K. S. R. COLLEGE OF ENGINEERING

K. S. R. COLLEGE OF ENGINEERING

An Autonomous Institution

(Approved by AICTE, Affiliated to Anna University, Accredited by NAAC A++ Grade)

K.S.R. Kalvi Nagar, Tiruchengode - 637215, Namakkal District, Tamil Nadu.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ENERGETICS'25

TECHNICAL MAGAZINE

(Volume 23 / Issue 02 / June 25)

ACADEMIC YEAR 2024-2025

With the Blessings of our Beloved Founder's

Lion.Dr.K.S.Rangasamy MJF

Founder - KSR Institutions

Forever in our hearts,
Forever in our thoughts!

Chairman's Message

Vision looks in ward and become duty.

Vision looks outward and become aspiration.

Vision looks upward and become faith.

**Shri R. Srinivasan BBM., MISTE.,
Chairman, KSR Educational Institutions.**

As we stand on the brink of new beginnings and boundless possibilities, I am filled with an immense sense of pride and optimism about what we can achieve together at KSR Educational Institutions. Our founder, Dr. K S Rangasamy, laid a strong foundation rooted in the belief that education is the most powerful tool to transform lives. Carrying forward his legacy, we remain committed to not just educating but empowering young minds to make a meaningful impact in the world.

In today's fast-paced, technology-driven society, the challenges are as dynamic as the opportunities are great. It is imperative for education to transcend traditional learning and encompass the development of holistic, innovative, and critical thinking skills. At KSR, we strive to equip you, our students, with the capabilities to not only adapt to changes but to drive them. We are dedicated to nurturing a generation of leaders, innovators, and thinkers who are ready to take on global challenges with local sensibilities.

Making an Impact is not just a phrase—it's our mission. It's about inspiring each one of you to pursue your passions with determination and a sense of responsibility towards the betterment of society. We encourage you to dream big, push boundaries, and question the status quo. Our campus is a melting pot of ideas where your creativity and ambitions are nurtured, allowing you to flourish in ways you never imagined.

Dean's Message

Dr. M. Venkatesan
Dean – KSRCE

As a Dean of KSRCE, I actively play my role to facilitate students to become best academicians, researchers and policy makers. I provide a diverse and inclusive work environment to my colleagues and drive them wherever necessary to play a role in getting utmost national and international agencies support Institution. A collaborative and integrated approach towards teaching, learning and research will be emphasized. I strongly believe that the KSRCE team will overcome the constraints facing to deliver the best Engineering services to the society and reach the desired goals.

Principal's Message

Dr. P. Meenakshi Devi
Principal - KSRCE

It gives me immense pleasure in presenting the department magazine for the session 2024 – 2025.

Today KSRCE is not just a college but is a FAMILY in which the educational community, the management, staff, students, parents and alumni work united to foster this FAMILY SPIRIT.

Creating industry ready, globally competitive students and socially acceptable human beings as citizen of India. I heartily congratulate **Prof. Dr. S. Ramesh, HoD/EEE** and his team members who have taken pains to bring out this magazine.

"Education is the manifestation of perfection already in man"

-Swami Vivekananda

HOD'S Message

Prof. Dr. S. Ramesh,
Head of the Department - EEE

As the summer sun glows pleasantly to heat up everything, the creativity and talents in every techie of our department is thirsty to project his/her talents and skills. On behalf of the editorial board, proudly presenting *ENERGETICS 2025* designed with a vision to quench the thirst by layering a platform for innovative ideas.

The soul of creativity lies in the dream to unveil inherent talent. The power of this dream fueled us forward and made *ENERGETICS 2025*, a reality. We are thankful to all who contributed to fulfill our dream. First and foremost, let me thank our chairman who was always with us, to provide a wonderful platform to nourish the talents. I extend my sincere thanks to our Dean, Principal who were always in the forefront to encourage and inspire to execute wonderful ideas. I thank all students and faculty coordinators for their overwhelming support to bring out *ENERGETICS 2025*. I also wish all outgoing students of 2025 a bright future ahead.

"Dream, Dream, Dream transfer into thoughts and thoughts result
in action Success will be yours."

-Dr. A. P. J. Abdul Kalam

ENERGETICS' 2K25

Electrical & Electronics Engineering

VISION OF THE DEPARTMENT

To produce competent Electrical and Electronics Engineers driving sustainable solutions through quality education and research.

MISSION OF THE DEPARTMENT

DM 1: Provide transformative education in Electrical and Electronics Engineering by integrating modern pedagogy and technology-enhanced learning.

DM2: Deliver holistic, value-driven education through cutting-edge laboratory facilities that meet the evolving needs of global industries.

DM3: Promote collaborative and interdisciplinary research to develop sustainable solutions.

DEPARTMENT PROFILE

The Department of Electrical and Electronics Engineering (EEE) was started in the year 2002 with an intake of 60 students. Over the years the Department has steadily grown and currently the student's intake is 60. Along with B.E., the Department also offers a one M.E., degree Programme in Power Electronics & Drives. Choice based credit system is introduced in regulation 2018.

The Department has been accredited by the National Board of Accreditation (NBA), New Delhi. The Department has good infrastructure with well-equipped laboratories and an exclusive Departmental library.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1:

Core Competency: Graduates will exhibit strong technical knowledge in Electrical and Electronics Engineering to analyze, design and develop sustainable engineering solutions.

PEO 2:

Professionalism: Graduates will integrate interdisciplinary knowledge and ethical responsibility to develop innovative solutions addressing societal challenges.

PEO 3:

Career Development: Graduates will engage in lifelong learning and research for sustainable development to meet the evolving needs of the industry.

PROGRAM OUTCOMES (POS)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO 1:

Power and Energy Systems: Design, operate, maintain efficient and sustainable electrical power systems with renewable energy integration.

PSO 2:

Embedded System and Automation: Develop embedded, real-time control systems, and power electronic solutions for industrial process automation.

REVOLUTIONIZING POWER SYSTEMS: IOT-DRIVEN SMART TRANSFORMER MONITORING

V.DINESHKUMAR, III EEE   *P.SONIYA, III EEE*

1. Introduction to Smart Transformer Monitoring

Smart Transformer Monitoring Systems leverage a network of IoT- enabled sensors to continuously track parameters such as temperature, load, oil levels, and moisture. This real-time data is transmitted to a centralized cloud- based platform, where predictive analytics can identify anomalies, trigger alerts, and even schedule maintenance proactively. Such a system drastically reduces the risk of unexpected failures, enhances operational reliability, and extends the lifespan of valuable electrical assets.

2. Transformer Monitoring

Transformers are key assets in the power grid and industrial processes. Transformer monitoring reduces business risk through:

• Providing better safety for workers and the public

• Reducing unexpected failures

• Reducing unplanned outages

The consequences of an unexpected transformer failure can be catastrophic, yet many failures are preventable. The condition of a transformer is only as good as its worst performing component. Transformer monitoring actively monitors various operating characteristics to make sure they are functioning properly.

Transformer monitors collect data and send alarms to notify the user if something looks off. There are a wide range of transformer monitors available that can detect the symptoms of transformer failure by monitoring the cooling system, load tap changer, dissolved gas, bushing power factor and capacitance, partial discharge, oil levels, pressure, temperatures and more

3. Smart Transformer Monitoring System Architecture

The working of a Smart Transformer Monitoring System using IoT. The system starts with the transformer, which is equipped with various sensors that monitor vital parameters such as temperature, oil level, and load. These sensor readings are captured by a central monitoring and control unit, which processes and displays the data.

Next, the information is transmitted securely to a cloud

platform where it can be stored and analysed. Cloud computing enables predictive maintenance by identifying anomalies in transformer performance in real time. Finally, the data is made accessible to engineers and operators through a web or mobile application interface, allowing for remote monitoring, timely alerts, and maintenance planning.

4. Conclusion

The Future of Smart Transformer Monitoring looking ahead, the integration of AI and machine learning with IoT in power transformers will further enhance decision-making, energy efficiency, and grid resilience. As we move towards smarter cities and sustainable energy systems, such innovations will play a pivotal role in shaping the future of power engineering. This architecture exemplifies how IoT enhances traditional power systems, ensuring efficiency, safety, and sustainability.

5. Challenges and Future Directions

While promising, IoT-based transformer monitoring systems faces several challenges:

Data Security:

Ensuring the security of data transmitted over IoT networks is critical to prevent cyber threats.

Integration with Existing Infrastructure:

Seamlessly integrating new IoT systems with legacy infrastructure can be complex and costly.

Scalability:

Managing large volumes of data from numerous transformers requires robust data handling and processing capabilities. Future research should focus on addressing these challenges by developing advanced security protocols, creating more efficient integration methods, and enhancing data processing algorithms. Additionally, exploring the use of advanced analytics and artificial intelligence can further improve the predictive maintenance capabilities of these systems.

*****

ADVANCED MATERIALS & NICHE INNOVATIONS
2D MATERIALS (GRAPHENE, MOS2) FOR SENSORS AND TRANSISTORS

INTRODUCTION:

2D materials are crystalline materials consisting of a single layer of atoms. Among them, Graphene (a single layer of carbon atoms) and Molybdenum Disulfide (MoS_2) are the most widely studied due to their unique electrical, optical, and mechanical properties.
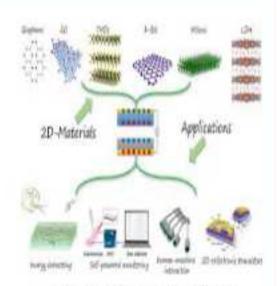
- Graphene: Discovered in 2004, it is ultra-thin, extremely strong, and an excellent conductor of electricity.

- MoS_2 (Molybdenum Disulfide): A semiconducting 2D material with a direct band gap, unlike graphene, making it suitable for transistor applications.

1. Structure & Properties

- Graphene: Hexagonal carbon lattice, high carrier mobility, zero band gap (semi-metal).

- MoS_2: Layered structure, semiconducting, has a band gap (~1.8 eV in monolayer form).

2. Electrical Behavior

- Graphene: High conductivity, fast electron transport.

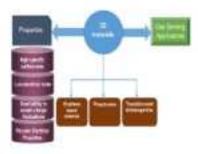- MoS_2: Useful in digital electronics due to its ON/OFF switching ability.

3. Synthesis Techniques

- Mechanical exfoliation
- Chemical vapor deposition (CVD)
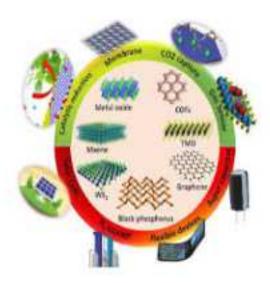- Liquid phase exfoliation

4. Integration with Electronics

- Can be deposited on flexible, transparent, or traditional silicon substrates.

- Compatible with CMOS technology.

TRANSISTORS:

- Graphene Field-Effect Transistors (GFETs): Very fast but poor switching due to zero band gap.

- MoS₂ FETs: Excellent ON/OFF ratio, low leakage, ideal for digital logic circuits.

ADVANTAGES:

Feature	Graphene	MoS₂
Electron Mobility	Very High (>200,000 $cm^2/V \cdot s$)	Moderate (~200 $cm^2/V \cdot s$)
Band Gap	Zero (limiting for digital switching)	Direct Band Gap (ideal for transistors)
Flexibility	Highly flexible and strong	Also flexible and scalable
Transparency	Transparent, great for optical sensors	Semi-transparent
Miniaturization	Ideal for ultra-small devices	Scalable for nano-electronics

APPLICATIONS:

SENSORS

- Gas sensors: Detect gases like NO_2, NH_3 at room temperature.

- Biosensors: Detect DNA, proteins, viruses due to large surface area and biocompatibility.

- Strain sensors: Monitor structural changes or wearables due to flexibility.

*****

73152314014 - HARIHARAN S,
III EEE
73152314008 - DHARANEESH G,
III EEE

ULTRA-SECURE DATA TRANSMISSION; SLOWLY ENTERING THE EEE SENSING FIELD

73152214049- SRIDEVI K, IV EEE

73152214006-DEVADHARSHINI D, IV-EEE

INTRODUCTION

Ultra-secure data transmission refers to the safe and encrypted transfer of data between electronic devices; especially sensors and controllers. In the field of EEE, secure communication is becoming essential due to the rise in IoT devices, smart grids, automation, and wireless sensor networks. These systems need protection against cyber threats, data hacking, and system failures caused by data tampering.

What is Ultra-Secure Data Transmission?

Ultra-secure data transmission refers to techniques that ensure confidentiality, integrity, and authenticity of data during communication. It prevents unauthorized access, eavesdropping, or tampering of data sent between sensors, devices, or systems.

Technologies Used in Ultra-Secure Transmission:

1. Quantum Key Distribution (QKD)

- Uses quantum mechanics to securely share encryption keys.

- Any eavesdropping attempt disturbs the system, making it detectable.

- Currently tested in secure sensor networks and military-grade communications.
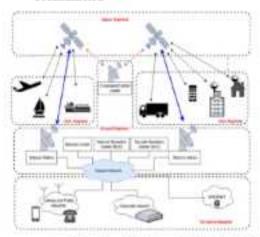
2. Blockchain-Based Sensing

- Sensor data is recorded in a tamper-proof ledger.

- Ensures traceability and authenticity of sensor data.

3. End-to-End Encryption (E2EE)

- Data from sensors is encrypted before transmission and only decrypted by the receiver.

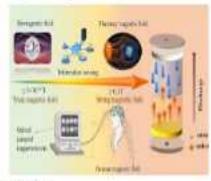- Widely used in industrial IoT and smart home applications.

4. Li-Fi (Light Fidelity) with Encrypted Transmission

- Optical wireless communication using light.

- Offers secure short-range, high-speed communication with low risk of interception.

- Useful for secure indoor environments.

5. Edge Computing + Security

- Data is processed near the source (e.g., smart sensor) rather than sent to cloud.

- Reduces exposure to threats and enables real-time encrypted processing.

Applications

- Smart Grids
- Healthcare Sensors
- Industrial IoT (IoT)
- Defense and Aerospace
- Autonomous Vehicles

Future Scope in EEE:

1. **Secure Sensor Networks** – Large-scale deployment in smart cities, grids, and agriculture.

2. **Integration with AI** – Smart detection of anomalies or intrusion in sensor data.

3. **Quantum Encryption Sensors** – New hardware supporting secure quantum communication.

4. **Bio-sensing with Blockchain** – Secure tracking of human vitals or biochemical data.

*****

SMART WATCH

73152314028– MONICA M
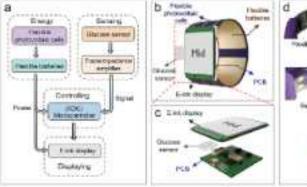### III-EEE

73152314026– MIRUTHIKA K
III-EEE

Introduction:

Wearable smart devices are already amongst us. Smart watches are one of the key factors of the wearable technology and are being used by a large population of consumers. Smart watches are trending devices that give its users the ability to be connected, send/receive emails and messages,

and low cost. This watch is programmed using Arduino's open-source libraries and functions. It provides the user another way to interact with the smart phone.

Features of Smart Watch:

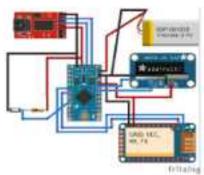The smart watch is developed with minimum cost. The watch will perform all the

and even make calls on the go. Given the phone has been picked out from pocket and now is on hands, a person still needs to do some steps such as unlocking the phone, finding the app. The numbers of steps involved in checking notifications in smart phone are high and thus a smart watch device is helpful. Smart watches that are already in this market are advanced and costly. The system we are developing is very small size

normal watch stuff such as showing day, date, time. It will also have an alarm and a stopwatch. Along with this the watch will be able to read data from mobile and display it on the watch screen using Bluetooth. It will display all the notifications on the smart phone and will also notify user if they receive phone calls. This will make easy for user to read their messages, emails, and receive phone calls.

With the increasing demand in the market for smart devices, the demand for smart watch is increasing. As the new technology is being invented, it is getting cheaper as the time progresses. With this we can say that with time cheap products are getting good and good products are getting cheap. Even the smart watch developed is cheap when considered with other watches in the market. This smart watch can display date, day and time. Along with this basic feature it can also be connected to the smart phone using a Bluetooth which will be helpful to display notifications received on the mobile device on the watch. Along with this it can also store three to seven messages in the memory.

fritzing

It can store small number of messages because of the limited memory space it had. Finally, we can say that the watch can perform functions which will help the user from not constantly checking their phones intern they can check their watch to see if they have received any important message or not which will save the users time as they won't waste time checking unwanted messages on the mobile

Applications:

1. Heart rate, Blood oxygen level, Blood pressure, Temperature monitoring.

2. Contactless Payment.

3. Digital wallet applications.

4. Messaging and calling.

5. Emergency calls for Assistance.

6. social media and notifications.

7. Games, Music, Photos.

8. GPS Tracking.

9. Location features.

Market Survey:

According to Allied Market Research, the smart watches segment is predicted to rise at the highest pace, with a CAGR of 19.9%. The health & sports segment led the wearable technology trends with over 39 % market share in 2015, and this is expected to continue during the forecast period (2015-2022). During the projected span, however, the entertainment market is expected to expand at the fastest rate of 35.7%.

*****

ELECTRIC VEHICLE TECHNOLOGY

Vehicle Overview:

Electric vehicle technology has advanced rapidly since its introduction, and today there are many plug-in hybrid and battery electric vehicle options available on the market. But how, exactly, do electric vehicles work and what are their advantages?

Enter the electric vehicle drive train! Unlike internal combustion technology—which uses combustion and pressure to propel a vehicle—electric vehicles, or EVs, are propelled by electromagnetism. These vehicles use electricity, typically stored in a battery, to power an electric motor. EV technology is used in hybrid electric vehicles, or HEVs; plug-in hybrid electric vehicles, or PHEVs; and battery electric vehicles, or BEVs.

The hybrid electric vehicle was the first EV technology to reach the modern vehicle market. HEVs, such as the Toyota Prius and Lexus CT-200-H, are popular because of their increased fuel efficiency. These vehicles combine an internal combustion engine and an electric motor with a small battery for storing electricity. Although an HEV is only fueled by gasoline,
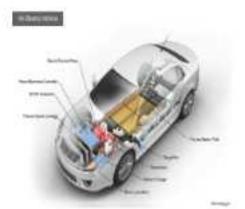
the vehicle's battery is also used to power the electric motor. The electricity stored in the battery primarily comes from recapturing energy through regenerative braking. This use of recaptured energy is one of the reasons an HEV is more fuel-efficient than a typical ICE vehicle.

Like the original hybrid, the plug-in hybrid electric vehicle is propelled by an internal combustion engine and an electric motor. However, the PHEV has a much larger battery pack that can be charged using electric vehicle supply equipment, or EVSE. This enables the vehicle to operate in all-electric mode—in which the vehicle is propelled using only the electric motor—until the

battery is mostly depleted. At this point the vehicle operates in hybrid mode until the fuel in the gas tank is depleted. Increasing the battery size and running the vehicle on electricity reduces tailpipe emissions and increases the vehicle's fuel- and energy-efficiency.

The final type of electric vehicle technology is the battery electric vehicle. This vehicle has no internal combustion engine and is powered only by the battery and electric motor. BEVs don't use gasoline and are only charged by EVSE. A BEV has the largest battery of all the vehicle types. It's also the most energy efficient and produces zero tailpipe emissions.

Vehicle Ranges:

Because each vehicle type incorporates different technologies, the range these vehicles can travel differs as well. ICE vehicles—fueled only on gasoline—typically can travel 350 to 450 miles on a full tank of gas.

Hybrid electric vehicles are more efficient in their use of gasoline and typically can travel 550 to 700 miles. Although they do have a battery and electric motor, this battery is only fueled during a typical drive cycle and is not a primary source of propulsion. However, due to regenerative braking, this small battery is the primary reason for the hybrid's increased fuel efficiency and range.

The larger battery in a plug-in hybrid electric vehicle enables the vehicle to operate in all-electric mode, typically traveling 20 to 40 miles just on electricity. PHEVs are designed to support average daily commutes and easy overnight recharging using a standard outlet. After most of the energy in the battery is depleted, the vehicle can operate in hybrid mode for longer distances, running off gasoline and using a small portion of the battery to support the electric drive train, for a full vehicle range of 450 to 550 miles.
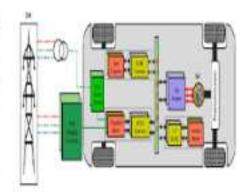
Finally, a battery electric vehicle has the simplest and most efficient drive train with a typical battery range of 150 to 300 miles. BEVs can be charged overnight

using standard residential Level 2 EVSE.

EV Regenerative Braking Modes:

The most noticeable difference between driving an electric vehicle and a conventional ICE vehicle is regenerative braking. Regenerative braking means the electric motor is operated in reverse, thereby applying a braking force through electromagnetism. This recaptures some of the vehicle's kinetic energy by charging the battery. Some electric vehicle models have specific driving modes that incorporate varying levels of regenerative braking.

Under normal driving conditions, an EV such as the Tesla Model S engages regenerative braking to slow the vehicle when the driver removes their foot from the accelerator. The "Standard" setting provides the maximum amount of regenerative braking power— it recaptures the most energy and reduces wear and tear on the brakes. Alternately, the "Low" setting incorporates a reduced regenerative braking force that recaptures less energy but allows the vehicle to coast farther than in the "Standard" mode.

An EV like the Tesla Model S also has specific settings for how the braking systems operate when the vehicle is stopped or moving at very low speeds. The "Creep" mode is designed to replicate the idling speed of an ICE vehicle. It disengages regenerative braking and applies a small amount of motor torque when stopped or at low speeds when the driver's foot is off the accelerator. This feature is most used in a parking lot when searching for a place to park.

Alternately, the "Roll" setting also disengages regenerative braking at low speeds but does not apply motor torque. This allows the vehicle to roll freely, like a vehicle in neutral.

Finally, the "Hold" setting continues to engage regenerative braking until the vehicle comes to a complete stop, which helps reduce brake wear and produces the greatest amount of recaptured energy. This feature also automatically engages the friction brakes when the vehicle is completely

stopped, holding the vehicle in place until the driver's foot is placed on the brake or the accelerator.

In all these braking modes, the brake pedal is always available and operates the same way as in a conventional vehicle under emergency braking conditions.

Regenerative braking modes vary with each vehicle make and model. For example, the Nissan Leaf provides three levels of regenerative braking modes, and the Chevrolet Bolt's system involves depressing paddles next to the steering wheel to maximize regenerative braking and bring the vehicle to a complete stop.

EVSE Types:

All plug-in electric vehicles, including plug-in hybrids and battery electric vehicles, use electric vehicle supply equipment, or EVSE, to charge their batteries.

There are three common types of EVSE. The first is referred to as a Level 1 charger. Typically, these units are portable cord sets that run off a standard 120-volt household outlet and provide approximately 2 to 5 miles of range per hour of charging. This is the most affordable type of charger, but it is limited in the daily range it can supply to a

vehicle. Therefore, this application is most common for PHEVs with smaller batteries, or for BEV drivers with a short daily commute to work.

Level 2 chargers provide more energy per hour and run off 208 or 240 volts. These chargers are more expensive and are typically installed as permanent pedestal-style or wall-mounted units. They provide a vehicle with about 10 to 20 miles of range per hour of charging. This is the most common application for long-range BEVs, as well as workplace and public charging stations.

Finally, a DC Fast Charger is the most expensive type of charger, but it provides the most energy per hour to the vehicle. A standard DC Fast Charger can provide 60 to 80 miles of range in about 20 minutes. These chargers are most common along highways and are only recommended to support occasional long-distance trips—because frequently charging the battery at such a high-power level can lead to battery degradation.

Reporting Energy Consumption:

For federal fleet vehicles, reporting energy consumption is a requirement of doing business. With ICE vehicles, fuel

consumption is typically reported through the fuel card provider that records each fueling transaction.

However, electric vehicles can be charged on-site or off-site at wall outlets, simple EVSE units, and networked units. Therefore, the recommended method for measuring energy consumption—expressed in kilowatt-hours—is through telematics.

Telematics platforms commonly capture kilowatt-hours and display them in an online dashboard. A fleet manager can select a custom date range to find a vehicle's energy consumption in kilowatt-hours over a certain time. This date range can be applied to all the electric vehicles in a fleet, providing the information necessary for annual federal fleet reporting.

Networked or smart-EVSE units are another good source of energy consumption information. These units frequently have online dashboards, like telematics, which capture energy consumption by vehicle. These dashboards are often accessible through smart phone applications as well. However, if the vehicle is occasionally charged on another network, the data from the primary EVSE unit may be incomplete. In this case, drivers should try to collect information from off-site charging stations to supplement the data from their primary EVSE unit.

The vehicles themselves also often display energy consumption or vehicle efficiency on their physical dashboard. Some vehicle models show lifetime energy consumption, so federal fleet managers will need to check the kilowatt-hours consumed annually to complete their FAST reports. However, if the vehicle displays the lifetime efficiency in miles per kilowatt-hour, fleet managers will need to divide the annual vehicle miles traveled by the vehicle efficiency to determine annual energy consumed.

(Annual miles)/ (miles/kWh) = annual kWh
Annual miles x kWh/mile = annual kWh

Conclusion:

Now that you know all about EV types, driving ranges, regenerative braking, drive trains, and charging, you are ready to drive your new electric vehicle.

*****

73152314508-VAKEESAN M K,
73152314507 - SRIRAM P,
III – EEE

LITHIUM-ION BATTERY

73152314057- THIVETHA S, III – EEE

Introduction:

Lithium-ion batteries power the lives of millions of people each day. From laptops and cell phones to hybrids and electric cars, this technology is growing in popularity due to its light weight, high energy density, and ability to recharge.

So how does it work?

A battery is made up of an anode, cathode, separator, electrolyte, and two current collectors (positive and negative).

The anode and cathode store the lithium. The electrolyte carries positively charged lithium ions from the anode to the cathode and vice versa through the separator. The movement of the lithium ions creates free electrons in the anode which creates a charge at the positive current collector. The electrical current then flows from the current collector through a device being powered (cell phone, computer, etc.) to the negative current collector. The separator blocks the flow of electrons inside the battery.

Charge / Discharge:

While the battery is discharging and providing an electric current, the anode releases lithium ions to the cathode, generating a flow of electrons from one side to the other. When plugging in the device, the opposite happens: Lithium ions are released by the cathode and received by the anode.

Energy Density VS Power Density:

The two most common concepts associated with batteries are energy density and power density. Power density is measured in watts per kilogram (W/kg) and is the amount of power that can be generated by the battery with respect to its mass. To draw a clearer picture, think of draining a pool. Energy density is like the size of the pool,

THE FUTURE

while power density is comparable to draining the pool as quickly as possible.

Applications:

- ✓ Portable Electronic Devices
- ✓ Cellular Phones,
- ✓ Digital Cameras,
- ✓ Global Positioning devices,
- ✓ Tablets, and
- ✓ Laptops
- ✓ Pacemakers

Advantages:

- ♦ Durability
- ♦ Store more power
- ♦ Lighter Weight
- ♦ Charging is easy
- ♦ Maintenance is low cost,
- ♦ No harm

Conclusion:

Whatever you need a Li-ion battery for, you can rely on its durability, recharge ability, safety, and long-lasting power supply. Lithium batteries have become a vital part of our everyday lives in so many ways. If you're looking to purchase lithium batteries for personal or commercial applications, you can rely on Eco Tree Lithium. The lithium-ion batteries they supply are designed in Europe and are the best and safest available.

*****

GPS (GLOBAL POSITIONING SYSTEM)

Global Positioning System:

The Global Positioning System was conceived in 1960 under the auspices of the U.S. Air Force, but in 1974 the other branches of the U.S. military joined the effort. The first satellites were launched into space in 1978. The System was declared fully operational in April 1995. The Global Positioning System consists of 24 satellites that circle the globe once every 12 hours, to provide worldwide position, time and velocity information. GPS makes it possible to precisely identify locations on the earth by measuring distance from the satellites. GPS allows you to record or create locations from places on the earth and help you navigate to and from those places. Originally the System was designed only for military applications, and it wasn't

until the 1980's that it was made available for civilian use also.

Segments of GPS:

- Space segment
- Control segment
- User segment

How GPS Works?

When a GPS receiver is turned on, it first downloads orbit information of all the Satellites. This process, the first time, can take as long as 12.5 minutes, but once this information is downloaded; it is stored in the receivers' memory for future use. Even though the GPS receiver knows the precise location of the satellites in space, it still needs to know the distance from each satellite it is receiving a signal from.

That distance is calculated, by the receiver, by multiplying the velocity of the transmitted signal by the time it takes the signal to reach the receiver. The receiver already knows the velocity, which is the speed of a radio wave or 186,000 miles per second (the speed of light).

To determine the time part of the formula, the receiver matches the satellites transmitted code to its own code, and by comparing them determines how much it

needs to delay its code to match the satellites code. This delayed time is multiplied by the speed of light to get the distance.

The GPS receivers' clock is less accurate than the atomic clock in the satellite; therefore, each distance measurement must be corrected to account for the GPS receivers' internal clock error.

Sources of GPS Error:

User mistakes account for most GPS errors:

Incorrect datum and typographic errors when inputting coordinates into a GPS receiver can result in errors up to many kilometers. Unknowingly relying on less than four satellites for determining position coordinates can also result in unreliable position fixes that can easily be off by a distance more than a mile. Even the human body can cause signal interference. Holding a GPS receiver close to the body can block some satellite signals and hinder accurate positioning. If a GPS receiver must be handheld without benefit of an external antenna, facing to the south can help to alleviate signal blockage caused by the body because most GPS satellites are oriented more in the earth's southern hemisphere. A GPS

receiver has no way to identify and correcting user mistakes.

Satellite clock errors:

Caused by slight discrepancies in each satellite's four atomic clocks. Errors are monitored and corrected by the Master Control Station.

Orbit errors:

Satellite orbit (referred to an "satellite ephemeris") pertains to the altitude, position and speed of the satellite. Satellite orbits vary due to gravitational pull and solar pressure fluctuations. Orbit errors are also monitored and corrected by the Master Control Station.

Ionospheric interference:

The ionosphere is the layer of the atmosphere from 50 to 500 km altitude that consists primarily of ionized air. Ionospheric interference causes the GPS satellite radio signals to be refracted as they pass through the earth's atmosphere – causing the signals to slow down or speed up. This results in inaccurate position measurements by GPS receivers on the ground. Even though the satellite signals contain correction information

for Ionospheric interference, it can only remove about half of the possible 70 nanoseconds of delay, leaving potentially up to a But this works only to a point. Fortunately, error caused by atmospheric conditions is usually less than 10 meters. This source of error has been further reduced with the aid of the Wide Area Augmentation System (WAAS), a space and ground-based augmentation to the GPS (to be covered later).

Tropospheric interference:

The troposphere is the lower layer of the earth's atmosphere (below 13 km) that experiences the changes in temperature, pressure, and humidity associated with weather changes. GPS errors are largely due to water vapor in this layer of the atmosphere. Tropospheric interference is insignificant to GPS. Receiver noise is simply the electromagnetic field that the receiver's internal electronics generate when it's turned on. Electromagnetic fields tend to distort radio waves. This affects the travel time of the GPS signals before they can be processed by the receiver. Remote antennas can help to alleviate this noise. This error cannot be corrected by the GPS receiver.

Multipath interference:

Multipath interference is caused by reflected radio signals from surfaces near the GPS receiver that can either interfere with or be mistaken for the true signal that follows an uninterrupted path from a satellite. An

example of multipath is the ghosting image that appears on a TV equipped with rabbit ear antennas. Multipath is difficult to detect and sometimes impossible for the user to avoid, or for the receiver to correct. Common sources of multipath include car bodies, buildings, power lines and water. When using GPS in a vehicle, placing an external antenna on the roof of the vehicle will eliminate most signal interference caused by the vehicle. Using a GPS receiver placed on the dashboard will always have some multipath Interference.

Selective Availability:

(S/A) was the intentional degradation of the satellite signals by a time varying bias. Selective Availability is controlled by the

DOD to limit accuracy for non - U.S. military and government users and was originally instituted for security reasons. In May 2000, bowing to pressure from business and the White House, the Pentagon set Selective Availability to zero. The Pentagon did not turn S/A off, but rather merely reduced the amount of signal interference to zero meters, effectively eliminating intentional position errors. The Pentagon retains the ability to reactivate S/A without notice to non-government GPS users. So, it's important to understand what Selective Availability is, and to be aware that it could be reactivated by the U.S. military at any time without prior notification.

Number of satellites visible:

The more satellites the receiver can "see", the better Earth's Atmosphere Solid Structures Metal Electro-magnetic Fields the accuracy. Signal reception can be blocked by buildings, terrain, electronic interference and sometimes dense foliage. The clear the view, to the receiver, the better the reception.

Satellite geometry:

This refers to the relative position of the satellites at any given time. Ideal satellite geometry exists when the satellites are located at wide angles relative to each other. Poor geometry exists when the satellites are in a line or in a tight grouping.

Applications:

* Agriculture
* Aviation
* Environments
* Marine
* Public Safety & Disaster Relief
* Surveying
* Mobile Phones
* Robotics
* Military purpose

*****

73152314048-SHIVARANJAN K
73152314041 - SAHANA R
III-EEE

SMART GRID

Introduction:

A Smart Grid is an electricity Network based on Digital Technology that is used to supply electricity to consumers via Two-Way Digital Communication. This system allows for monitoring, analysis, control and communication within the supply chain to help improve efficiency, reduce the energy consumption and cost and maximize the transparency and reliability of the energy supply chain.

Smart Grid & Need of Smart Grid?

A Smart Grid is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – to efficiently deliver sustainable, economic, and secure electricity supplies.

- System (Generation, Transmission, Distribution) with an advanced two-way communications system
- Enables real-time monitoring and control
- Provide greater visibility and transparency
- Consequently, enables cost reduction and efficiency improvement

Smart Grid is based on Digital Technology that is used to supply electricity to consumers via Two-Way Digital Communication. This system allows for monitoring, analysis, control and communication within the supply chain to help improve efficiency, reduce the energy consumption and cost and maximize the transparency and reliability of the energy supply chain.

The flow of electricity from utility to consumer becomes a two-way conversation, saving consumers money, energy, delivering more transparency in terms of end-user use,

and reducing carbon emissions.

Need for establishment of Smart Grid:

A smart grid distribution system, whose objective is to develop a power grid more efficient and reliable, improving safety and quality of supply in accordance with the requirements of the digital age.

- Higher Penetration of renewable resources or distributed generation
- Extensive and effective communication overlay from generation to consumers
- Use of advanced sensors and high-speed control
- Higher operating efficiency.
- Greater resiliency against attacks and natural disasters

Automated metering and rapid power restoration provided greater customer participation Presently the Indian Electricity System faces several challenges such as:

- ➢ Shortage of power
- ➢ Power Theft
- ➢ Poor access in rural areas
- ➢ Huge losses in the Grid
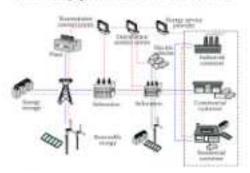- ➢ Inefficient Power Consumption
- ➢ Poor reliability

To overcome these problems; smart grid is

needed.

Application of Smart Grid:

The areas of application of smart grids include smart meters integration, demand management, smart integration of generated energy, administration of storage and renewable resources, using systems that continuously provide and use data from an

energy network.

****

73152214041 - SANDHIYA S
73152214043 - SARANYA DEVI S
IV-EEE.

WIRELESS TRANSMISSION

73152314056 - THIBISH D, III EEE   73152314057 - THIVETHA S, III EEE

Introduction:

Unless you are particularly organized and good with tie wrap, you probably have a few dusty power cord tangles around your home. You may have even had to follow one cord through the seemingly impossible snarl to the outlet hoping that the plug you pull will be the right one. This is one of the downfalls of electricity. While it can make people's lives easier, it can add a lot of clutter in the process. For these reasons, scientists have tried to develop methods of wireless power transmission that could cut the clutter or lead

to clean sources of electricity.

Researchers have developed several techniques for moving electricity over long distances without wires. Some exist only as theories or prototypes, but others are already in use.
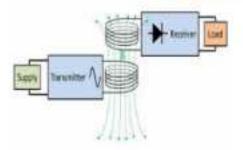
These are:

> Short range,
> Moderate range,
> Long range.

Short Distance Induction:

These methods can reach at most a few centimeters the action of an electrical transformer is the simplest instance of wireless energy transfer. The primary and secondary circuits of a transformer are electrically isolated from each other. The transfer of energy takes place by electromagnetic coupling through a process known as mutual induction. (An added benefit is the capability to step the primary voltage either up or down.) The electric toothbrush charger is an example of how this principle can be used.

A toothbrush's daily exposure to water makes a traditional plug-in charger potentially dangerous. Ordinary electrical connections could also allow water to seep into the toothbrush, damaging its components. Because of this, most toothbrushes recharge through inductive coupling. You can use the same principle to recharge several devices at once.

Moderate Distance:

Household devices produce relatively small magnetic fields. For this reason, chargers hold devices at the distance necessary to induce a current, which can only happen if the coils are close together. A larger, stronger field could induce current from farther away, but the process would be extremely inefficient. Since a magnetic field spread in all directions, making a larger one would waste a lot of energy. An efficient way to transfer power between coils separated by a few meters is that we could extend the distance between the coils by adding
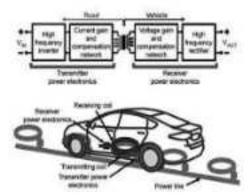
resonance to the equation. A good way to understand resonance is to think of it in terms of sound. An object's physical structure -- like the size and shape of a trumpet -- determines the frequency at which it naturally vibrates. This is its resonant frequency. Induction can take place a little differently if the electromagnetic fields around the coils resonate at the same frequency. The theory uses a curved coil of wire as an inductor. A capacitance plate, which can hold a charge, attaches to each end of the coil. As electricity travels through this coil, the coil begins to resonate. Its resonant frequency is a product of the inductance of the coil and the capacitance of the plates. Electricity, traveling along an electromagnetic wave, can tunnel from one coil to the other if they both have the same resonant frequency. In a short theoretical analysis, they demonstrate that by sending electromagnetic waves around in a highly angular waveguide, evanescent waves are produced which carry no energy. An evanescent wave is near field standing wave exhibiting exponential decay with distance. If a proper resonant waveguide is brought near the transmitter, the evanescent waves can allow the energy to tunnel (specifically evanescent wave coupling, the electromagnetic equivalent of tunneling to the power drawing waveguide, where they can be

rectified into DC power. Since the electromagnetic waves would tunnel, they would not propagate through the air to be absorbed or dissipated and would not disrupt electronic devices.

If both coils are out of range of one another, nothing will happen, since the fields around the coils aren't strong enough to affect much around them. Similarly, if the two coils resonate at different frequencies, nothing will happen. But if two resonating coils with the same frequency get within a few meters of each other, streams of energy move from the transmitting coil to the receiving coil. One coil can even send electricity to several receiving coils, if they all resonate at the same frequency.

"Resonant inductive coupling" has key implications in solving the two main problems associated with non-resonant inductive coupling and electromagnetic radiation, one of which is caused by the other: distance and efficiency. Electromagnetic induction works on the principle of a primary coil generating a predominantly magnetic field and a secondary coil being within that field, so a current is induced within its coils.

This causes the relatively short range due to the amount of power required to produce an electromagnetic field. Over greater distances

the non-resonant induction method is inefficient and wastes much of the transmitted energy just to increase range. This is where the resonance comes in and helps efficiency dramatically by "tunneling" the magnetic field to a receiver coil that resonates at the same frequency. Unlike the multiple-layer secondary of a non-resonant transformer, such receiving coils are single layer solenoids with closely spaced capacitor plates on each end, which in combination allow the coil to be tuned to the transmitter frequency thereby eliminating the wide energy wasting "wave problem" and allowing the energy used to focus in on a specific frequency increasing the range.

Long-distance Wireless Power:

Whether or not it incorporates resonance, induction generally sends power over relatively short distances. But some plans for wireless power involve moving electricity

over a span of miles. A few proposals even involve sending power to the Earth from space. In the 1980s, Canada's Communications Research Centre created a small airplane that could run off power beamed from the Earth. The unmanned plane, called the Stationary High Altitude Relay Platform (SHARP), was designed as a communications relay. Rather flying from point to point, the SHARP could fly in circles two kilometers in diameter at an altitude of about 13 miles (21 kilometers). Most importantly, the aircraft could fly for months at a time. The secret to the SHARP's long flight time was a large, ground-based microwave transmitter. The SHARP's circular flight path kept it in range of this transmitter. A large, disc-shaped rectifying antenna, or rectenna, just behind the plane's wings changed the microwave energy from the transmitter into direct-current (DC) electricity. Because of the microwaves' interaction with the rectenna, the SHARP had a constant power supply if it was in range of a functioning microwave array.

Need for Wireless Power Transmission:

Wireless transmission is employed in cases where instantaneous or continuous energy transfer is needed, but interconnecting wires are inconvenient. Number of household points receives electricity at the same frequency using single transmitting coil if they all are at resonance. So, this setup could recharge all the devices in a room at once. The unmanned planes or robots which are run by the wireless power over an area, as they could fly for months at a time, could be used for research as well as a mini satellite.

*****

ARTIFICIAL INTELLIGENCE

73152214030 - MOHAMMED FAZIL N

Introduction:

According to the father of Artificial Intelligence, John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent

computer programs"

Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

Philosophy of AI:

While exploiting the power of the computer systems, the curiosity of human,

73152214031 - MOHANKUMAR E

lead him to wonder, "Can a machine think and behave like humans do?" Thus, the development of AI with the intention of creating similar intelligence in machines that we find and regard high in humans.

Goals of AI:

To Create Expert Systems – The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.

To Implement Human Intelligence in Machines – Creating systems that understand, think, learn, and behave like humans.

What Contributes to AI?

Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology,

Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development

of computer functions associated with human intelligence, such as reasoning, learning, and problem solving. Out of the following areas, one or multiple areas can contribute to build an intelligent system.

Programming Without and With AI:

The programming without and with AI is different in following ways

Programming Without AI	Programming With AI
A computer program without AI can answer the specific questions it is meant to solve.	A computer program with AI can answer the generic questions it is meant to solve.
Modification in the program leads to change in its structure.	AI programs can absorb new modifications by putting highly independent pieces of information together.
Modification is not quick and easy. It may lead to affecting the program adversely.	Quick and Easy program modification.

What is AI Technique?

In the real world, the knowledge has some unwelcomed properties −

- Its volume is huge, next to unimaginable.
- It is not well-organized or well-formatted.
- It keeps changing constantly.

AI Technique is a manner to organize and use the knowledge efficiently in such a way that

- It should be perceivable by the people who provide it.
- It should be easily modifiable to correct errors.
- It should be useful in many situations though it is incomplete or inaccurate.
- AI techniques elevate the speed of execution of the complex program it is equipped with.

Applications of AI:

AI has been dominant in various fields such as

Gaming − AI plays crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where machine can think of large number of possible positions based on heuristic

knowledge.

Natural Language Processing – It is possible to interact with the computer that understands natural language spoken by humans.

Expert Systems – There are some applications which integrate machine, software, and special information to impart reasoning and advising. They provide explanation and advice to the users.

Vision Systems – These systems understand, interpret, and comprehend visual input on the computer. For example,

Speech Recognition – Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.

Handwriting Recognition – The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.

Intelligent Robots – Robots can perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes, and they can adapt to the new environment.

Possible application for Artificial Intelligence

History of AI:

Here is the history of AI during 20th century

1923-Karel Čapek play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English.

1943-Foundations for neural networks lay.

1945-Isaac Asimov, Columbia University alumni, coined the term Robotics.

1950-Alan Turing introduced Turing Test for evaluation of intelligence and published Computing Machinery and Intelligence.

Claude Shannon published Detailed Analysis of Chess Playing as a search.

1956-John McCarthy coined the term Artificial Intelligence. Demonstration of the first running AI program at Carnegie Mellon University.

1958-John McCarthy invents LISP programming language for AI.

1964-Danny Bob row's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.

1965-Joseph Weinbaum at MIT built ELIZA, an interactive problem that carries on a dialogue in English.

1969-Scientists at Stanford Research Institute Developed Shakey, a robot, equipped with locomotion, perception, and problem solving.

1973-The Assembly Robotics group at Edinburgh University built Freddy, the Famous Scottish Robot, capable of using vision to locate and assemble models.

1979-The first computer-controlled autonomous vehicle, Stanford Cart, was built.

1985-Harold Cohen created and demonstrated the drawing program, Aaron.

1990-Major advances in all areas of AI – Case-based reasoning

1997-The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.

2000-Interactive robot pets become commercially available. MIT displays Kismet, a robot with a face that expresses emotions. The robot Nomad explores remote regions of Antarctica and locates meteorites.

*****

INTERNET OF THINGS-AIDED SMART GRID

73152214052 - VARNA N S, IV EEE
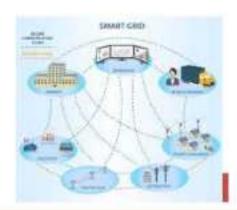73152214053 - VASANTH S, IV EEE
73152214054 - VASUKI S, IV EEE

Introduction:

A traditional power grid consists of many loosely interconnected synchronous Alternate Current (AC) grids. It performs three main functions: generation, transmission, and distribution of electrical energy in which electric power flows only in one direction, i.e., from a service provider to the consumers. Firstly, in power generation, several large power plants generate electrical energy, mostly from burning carbon and uranium-based fuels. Secondly in power transmission, the electricity is transmitted from power plants to remote load centers through high voltage transmission lines. Thirdly in power distribution, the electrical distribution systems distribute electrical energy to the end consumers at reduced voltage. Each grid is centrally controlled and monitored to ensure that the power plants generate electrical energy in accordance with the needs of the consumers within the constraints of power systems. Nearly, all the generation, transmission and distribution of electrical energy is owned by the utility companies who provide electrical energy to consumers and bill them accordingly to recover their costs and earn profit.

History of Power Grid:

The traditional power grid worked very well from its inception in 1870 until 1970. Even though the consumers' demand for energy grew exponentially, it was still rather predictable. However, there has been a dramatic change in electrical energy consumption since 1970, as the load of electronic devices has become the fastest growing element of the total electricity demand and new sources of high electricity consumption have been developed, such as electric vehicles (EVs).

The power grids endure a significant wastage of energy due to several factors, such as consumers' inefficient appliances and lack of smart technology, inefficient routing and dispensation of electrical energy, unreliable communication and monitoring, and most importantly, lack of a mechanism to store the generated electrical energy. Furthermore, power grids face some other challenges as well, including growing energy demand, reliability, security, emerging renewable energy sources and aging infrastructure problems to name a few. To solve these challenges, the Smart Grid (SG) paradigm has appeared as a promising solution with a variety of information and communication technologies. Such technologies can improve the effectiveness, efficiency, reliability, security, sustainability, stability, and scalability of the traditional power grid. SG solves the problem of electrical energy wastage by generating electrical energy which closely matches the demand. SG helps to make important decisions according to the demand of energy, such as real time pricing, self-healing, power consumption scheduling and optimized electrical energy usage. Such decisions can significantly improve the power quality as well as the efficiency of the grid by maintaining a balance between power generation and its usage. SG differs from

traditional power grids in many aspects.

For instance, SG offers a bi-directional communication flow between service providers and consumers, while a traditional power grid only offers only unit-directional communication from the service provider to the consumer. SG provides supervisory control and data acquisition (SCADA), advanced metering infrastructure (AMI), smart meters, fault tolerance, unauthorized usage detection, and load balancing, as well as self-healing, i.e., detection and recovery from faults. SG deploys various types of devices for monitoring, analyzing, and controlling the grid. Such monitoring devices are deployed at power plants, transmission lines,
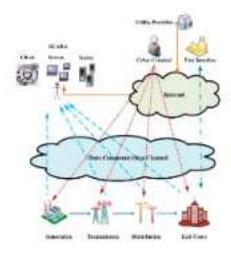
transmission towers and distribution centers and consumers premises. The numbers of such devices are large.

One of the main concerns for SG is the connectivity, automation and tracking of such large number of devices, which requires distributed monitoring, analysis and control through high speed, ubiquitous and two-way digital communications.

Big Data and Cloud for IoT-Aided SG Systems:

The integration of IoT technology with SG comes with a cost of managing huge volumes of data, with frequent processing and storage. Such data includes consumers load demand, energy consumption, network components status, power lines faults, advanced metering records, outage management records and forecast conditions. This means that the utility companies must have hardware and software of data collection by IoT devices in SG makes the data size very large. The variety is represented by the different sensors that produce different data. The data velocity represents the required speed for the data collection and processing. Hence, IoT-aided

SG systems can apply the techniques of big data management and processing (such as hardware, software and algorithms).

Conclusion:

Smart Grid (SG) is the future grid which solves the problems of uni-directional information flow, energy wastage, growing energy demand, reliability, and security in the traditional power grid.

The Internet of Things (IoT) technology provides connectivity anywhere and anytime. This realizes the IoT-aided SG system which supports and improves various network functions at the power generation, transmission, distribution, and utilization.

*****

PIEZO ELECTRIC TRANSDUCER

Introduction:

An Industrial Instrument - Instrumentation is the heart of industrial applications. Instrumentation is the art and science of measuring and controlling different variables such as flow, level, temperature, angle, displacement etc. A basic instrumentation system consists of various devices. One of these various devices is a transducer.

A transducer plays a very important role in any instrumentation system. An electrical transducer is a device which can convert the physical quantity into a proportional electrical quantity such as voltage or electric current. It converts any quantity to be measured into usable electrical signal. This physical quantity, which is to be measured can be pressure, level, temperature, displacement etc. The output which is obtained from the transducer is in the electrical form and is equivalent to the measured quantity. There are of many different types of transducers, they can be classified based on various criteria as types of Transducers based on

Quantity to be Measured:

➤ Temperature transducers (e.g., a thermocouple)
➤ Pressure transducers (e.g., a diaphragm)
➤ Displacement transducers (e.g., LVDT)
➤ Flow transducers

Principle of Operation:

➤ Photovoltaic (e.g., a solar cell)
➤ Piezoelectric

Chemical:

➤ Mutual Induction
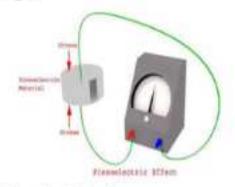➤ Electromagnetic
➤ Hall Effect
➤ Photoconductors

External Power Source

Active Transducer:

Active transducers are those which do not require any power source for their operation. They work on the energy conversion principle. They produce an electrical signal proportional to the input (physical quantity). For example, a thermocouple is an active transducer.

Passive Transducers:

Transducers which require an external power source for their operation is called as a passive transducer. They produce an output signal in the form of some variation in resistance, capacitance or any other electrical parameter, which than must be converted to an equivalent current or voltage signal.

Piezoelectric Effect
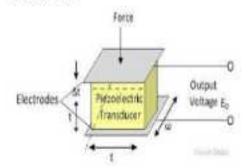
Piezoelectric Transducer:

Piezoelectric material is one kind of transducers. We squeeze this material, or we apply force or pressure on this material it converts it into electric voltage and this voltage is function of the force or pressure applied to it. The material which behaves in such a way is also known

as piezoelectric Sensor. The electric voltage produced by piezoelectric transducer can be easily measured by voltage measuring instruments, which can be used to measure stresses or forces. The physical quantity like mechanical stress or force cannot be measured

directly. Therefore, piezoelectric transducer can be used.

Piezoelectric Actuator:

Piezoelectric actuator behaves in reverse manner of piezoelectric sensor. It is the one in which the electric effect will cause the material to deform i.e. stretch or bend. That means in piezoelectric sensor, when force is applied to stretch or bend it, an electric potential is generated and in opposite when on a piezoelectric actuator, an electric potential is applied it is deformed i.e. stretched or bend. Piezoelectric transducer has high sensitivity. So, it acts as sensor and used in accelerometer due to its excellent frequency of response. The piezoelectric effect is used in many applications that involve production and detection of sound, electronic frequency generation. It acts as ignition source for cigarette lighter and used in sonar, microphone, force, pressure and displacement measurement
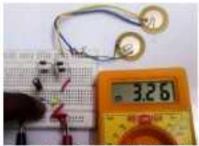

Application of Piezoelectric Materials:

1. In microphones, the sound pressure

is converted into electric signal and this signal is ultimately amplified to produce louder sound.

2. Automobile seat belts lock in response to a rapid deceleration is also done by piezoelectric material.

3. It is also used in medical diagnostics.

4. It is used in electric lighter used in kitchens. Pressure made on piezoelectric sensor creates an electric signal which ultimately causes flash to fire up.

5. They are used for studying high speed shock waves and blast waves.

6. Used in fertility treatment.

7. Used in Inkjet printers

8. It is also used in restaurants or airports where when a person steps near the door and the door opens automatically.

Examples of Piezoelectric Material:

1. Barium Titanate.
2. Lead zirconate titanate (PZT).
3. Rochelle salt.

Advantages of Piezoelectric Transducer:

1. No need of external force.

2. Easy to handle and use as it has small dimensions.

3. High frequency response it means the parameters change very rapidly.

Disadvantages:

1. It is not suitable for measurement in static condition.

2. It is affected by temperatures.

3. Output is low, so some external circuit is attached to it.

4. It is very difficult to give desired shape to this material and desired strength.

Conclusion:

A transducer can be used in industry for various purposes by which the physical, mechanical, or optical quantity to be measured is transformed directly by a suitable mechanism into an electrical voltage or current proportional to the input measured.

*****

73152314001 – ABISHEK V

73152314002 – AISWARYA M

III - EEE

ENERGETICS' 2K25

EDITORIAL BOARD
FACULTY COORDINATORS
Dr. R. Sankerganesh, ASP/EEE,
Mr. P. Manikandan, AP/EEE,

STUDENT COORDINATORS
73152314047- SARIKA P, III EEE
73152314049- SHREENITHI G, III EEE
73152314048- SHIVARANJAN K, III EEE

THANK YOU!