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RESEARCH ARTICLE OPEN ACCESS

IoT Based Battery management system for electric vehicles

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ABSTRACT
Electric vehicles (EVs) rely on batteries to be the most important part of providing clean transportation. An electronic controller that monitors and manages the filling and draining of battery packs is called a Battery Management System (BMS). The modern electrified automobile requires battery tracking because the cell infrastructure is responsible for motorists' well-being, functioning, or survival. The Internet of Things (IoT) technological advances have enormous scope for use in developing and improving electrified vehicles. EVs have received considerable attention in the present time, due to their progression in cell life and low emissions. The cell's restricted capacity and the limited number of recharge or battery charging facilities are the major problems that EVs are currently experiencing. This method builds the required equipment and makes it possible to accurately predict the remaining energy using BMS.

Key Words: Battery Management System (BMS), Internet of Things (IoT)

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I. INTRODUCTION

Electric vehicles rely on batteries to provide green transportation. In electrified mobility, lithium chemistry is now widely acknowledged as the preferred power storage technology [1]. A battery management system is an electrical controller that monitors and manages rechargeable charging (BMS). This is essentially battery tracking, which is keeping track of key performance metrics like the voltage, current, and battery temperature when charging and discharging [2]. The battery deterioration cycle can be slowed by correctly maintaining the battery and maintaining its charging discharge under various demanding scenarios [3].

The Internet of Things (IoT) is the connecting of common devices via a network. It's a wireless electrical link aimed at connecting everyday objects [4]. The interface connects coding in electrical devices, detectors, and devices to a Wi-Fi connection [4]. The automobile sector, which includes the selling of electrified vehicles and, more recently, driverless vehicles [4, 5], is another significant use of IoT equipment. Temperature tracking during charging improves the safety and performance of electric vehicle battery packs [6].

Previous battery tracking systems [7] monitored and tracked the battery's state, alerting the driver via the vehicle's battery display. Because of advancements in network building alerts [7], the IoT platform may be used to warn producers and customers about charge levels. The envisaged IoT-based battery management system consists of two main components: tracking tools and user interfaces [7, 8]. According to empirical data, the platform is prone to detecting deteriorating battery status and sending a notification to users for further action [8].

Battery Charge Status is a metric that indicates how much charge a battery can hold or, in another context, how much charge the battery currently has. Overcharging is impossible if the amount is computed correctly [9]. When the battery is overloaded, the battery management system uses controllers and detectors to detect the emission of these poisons. Examine a battery's basic parameters, such as voltage, current, and heat [2, 9]. It also includes a GPS module for tracking autos. These values are displayed on the cloud, bringing the Internet of Things concept to life [9].

Man-machine or machine-machine interaction is possible with the Internet of Things [10]. The three fundamental features of IoT are that it is significant, intelligent, and internet-connected. Data collection, bilateral communication, management, and response management are the four characteristics of IoT [10].

Battery management systems are used in electric vehicles to track and control the charging and discharging of battery packs, improving

performance. The battery management mechanism keeps the cell running smoothly and safely, but it also raises the risk of sensory dementia [11]. The state of the battery is monitored using a variety of metering methods, including voltage, current, and ambient temperature. The environment is assessed using a variety of detectors [11]. In addition, IoT and Cloud Visualized Asset Research improves the usability, price, responsiveness, security, durability, and versatility of bulk power storage systems by revamping the battery management system to detect battery pack well-being.

Because of its high-power density, overhead power, and charge-discharge efficiency, Li-ion science is the ideal battery option for the transfer of modern rapid energy technologies, such as autos. Overloads and load variations, on the other hand, might harm the battery, limit its life, or result in dangerous situations. The Battery Monitoring Framework is intended to keep battery voltages and temperatures within acceptable operating parameters.

The utilization of clean power is becoming increasingly important in today's generation. As a result, electric cars have become the most environmentally friendly means of transportation [14]. The technique presented here was created in response to a demand for a generic design strategy that can be applied to any case involving battery management requirements and that can be utilized in conjunction with a battery monitoring system [15]. Electrified vehicles are gaining popularity since they are less expensive and better for the environment [16]. As gasoline prices rise, electric vehicles are becoming increasingly popular. Many automakers are seeking alternatives to petroleum as a source of energy as a result of these possibilities. Electricity companies have the opportunity to help the environment by lowering pollution [16].

Furthermore, electric vehicles have substantial benefits in terms of energy efficiency and environmental preservation. Overcharging the cell can result in a reduction in battery capacity as well as major security concerns including an explosion [16]. Customers require an electrified automotive battery monitoring system that transmits battery status to avoid this situation. IoT innovation has led to advancements in alarm device architecture [16], which may be used to inform the manufacturer and customers about the battery status.

The Internet of Things (IoT) expands internet access to traditional goals by allowing various types of gadgets and everyday goods to be connected online, putting the entire world in the hands of recipients. This work presents the design of a battery management system using the Internet of Things platform, which was motivated by the aforementioned issues [17].

II. METHODOLOGY

The rechargeable battery's life cycle is shortened due to excessive charge and deep drain. Because the car is electrically powered, there is a greater risk of short-circuiting, which can cause a fire in rare circumstances, such as when the temperature suddenly rises. Under any conditions, EV users risk falling into the rubbish if they are unaware of the obstruction in front of or adjacent to their car. Due to battery safety concerns, EVs have several constraints. An excessive charge for clarification could result in a gas leak or explosion. Everything in an electric vehicle is controlled by a battery. The battery is the heart of the electric vehicle. To ensure security, durability, maximum efficiency, and financial feasibility, a correctly built real-time BMS is essential for battery condition evaluation. Charge standardization increases the machine's lifespan and protects it. The use of recyclable batteries decreases reliance on other types of energy, lowering greenhouse gas emissions.

TYPES OF BATTERY MANAGEMENT SYSTEM

1. Monitoring BMS: The monitoring Battery management system is made up of a variety of sensors that will be linked to the equipment (humidifiers, temperatures, lights on/off, fans on/off, and so forth). The software will then request a controller to see if it is connected to these sensors.
2. Control BMS: When a BMS is utilized as a control system, it is built similarly to a monitoring system but with outputs. This will have control over switches on and off as well as scheduled chores.

BATTERY MANAGEMENT SYSTEM

A battery management system (BMS) is not only beneficial for determining the condition of a battery, but it also protects the battery while it is in operation. Battery management system for continuous tracking, data gathering, and communication to an external interface so that customers may observe the state and overall status of the battery. Voltage, temperature and current are all within a safe operating range for each battery cell and chemistry. When the BMS cell is down or exceeds specified criteria, it may be detected and maintained. Because lithium is a highly reactive chemical, the BMS must guarantee that each lithium battery remains within predetermined limitations. In the long run, this will protect and preserve the battery. Another important safety feature of BMS is cell balancing. The battery pack's cells do not function in the same way. One cell in the chain may

be weaker or stronger than the others, be charged quickly, or be discharged. It might hurt a pack's overall health if there aren't enough rewards. The stability of the entire pack is affected by a single cell short circuit or failure. The BMS aids in the monitoring and control of the requested charge from each cell in the chain, ensuring that the charge's state is evenly distributed.

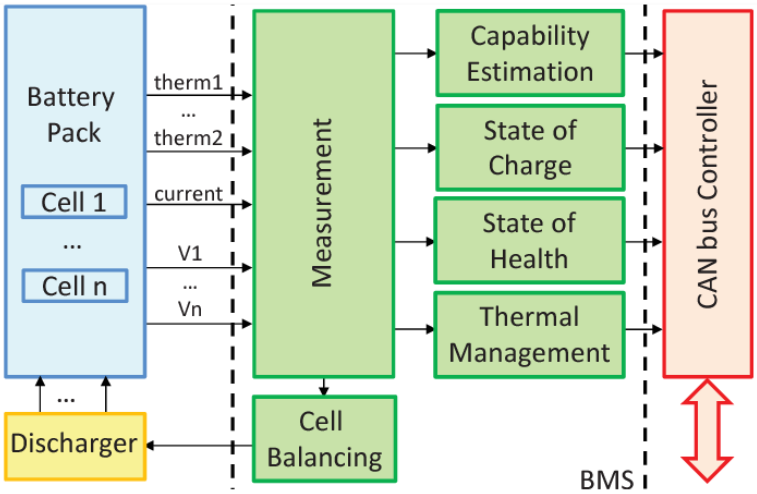

Fig 1: Block diagram of Battery Management System

SCHEMATIC LAYOUT OF PROJECTED METHOD

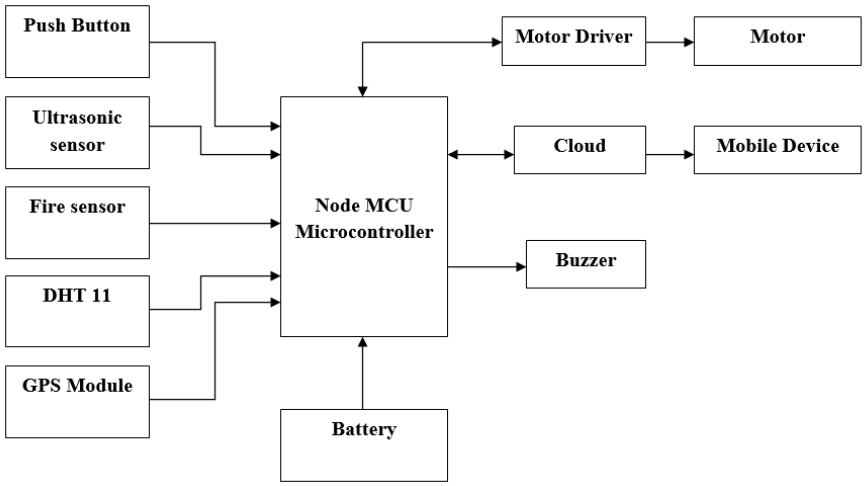

Fig 2: Schematic layout of projected method

- Voltage detection system, real position tracing, temperature tracking sensor, fire detection, distance monitor, and information processing framework are all part of the unit. Internet of things is used to link and manage all of these components.
- The battery's state is degraded by overcharging as well as deep discharge.
- The battery control devices decide at the time of charging, how much current can go in safely and communicate the same to the charger.
- The battery management device communicates with the motor controller during the discharge of the battery to prevent cell voltages from reaching too low.
- Microcontroller reads the sensor value and standardizes it into sensible data and it will be sent through a wireless medium.
- The battery management system uses data points obtained such as temperature, voltage, current to estimate the battery's charge status and health status.
- To ensure the smooth operation of the engine, the control units in the battery transmit the required data concerning the battery parameters to the motor controller.

- After reading data obtained from the available sensors, if there is any change in the value beyond the limit, then the buzzer gives an alarm notification to the user.
- All the real-time data can be accessed through the BLYNK application.

BLYNK APPLICATION:

Blynk is an internet infrastructure software company providing things. Blynk has pioneered IoT app-building no-code approach and has gained world popularity in 2014. Today, companies of all sizes – from new start-ups to large companies – build connected products using this software platform.

Blynk is a new platform for quick interfaces to monitor and control your iOS and Android devices' hardware projects. Can create a project dashboard after you download the Blynk app, and arrange on-screen buttons, sliders, graphs, and other widgets.

The Internet of Things was developed by Blynk. It can remotely control hardware, display sensor data, store data, visualize and do a lot of other cool things.

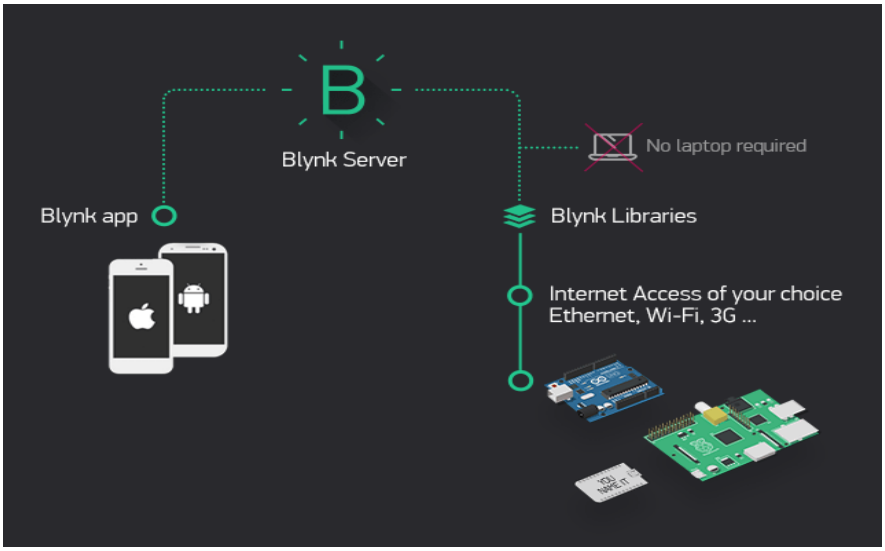

Fig 3: Blynk application overview

CIRCUIT DIAGRAM AND WORKING PRINCIPLE

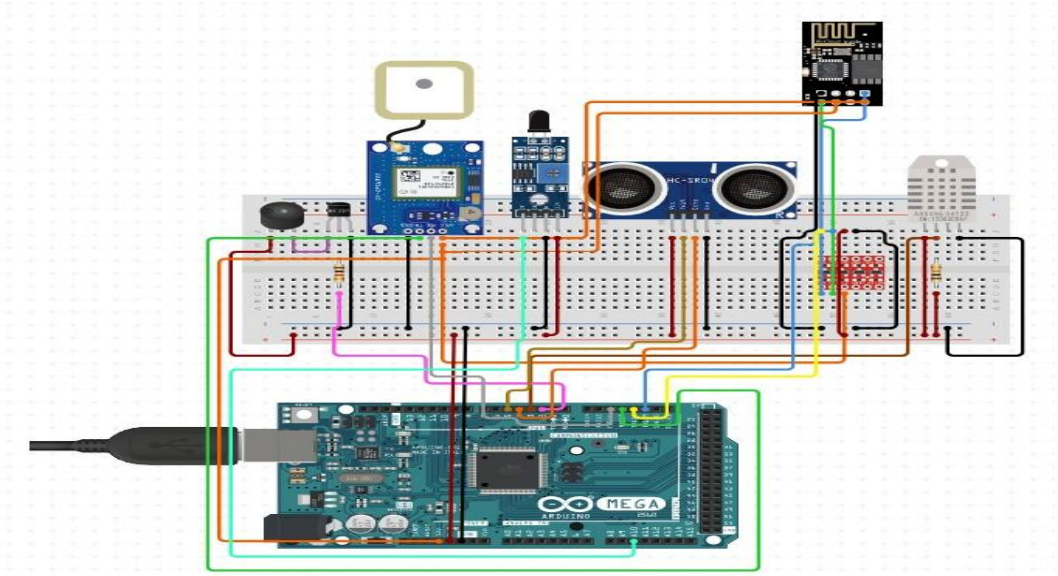

Fig 4: Circuit Diagram of the proposed work

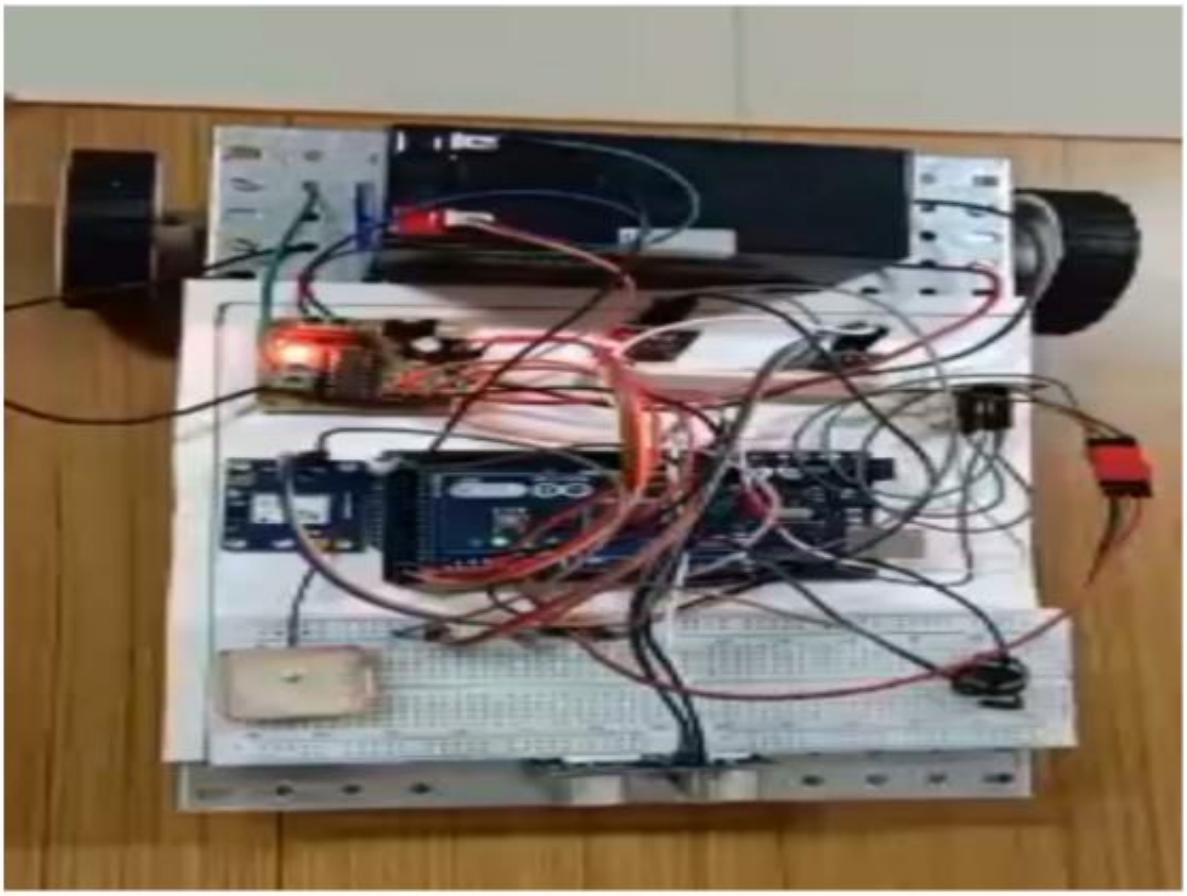

Fig 5: Picture of Developed model

The battery's state is degraded by overcharging as well as deep discharge. The battery control devices decide at the time of charging, how much current can go in safely and communicate the same to the charger. The battery management device communicates with the motor controller during the discharge of the battery to prevent cell voltages from reaching too low. The microcontroller reads the sensor value and standardizes it into sensible data and it will be sent through a wireless medium. The battery management system uses data points obtained such as temperature, voltage, current to estimate the battery's charge status and health status. To ensure the smooth operation of the engine, the control units in the battery transmit the required data concerning the battery parameters to the motor controller. After reading data obtained from the available sensors, if there is any change in the value beyond the limit, then the buzzer gives an alarm notification to the user.

WORKING PRINCIPLE OF THE PROPOSED MODEL

• The module consists of Voltage Monitoring devices, Live Location Tracking, Temperature Monitoring System, Fire Detector, Ultrasonic Sensor & Data Reading System. All these systems are interconnected and accessed using IOT Technology.

• The BMS monitors the charging and discharging of the battery, to maintain the health of the battery.

• BMS uses data points such as temperature, voltage, and current to estimate the charge of the battery.

• All the control units in the microcontroller, access the data points and send the data through a Wi-Fi module.

• The real-time data is received by the BLYNK application by the user.

• If in case, the temperature, voltage and current data points cross beyond the limit, then the user is notified by the buzzer.

The system has an IOT-based electrical vehicle battery monitoring system to ensure that the battery state can be tracked online. The system consists of the development of hardware for monitoring the battery. The system is capable to show information such as battery condition, temperature, location via sensors incorporated. The smartphone application

shows the remainder of the battery degradation state to the user.

III. CONCLUSION

The battery management system for an electric vehicle is very attractive but requires a lot of care with the addition of a wireless system as it is a critical factor in e-mobility. It is observed that battery monitoring plays a vital role in EV's safety, the life of the battery, and the proper operation of the battery system. It shows the potential ability of the system which simultaneously measures the temperature, humidity of the battery atmosphere along with the battery monitoring. Besides BMS, this monitoring technique can be implemented for other parts like the bearing, engine with reasonable customization. In our project along with battery monitoring, we are ready including managing other parameters like voltage, current, temperature, humidity, and fire sensing. As of now by using a battery management system with maintained reliability and safety, we can achieve a reduction of greenhouse gases effectively.

REFERENCES

[1]. H. G. M. W. V. L. M. G. F. B. G. F. L. F. R. R. R. S. S. S. A. T. M. C. W. P. M.Brandl, "Batteries and Battery Management Systems for Electric Vehicles," p. 6, 2012.

[2]. S. D. M. J. H. S. Mr. Rohit, "Battery management system in an electric vehicle," in 7th International Conference on Recent Trends in Engineering, Science & Management, 2017.

[3]. B. P. D. H. W. K. D. H. F. H. K. W. E. Cheng, "Battery-Management System (BMS) and SOC Development for Electrical Vehicles," vol. 60, p. 13, January 2011.

[4]. F. A. M. S. A. Y. R. Mohammad Asaad, "IoT enabled Electric Vehicle's Battery Monitoring System," p. 10, 2017.

[5]. B. C. Florea, "Electric Vehicles Battery Management Network Using Blockchain IoT," p. 6, 2020.

[6]. J. H. F. A. M. Bo Wang, "A Wireless Battery Temperature Monitoring System for Electric Vehicle Charging".

[7]. N. I. M. A. R. A. A. B. S. S. M. S. S. S. S. M. F. H. Mohd Helmy Abd Wahab, "IoT-Based Battery Monitoring System for Electric Vehicle," International Journal of Engineering & Technology, 2018.

[8]. K. P. A. P. A. B. D. M. K. K. Nikita N. Mutrak, "IoT based Battery Monitoring System," International Research Journal of Engineering and Technology, vol. 7, no. 6, p. 5, 2020.

[9]. P. V. D. D. S. Harish N, "IoT Based Battery Management System," International Journal of Applied Engineering Research, vol. 13, p. 4, 2018.

[10]. F. A. M. S. A. Y. R. Mohammad Asaad, "IoT enabled Electric Vehicle's Battery Monitoring System".

[11]. I. P. R. S. V. R. O. S. A. Hariprasad, "Battery Management System in Electric Vehicles," International Journal of Engineering Research & Technology, vol. 9, no. 5, 2020.

[12]. D. M. A. A. J. S. V. Y. L. Taesic Kim, "Cloud-Based Battery Condition Monitoring and Fault Diagnosis Platform for Large-Scale Lithium-Ion Battery Energy Storage Systems," 2018.

[13]. K. M. Manideep Cherkuri, "Battery Management System Design for Electric Vehicle".

[14]. R. Hu, Battery Management System For Electric Vehicle Applications, Canada, 2011.

[15]. K. K. S. N. M. John Chatzakis, "Designing a new generalized battery management system," IEEE Transactions on Industrial Electronics, 2003.

[16]. A. B. C. P. P. K. S. S. S. R. M. Vethekar, "Review on IOT based electric vehicle battery management system using LAB View," International Journal of Future Generation Communication and Networking, vol. 13, p. 7, 2020.

[17]. A. M. Anjali Vekhande, "IOT-Based battery parameter monitoring system for an electric vehicle," International journal of creative research thoughts, vol. 8, no. 7, p. 7, 2020.