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DEPARTMENT OF ELECTRICAL ENGINEERING
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OVERVIEW

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THE PRINCIPAL DESK

Dear Readers,

It is a matter of immense pleasure to know that the Department of Electrical Engineering has taken a keen interest to create a common platform for the faculty and students to go beyond classroom activities, to explore new possibilities and collaborate with technology dynamically. I am confident that this magazine will give impetus to research culture amongst students and faculty with emphasis on entrepreneurship.

I congratulate the entire editorial team for their hard work and dedication in giving the requisite shape to this magazine. I hope this magazine will inspire passion among the faculty and students.

I wish them all the very best in their future endeavors as well.



DR. ARUN KUMAR

PRINCIPAL

VIVA INSTITUTE OF TECHNOLOGY

FROM HOD'S DESK

Dear Readers,

Learning is a continuous process. Throughout life, a human being remains a student. Based on the same, the Department of Electrical Engineering of VIVA Institute Of Technology is glad to present in front of you a new technical magazine "ELECTROTREND". In this, we encourage our students and faculty members to present articles on new technologies in engineering going on all across the world. Nowadays technology changes at rapid speed; due to this it's impossible for anyone to survive with his existing knowledge for long term without upgrading to recent trends. It seems to be very important to be in touch with recent trends in engineering. To achieve this effectively faculty members and students need to be motivated to read and write articles based on new technology in engineering. "ELECTRO-TRENDS" is a platform provided by the Department of Electrical Engineering to explore the hidden talents of faculty and students.

The department of electrical engineering also focuses on a high level of teaching quality during lectures and practicals. We also encourage students to participate in workshops, industrial visits, conferences, STTP and technical competitions. "ELECTRO-TRENDS" will help students to grow in all aspects of electrical engineering such as Power system Analysis & Protection, Renewable Energy & its sustainability, Smart grid Technology, Advance trends in Electrical engineering and so on.

At last, I wish to congratulate all members who have participated in making this magazine successful.



PROF. BHUSHAN SAVE

HEAD OF DEPARTMENT

DEPARTMENT OF ELECTRICAL ENGINEERING



DEPARTMENT VISION

To aspire for excellence in imparting quality education in the field of Electrical Engineering with an eagerness of developing a professional mindset along with good human values.

DEPARTMENT MISSION

- To maintain a benchmark in quality of educational standards in the field of Electrical Engineering.
- To provide a platform for exploring a professional mindset.
- To promote ethical practices for developing good human values.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide students with the knowledge of basic sciences and social sciences in general and Electrical engineering in particular, so as to impart the necessary skills to analyze and synthesize electrical circuits, algorithms and complex apparatus.
- To inculcate in students Professional attitude, effective communication skills and capability to succeed in multi-disciplinary and diverse fields.
- To provide technical knowledge, skills and competence to identify, comprehend and solve problems in industry, research and academics related to power, information and hardware.
- To prepare and inspire the students to become future researchers/scientists with innovative ideas for sustainable development.



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Regenerative AI: A Technology, Building a Sustainable Future

In recent years, Artificial Intelligence (AI) has evolved rapidly, transforming industries and reshaping the way we live and work. From predictive analytics to autonomous vehicles, AI technologies have demonstrated their potential to revolutionize countless aspects of society. However, as AI continues to advance, concerns about its environmental impact and sustainability have come to the forefront. In response, a new paradigm of AI, known as Regenerative AI, is emerging as a promising solution to address these challenges and build a more sustainable future.

Regenerative AI goes beyond traditional AI approaches by emphasizing not only performance and efficiency but also sustainability and environmental stewardship. At its core, Regenerative AI seeks to minimize the environmental footprint of AI systems while maximizing their positive impact on society and the planet. This involves integrating principles of regenerative design, renewable energy, and responsible resource management into the development and deployment of AI technologies.

One of the key principles of Regenerative AI is energy efficiency. Traditional AI algorithms often require significant computational resources, leading to high energy consumption and carbon emissions. In contrast, Regenerative AI prioritizes energy-efficient algorithms and architectures that minimize power consumption without compromising performance. By optimizing algorithms for energy efficiency and leveraging renewable energy sources such as solar and wind power, Regenerative AI aims to reduce the carbon footprint of AI systems and mitigate their environmental impact.

Another important aspect of Regenerative AI is ethical and responsible AI governance. As AI technologies become increasingly pervasive in society, ensuring ethical and equitable use of AI is paramount. Regenerative AI promotes transparency, fairness, and accountability in AI systems, safeguarding against bias, discrimination, and misuse. By embedding

ethical principles and human values into the design and development of AI systems, Regenerative AI strives to create AI technologies that serve the greater good and contribute to the well-being of individuals and communities.

Regenerative AI offers a wide range of benefits across various domains, encompassing environmental, societal, economic, and technological aspects. Here are some of the key benefits:

- 1. Environmental Sustainability:** Regenerative AI promotes energy efficiency and reduces the carbon footprint of AI systems, contributing to environmental sustainability. By optimizing algorithms and architectures for energy efficiency and leveraging renewable energy sources, Regenerative AI minimizes the environmental impact of AI technologies, helping to mitigate climate change and preserve natural resources.
- 2. Resource Conservation:** By prioritizing responsible resource management and minimizing resource consumption, Regenerative AI helps conserve valuable resources such as energy, water, and materials. This promotes sustainable resource use and reduces waste generation, leading to more efficient and environmentally friendly AI systems.
- 3. Ecosystem Restoration:** Regenerative AI can be applied to support ecosystem restoration and conservation efforts. By analyzing large-scale environmental data and modeling complex ecological systems, Regenerative AI enables the development of innovative solutions for restoring degraded ecosystems, protecting biodiversity, and promoting sustainable land and water management practices.
- 4. Ethical and Equitable AI:** Regenerative AI emphasizes ethical and responsible AI governance, promoting transparency, fairness, and accountability in AI

systems. By addressing issues such as bias, discrimination, and privacy concerns, Regenerative AI helps ensure that AI technologies are developed and deployed in a manner that respects human rights and promotes social justice and equity.

5. **Inclusive Innovation:** Regenerative AI fosters collaboration and knowledge sharing across diverse stakeholders, including researchers, policymakers, businesses, and communities. By promoting open-source initiatives, collaborative research efforts, and interdisciplinary partnerships, Regenerative AI democratizes access to AI technologies and enables inclusive innovation, empowering individuals and communities to participate in and benefit from the AI revolution.
6. **Economic Growth:** Regenerative AI drives economic growth and creates new opportunities for sustainable development. By investing in Regenerative AI technologies and fostering a supportive ecosystem for innovation and entrepreneurship, governments, businesses, and organizations can unlock new sources of value and catalyze positive economic transformation across industries and sectors.
7. **Resilience and Adaptation:** Regenerative AI helps build resilience and adaptability in the face of global challenges such as climate change, natural disasters, and pandemics. By leveraging AI technologies for early warning systems, risk assessment, and

decision support, Regenerative AI enables proactive and adaptive responses to complex and dynamic threats, enhancing the resilience of societies and ecosystems.

8. **Technological Advancement:** Regenerative AI drives technological advancement and fosters interdisciplinary research and development. By pushing the boundaries of AI innovation and exploring new frontiers in fields such as renewable energy, healthcare, agriculture, and conservation, Regenerative AI expands the possibilities for addressing pressing global challenges and advancing the frontiers of science and technology.

In summary, Regenerative AI offers a holistic approach to AI development and deployment, promoting sustainability, inclusivity, and innovation for the benefit of people and the planet. By embracing the principles of Regenerative AI and committing to responsible and ethical AI governance, we can harness the transformative power of AI to create a more sustainable, equitable, and resilient future for all.



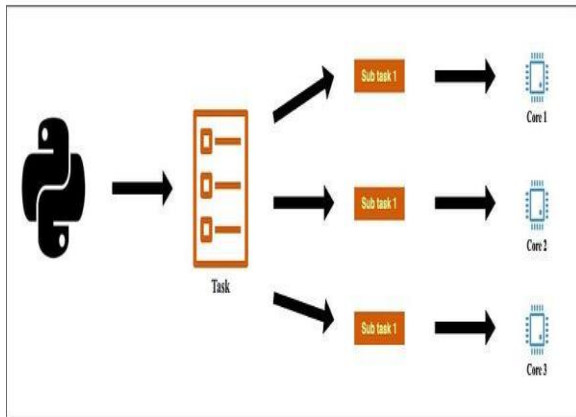
Dr. Deepak Sajnekar

Harnessing the Power of Multiprocessing with Python

Introduction

In the realm of computing, the demand for faster and more efficient processing has become a constant pursuit. Whether it's handling large datasets, performing complex simulations, or executing resource-intensive algorithms, the need for speed is paramount. This is where the concept of multiprocessing shines, and Python, with its versatility and ease of use, offers robust solutions for leveraging the power of multiple processors or cores.

Multiprocessing, simply put, is the ability to execute multiple tasks concurrently, thereby distributing the workload across multiple processing units. Traditionally, this was achieved through multithreading, but with the advent of multicore processors, multiprocessing has emerged as a more scalable and efficient approach.



Python's multiprocessing module provides a high-level interface for creating and managing multiple processes, allowing developers to take full advantage of modern hardware architectures. By spawning separate Python interpreter processes, each with its own memory space, multiprocessing enables true parallelism, unlike the Global Interpreter Lock (GIL) that limits multithreading.

One of the key advantages of multiprocessing in Python is its simplicity. With just a few lines of code, developers can parallelize tasks, making them execute concurrently and significantly reducing overall execution time. Let's explore a simple example to illustrate this:

Python code:

```
import multiprocessing

def square(n):

    return n * n

if __name__ == '__main__':

    numbers = [1, 2, 3, 4, 5]

    with multiprocessing.Pool() as pool:

        results = pool.map(square, numbers)

    print(results)
```

In this example, we define a function `square()` that computes the square of a given number. Using the `multiprocessing.Pool` class, we create a pool of worker processes. The `map()` function then distributes the workload (in this case, the list of numbers) among the available processes, with each process executing the `square()` function concurrently. Finally, the results are collected and printed.

Multiprocessing in Python is not limited to CPU-bound tasks; it can also be applied to I/O-bound operations, such as reading and writing files, making network requests, or interacting with databases. By parallelizing I/O-bound tasks, developers can effectively utilize idle CPU time, further enhancing overall system performance.

However, like any parallel computing paradigm, multiprocessing comes with its own set of challenges. Managing shared resources, handling inter-process

communication, and avoiding race conditions are some of the common pitfalls that developers may encounter. Thankfully, Python provides robust synchronization primitives, such as locks, semaphores, and queues, to address these challenges and ensure thread-safe execution.

Furthermore, understanding the underlying hardware architecture and optimizing the number of processes based on the available CPU cores is essential for achieving optimal performance. While multiprocessing offers significant performance gains, indiscriminate use of too many processes can lead to diminishing returns or even degradation in performance due to increased overhead.

In conclusion, multiprocessing in Python empowers developers to harness the full

potential of modern hardware architectures, enabling them to build faster, more scalable, and more responsive applications. By leveraging the simplicity and versatility of Python along with the multiprocessing module, developers can unlock new possibilities in parallel computing and tackle even the most demanding computational tasks with ease.



Prof. Anojkumar Yadav



Protecting the Spark: Strengthening Electrical Systems with Cybersecurity

Introduction:

In a time where digitalization merges with all aspects of modern life, no one can overemphasize the importance of cyber security. The integrity of critical infrastructure, particularly power systems, goes beyond data breaches and identity theft. This article focuses on cybersecurity in electricity supply chains – it explores changing threats, new defense strategies as well as the need for engineers to secure our power backbone. **The Emergence Of Threats:** Electrical grids were once isolated monsters but now they are complex networks made up of sensors connected by controllers which communicate through data links. This is meant to increase efficiency and control but it also creates more points that can be attacked by hackers. There are many risks involved in attacking power infrastructure; from nation states interrupting rival countries' services to cyber criminals looking for money. If an electric system is hacked there could be localized outages or worse still general blackouts that would paralyze everything.

Grid-Vulnerabilities:

To create strong cybersecurity strategies, it is important to understand the weaknesses of an electric system. A significant risk is posed by legacy infrastructure which employs outdated protocols and lacks adequate security measures. Additionally, this complexity is enhanced through different components from various vendors with different security postures making up modern-grid architecture.

Defense Mechanism Innovations: Engineers and cyber security experts have developed innovative defense mechanisms designed specifically for electrical systems in light of the ever-increasing threat landscape. For instance; Intrusion detection systems (IDS) can act as watchful protectors by continuously monitoring network traffic for any unusual activity that may be indicative of an attack while intrusion prevention systems (IPS) are capable of stopping attacks as they happen in real-time. Furthermore, data integrity and confidentiality

will be ensured if encryption protocols are adopted which also reduces unauthorized access risks including tampering with information during transmission or storage.

The Role of Artificial Intelligence:

Artificial intelligence (AI) is a powerful weapon against cyber threats. Machine learning algorithms go through large sets of data to identify patterns that indicate malicious activity and enable electrical systems to adapt in order to proactively respond to new threats. This might be detecting complex phishing attempts or recognizing abnormal behavior within a system; AI supports human skills so as to protect critical infrastructure from evolving cyber attacks.

Collaborative Efforts and Regulatory Frameworks:

The point is made that all cyber threats are interconnected, thus it is essential for businesses working together with each other across sectors; governments on various levels including international organizations such as UN agencies like UNESCO or ITU along side national governments ; academia which includes universities not only within countries but also internationally should come up with joint projects if they want any real progress against them achieved. In this regard information sharing programs play an important role by spreading knowledge about hazards quickly enough for people to take action against them promptly too where necessary since knowing what we are dealing with helps us better handle situations more effectively. It is also important that laws requiring high standards of security must be established so as to create incentives for companies to invest heavily in safeguards thereby promoting resilience throughout the entire field of electrical engineering.

Conclusion:

As society traverses towards an increasingly digitized future, the integrity and resilience of electrical systems hinge upon robust cybersecurity measures. Engineers, armed with innovation and vigilance, stand at the vanguard of

this endeavor, safeguarding the spark that powers civilization. Through collaborative endeavors, technological innovation, and unwavering commitment to cybersecurity, we fortify the foundation upon which our modern world rests, ensuring a future illuminated by the steadfast glow of secure electrical systems.



Prof. Rahul Abhyankar



Revolutionizing Electrical Industries: Integration of Artificial Intelligence & Machine Learning in Electrical Engineering

Introduction

Artificial intelligence (AI) is a wide-ranging tool that enables people to rethink how we integrate information, analyze data, and use the resulting insights to improve decision making—and already it is transforming every walk of life. In this report, Darrell West and John Allen discuss AI's application across a variety of sectors, address issues in its development, and offer recommendations for getting the most out of AI while still protecting important human values.

Integration of AI and ML in Electrical Engineering

1. Smart Grid Technology

AI and ML are pivotal in the development and operation of smart grids, which are modern electricity networks known for their optimized efficiency through real-time data analysis. These technologies allow for predictive maintenance, load forecasting, and the integration of renewable energy sources into the grid with greater efficiency. AI algorithms can predict peak load times and adjust the grid's operations accordingly to prevent outages and manage demand.

2. Power System Monitoring

Machine learning models are extensively used for monitoring the health and status of power systems. By analyzing data from sensors and IoT devices, ML algorithms can detect anomalies, predict failures, and schedule maintenance tasks without human intervention. This reduces downtime and extends the lifespan of expensive equipment.

3. Energy Consumption Optimization

In both industrial and residential contexts, AI is used to optimize energy consumption. Smart thermostats and AI-integrated HVAC systems learn from user behavior to adjust settings in real-time, thereby improving energy efficiency and reducing costs. On a larger scale, AI systems analyze consumption patterns and adjust energy distribution accordingly.

4. Design and Simulation

AI tools aid in the design and simulation of electrical circuits and systems. By automating complex calculations and model testing, AI accelerates the design process, increases the accuracy of simulations, and helps in predicting system behaviors under various scenarios. This not only speeds up the development cycle but also enhances the reliability of new designs.


5. Renewable Energy Integration

The variable nature of renewable energy sources like solar and wind requires advanced forecasting tools to efficiently integrate these resources into the power grid. ML models excel in predicting weather conditions and energy production levels, facilitating better grid management and storage solutions.

Benefits of AI and ML in Electrical Engineering

Increased Efficiency: Automated systems optimize power flow and distribution, reducing waste and increasing overall grid efficiency.

Enhanced Reliability and Safety: Early fault detection and predictive maintenance prevent accidents and improve the reliability of electrical systems.



Cost Reduction: AI-driven automation reduces the labor costs associated with monitoring and maintenance while improving operational efficiency.

Environmental Benefits: Optimizing the use of renewable energy sources reduces dependence on fossil fuels and decreases greenhouse gas emissions.

Challenges and Considerations

Data Privacy and Security: The heavy reliance on data for AI and ML applications raises concerns about data privacy and the security of the systems against cyber threats.

Integration with Legacy Systems: Many existing electrical systems are not designed to integrate seamlessly with AI and ML technologies, which can be a barrier to adoption.

High Initial Costs: Although cost-effective in the long run, the initial investment in AI and ML technologies can be significant.

Skilled Workforce: There is a growing need for professionals who are skilled at the intersection of AI, ML, and electrical engineering to develop, maintain, and operate these advanced systems.

In recent years, the fields of artificial intelligence (AI) and machine learning (ML) have gained significant momentum and are transforming various industries. The electrical sector is no exception, as AI and ML technologies are revolutionizing the way electrical-based industries operate. From power generation and distribution to smart grids and energy management, the integration of AI and ML is driving innovation, improving efficiency, and ensuring sustainability. This article explores the remarkable impact of AI and ML in electrical industries and highlights their potential for a brighter and more intelligent future.

Enhancing Energy Generation and Distribution

AI and ML techniques are being leveraged to optimize energy generation and distribution processes. Advanced algorithms can analyze vast amounts of data, weather patterns, demand forecasts, and historical trends to predict energy requirements accurately. This enables utilities to optimize their energy production, minimize downtime, and reduce costs. Additionally, AI-powered systems can optimize energy distribution by intelligently routing electricity through the grid, balancing loads, and ensuring uninterrupted power supply.

Smart Grid Management

The concept of the smart grid relies heavily on AI and ML to create a more efficient and reliable energy infrastructure. AI algorithms can analyze data from various sensors and devices embedded throughout the grid, enabling real-time monitoring and control. This allows for the identification and mitigation of power outages, quick response to faults, and efficient integration of renewable energy sources. Furthermore, AI-powered analytics help utilities gain valuable insights into energy consumption patterns, enabling demand response programs and promoting energy conservation.

Predictive Maintenance

Maintenance plays a crucial role in electrical industries to prevent equipment failures and optimize operational efficiency. AI and ML techniques enable predictive maintenance, which utilizes data from sensors and monitoring systems to predict equipment failures before they occur. By analyzing historical data and identifying patterns, AI algorithms can detect anomalies, estimate remaining useful life, and schedule maintenance activities accordingly. This approach minimizes downtime, reduces costs associated with unscheduled repairs, and increases the lifespan of critical electrical infrastructure.

Energy Efficiency and Conservation

AI and ML technologies are instrumental in promoting energy efficiency and conservation. With the help of smart meters and IoT devices, AI algorithms can collect real-time data on energy consumption patterns in residential, commercial, and industrial settings. By analyzing this data, ML models can provide personalized recommendations to consumers on how to optimize their energy usage, reduce wastage, and lower their carbon footprint. Furthermore, AI-powered energy management systems can automatically adjust energy consumption based on demand, optimizing efficiency and reducing energy costs for businesses and households.

Renewable Energy Integration

The integration of renewable energy sources such as solar and wind power poses unique challenges for electrical industries. AI and ML techniques aid in the efficient integration of these intermittent energy sources into the grid. AI algorithms can forecast renewable energy generation based on weather conditions, historical data, and other variables, enabling grid operators to manage the supply-demand balance effectively. ML models can also optimize the operation of energy storage systems, ensuring the

maximum utilization of stored energy during peak demand periods.

Future Outlook

The future of AI and ML in electrical engineering looks promising, with ongoing advancements that could lead to more autonomous, efficient, and smart electrical systems. Innovations like AI-powered autonomous electric vehicles, more efficient battery storage technologies, and smarter consumer electronics are on the horizon. As technology continues to evolve, the integration of AI and ML in electrical engineering will likely become more profound and widespread, potentially leading to a more sustainable and efficient future for energy production and management.

In conclusion, AI and ML are not just modern tools but fundamental elements that will continue to shape the landscape of electrical engineering in the years to come. Their ability to process vast amounts of data and automate complex decisions is pivotal in addressing the challenges of modern energy demands and the efficient use of electrical power.



Prof. Sangita Kamble



Power to the People: The Renewable Energy Revolution We Need

The international is at a crossroads. Our dependence on fossil fuels has fueled financial growth, however at a devastating fee to our planet. Climate exchange is now not a looming danger; it is a fact we face daily, with rising temperatures, intense climate occasions, and growing sea degrees. The need for a clean electricity revolution is plain, and renewable strength resources are rising as the heroes of this tale.

This isn't pretty much saving polar bears (even though it truly is quite important too). A shift to renewables offers a large number of advantages for our generation:

Environmental Sustainability: Renewables like sun, wind, geothermal, and hydropower harness the electricity of nature without releasing harmful greenhouse gases. This combats climate alternate and protects our ecosystems for destiny generations.

Energy Security: Unlike fossil fuels, which might be concentrated in specific areas, renewables can be harnessed nearly everywhere. This reduces dependence on volatile geopolitics and empowers countries to be electricity unbiased.

Economic Opportunities: As the renewable electricity region expands, it creates new jobs in production, set up, preservation, and research. This fosters innovation and drives economic increase in a sustainable way.

Public Health: Fossil gas burning contributes to air pollution, leading to respiration illnesses and different fitness problems. A shift to renewables way cleaner air and a more healthy population.

The Rise of the Renewables: A Technological Renaissance

The beyond few decades have witnessed a splendid transformation in renewable power

technology. Solar panels, as soon as a luxury, are actually becoming increasingly less costly and efficient. Wind generators are attaining record heights, shooting extra wind power than ever before. Geothermal and hydropower are imparting reliable baseload energy, whilst advances in ocean electricity and biomass are unlocking even extra capability.

Here's a better have a look at a number of the key players in the renewable electricity revolution:

Solar Power: Harnessing the sun's rays, solar panels are becoming ubiquitous on rooftops and in solar farms. Technological improvements are making them more efficient and low-priced, riding great adoption.

Wind Power: From towering generators on land to huge offshore wind farms, wind strength is a powerful supply of clean power. Advancements in blade design and materials are growing wind energy seize and making it a greater reliable source.

Hydropower: Utilizing the pressure of transferring water, hydropower is a mature generation that remains a full-size source of renewable strength. While huge dams may have environmental impacts, smaller-scale hydro tasks are being developed to reduce those worries.

Geothermal Power: Geothermal power faucets into the Earth's inner heat to generate strength. Though geographically restrained, it offers a reliable and baseload source of easy power in suitable locations.

Emerging Technologies: Ocean electricity, harnessing the energy of waves, tides, and currents, holds monstrous capacity. Biomass power, utilising natural depend to create energy, is every other street of exploration. These technologies are still of their early ranges of

improvement but offer exciting possibilities for the future.

Challenges and Solutions: The Road Ahead

The renewable electricity revolution is not without its demanding situations. Integrating those intermittent assets (sun and wind) into the existing grid requires revolutionary answers like smart grids and power storage technologies.

Here are a few key answers to consider:

Grid Modernization: Upgrading our electric grids to be more smart and flexible might be critical to efficaciously integrate and control variable renewable power sources.

Energy Storage: Developing cost-effective power storage answers, like batteries and pumped hydro, will allow us to keep extra renewable electricity in the course of peak production and put it to use at some point of durations of low technology.

Policy and Incentives: Government policies that incentivize renewable strength development and penalize fossil gas use are essential for accelerating the transition. Additionally, investment research and improvement on this region can release even extra opportunities.

You Are the Change: Getting Involved in the Revolution

The renewable strength revolution isn't always pretty much generation or policy; it is about people. We, the college generation, have the energy to form a cleaner destiny. Here are a few methods you could get concerned:

Educate Yourself: Learn greater approximately renewable strength and its ability. Share your information along with your peers and community.

Demand Change: Advocate for policies that aid renewable power and maintain your elected officers responsible for sustainable practices.

Make Informed Choices: Support corporations which might be dedicated to renewable strength and make sustainable selections on your day by day lifestyles.

Consider a Career in Renewables: The renewable power area gives interesting profession opportunities in engineering, research, policy, and commercial enterprise.

The future of our planet depends on a smooth power revolution. By embracing renewable energy resources, we can create a sustainable destiny for ourselves and generations to return. It's time to harness the energy of nature and build a world powered via smooth strength.



Prof. Tejas Sankpal



Electricity Market Operations and Regulation

Introduction:

Electricity is not just a commodity; it's the lifeblood of modern society. Behind the flick of a switch lies a complex network of market operations and regulations that ensure the reliable supply of power to homes, businesses, and industries. This article delves into the intricate workings of electricity markets, exploring their operations and the regulatory frameworks that govern them.

Understanding Electricity Market Operation:

Electricity markets are dynamic ecosystems where supply and demand intersect in real-time. At the heart of these markets are wholesale and retail segments, each playing a crucial role in the distribution and pricing of electricity.

Wholesale Markets:

Wholesale markets facilitate the buying and selling of bulk electricity among generators, transmission system operators (TSOs), and distribution system operators (DSOs). These markets operate on various models, including:

Energy-Only Markets: Participants bid to supply or consume electricity at predetermined intervals, with prices determined by supply and demand dynamics.

Capacity Markets: Designed to ensure system reliability, capacity markets incentivize generators to maintain sufficient capacity to meet peak demand.

Ancillary Services Markets: Providers offer services such as frequency regulation,

voltage control, and black start capabilities to maintain grid stability.

Retail Markets:

Retail markets connect electricity suppliers with end-users, enabling consumers to choose their electricity provider and pricing plans. Retail markets vary in structure, with some regions offering competitive retail choice while others maintain regulated monopolies.

Regulatory Frameworks:

Effective regulation is essential to ensure fair competition, promote investment, and safeguard consumer interests within electricity markets. Regulatory frameworks vary across jurisdictions but generally encompass the following key elements:

Market Structure and Oversight:

Regulators establish market rules, oversee compliance, and resolve disputes to maintain market integrity and transparency. They also regulate market participants, including generators, suppliers, and grid operators, to prevent market manipulation and ensure fair competition.

Price Regulation:

Regulators may implement price controls or mechanisms to prevent market manipulation, promote affordability, and mitigate price volatility. Price regulation mechanisms include price caps, price floors, and cost-of-service regulation, depending on market conditions and policy objectives.

Grid Access and Interconnection:

Regulators oversee grid access and interconnection processes to facilitate the integration of new generators and promote grid reliability. They establish technical standards, tariff structures, and interconnection procedures to ensure safe and efficient grid operation.

Renewable Energy Policies:

Regulators play a central role in promoting renewable energy deployment through policies such as renewable portfolio standards, feed-in tariffs, and net metering. These policies incentivize investment in clean energy technologies and support the transition to a low-carbon energy system.

Consumer Protection:

Regulators implement consumer protection measures to safeguard the rights and interests of electricity consumers. These measures include billing transparency, dispute resolution mechanisms, and consumer education programs to empower consumers to make informed choices.

Real-World Examples:

Electricity market operations and regulation vary significantly across regions and countries. Here are some real-world examples illustrating diverse approaches to market design and regulation:

United States:

The United States features a diverse mix of electricity markets, including energy-only markets in regions such as Texas (ERCOT), capacity markets in PJM Interconnection, and vertically integrated utilities in states like Florida. Regulatory oversight is provided by

entities such as the Federal Energy Regulatory Commission (FERC) at the federal level and Public Utility Commissions (PUCs) at the state level.

European Union:


The European Union operates a liberalized electricity market under the oversight of the European Commission and national regulatory authorities. The EU's Internal Electricity Market (IEM) promotes cross-border trade, competition, and integration of renewable energy sources through harmonized market rules and regulatory frameworks.

Australia:

Australia's National Electricity Market (NEM) operates on an energy-only market model, with the Australian Energy Regulator (AER) overseeing market operations and regulation. Recent reforms aim to enhance market competition, reliability, and renewable energy integration, including the introduction of capacity mechanisms in some states.



Prof. Amitkumar S. Vishwakarma



Emerging Trends in Electrical Engineering – Artificial Intelligence and Machine Learning Applications

Introduction:

In the realm of electrical engineering, rapid advancements in artificial intelligence (AI) and machine learning (ML) are revolutionizing traditional practices and opening new avenues for innovation. From optimizing power systems to enhancing device performance, the integration of AI and ML technologies is reshaping the landscape of electrical engineering. This article explores the transformative impact of AI and ML applications in electrical engineering, highlighting key trends, challenges, and future prospects.

AI and ML in Power Systems:

One of the most significant applications of AI and ML in electrical engineering is in power systems. These technologies enable predictive maintenance, fault detection, and optimization of energy distribution networks. AI algorithms analyze vast amounts of data from sensors, meters, and other devices to predict equipment failures and optimize system performance. ML techniques, such as neural networks and reinforcement learning, are used to develop predictive models for load forecasting and energy demand management, ensuring efficient utilization of resources and grid stability.

Smart Grid Optimization:

The advent of smart grid technology has created opportunities for AI and ML

applications to enhance grid reliability, flexibility, and efficiency. AI-based algorithms optimize power flow, voltage regulation, and demand response in real-time, enabling dynamic control of grid operations. ML models analyze historical data to identify patterns and anomalies, facilitating predictive maintenance and grid resilience. Furthermore, AI-driven energy management systems enable intelligent decision-making for grid operators, balancing supply and demand while integrating renewable energy sources seamlessly.

Energy Efficiency and Conservation:

AI and ML technologies play a vital role in improving energy efficiency and conservation in electrical systems. Advanced control algorithms optimize the operation of HVAC systems, lighting, and appliances in buildings, reducing energy consumption without compromising comfort or productivity. ML-based energy management systems learn from user behavior and environmental conditions to adapt energy usage patterns dynamically, maximizing efficiency. Moreover, AI-driven building automation systems enable predictive maintenance and fault detection, minimizing downtime and reducing maintenance costs.

Intelligent Power Electronics:

Power electronics is another area witnessing the integration of AI and ML technologies for improved performance and reliability. AI-

based control strategies optimize the operation of converters, inverters, and motor drives, enhancing efficiency and reducing losses. ML algorithms are employed for fault diagnosis and condition monitoring of power electronic devices, enabling early detection of abnormalities and preventive maintenance. Additionally, AI-driven design tools aid in the development of customized power electronic systems tailored to specific applications, accelerating the design process and optimizing performance.

Autonomous Systems and Robotics:

The convergence of AI, ML, and robotics is driving the development of autonomous systems in electrical engineering. Autonomous drones equipped with AI algorithms are deployed for inspection and maintenance of power infrastructure, reducing human intervention and enhancing safety. ML-based robotic systems perform complex tasks, such as cable laying and substation maintenance, with precision and efficiency. Moreover, AI-driven autonomous vehicles are employed for transportation and logistics in power plants and substations, streamlining operations and optimizing resource utilization.

Challenges and Future Directions:

Despite the promising potential of AI and ML in electrical engineering, several challenges need to be addressed to realize their full benefits. Data quality and availability remain significant hurdles, requiring robust data collection and preprocessing techniques. Moreover, the integration of AI and ML into existing infrastructure requires careful planning and investment in training and workforce development. Additionally, ensuring the security and privacy of data in AI-driven systems is paramount, necessitating robust cybersecurity measures and regulatory frameworks.



Prof. Sapna Gahlot



Unlocking the Potential of Vehicle-to-Grid Technology: A Sustainable Energy Solution

Introduction:

In the contemporary landscape of energy innovation, Vehicle-to-Grid (V2G) technology has emerged as a beacon of promise, offering a symbiotic relationship between the transportation and electricity sectors. This article delves into the intricacies of V2G technology, exploring its fundamental principles, advantages, challenges, and its transformative potential in shaping a sustainable energy future.

Understanding Vehicle-to-Grid Technology:

At its core, V2G technology enables electric vehicles (EVs) to serve not only as consumers of electricity from the grid but also as sources of power, capable of feeding excess energy back into the grid. This bidirectional flow of electricity occurs when EVs are parked and plugged into charging stations, effectively transforming them into dynamic energy storage units. By harnessing the energy stored in EV batteries, V2G systems facilitate the seamless exchange of electricity between vehicles and the grid, thereby optimizing energy utilization and grid stability.

Advantages of V2G Technology:

The advantages of V2G technology are manifold and far-reaching. Foremost among these is its capacity to enhance grid stability and resilience. By aggregating the energy storage capacity of EV batteries, V2G systems offer a flexible resource for balancing supply and demand fluctuations, particularly in the context of intermittent renewable energy sources such as solar and wind power. During periods of peak demand or renewable energy surplus, V2G-enabled EVs can inject stored energy back into the grid, mitigating grid imbalances and bolstering overall system reliability.

Environmental Benefits:

In addition to grid stability, V2G technology holds immense promise for advancing environmental sustainability. By enabling the integration of renewable energy sources into the grid more effectively, V2G systems contribute to decarbonizing the energy sector and reducing greenhouse gas emissions. EVs charged during times of abundant renewable energy generation effectively store clean energy for later use, displacing the need for fossil fuel-based power generation and promoting a transition towards a low-carbon energy system.

Economic Opportunities:

From an economic perspective, V2G technology opens up a plethora of opportunities for revenue generation and cost savings. Owners of V2G-enabled EVs can participate in various grid services and energy markets, leveraging their vehicles' energy storage capabilities to earn incentives and offset electricity costs. Moreover, V2G systems offer utilities the potential to optimize their operations, reduce infrastructure investments, and improve overall grid efficiency, leading to cost savings that can benefit both consumers and utilities alike.

Challenges and Considerations:

However, the widespread adoption of V2G technology is not without its challenges. Technical standards, interoperability issues, and concerns about battery degradation are among the key hurdles that must be addressed to ensure the seamless integration and scalability of V2G systems. Furthermore, regulatory frameworks and market structures need to evolve to incentivize V2G deployment and provide a conducive environment for innovation and investment in this burgeoning field.

Conclusion:

In conclusion, Vehicle-to-Grid (V2G) technology represents a paradigm shift in the way we conceptualize and utilize energy resources. By harnessing the latent potential of electric vehicles as mobile energy storage units, V2G systems offer a sustainable and dynamic solution to the challenges facing modern energy systems. With continued innovation, collaboration, and regulatory support, V2G technology has the power to revolutionize the energy landscape,

paving the way towards a more resilient, efficient, and sustainable future.



Prof. Reema S. Gupta



The Impact of Robotics on Modern Art

In recent years, the integration of robotics in modern art has sparked a significant shift in the way art is created, experienced, and perceived. This fusion of technology and creativity has led to the emergence of new forms of artistic expression, challenging traditional boundaries and redefining the relationship between art and technology.

Evolution of Robotic Art

Historical Background

The use of robotics in art can be traced back to the mid-20th century when artists and engineers began experimenting with kinetic sculptures and interactive installations. Artists such as Nicolas Schoffer and Edward Ihnatowicz pioneered the integration of robotics into art, laying the groundwork for the evolution of robotic art.

Contemporary Developments

With advancements in robotics and artificial intelligence, contemporary artists have embraced these technologies to push the boundaries of artistic innovation. Robotic art installations, interactive sculptures, and immersive experiences have become prevalent in art galleries, museums, and public spaces around the world.

Impact on Artistic Creation

Blurring Boundaries

The introduction of robotics in art has blurred the distinction between the creator and the creation. Artists are now collaborating with engineers, programmers, and roboticists to bring their visions to life, transcending traditional artistic mediums and techniques.

Interactivity and Immersion

Robotic art has redefined the viewer's role from passive observer to active participant. Interactive installations and robotic sculptures engage the audience on a sensory and emotional level, creating immersive experiences that challenge perceptions of art as a static form.

Redefining Artistic Expression Exploration of New Mediums

Robotics has enabled artists to explore unconventional mediums and techniques, giving

rise to a new wave of artistic expression. From robotic painting and sculpture to algorithmic art generated by AI, the integration of technology has expanded the possibilities for creative expression.

Reflection of Technological Culture

Robotic art often serves as a reflection of contemporary technological culture, addressing themes such as automation, artificial intelligence, and human-robot interaction. Artists use robotics as a means to provoke critical discourse on the impact of technology on society and the human experience.

Influence on Audience Engagement

Multisensory Experiences

Robotic art installations offer multisensory experiences that transcend traditional visual and auditory stimuli. The incorporation of movement, sound, and interactivity captivates audiences, fostering deeper engagement and emotional connection with the artwork.

Accessibility and Inclusivity


The interactive nature of robotic art has made art more accessible and inclusive, appealing to audiences of diverse ages and backgrounds. This democratization of art has expanded the reach of artistic experiences beyond traditional art spaces.

Technological Investment and Innovation

The integration of robotics in art has driven technological investment and innovation within the art industry. Artists, institutions, and technology companies are investing in research and development to advance robotic systems tailored for artistic applications. This investment fosters technological innovation and creates new market opportunities for the production and utilization of robotic art technologies.

Cultural and Educational Impacts

The presence of robotics in the art industry has cultural and educational implications, influencing perceptions of creativity, technology, and artistic expression. The fusion of robotics and art can serve as a platform for interdisciplinary collaboration, inspiring new educational



programs, and fostering a deeper understanding of the intersection between art and technology.

Future Implications

The integration of robotics in modern art continues to evolve, presenting new opportunities and challenges for artists, technologists, and audiences alike. As technology advances, robotics will likely play an increasingly prominent role in shaping the future of artistic creation and cultural experiences.

In conclusion, the impact of robotics on modern art has been transformative, redefining artistic practices, engaging audiences in new ways, and shaping the cultural landscape. The fusion of art and technology has not only expanded the horizons of creative expression but also contributed to a broader discourse on the intersection of humanity, technology, and the arts.

As robotics and art continue to converge, the possibilities for innovation and exploration are boundless, promising an exciting future for the evolution of artistic expression in the digital age.

The integration of robotics in the art industry has brought about significant economic implications, affecting various aspects of art production, consumption, and market dynamics. The economic impact of robotics on the art industry can be examined through the lens of production efficiency, market demand, and the reconfiguration of artistic labor.

Conclusion

The economic impact of robotics on the art industry is multifaceted, encompassing production efficiency, technological investment, market dynamics, labor considerations, and cultural influences. As robotics continues to shape the artistic landscape, it is crucial for stakeholders in the art industry to navigate the economic implications of this integration, ensuring the sustainable growth, accessibility, and ethical considerations of robotic art within the broader art market.

Ankit Chandrakant Patil

Student Pass out 2022-23 Electrical

Electric Modular Wheelchair

INTRODUCTION

The growing demand for transportation within diverse environments, whether indoors, workplaces, or public spaces, presents a significant challenge for individuals with disabilities, particularly those with leg impairments. While Electric Uni-Bike assisted Wheelchair offer an innovative solution to this demand, their substantial cost compared to manual wheelchairs remains a considerable hurdle. Despite this financial barrier, these advanced electric mobility aids offer extensive advantages that extend beyond individual empowerment. Beyond facilitating individuals, Electric Uni-Bike assisted Wheelchairs and similar mobility devices play a pivotal role in shaping a future that prioritizes both environmental sustainability and inclusivity. Their contribution to reducing emissions and promoting cleaner modes of transportation aligns seamlessly with the eco-conscious principles of electric vehicles. By embracing these innovations, it actively contributes to a more environmentally friendly future, emphasizing a shift towards ecologically sustainable mobility solutions. Furthermore, Electric Uni-Bike assisted Wheelchair represent a clear step towards ensuring that everyone, regardless of physical ability, can participate in activities previously hindered by mobility challenges. It not only provides individuals with the ability to move but also symbolize the broader integration of inclusivity into our societal fabric.

OBJECTIVE

The primary objectives of this project encompass the conceptualization, development, and integration of a one-wheeled electric bike with a wheelchair, purposefully tailored to meet the specific mobility requirements of individuals facing leg disabilities. Central to the project is the utilization of a sophisticated Brushless DC (BLDC) motor, accompanied by the incorporation of advanced attachments commonly associated with contemporary electric bikes. This initiative aims to deliver a comprehensive solution, emphasizing heightened

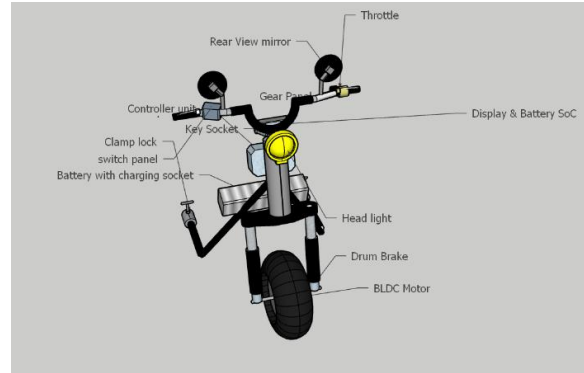
user independence and seamless maneuverability. Technical goals include overcoming challenges related to user adaptation and refining the dynamics of precise maneuvering, ensuring the system's adaptability to diverse user profiles. Furthermore, the project seeks to address nuanced technical aspects such as power management optimization, durability, and safety considerations. These secondary objectives aim to enhance the overall reliability and functionality of the integrated system, contributing to an efficient and user-friendly mobility solution. Additionally, the project sets out to explore possibilities for incorporating smart technologies, such as sensor integration and connectivity features, to further augment the user experience. By pursuing these multifaceted objectives, the project aspires to make a substantial contribution to the advancement of assistive mobility technology, fostering inclusivity and improving the overall quality of life for individuals with leg disabilities.

METHODOLOGY

1. Principle

The Electric Uni-Bike assisted Wheelchairs operate on a fundamental principle of converting electrical energy into mechanical motion to facilitate mobility for individuals. At the front of these wheelchairs lies a 1000W BLDC electric motor propulsion system which has fork structured type attachment powered by a 60V 12Ah rechargeable battery. The battery serves as the primary energy source, supplying power to electric motors infused into the tire and other equipment. A 32A 40-60-72 V Regenerative sine wave controller is connected across the battery to control the desired output of the rider. The controller acts as the main brain of this system where we connect a 3-speed throttle of speed mode option of ECO-CITY-SPORT. ECO mode will consume less power while delivering a slow speed of approx. 0-15kmph kmph and offering a longer range of up to 28km per full charge to the rider. While the CITY mode will consume Optimum power delivering moderate speed of 15-25 kmph with a good range of 20 km per charge. Lastly, SPORT mode will consume high

power while delivering 25-40kmph of top speed with an adequate range of 12-15 Km per charge. The throttle has a rotational speed control at handlebar of the rider, controlling the rotation will control the speed of up to 55 Kmph. The controller here also has a function of FORWARD/REVERSE action switch, the rider can move the wheelchair backward if needed. Controller also functions as a controller to a DC-DC converter which converts (Steps down) 60V from battery to operatable 12V to function the Lights, Indicators, and Display. The battery is also equipped with a BMS (Battery Management System) which regulates the battery power according to the controller power input. The motor consumes 25-50W/km from the battery while operating. This propulsion system also ensures the safety of the rider with effective regenerative braking. Safety parameters of this vehicle is an important aspect of the system. To ensure safety of the rider, an attached seat-belt is installed and adjustable helmet is advised. All necessary equipment is installed such as Side mirrors, Left-Right Indicators are installed to ensure that rider is safe to ride on roads while maintaining the road safety measures and regulations.



2. Design Methodology

The design of this model is necessary as it not available, so to design such frame of the bike for more endurance and safety at traction, a basic 3D model was developed on Sketch-up 3D software to know the structure strength and dynamics of the frame, ANSYS was used. After getting a thorough insights and R&D on the model, a final 3D model was drafted. Frame of GI (Galvanized Iron) and MS (Mild Steel) were used for welding as this material is standard and widely used for bike frames. Telescopic suspension of Aprilia Uni-bike was suitable according to the axle length to tire and fork for cone-set. Handle cone-set was mainly design with a proper turning and effortless motion to control via bearings concealed in ID (inner Diameter) to an exterior rod of OD (Outer Diameter). Welding all material under superior guidance with all the fittings like nut-bolts, fasteners and supporting limb attach, assembling all the necessary components on the frame rods.

Fig. no. 1.1(a) Block Diagram of Modular Electric Uni-Bike assisted Wheelchair

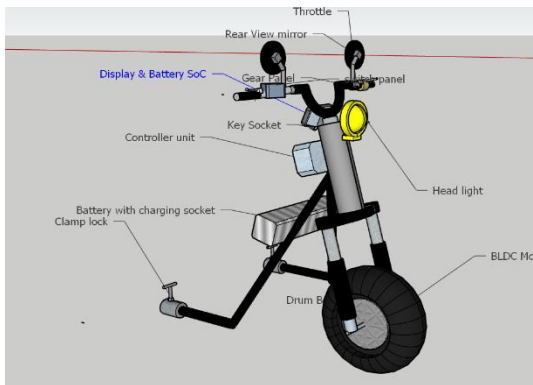



Fig. no. 1.1(b) Flow Diagram of Modular Electric Uni-Bike assisted Wheelchair

3. Mathematical modelling

This part needs to be assembled and weld with precision as some parts like motor and controller panel are vulnerable to heating of weld and it may damage the parts. After Welding and attaching all the external frame and components together, all the wiring is to be connected but with proper cautions and mapping because some wires such as Hall Sensor of the motor which detects the position of the winding of the motor are sensitive in case of physicality. All components are attached as per planned, for the throttle and control switch unit on handle bar including side



mirrors and brake levers. For battery to be safe and easy to be removable, a battery case is design and welded on the legs of the structure. Wiring can be referred.

Wiring once done the model needs to be trialed on road surface to ensure endurance of the vehicle.

4. Components

The operating principle of an electric Uni-bike involves integrating electrical and mechanical components to provide propulsion. Below are the main operating components of electric bicycles: Electric motor: Front Tire of Uni-bike type attachment are equipped with an electric motor, a 1000W brushless DC motor (BLDC), powered by a rechargeable battery. The motor is responsible for converting electrical energy into mechanical movement and with regenerative braking, power can be stored for long rides.

Rechargeable Battery: A 60V 12Ah Li-ion battery serves as the energy storage unit, supplying power to the electric motor. Typically, lithium-ion batteries are used due to their high energy density and efficiency. Controller: A 32A 72V Regenerative Sine Wave controller regulates the flow of electrical energy from the battery to the motor, controlling speed and output torque. It interprets signals from the bike's hall sensors and rider inputs to adjust the motor's performance accordingly. Throttle: The e-Uni-bike have a throttle, allowing the rider to control the motor directly. Ensuring 3 speed operation with Forward/Reverse action, this feature provides an additional option for propulsion, especially in situations where pedaling is impractical.

Frame and mechanical components: The frame and mechanical components of an e-Uni-bike attachment are designed to accommodate the electrical system. This includes mounting the battery, motor and wiring, as well as integrating traditional Uni-bike components such as clamps, tire suspensions and brakes. Sensors: Sensors, including speed sensors and torque sensors, play

an important role in determining the level of assistance provided by the motor. They provide real-time data to the controller for precise adjustments. Display and control unit: The display unit on the handlebar provides information such as speed, battery level and support mode. It may also include controls to adjust the level of assistance and activate features such as lights. Control unit here serves the basic purpose of switching on/off all accessories such as horn, LED headlight, side indicators and Pass Light.

5. Method of Modulation between Electric Uni-bike and Wheelchair

Mechanical interlocking clamp are used on the electric bike attachment which attaches to the wheelchair to make the propulsion of rider. As the Electric motor is used infused with the tire, it has a drum braking mechanism for the front end of Electric Uni-Bike to ensure proper braking at ease. Two limbs of this attachment are to be inserted into a rod welded on wheelchair, once the limbs are inside the rod, rider needs to fasten the latch until it is tight to attach the wheelchair from Electric Uni-bike module. Rider also needs to ensure about seat belt.

CONCLUSION

In summary, the integration of a one-wheeled electric bicycle with a wheelchair marks a significant advancement in assistive mobility technology for individuals with leg disabilities. Powered by a Brushless DC (BLDC) motor and featuring innovative attachments, this innovation offers greater autonomy and mobility. However, challenges in maneuverability and user adaptation, along with limitations on variable terrains, must be acknowledged. Despite these obstacles, the project demonstrates transformative potential in enhancing the quality of life for individuals with leg disabilities by combining electric bike technology with wheelchair accessibility. Ongoing refinements and adaptability measures aim to address these challenges, ensuring a comprehensive solution for the target demographic.

Raj Saroj
Student- BE Electrical

SAND BATTERY

Introduction to Thermal Energy Storage

Thermal energy storage (TES) is one form of energy storage. In this case, when the temperature is increased material gains energy, and when the temperature is decreased material loses its energy. TES can help to balance energy demand and supply on a daily, weekly, and even seasonal basis, presented in thermal systems. TES can also help to reduce peak demand, energy consumption, CO2 emissions, and costs and also increase the overall efficiency of energy systems. Thermal energy storage is much cheaper than electrical energy storage. TES provides several benefits to heating and cooling networks (DHC), including reducing peak thermal demands, increasing the efficiency of the system, and integrating other heat sources such as industrial waste heat or seawater. The application of thermal energy storage with renewable energy sources, waste heat, or surplus energy production can replace heat or cold generation from fossil fuels, reducing greenhouse gas (GHG) emissions and reducing the need for the thermal power capacity of the generators.

Problems with Renewable Energy

- The very first issue of Renewable energies such as solar and wind power is their weather dependency.
- They cannot be used as continuous sources 24x7 which brings the issue of storage.
- Large space required for Installation of solar and wind plants.
- In many cases, it costs more to store electricity than to make it.
- Wind and solar energy are quite cheaper as compared to gas and coal but when we add the cost of storage, these renewables can lose to fossil fuels, so a cheaper alternative is required.

What is a Sand Battery?

A “sand battery” is a high-temperature thermal energy storage that uses sand as its storage medium. It stores energy in the sand as heat. The sand does not store electricity but stores energy in the form of heat. Sand is a very effective medium for retaining heat over a long period, storing power for months at a time. Its main purpose is to work as a high-power and high-capacity reservoir for excess wind and solar energy. The energy is stored as heat, which can be used to heat homes or to provide hot steam and high-temperature process heat to industries that are often fossil-fuel dependent.

How Sand Battery Works


It receives electricity through cheaper renewable sources like solar and wind. And that Electricity is converted to heat and transferred to sand. It has a Heat Exchanger buried inside and is capable of storing 8-megawatt hours of Energy at a nominal power rating of 100KW with sand heated to somewhere around 500 to 600 degree Celsius.

During the discharge phase air or another gas is pumped through heated sand, extracting the stored thermal energy and converting back into electricity. As the gas flows through heated sand it absorbs heat which is then used to generate steam, drive turbines and generate electricity.

Energy is stored as heat which is used to heat homes or to provide hot stream and high-temperature process heat to industries that are often fossil-fuel dependent. The sand battery’s ability to store and release thermal energy efficiently makes it a versatile and adaptable energy solution.

Advantages of Sand Battery

Large-scale sand batteries can meet energy demands, providing balance to national grids. Most batteries are currently made up of lithium and lithium is expensive and has a large carbon footprint since it requires mining. Mining involves fossil fuels, uses large amounts of water, and generates pollution, which can cause environmental degradation.



Sand batteries are low-cost as sand is free and easy to obtain. Sand is a non-toxic and non-hazardous material ensuring that sand battery poses minimum environmental risks. Heating devices in many countries consume a significant part of total electricity generated and this cheaper method could eliminate a major part of Consumption.

Conclusion

The Sand battery represents a remarkable innovation in the field of energy storage. By

leveraging the unique properties of sand this technology offers cost-effective, scalable, and environmentally friendly solutions for storing and releasing energy. As research and development continue, the sand battery holds the promise of transforming the energy landscape and driving us closer to a sustainable future.

Mayur Pathare
Student-BE Electrical

Understanding Electrical Machines: A Comprehensive Overview

Electrical machines are devices that convert electrical energy into mechanical energy (or vice versa) through electromagnetic induction. They play a crucial role in various applications, from industrial machinery to household appliances. Let & deeper into the world of electrical machines to understand their types, working principles, and applications.

Types of Electrical Machines

1. **Generators:** Generators convert mechanical energy into electrical energy. They are essential in power plants, where turbines or engines drive them to produce electricity.
2. **Motors:** Motors, on the other hand, convert electrical energy into mechanical energy. They power a wide range of devices, from small household appliances to large industrial machinery.
3. **Transformers:** Transformers are devices that transfer electrical energy between circuits through electromagnetic induction. They are vital in electricity distribution, stepping up voltage for transmission and stepping down voltage for distribution.

Working Principles

Electromagnetic Induction: Both generators and motors operate on the principle of electromagnetic induction, where a magnetic field interacts with conductors to produce a voltage or a force.

□ **Faraday Law:** Faradays Law states that a changing magnetic field induces an electromotive force (EMF) in a conductor. This principle is the basis for the operation of generators.

□ **Lorentz Force Law:** The Lorentz Force Law describes the force experienced by a charged particle in an electromagnetic field. This law is fundamental to understanding the motion of conductors in motors.

Applications

1. Industrial Machinery: Electrical machines power a wide range of industrial machinery, including pumps, compressors, and conveyor systems.

2. Transportation: Electric vehicles (EVs) use electric motors for propulsion, highlighting the importance of electrical machines in sustainable transportation.

3. Renewable Energy: Wind turbines and hydroelectric generators rely on electrical machines to convert kinetic energy into electrical energy.

4 Home Appliances: From washing machines to refrigerators, many household appliances use electric motors for their operation.

Future Trends

- **Efficiency Improvements:** Ongoing research focuses on improving the efficiency of electrical machines to reduce energy consumption and environmental impact.
- **Integration with Renewable Energy:** Electrical machines are integral to the integration of renewable energy sources into the power grid.
- **Smart Technologies:** Smart technologies, such as variable frequency drives, are enhancing the control and efficiency of electrical machines.

In conclusion,

electrical machines are essential components of modern society, enabling the efficient conversion and utilization of electrical energy. As technology advances, these machines will continue to play a crucial role in shaping a sustainable energy future.

Jinesh Sane & Prathmesh Tawde
Student-SE Electrica

STUDENT ACHIEVEMENTS

| Sr. No | Participants | Paper Title/ Workshop/Project Competition | Presented At | Date | Rank |
|--------|---------------------------|---|--|---------------|-------------------|
| 1 | Pranay Yashwant Patari | PRESENTATION SINGLE OPERATOR TYPE ARC WELDING- TRANSFORMERS - | BIS Standard Club: Presentation on Standards | 29th Jan 2024 | 1st Prize |
| | Omprakash Lalji Gupta | | | | |
| | Manas pawar | | | | |
| | Ankush Tare | | | | |
| 2 | Samruddh Soma Gawade | PRESENTATION SELECTION, INSTALLATION AND MAINTENANCE OF FIRE EXTINGUISHER | BIS Standard Club: Presentation on Standards | 29th Jan 2024 | 2nd Prize |
| | Rahul Ramesh Gavali | | | | |
| | Mihir Avinash Thakur | | | | |
| | Nandkishor Shrikant gupta | | | | |
| | Sahil Gavit | | | | |
| 3 | Bhavesh Lade | PRESENTATION on AIR-BREAK SWITCHES AND REWIRABLE TYPE FUSES FOR VOLTAGES NOT EXCEEDING 650 V A.C. | BIS Standard Club: Presentation on Standards | 29th Jan 2024 | 3rd Prize |
| | Siddhant Sunil Parulekar | | | | |
| | Abinash paikaray | | | | |
| | Suresh Ashok Jadhav | | | | |
| 4 | Omraj Sanjay Jadhav | PRESENTATION on PVC INSULATED (HEAVY DUTY) ELECTRIC CABLES | BIS Standard Club: Presentation on Standards | 29th Jan 2024 | Consolation Prize |
| | Arun Kiran Darnule | | | | |
| | Ashish Mahendra Pawar | | | | |
| | Kaushik Dattatrey Jadhav | | | | |

| | | | | | |
|---|-------------------------|--|------------------------------|-----------------|-----|
| | Katrik Talekar | | | | |
| 5 | Jay Rewale | Ranked ' 1st ' Paper Presentation At NCRENB 2023-24, Modular Electric Wheelchair. | Viva Institute Of Technology | 15th March 2024 | 1st |
| | Raj Saroj | | | | |
| | Harsh Shukla | | | | |
| 6 | Vivek Karwande | Ranked ' 2nd ' Paper Presentation At NCRENB 2023-24, A Comparative review of robotic lifesaving assistant for pool rescue. | Viva Institute Of Technology | 15th March 2024 | 2nd |
| | Mayur Pathare | | | | |
| | Rohit Surve | | | | |
| 7 | Jay Rewale | Ranked "2nd " In “Technovation 2024 Modular Electric Wheelchair for Handicap | Viva Institute Of Technology | 5th April 2024 | 2nd |
| | RajSaroj | | | | |
| | Harsh Shukla | | | | |
| 8 | Mirgal Prasad Umesh | Ranked "3rd " In “ Technovation 2024 Mini Project Translate sign Language into Speech | Viva Institute Of Technology | 5th April 2024 | 3rd |
| | Gawade Pratik Pandurang | | | | |
| | Parsekar Viraj P | | | | |



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ALUMNI CORNER

I would like to share some of my thoughts and experiences with the department that occurred in the span of 3 years of my study. I came here via direct second year admission with the intention to clear out my basics which I was not able to cover in my diploma studies. As soon as I entered the college there was an added pressure right from the first day as but the staff made sure that maximum of us cleared it in the first attempt itself and indeed we all did it. I can say the teachers managed to clear them out with every way possible from their side and this was actually a very tragic time for our department as it was short of staff but even after that our HOD, class coordinator and each and every teacher (including the support staff) everyone came together and managed everything well which indeed paced a good way for our fare-the-well.

I would like to thank Bhushan Save sir for all the practical examples which he used to deliver during the lectures and along with it the movie

learning tips which indeed connected so many dots for us, lastly a big thank to our teachers and all the support staff for all their vital contribution through which we cleared our difficulties with ease.

Thank you.



Ankit C. Patil

Batch 2022-23

My name is Anuj Ramakant Kap, a student of BE Electrical Engineering at the Viva Institute of Technology. I'm excited to share my experience with the electrical department and the VIVA Institute of Technology.

One of the things that really stand out about the department is the exceptional infrastructure and resources available to us. The faculty members are highly experienced and passionate about their subjects, and they are always ready to help and guide us.

The department always focuses on the practical learning and the co-curricular and extra-curricular

activities. They also organize the events, workshops and seminars to keep us updated with the latest trends and technology in the field.

Another aspect worth mentioning is the career guidance and the placement support we received. The overall experience at the Electrical department was incredible. They have played a vital role in shaping my career, so I'm very, very thankful to the Electrical Department and the VIVA Institute of Technology.



Anuj Kap
Batch 2022-23

Greetings to all!

I am a student of the Electrical Department at VIVA Institute of Technology of the 2023 batch. I am here to express my heartfelt appreciation for our institute and the remarkable electrical department.

Throughout my journey here, I have been fortunate to receive an education from experienced and exceptional faculty members of an electrical department. They have wholeheartedly demonstrating their experience and dedication to our growth and development.

Their ability to simplify the complex concept and provide the practical examples has made the learning both enjoyable and inviting. Moreover, the practical sessions in well equipped laboratories has been a key strength of this institution.

In the end, I sent my heartfelt gratitude to thank the institute and department for the great teaching-learning experience and shaping our future.

Thank you.



Shubh Arekar
Batch 2022-23

Toppers List

B.E. Electrical (Semester VII)

| Sr. No. | Rank | Name | CGPI |
|---------|--------|---------------|------|
| 1. | First | Harsh Shukla | 8.12 |
| 2. | Second | Mayur Pathare | 8.07 |
| 3. | Third | Akash Naik | 7.66 |

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| Sr. No. | Rank | Name | CGPI |
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| 1. | First | Joil Roshan Shamsundar | 8.86 |
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| 3. | Third | Urumkar Kartik Shreedhar | 7.27 |

S.E. Electrical (Semester III)

| Sr. No. | Rank | Name | CGPI |
|---------|--------|-------------------------|------|
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