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IoT based Breaking Control System for EV Vehicle and Monitoring System

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***Abstract*— It is imperative that we transition to the use of electric vehicles because these vehicles are the next generation of transportation. Overcharging or over discharging can damage the batteries in electric vehicles, therefore it's important for them to correctly assess the charge status to keep them working for longer and protect the components they power. In this article, we offer an inexpensive, IoT-based system for electric vehicle battery management and monitoring. A user-friendly application that leverages the power of the Internet of Things is at the heart of its design. Important information about the battery's status, such as its capacity and the current entering and leaving it, is provided by the system. You might be able to observe these changes unfold in real time. This system is built using the Blynk Internet of Things platform, the Blynk mobile app, and an ESP32 microcontroller.**

Keywords*— *EV Vehicle, Breaking Control System, Monitoring System.

I. INTRODUCTION

As the price of petrol continues to rise, electric cars (EVs) are also becoming increasingly popular. Several automobile manufacturers are investigating various alternative fuel sources to petrol as a result of the circumstances described above. Electrical energy sources produce fewer pollutants than other types of energy sources, which may be beneficial to the environment. To rub salt in the wound, electric vehicles provide substantial benefits in terms of reducing energy use and protecting the environment. Most electric vehicles use battery packs that incorporate lithium-ion [1, 2]. The electric vehicles (EV) battery pack is composed of lithium-ion cells. The required voltage is often supplied by incorporating these components into modules and connecting them in series. Due to their critical nature, lithium-ion batteries are required to maintain a specific temperature and voltage range for their own protection. The cell could undergo degeneration if the voltage or temperature falls below the critical point. If these values go over the safe range, the cell could burst. Standard lithium-ion batteries should maintain a voltage and temperature consistent with [2.5; 4.2] V and [13] C, correspondingly. Inside the parameters of the cell, there is a range of values that are deemed to be inside the safety window [3].

A number of elements, including the capacity of the battery, the complexity of the engine, and the age of the battery, all have an impact on the driving range. Improving and upgrading battery monitoring and management systems has become necessary due to the recent focus on increasing the drivable distance of electric cars (EVs) [4, 5]. There are mechanisms in electric vehicles that report the health of the battery pack and make sure it runs safely. An example of such a system is the BMS, or Battery Management System. The BMS can also measure the battery's SoC, or state of charge, according to [3]. The State of Charge (SoC) helps users keep tabs on their batteries as they charge or discharge them, which extends their battery life. It's a crucial part of any battery. In order to assess the battery's health, system on a chip (SoC) is a crucial enabler. This allows the battery to be charged and drained in a safe manner, which in turn extends its lifespan [7], [8]. A battery's state of charge (SoC) is also a representation of the proportion of its maximum potential capacity that is still available for charging.

The system-on-chip (SoC) of the battery is analogous to the fuel gauge of a gas-powered vehicle. It displays the amount of energy that is still available in the battery to power an electric vehicle. A reliable and secure vehicle process is ensured by a battery SoC calculation that is accurate. This calculation helps to provide real-time information on the capacity and energy of the battery. Comparatively, batteries are composite electrochemical devices whose nonlinear performance changes in response to both internal and external stimuli [9]. This complicates the process of detecting the SoC of specific batteries. During the driving cycle, the vehicle's batteries, particularly Li-ionized batteries, are positioned on an axis with a very high energy density, making them ideal for high energy density operations [10]. The process of coulomb counting is straightforward and does not require any technical terminology. To incorporate and quantify charging, coulomb counting necessitates monitoring the input and output currents of the battery. By combining the present active data throughout time, one may ascertain the overall power input or output from the battery. Ampere-hours are the standard unit of measurement for capacity, which is the result of this process. Various types of batteries for all-electric vehicles are suitable candidates for the technique [11], [12].

The internet of things (IoT) is an intriguing field of study in the modern world. In the Internet of Things, which is now in the process of development and is being utilised by a large number of people [13], [14], every electronic item that is located around us has the potential to be connected to each other in order to form communications. The linking of intangible objects that have embedded circuits, sensors, actuators, and networking links is another aspect of the Internet of Things. The devices can collect and share data because to their connectivity [15]. Physical equipment, in contrast to the IoT's network of interconnected objects, may be hardwired into the virtual realm and accessed from any location. Many new real-time applications have become possible with the emergence of IoT devices. These include media, environmental monitoring, smart manufacturing, intelligent healthcare, smart buildings, home automation, energy management, transportation, and many more. This is made possible by the fact that these devices are capable of operating remotely.

II. PROPOSED SYSTEM

The Internet of Things-based solution that is being proposed for electric vehicle users. An app for mobile devices can make the installed system a reality, letting administrators keep tabs on everything. The electric vehicle's battery status, input current, and output current may all be tracked with this app. In addition to controlling the charging process, it summarises the overall charging current. All of these indicators are shown in real time and are updated frequently. A Li-Ion battery, two current sensors, a microcontroller with built-in Wi-Fi (ESP32), a fuel gauge sensor for the battery, and a charger for the battery are the parts that comprise the proposed system. Additionally, a mobile telegram application is used to send a message that contains a summary of the overall charging current after each charging activity. The fact that the ESP32 comes with Wi-Fi and Bluetooth already installed is the primary argument for choosing it. Therefore, there is no requirement for additional radio modules, as is the case with the majority of Arduinos. There is only one chip, the ESP32, and it has everything in a single package. A Li-Ion battery's fuel gauge sensor, together with two current sensors, are connected to an ESP32 to enable the system to function. Through its built-in Wi-Fi module, the ESP32 collects and processes data received from the sensors before sending it to Blynk Server. The blynk android app not only controls the charging process, but it also displays and updates all relevant data in real time.

A. Hardware requirement:

- ESP32
- DS18b20 Temperature Sensor
- Voltage Sensor
- ACS712 Current Sensor
- Vibration Sensor
- Battery
- LCD Display
- Buzzer
- Relay

B. Software requirement:

- Adruino IDE
- Proteus
- Embedded C
- Thingspeak IOT

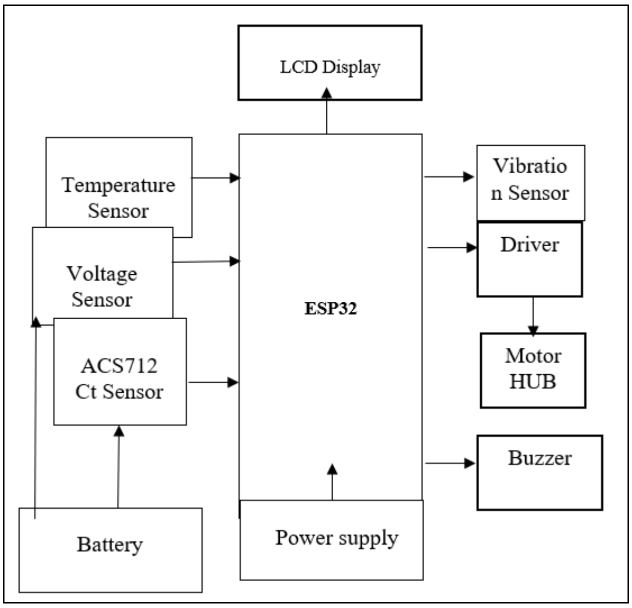

Fig 1: Block diagram

III. RESULTS AND STUDY

The speed and distance status, LED display & voltage and time curve results are shown in figure 2, figure 3, figure 4 respectively.

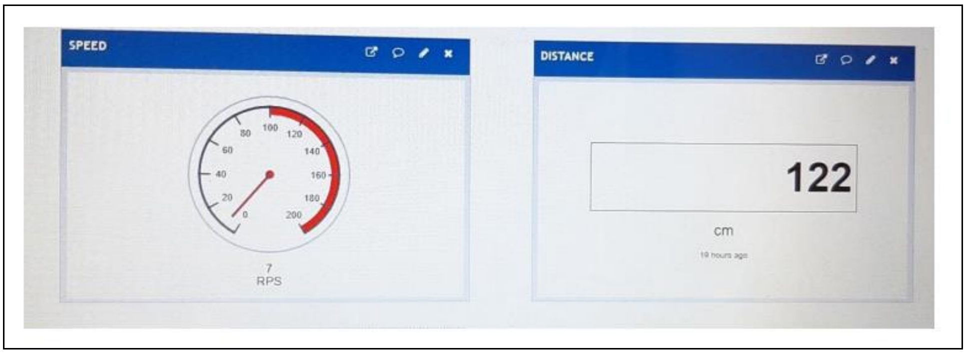

Fig 2: Speed and distance status

Fig 3: LED Display

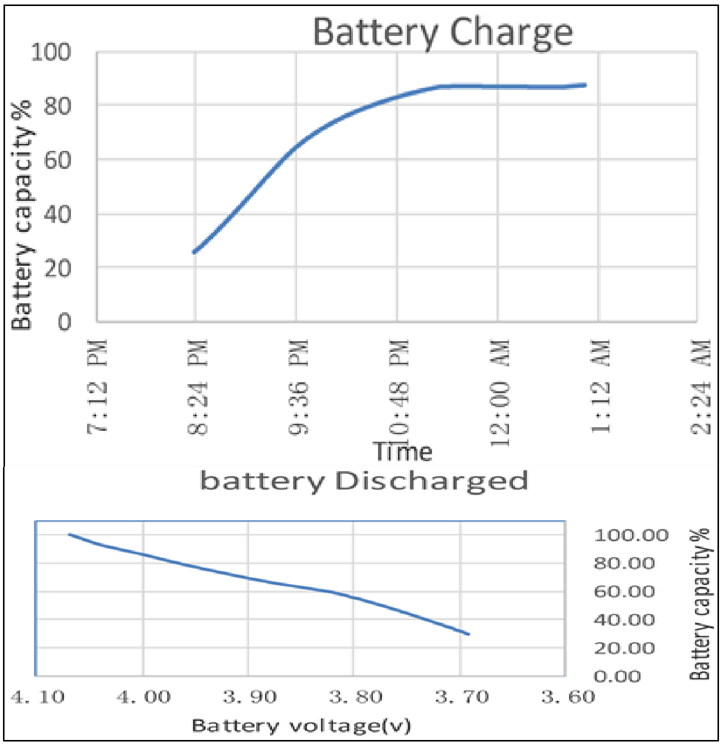

Fig 4. The voltage and time curve of the battery's charge and discharge.

IV. CONCLUSION

The Electromagnetic Braking System certainly has a bright future ahead of it, especially if there is an increase in the funds allocated to research and development. If sensors with a high sensing range and high accuracy are provided, then it is possible to achieve even faster and more accurate braking. The large vehicle's skidding can be managed more readily and effectively; this is a significant improvement. In nations where advanced road infrastructure is available, these brakes are of great assistance because they come with additional characteristics such as regenerative braking and a great deal of other functions. This technique is easily adaptable to upcoming electric vehicles.

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