLD THE KEY TO MAKING ELECTRIC VEHICLES MORE USABLE BY INCREASING BATTERY PERFORMANCE.



Incorporation of Nanotech in Battery Construction

-Hemanth P., E6A

Nanotechnology is the engineering of functional systems at the molecular scale. Materials reduced to the nanoscale can show different properties compared to what they exhibit on a macroscale. Several phenomena become pronounced as the size of the system decreases. These include statistical mechanical effects, as well as quantum mechanical effects, for example the 'quantum size effect' where the electronic properties of solids are altered with great reductions in particle size. Additionally, a number of physical (mechanical, electrical, optical, etc.) properties change when compared to macroscopic systems. One example is the increase in surface area to volume ratio altering mechanical, thermal and catalytic properties of materials. Two main approaches are mentioned. In the 'bottom-up' approach, materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition. In the "top-down" approach, nano-objects are constructed from larger entities without atomic-level control. Nano technology has a wide variety of applications in medical, manufacturing, defence, electrical etc. Most applications are

limited to the use of 'first generation' passive nanomaterials which includes titanium dioxide in sunscreen, cosmetics, surface coatings, Carbon allotropes used to produce gecko tape, silver in food packaging, clothing, disinfectants and household appliances, zinc oxide in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes and cerium oxide as a fuel catalyst.

How can nanotech improve batteries?

Increasing the available power from a battery and decreasing the time required to recharge a battery. These benefits are achieved by coating the surface of an electrode with nanoparticles. This increases the surface area of the electrode thereby allowing more current to flow between the electrode and the chemicals inside the battery. This technique could increase the efficiency of hybrid vehicles by significantly reducing the weight of the batteries needed to provide adequate power. Increasing the shelf life of a battery by using nanomaterials to separate liquids in the battery from the solid electrodes when there is no draw on the battery. This separation prevents the low level discharge that occurs in a conventional battery, which increases the shelf life of the battery dramatically. Using films of carbon nanotubes to make high-powered, fast-charging lithium metal batteries is a logical replacement for common lithium-ion batteries. Thin nanotube films effectively stop dendrites that grow naturally from unprotected lithium metal anodes in batteries. Over time, these tentacle-like dendrites can pierce the battery's electrolyte core and reach the cathode, causing the battery to fail. That problem has both dampened the use of lithium metal in commercial applications and encouraged researchers worldwide to solve it. Lithium metal charges much faster and holds about 10 times more energy by volume than the lithium-ion electrodes found in just about every electronic device, including cellphones and electric cars.

Nano Batteries

Nano batteries are batteries utilizing innovation at the nano scale, a size of minute particles that measure under 100 nanometers. They are for the most part portrayed by three segments: cathode, anode, and electrolyte. Most research is being done on the cathode and electrolyte materials. By lessening the extent of the materials utilized as a part of a nano battery, higher conductivity can be achieved, prompting an expansion in control, in both charge and release. Nanotechnology has the potential to create many new materials and devices with a wide range of applications, such as nanomedicine, nanoelectronics, biomaterial energy production, and consumer products. With respect to arranging and making cathode materials, nanotechnology-based systems have indicated different points of interest for upgraded imperativeness and security. They have longer battery lives and wider operating temperatures and hold a great potential in the coming years.

A Glance at Evolutionary Learning

-Naveen Ram, E8A

Evolution, often associated with Charles Darwin's work in biology, may not initially appear relevant to engineering. However, in essence, evolution refers to the gradual, inheritable change over generations driven by genetic variations. This process, as famously observed by Darwin during his voyage on the HMS Beagle and his study of Galápagos finches, forms the basis of modern evolutionary studies. So, what's the connection to engineering, especially in machine learning? This article explores the fascinating methods used to address complex problems, drawing inspiration from the principles of evolution.

Evolutionary learning is a class of generic population based metaheuristic optimization algorithms which is inspired from natural processes and biological evolution. Metaheuristic algorithms are designed to find or generate sufficiently good solutions even when perfect or complete information about the optimization problems are unknown. These algorithms don't guarantee a global optimal solution. Consider a backpack and some objects of certain value and weight. The weight that can be accommodated in the backpack is limited. The goal is to pick the objects in such a way that the backpack occupies maximum value and doesn't exceed the weight limit. This problem is known as the knapsack problem and has been studied for more than a century. This is called the P-versus-NP problem, that's for you to find out. When these kinds of problems are given to a computer, by conventional techniques, it must find all the combinations of items in the weight constraint and choose the best value option among those. The time taken for a computer to optimise the knapsack problem depends on the number of items present in the problem. If the number of objects is 5, it takes approximately 0.000003 seconds. What happens when the number of objects are increased? For 20 objects, it takes 1 second, for 22 objects, the time changes to 3.91. The knapsack problem with 77 items can occupy the computer for 5 billion years. The time required to solve this problem increases exponentially as the number of items are increased. The solution

EVOLU
ALGOR

Evolutionary algorit
the most complicated
of candidate solution
algorithms generate
individual will be a
fitness function eva
these characteristics
the population to cr
repeated over a numb
solutions obtained f
close approximation
between problem co
it can solve any co
minimum amount of
are: it doesn't ensure
for convergence to a

utionary rithms

hms (EAs) provide solutions for some of d and studied problems using the concepts ns and fitness functions. The evolutionary e random populations, in which each a possible solution to the problem. The luates how good a solution is. Based on s, evolutionary operators are applied on reate more fit individuals. The process is ber of cycles to obtain better solutions. The rom EAs are not the perfect ones, but a of the perfect solution. There are no links mplexity and algorithm complexity, thus, mputationally complex problems with a f resources and time. The drawbacks of EAs e a global optimal solution and time taken good solution cannot be determined.

Theoretical Background

All EA optimization strategies are equally effective for all optimization problems. That means one EA is not better than the other. This is called No free lunch theorem. “There ain’t no such thing as free lunch” which means there are no shortcuts to find the optimal solution. The only solution for finding the global optimum is to exploit the problem in some way like using a better fitness function for evaluating the individual, finding a more suitable evolutionary operator or instead of random initialization of population, using a much better method in population initialization for convergence to the solution. The problem faced with every EA is the failure to converge to a global optimum value. This can only be solved by using accurate evolutionary operators suited to the application. Generally, while using EA, the fitness of the population increases in successive generations due to the selection of elite individuals (or best solutions) to pass on their characteristics to the next generation. When fitness of individuals increases, more the chances of convergence to optimum value, but the speed of convergence cannot be determined.

Genetic Algorithm

Genetic algorithms draw their inspiration from the principles of biological evolution and natural selection. To seek out the most optimal solution, this algorithm initiates by generating a population of solutions, often encoded as binary or real numbers, in a random fashion. The viability of these solutions is assessed through the application of a fitness function. If a superior solution, within the boundaries of our predefined tolerance, is not present within the population, genetic operators are deployed. These genetic operators include selection mechanisms such as roulette wheel selection, rank selection, and tournament selection, which are employed to identify prospective parent solutions. The selected parent solutions then undergo processes like uniform crossover or n-point crossover, giving rise to a new generation of offspring solutions. These offspring may undergo mutation before being reintroduced into the population, while some of the less fit individuals are culled. This cyclical process iterates over multiple generations, steadily refining the solutions present within the population. Ultimately, this iterative refinement leads to the discovery of a globally optimal solution. In the realm of genetic programming, these principles are harnessed to evolve and optimize computer programs.

Ant Colony Optimization

The Ant Colony Optimization Algorithm, commonly referred to as ACO, draws its inspiration from the intricate foraging behaviors and pheromone communication observed in ants. In this remarkable natural phenomenon, ants communicate through the secretion of a chemical known as pheromone, which they deposit onto the terrain during their foraging expeditions. When a diligent ant discovers a source of sustenance, it transports a portion of it back to the colony, leaving a trail of pheromone in its wake. Fellow ants, guided by their remarkable instincts, follow these pheromone-laden trails in their quest for nourishment. However, there's a catch – if the path to the food source is excessively long, the pheromone gradually evaporates, necessitating a series of trial-and-error journeys. Through numerous iterations of exploration, these industrious insects eventually converge upon the most efficient and shortest path to their nourishment source. The brilliance of this natural process serves as the foundational concept behind ACO, which harnesses these principles to tackle complex graph-based problems, particularly in the domain of optimizing routes and identifying the shortest paths. In essence, the Ant Colony Optimization Algorithm is a testament to the elegant efficiency of nature's problem-solving ability.

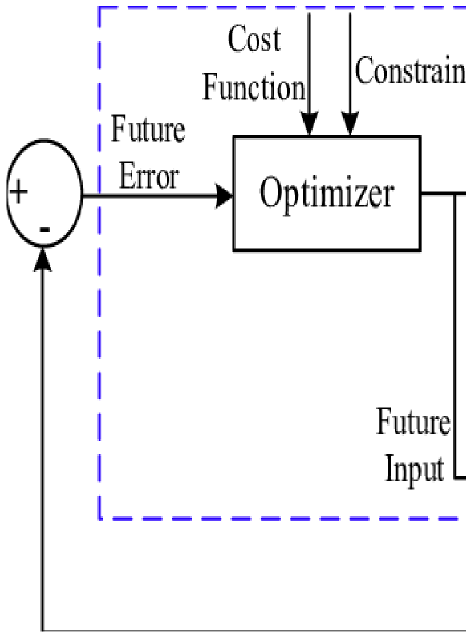
Particle Swarm Optimization and Other Algorithms

The PSO algorithm draws its inspiration from the collective behaviors observed in the animal kingdom, such as the synchronized movements of a bird flock or the coordinated maneuvers of a school of fish. This algorithm operates by iteratively enhancing candidate solutions, employing the principles of swarm intelligence found in nature. In a flock of birds, each individual bird has a limited field of vision, but as part of a cohesive group, their collective awareness extends far beyond what any single bird can perceive. Similarly, when a problem is presented to the PSO algorithm, it assembles a swarm of potential solutions, harnessing the power of this collective intelligence to navigate and optimize across the complex terrain of the problem's error surface. Beyond PSO, there exists a fascinating array of other evolutionary algorithms, each inspired by distinct aspects of the natural world. These include the Cuckoo Search algorithm, which takes cues from the brooding and parasitic behavior of cuckoos; the Bee Colony Optimization Algorithm, mirroring the foraging patterns of honeybees; the Firefly algorithm, which simulates the captivating dance of fireflies as they are drawn toward light; and the Runner Root Algorithm, inspired by the growth patterns of both runners and plant roots. These diverse approaches exemplify the rich tapestry of nature's wisdom that informs the field of optimization in electrical engineering and beyond.

Advanced Control Techniques for Electric Machines

-Sandra Dinakar, E2B

Electric machines play a key role in many industrial applications, including electric vehicles, renewable energy systems, and industrial automation. The performance and efficiency of these machines depend on their control techniques. The control strategies play a significant role for operation of electric machines. In recent years, there have been significant developments in advanced control strategies for electric machines which provides wide sustainability, high versatility and high efficiency for machine operation. This article provides an overview of some of these advanced control techniques for electric machines.

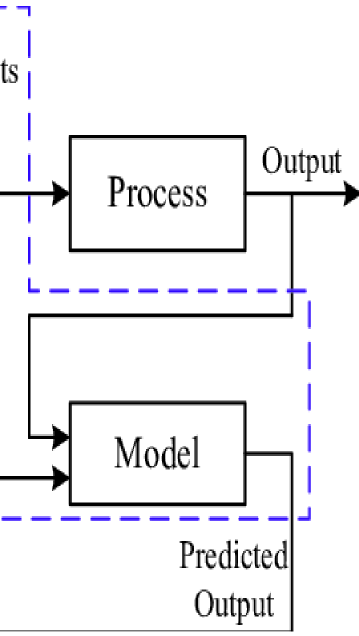


MODEL PREDICTIVE CONTROL (MPC)

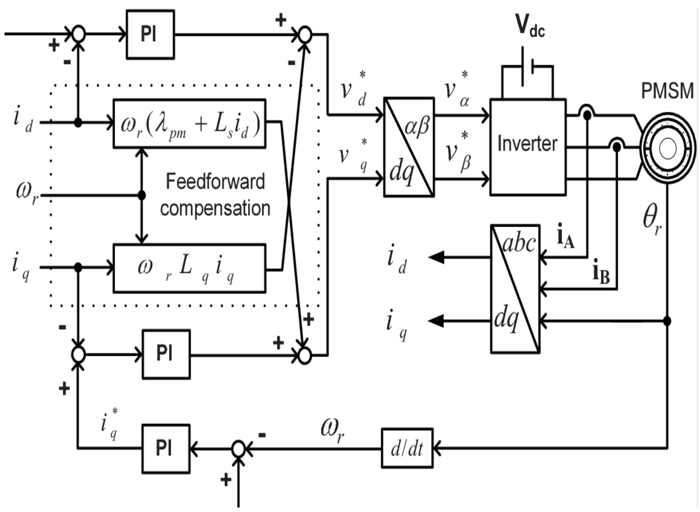
Electric machines play a key role in many industrial applications, including electric vehicles, renewable energy systems, and industrial automation. The performance and efficiency of these machines depend on their control techniques. The control strategies play a significant role for operation of electric machines. In recent years, there have been significant developments in advanced control strategies for electric machines which improves wide sustainability, high versatility nad high efficiency for machine operation. This article provides an overview of some of these advanced control techniques for electric machines.

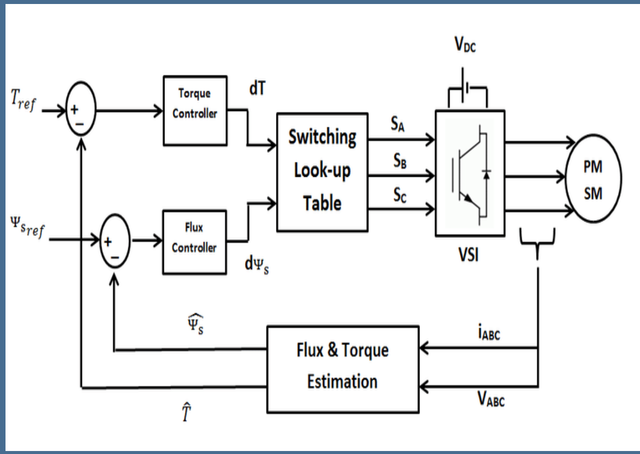
FIELD-ORIENTED CONTROL (FOC)

FOC is a control technique that is commonly used in the control of electric motors, such as permanent magnet synchronous motors (PMSMs) and induction motors. FOC decouples the stator current into two orthogonal components, one for the magnetic flux and the other for torque. This enables precise control of the motor speed and torque. FOC has been proven to provide excellent performance in terms of efficiency, speed control, and torque ripple reduction. In traditional motor control methods, the stator currents are controlled to achieve the desired speed or torque. However, this approach is limited by the non-linear relationship between the stator currents and the



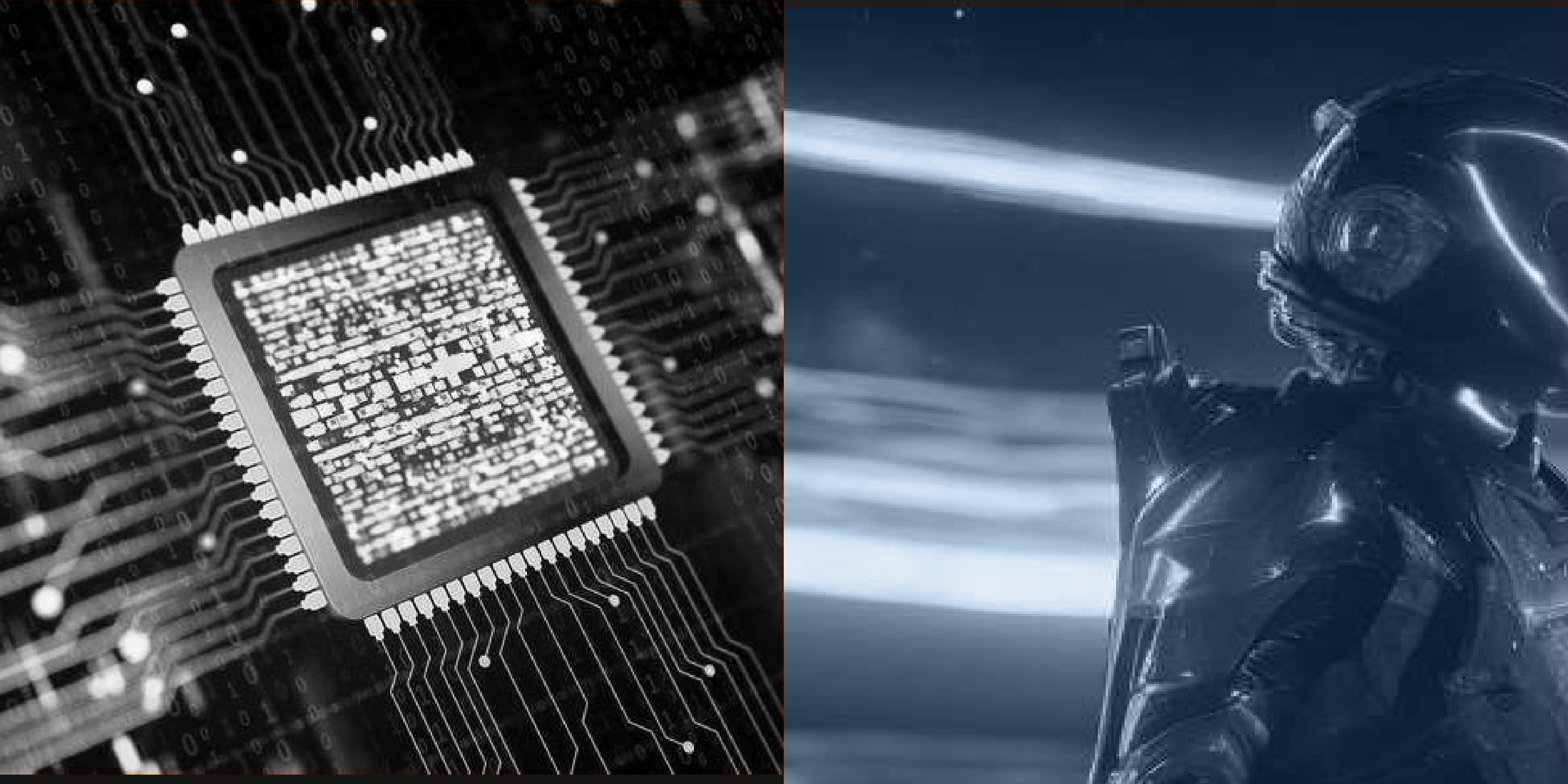
magnetic fields produced by the rotor. This results in less efficient operation and less accurate control. FOC overcomes these limitations by decoupling the stator currents into two components - one component that produces a magnetic field aligned with the rotor and another component that produces a magnetic field perpendicular to the rotor. The FOC approach involves using a mathematical model of the motor and a feedback control system to control the motor's two components of current separately. This enables the motor to produce a magnetic field that is precisely aligned with the rotor's magnetic field, resulting in highly efficient and precise control of the motor. FOC is widely used in various industrial applications, such as electric vehicles, robotics, and HVAC systems, to achieve high performance and efficiency. For example, in electric vehicles, FOC is used to control the motor's torque and speed, resulting in more efficient and smoother operation. In robotics, FOC is used to control the motors that drive the robot's movement and control the robot's position accurately. One of the major advantages of FOC is its ability to operate at high speeds and high torque levels, making it ideal for high-performance applications. It also reduces the motor's energy consumption by minimizing the losses caused by current harmonics and other non idealities.





DIRECT TORQUE CONTROL (DTC)

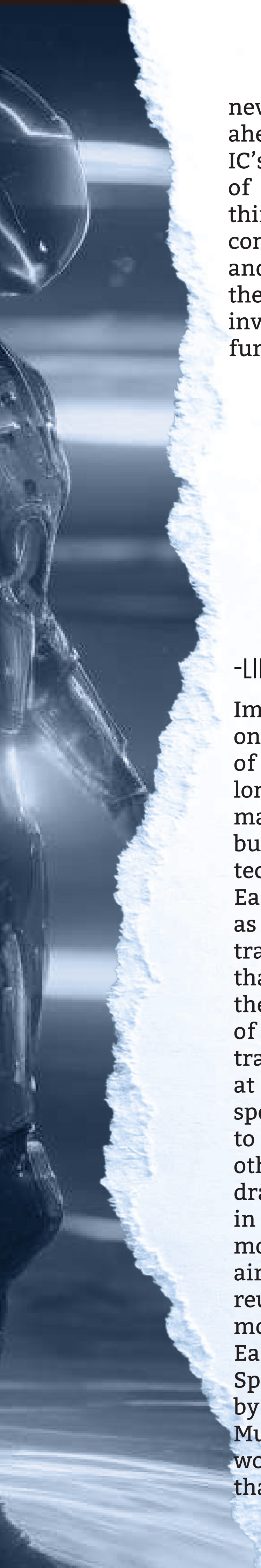
DTC is a control technique that provides direct control of the motor torque and speed without the need for a separate speed sensor. DTC uses a hysteresis band to compare the actual and reference torque, and then adjusts the voltage and current accordingly. DTC is a simple and effective control technique that has gained widespread popularity in the control of electric machines. One of the significant advantages of DTC is its ability to operate at very low speeds and even in the absence of position sensors. This makes it suitable for a wide range of applications, including electric vehicles, industrial machinery, and robotics. In electric vehicles, DTC is used to control the torque and speed of the motor, resulting in smooth and efficient operation. In industrial machinery, DTC is used to control the motor's torque and speed to achieve precise and dynamic motion control. In robotics, DTC is used to control the motor's position and speed, enabling accurate and smooth movement. Another benefit of DTC is its ability to reduce the motor's wear and tear, resulting in longer motor life and reduced maintenance costs. This is achieved by minimizing the motor's thermal losses and reducing the mechanical stress on the motor's components. DTC is also highly flexible, allowing for easy adaptation.



The Future of Integrated Circuits

-Geethu J. S., E4

I still remember the very first day when we had begun our digital electronics lab sessions, we had an introduction to the most commonly used IC's for the implementation of various logic gates and the IC trainer kits. We were familiar with IC's from the first year of our college life as we have had a brief introduction session on it in our second semester. But they had became an irreplaceable part of our lives during the middle of our engineering degree. Now let's just peep into a brief historical background of IC's.An integrated circuit or monolithic integrated circuit (IC) is a set of electronic circuits on one small flat piece of semiconductor material, usually silicon. An early attempt at combining several components in one device was the Loewe 3NF vacuum tube from the 1920s. The monolithic IC chip was enabled by the inventions of the planar process by Jean Hoerni and p–n junction isolation by Kurt Lehovec. Today IC's are widely used in mobile phones, computers and electronic equipments and TTL and MOS continues to be the most commonly used type of ICs. The advantages integrated circuits ranges from their extremely small size, low power consumption, reliability, reduced cost, very small weight and easy replacement. Coming back to our area of discussion, we were told that the IC's we use in labs like the 7400 series are not presently in use and are produced only for academic purposes. The 7400 series chips are hardly used in commercial scenerio nowadays. But CMOS variants like the 74HCT00 series are still widely used, even in microcontroller-based systems as glue logic. The advantage of using this series is that we don't have to use a quad or hex chip as single gates are available. There are high chances that integrated circuits will disappear anytime in the next 100 years. Rather, fewer and fewer integrated circuits will show up in homes and businesses because all electronic computation will be done in the cloud over fiber optic Terabit networking. Nano-electronics (circuits built with components on the scale of 10nm) seem to be the most promising successor to lithographic based ICs. By 2076 3-D room-temperature, superconducting, quantum, neuromorphic, and photonic mixed-signal devices will be the common denominator for

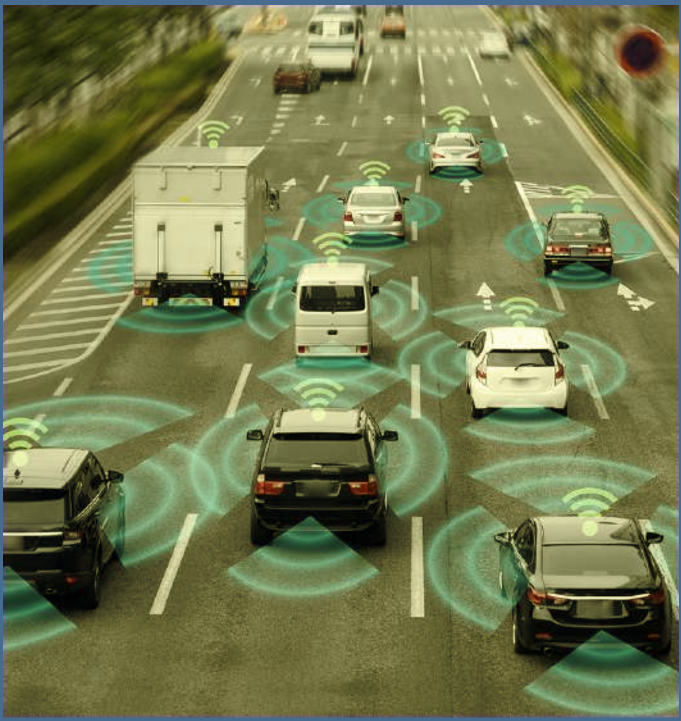


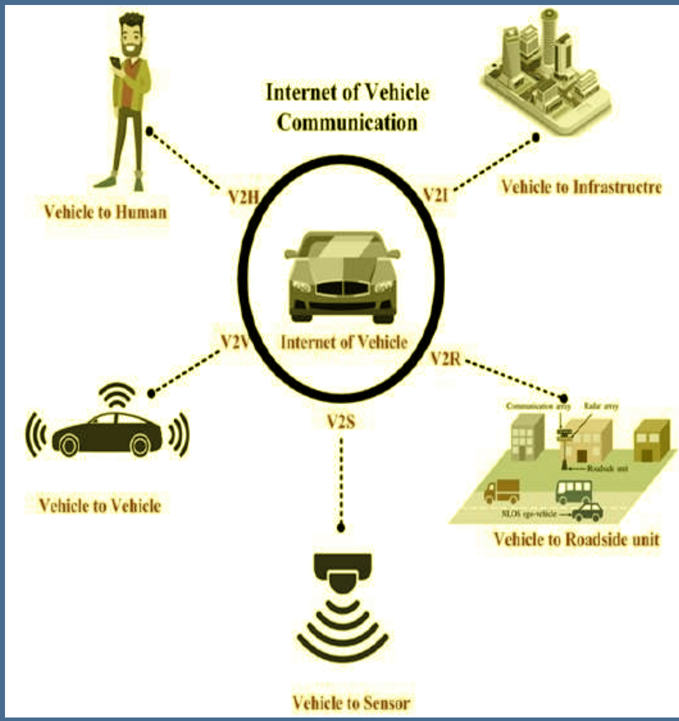
never takes a nap. Instead, it powers ahead minute by minute. The invention of IC's were a major leap mainly in the world of computers. It replaced transistors in third generation computers and made computers really dependable, effective and small. But time has come where these IC's would be replaced by further inventions whichwould make our jobs furthermore simple.

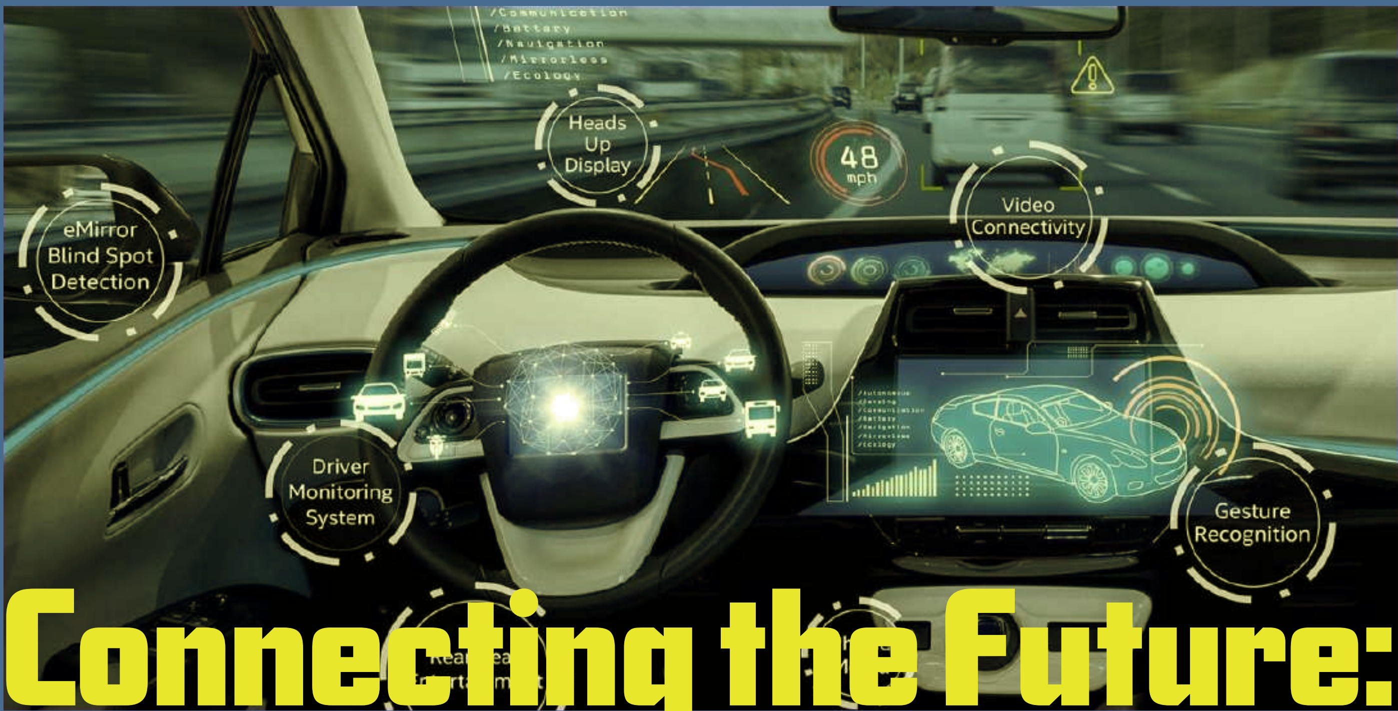
Earth to Earth Travel: Revolutionizing Transportation

-Lima Susan Sunil., E2A

Imagine traveling from one point on Earth to another in just a matter of hours, bypassing the need for long flights or road trips. This may sound like science fiction, but with recent advancements in technology, it is becoming a reality. Earth to Earth travel, also known as point-to-point or suborbital travel, is a revolutionary concept that can alter the way we travel in the future. This travel is a mode of transportation that seeks to transport passengers and cargo at speeds near to or exceeding the speed of sound. The objective is to use suborbital spaceflights or other highspeed technologies to drastically decrease travel times in comparison to conventional modes of transportation such as airplanes or cars. The idea of using reusable rockets is currently the most visible example of Earth-to-Earth travel. Companies such as SpaceX and Blue Origin, headed by visionary entrepreneurs Elon Musk and Jeff Bezos, are actively working on developing rockets that can transport people from one point on Earth to another in a matter of hours rather than days or weeks. One of the most significant advantages of Earth to Earth travel is the ability to significantly reduce journey times. A suborbital rocket, for example, could transport passengers from New York to Shanghai in a few hours, as opposed to a journey that would take more than 15 hours. Long-distance travel may become more accessible and convenient as a result, offering up new opportunities for business, tourism, and personal travel. Earth-to-Earth travel has the ability to more effectively connect remote regions of the globe. Suborbital travel, for example, could make difficult terrain or limited infrastructure more accessible, resulting in greater economic opportunities and social growth. transportation. It may still be in its early stages, but Earth to Earth travel has the potential to transform the way we move around the world, opening up new possibilities for travel and commerce.







Connecting the Future: Internet of Vehicles

-GOKUL S. R.., E6

The concept of the Internet of Vehicles (IoV) is rapidly reshaping Intelligent Transportation Systems (ITS), ushering in a new era of innovation. IoV seamlessly merges Vehicular Ad Hoc Networks (VANETs) with the Internet of Things (IoT), bolstering the development of smart cities and intelligent transportation systems while laying the foundation for autonomous driving. This groundbreaking technology presents a host of advantages, including addressing diverse traffic and driving concerns, enhancing passenger safety, and ensuring a comfortable driving experience. Unveiling the general architecture of IoV, characteristics that define IoV are discussed now. Connectivity: IoV thrives on robust connectivity, facilitating real-time data exchange among vehicles, infrastructure, and other connected devices. High-speed networks and efficient communication protocols are the lifeblood of this interconnected system.Data Sharing: IoV fosters the exchange of crucial data, encompassing vehicle speed, location, and performance metrics. This data serves as the cornerstone for optimizing traffic flow, route optimization, and accident prevention. Automation: IoV empowers automation in various driving functions, from parking to lane changes and collision avoidance. It forms the bedrock for the development of autonomous vehicles capable of operating without human intervention. Integration: IoV seamlessly integrates an array of technologies, including sensors, wireless communication, and cloud computing, creating a comprehensive and highly interconnected ecosystem. Security: Given the transmission of sensitive data like personal information and vehicle performance data, IoV places paramount importance on robust security measures to thwart unauthorized access and safeguard user privacy. Scalability: IoV is designed to be highly scalable, accommodating the ever-growing number of connected devices and the surging demand for data processing and storage.

Understanding VANET in IoV

VANET, or Vehicular Ad Hoc Network, serves as a pivotal component in the IoV ecosystem, providing the essential communication infrastructure. VANET relies on Dedicated Short Range Communications technology, enabling seamless communication between vehicles and other networked devices, an indispensable element in realizing the vision of a connected and smart transportation system.

The Role of RFID in IoV

One of the core technologies underpinning IoV is Radio-Frequency Identification (RFID). RFID technology plays a critical role in enhancing road safety and streamlining traffic management—a primary objective of IoV networks. RFID, employing wireless communication through radio waves, consists of three key components: RFID tags (attached to objects to establish their uniqueness), RFID readers (transmitting radio signals to query the tags), and electronic databases (storing tag-related information). The applications of RFID in IoV are numerous and diverse, ranging from automatic toll collection to traffic-flow monitoring.

Security Challenges and Mitigation Strategies

IoV networks are not immune to security threats and attacks, falling into two categories: active and passive. Active attacks involve malicious participation aimed at gaining unauthorized access or manipulating the network, while passive attacks entail information gathering without network interference. Given the critical real-time data in IoV, security and privacy are paramount. Ensuring secure communication between RFID servers and tags, with minimal computational cost, is essential, particularly as traditional cryptographic methods are ill-suited to these resource-constrained systems.

Lightweight Cryptograpghy for IoV

Security is a paramount concern in the Internet of Vehicles (IoV) due to the potential consequences of unauthorized access and malicious manipulation of sensitive data. While cryptography has long been the bedrock of information security, applying traditional cryptographic methods to IoV poses unique challenges. IoV devices often have limited computational resources, making it imperative to explore lightweight cryptography solutions that provide robust security without overwhelming these constrained devices. In this context, researchers and engineers are turning their attention to the development and implementation of lightweight cryptographic algorithms specially designed for IoV and other resource-constrained environments. These cryptographic solutions balance the need for security with the need for efficiency, ensuring that the cryptographic operations can be performed swiftly and with minimal resource consumption. There are two fundamental categories of cryptographic algorithms being considered for IoV. Asymmetric Key Cryptography approach employs distinct keys for encryption and decryption, often referred to as public and private keys. However, they typically involve more complex computations, which can be resource-intensive. Symmetric key algorithms use the same key for both encryption and decryption. They are generally faster and require fewer resources but may be considered less secure than their asymmetric counterparts.

FUTURE RESEARCH AVENUES IN IOV

Several exciting research directions beckon in the realm of IoV, including smart parking technologies, bolstering IoV security, route optimization, integration with 5G and 6G technologies, efficient data management, and more. These avenues promise to further advance the capabilities and potential of IoV, solidifying its position as a transformative force in the field of transportation and beyond.

SIM
TOOLS

Several simulation
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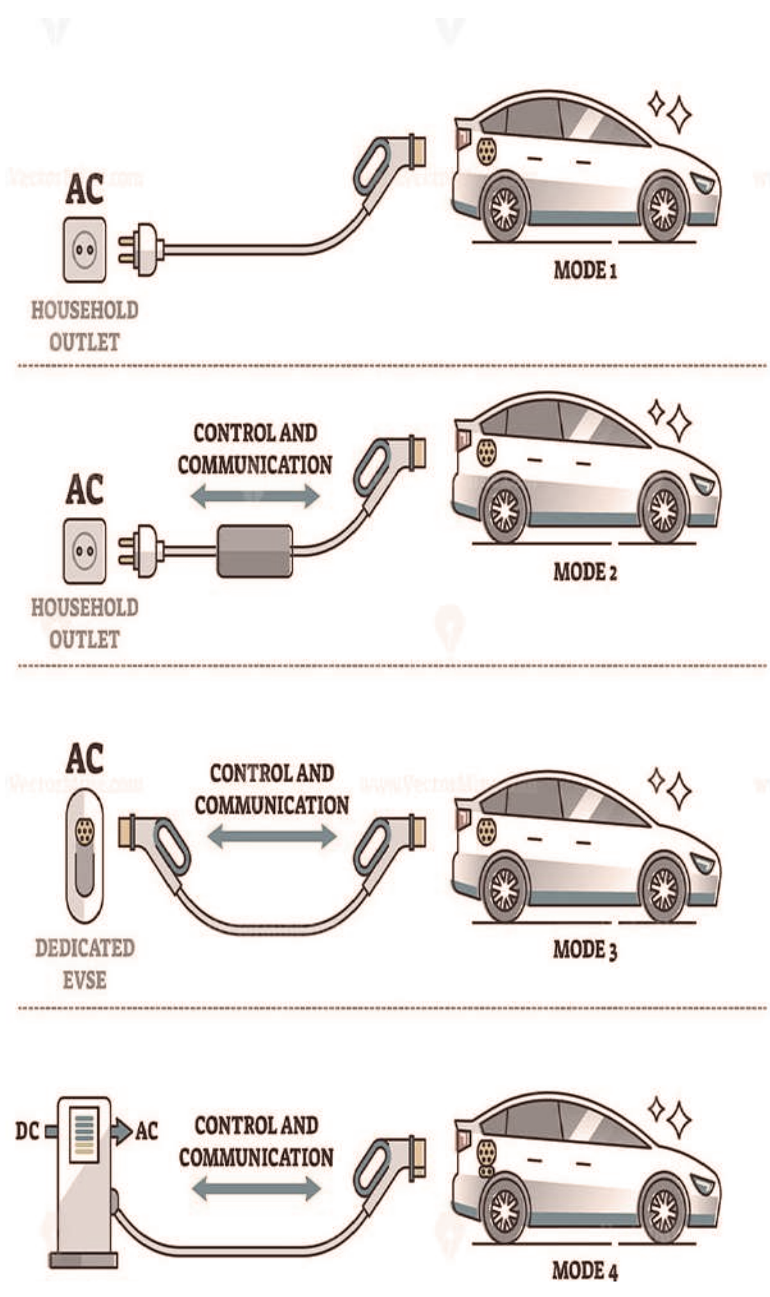
IoV's Societal Impact

The Internet of Vehicles (IoV) is not just a technological marvel; it is a transformative force with profound implications for society as a whole. As this innovative concept continues to evolve, it brings about a multitude of benefits that extend far beyond the realm of technology, reshaping the way we live, work, and interact with our environment. One of the most pressing challenges in urban centers is traffic congestion, which not only wastes time but also contributes to pollution and frustration. IoV has the potential to alleviate this burden significantly. Through real-time data exchange and intelligent traffic management, IoV can optimize traffic flow, reroute vehicles to avoid congested areas, and coordinate traffic signals for smoother movement. Safety is a paramount concern on our roads. IoV plays a pivotal role in enhancing road safety through features such as collision avoidance systems, blind-spot monitoring, and real-time hazard alerts. With IoV's ability to optimize routes, reduce traffic congestion, and provide real-time information on fuel-efficient driving techniques, the environmental impact of transportation is poised to decrease significantly. Reduced idling time in traffic and more efficient routes translate to lower fuel consumption and fewer greenhouse gas emissions. IoV's influence extends beyond vehicles to the roadside environment. Smart infrastructure, equipped with sensors and communication capabilities, can offer a range of services to both drivers and pedestrians. In conclusion, the Internet of Vehicles (IoV) represents a transformative paradigm shift in transportation that holds the potential to reshape our cities.

Charging Ahead: A Dive into EVs

-S. Amrith Nair., E4B

The future of Electric Vehicles (EVs) is incredibly promising as the world accelerates toward a cleaner, more sustainable transportation landscape. EVs are poised to revolutionize the automotive industry, and recent discoveries of vast lithium reserves in Jammu and Kashmir have propelled India closer to its ambitious goal of having only electric vehicles on its roads by 2030. Lithium, a critical component in batteries, is the linchpin for this transition. The burgeoning developments in this sector underscore India's potential as a major player in the EV industry. With the rise in EV production, the need for charging infrastructure has become indispensable. The Indian government recognized this need and initiated the second phase of the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme in 2019, which includes the establishment of 2,700 charging stations across cities, highways, and public areas throughout the country. In this article, we delve into the various methods and modes of charging employed in electric vehicles, shedding light on the intricacies of powering the future of transportation. Charging an electric vehicle essentially boils down to two key considerations: where you choose to charge and how quickly you aim to replenish the battery. These two factors are intrinsically linked.



AC Charging Modes

Most electric vehicles today employ Alternating Current (AC) ie. onboard charger within the vehicle converts AC power to Direct Current (DC) and subsequently transfers it to the battery. Charging modes refer to different types of connections and safety features employed during the charging process. Four primary charging modes exist:

Mode 1: Charging from a standard household AC socket without additional safety measures. Mode 1, while simple, lacks safety features and is not widely recommended. It connects the EV directly to a household socket, limited to a maximum current of 16 amps and a voltage not exceeding 250 volts in single-phase systems (or 480 volts in three-phase networks). This mode is often restricted or prohibited in many regions due to safety concerns.

Mode 2: Mode 2 charging involves a standard household AC outlet but incorporates safety features in its cable control box. It necessitates a specific safety system between the point of connection and the EV. Mode 2 typically operates at a maximum current of 32 amps and a maximum voltage of 250 volts (single-phase) or 480 volts (three-phase). It can be used with both household and industrial sockets.

Mode 3: In Mode 3, Electric Vehicle Supply Equipment, is used to charge the EV from a wall box or charging station. This mode employs a dedicated service equipment along with the EV's onboard charger. AC current from the charging station is transferred to the onboard circuitry for battery charging. Mode 3 usually supports charging up to 32 amps and 250 volts in single-phase, or 32 amps and 480 volts in three-phase systems.

Mode 4: Mode 4 represents direct current (DC) connection for fast charging. It requires dedicated wiring and installations, typically mounted in garages or charging stations. Mode 4 chargers provide higher power levels than AC systems, thus faster EV charging.

WIRELESS CHARGING MODES

Wireless charging, also known as inductive charging, leverages electromagnetic fields to transmit energy between an EV and a charging pad through electromagnetic induction, eliminating the need for physical plug and socket connections. Two primary categories of wireless charging systems exist.

STATIC CHARGING

This approach employs two electromagnetically linked coils—an embedded primary coil in a charging pad on the road's surface and a secondary coil on the EV, usually located on the vehicle's bottom or top. The primary coil is placed on the road surface in a pad-like construction, linked to the electricity network. The secondary coil is placed on the vehicle along with additional power converters and circuitry, ideally on the bottom or top of the car. In this system, very high-frequency AC is transmitted from the transmitter coil. The received energy is converted from AC to DC using the power converter and is transferred to the battery bank. For safety measures, the receiver coil is enclosed with a battery management system and power control, along with a wireless communication network to receive feedback from the primary side. The charging duration of an electric vehicle depends on its charging pad sizes, supply level and the air gap.

Dynamic Charging

The other way to charge a car wirelessly is by Dynamic charging method. In this type of wireless charging system, the battery size is reduced, and vehicles are charged while in motion. This uses the same technological principles as stationary, wireless charging, but the charge points are embedded in the road networks. So drivers can top up their cars as they drive. In this system, the transmitter is enclosed with a primary charging pad installed beneath the road's concrete along the pathway with high-frequency AC along with its circuitries. The receiver, held with a secondary coil, is placed below the front of the vehicle with a power converter and a battery management system. This converts high-frequency AC into DC and charges the battery bank. The coils emit an electromagnetic field that is picked up by vehicles driving over them and converted into electricity to charge the cars. This would result in less stationary charging, as vehicles can travel longer distances without losing charge.

How Much Time Does It Take to Charge?

Charging an electric vehicle's battery depends on several factors, including its capacity, the charger's power rating, and the state of the battery. Larger batteries take longer to charge, and starting from an empty battery will require more time than topping up from halfway. The vehicle's maximum charging rate, the charger's rate, and environmental conditions also play crucial roles. For instance, DC charging is fastest up to 80% to 90% capacity but slows down significantly beyond that point.

In conclusion, the future of EV charging methods will likely involve a mix of these approaches. Continued research and development will improve efficiency, reliability, and accessibility of EV charging infrastructure, ensuring a seamless transition to a cleaner and more sustainable transportation future.

Unlocking The Human Potential

-Aysha Riyaz., E2B

In a world increasingly focused on renewable energy, scientists have discovered a remarkable and untapped resource right within our own bodies. Every move we make, from a simple blink to the beating of our hearts, holds the potential to generate energy on a minuscule scale. This energy can power vital medical devices like pacemakers, diabetic alert systems, and even charge our mobile phones and gadgets. Welcome to the fascinating world of triboelectric energy harvesting, where the future of sustainable power lies. At the core of this groundbreaking technology is the triboelectric effect, a phenomenon that occurs when two different materials come into contact and generate electrical charges through friction. This everyday electrostatic occurrence is now being harnessed to unlock the energy generated by the human body's movements. When two materials touch, a chemical bond forms between parts of their surfaces, creating adhesion. This leads to the transfer of charges—either electrons or ions/molecules—from one material to the other as they seek to balance their electrochemical potential. Upon separation, some atoms hold onto extra electrons, while others release them. This process generates triboelectric charges on the material surfaces. Historically, triboelectricity has been considered a nuisance, causing static shocks and interfering with electronic devices. However, recent breakthroughs have transformed it into a valuable energy source. In 2012, Zhong Lin Wang's research group introduced Triboelectric Nanogenerators

From Adversary to Ally: The Birth of Triboelectric Nanogenerators (TENGs)

(TENGs), a game-changing technology that converts small-scale mechanical energy into electricity. TENGs have demonstrated impressive capabilities, boasting an output area power density of up to 500 W/m² and an instantaneous conversion efficiency of around 70%. Unlike traditional generators, TENGs require no magnets or coils, making them lightweight, low-cost, and easily fabricated with various organic materials. Notably, TENGs excel at harvesting low-frequency energy, making them ideal for capturing energy from human body motion and ocean waves (known as blue energy). Human body movements, such as breathing and muscle contractions, represent an abundant source of mechanical energy. TENGs tap into this resource by utilizing the triboelectric effect. As two dissimilar materials come into contact and separate due to mechanical force, a potential difference is created. This difference drives electrons to flow between electrodes on the material surfaces, effectively converting mechanical motion into electrical energy. The applications of TENGs are far-reaching. Researchers have developed bandages that accelerate wound healing by applying electrical pulses powered by the movement of the ribcage during breathing. Additionally, wireless patches harness energy from bodily movements to promote hair growth through gentle electric pulses.

The energy available within our bodies through physiological processes far exceeds the requirements of small electronic devices. The journey of science continues to amaze us as we unlock new possibilities for a greener and more sustainable future.

E2

Engineering Endeavours: Student Insights from Field Visits

In a significant learning opportunity, the 2022-26 batch of the Department of Electrical and Electronics Engineering embarked on their first industrial visit to Thenmala on March 18, 2023. Accompanied by their dedicated faculty members, the students had the privilege to explore the remarkable Kallada power station. The Kallada Irrigation Project (KIP) encompasses a storage dam spanning the Kallada River and a pickup weir located 5 kilometers downstream, featuring two canal systems branching from both sides of the weir. These canals serve the purpose of irrigating a cultivable command area covering an impressive 61,630 hectares. The headworks are situated in Kollam district, while the expansive command area spans Kollam, Pathanamthitta, and Alappuzha districts. What sets the Kallada power station apart is its innovative approach to harnessing the potential of the Kallada Irrigation Reservoir's water release. It stands as the pioneering hydroelectric project in Kerala to capitalize on water resources initially designated for irrigation, effectively merging agricultural and power generation endeavors. The dam itself falls under the ownership and management of the Irrigation Department. Once electricity is generated, the water is released into the Kallada River, subsequently diverted to irrigation canals through a diversion weir during the irrigation seasons. The power generated within the station is efficiently evacuated via two 66 kV feeders. This industrial visit proved to be an enlightening experience.

E4

Engineering Endeavours: Student Insights from Field Visits

In a fascinating educational journey, the 2021-25 cohort of the Department of Electrical and Electronics Engineering embarked on a memorable visit to the Panniyar Powerhouse in Idukki on December 19, 2023. This endeavor saw a contingent of 103 bright students accompanied by four dedicated faculty members. Nestled in the serene surroundings of Panniyar Village within Kerala's Idukki District, the Panniyar Powerhouse stands as a significant hydropower project boasting an impressive 126 MW capacity. Commissioned back in 1963, this powerhouse is categorized as a 'Major' project due to its substantial capacity, crossing the 25 MW threshold. The Powerhouse itself is designed as a surface powerhouse, with its operational status firmly marked as 'Working.' Power generation at this facility relies on the waters of the Panniar/Periyar, situated within the hydroelectric basin of West Flowing Rivers in the Southern Hydroelectric Region of India. The project's development type falls under the 'Storage' category. Owned by the Kerala Government and operated by the Kerala State Electricity Board, the Panniyar Hydroelectric Project primarily benefits the state of Kerala. The plant's construction was completed in 1964, and it promptly commenced its power generation operations. The facility houses two turbines, each boasting a capacity of 15 MW. For the students, this industrial visit was an invaluable opportunity to witness the inner workings of a power plant and gain insights into hydropower generation.

E6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KARNATAKA POWER TRANSMISSION CORPORATION


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KARNATAKA POWER TRANSMISSION CORPORATION

Engineering Endeavours: Student Insights from Field Visits

In a valuable educational endeavor, the Department of Electrical and Electronics Engineering's 2020-24 batch embarked on a field trip to the 66/33/11kV MUSS Ponnampet, Karnataka Power Transmission Corporation Limited, on November 25, 2022. Accompanied by four dedicated faculty members, a total of 123 students delved into the intricacies of the power transmission system. During this enlightening visit, students had the opportunity to gain firsthand insights into the various components that constitute a power substation. The Assistant Engineer at the facility provided a comprehensive introduction to these crucial system elements and elucidated the station's operational mechanisms. Notable components discussed included Current Transformers (CT), Potential Transformers (PT), the Protection System, Earthing System, Feeders, and more. The visit also included a detailed explanation of the various feeder and transformer protection mechanisms, offering students a profound understanding of the system's safety measures. Furthermore, students were introduced to various types of circuit breakers and isolators, broadening their knowledge of essential substation equipment. By the end of this informative visit, students had not only expanded their theoretical understanding but also gained invaluable practical knowledge about several pivotal power system components. This visit exemplifies the department's commitment to providing a well-rounded education that bridges the gap between theory and real-world applications.

E8


LARJI HYDRO ELECTRIC PROJECT
126 MW
LAYOUT PLAN
SALIENT FEATURES


LARJI HYDRO ELECTRIC PROJECT
126 MW
LAYOUT PLAN
SALIENT FEATURES

Engineering Endeavours: Student Insights from Field Visits

The Department of Electrical and Electronics Engineering's 2019-23 batch embarked on an enlightening visit to the Larji Hydro Electric Plant in Mandi, Himachal Pradesh, on October 8, 2022. This educational expedition featured 121 students, accompanied by 5 faculty members. Larji Hydro Electric Plant, a commendable 126 MW hydropower project, is nestled in the picturesque Beas river basin of Himachal Pradesh, India. This active single-phase project, owned by the Himachal Pradesh State Electricity Board since its completion in 2007, harnesses the power of the Beas river with a net head of 56.84 meters. The penstock, a crucial component, stretches over 83.33 meters with a diameter of 4.5 meters. It generates an impressive 598.7 GWh of electricity at a cost of $318.296 million. During this visit, students observed the plant's three 42 MW generators (expandable to 45 MW), with one currently in operation. Water from the reservoir flows into the penstock, equipped with a Main Inlet Valve (MIV) for maintenance. Electricity generated is at 11 kV, later transformed to 132 kV using an oil-forced water-forced (OFWF) cooled transformer. Safety measures include a backup diesel generator for external power failures, efficient power distribution through four feeders, and a Gas Insulated Switchgear (GIS) system. Fireproof construction and automatic fire-extinguishing balls enhance safety. This visit bridged theory and practice, offering students insights into hydropower generation and plant operations. Engaging discussions with plant officials enriched their learning journey.


THANGAL KUNJU MUSALIAR
COLLEGE OF ENGINEERING