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AVOID FIRE ACCIDENT IN ELECTRIC VEHICLES USING IOT

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Abstract

The integration of IoT technology in Electric Vehicles (EVs) revolutionizes fault detection and battery management, ensuring optimal performance and safety. By leveraging sensors like voltage and temperature sensors, the system continuously monitors battery status, enabling proactive maintenance to prevent critical failures.

Fire sensors further enhance safety by detecting overheating, while an ATmega328P microcontroller coordinates system functions. Wireless connectivity via NodeMCU allows remote monitoring via platforms like IoT Cloud, facilitating real-time status updates and proactive fault management.

The incorporation of AI-based analytics in fault detection ensures predictive maintenance, minimizing risks and extending battery life. With features including relay control and an LCD display, the system empowers users to efficiently manage EVs, ensuring reliability and safety.

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Keywords: Electric Vehicle Safety, IoT Monitoring, Fire Prevention, Battery Thermal Management, Smart Alert System, Lithium-Ion Safety

1. Introduction

The global shift toward sustainable transportation has brought **Electric Vehicles (EVs)** to the forefront of innovation. EVs offer substantial environmental benefits, including reduced greenhouse gas emissions, lower air pollution, and decreased reliance on fossil fuels. However, despite their advantages, EVs present a new set of challenges—particularly related to **safety risks arising from battery-related failures**.

Modern EVs are powered primarily by **lithium-ion battery packs**, which are energy-dense and highly efficient but also thermally sensitive. Factors such as **overcharging, internal short circuits, mechanical damage, manufacturing defects, or exposure to high temperatures** can trigger a dangerous phenomenon known as **thermal runaway**. This process causes the battery cells to overheat hazards. One of the most promising approaches is the integration of the uncontrollably, potentially leading to smoke, fire, or even explosions. In recent years, several high-profile EV fire incidents have raised serious concerns among consumers and regulatory bodies worldwide.

To address these issues, the automotive industry is exploring new technological solutions that can proactively detect and prevent such**Internet of Things (IoT)** into the EV ecosystem. IoT enables real-time data collection, remote monitoring, and intelligent response mechanisms using embedded sensors, microcontrollers, and cloud platforms.

This paper focuses on the development of an **IoT-based fire prevention system for electric vehicles**, designed to continuously monitor critical battery parameters such as temperature, voltage, current, and gas emissions. By analyzing sensor data in real-time and applying rule-based thresholds, the system can predict potential fire risks and take immediate safety actions—such as disconnecting the battery, alerting the driver, sharing GPS location, or activating a fire-suppression mechanism.

The objective of this research is to demonstrate how a cost-effective and scalable IoT solution can significantly **enhance EV safety**, reduce the risk of life-threatening accidents, and increase public confidence in electric mobility. As the adoption of EVs continues to rise, integrating smart monitoring systems will become essential not only for passenger safety but also for regulatory compliance and industry standards.

2. LITERATURE SURVEY

Tran, M.-K.; Sherman, S.; Samadani, E.; Vrolyk, R.; Wong, D.; Lowery, M.; Fowler, M. has research on the title of Environmental and Economic Benefits of a Battery Electric Vehicle Powertrain with a Zinc–Air Range Extender in the Transition to Electric Vehicles it evaluates the use of a zinc-air range extender in electric vehicles (EVs) to enhance their range and efficiency.

Cunanan, C.; Tran, M.-K.; Lee, Y.; Kwok, S.; Leung, V.; Fowler,

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M. researched on the title of A Review of Heavy-Duty Vehicle Powertrain Technologies: Diesel Engine Vehicles, Battery Electric Vehicles, and Hydrogen Fuel Cell Electric Vehicles.The description is about the reviews and compares diesel engine vehicles, battery electric vehicles, and hydrogen fuel cell electric vehicles.

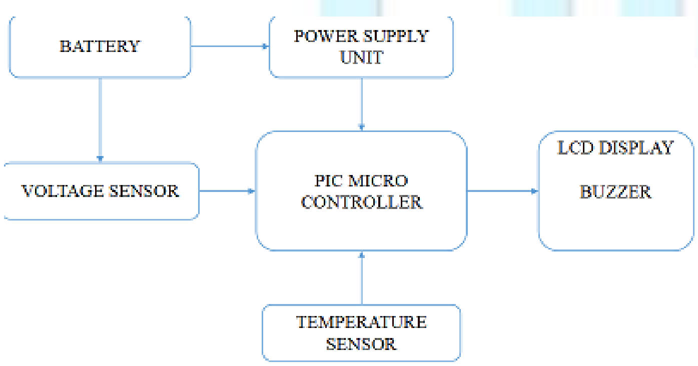
Tran, M.-K.; Fowler, M.on basis of titleSensor Fault Detection and Isolation for Degrading Lithium-Ion Batteries in Electric Vehicles Using Parameter Estimation with Recursive Least Squares ,it presents a method for detecting and isolating sensor faults in lithium-ion batteries using recursive least squares.

Adaikkappan and N. Sathiyamoorthy based on the title Modeling State of Charge Estimation and Charging of Lithium-Ion Battery in Electric Vehicle: A Review it discribes about Reviews various methods for state of charge (SOC) estimation and battery charging in lithium-ion batteries for EVs.

Uzair, G. Abbas, and S. Hosain researched on Characteristics of Battery Management Systems of Electric Vehicles with Consideration of the Active and Passive Cell Balancing Process ,it discusses battery management systems (BMS) for electric vehicles, with a focus on active and passive cell balancing.

Da Li , Zhaosheng Zhang , Zhenpo Wang , Member, IEEE, Peng Liu , Zhicheng Liu, and Ni Lin,enquire based on the title Timely Thermal Runaway Prognosis for Battery Systems in Real-World Electric Vehicles,it explain based on Temperature Abnormality battery management in EV by using lithium ion battery and lead acid battery

3.EXISTING SYSTEM

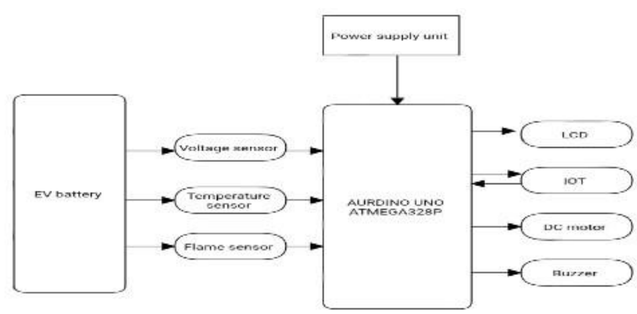


The existing system is designed to monitor and manage battery parameters in Electric Vehicles (EVs). It includes a microcontroller that processes data from various sensors.
A voltage sensor monitors battery levels, while a temperature sensor detects overheating. If the temperature or voltage exceeds predefined limits, the system activates a buzzer and displays warnings on an LCD screen.
A DC motor represents the propulsion system, operating based on battery conditions. The system is powered by a stable power supply unit to ensure proper functionality.
However, this system has limitations, such as the absence of real-time remote monitoring, predictive fault detection, and wireless communication, requiring manual intervention for fault handling.

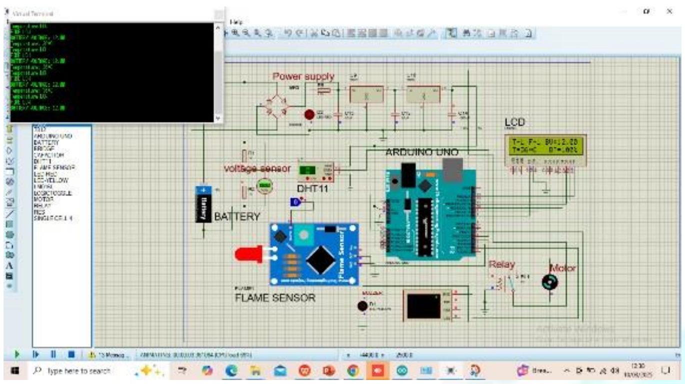
CONDITION	TEMPERATURE	VOLTAGE	FLAME
NORMAL	Less than 42 degree	11-12v	No
ABNORMAL	Greater than or equa to 42 degree	Less than 10v	Yes

4.PROPOSED SYSTEM

The proposed system is an IoT-based smart battery management system designed to improve the safety and efficiency of Electric Vehicles (EVs).
It continuously monitors battery voltage, temperature, and potential fire hazards using sensors. If any abnormal conditions are detected, the system triggers real-time alerts and automatic fault-handling mechanisms to prevent failures.
This system integrates wireless communication via an IoT module, enabling remote monitoring and control. reducing risks and extending battery lifespan. An LCD display provides real-time status updates, while a buzzer alerts users of critical issues. By optimizing power management, this system ensures safer and more reliable EV operation.



5.RESULT



6.CONCULSION

In this paper, we have proposed an IoT-based battery monitoring system for electric vehicles that leverages wireless communication and cloud computing to collect and analyze battery data in real-time. Our system offers granular and accurate insights into battery health and performance, real-time monitoring and analysis capabilities, cloud-based analysis, and enhanced safety. Through our experiments and evaluations, we have demonstrated the effectiveness and reliability of our system in detecting potential issues and providing actionable insights to users. We have also shown that our system can be easily integrated into existing electric vehicle infrastructure and can scale to accommodate large fleets of vehicles. The paper described the design and development of an IoT-based battery monitoring system for electric vehicle to ensure the battery performance degradation. We are developing the system for battery management in electric vehicle by controlling the crucial parameters such as voltage and temperature. It is very important that the BMS should be well maintained with battery reliability and safety. This present paper focusses on the study of Battery Management System and optimizes the power performances of electric vehicles. Moreover, the target of reducing the greenhouse gases can greatly be achieved by using battery management system.

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