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IOT BASED BATTERY MONITORING SYSTEM

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ABSTRACT:

The primary goal of incorporating IoT technology into a battery monitoring system is to increase battery efficiency, real-time monitoring, improved safety, remote management, and environmental sustainability. This Battery Management System (BMS) tries to identify the release of these gases from the battery when it is overcharged and monitors the battery's other fundamental properties such as voltage, current, and temperature via sensors. Furthermore, these numbers are shown on the Cloud, introducing the concept of the Internet of Things (IoT). This assignment suggests the use of IoT technology to monitor device performance, allowing for direct monitoring.

INTRODUCTION

The State of Charge (SoC) and State of Health (SoH) of the battery are measures of the amount of charge that the battery can store, or in other words, the degree of charge and health that the battery now has. There are several techniques for measuring the battery's SoC parameter. All of these measures have downsides. If the percentage is accurately determined, there is no risk of overcharging the battery, which can harm its health and shorten its lifespan. However, because they all have limitations, the battery may be overcharged in some instances. In the case of automobile batteries, the alternators will also feature an inbuilt voltage regulator that can give consistent

Overheating a battery reduces its performance, which in turn reduces its lifespan. Overheating produces a variety of gases, which increases the amount of gases in the environment. The previous battery monitoring system just monitored and detected the battery's state, alerting the user via a battery indicator within the car. Due to advancements in notification system design, internet of things (IoT) technology may be utilised to alert the manufacturer and users about the battery state.

RELATED WORK

1.1. Technology Based on Wireless Communication

Wireless communication is a sort of data transmission that is carried out and supplied wirelessly. This is a wide phrase that refers to any processes and methods for connecting and communicating between two or more devices utilising a wireless signal via wireless communication technologies and equipment. Previous work has employed a variety of technologies for wireless battery monitoring systems, including Node MCU ESP2866, GSM, GPRS, Android, WIFI, and Bluetooth connectivity.

1.2. Technology Based on Wireless Battery Monitoring System

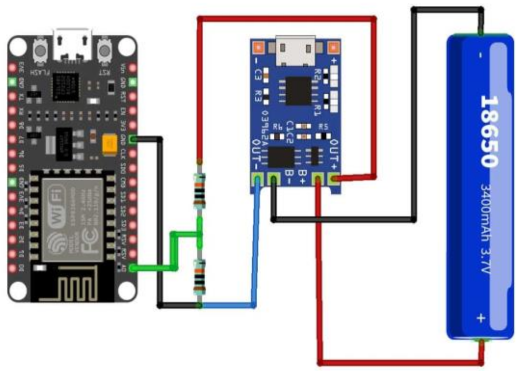
Reliable battery management is required for safety reasons. Battery failure can occur due to a variety of factors, including battery degradation and design faults. Manual battery monitoring systems, like standard battery monitoring systems, do not save data to a database. However, only real-time data should be shown. As a result, it is critical to remotely monitor battery systems utilising wireless technology. Various battery monitoring systems employing wireless communication have been created for the industry, such as uninterruptible power supply (UPS), which is crucial to assure continuity of power supply for home and commercial during power outages.

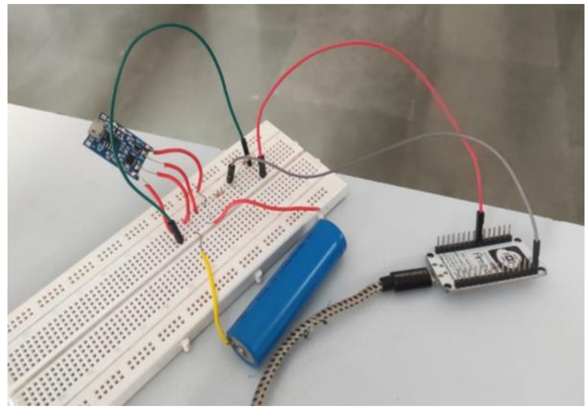
METHODOLOGY

A. Components The components used in this project are:

1. Node MCU ESP8266 Wi-Fi Module.
2. A lithium ion battery.
3. TP-4056 Charging Module
4. Micro-USB cables.

B. Circuit Schematics and Design We created a circuit to show data over the cloud using the Node MCU ESP8266 module. Here is a screenshot of the circuit.





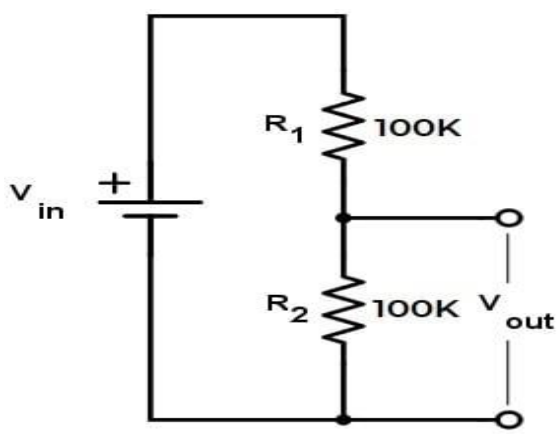
Calculating Battery Voltage

Because the NodeMCU analog pin can only handle 3.3v, we must first create arrangements to convert high input voltages inside the range of the NodeMCU analogue pin, and then write code to compute the actual voltage being monitored.

Voltage divider circuits are now used to convert voltage. The voltage divider reduces the voltage detected within the range of the NodeMCU's analogue input, which is 3.3v. We must determine the values of the circuit's needed resistors. The maximum input voltage is determined by the resistor values used. So I chose R1=100k and R2=100k (these are the written numbers, but the actual values may change; first measure the actual value using a multimeter, then use these values for future calculations).

Vout (A0) = (VIN*R1) / (R1+R2)Max

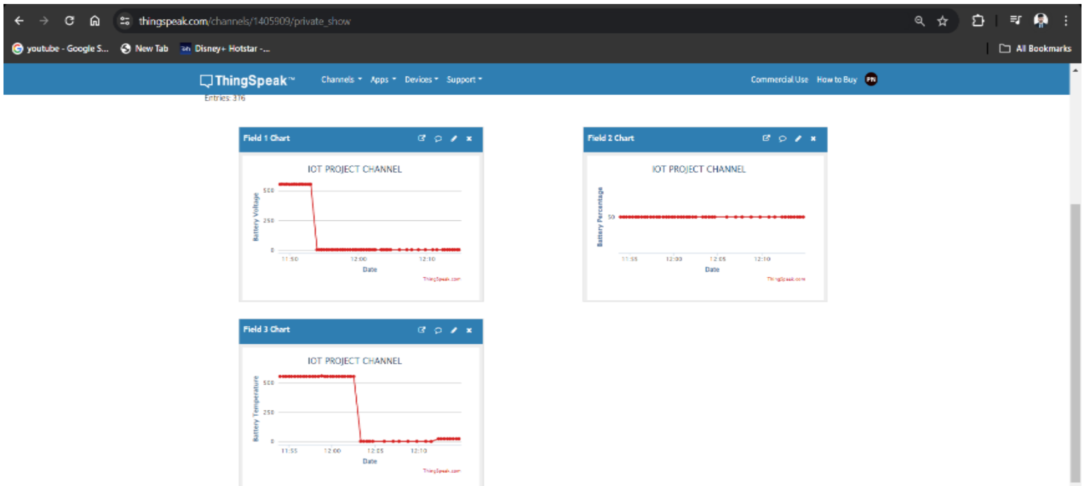
Vin = Vout*(R1+R2) / R1




```
float voltage = (((val * 3.3) / 1024) * 2 + calibration); //multiply by two as voltage divider network is 100K & 100K Resistor
float bat_percentage = map(voltage, 2.8, 4.2, 0, 100);
float temp = ((val*13) * 3.3) / 1024.0;
```

RESULTS AND DISCUSSIONS

As we all know, the battery is the most important component in any system or gadget since it runs everything. As a result, we must constantly monitor the battery's voltage. We are all aware that incorrect charging and draining of a battery can result in battery damage or system failure. The majority of electrical and electronic equipment feature a Battery Monitoring System (BMS). Actually, the BMS (Battery Monitoring System) checks all of the battery's attributes, such as voltage, current, temperature, and percentage. In this project, we created a Battery Monitoring System with ESP8266 and Arduino IoT Cloud. This method allows us to check battery voltage and %. As a result, this technology is ideal for monitoring battery charging and draining status remotely.



FUTURE SCOPE

We intend to integrate thermal management protection shortly. Although lithium-ion cells appear to have a wide temperature range, at low temperatures, chemical reaction rates reduce dramatically, reducing overall battery capacity. They outperform lead-acid or NiMh batteries in terms of low-temperature capabilities, although temperature management is essential since charging below 0 °C (32 °F) is physically problematic. When charged at temperatures below freezing, the anode may develop metallic lithium plating. As a result of this permanent damage, the cells' capacity is reduced, and they are more susceptible to failure under stressful conditions such as vibration. To manage the temperature of the battery pack via heating and cooling.

CONCLUSION

The major issue of a BMS is functional safety. During charging and discharging activities, it is critical that the voltage, current, and temperature of each cell or module under supervisory control do not exceed the prescribed SOA limits. Long-term limit violations can degrade a battery pack, which can be costly and generate dangerous thermal runaway scenarios. Furthermore, lower voltage threshold limits are thoroughly examined for functional safety and lithium-ion battery protection. If the Li-ion battery remains in this low-voltage condition, copper dendrites may form on the anode, potentially leading to increased self-discharge rates and safety hazards. The incredible energy density of lithium-ion systems comes at a high cost, leaving little room for mistakes in battery management. This is one of the most successful and trustworthy.

ACKNOWLEDGMENT

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