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Department of Electrical & Electronics Engineering
V Semester Mini Project
Review 1

IoT-based BMS (Battery Management System) with Thermal Management for Ev.

Under the Guidance of Prof. Siddarameshwar. H. N

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Synopsis

- *The rapid advancement of electric vehicle (EV) technology has driven significant research into battery management systems (BMS), thermal control, and real-time monitoring solutions.*

- *A major challenge for EVs today is maintaining battery safety and efficiency, motor thermal state, and unacceptable heat dissipated by power converters and other components of EVs. Particularly with lithium-ion batteries, which are favored for their high energy density, long life, and low self-discharge rates.*

- *To address these challenges and enhance EV performance, we focus on integrating IoT-enabled monitoring with improved thermal management.*

Introduction

- The problem statement represents an IoT-based Battery Management System (BMS) integrated with a Thermal Management System for electric vehicles (EVs).
- The system uses temperature sensors to collect data from key EV components, such as the battery, motor, and power converters, which is processed by the ESP8266 microcontroller.
- If the temperature exceeds a critical threshold, the cooling system is activated to maintain safe operating conditions.
- The IoT connectivity enables real-time data transmission to a cloud server, allowing users to monitor battery status through a connected device remotely.
- The system ensures efficient thermal regulation, prevents overheating and enhances both battery safety and lifespan.
- By providing real-time monitoring and control, it optimizes EV performance, improves safety, and increases battery longevity and efficiency.

OBJECTIVES :

- **Temperature Monitoring**: Continuously monitor the temperature of electric vehicle (EV) components such as the motor, battery, and power electronic converters.

- **Overheating Prevention**: Detect overheating conditions by setting threshold temperature values for each component, ensuring the safety and longevity of the EV.

- **Automated Cooling Control**: Implement an automated cooling system that activates when the temperature of any component exceeds the threshold, it is done by a Mosfet which acts as a switch, effectively reducing heat and protecting the EV's critical systems.

- **User Notification via IoT**: IoT technology is used to provide real-time notifications to the user about the temperature status of the EV, particularly when overheating conditions arise.

OBJECTIVES continued…

- **Data Logging and Analysis**: Record temperature data over time to identify patterns, predict overheating conditions, and optimize thermal management for future EV models.

- **Energy efficiency**: Optimize cooling mechanisms to reduce power consumption, ensuring minimal energy wastage while effectively managing heat.

- **System Integration**: Seamlessly integrate the IoT-based thermal management system with the Battery Management System (BMS) to provide a unified and reliable solution for both thermal regulation and battery health.

METHODOLOGY:

❖ **Component Identification and Sensor Placement**:

- Identifying the critical components of the EV that require temperature monitoring, including the motor, battery pack, and power electronic converters.
- Placing the temperature sensors at exact locations to ensure accurate thermal readings.

❖ **Threshold Definition and Heat Management**:

- Defining appropriate threshold temperature values for each EV component based on their material and operational limits.
- Designing a cooling control system that includes electric fans, liquid coolers, or air ventilation systems, which will be triggered when the temperature exceeds the preset threshold.

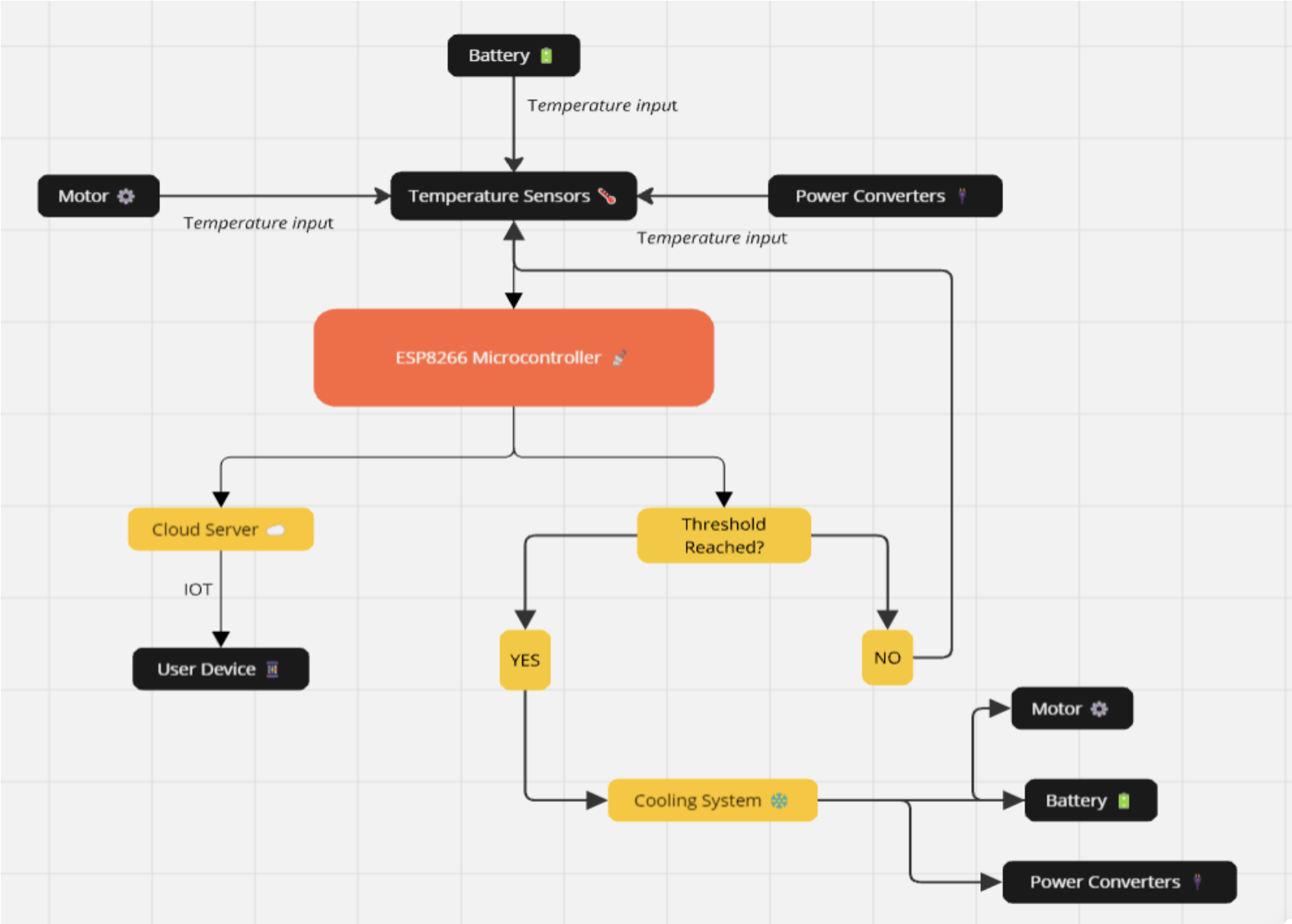
❖ **Automated Control System**:

- We develop an algorithm that automatically activates cooling mechanisms, such as fans or liquid cooling systems, when sensors detect temperatures above the threshold.
- Implement safety protocols for emergency shutdown if the cooling system fails to bring temperatures under control.

❖ **IoT-based User Interface**:

- Creating a user-friendly interface that provides real-time updates on the EV's temperature via a mobile app or dashboard.
- Notify users when the system detects potential overheating, with alerts for manual intervention if necessary.

BLOCK DIAGRAM :



LITERATURE SURVEY:

❖Battery Thermal Management :

- Research has shown that controlling battery temperature is crucial for both performance and battery longevity. High temperatures can lead to thermal runaway, where heat causes uncontrolled reactions, possibly leading to explosions. Conversely, low temperatures can diminish battery capacity and efficiency. Traditional BMS methods typically use uniform temperature control, applying the same cooling or heating to all cells. However, this is inefficient, as it doesn’t account for the individual needs of each cell.

- Recent advances, like real-time thermal management systems, offer improved solutions. These systems use cell-specific temperature control, adjusting the cooling or heating based on each cell’s condition. This not only prevents overheating but also extends battery life by up to 58% compared to older systems. This demonstrates how critical precise temperature control is for both safety and efficiency.

LITERATURE SURVEY:

❖IoT-Based Battery Monitoring Systems:

- The integration of IoT in BMS represents a significant advancement in managing EV batteries. IoT-enabled systems allow real-time monitoring of key battery metrics such as voltage, temperature, state of charge (SOC), and overall health. With real-time data accessible via mobile apps, IoT-based BMS enhances user experience and battery safety.

- One of the key benefits of IoT-based BMS is its ability to prevent overcharging, which can shorten battery life. The system provides users with real-time updates on battery status, helping to avoid damage from improper charging. This highlights the growing importance of connectivity and real-time data in making EVs safer and more user-friendly.

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THANK YOU

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