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Imagination is more important than knowledge.

Albert Einstein

Vision

To emerge as a global leader in the area of technical education through the pursuit of excellence with future of skills and innovation to match the ever changing global scenario.

Mission

- **Inculcating best engineering skills, professional ethics and practices.**
- **Working collaboratively with technical Institutes /Universities/ Industries of National and International repute.**
- **Providing strong foundations by adopting effective teaching learning methods.**
- **Developing leadership qualities, effective soft skills, critical thinking and attitude of lifelong learning by organizing student centric activities.**

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Our aim to promote the highest standards of technical education in the state, aspires to become a model Polytechnic, providing innovative solutions to existing polytechnic, in transforming the skill sector in India and produce world skill champions from its CoE centres. The objective Polytechnic aims at educating the students to become not only competent professionals but also excellent human beings, who would contribute towards the welfare of the society and help in raising the quality of life of its people.

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I. TECHNICAL SECTION

Automation of Industry-Industrial Internet of Things (IIoT)

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1.0 Introduction:

Industry 5.0 is the current trend of automation and data exchange in **manufacturing** technologies. It includes cyber-physical systems, the Internet of things and cloud computing & creates what has been called a "***smart factory*** "and based on robot and smart machines working alongside people with added resilience and sustainability goals towards more automations. Industry 5.0 refers to a new phase in the Industrial Revolution that focuses heavily on Interconnectivity, automation, machine learning, and real-time data. It also referred to as **Industrial Internet of Things** (IIoT) or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management. All will face a common challenge-the need for connectedness and access to real-time insights across processes, partners, and products and people. It helps manufacturers with current challenges by becoming more flexible and reacting to changes in the market easier. It can increase the speed of innovation and is very consumer cantered, leading to faster design processes.

2.0 Stages of Industry Revolution from First (1.0) to Fifth (5.0)

The First Industrial Revolution

The first industrial revolution happened between the late 1700s and early 1800s. During this period of time, manufacturing evolved from focusing on manual labour performed by people and aided by work animals to a more optimized form of labour performed by people through the use of water and steam-powered engines and other types of machine tools.

The Second Industrial Revolution

In the early part of the 20^{th} century, the world entered a second industrial revolution with the introduction of steel and use of electricity in factories. The introduction of electricity enabled manufacturers to increase efficiency and helped make factory machinery more mobile. It was during this phase that mass production concepts like the assembly line were introduced as a way to boost productivity.

The Third Industrial Revolution

Starting in the late 1950s, a third industrial revolution slowly began to emerge, as manufacturers began incorporating more electronic-and eventually computer-technology into their factories.

During this period, manufacturers began experiencing a shift that put less emphasis on analog and mechanical technology and more on digital technology and automation software.

The Fourth Industrial Revolution or Industry 4.0

In the past few decades, a fourth industrial revolution has emerged, known as Industry 4.0. Industry 4.0 takes the emphasis on digital technology from recent decades to a whole new level with the help of interconnectivity through the Internet of Things (IoT), access to real- time data, and the introduction of cyber-physical systems. Industry 4.0 offers a more comprehensive, Interlinked, and holistic approach to manufacturing. It connects physical with digital, and allows for better collaboration and access across departments, partners, vendors, product, and people. Industry 4.0 empowers business owners to better control and understands every aspect of their operation, and allows them to leverage instant data to boost productivity, improve processes, and drive growth.

The Fifth Industrial Revolution or Industry 5.0

Now a days, a fifth industrial revolution has refers to Industry 5.0 which based on robot and smart machines working alongside people with added resilience and sustainability goals included. Where Industry 4.0 focused on technologies such as the Internet of Things and big data, Industry 5.0 seeks to add human, environmental and social aspects back into the equation. But this will be powered by cutting-edge technologies, including: Predictive analytics and AI for data-driven decisions and predictive maintenance. Industrial IoT and sophisticated sensors for connectivity and coordination. Advanced robotics like Cobots, exoskeletons, and autonomous vehicles and also will be focused on sustainable decision-making throughout the value chain. Today, most large companies have net-zero carbon targets by 2050. Thisis expected to create higher-value employment with larger freedom for design thinking and creativity. It helps to improve the productivity of labour and greater opportunity for customization to customers.

3.0 Basic Industrial Internet of Things (*IIoT) Concepts.*

There are hundreds of concepts and terms that relate to IIoT and Industry 4.0, but here are 12 foundational words and phrases to know before you decide whether you want to invest in Industry 4.0 solutions for your business:

- **Enterprise Resource Planning (ERP):** Business process management tools that can be used to manage information across an organization.
- **IoT:** IoT stands for Internet of Things, a concept that refers to connections between physical objects like sensors or machines and the Internet
- **IIoT:**IIoT stands for the Industrial Internet of Things, a concept that refers to the connections between people, data, and machines as they relate to manufacturing
- **Big data:** Big data refers to large sets of structured or unstructured data that can be compiled, stored, organized, and analyzed to reveal patterns, trends, associations, and opportunities
- **Artificial intelligence (AI):** Artificial intelligence is a concept that refers to a computer's ability to perform tasks and make decisions that would historically require some level of human intelligence.
- **M2M:** This stands for machine-to-machine, and refers to the communication that happens between two separate machines through wireless or wired networks
- **Digitization:** Digitization refers to the process of collecting and converting different types of information into a digital format
- **Smart factory:** A smart factory is one that invests in and leverages Industry 4.0 technology, solutions, and approaches

- **Machine learning**: Machine learning refers to the ability that computers have to learn and improve on their own through artificial intelligence without being explicitly told or programmed to do so.
- **Cloud computing:** Cloud computing refers to the practice of using interconnected remote servers hosted on the Internet to store, manage, and process information.
- **Real-time data processing:** Real-time data processing refers to the abilities of computer systems and machines to continuously and automatically process data and provide real-time or near-time outputs and insights.
- **Ecosystem:** An ecosystem, in terms of manufacturing, refers to the potential connectedness of your entire operation-inventory and planning, financials, customer relationships, supply chain management, and manufacturing execution.

- **Cyber-physical systems (CPS):** Cyber-physical systems, also sometimes known as cyber manufacturing, refers to an Industry 4.0-enabled manufacturing environment that offers real-time data collection, analysis, and transparency across every aspect of a manufacturing operation.

4.0 Smart Manufacturing Use Cases.

One of the best ways to understand the concept of smart manufacturing better is to think about how it could be applied to your business, or a business similar to your business. Here are three use cases that can help you understand the value of Industry 4.0 in a manufacturing operation:

1. **Supply chain management and optimization-**Industry 4.0 solutions give businesses greater insight, control, and data visibility across their entire supply chain. By leveraging supply chain management capabilities, companies can deliver products and services to market faster, cheaper, and with better quality to gain an advantage over less efficient competitors

2. **Predictive maintenance/analytics-**Industry 4.0 solutions give manufacturers the ability to predict when potential problems are going to arise before they actually happen. Without lot systems in place at your factory, preventive maintenance happens based on routine or time. IoT systems preventive maintenance is much more automated and streamlined. Systems can sense when problems are arising or machinery needs to be fixed, and can empower you to solve potential issues before they become bigger problems. Predictive analytics allow companies to not just ask reactive questions like, “what has happened?” or “why did it happen?” but also proactive questions like, like, “what is going to happen,” and, “what can we do to prevent it from happening?” These type of analytics can enable manufacturers to pivot from preventive maintenance to predictive maintenance

3. **Asset tracking and optimization-**Industry 4.0 solutions help manufacturers become more efficient with assets at each stage of the supply chain, allowing them to keep a better pulse on Inventory, quality, and optimization opportunities relating to logistics. With IoT in place at a factory, employees can get better visibility into their assets worldwide. Standard asset management tasks such as asset transfers, disposals, reclassification, and adjustments can be streamlined and managed centrally and in real time.

5.0 Benefits of Adopting an Industry 4.0 Model.

Industry 4.0 spans the entire product life. Fe cycle and supply chain design, sales, inventory, scheduling, quality, engineering, and customer and field service. Everyone shares informed, up-to-date, relevant views of production and business processes and much richer and timelier analytics

List of some of the benefits of adopting an Industry 4.0 model for your business:

- **It makes you more competitive, especially against disruptors like Amazon.** As companies like Amazon continue to optimize logistics and supply chain management, you need to be investing in technology and solutions that help you improve and optimize your own operation.
- **It make you more attractive to the younger workforce**. Companies that invest in modern, m, innovative Industry 4.0 technologies are better positioned to attract and retain new workers.
- **It makes your team stronger and more collaborative.** Companies that invest Industry 4.0 solutions can increase efficiency, boost collaboration between departments, enable predictive and prescriptive analytics, and allow people including operators, managers, and executives to more fully leverage real-time data and Intelligence to make better decisions while managing their day -to-day responsibilities.
- **It allows you to address potential problems.** Predictive Issues analytics, real-time data, before they become internet-connected machinery, big and automation can all help you be more proactive when it comes to addressing and solving potential maintenance and supply chain management issues.
- **It allows you to trim costs, boost profits, and fuel growth.** Industry 4.0 technology helps you manage and optimize all aspects of your manufacturing processes and supply chain. It gives you access to the real-time data and insights you need to make smarter, faster decisions about your business, which can ultimately boost the efficiency and profitability of your entire operation.

6.0 Challenges to Consider and Overcome.

As you consider whether or not to invest in Industry 4.0, you may be thinking about some of the potential challenges associated with incorporating new technology and processes into your organization. You're not alone. To grasp the full picture of Industry 5.0 and its implications, one must first understand how the initiative is defined.

Role of Robots

Robots make an enormous contribution to works such as loading, unloading, painting, welding, etc. An autonomous robot is used to conduct a more accurate independent technique of manufacturing and to operate in locations where human employees are limited to operate. A major trend is a cooperative robot, or so-called "COBOT" intended to operate with human employees to assist them with a multitude of duties (Fukuda, 2019). Industry 5.0 has devices interconnected to optimize productivity and human effectiveness.

Role of Big Data and Artificial Intelligence

In order to generate symmetrical innovation, industry 5.0 can acquire understanding from big data which generates a network of digital knowledge. In order to enhance precision and performance, it utilizes cooperative robots and can do what a person intends to do. For instance, collaborative robots can be used on the operating table to perform distinctive surgery. Big Data comprises four aspects, according to Forrester's concept: information volume, information variety, information value, speed of creation of fresh information and interpretation (Schumacher et al., 2016).

One of the enablers is the IoT, in which sensor-equipped machines with connectivity transmit data to other machines and computer systems, automate many processes and also collect large amounts of new data types (Fukuda, 2019). Big data and IoT is already a game changer in industry 4.0 and these entities create greater impact in industry 5.0. Large amount of data is generated which is analysed using big data analysis techniques and Artificial Intelligence algorithms to make smart decisions. Also, more sensors and intelligent devices are used in industry 5.0 which constitutes for IoT which ensures high quality, precision and productivity with higher customization. Industry 5.0 generates a new kind of job opportunities such as creative and innovative thinking, technology interface, managing COBOTs, creating artificial algorithms, and many more.

3D Printing?

3D printing is a manufacturing process that creates a three dimensional object by incrementally adding material until the object is complete (this contrasts with subtractive manufacturing techniques such as milling, in which an object is created by selectively removing parts from a piece of raw material).

A 3D printer is simply a machine that can take a digital 30 model and turn it into a tangible 3D object via additive manufacturing. While these printers come in many forms, they all have three basic parts

Key Components of 3D Printing are:

1. Digital File
2. Printing Machine
3. Printing Materials

Collaborative Robots- Cobots

Cobots or collaborative robots are intended to work alongside humans. Equipped with sensor and vision technology, they do **not need to be secured behind a cage** like the industrial robots.

Cobots are more users friendly, intelligent, and affordable. They are **more precise, consistent and faster** than human workers and can **work in any environment,** adding to their flexibility, Robots eliminate dangerous jobs for humans because they are capable of working in hazardous environments. They can handle lifting heavy loads, toxic substances, and repetitive tasks.

Why Cobots?

Easy to program: No programming expertise needed. Often, they are virtually plug and play or easily programmed through a tablet or by adjusting the cobot's arms.

Fast to setup: unlike traditional Industrial robots that take weeks to be operational, the setup time for most cobots is just a few hours.

Flexible: Cobots are flexible and mobile, don't require a lot of space and can beredeployed very easily to support new and multiple applications.

Safe: Equipped with sensors & vision cobot can sense obstacles and adjust their speed or reverse to avoid crashing into humans (or other obstacles).

Virtual Reality – VR

Virtual reality (VR) is also called a computer simulated reality which delivers an immersive experience. VR are used with the real headsets to create an imaginary world with the life like sounds, imageries and other feelings that are the imitation of a real environment. An accurate VR App development setting will immerse all the five sense in the human body including taste, smell, sight, sound, and touch, but in reality, it is not always possible. VR uses two types of main headsets:

1. **PC-connected**

These headsets are connected to a computer or gaming console that provides with top-quality visual experience. They can also be used with special controllers and users can interact with the virtual world.

2. **Standalone**

These headsets are not needed to be connected to a computer or a gaming console. Most of the standalone headsets use a smart phone screen for interacting with virtual reality. They are quite affordable and easy to use

Augmented Reality – AR

Augmented reality (AR) is live and direct or indirect viewing of a real-world environment where its elements are amplified or augmented using audio, video, graphics, or GPS data. It gives you a lot more freedom that what you get in the real world. Smartphone and tablets are two of the most widespread means of AR as of now. Two types of main devices are:

1. **Portable devices**

AR is perhaps the most reachable and handy reality technology, as people can get access to it using portable devices like smart phones and tablets in order to use applications based on augmented reality. AR apps simply use a Smartphone camera in order to seize the real world. Then the virtual items are overlaid, and users can easily see them on their portable device.

2. **AR glasses and headsets**

Another way to enjoy augmented reality is by using smart glasses or AR headsets. As compared to VR headsets, these AR glasses and headsets don't engage the users into a completely virtual environment. Instead, they just add virtual in the real world.

Mixed Reality- MR

Mixed Reality is also called as hybrid reality. It is the merger of real and virtual environments in order to create new environments and visuals. In that new environment, both physical and digital entities exist together, interacting in real time. It means a new imagery is placed inside a real space in such a manner that the new imagery can interact to a degree, with the real world as you know it The distinguishing factor of MR is that the artificial content and the real or physical world content can interact with one another in real time. There can also bea different form of mixed reality. In this new form of mixed reality, users watch and interact with a fully virtual environment which is overlapped on the real world surrounding the users.

8.0 Conclusion.

The Industrial Internet of Things (IIoT) is a term coined by GE and refers to the integration of complex physical machinery with networked senor and software. This enable the collection of data from machines, analyze the data and use it in real time to adjust operations Machines are able to communicate with each other to operate autonomously or semi-autonomously Data can be captured for Big Data Analytics and Machine Learning.Further industrial revolution relates to human-machine interaction to make jobs easier and quicker. Industry 5.0 brings the personalization idea to the next stage. Industry 5.0 is used with greater effectiveness to meet the extremely personalized demand and to build a virtual environment, advanced computers and information technologies. Industry 5.0 is the realization of optimal integration of big data, Artificial Intelligence, internet of things (IoT), cloud computing, COBOTSs, innovation and creativity. Industry 5.0 is expected to create higher-value employment with larger freedom for design thinking and creativity. It helps to improve the productivity of labor and greater opportunity for customization to customers. On the flip side, due to highly automated manufacturing systems, skill development for the workforce is a humongous task. There is an increased cyber security threat in critical industrial systems and manufacturing lines at industry 5.0 due to its increased connectivity and use of standard communications protocols. Even though industry 5.0 provides greater autonomy to robots, important and moral based decision making is vested with humans. Overall, industry 5.0 is expected to revolutionize the production systems and process by allowing larger collaboration between humans and robots in providing tailored products to customers.

References:

1. Temasek Foundation -Managing a Modern Institution
2. Epicor Resources - Resources Internet Materials
3. Tech rader- Resources from Internet
4. Fukuda, K. (2019). Science, Technology and Innovation Ecosystem Transformation Toward Society 5.0. International Journal of Production Economics.
5. Haleem, A., &Javaid, M. (2019). Industry 5.0 and its expected applications in medical field. Current Medicine Research and Practice.
6. Qin, J., Liu, Y., & Grosvenor, R. (2016). A categorical framework of manufacturing for industry 4.0 and beyond. Procedia Cirp, 52, 173-178.
7. Rossi B. Manufacturing Gets Personal in Industry 5.0. Reconteur; 2018. https:// www.raconteur.net/technology/manufacturing-gets-personal-industry-5-0.

The Role of English in Technical Education: A Gateway to Success

Salman Khan, Asst. Professor, BSH

"Language is the road map of a culture. It tells you where its people come from and where they are going." — Rita Mae Brown In the grand tapestry of human progress, technical education stands as the warp and weft that weave innovation into the fabric of our daily lives. Engineers, scientists, and technocrats are the architects of modern civilization, sculpting a future powered by artificial intelligence, quantum computing, and sustainable technology. Yet, amidst this dazzling symphony of equations and algorithms, there exists an oft-overlooked yet indispensable skill—proficiency in English. It is not merely a language but a veritable passport to the global stage, an intellectual currency that facilitates the seamless exchange of knowledge and ideas. One need not look further than Sundar Pichai, the cerebral virtuoso helming Google, to appreciate the transformative power of linguistic dexterity. An alumnus of IIT Kharagpur, his technical prowess was unquestionable, yet his ability to articulate ideas with lucidity and gravitas propelled him to Silicon Valley's zenith. His eloquence in English enabled him to navigate corporate boardrooms, engage with global stakeholders, and command the respect of his peers. His trajectory underscores a fundamental truth—technical acumen becomes an unstoppable force when paired with articulate communication. English, the lingua franca of academia and industry, is the conduit through which the world's most ground-breaking ideas are disseminated. The vast corpus of scientific literature, from erudite treatises on astrophysics to cutting-edge research in biotechnology, is predominantly published in English. A brilliant mind shackled by linguistic inadequacy risks relegating its ideas to obscurity, no matter how revolutionary they may be. The late Dr. A.P.J. Abdul Kalam, India's beloved "Missile Man," was not merely a luminary in rocketry but also an orator par excellence. His ability to distill esoteric scientific concepts into accessible discourse made him a statesman of science and an inspirer of minds across generations. Beyond the ivory towers of research institutions, English assumes an even more pragmatic role in the professional sphere. The modern workplace is a crucible of cross-cultural collaboration, where engineers from Tokyo brainstorm with designers in Berlin and software developers in Bengaluru code alongside project managers in San Francisco. In such an ecosystem, linguistic clarity is not a luxury but a necessity. A single miscommunication can trigger cascading inefficiencies, jeopardizing multimillion-dollar ventures. Consider Ratan Tata, the paragon of corporate sagacity, who spearheaded Tata Motors' acquisition of Jaguar Land Rover. His ability to engage in high stakes negotiations, eloquently presents his vision and forge global alliances exemplifies how command over English can amplify technical expertise into global leadership. The importance of English extends beyond the realms of employment; it is the bedrock upon which innovation thrives. The world's most prodigious

technological leaps have not emerged in isolation but through the confluence of brilliant minds unshackled by linguistic barriers. The meteoric ascent of Elon Musk is instructive in this regard. Though revered for his audacious ventures in space travel and electric mobility, Musk's ability to articulate his ideas with infectious enthusiasm has galvanized public support and attracted investment. A technical genius bereft of linguistic flair may find their vision lost in translation, languishing in the shadow of less inventive yet more articulate counterparts. Yet, despite its manifest significance, English remains a formidable hurdle for many students in technical fields, particularly those hailing from vernacular backgrounds. The trepidation of speaking in English, the self-imposed gag order induced by the fear of grammatical faux pas, often stifles their confidence. But the illustrious career of Dr. K. Radhakrishnan, the former chairman of ISRO, is a testament to the triumph of perseverance over linguistic insecurity. Rising from humble beginnings, he mastered the intricacies of space exploration and honed his communication skills, enabling him to lead India's Mars Orbiter Mission to resounding success. His eloquence in English allowed him to engage with international space agencies, securing India's place at the high table of global space exploration. Addressing this linguistic lacuna requires a paradigmatic shift in technical education. English must not be relegated to the periphery of the curriculum but be woven into the very fabric of technical pedagogy. Institutions must cultivate an ecosystem where language learning is not an onerous imposition but an organic, immersive experience. Encouraging students to participate in debates, research symposiums, and technical paper presentations can be a crucible for honing their communicative dexterity. The digital age has democratized access to linguistic enrichment. With only a smartphone and an internet connection, a remote village student can immerse themselves in TED Talks, engage in MOOCs from Ivy League universities, or participate in global coding communities. Writing technical blogs, contributing to open-source projects, and engaging in professional discourse on platforms like LinkedIn can further refine their linguistic and technical prowess. Ultimately, English is not merely a communication tool; it is the scaffolding upon which careers are built, and revolutions are scripted. From the corridors of academia to the nerve centers of corporate boardrooms, from research labs to entrepreneurial incubators, the ability to articulate ideas with precision and eloquence can be the fulcrum upon which success pivots. While technical knowledge forms the bedrock of professional competence, linguistic prowess elevates it, ensuring that one's innovations do not languish in the obscure recesses of academia but instead shape the world. It is, therefore, incumbent upon technical students to embrace English not as an alien imposition but as an empowering ally, a force multiplier that can propel their ambitions to stratospheric heights. In the grand narrative of progress, those who wield knowledge and language with equal dexterity do not merely participate in the future—they define it.

"One language sets you in a corridor for life. Two languages open every door along the way." — Frank Smith

CELLULAR AUTOMATA

Sambhu Prasad Panda, HOD, CSE

Abstract: Cellular automata (CAs) are powerful computational models that have gained attention for their ability to simulate complex systems and phenomena from simple rules. These discrete, grid-based systems have applications in fields ranging from physics and biology to cryptography and artificial intelligence. This article delves into the underlying principles of cellular automata, the different types of CAs, their famous implementations, and their diverse applications in real-world problems.

Introduction

In the world of computation and mathematical modelling, cellular automata (CAs) are a class of models that explore how simple, local interactions between cells can lead to complex and sometimes unexpected global behaviour. Originating from the work of mathematicians and computer scientists such as John von Neumann and Stanislaw Ulam in the 1940s, CAs have since found applications in various domains, including physics, biology, and computer science. Their ability to simulate complex patterns with minimal computational resources makes them an invaluable tool for researchers and practitioners alike.

What Are Cellular Automata?

A cellular automaton consists of a grid of cells, where each cell can exist in one of a finite number of states. The grid can be one-dimensional, two-dimensional, or even higher-dimensional. The state of each cell at the next time step is determined by a set of local rules that consider the current state of the cell and the state of its neighbours.

Key components of a CA:

1. **Grid**: A collection of cells arranged in a regular pattern, typically 1D, 2D, or higher-dimensional grids.
2. **Cell states**: Each cell can be in one of a predefined set of states, which can be binary (alive or dead) or have multiple possible values.
3. **Neighborhood**: The set of adjacent cells that affect the state of a given cell. The neighborhood can be defined in various ways, such as the **Von Neumann** (orthogonal neighbors) or **Moore** (all eight surrounding cells) neighborhoods.
4. **Update rules**: A set of rules that determine how a cell's state evolves based on its current state and the states of its neighbors.

Types of Cellular Automata

1. Elementary Cellular Automata (1D CAs): Elementary cellular automata, as introduced by Stephen Wolfram, are the simplest form of CAs. These operate on a one-dimensional grid, where each cell has only two neighbors (one on either side). Each cell can have one of two states (binary). The next state of a cell is determined by its current state and the states of its two immediate neighbors. There are 256 possible update rules for a 1D CA with binary states.

A famous example is **Rule 30**, which exhibits chaotic and seemingly random behavior from simple initial conditions. Rule 110 is another well-known example, notable for its computational universality—meaning it can perform any computation that can be done by a Turing machine.

2. Two-Dimensional Cellular Automata: Two-dimensional CAs are often used to model more complex systems, as they can simulate a variety of patterns that emerge in nature, such as the growth of crystals, the behavior of fluid dynamics, and the spread of disease. The most well-known two-dimensional CA is **Conway's Game of Life**, a binary automaton where each cell is either "alive" or "dead." Its simple rules—cells survive if they have two or three neighbors, and dead cells with exactly three neighbors come to life—lead to a variety of complex and often unexpected patterns, including gliders, oscillators, and spaceships.

3. Higher-Dimensional Cellular Automata: Higher-dimensional cellular automata extend the grid beyond two dimensions and can simulate even more complex systems. These can be applied to model phenomena in physics (such as the behavior of fluids in 3D), traffic flow in urban planning, or even the structure of molecular biology in protein folding.

Fundamental Rules and Behaviour

The behaviour of a cellular automaton is determined by the rules governing the interaction of neighbouring cells. These rules are often designed to mimic natural processes or to produce interesting patterns. Some of the most widely studied rules include:

1. **Conway's Game of Life**: A 2D binary CA where cells live or die based on their neighbours. It is known for the emergence of complex structures such as oscillators, gliders, and patterns that "self-replicate."
2. **Rule 30**: A one-dimensional CA that starts with a single "alive" cell and evolves into a chaotic, seemingly random pattern. This rule has been used in cryptography for generating pseudorandom sequences.
3. **Langton's Ant**: A simple two-dimensional CA where an "ant" moves according to a set of simple rules based on the colour of the cell it is on. Despite the simplicity, Langton's Ant eventually builds a regular, repetitive pattern after a long period of seemingly random movement.

Applications of Cellular Automata

1. Physics and Natural Phenomena: Cellular automata have been used to simulate a variety of physical processes, such as the diffusion of particles, heat conduction, and the formation of patterns in nature (like the arrangement of leaves or the growth of crystals). The ability to simulate large-scale complex behaviors from simple rules makes them ideal for modeling systems where the exact underlying equations may be too complex or unknown.

2. Biology: In biology, CAs can model processes such as the spread of diseases, the growth of plants, or the behavior of populations. For instance, **CA models** have been used to simulate the spread of epidemics, examining how diseases propagate through populations based on contact rules. They can also model cellular growth, like the formation of tissues and the self-replication of organisms.

3. Cryptography: Some CAs, like Rule 30, are used in cryptographic systems to generate pseudo-random numbers, which are essential for encryption algorithms. Their unpredictable and complex behavior makes them ideal for applications in creating cryptographic keys or secure hash functions.

4. Artificial Life and Complex Systems: Cellular automata are often used in the study of artificial life (A-Life) to investigate how simple rules can lead to emergent complexity, much like life itself. CAs have been used to study self-replication, evolution, and cooperation among simple agents, providing insights into the basic principles of life and evolution.

5. Traffic Flow and Urban Planning: Cellular automata can be used to model and simulate traffic flow on roads and intersections. These simulations help researchers optimize traffic management, reduce congestion, and improve urban planning strategies.

Conclusion

Cellular automata are a powerful, flexible tool for modelling a wide variety of systems across many disciplines. Whether in physics, biology, cryptography, or computer science, CAs provide a framework for understanding how local interactions can give rise to complex, emergent behaviour. From the elegant simplicity of Conway's Game of Life to the chaotic unpredictability of Rule 30, cellular automata continue to captivate researchers and practitioners alike. As computing power continues to grow and our understanding of complex systems evolves, the potential applications of CAs in real-world problem-solving will undoubtedly expand, offering new insights into the fundamental processes of nature and computation.

Dye-Sensitized Solar Cells (DSSCs):
A Promising Renewable Energy Solution

Ms. Anita Sahoo, Technical Assistant, BSH

Introduction

Global energy demands are escalating, and the depletion of fossil fuels necessitates the exploration of alternative energy sources. Solar energy, abundant and renewable, offers a sustainable solution. Among various solar technologies, Dye-Sensitized Solar Cells (DSSCs) have emerged as a cost-effective and efficient option for harnessing solar energy. Developed by Professor Michael Grätzel in 1991, DSSCs belong to the thin-film solar cell family and are recognized for their simplicity in manufacturing, affordability, and effective use of natural dyes as photosensitizers.

Components of DSSCs

1. *Working Electrode*: The working electrode in a DSSC is crucial for its operation. It typically consists of a 10 µm-thick mesoporous film of TiO_2 nanoparticles, each about 20 nm in size, applied to a glass substrate coated with fluorine-doped tin oxide (FTO).

2. *Redox Electrolyte*: The electrolyte is a solution that contains a suitable redox couple, most commonly iodide/triiodide, along with additives that improve the performance of the solar cell. The role of the electrolyte is to mediate the electron transfer between the photoexcited dye and the counter electrode.

3. Counter Electrode: This electrode, often made of platinum due to its excellent catalytic properties, facilitates the transfer of electrons back to the redox electrolyte, regenerating the electrolyte by reducing triiodide ions back to iodide.

4. *Transparent and Conductive Substrate*: High transparency (>80%) and electrical conductivity are essential for the substrate used in DSSCs. FTO and ITO (indium tin oxide) are commonly used as conductive substrates because they allow maximum sunlight to reach the dye while facilitating efficient charge transfer to minimize energy loss.

5. *Photosensitizers (Dyes):* Photosensitizers are the molecules responsible for absorbing photon energy. In DSSCs, dyes can be either synthetic, such as Ruthenium (II) polypyridyl complexes, or natural, such as chlorophyll, anthocyanins, and carotenoids.

Working Mechanism of DSSCs

The operation of DSSCs involves a series of steps that convert sunlight into electrical energy:

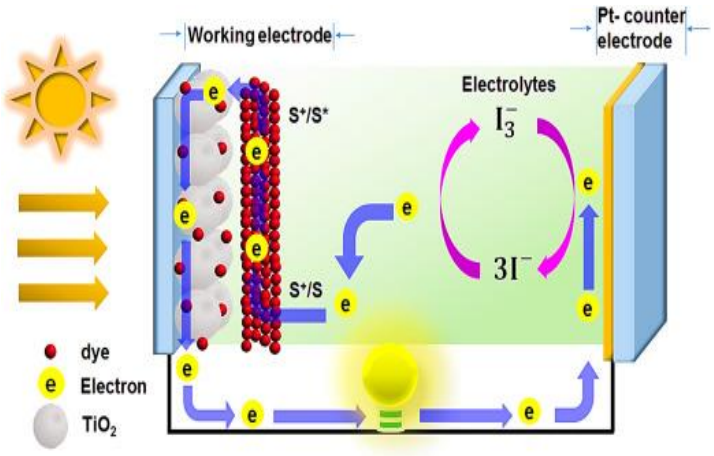
1. **Photon Absorption**: When sunlight strikes the DSSC, the dye molecules absorb photons, causing electrons in the dye to become excited to a higher energy state.

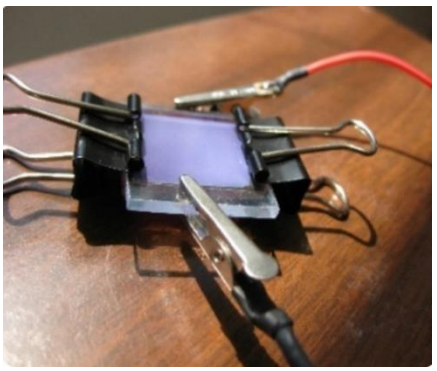
2. **Electron Injection**: The excited electrons are then injected into the conduction band of the TiO2 semiconductor layer, leaving behind oxidized dye molecules.

3. **Electron Transport**: These electrons move through the TiO_2 nano particle network and reach the external circuit due to the potential difference applied across the cell.

4. **Electrolyte Regeneration**: The electrolyte in contact with the counter electrode accepts electrons from the external circuit, reducing triiodide ions (I^{3-}) to iodide ions (I^-). These iodide ions then diffuse back to the photoelectrode, where they re-oxidize to triiodide ions, completing the redox cycle.

5. **Electric Current Generation**: The flow of electrons through the external circuit from the photoelectrode to the counter electrode generates an electric current that can be used to power electrical devices.





Operating principle of dye-sensitized solar cell

Advantages of DSSCs

1. *Lightweight*: By using plastic substrates instead of glass, the weight of DSSCs can be minimized. This reduction in weight allows for installation in a variety of locations, including places where the appearance of traditional solar panels might be unsuitable.

2. *Low-Light Performance*: DSSCs can generate electricity even under low-light conditions, including cloudy skies and indoor environments. Unlike traditional silicon-based solar cells, which

require direct sunlight, DSSCs can operate effectively in diffuse light, making them versatile for various lighting conditions.

3. *Environmental Friendliness*: The components of DSSCs are non-toxic and recyclable, making them an environmentally friendly option for solar energy. The ability to recycle DSSC materials reduces waste and enhances the sustainability of this technology.

4. *Cost-Effective Production*: The manufacturing processes for DSSCs are relatively simple and do not require expensive vacuum systems. This simplicity in production significantly lowers the overall cost, making DSSCs an affordable alternative to silicon solar cells.

6. *Flexibility*: DSSCs can be formed into flexible thin films, allowing for innovative applications, including wearable electronics and portable solar chargers.

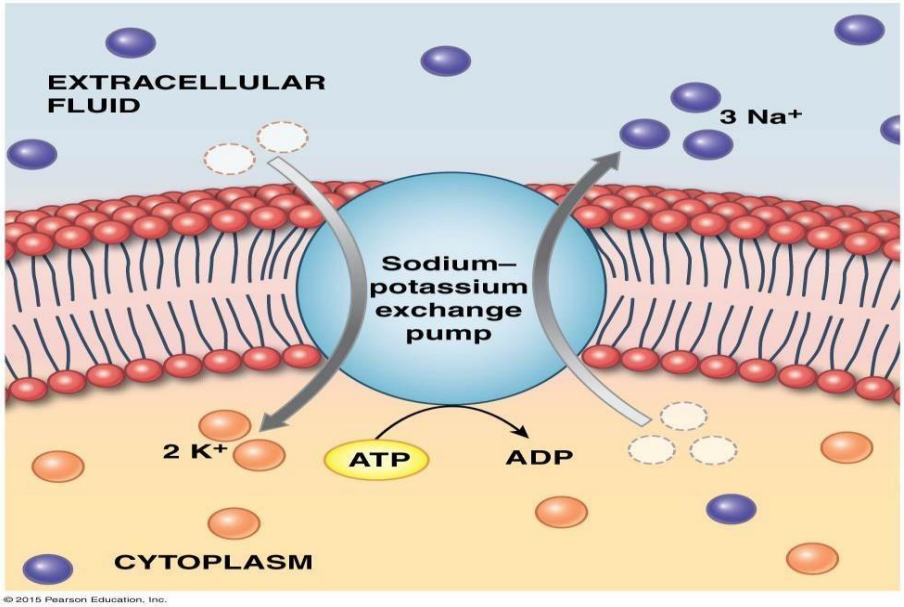
7. *No Need for Sunlight Intensity Optimization*: DSSCs do not require precise alignment for optimal sunlight intensity. They can generate electricity effectively without the need for tracking systems to follow the sun's movement.

Preparation of Potash Fertiliser from a Silicate mineral using eggshell

Dr Jayashree Samantray, Assistant Professor, BSH

Potassium ranks seventh in its abundancy in the earth's crust resulting vast reserve of potassium-containing soil. It is always present in nature in a combined form with one or more elements due to its high reactivity with oxygen and water.

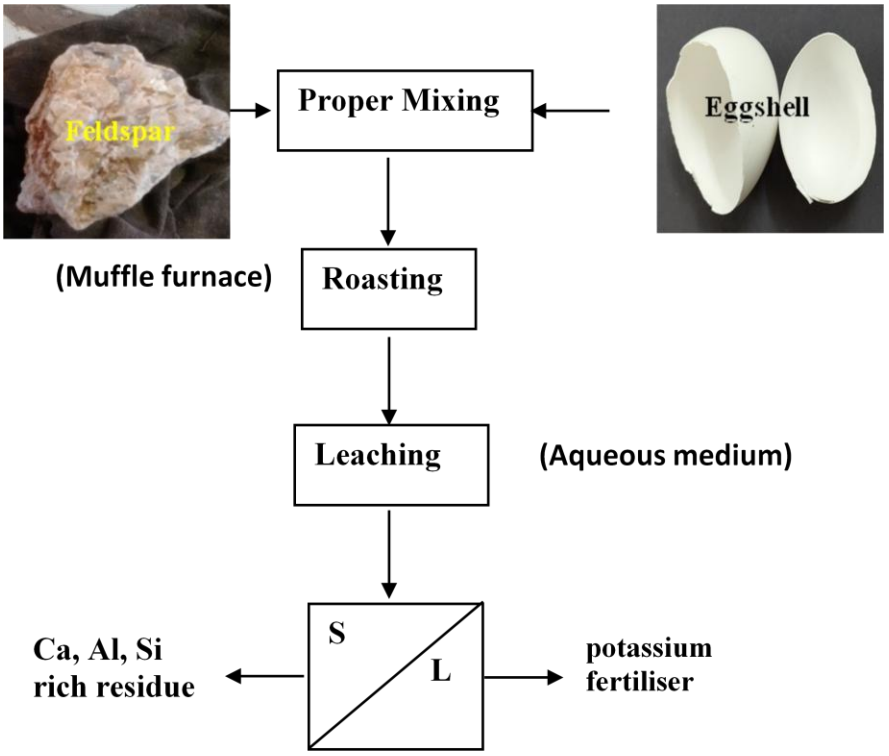
Potassium is a vital element required by all living organisms for the smooth functioning of organ systems. The chief functions of potassium are the regulation of fluid balance along with monitoring the electrical activity of the heart and the proper functioning of the nerves and muscles. The cell membranes comprise a specialised protein known as sodium-potassium pump or Na/K-ATPase which accounts for simultaneous transport of potassium and sodium ions. This mechanism is essential for cell physiology. The Na-K pump exchanges three sodium ions with two potassium ions by using one ATP molecule. Therefore this pump helps in maintaining a higher sodium ion concentration in the extracellular fluid and that of potassium in the intracellular fluid. It is significant for nerve cells, which helps in giving response to stimuli and in the transmission of nerve impulses. Potassium is essential for protein synthesis and carbohydrates metabolism. It maintains blood pressure, bone strength, and helps in reducing the formation of kidney stones. Its deficiency results in weakness, fatigue and constipation which gradually lead to paralysis, painful gut obstructions, and respiratory failure.



India is an agriculture based nation and it fulfils all its' potash requirement through imports. India's entire requirement of potash fertiliser is met through imports because it is deprived of potassium rich minerals. Potassium rich minerals are not available in India however low grade minerals and rocks of K like feldspar, glauconitic sandstone, nepheline syenite (NS) etc. are available in plenty.

Egg shell, a bio-waste is used as a no-cost precursor for synthesis of $CaCl_2$. India ranks third in the production of eggs after China and the USA. After the preparation of various products from eggs, eggshells are simply dumped due to lack of proper knowledge for further use.

- The potassium bearing feldspar that was considered for extraction studies possesses 11.6 % K_2O and microcline and orthoclase as the major potassium bearing phases. $CaCl_2$ was found out to be the most effective roasting agent that converted potassium in the silicate matrix to its chloride salt and recovered completely on water leaching. Eggshell, a bio-waste is used in combination with hydrochloric acid as precursors of calcium chloride to be used as the roasting agent for feldspar.
- Complete extraction of potassium was achieved by roasting feldspar with eggshell powder and 1.5 times the stoichiometric amount of hydrochloric acid. The optimised conditions were feldspar to ESP in the ratio of 1:1.8 at 900 °C for 30 minutes followed by leaching with water at ambient temperature.



The Impact of 5G: What Students Need to Know About the Next Generation of Connectivity!!

Mirza Tanweer Abbas, F22029007059, CSE

In 2025, 5G technology is no longer a distant dream; it's quickly becoming a transformative force shaping the way we live, work, and study. As the next generation of mobile connectivity, 5G promises faster speeds, lower latency, and more reliable connections, all of which could drastically change the college experience for students. But what exactly does 5G mean for you, the student? And how can you leverage its benefits for academic success, social connections, and even future career opportunities

The Potential Impact of 5G on day to day life:

1. Faster Internet Speeds: A Game Changer for Remote Learning

One of the most obvious benefits of 5G is its ability to deliver internet speeds that are up to 100 times faster than 4G. For students, this translates to quicker downloads, faster streaming, and smoother online classes. Whether you're in a lecture, working on a research project, or collaborating on a group assignment, the ability to access large files, stream high-definition videos, or participate in virtual labs without lag can greatly enhance your productivity

2. Low Latency: Real-Time Communication for Global Collaboration

5G's ultra-low latency is one of its most impressive features, with delays as low as 1 millisecond compared to 30-50 milliseconds on 4G. This means that real-time communication will become more seamless, opening the door for smoother online collaboration across time zones and borders. 5G will make this experience far more efficient, especially for tasks that require live feedback, such as coding, design work, or collaborative writing.

3. Empowering the Internet of Things (IoT) on Campus

5G's enhanced connectivity also extends to the Internet of Things (IoT)—the network of devices that are interconnected via the internet. On campus, this could mean smart classrooms, where lighting, temperature, and even seating arrangements are adjusted based on students' preferences or schedules. For example, 5G will make it possible for real-time tracking of campus resources, from library books to laundry machines, ensuring that students can make the most of their time.

4. Gaming, Entertainment, and Virtual Experiences: The Future of Fun

For many students, gaming, streaming, and entertainment play a significant role in campus life. 5G will elevate these experiences to new heights. With faster speeds and lower latency, you can expect seamless multiplayer gaming, ultra-high-definition video streaming, and immersive virtual experiences. This is particularly exciting for those studying gaming, media, or related fields, as 5G will enable more sophisticated AR and VR applications. For example, VR could become an even more powerful educational tool, providing immersive experiences in fields like history, biology, architecture, or engineering.

5. Career Opportunities: A Connected Workforce

As 5G unlocks new opportunities for remote work, it will also shape the types of careers and industries that are available to you after graduation. Students entering fields such as tech, digital marketing, data science, and graphic design will benefit from a more connected job market, as faster internet speeds will enable better collaboration across teams located in different parts of the world. Additionally, emerging industries such as 5G network management, cybersecurity, autonomous vehicles, and the smart city movement are all expected to grow in the coming years, opening up exciting career opportunities for students in STEM fields.

6. The Potential Downsides: Privacy, Security, and Health Concerns

As with any new technology, 5G also comes with potential concerns. With the rise of 5G-enabled devices, there will be a growing need to address privacy and security issues. Students must remain vigilant about protecting their personal data, especially as IoT devices become more ubiquitous and as more sensitive information is shared online. There have also been

discussions surrounding the health effects of 5G radiation. While current research shows that the radiofrequency radiation from 5G networks is well within safe limits.

7. Preparing for the 5G Future: How Students Can Get Ahead

To take full advantage of the 5G revolution, students should start developing skills and knowledge in areas that are likely to benefit from this technology. As 5G networks continue to roll out, many mobile carriers are upgrading their infrastructure, and many new smartphones, laptops, and tablets now come with 5G capabilities. Staying up-to-date with technology can help ensure you're ready to embrace the benefits that 5G has to offer.

Conclusion:

As 5G continues to roll out across the globe, students have a unique opportunity to harness its power for academic, professional, and personal growth. From faster internet speeds to immersive learning experiences, the next generation of connectivity promises to revolutionize the way students engage with the world around them. By understanding the potential of 5G and staying informed, you can ensure that you're not only prepared for this shift but can actively use it to enhance your college experience and future career prospects. The future is fast, and with 5G, it's closer than ever.

Exploring the Advantages and Disadvantages of Artificial Intelligence

Neha Niharika Swain, F23029007057, CSE

Introduction:

Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the 21st century, revolutionizing various aspects of our lives. From powering virtual assistants to driving autonomous vehicles, AI is reshaping industries and economies worldwide. However, this rapid advancement comes with its own set of advantages and disadvantages, sparking debates about its ethical implications and societal consequences.

Advantages of Artificial Intelligence:

1. Increased Efficiency: AI systems can automate repetitive tasks, leading to enhanced productivity and efficiency in various industries. From manufacturing to customer service, AI streamlines processes and reduces human effort.
2. Improved Decision Making: AI algorithms analyze vast amounts of data to provide insights and make informed decisions. This capability is particularly valuable in sectors like healthcare and finance, where accurate predictions can save lives and mitigate risks.
3. Personalized Experiences: AI-powered recommendation systems use data analysis to deliver personalized content and services to users. This not only enhances user satisfaction but also drives business growth through targeted marketing.
4. Enhanced Safety: AI-enabled technologies, such as autonomous vehicles and surveillance systems, improve safety by detecting and responding to potential threats in real-time. This has the potential to reduce accidents and crime rates significantly.
5. Innovation Catalyst: AI fosters innovation by enabling the development of new products and services. From advanced robotics to medical diagnostics, AI-driven innovations push the boundaries of what's possible, fueling economic growth and competitiveness.

Disadvantages of Artificial Intelligence:

1. Job Displacement: Automation powered by AI has the potential to replace human workers in various industries, leading to job displacement and economic inequality. This poses significant challenges for workforce adaptation and social stability.
2. Bias and Discrimination: AI systems can inherit biases present in the data they are trained on, leading to discriminatory outcomes, particularly in decision-making processes. Addressing these biases requires careful algorithm design and diverse datasets.
3. Privacy Concerns: AI technologies often rely on vast amounts of personal data, raising concerns about privacy and data security. Unauthorized access to sensitive information by malicious actors can have serious consequences for individuals and society as a whole.
4. Ethical Dilemmas: The use of AI in sensitive areas such as healthcare and criminal justice raises ethical dilemmas regarding consent, fairness, and accountability. Striking a balance between innovation and ethical principles is crucial for responsible AI deployment.
5. Dependence and Control: Overreliance on AI systems may erode human skills and autonomy, leading to a loss of control over critical decision-making processes. Ensuring human oversight and transparency in AI development is essential to prevent unintended consequences.

Conclusion:

Artificial Intelligence offers immense potential to transform industries, drive innovation, and improve quality of life. However, realizing these benefits requires addressing the associated challenges and risks, including job displacement, bias, privacy concerns, ethical dilemmas, and loss of human control. By fostering interdisciplinary collaboration and adopting ethical frameworks, we can harness the power of AI responsibly and create a future where humans and machines coexist harmoniously.

A Brief History and Introduction to NVIDIA

Hammad Ahmad, F22029007044, CSE

Founded in 1993 by Jen-Hsun Huang, Chris Malachowsky, and Curtis Priem, NVIDIA quickly rose to prominence in the technology sector with its focus on graphics processing units (GPUs). Headquartered in Santa Clara, California, the company's initial mission was to create cutting-edge graphics technology for the burgeoning video game industry. Little did they know, this pursuit would lead to innovations that would transform multiple industries, including gaming, artificial intelligence (AI), and high-performance computing?

Expansion into Professional Markets and AI

As gaming demand grew, NVIDIA expanded its reach beyond just graphics and into the world of professional graphics processing. Its Quadro series of graphics cards catered to industries such as architecture, digital content creation, and engineering. This move allowed NVIDIA to capture a significant share of the professional graphics market.

Leadership in AI and the Future of Computing

In the 2010s, NVIDIA's leadership in AI and machine learning became undeniable. The company's Tesla GPUs were embraced by data scientists and researchers for their ability to accelerate AI algorithms, transforming industries from healthcare to automotive. NVIDIA's Deep Learning Super Sampling (DLSS) and Ray Tracing technologies also set new benchmarks in gaming graphics, creating a more immersive and realistic experience for players worldwide.

The launch of the NVIDIA DGX systems, designed to optimize deep learning workloads, further solidified the company's position as a leader in AI and high-performance computing.

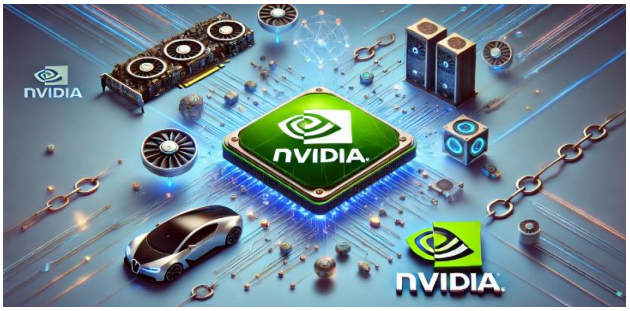
Today: A Dominant Force in AI and Graphics

Today, NVIDIA is not just a leader in the gaming sector but a driving force in AI, cloud computing, autonomous vehicles, and professional visualization.

NVIDIA's Technological Leap: Redefining the Future of AI and Graphics: As the world of technology evolves, few companies are pushing the envelope quite like NVIDIA. From groundbreaking advancements in artificial intelligence (AI) to cutting-edge graphics processing units (GPUs), NVIDIA is at the forefront of the next technological revolution. With a series of exciting new releases and innovations unveiled in 2025, NVIDIA is once again setting the stage for a future where AI, gaming, and professional computing seamlessly converge.

Blackwell Ultra & Vera Rubin: The Future of AI Chips

At the GPU Technology Conference (GTC) 2025, NVIDIA introduced the Blackwell Ultra, a next-generation AI chip set to launch later this year. Designed to meet the growing demand for powerful AI systems, the Blackwell Ultra promises to deliver unmatched performance, combining enhanced memory capabilities, energy efficiency, and robust processing power.



DGX Spark & DGX Station: Personal AI Supercomputing

For those seeking to bring AI capabilities to the edge, NVIDIA has unveiled the DGX Spark and DGX Station, two personal AI systems designed to empower developers and data scientists.The DGX Station , brings supercomputing power to personal workstations, allowing professionals to run AI models and workflows directly on their desks. These innovations make AI accessible to a broader range of industries and individual users, unlocking new possibilities for AI-driven innovation at scale.

The AI-First Vision

At the heart of NVIDIA's innovations lies its commitment to an AI-first computing approach. It's not just about powerful hardware; NVIDIA is also pioneering software and platforms that enable AI at every level of computing. From GPU-accelerated AI workloads to AI-driven development tools, NVIDIA's vision is clear: the future is AI-powered.

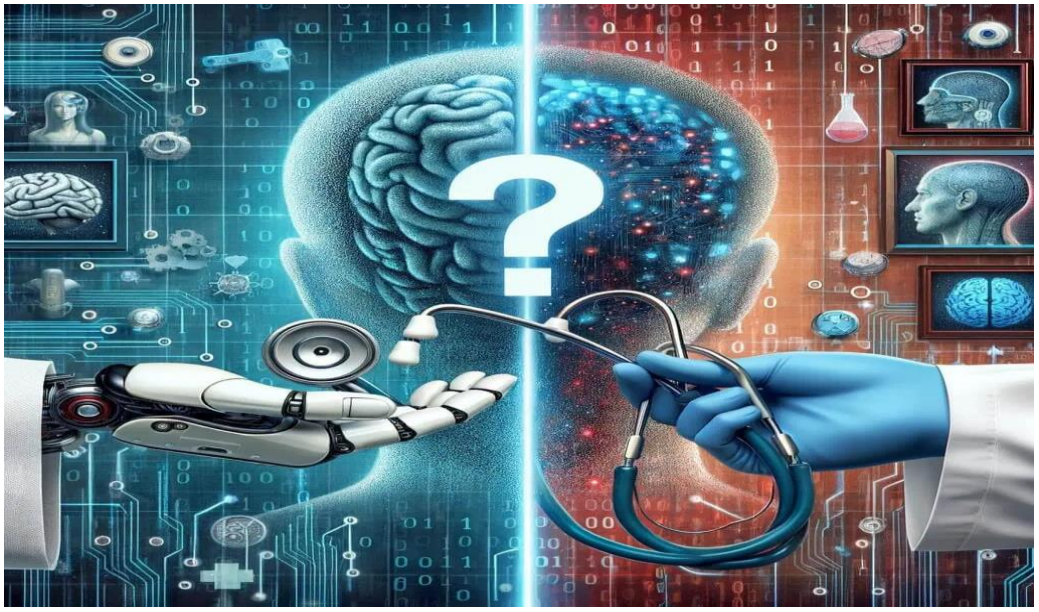
With its advancements in AI chips, next-gen GPUs, DLSS technology, and AI-driven workstations, NVIDIA is shaping the future of computing, gaming, and professional applications. Whether you're a gamer looking for the best visual experience, a developer seeking cutting-edge AI tools, or a professional working on complex simulations, NVIDIA is making it possible to push the limits of what's achievable.

Conclusion: Paving the Way for Tomorrow

As we look ahead, NVIDIA's latest technological innovations provide a thrilling glimpse into the future. With the power to reshape industries and revolutionize how we interact with digital content, these advancements are only the beginning. Whether you're a gamer, creator, or AI developer, NVIDIA's new technologies are set to propel us into a future where AI and high-performance computing are at the heart of every experience.

Revolutionizing Healthcare with YOLOv9: The Power of Computer Vision

Ms Ipsita Ankita Hota, Assistant Professor, CSE



Introduction

The healthcare industry is experiencing a transformation with the integration of artificial intelligence (AI). Among the most promising AI advancements is computer vision, which enables machines to interpret and analyze medical images with human-like accuracy. YOLO (You Only Look Once), a state-of-the-art real-time object detection model, has evolved through multiple versions, with YOLOv9 being its latest iteration. This model promises enhanced speed, accuracy, and efficiency, making it a game-changer for medical diagnostics, patient monitoring, and surgical assistance.

Understanding YOLOv9 in Healthcare

YOLOv9 is a deep learning- based object detection model that processes images in a single pass, making it significantly faster than traditional AI models. It is designed to detect and classify objects in real time, which is crucial for medical applications where rapid decision-making can save lives.

Applications of YOLOv9 in Healthcare

1. Medical Imaging and Diagnostics

Medical imaging is one of the most critical areas where YOLOv9 can make a significant impact. The model can analyze and interpret X-rays, MRIs, CT scans, and ultrasounds, identifying potential diseases such as cancer, bone fractures, lung diseases, and diabetic retinopathy.

2. Surgical Assistance and Robotics

YOLOv9 can be integrated into surgical systems to assist doctors during complex procedures. It can help in identifying organs, tissues, and surgical instruments, guiding robotic surgical arms, and alerting surgeons about critical areas to avoid during operations.

3. Patient Monitoring and Fall Detection

Hospitals and nursing homes face challenges in monitoring patients, especially those at risk of falls or requiring intensive care. YOLOv9 can be used for ICU monitoring, fall detection, and elderly care by analyzing real-time movements and alerting medical staff in case of emergencies.

4. Drug Identification and Pharmacy Management

YOLOv9 can streamline pharmaceutical processes by recognizing and verifying medications, automating pill counting, and detecting counterfeit drugs. This ensures better medication safety and improves inventory management in pharmacies.

Benefits of YOLOv9 in Healthcare

1. Increased Accuracy – Reduces human error in medical imaging and diagnostics.
2. Faster Decision-Making – Enables quicker medical responses.
3. Cost Efficiency – Reduces the need for extensive manual labor.
4. Better Patient Outcomes – Early disease detection leads to more effective treatments.
5. Scalability – It can be integrated across various healthcare systems worldwide.

Challenges and Ethical Considerations

1. Data Privacy and Security – AI in healthcare requires access to large datasets, raising concerns about patient confidentiality.
2. Need for High-Quality Training Data – Medical data is often limited or inconsistent, impacting model accuracy.

3. Ethical AI Decision-Making – AI should assist doctors, not replace human judgment.
4. Regulatory Approvals – Medical AI applications must pass rigorous clinical trials before being widely adopted.

The Future of YOLOv9 in Healthcare

The potential of YOLOv9 in healthcare is vast, with ongoing research exploring AI-assisted robotic surgery, advancements in telemedicine, wearable AI integration, and personalized treatment plans. As AI continues to evolve, YOLOv9 and future models will play an even greater role in making healthcare more efficient and life-saving.

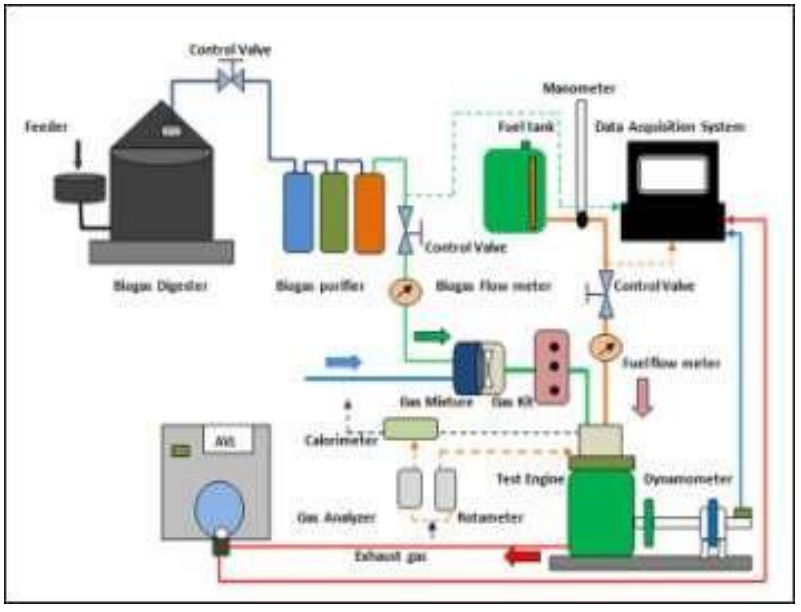
Conclusion

YOLOv9 is at the forefront of AI-driven healthcare innovation, transforming medical imaging, surgery, patient monitoring, and pharmacy management. Despite challenges related to data privacy, ethical concerns, and regulatory approvals, the future of YOLOv9 in healthcare is promising. As AI technology continues to advance, it will revolutionize medical practices, making healthcare smarter, faster, and more precise.

Multiple response optimization for performance and emission of a CI engine using waste plastic oil and biogas in dual fuel mode operation

Mr. Radhamohan Kabisatapathy, HOD, ME

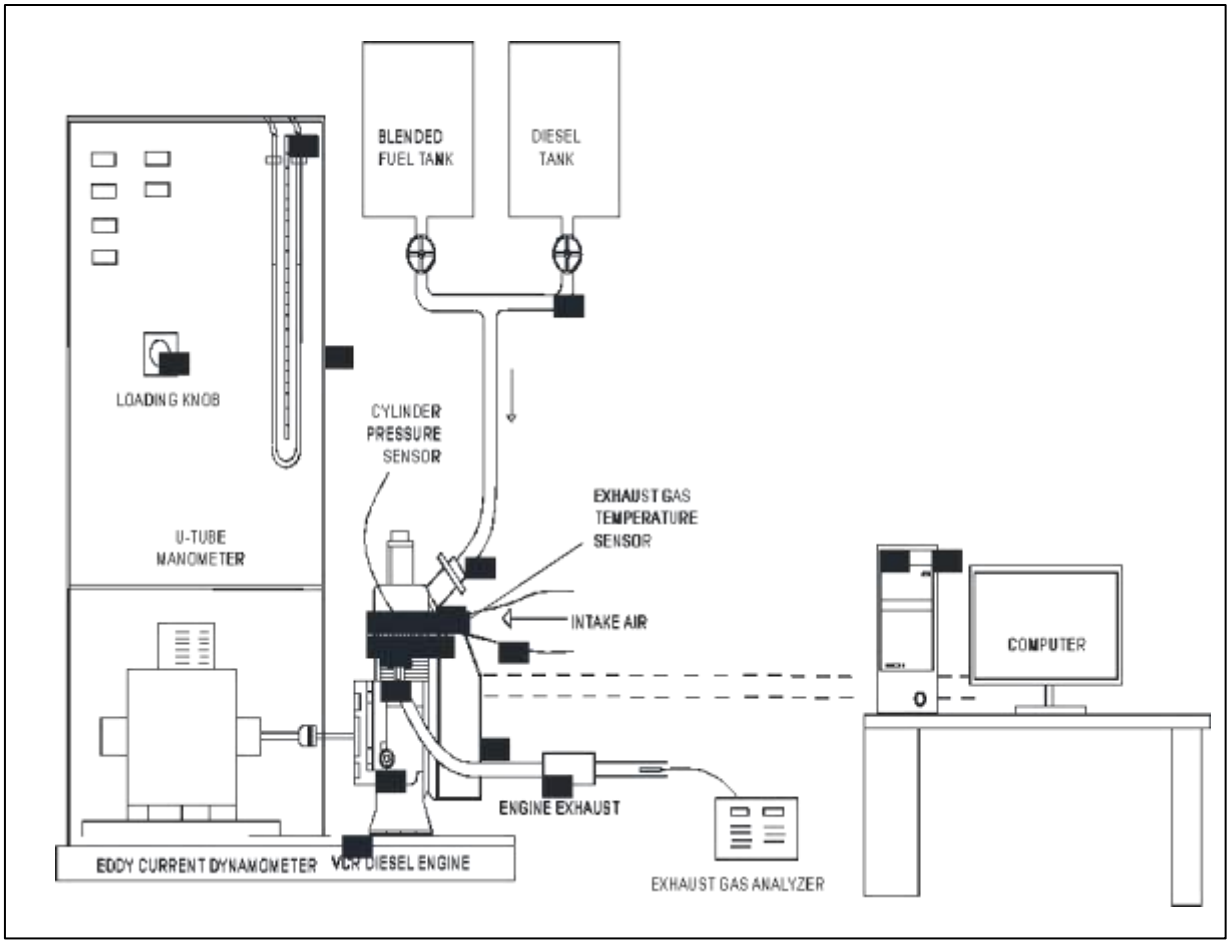
The availability of waste biomass and the advancement of waste-to-biogas technology has aided in the promotion of biogas as a viable alternative to fossil fuels. The objective of this research is to find the best proportion of biogas to use in a blend of waste plastic oil (WPO) and diesel in the dual fuel mode of engine induction for improved performance and emissions. In the CI engine, biogas (of 10%, 20%, 30%, and 40% by volume) is added as supplementary fuel alongside 20WPO-diesel blends. The optimal engine performance and emission are evaluated employing response surface methodology (RSM). The most desirable engine performance, i.e., higher energy and exergy efficiency, and lowest BSFC, HC, and NOx emissions, is determined by using the response surface technique with potential engine parameters such as different engine loads, compression ratios, and various proportions of biogas with test fuel. The energy efficiency, exergy efficiency, BSFC, and CO, HC, and NOx emissions, of 18.6%, 50.05%, 0.46kg/kWh, 0.16 ppm, 41.28 ppm, and 107.81 ppm respectively are found at optimum conditions of 57.12% engine load, 18 compression ratio, and 20% volume biogas with 20% WPO-diesel blend, with total desirability, D of 0.90029.



Determination of sustainability index along with energy- exergy-emission-economic analysis of a VCR diesel engine fuelled with diesel-bioethanol-Al_2O_3 nanoparticles

Dr. Brundan Sahoo, Assistant Professor, ME

One of the biofuels made from waste rice straw is mixed with diesel in different percentages [e-diesel (R10, R15, R20)] and diesel-bioethanol blends with 25 ppm Al2O3 nanoparticles [Nanofuel (NF0, NF10, NF15, NF20)] are tested in a VCR CI engine under varying the load intensities (0kg- no load, 10kg- full load) and at different compression ratio (CR: 14 and 18). Brake thermal efficiency in energy efficiency, exergy efficiency, brake specific fuel consumption (BSFC), heat release rate (HRR), peak cylinder pressure, and the emission of CO, HC, and NOx are the output parameters of the current investigation. The cost of e-diesel and Nanofuel was then predicted using economic analysis to compare them with regular diesel fuel. Except for BSFC, it has been seen that other parameters rise when the load changes from zero to full. Similar to this, all metrics, except BSFC, CO, and HC emissions, increase when the CR is increased from 14 to 18 and drop as the fuel type is changed from diesel to e-diesel and Nano-fuel. For the maximum load and CR condition, the NF0 exhibits maximum energy efficiency of 30.42%, maximum exergy efficiency of 63.5%, HRR of 61J/degree, peak cylinder pressure of 84 bar, the relative cost of -10.215%, and minimum BSFC of 0.463 kg/kW-hr, whereas the NF15 and F0 exhibit minimum emission of CO of 0.157%, HC of 43 ppm, as well as NOx of 422. NF0 attains a higher sustainability index of 1.817 compared to other fuels due to a lower depletion rate followed by NF10, F0, and NF15 of 1.803, 1.781, and 1.772 respectively. A higher waste energy ratio is observed for R20 of 0.751 followed by R15, NF20, and NF15 of 0.727, 0.704, and 0.651 respectively.


BLENDED FUEL TANK
DIESEL TANK
LOADING KNOB
CYLINDER PRESSURE SENSOR
EXHAUST GAS TEMPERATURE SENSOR
U-TUBE MANOMETER
INTAKE AIR
COMPUTER
ENGINE EXHAUST
EDDY CURRENT DYNAMOMETER
VCR DIESEL ENGINE
EXHAUST GAS ANALYZER

Advanced Electrical Technologies Shaping the Future

Mrs. Pallavi Mishra, Assistant Professor, ME

Electrical Engineering is evolving rapidly with several cutting-edge technologies. Some of the latest advancements include:

- **Wireless Power Transmission:** Innovations in wireless charging technology are paving the way for wire-free energy distribution, making electric vehicle charging and consumer electronics more convenient.
- **Artificial Intelligence in Power Systems:** AI-powered predictive maintenance, fault detection, and energy management systems are optimizing power grid operations and enhancing efficiency.
- **Flexible Electronics:** The development of flexible and wearable electronic devices is revolutionizing medical monitoring, industrial sensors, and consumer electronics.
- **Superconductors:** Advances in superconducting materials are improving the efficiency of power grids, electric motors, and magnetic energy storage.
- **Quantum Computing in Electrical Systems:** Quantum algorithms are being explored for solving complex electrical engineering problems, from optimization in power networks to improving signal processing techniques.
- **Internet of Energy (IoE):** The IoE connects power generation, storage, and consumption devices, enabling real-time energy management and efficiency improvements.

Smart Grids: The Future of Intelligent Power Distribution

Mr. Subhankar Dash, ***HoD, ME***

Smart grids are revolutionizing the way electricity is generated, transmitted, and consumed by integrating digital communication technology with electrical networks. These advanced systems enhance efficiency, reliability, and sustainability in power distribution.

Key Features of Smart Grids:

1. Two-Way Communication: Unlike traditional grids, smart grids allow real-time communication between consumers and power providers, optimizing energy usage.
2. Self-Healing Networks: Smart grids can detect faults, isolate affected areas, and restore power automatically, minimizing downtime.
3. Advanced Metering Infrastructure (AMI): Smart meters provide real-time data on electricity usage, helping consumers manage their consumption effectively.
4. Integration with Renewable Energy: Smart grids facilitate the seamless incorporation of solar, wind, and other renewable sources, reducing reliance on fossil fuels.
5. Energy Storage Solutions: Battery storage and advanced energy management systems ensure a stable and reliable power supply even when renewable generation fluctuates.
6. Cybersecurity Measures: As smart grids rely on digital technology, robust security mechanisms are in place to prevent cyber threats and unauthorized access.

Benefits of Smart Grids:

- Improved Efficiency & Reliability: By reducing power losses, optimizing load distribution, and enabling automated maintenance, smart grids enhance overall system efficiency.
- Sustainability & Environmental Benefits: The integration of renewables reduces greenhouse gas emissions and promotes a cleaner energy ecosystem.
- Cost Savings: Consumers benefit from lower electricity bills through demand response programs, while utilities reduce operational costs with predictive maintenance.
- Empowered Consumers: Smart grids enable users to track energy usage in real-time, adjust consumption habits, and even sell excess electricity back to the grid.

Challenges in Implementing Smart Grids:

- High Initial Investment: The deployment of smart infrastructure requires significant financial resources.
- Data Privacy & Security Risks: The increased use of digital communication raises concerns about cyber threats and data privacy.
- Integration Complexity: Upgrading existing power networks to smart grids requires substantial technical and regulatory efforts.

Despite these challenges, smart grids are shaping the future of electrical engineering by enabling intelligent, adaptive, and sustainable power systems. Their continued evolution will play a critical role in meeting the world's growing energy demands efficiently and securely.

Theodolite

Mr. Ambika Prasad Mohanty, HOD, CE

A **theodolite** is a precision optical instrument for measuring angles between designated visible points in the horizontal and vertical planes. The traditional use has been for land surveying, but it is also used extensively for building and infrastructure construction, and some specialized applications such as meteorology and rocket launching.

It consists of a moveable telescope mounted so it can rotate around horizontal and vertical axes and provide angular readouts. These indicate the orientation of the telescope, and are used to relate the first point sighted through the telescope to subsequent sightings of other points from the same theodolite position. These angles can be measured with accuracies down to micro radians or seconds of arc. From these readings a plan can be drawn, or objects can be positioned in accordance with an existing plan. The modern theodolite has evolved into what is known as a total station where angles and distances are measured electronically, and are read directly to computer memory.

In a transit theodolite, the telescope is short enough to rotate about the trunnion axis, turning the telescope through the vertical plane through the zenith; for non-transit instruments vertical rotation is restricted to a limited arc.

The optical level is sometimes mistaken for a theodolite, but it does not measure vertical angles, and is used only for leveling on a horizontal plane (though often combined with medium accuracy horizontal range and direction measurements).

II. PROSE & POETRY

ଏଇତ ଜୀବନ

ଏଇତ ଜୀବନ,

କେବେ ଦୁଇ ପାଖେ ଛାଇ

ମଳୟ ପବନ

ପୁଣି କେବେ ଟାଣ ଖରା

କେବେ ଫୁଲ ଭରା ପଥ

ପୁଣି କେବେ କଣ୍ଟା ଭରା ।।

ଏଇତ ଜୀବନ

କେବେ ଜୀତିବାର ଖୁସି

ସମୟ ଖେଳରେ

କେବେ ଦୁଃଖ ହାରିବାର

କେବେ ଇଚ୍ଛା ହୁଏନି ବଞ୍ଚିବା ପାଇଁ

କେବେ ଡର ମରିବାର ।।

ଏଇତ ଜୀବନ

କେବେ ଆପେ ବୁଝିହୁଏ

ସରଳ ଭାଷାରେ

କେବେ ଅବୁଝା କାହାଣୀ ଟିଏ

କେବେ ଆପଣାର ସବୁ

କେବେ ଏକା ଚାଲିବାକୁ ହୁଏ ।।

ଚନ୍ଦନ ନାୟକ

(ପଦାର୍ଥ ବିଜ୍ଞାନ)

The Melody of Numbers

Numbers dance, a silent song,
Patterns weaving, crisp and strong.
Circles spin, and angles meet,
In lines and curves, pure math we greet.

From one to ten, and far beyond,
Each digit sings a magic bond.
Fractions whisper, soft and light,
While algebra takes soaring flight.

Geometry paints the world so wide,
With shapes and symmetry as its guide.
A golden ratio, bright and true,
In flowers, shells, and oceans blue.

Equations speak, a secret code,
In every bridge and every road.
Infinity calls, so vast, so deep,
A place where numbers laugh and leap.

So fear not math, but see its art,
A rhythmic beat, a beating heart.
Embrace its wonders, vast and free,
For math is life's own melody!

Dr. Soumyarani Mishra

Assistant Professor, Mathematics

THE BOND

In halls of learning, where minds ignite,
A sacred bond, a guiding light,
Teacher and student, hand in hand,
In this dance of knowledge, they both stand.

With patience and wisdom, the teacher imparts,
Nurturing minds, igniting hearts.
With open ears and eager minds,
Students absorb the lessons, one of a kind.

Beyond textbooks and classroom walls,
They forge a bond that never falls,
For in the journey of discovery,
They find a bond, pure and free.

In moments of doubt, the teacher's there,
With words of encouragement, they share.
And when the student reaches high,
The teacher beams with pride, no need to try.

For in this dance of give and take,
They both grow, their spirits awake.
A teacher's love, a student's trust,
A bond unbreakable, forged from dust.

So let us honor this bond so grand,
Between teacher and student, hand in hand.
For in the heart of education's flame,
Lies a bond that forever reigns.

Dr Krutika Lokapriya Routray
Assistant Professor, Physics

The Engineer’s Anthem

With wires and tools, we start the race,

Building systems, solving space.

Circuits, motors, volts, and amps,

We light the way, ignite the lamps.

Innovation’s in our hands,

Creating tech that spans the lands.

From microchips to megawatts,

We engineer, we break the knots.

Bringing energy near and far,

Charging up electric cars.

Renewables, the time is right,

Engineers, let’s shine the light.

Through every wire, every spark,

We create, we leave a mark.

Future’s bright, future’s free,

Electrical minds, we hold the key.

Aditya Kumar Behera

F22029002003, EE

"Echoes of the Earth"

The river flows, the leaves dance free,

A gentle song in harmony.

The sky is wide, the sun burns bright,

A golden spark, a guiding light.

The rain falls soft, it soaks the ground,

Life awakens, all around.

Roots grow deep, the forests rise,

A whispered call to endless skies.

Waves embrace the silent shore,

Mountains stand forevermore.

The wind it sings, the earth it hums,

A melody where all life comes.

So tread with care, hear nature’s sound,

Every heartbeat shakes the ground.

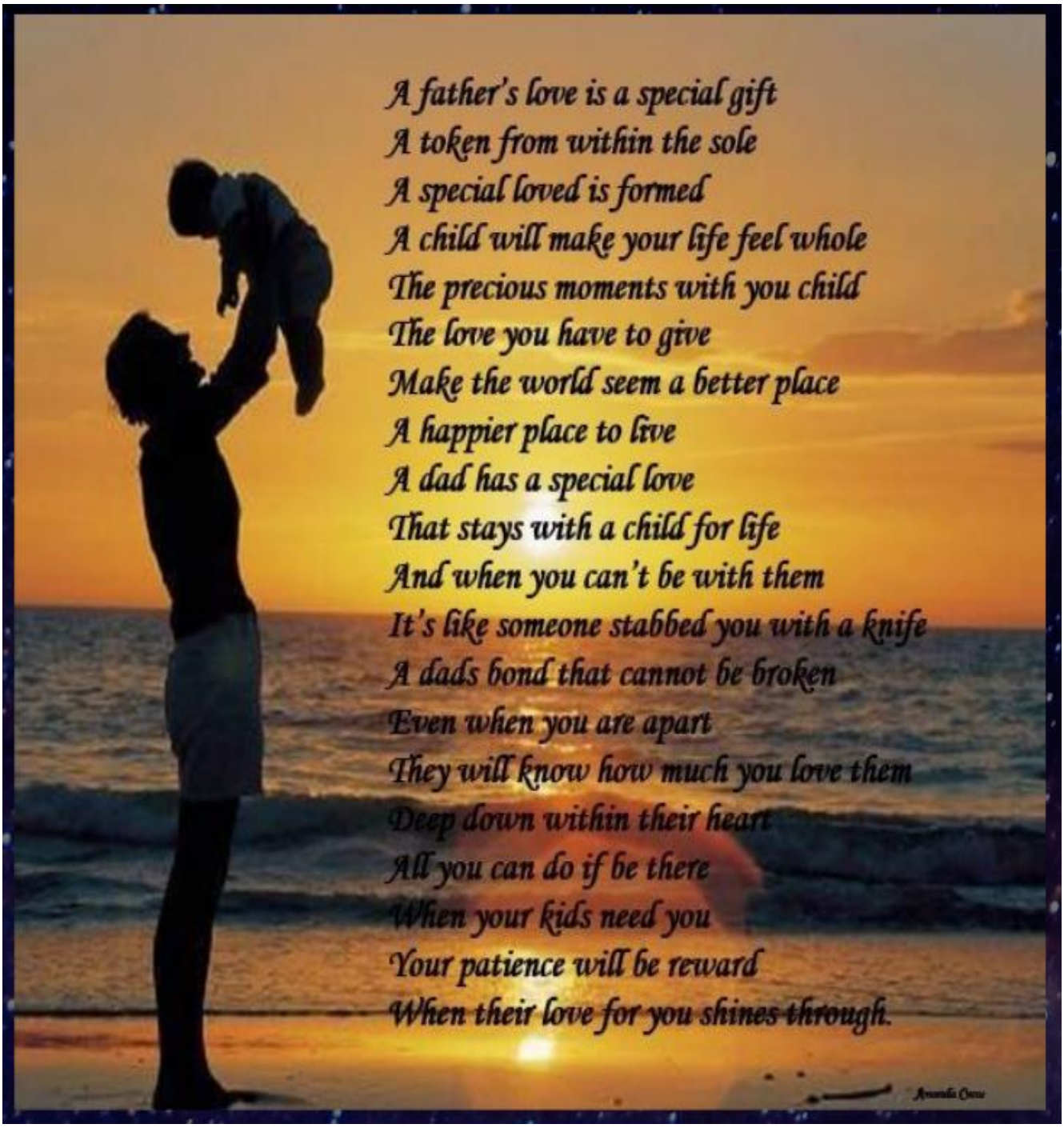
The earth it speaks in voices old,

A tale of life in green and gold.

Mrs. Pallavi Mishra

Assistant Professor, EE

FATHER'S LOVE



Santosh Kumar

F22029001021

Civil

III. ART GALLERY

Art by Shrabani

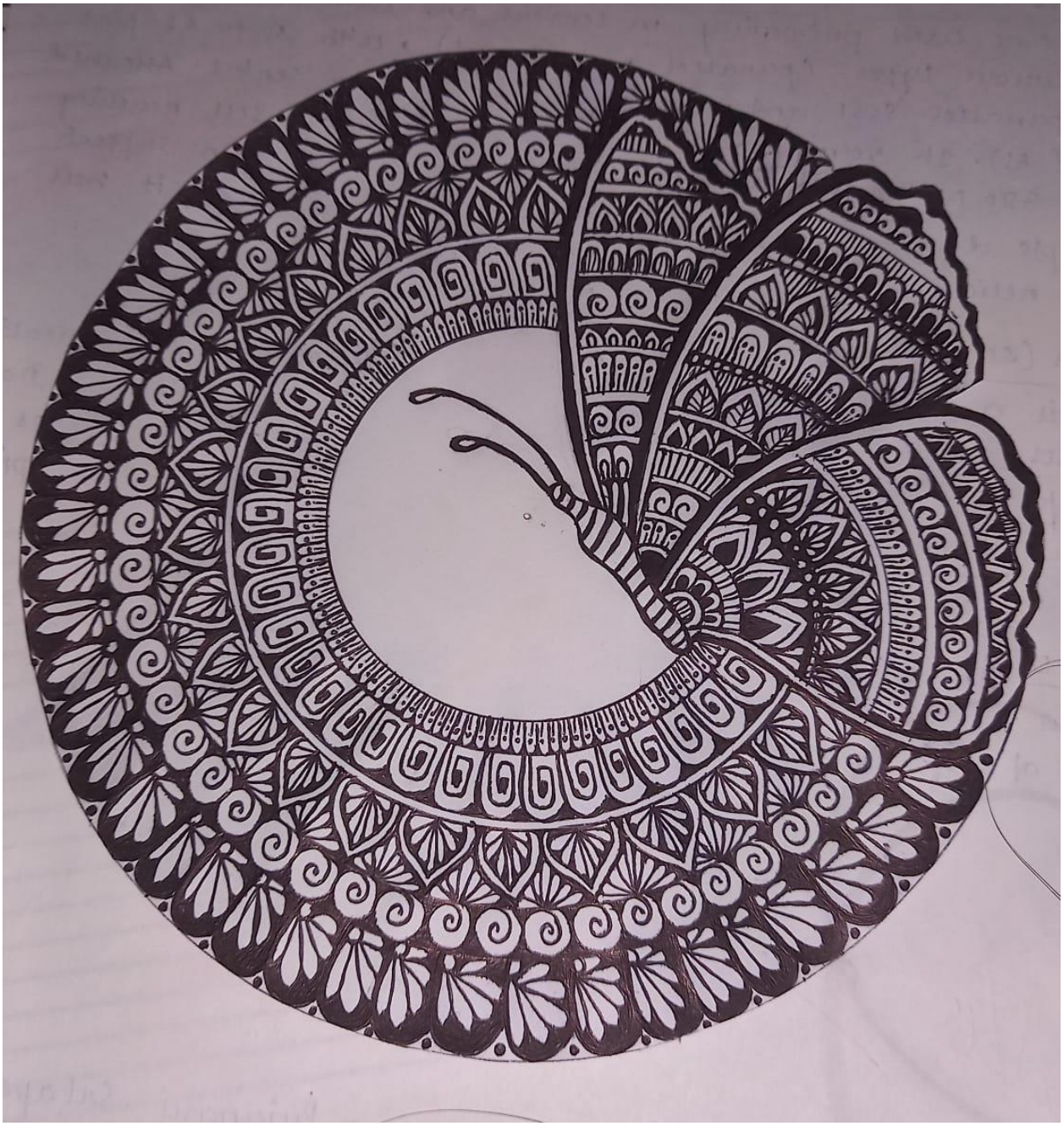
F22029007094

CSE

Art by Subhadarshini Mishra

F22029007102

CSE



Art by Pujarani Satapathy

F22029007071

CSE

Art by Swagatika Rout

F22029007107

CSE

Art by Pujarani Satapathy
F22029007071

CSE

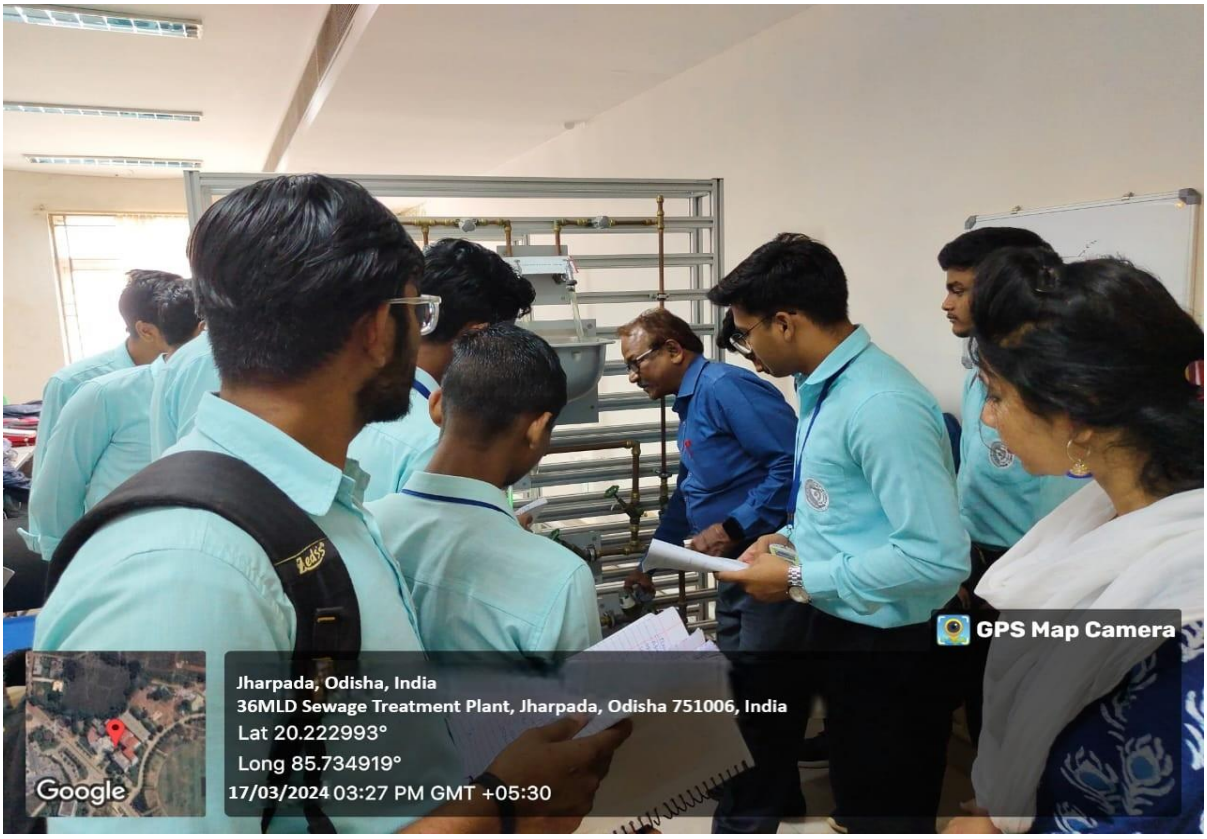
IV. PHOTOS: INDUSTRY VISIT, SEMINAR & ACHIEVEMENTS

Industrial Visits/Tours for Students:

Location: Railway Coach Factory, Mancheswar

Industrial Visits/Tours for Students:

Location: 36 MLD Sewage Treatment Plant, Bhubaneswar



CoE on Mobile Hydraulics

CoE Visit of Electrical Department

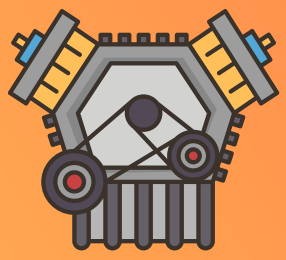
Workshop on cyber security

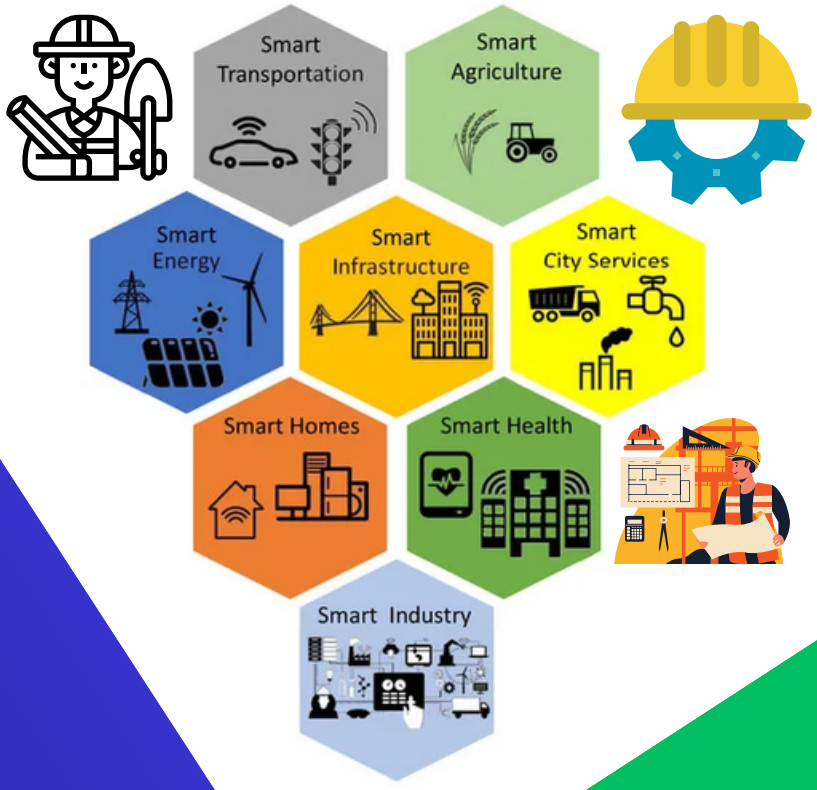
Seminar on Power system protection

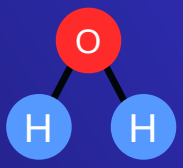

2
1
3

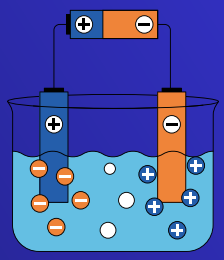
CONCLUSION

Let us continue to push the boundaries of innovation, collaborate across disciplines, and harness the power of technology to build a smarter, more sustainable world. As engineers, our role extends beyond designing and implementing systems—we are shaping the future of energy, automation, and intelligent solutions. By embracing emerging technologies, investing in research, and fostering a culture of continuous learning, we empower the next generation to drive meaningful change. Together, we can inspire future engineers, develop ground-breaking solutions, and electrify the future with ingenuity.









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