Workshop Report 1: Electrical Vehicles Design with Simulation

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Event Overview

The "Electrical Vehicles Design with Simulation" workshop was conducted from **23rd September 2024 to 28th September 2024** and was organized by the **Department of Electrical & Electronics Engineering** at **Annamacharya University** (formerly Annamacharya Institute of Technology and Sciences, Rajampet). The workshop was held in association with **Technotran Electronics Solutions** and **IEEE Ananthapuram Sub-Section**.

The workshop aimed to provide participants with a comprehensive understanding of designing electric vehicles (EVs) through simulations using **MATLAB Simulink**. This workshop was a mix of theoretical knowledge and hands-on practical sessions that focused on the simulation and prototyping of electric vehicle systems.

Objectives of the Workshop

- **Understanding Electric Vehicle Design**: To familiarize participants with the core principles of electric vehicle (EV) design, including the powertrain, energy storage, and charging systems.
- **Hands-On Simulation**: To provide participants with the ability to model and simulate electrical systems used in electric vehicles using **MATLAB Simulink**.
- **Practical Application**: To develop practical skills in designing and analyzing the performance of EV components, such as the battery system, electric motors, and controllers.
- **Emerging Trends**: To expose students to the latest developments in electric vehicle technology and how simulation tools are used to optimize designs and performance.

Key Focus Areas

1. **Introduction to Electric Vehicles**
    - Types of Electric Vehicles (EVs): BEVs (Battery Electric Vehicles), PHEVs (Plug-in Hybrid Electric Vehicles), FCEVs (Fuel Cell Electric Vehicles).
    - Components of Electric Vehicles: Powertrain, battery management system, electric motors, and controllers.
    - Basic working principles of electric vehicles, energy flow, and vehicle dynamics.
2. **MATLAB Simulink for Simulation**
    - Introduction to **MATLAB Simulink** as a tool for simulating electric vehicle systems.

- Building and running simulations for electric vehicle performance in terms of battery charge/discharge cycles, motor speed, power consumption, and regenerative braking.
- Introduction to libraries in Simulink for modeling different vehicle systems such as motors, energy storage, and control systems.

3. **Designing EV Systems Using MATLAB Simulink**
   - **Battery Management System (BMS)**: Simulation of battery charging/discharging behavior and power management.
   - **Motor and Controller Design**: Simulation of electric motor dynamics, motor control strategies (e.g., Field Oriented Control, Direct Torque Control), and torque-speed characteristics.
   - **Energy Management System (EMS)**: Simulating the coordination between different power sources (e.g., battery and supercapacitors).
   - **Regenerative Braking**: Understanding how energy can be recovered during braking and the impact of this on battery life.
4. **Electric Vehicle Prototyping**
   - Practical demonstration of prototyping an electric vehicle using simulation tools.
   - Simulating different road conditions, driving cycles, and power demands to assess the overall performance of the EV.
   - Analyzing the efficiency of various components, including the motor, battery, and energy converter systems.

Training and Hands-On Sessions

The workshop included **interactive sessions** where participants were introduced to:

- **Simulink Models**: The attendees were taught how to build and modify Simulink models for electric vehicle subsystems.
- **Simulation Exercises**: Students worked on creating simulations for battery models, EV charging and discharging cycles, and other key components.
- **Performance Optimization**: Participants were encouraged to optimize the design of EV subsystems using simulation tools, understanding the impact of different parameters on vehicle performance.

Outcome of the Workshop

- **Practical Skills Acquired**: The participants learned how to simulate an electric vehicle using **MATLAB Simulink**. They gained a better understanding of how to model and optimize electric vehicle systems for efficiency, performance, and sustainability.

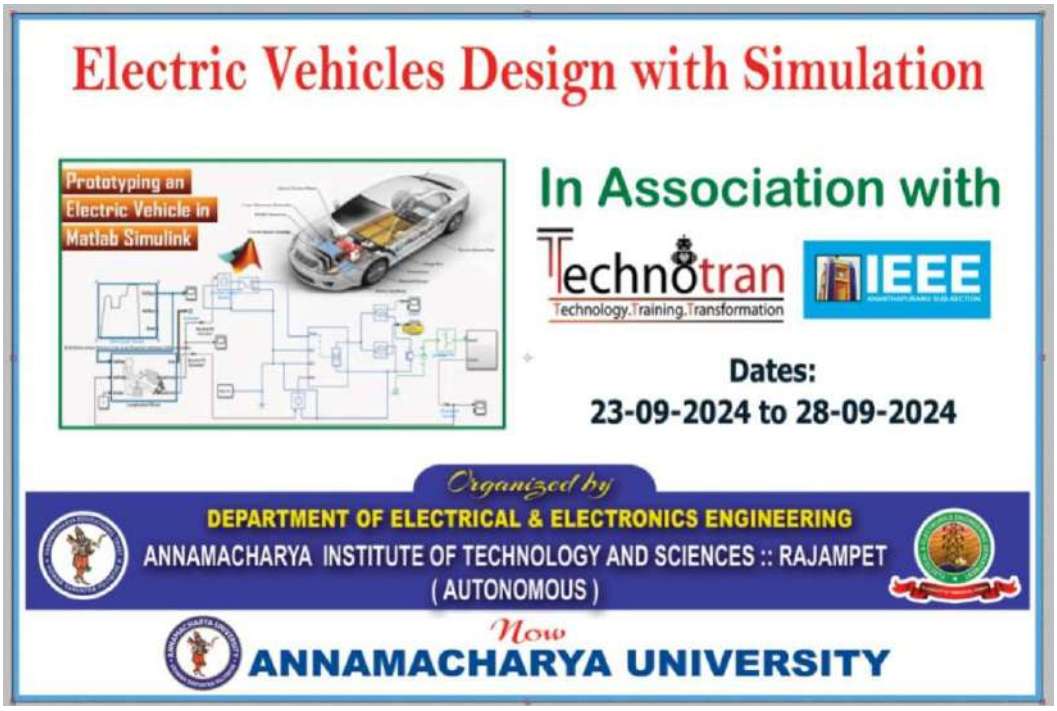
- **Hands-On Experience**: Participants worked on actual simulations of electric vehicles, experiencing firsthand how simulations can help in designing and testing real-world systems.
- **Increased Knowledge on Electric Vehicle Technologies**: The workshop provided participants with a deep dive into electric vehicle technologies, including battery management, energy storage, motor control, and vehicle dynamics.

Number of Students Participated

The workshop saw an active participation of **111 students** from various engineering backgrounds, primarily from electrical and electronics engineering disciplines, eager to learn about electric vehicle design and simulation.

Feedback and Future Recommendations

- **Student Feedback**: The participants expressed satisfaction with the hands-on experience and the knowledge gained through practical simulations. They appreciated the use of **MATLAB Simulink** as an industry-standard tool for simulation and modeling.
- **Future Improvements**: It was suggested that additional focus be placed on more advanced topics such as vehicle-to-grid (V2G) technology and advanced battery chemistries in future workshops.

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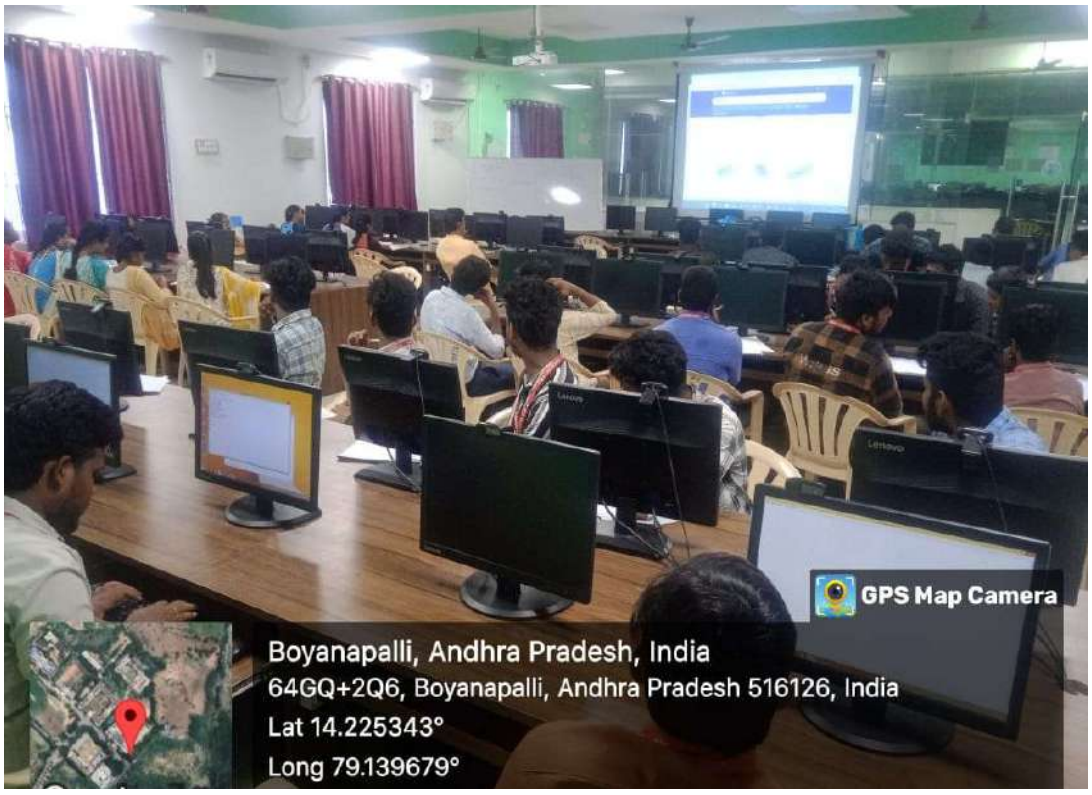
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Workshop Report 2: PCB Designing and Fabrication

Event Overview

The "PCB Designing and Fabrication" workshop was conducted from **15th October 2024 to 20th October 2024** and was organized by the **Department of Electrical & Electronics Engineering** at **Annamacharya University** (formerly Annamacharya Institute of Technology and Sciences, Rajampet). The workshop was held in collaboration with **STEMTEC AI and Robotics Technology Pvt. Ltd.**.

The main goal of the workshop was to introduce participants to the essential concepts of **Printed Circuit Board (PCB) design** and **fabrication techniques**, as well as provide hands-on experience in designing and assembling PCBs. It was tailored to cater to both theoretical understanding and practical knowledge, preparing students for real-world PCB design and manufacturing processes.

Objectives of the Workshop

- **Understanding PCB Design**: To provide participants with foundational knowledge of how to design effective PCBs, considering factors like component placement, signal integrity, and circuit layout.
- **Hands-On Fabrication**: To offer hands-on experience in the PCB fabrication process, from designing the schematic to producing the final circuit board.
- **Tools and Techniques**: To introduce participants to industry-standard tools used for PCB design and fabrication.
- **Practical Applications**: To equip students with the ability to design functional PCBs for various electronic systems and understand how they can be used in real-world applications.

Key Focus Areas

1. **Introduction to PCB Design**
    - Overview of PCB design and its importance in modern electronics.
    - **Types of PCBs**: Single-sided, double-sided, and multilayer PCBs.
    - Basic **PCB terminology**, including traces, vias, pads, and components.
    - **Design Considerations**: Signal integrity, power distribution, and grounding techniques for high-performance circuits.
2. **PCB Design Process**
    - **Schematic Design**: Introduction to schematic capture tools and circuit design.

- **Layout Design**: Using PCB design software (such as Eagle, KiCad, or Altium Designer) for creating PCB layouts. Focus on correct component placement and routing.
- **Design Rule Checks (DRC)**: Ensuring that the design adheres to industry standards and is free of design errors that could affect functionality.
- **Gerber Files**: The creation and significance of Gerber files for PCB manufacturing.

3. **PCB Fabrication Techniques**
   - **PCB Manufacturing Process**: Overview of the PCB fabrication process, including copper etching, drilling, and layering.
   - **Etching Process**: Introduction to the chemical etching process used to create traces on the PCB.
   - **Soldering and Assembly**: Practical demonstration of soldering electronic components onto the PCB. Introduction to both manual soldering and automated soldering methods.
   - **Testing and Debugging**: How to test and debug a PCB after fabrication to ensure it works as intended.
4. **Hands-On PCB Design and Fabrication**
   - Participants were introduced to design tools and software used in the industry, with a hands-on session that guided them in designing their own simple PCBs.
   - After designing the PCBs, participants fabricated their own PCBs using the standard etching process and assembled components onto the boards.
   - A troubleshooting session helped participants understand how to detect common mistakes during fabrication and assembly.

Training and Hands-On Sessions

The workshop was structured to balance **theoretical learning** with **hands-on activities**:

- **Introduction to PCB Design Software**: Participants were taught how to use PCB design software to create schematics and layout for their PCB designs.
- **PCB Fabrication Demonstration**: A step-by-step demonstration was provided for the process of fabricating a PCB, including etching and drilling.
- **Assembly and Testing**: Students assembled components onto their fabricated PCBs, followed by testing to ensure that the circuit functioned properly.

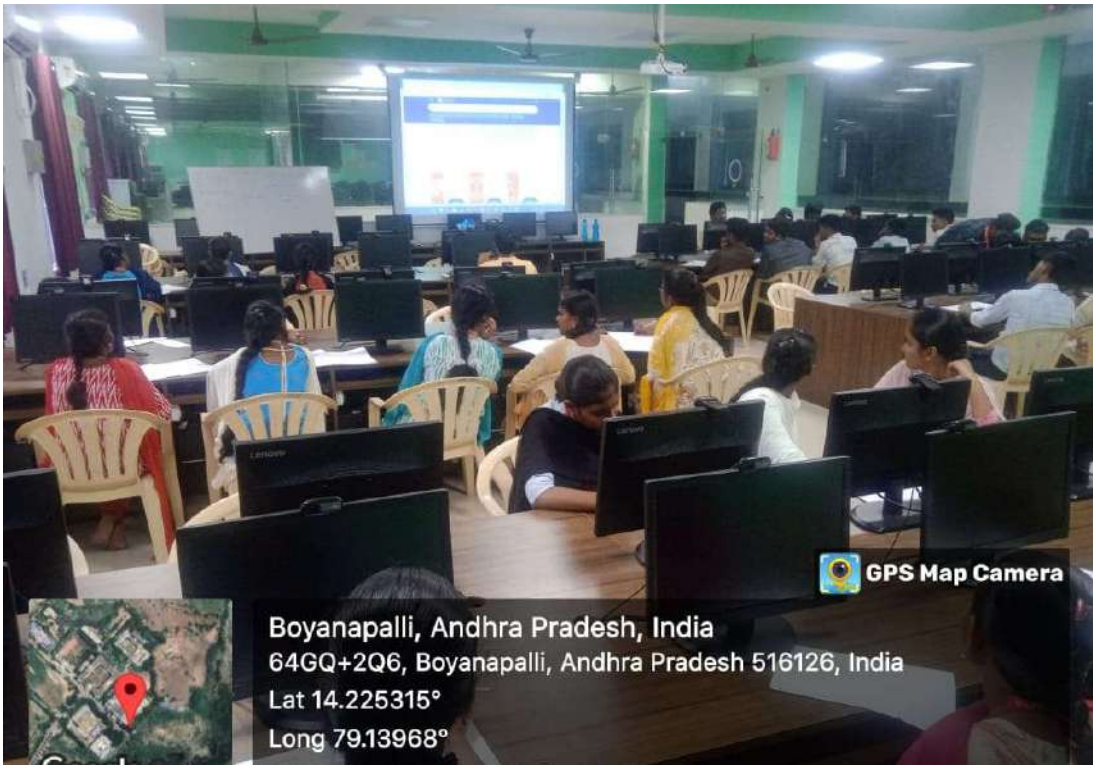
- **Real-World Projects**: The participants had the opportunity to design and fabricate a basic functional PCB, applying everything they learned throughout the workshop.

Outcome of the Workshop

- **Knowledge and Skills Acquired**: Participants learned the core principles of PCB design, including designing circuits, understanding layout considerations, and using industry-standard tools for design and fabrication.
- **Hands-On Experience**: Students gained direct experience in PCB fabrication, from designing the schematic to assembling the components and testing the final product.
- **Improved Understanding of the PCB Manufacturing Process**: The workshop enabled participants to understand the practical challenges and processes involved in turning a design concept into a functional PCB.

Number of Students Participated

The workshop had active participation from **167 students**, primarily from electrical, electronics, and related engineering disciplines, who gained valuable knowledge and practical skills in PCB design and fabrication.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