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BATTERY MANAGEMENT SYSTEM IN ELECTRIC VEHICLE WITH CHARGE MONITORING AND FIRE PROTECTION USING IOT

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Abstract: In this paper, a Battery Management System (BMS) is proposed for electric vehicles (EVs) which couples charge monitoring and fire safety via Internet of Things (IoT) technology. The BMS's mission statement is to enhance EV safety and performance as it continuously monitors the battery's state and shields it from overcharging that may lead to fire accidents. This IoT-based system provides a platform for collecting real-time data on fire risks and allows for proactive measures; in case there are any irregularities detected. This BMS uses sensors to supervise different parameters like temperature, voltage, and current while the centralized control unit manages battery charging process. Furthermore, the system encompasses fire detectors and an emergency disconnect mechanism that would isolate the battery if there were signs of fires thus helping protect both vehicle occupants and the car itself from harm. As such, this proposal presents a one-stop-shop solution to handling EV batteries by enhancing their security as well as bettering its operations.

I. INTRODUCTION

Electric Vehicles (EVs) are transportation modes powered by electric motors, reducing emissions, reliance on fossil fuel, and operating costs due to their affordability and superior efficiency, unlike hybrid vehicles that use internal combustion engines. They are powered by renewable energy, contributing to cleaner air and energy independence. Governments and automakers are promoting EVs through incentives and models, reflecting consumer attitudes towards sustainable transportation. The demand for EVs is escalating globally, with governments offering incentives to encourage their adoption. However, these vehicles face challenges such as battery short-circuits, which can lead to thermal runaway, a condition where increasing temperature, which results in fire. This issue is particularly common when the heat is generated that interacts with flammable substances like gasoline, making the electric vehicle catch fire. This project aims to develop a comprehensive Battery Management System for Electric Vehicles with advanced charge monitoring and fire protection features using the Internet of Things. The BMS will be designed to optimize the performance, safety, and lifespan of EV batteries, while ensuring the highest level of user convenience and performance.

In summary, IoT-enabled BMS with charge monitoring and fire protection features are essential elements to guaranteeing safety and performance alongside longevity on batteries inside electric vehicles (EV) among others. This allows connection between IOT devices and sensor systems hence enabling real time connections into electric vehicles systems.

II. LITERATURE SURVEY

[1] "Lithium-ion Battery Management System for Electric Vehicles" published by MDPI on April 3,2012. The objective of 27 February, 2023.The objective of this project is to voltage and current monitoring, charge and discharge estimation, protection and battery data actuation and storage. This paper demonstrates that despite using appropriate algorithms and intricate approaches/models, BMS still encounter a number of challenges. Using Lithium-ion batteries will help to the efficiency and longevity of vehicle.

[2] "Recent work on electric vehicles" published by IEEE in 2009.This paper is about the working of the electric vehicle. In this paper we learned about the components and working of the electric vehicles and also about the charging process of the Ev. Total condition of ev charging and energy storage is learned from this.

[3] "IoT based Battery Monitoring system for Electric Vehicle" published by International Journal of Engineering & Technology in 2018.This paper is describing the application of IoT for battery performance of Electric Vehicle. In order to enable direct monitoring, the concept of employing IoT technology to track the vehicle's performance is put forth in this work. The monitoring device and the user interface make up the two main components of the suggested internet of things based BMS.

[4] "Electric Vehicles: Benefits, Challenges, and Potential Solutions for Widespread Adaptation" published by MDPI on 13 May,2023. This paper gives the benefits and challenges of the Electric Vehicle. By learning above the challenges, we improved this project. And also about the benefits of the ev. scarcity of charging stations is a significant issue that needs to be addressed, especially in regions with low population densities is the main challenge so by implementing this we can know about parameters of battery so we can charge easily when low battery occurs.

III. METHODOLOGY

3.1. BLOCK DIAGRAM

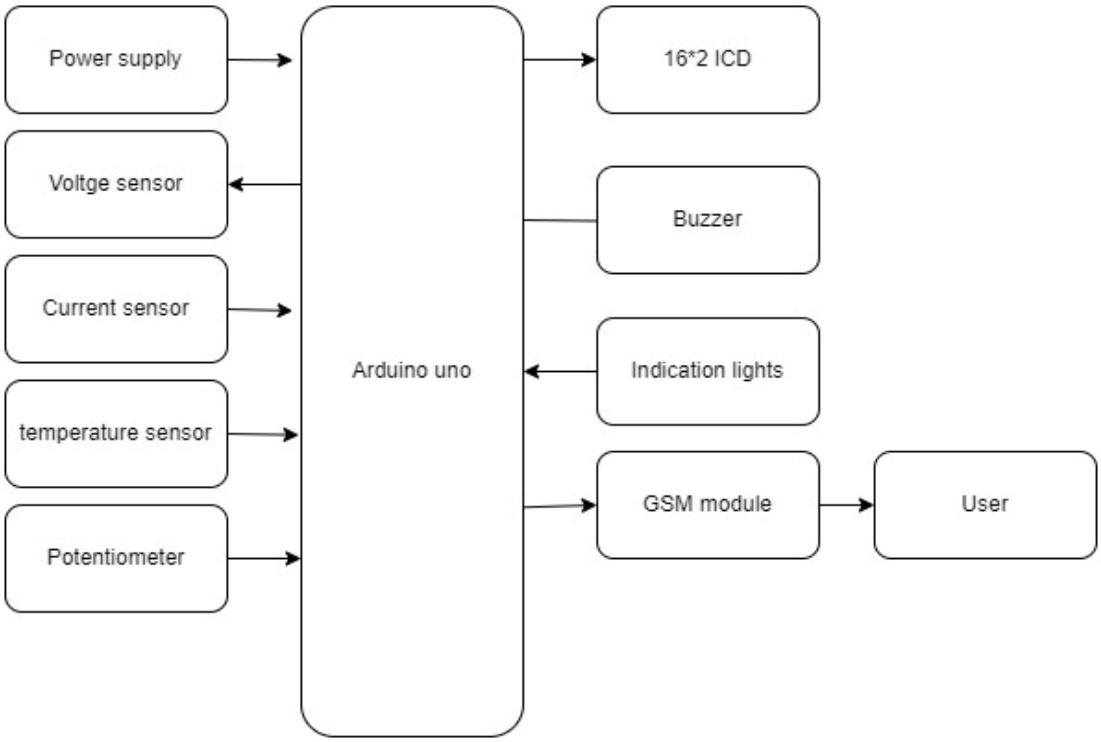

Fig.1. Block Diagram

3.2. COMPONENTS

- Arduino Uno
- GSM Module
- DHT11 Temperature and Humidity Sensor
- Buzzer
- Relay Module
- Node MCU
- Li-ion batteries
- Current Sensor
- LCD 16×2
- Potentiometer

3.3. DESCRIPTION

This proposed project consists of Arduino micro controller giving power through 3 Li-ion batteries connected in series each of 3.7v. This gives the voltage to the drive connected with sensors. We have temperature and current sensors which helps for real time charge monitoring which helps for improving SoC.

Node MCU is connected with Arduino for real time charge monitoring through user's devices. It also gives the alert to the user's device if any over charge or low battery occurs.So it will helps to the user to alert. And a relay module is connected to Arduino if any over temperature is produces then relay is switch on so there will be no damage to vehicle.

The battery management system (BMS) oversees the temperature of the battery cells and can identify unusual rises that might suggest a fire risk. If such increases are detected, the BMS can act by lowering the charging speed or deactivating the battery pack to prevent overheating and reduce the likelihood of a fire.

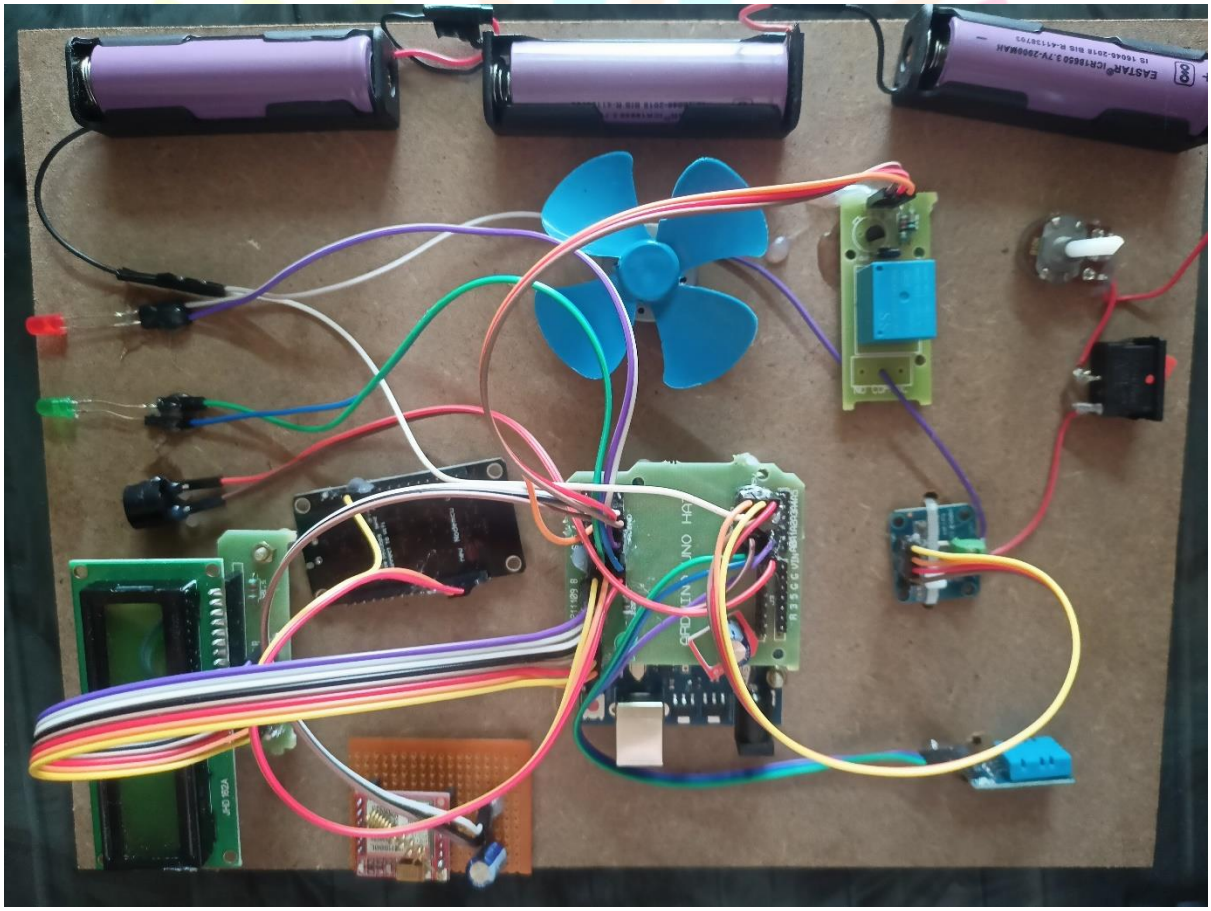

Fig.2.Model of Project

IV. RESULTS

i. Low Voltage:

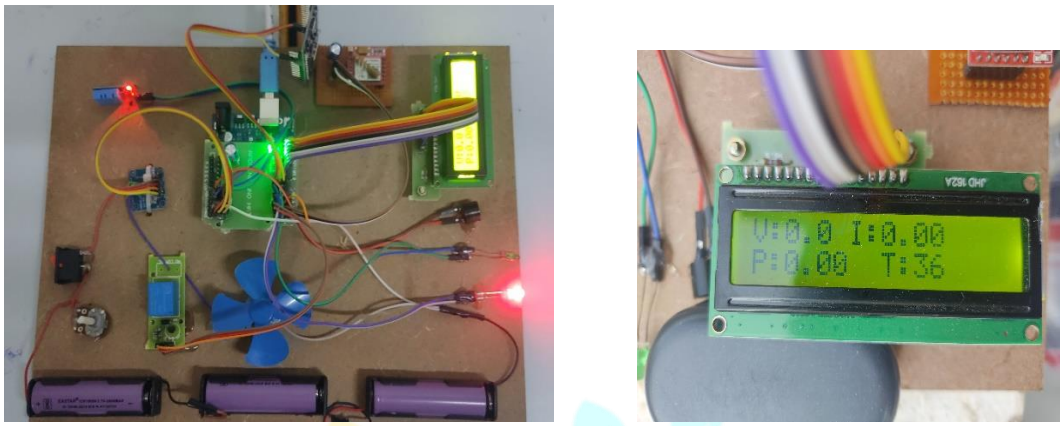

Fig.3.Low Voltage

ii. Normal Voltage:

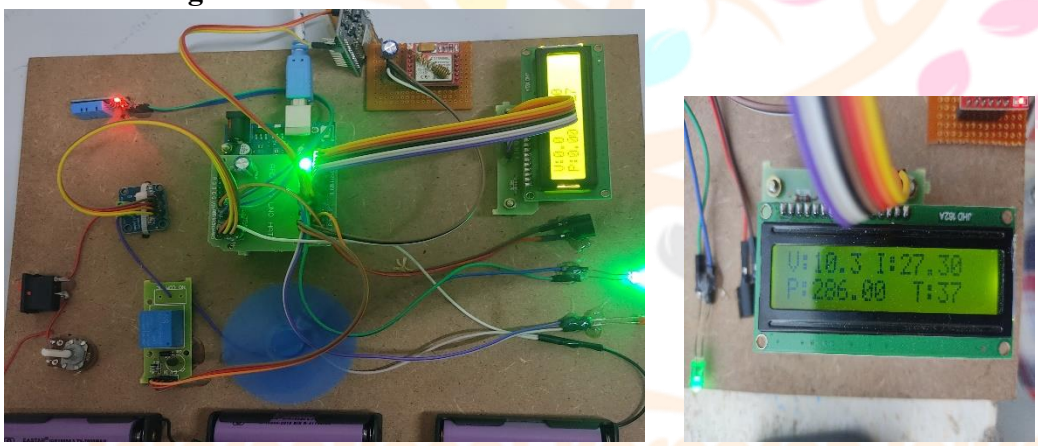

Fig.4.Normal Voltage

ThingView App:

i. Voltage Monitoring:

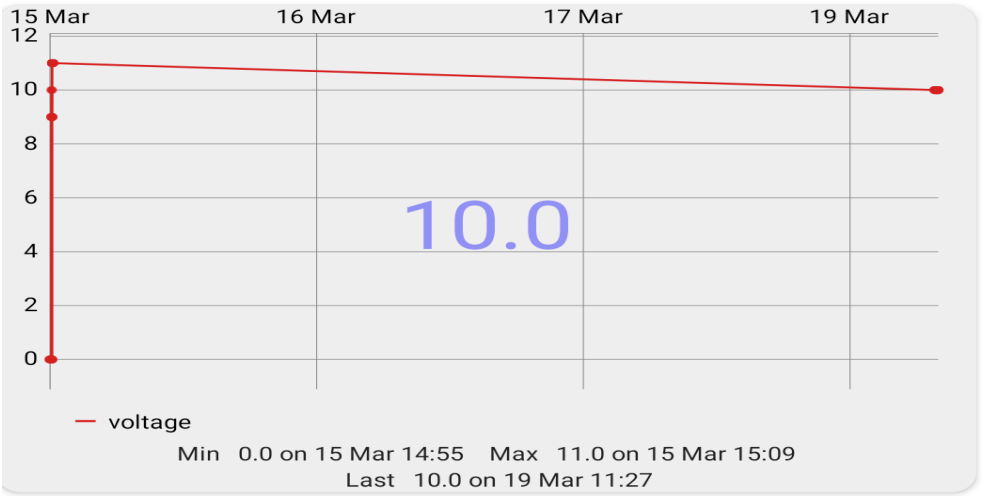

Fig.5.Voltage monitoring in ThingView App

ii. Current Monitoring:

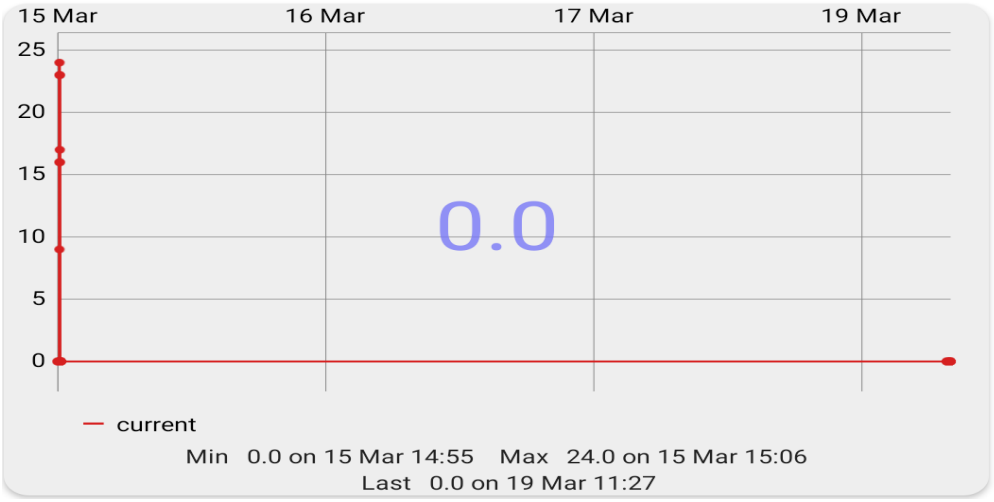

Fig.6.Current monitoring in ThingView App

iii. Power Monitoring:

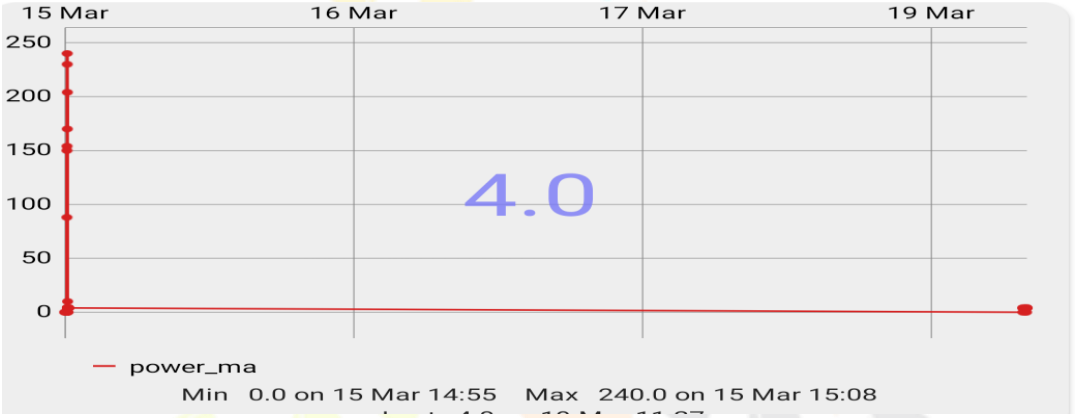

Fig.7.Power monitoring in ThingView App

iv. Temperature Monitoring:

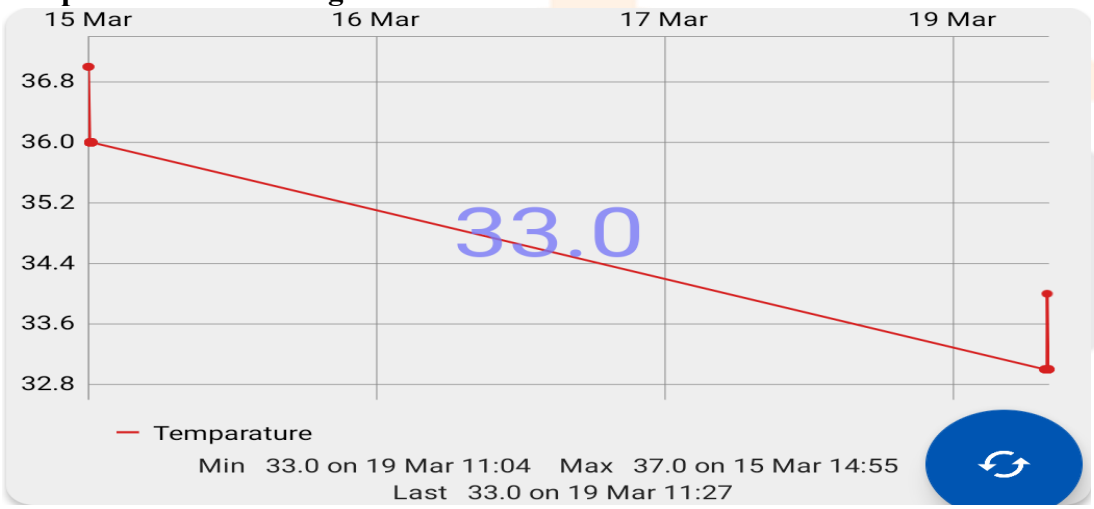

Fig.8.Temperature Monitoring in ThingView App

V. Conclusion

Battery health, state of charge and temperature can be monitored in real time when IoT is integrated into Battery Management System (BMS) for optimized performance and safety. BMS can communicate with a central server using IoT, hence it triggers alarms and shutdowns during abnormal conditions. This level of monitoring and control significantly reduces fire hazards while prolonging battery life; consequently making it a core technology towards ensuring electric vehicle's safety as well as efficient.

VI. REFERENCES

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