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Electric Vehicle Battery Condition Monitoring System

Prof. Preeti S B[1], Prof. Shrikanth Shirkol[2], Chinmayi Timalapur[3], Darshan H Chabbi[4], Divya M Agadi[5] and Sudeeksha S S[6]
[1]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA
[2]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA
[3]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA
[4]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA
[5]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA
[6]Department of Electronics and Communication, SDM College of Engineering and Technology, Dharwad, Karnataka, INDIA

[2]Corresponding Author: shrikanthks09@gmail.com

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ABSTRACT

The battery is the most crucial and costly component in electric cars. Indeed, the battery serves as the sole provider of electrical power for an electric vehicle. Nevertheless, the vehicle's power source gradually weakens, leading to a reduction in performance. This is a significant concern for makers of batteries. This research proposes the utilization of Internet of Things (IoT) methods to monitor and exhibit the battery's functioning.

At this point, the several measurements of the battery, such as voltage, current, and temperature, are monitored, examined, and displayed. This notification serves to caution the user about the need to avoid overcharging or excessively discharging the battery. Observation can be conducted by employing diverse sensors. The microcontroller unit receives data on voltage, current, and temperature, and then sends battery data to the cloud for display. The monitoring system has the capability to display real-time data on voltage, current, and temperature. This data may be simultaneously seen on both an Android smartphone and a PC. Consequently, it is possible that we can enhance the battery's efficiency and longevity. The suggested IoT-based battery monitoring system consists of two primary components: the user interface and the results presentation. Based on the test findings, the system has the capability to detect diminished battery performance and alerts the user to take appropriate action.

***Keywords*—** Electric Vehicle (EV), Battery, Monitoring System

I. INTRODUCTION

Nowadays due to their low maintenance requirements, cost efficiency, and the lack of greenhouse gases, electric vehicles are becoming increasingly popular. Clearly, the battery is the sole source of energy for a car. However, the power of the car gradually decreases, leading to a decrease in performance. Battery production is a major concern. However, there are costs associated with battery abuse, which include overcharging and deep water pumping. Battery performance over time and its duration are also affected by this problem. The previous battery monitoring system wasable to monitor, detect, and alert the user only with a battery indicator inside the car when the battery was in poor condition. This can be considered as one of the remedial support processes that a manufacturer can perform. IoT uses internet connectivity beyond normal applications, where a variety of machines and everyday objects can be connected to the internet, making the world at the fingertips of the user. As such, the IoT design enabled the Electric Vehicle battery control system is activated. In this work, a vision is proposed to monitor and demonstrate vehicle performance using IoT techniques. Here, several battery metrics including voltage, current, and temperature are tracked, and shown. This information gives advice on how to prevent overcharging and deep battery drain. With the aid of various sensors, viewing is possible. To display the data, the micro-controller unit receives transmissions of the voltage, current, and temperature, as wellas the battery information. Since batteries are an EV's primary power source, their performance has a big impact on how powerful they are. As a end product, manufacturers are looking for advancements in both BMS and battery technologies. Because operating conditions have an impact on the chemical reactions in batteries, battery degradation might differ depending on the environment. Manufacturers who want to improve the market share of their products must have a thorough and developed BMS. In this report, the main BMS issues were covered.

The monitoring system may concurrently display data on an Android smartphone and a PC as well as real-time voltage, current, and temperature readings. This might improve battery performance and lifespan. A monitoring device and a user interface with results are the two primary parts of the proposed IoT-based battery

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monitoring system. According totest results, the system is able to identify poor battery performance and notify the user with notification messages for additional processing.

II. LITERATURE SURVEY

1. Mohd Helmy Abd Wahab, Nur Imanina Mohamad Anuar, Radzi Ambar, Aslina Baharum, Shanoor Shanta, Mohd Suffian Sulaiman, Shukor Sanim Mohd Fauzi, Hafizul Fahri Hanafi, et all has worked on the IoT-Based Battery Monitoring System forElectric Vehicle.

This paper presents the use of electrical energy sources may improve the environment since there are less pollution. In addition, EV produces great advantages in terms of energy saving and environmental protection. Most EVs used rechargeable battery which is lithium ion battery. It is smaller to be compared with lead acid.

2. Mudit-Thapliyal et all has worked on the paper IoT For Electric Vehicle Monitoring & Management.

This paper presents the BMS helps to monitor the charging and discharging cycle of the battery and ensures the battery's healthand also minimizes the risk of damage by confirming that enhanced energy is being delivered to power the electric vehicle.

3. Mahmood H. Qahtan, Emad A. Mohammed, Ahmed J. Ali. et all has worked on the paper IoT-Based Electrical Vehicle's Energy Management and Monitoring System.

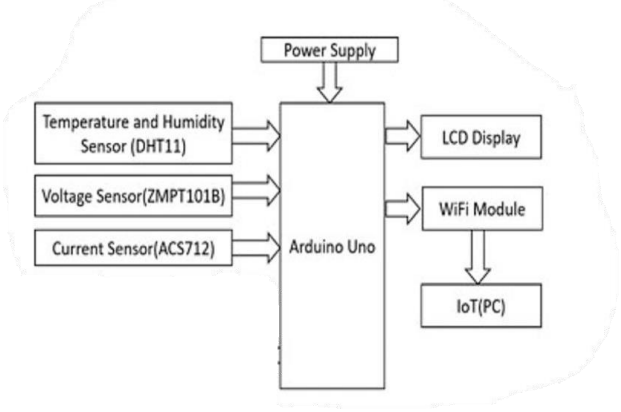
This paper presents the battery the executives and observing arrangement of electric vehicles, minimal expense and IoT-based, progressively, and effectively used to help clients through an application supporting the Web of Things innovation to show the fundamental data expected about the battery's status as battery limit and the charging and consuming flow.

4. Lekshmi Sree B, Kiranmayee, A.Sangari, J Anto Sheeba Eswaramoorthy K, D.Sivamani, et all has worked on the paper IoT-Based Battery Monitoring System for Electric Vehicle.

This paper presents the use IoT approaches to monitor and display the battery performance. Here, the various battery metrics, including voltage, current, and temperature, are tracked, observed, and shown. This alerts the user to prevent the battery from being overcharged or deeply discharged.

III. TECHNOLOGY BASED ON BATTERY CONDITION MONITORING SYSTEM

The suggested system's overview is depicted in Figure 1. Initially, for the system to function, the power sensor gauges the lithium-ion battery's level. Simultaneously, the SIM808 GSM/GPRS shield uses the GPS feature to identify a car's position. The Arduino UNO sub-controller receives the analysis of the battery power level and the position of the vehicle for processing. The processed data is transmitted to the user interface of the battery wireless computer through the SIM808 shield, as indicated in the diagram. When the data transmission is successful, the computer's visible battery monitoring connection will show the most recent battery status information. An email alert is delivered to the user when the battery produces a low voltage level. The online battery system has the ability to measure battery characteristics as well as battery voltage by connecting to abattery monitoring system. The following sections provide anexplanation of how the system information is organized.



A. Microcontroller Unit

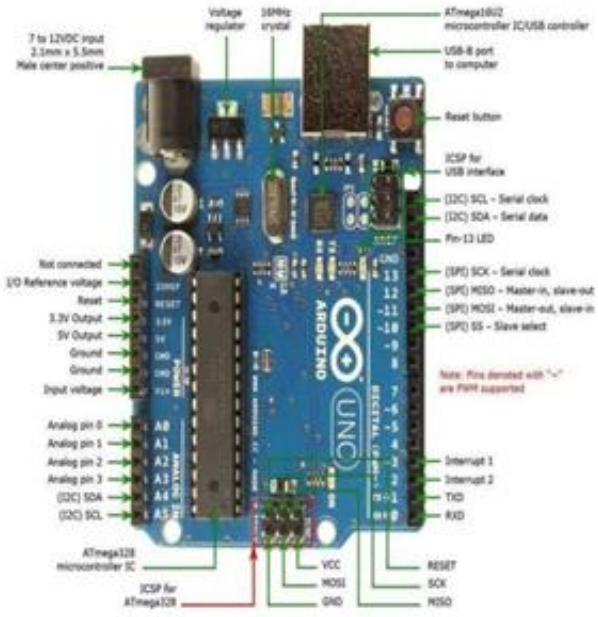


Figure 2: Arduino Uno

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Based on the ATmega328 (datasheet shown in Fig. 2), the Arduino Uno microcontroller board is used. The microcontroller comes with everything it needs to function.

B. Current Sensor

The component is a hall sensor straight-line circuit breaker with brass wires placed close to the matrix region. Fig. 3 illustrates how the device's precision is improved by the magnetic signal'sclose proximity to the Hall transducer. Accurate precision voltage is provided by the Bi CMOS Hall IC with steady Chopper, which is intended for accuracy after packing. The current sensing idea employs a manner where the output of the device has a straight slope when the rising wave exceeds the primary copper conductor. (from pins 1 and2 to pins 3 and 4)

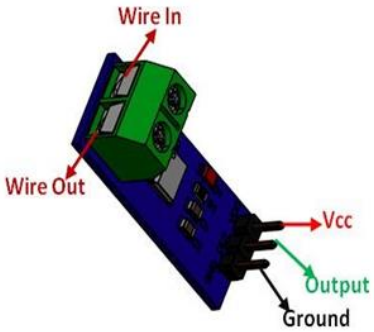

Figure 3: Current sensor

C. Voltage Sensor

The module in Fig. 4 may cause the input voltage of the red terminal to be 5 times lower than the starting voltage and is based on the theory of resistance points. Because the maximum analogue input voltage for Arduino is 5 V, the input voltage for this module cannot be greater than 5 V x 5 = 25 V(in the case of a 3.3 V system, the input voltage cannot be greater than 3.3 V x5 = 16.5 V). Wireless battery management systems are now adopting Internet of Things (IoT) related technologies at a rapid rate. Each charging curve may be calculated by the sophisticated cloud software, ensuring that the battery is fully charged and extending battery life. This LoRaWAN technology that uses long distance and low power can play an important role in the design and implementation of an intelligent IoT-based battery management system. An intelligent IoT-based battery management system can benefit from the long-range, low-power LoRaWAN technology in its design and implementation.

Figure 4: Voltage sensor

D. Temperature Sensor

The LM35 series as shown in fig 5 is integrated circuit heating devices with an output voltage equal to the centigradea single power supply or with multiple and smaller sources.

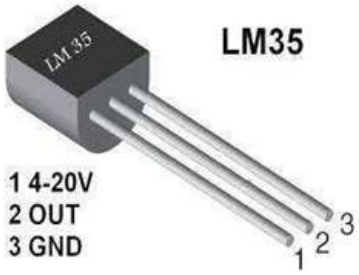

Figure 5: Temperature Sensor

E. ESP8266 WiFi Module

The output voltage of the integrated circuit heating devices of the LM35 series is shown in fig 6. It is equal to the temperature in degrees Celsius. The LM35 provides a typical accuracy of 14 °C at room temperature and 34 °C Covers the complete temperature range between 55 °C and 150 °C without the need for external measurement or modification. If cutting is ensured and measured at the wafer level, the price is low. The LM35 device's low output impedance, line output, and exact internal measurement make it very handy for visual reading or control circuits. This gadget may be powered by a single power source or several smaller ones. The LM35 gadget has a very low self-heat below 0.1 °C in calm air since it emits just 60 A of electrical power. A Wi-Fi chip module known as the ESP8266was developed.

Figure 6: ESP8266 WiFi module

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F. Lead acid battery

Lead acid batteries are very powerful and rechargeable batteries as shown in fig 7. because of their dependability andlow cost per watt, they are quite popular. As shown in Fig. 7,there are a few alternative batteries that offer comparable energy to lead acid batteries.

Figure 7: Lead acid battery

IV. HARDWARE IMPLEMENTATION

It is necessary to have a battery management system (BMS) in order to keep track of the operating system, performance, and battery life metrics including charge and discharge rates. Comprises of battery, voltage sensor, current sensor, temperature sensor, Arduino Uno, ESP8266 WiFi module, motor and microcontroller unit for measuring characteristics such battery voltage, current, and temperature. The battery's state of charge (SOC) and state of health (SOH) may be estimated using the values. The voltage, current, and temperature sensor's output are supplied to the Arduino Uno to display the measured parameter on the monitor, a WIFI module coupled to an Arduino Uno provides the data. The motor's speed is decreased to its typical speed if the observed temperature is excessive. If not, it is normal, and we can run themotor at full speed. Online monitoring and status assessment of the batteries of electric cars are essential for their safe and dependable operation. Every car owner and service provider will find it very handy to check the state of their vehicle's batteries at any time and from any location with a battery monitoring system. Around the same period Readings of the battery's voltage level are provided to an ESP32 centre MCU micro-controller for management.

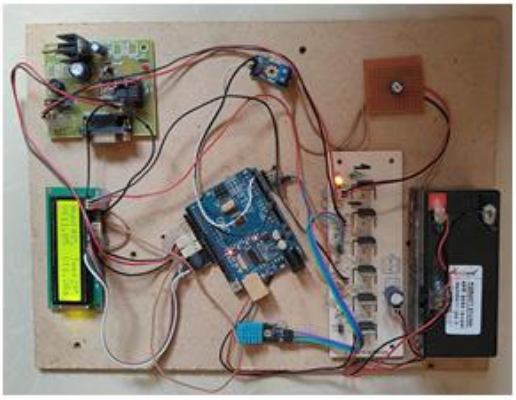

Figure 8: Hardware setup

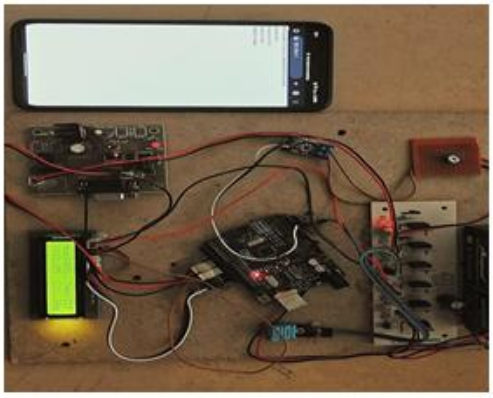

Figure 9: Hardware result

V. CONCLUSION

The plan and improvement of an IoT based battery observing framework for electric vehicle to guarantee the battery execution debasement can be checked on the web. The objective is to proof that the concept of the idea can be realized.The development of the system consists of the development ofthe hardware for the battery monitoring device and a web-based battery monitoring user interface. The system is capable of showing information such as Battery temperature, Current, Humidity and voltage of the battery. Further modification can be done to improve the system by adding more functions into the system. The system can be used in smartphones by developing smartphone application that can help user to monitor battery and as a battery degradation reminder.

REFERENCES

[1] Nur Imanina Mohamad Anuar, Radzi Ambar, Aslina Baharum, Shanoor Shanta, Mohd Suffian Sulaiman & Shukor Sanim Mohd Fauzi. (2018).

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https://doi.org/10.5281/zenodo.11502656

IoT-based battery monitoring system for electric vehicle.

[2] Mahmood H. Qahtan, Emad A. Mohammed & Ahmed J. Ali. (2022). *IoT-based electrical vehicle's energy management and monitoring system*.

[3] Mudit-Thapliyal. (2022). *IoT for electric vehicle monitoring & management*.

[4] Lekshmi Sree B, Kiranmayee V, A. Sangari, J. Anto Sheeba Eswaramoorthy K & D.Sivamani. (2023). *IoT-based battery monitoring system for electric vehicle*.

[5] Shirakol, Shrikanth & S. S. Kerur. (2023). An improved vlsi architectural design of discrete cosine transform based on the loeffler-dct algorithm. *International Journal of Intelligent Engineering & Systems*, *16*(5), 173-184.