E-Vehicle Engineering Laboratory

The E-Vehicle Engineering Laboratory is a state-of-the-art facility dedicated to providing comprehensive, hands-on training and testing for electric vehicle (EV) components. Equipped with both electric 3-wheelers and 2-wheelers, the lab allows students, and engineers to engage in in-depth component analysis and performance testing of EVs. This lab is designed to bridge theoretical knowledge with practical experience in the rapidly growing field of electric mobility.

By offering a detailed setup that includes working models of electric two-wheelers and three-wheelers, the lab provides an immersive learning environment. Participants will work with real-world EV components, including motors, batteries, controllers, and powertrains, while gaining insight into the intricate systems that power electric vehicles. Additionally, the lab integrates CAN data loggers for onboard diagnostics, enabling real-time data collection and analysis for performance optimization.

1. Electric Vehicle Drivetrain: Analyzing Powertrain Components

The electric vehicle drivetrain is central to understanding vehicle dynamics, energy efficiency, and overall performance. The lab offers a detailed exploration of key drivetrain components, including electric motors, battery systems, and controllers.

Key learning objectives include:

- Hands-on analysis of EV powertrains using electric two-wheelers, three-wheelers, and four-wheelers.
- Motor performance testing under varying loads, speeds, and power demands, helping participants understand how the motor contributes to energy consumption and vehicle performance.
- Gaining insights into the role of electric motors in determining overall vehicle efficiency and driving behavior.
- Exploring the interaction between motors and other drivetrain components, such as battery packs and controllers, to optimize energy transfer and maximize range.

This practical approach helps students and professionals understand the full scope of an EV's powertrain system and its influence on performance, sustainability, and energy consumption.

2. Controller and Motor and other components Integration with EVs

The motor controller plays a key role in controlling the electric motor's speed and torque. In the lab, students will experiment with motor controllers to understand how they manage the power delivered from the battery to the motor.

Learning objectives include:

- Understanding the function of motor controllers in managing power delivery, speed, and torque.
- Testing and optimizing the interaction between controllers and motors to achieve smooth, efficient vehicle performance.
- Exploring control algorithms and their impact on vehicle dynamics, including acceleration, deceleration, and energy consumption.
- Analyzing the load-Torque characteristics

This allows participants to experiment with different motor controller settings and analyze their effects on the overall driving experience.

3. Onboard Diagnostics: Real-Time Performance Monitoring with CAN Bus Technology

The integration of CAN (Controller Area Network) bus technology is pivotal in modern electric vehicles for real-time diagnostics and performance monitoring. The E-Vehicle Engineering Laboratory offers a hands-on learning environment where students can study the CAN bus system and its role in the continuous monitoring of vehicle performance.

Learning objectives include:

- Understanding how CAN bus technology facilitates onboard diagnostics for electric vehicles.
- Real-time data collection and analysis of vehicle performance, including motor speed, battery voltage, current draw, and power usage.
- Gaining insight into system health monitoring, including fault detection, error codes, and performance issues in components like motors, batteries, and controllers.
- Utilizing CAN data loggers to capture and analyze diagnostic data, supporting the troubleshooting and optimization of EV systems.

This hands-on experience with CAN bus technology enables participants to make data-driven decisions about performance enhancement and maintenance strategies for EVs, ensuring their reliability and longevity.

4. Battery and Charging System Testing

The **battery system** is one of the most critical components of any electric vehicle, as it directly impacts range, performance, and charging efficiency. In the lab, students will analyze and test battery performance under different conditions using CAN logger.

Key learning objectives include:

- Battery testing to assess charging and discharging rates, capacity, and efficiency by analyzing CAN data.
- Studying battery management systems (BMS) and their role in optimizing battery life, performance, and safety.
- Understanding the interaction between batteries and powertrain components, focusing on how batteries respond under different operating conditions through CAN data.

The **E-Vehicle Engineering Laboratory** provides a comprehensive and hands-on approach to learning about electric vehicle technology. Whether you're an engineer looking to enhance your understanding of EV systems or a student aspiring to enter the electric mobility field, the lab offers valuable insights into the design, optimization, and diagnostics of EV components.

Key features of the lab include:

- Real-World EV Models: Work with fully operational electric vehicles, including two-wheelers, three-wheelers, and four-wheelers, to perform real-world testing and analysis.
- Advanced Data Logging Systems: Utilize CAN bus data loggers to capture and analyze performance metrics, optimizing EV systems for efficiency and reliability.
- Component Testing and Optimization: Explore electric motor and battery performance, motor controller interactions, and overall drivetrain efficiency in real-world settings.

- Hands-On Learning: Gain practical experience in powertrain analysis, system diagnostics, battery testing, and more, preparing you for real-world applications in electric vehicle engineering.

The laboratory is equipped with the tools, technology, and expertise to prepare students and professionals for the future of electric mobility. Through a blend of theory and practice, participants will leave the lab with a thorough understanding of how electric vehicles work and the critical components that contribute to their performance, safety, and sustainability.

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