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IOT BASED BATTERY MONITORING OF ALERTING FOR ELECTRICAL VEHICLE

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ABSTRACT
The increasing adoption of electric vehicles (EVs) has heightened the demand for efficient and reliable battery monitoring systems. An Internet of Things (IoT)-based battery monitoring and alerting system for EV applications provides a comprehensive approach to track and manage the performance and health of EV batteries in real-time. This system utilizes advanced sensors and communication technology to gather data on various battery parameters such as voltage, current, temperature, and state of charge (SOC). The collected data is then transmitted wirelessly to a central monitoring platform, where it can be analyzed for early detection of potential issues such as overcharging, undercharging, or temperature anomalies.
The system employs intelligent algorithms to provide proactive alerts and notifications to EV owners or operators when the battery's health or performance deviates from the optimal range. This real-time alerting enables timely interventions, preventing costly damage and ensuring the longevity of the battery. Furthermore, the system's data analytics capabilities facilitate predictive maintenance, allowing users to schedule servicing or replacements before critical failures occur. Overall, the IoT-based battery monitoring and alerting system enhances the safety, reliability, and efficiency of EVs, promoting sustainable transportation solutions and improving user experience.
Keywords : IOT, Battery Monitoring, Electric Vehicles, ESP32, BMS Module, Current Sensor, Voltage Sensor, Lithium Battery, LCD Display, Alerting System.

1. Introduction

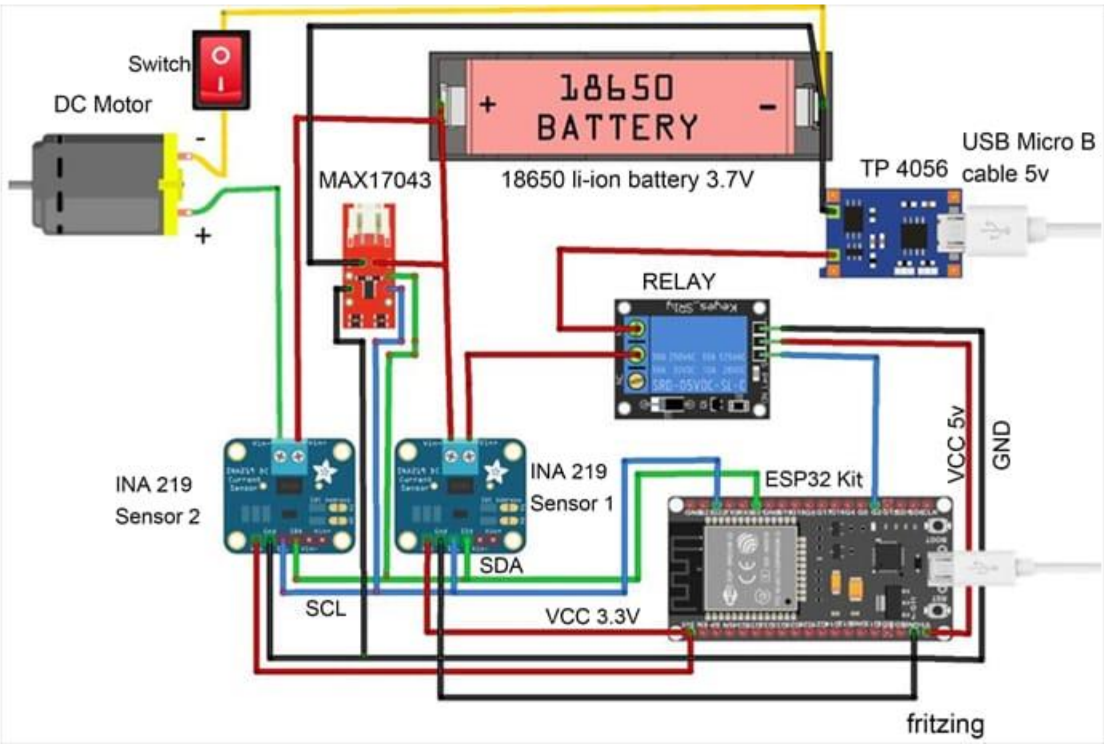
Electronic notice board can be used at different places where the information is displayed. For example, if the system is implemented in colleges all the information uses to the students can be shorted by the higher authorities of the college. It is very easy to use this kind of notice board and display the information. This process helps in having less physical work which is mostly used for physically challenged people.
The main aim of the project is to have an electronic notice board where the least information can be shorted by the faculty to the students. The system w is using is a wireless system so there is no mess of wires on the board and so the system is very flexible ad it can store the information up to 30 meters. The input here we are using is an android phone. This phone is connected to electronic notice board by using Wi-Fi through connection terminal app.
The following components are used to create hardware module
1. Microcontroller ESP32
2. Battery Management System (BMS)
3. Wireless Communication Module
4. Power Supply
5. User Interface Components
6. Display Interface

Scope of the method

- Constantly monitors the battery's health, charge level, and temperature in real-time.
- Provides early warnings and alerts about potential issues or failures, allowing for proactive maintenance and intervention.
- Enables remote access to battery data and alerts via a mobile app or web interface, allowing vehicle owners or manufacturers to monitor the battery's status from anywhere.
- Collects and analyzes historical data to identify patterns and trends, facilitating predictive maintenance and optimization of battery performance.

- Improves safety by monitoring critical parameters such as battery temperature and voltage, preventing potential hazards like overcharging or overheating.
- It Helps to extend the lifespan of the battery by ensuring optimal charging and usage patterns, reducing the risk of premature degradation.
- Scalable architecture allows for the addition of more sensors or functionalities to adapt to evolving needs and technologies in the electric vehicle industry.

2.1 The Flow of the System



Power flow within an IoT-based battery monitoring and alerting system for electric vehicles is a dynamic process that involves multiple components working together seamlessly to ensure the efficient and safe operation of the system. At its core, the system begins with the battery pack, which serves as the primary power source for the electric vehicle. The battery management system (BMS) acts as the gatekeeper, managing the flow of power into and out of the battery pack. It continuously monitors key parameters such as voltage, current, and temperature to ensure the battery operates within safe limits.

When the vehicle is in operation, power flows from the battery pack to the electric motor, propelling the vehicle forward. Simultaneously, the BMS communicates with the monitoring hardware module, which consists of a microcontroller, sensors, and wireless communication modules. The sensors gather data on various parameters such as battery voltage, current, and temperature, which is then processed by the microcontroller.

The microcontroller analyzes the data and compares it against predefined thresholds to determine if any abnormalities or potential issues exist. If anomalies are detected, the microcontroller triggers alerts or warnings via the wireless communication module, transmitting them to the vehicle owner or manufacturer in real-time. This early warning system allows for prompt action to be taken, such as adjusting charging parameters or scheduling maintenance, to prevent potential battery failures or safety hazards.

Additionally, the monitoring hardware module may include a display interface to provide real-time feedback to the vehicle operator, allowing them to monitor the battery's status directly. This user interface can display vital information such as battery charge level, temperature, and any active alerts

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or warnings.
Overall, the power flow within the system is a continuous loop of data collection, analysis, and communication, aimed at ensuring the optimal performance and safety of the electric vehicle's battery system. By leveraging IoT technology, this system empowers vehicle owners and manufacturers with the information they need to make informed decisions and maintain the longevity of their electric vehicle batteries.

2.1 The Block Diagram of the System

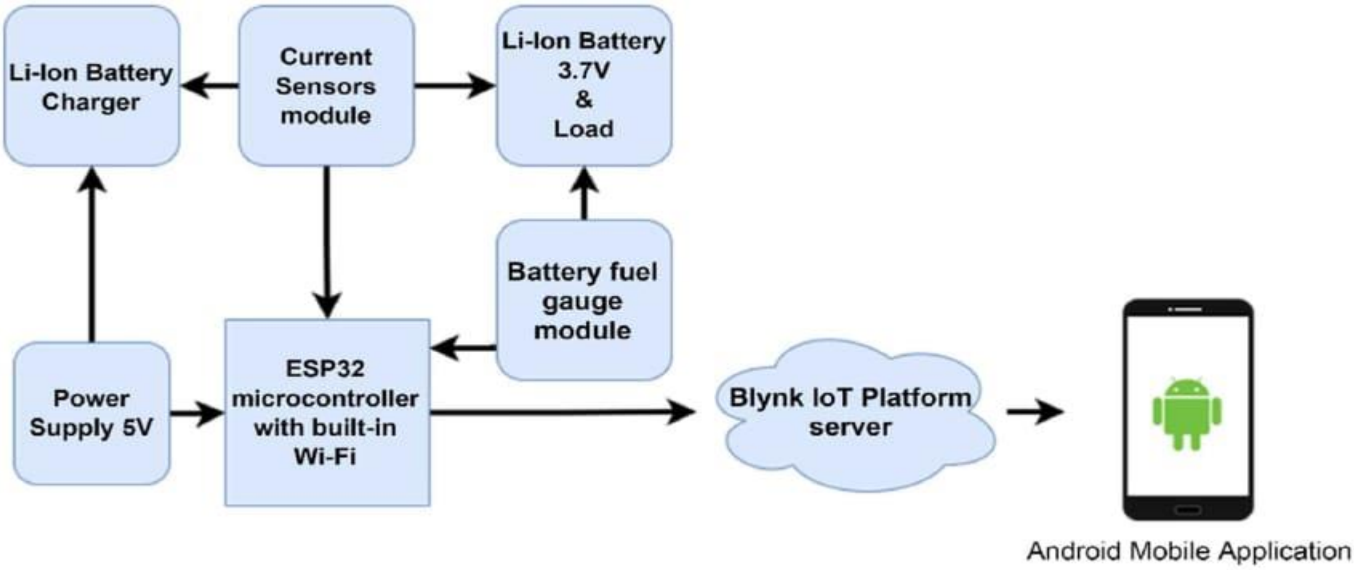

Figure 2.System Block Diagram

The IoT-based battery monitoring and alerting system for electric vehicles encompasses several interconnected components that work together to ensure the optimal performance and safety of the vehicle's battery system. At the heart of the system lies the Battery Management System (BMS), which serves as the guardian of the battery pack, continuously monitoring critical parameters such as voltage, current, and temperature. The BMS acts as a gatekeeper, regulating the flow of power into and out of the battery pack to maintain safe operating conditions.
Connected to the BMS is the Monitoring Hardware Module, which includes a microcontroller, sensors, and wireless communication modules. This module collects real-time data from the BMS, capturing vital information about the battery's health and performance. The microcontroller processes this data, analyzing it against predefined thresholds to detect any abnormalities or potential issues. If anomalies are identified, the microcontroller triggers alerts or warnings through the wireless communication modules, allowing for prompt action to be taken to mitigate risks or prevent battery failures.
Furthermore, the system includes a User Interface/Alert System, which provides feedback to the vehicle operator. This interface may consist of a display panel integrated into the vehicle dashboard or a mobile application accessible to the vehicle owner. It offers real-time information about the battery's status, including charge level, temperature, and any active alerts or warnings. This empowers the vehicle operator to monitor the battery's health closely and take appropriate actions as needed, such as adjusting charging parameters or scheduling bmaintenance

3. CONCLUSION

IoT-based battery monitoring and alerting system for electric vehicles represents a significant advancement in ensuring the safety, reliability, and efficiency of electric vehicle battery systems. By integrating components such as the Battery Management System (BMS), Monitoring Hardware Module, and User Interface/Alert System, this system enables real-time monitoring, early detection

of abnormalities, and proactive intervention to prevent potential battery failures or safety hazards.
The following can be concluded from the above work-:
1. Early detection of abnormalities allows for proactive maintenance interventions, preventing potential battery failures and reducing downtime for electric vehicles.
2. As electric vehicle technology evolves, the IoT-based battery monitoring system will continue to drive innovation, shaping a cleaner, greener, and more sustainable future for mobility.
3. The IoT-based battery monitoring system improves safety by providing real-time monitoring and early detection of potential issues, minimizing the risk of battery failures or safety hazards.

4. SUGGESTIONS
In the design and manufacture of this final work there are still deficiencies that need to be corrected in order to perfect this final work ,including:
1. the IoT-based battery monitoring system for electric vehicles. Firstly, advanced data analytics algorithms can be implemented to predict potential battery issues before they occur, enabling proactive maintenance. Secondly, expanding sensor capabilities by integrating additional sensors such as humidity or vibration sensors can provide more comprehensive insights into battery health.
2. Thirdly, integrating predictive maintenance features into the system can automate scheduling of maintenance tasks based on real-time battery health assessments. Furthermore, continuous refinement of the user interface can enhance usability for both vehicle operators and manufacturers. Exploring energy harvesting technologies like solar panels or regenerative braking systems can supplement power supply for the monitoring hardware module.

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