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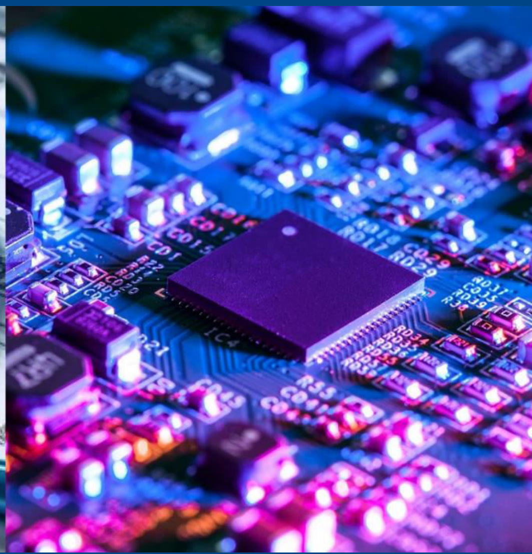

International Journal of Multidisciplinary Research in Science, Engineering and Technology

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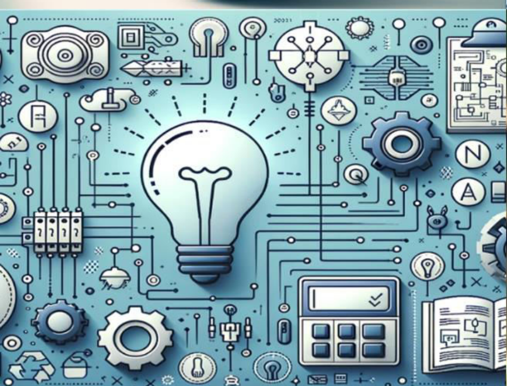

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EV Battery Charging Protection and Monitoring

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ABSTRACT: In today's world, the shift toward electrified mobility is accelerating to reduce pollution from fossil-fueled vehicles and provide a more affordable alternative to expensive fuel. With the high cost of EV batteries, ensuring safe charging is essential to prolong battery life and avoid damage from supply fluctuations or excessive temperature. The proposed system addresses these challenges by providing IoT-enabled control and monitoring of EV batteries. This system helps extend battery lifespan by protecting against voltage and temperature irregularities and allows for enhanced performance monitoring and control over internet applications. The system employs current, voltage, and temperature sensors to continuously measure power delivery and monitor battery temperature. These sensors send data to a microcontroller, which converts the signals into corresponding values, compares them against preset cutoff thresholds, and displays the readings. A keypad and display enable users to set charging time, while the microcontroller automatically disconnects the power supply if input fluctuations are detected or the set charging time is reached, preventing overcharging or faults. The microcontroller also sends data and alerts to a webpage or Android application via a WiFi module, allowing users to remotely manage charging. An audio alert through a buzzer enhances safety notifications, and a power supply provides the necessary power to each component. With adjustable cutoff values, the proposed system is compatible with various vehicle batteries, offering a robust and adaptable solution for EV battery protection. KEYWORDS: Battery Protection, Electric Vehicle, Arduino, Battery Management Unit, IoT

I. INTRODUCTION

To satisfy the fuel need for petroleum vehicles become costly day by day. To solve this problem, use of electric vehicle is the best solution. Electric vehicles are the best alternative for transportation to minimize use of petroleum products & reduction in pollution levels caused due to resources used presently. Government pushing people and researchers towards electric vehicles. Every vehicle has speedometer to display speed of vehicle. But, one of the most important part of vehicle is battery. Which has not gained sufficient attention till now. But now, when new era of electric vehicles is begin, importance of battery is as high as sky. So to make user sure about the health of battery, it is very important to develop an system which will monitor the battery parameters and tells us about battery health.

A Battery Management System (BMS) is an electronic system that monitors, calculates, and reports secondary data about a rechargeable battery (single cell or battery pack).Since EV batteries are most high cost component, charging EVs safely is the most important. To protect battery from any fluctuation in supply or high temperature, proposed system is designed. This system will also provide IOT connectivity and control of EV batteries. This system will help to improve the life of batteries by protecting it from any fluctuation and temperature rise. Similarly it will provide better performance monitoring over IOT.

II.LITERATURE SURVEY

2.1 S. Saravanan, R. Arumugam, and K. Ramalingam,
This paper presents a real-time Battery Management System (BMS) designed for electric vehicles using Lab VIEW software. The BMS is developed to monitor battery parameters such as voltage, current, and temperature in real-time, ensuring efficient battery utilization and enhancing the overall performance and reliability of electric vehicles.

2.2 Y. Chen, Z. Deng, and Z. Chen
This review paper offers an in-depth examination of Battery Management Systems (BMS) designed for battery packs in electric vehicle applications. It discusses crucial considerations such as cell balancing methods, state of charge estimation techniques, thermal management strategies, and communication protocols, elucidating their roles in optimizing battery performance, longevity, and safety in electric vehicles.

2.3 X. Liu, Y. Zhang, and S. Li
This paper offers a comprehensive review of advanced control strategies utilized in Battery Management Systems (BMS) for electric vehicles. It discusses control techniques such as model predictive control, fuzzy logic control, and adaptive control, exploring their applications in optimizing battery performance, efficiency, and longevity in electric vehicles.

2.4 J. Zhu, Y. Wang, and Y. Li
This paper provides a comprehensive review of fault diagnosis methods employed in Battery Management Systems (BMS) for electric vehicles. It discusses various techniques such as model-based diagnosis, data-driven approaches, and artificial intelligence-based methods, highlighting their roles in detecting and mitigating faults to ensure the safety and reliability of EV batteries.

2.5 H. Jiang, H. Hu, and X. Lai
This paper presents the design and implementation of an integrated Battery Management System (BMS) tailored for electric vehicle battery packs. The integrated BMS encompasses functionalities such as cell balancing, state estimation, thermal management, and fault diagnosis, aiming to enhance the overall performance, safety, and reliability of electric vehicle batteries

III. PROBLEM STATEMENT

The problem of Electric Vehicle (EV) charger protection and monitoring arises from the increasing adoption of electric vehicles and the need to ensure safe and efficient charging infrastructure. This system aims to safeguard EV charging stations and optimize the performance of Battery.
Solving the identified problem of EV charger
It involves a comprehensive approach that combines hardware and software solutions to ensure the safety security and Monitoring of charging infrastructure.
Risk Assessment:
Begin with a thorough risk assessment to identify potential threats and vulnerabilities to EV chargers. This includes assessing the physical location, weather conditions, and potential malicious activities.
Hardware Protection:
Implement Surge Protection Devices (SPDs) to safeguard against power surges and voltage spikes.
Employ physical security measures such as enclosures, locks, and tamper-proofing to deter unauthorized access.
Remote Monitoring:
Deploy sensors to collect real-time data on charger status, power consumption, and environmental conditions.
Utilize secure communication protocols to transmit data to a central monitoring system.
Implement user authentication and access controls for remote management.
Data Analytics:
Analyze collected data to identify anomalies or irregularities in charger performance.
Implement machine learning algorithms for predictive maintenance, predicting potential hardware failures before they occur.
Use data insights to optimize charger utilization and energy management.

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IV. METHODOLOGY

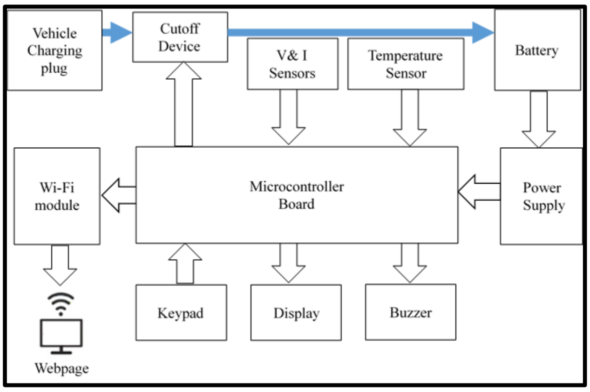

Figure: Block Diagram for BMS

The methodology for EV charger protection and monitoring involves a systematic approach to ensuring the safety, security, and efficient operation of electric vehicle charging stations.

Microcontroller atmega328 : ATmega328/328P is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328/328P has 32KB internal flash memory. ATmega328/328P has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM).

Voltage sensor : A voltage sensor is a device that measures voltage. Voltage sensors can measure the voltage in various ways, from measuring high voltages to detecting low current levels. These devices are essential for many applications, including industrial controls and power systems.

Current sensor : A current sensor is a device that detects and converts current to an easily measurable output voltage, which is proportional to the current through the measured path.
Temperature Sensor : A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal.

DC Battery : A lithium-ion battery is a type of rechargeable battery that is charged and discharged by lithium ions moving between the negative (anode) and positive (cathode) electrodes.

WiFi module : Wifi modules or wifi microcontrollers are used to send and recieve data over Wi-Fi. They can also accept commands over the Wi-Fi. Wi-Fi modules are used for communications bewtween devices. They are most commonly used in the field of Internet of Things.

LCD display : LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

Cut Off Devices : A device that terminates the flow or supply of something. An energy cut-off device is a safety device found in a water heater.

LEDs : an electronic device that emits light when a voltage is applied to it.

Buzzer : A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric.Another More components are also used.

In this paper, an cost effective and compact system will be design which will make the EV charging process safe, convenient and will help to increase the life of EV battery. Major design objectives of paper are as follow:

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- Measure and detect the fluctuation in input voltage and current.
- Measure and detect the high temperature.
- Measure and display the battery percentage.
- System must automatically cutoff the charging once battery is full to protect it from overcharging.
- Cut off the supply automatically when any value crosses the set limit.

V. ADVANTAGES

System will protect the battery against any fluctuation or fault in supply.
System will protect battery from overheating in case of long use or damage. Interactive HMI system will provide option to user to adjust the cutoff values
System will enable users to set the charging time as per flexibility and convenience. System will provide online monitoring and control of charging status and battery percentage.
IOT based system will automatically save the log of readings for future reference.
Since the system cutoff values are adjustable, it can be compatible with any vehicle's battery.

VI. CONCLUSION

In conclusion, the literature on Electric Vehicle (EV) battery charging protection reflects a comprehensive and evolving field, driven by the imperative to ensure the safety, efficiency, and reliability of EV charging systems. The diverse research efforts encompass a range of protective measures, addressing challenges such as overvoltage, undervoltage, overcurrent, temperature fluctuations, short circuits, reverse polarity, electromagnetic interference (EMI), and the establishment of proper isolation and grounding.

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