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IOT-BASED BATTERY MANAGEMENT SYSTEM INELECTRIC VEHICLES

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ABSTRACT:

We can check battery voltage and Percentages in electric vehicles using this system anywhere in the world. As we all know, the battery is the most important component in any system or product because it powers the overall structure. As a result, we must monitor the battery's voltage level. We are all aware that an inefficient charging and discharging mechanism might result in battery damage or system failure. The majority of electrical/electronic equipment has a Battery Management System (BMS). The BMS monitorsall of the battery's attributes such as voltage, current, temperature, and the auto cut-off mechanism. To guarantee the proper handling and storage of Lithium-Ion or Lithium Polymerbatteries in the vehicles.

The BMS can monitor the current battery state as well as alert the user through a battery indicator. However, in this research, we employed Internet of Things (IOT) technology to remotely inform consumers. We may now automatically inform users thanks to the utilizationof the Internet of Things. From anywhere in the globe, the user may check the battery status ontheir smartphone as well as computer dashboard. The Node MCU ESP8266 board will be usedin an IOT-based Battery Monitoring Program to deliver battery status information to the Arduino IOT cloud. In both charging and discharging scenarios, the IOT Cloud Panel provides the voltage level and the battery percentage. These all processes are carried out with the help of software.

KEYWORDS: IOT, Battery Management system, battery, user interface, Electric vehicles

INTRODUCTION

Due to rising fuel prices, electric vehicles (EVs) are becoming increasingly popular these days. For environmentally friendly mobility, electric vehicles rely on batteries. Lithium chemistry is currently widely recognized as the primary power storage technique for electrifiedmobility. Most electric vehicles (EVs) use lithium-ion batteries, which are rechargeable. Whencompared to lead acid, it is smaller. In contrast to a lead acid battery, it offers a steady power source and a life cycle that is 6 to 10 times longer. The life cycle of lithium-ion batteries can be shortened for a variety of reasons, including overcharging and deep discharges. The safety of current battery technology is now a key factor that restricts the use of EVs. For instance, overcharging a battery may result in serious safety incidents like fire in addition to significantly reducing the battery's lifespan. To avoid the difficulties, an EV battery monitoring system thatcan alert the user to the battery's condition is required. The networking of everyday gadgets isknown as the Internet of Things (IoT). It serves as a wireless electrical connection between everyday items. The interface establishes a Wi-Fi connection between electrical device codes,detectors, and devices. IoT technology can be utilized to alert the manufacturer and users aboutthe battery's condition. The proposed design and development of a battery monitoring system using IoT technology is motivated by the challenges mentioned above.

BATTERY MANAGEMENT SYSTEM(BMS)

A battery pack is an assembly of battery cells that are electrically organized in a row bycolumn matrix to enable the delivery of a targeted range of voltage and current for some time against anticipated load scenarios. A battery management system (BMS) is technology solely dedicated to

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the supervision of a battery pack. Battery management systems (BMS) continuously improve battery performance, monitor batteries, protect batteries, estimate batteries' operational states, and report operational status to external devices.

Monitor Battery Level Esp8266 And Blynk Iot

For demonstration, we will build an IoT weather station using DHT22 Temperature& Humidity sensor, ESP8266 development board, and Blynk IoT Cloud for remote monitoring. The sample design for this system is powered by a single 3.7V lithium-ion battery.This battery can power node MCU boards for around 10 hours. We need to charge the batteryagain using the TP4056 charging module. But sometimes I forget to charge and the whole system is down. So, to address this issue, I considered installing a battery monitoring device. In the battery status monitoring system we can only monitor battery voltage and percentage. But now with the help of the Blynk IoT, we can directly notify the users remotely when the battery percentage is below a threshold value. We can check the Temperature & Humidity sensor data along with the battery voltage and battery percentage in both the charging and discharging case on their smartphones or Computer dashboards from anywhere in the world.

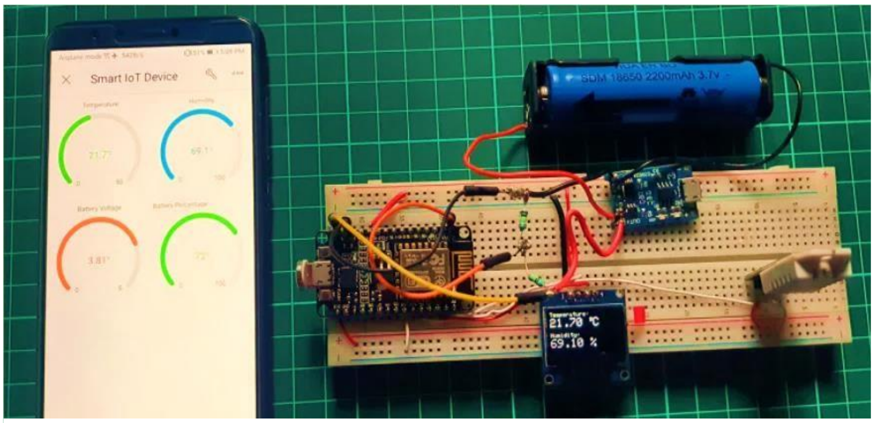

Figure 1: Prototype sample model of the battery management system

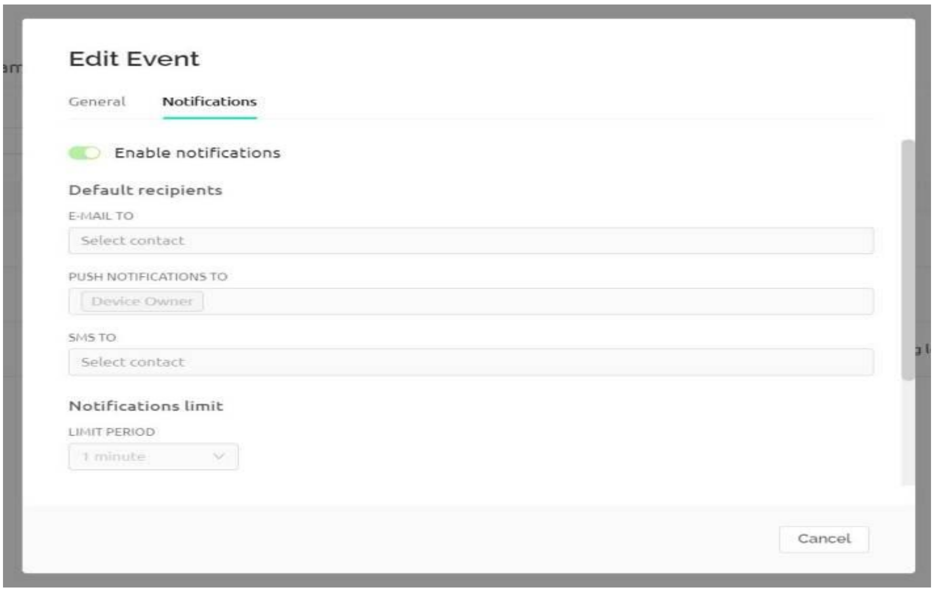

Figure 2:user interfacing details -entering the area in the BLYNK IOT

BATTERIES IN EV

Some of the batteries that are best suited for an electric vehicle are

- Lithium-Ion Batteries
- Lead acid batteries
- Nickel Metal Hydride Batteries
- Ultracapacitors

Lithium-Ion Batteries

Lithium-ion batteries are typically used in classic electric vehicles. Since lithium-ion batteries have a high energy density per mass (125–600+ Wh/L), more energy may be transferred or stored with the same amount of volume. A greater range is also made possible by a high energy density, which reduces the frequency of charging for the consumer. These batteries are one of the most effective in this group of EV batteries due to their high power-to-weight ratio, high energy efficiency, strong high-temperature performance, and minimal self- discharge. The majority of lithium-ion batteries have an efficiency of 95 percent or higher, meaning that 95 percent or more of the energy they store is used. Battery recycling has the drawback of being expensive due to material recovery costs. The main drawbacks of lithium- ion batteries are their expensive price, which is reasonable given the quality and efficiency theyoffer, and overheating.

Lead Acid Batteries

The efficiency of lead acid batteries is between 80 and 85 percent. Although not always,lead acid batteries are noted for their affordability and ability to deliver great power, safety, and dependability. It takes more than 10 hours to fully charge a lead-acid battery. Because theyare massive, heavy, and take up more room, lead acid batteries are perfect for large-scale stationary applications where space is at a premium and energy needs are minimal. They are utilized in commercially available electric-drive cars for secondary/ancillary loads. Lead-acidbatteries are significantly less energy-efficient and significantly more expensive than Lithium-ion batteries.

Nickel Metal Hydride Batteries

They provide good specific energy and specific power abilities, nickel metal hydride batteries are frequently used in computers, medical equipment, and hybrid electric vehicles. The Nickel Cadmium batteries were replaced with this Nickel Metal Hydride battery to addressthe toxicity issue. These nickel metal hybrid batteries are more fragile and challenging to charge than Ni-Cd batteries, nevertheless. These batteries have a substantially longer life cyclethan lead-acid batteries.

Ultracapacitors

Between an electrode and an electrolyte, a (polarised) liquid serves as the energy storage medium in ultracapacitors, also referred to as supercapacitors. The more surface area aliquid has, the more energy it can hold. They are fantastic energy storage technologies, with ahigh capacitance that can reach hundreds of farads. They have a lower energy capacity than batteries of comparable size, but they discharge their energy considerably more quickly because there is no chemical reaction involved. For this reason, they are used to quickly charging electric vehicles as they go from one place to another. Additionally, ultracapacitors can boost power during acceleration and uphill travel while also aiding in brake energy recovery. Compared to regular batteries, ultracapacitors have a substantially longer lifespan.Nomatter how amazing these powered-up capacitors are, they cannot, without leveling up, replacethe batteries in electric vehicles. Bulky batteries in electric car models of the future are probablygoing to be replaced with ultracapacitors.

METHODOLOGY

We will create a system to keep track of the DHT22's temperature and humidity as wellas the battery's voltage and the status during charging and discharging. We use NodeMCU, a microcontroller equipped with an ESP8266 wifi chip. A smaller board like the Wemos D1 Minican also

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be used. This WiFi chip can join a WiFi network and frequently upload data to a server. The D4 pin of the NodeMCU is linked to the Out pin of the DHT22 sensor. D1 and D2pins are linked to SCL and SDA pins, respectively. Whereas the 3.3V and GND pins are linkedto the VCC and GND of the DHT22 sensor and the OLED, respectively.

The TP4056 module works well for battery management applications, thus you can useit to charge the battery. Only 3.3V can be used as the input analog voltage for the ESP8266 chip. However, the battery voltage can reach 4.2V. So, to reduce the input voltage, we must create a voltage divider network.

CIRCUIT DIAGRAM

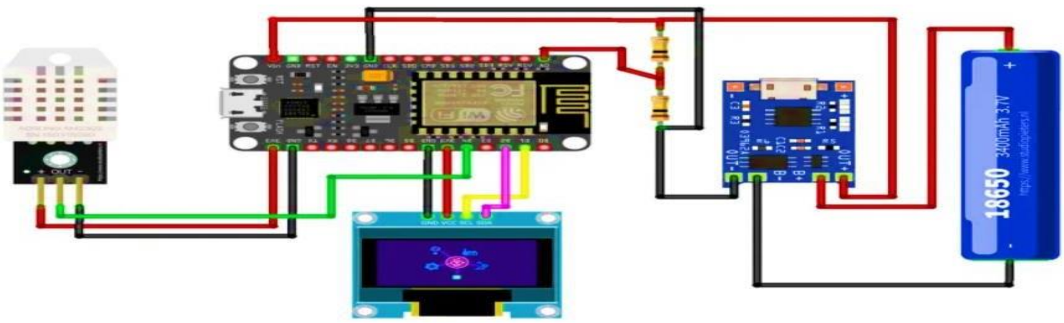
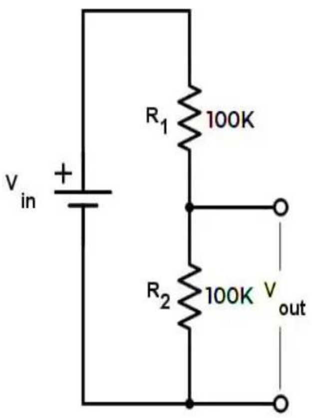


Figure 3: circuit diagram of the designed model

Voltage Divider Network Calculations



The battery has a 4.2V maximum voltage and a 2.8V cut-off voltage. The ESP8266 Analog Pin can readily support any voltage lower than 3.3V. First, we need to lower the voltagelevel. There are two 100K resistors and a 4.2V supply voltage. This will result in a 2.1V output.The same voltage divider network is also used to reduce the minimum voltage, which is 2.8V as a cut-off voltage and steps down to 1.4V. As a result, the ESP8266 Analog Pin supports boththe upper and lower voltage. The project is assembled in its entirety here. The circuit diagram'sconnection is the same as this one. You can also use a lithium-ion battery of any capacity for testing. For instance, I am using a battery with a 2200mAh capacity.

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Cell voltage charge	Charging temperature	Cell voltage discharge	Discharging temperature
3.3v	20°C	3.7v	23°C
3.5v	23°C	3.6v	24°C
3.6v	25°C	3.5v	26°C
3.7v	28°C	3.3v	30°C

Figure 4:Output calculated of the designed system

We can see that the temperature is raised when charging and that there is a slight temperature rise whenever the batteries are charged above 80%. In the discharging graph, the data is exactly the opposite: as the batteries deplete, the temperature rises.

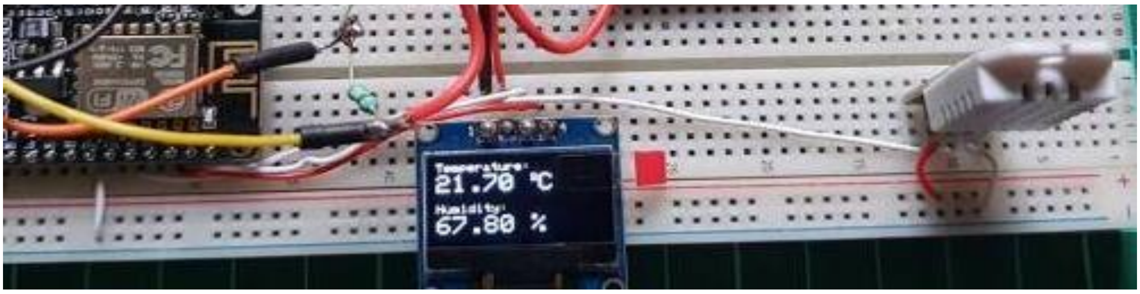

Figure 5: output displayed from the designed module

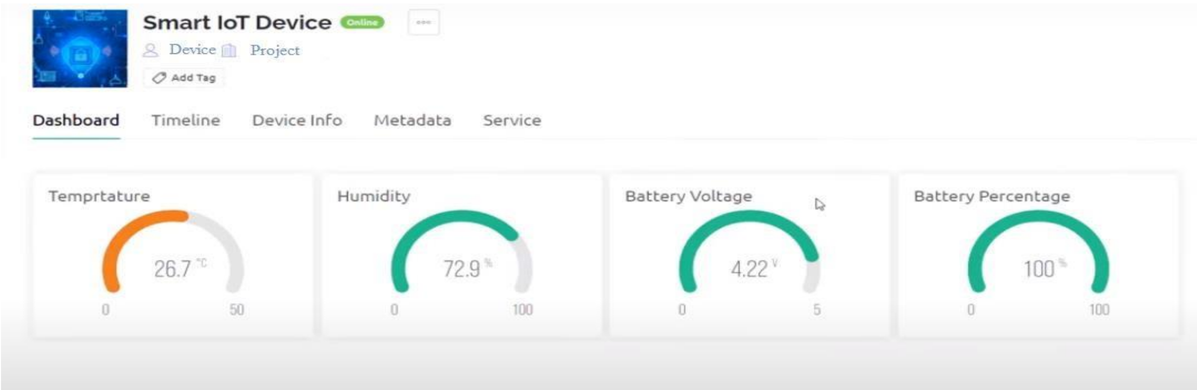

Figure 6: Data received in the BLYNK IOT SITE

Source Code For Temperature And Humidity

```
float voltage;
int bat_percentage;
int analogInPin  = A0;    // Analog input pin
int sensorValue;
float calibration = 0.40; // Check Battery voltage using multimeter & add/subtract the value
```

Figure 7: code battery voltage inputs

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```
    //Print data on serial monitor
  Serial.print("Temperature: ");
  Serial.print(t);
  Serial.println(" *C");

  Serial.print("Humidity: ");
  Serial.print(h);
  Serial.println(" %");

  Serial.print("Analog Value = ");
  Serial.println(sensorValue);
  Serial.print("Output Voltage = ");
  Serial.println(voltage);
  Serial.print("Battery Percentage = ");
  Serial.println(bat_percentage);

  Serial.println();
  Serial.println("****************************");
  Serial.println();
  delay(1000);
```

Figure 8: Output printing statements

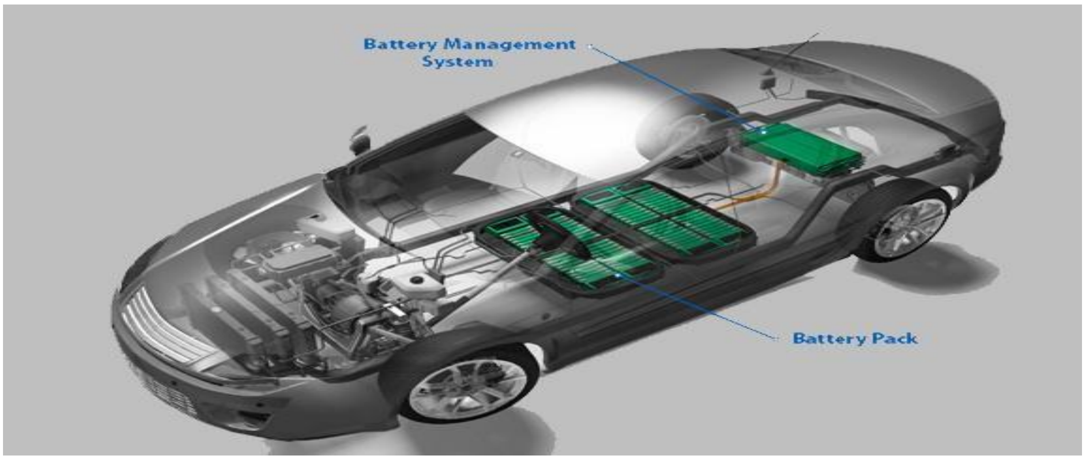

Figure 9: the image of BMS in the EV

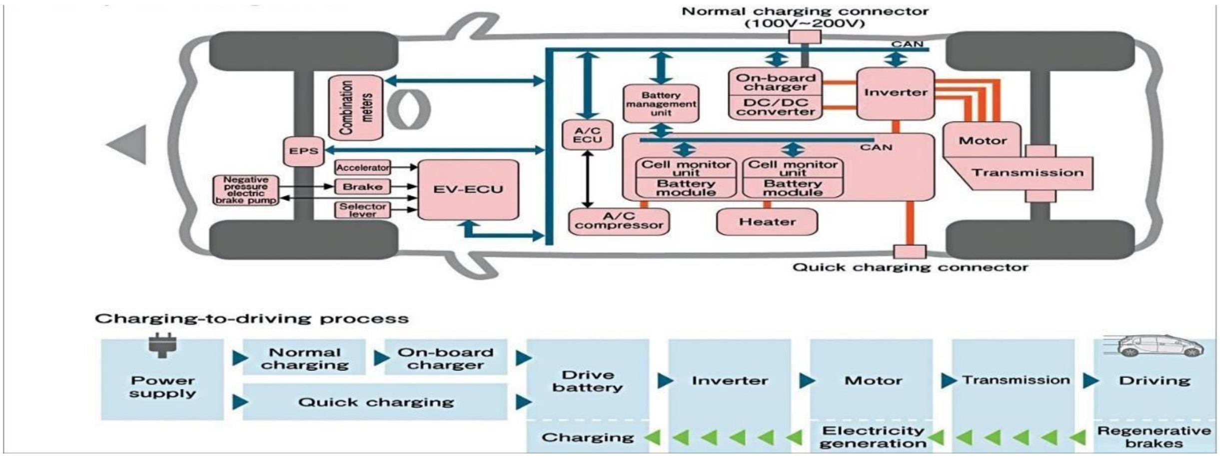

Figure 10:Overall configuration in the EV.

CONCLUSION:

This battery management system is applicable for Electric and Hybrid Electric Vehicles, Applicable for fuel cell and Ultracapacitor based systems, Applicable Energy Storage Systems, Applicable Agricultural, and Off-Road vehicles, and Applicable to Unmanned aerial vehicles

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(Drones). This is model single battery model, this can be implemented in electric vehicles, in which a group of batteries will be present, charging and discharging occurs, the discharging will be occurring in the battery soon when the temperature in the battery increases,so we needed to cool down the temperature, so coolant needs to be there in the EV. The SOC and SOH are considered to be important factors in the BMS. If this system is implemented inEV means, it will increase the lifespan of the battery used in all segments of EV.

REFERENCE:

1. https://theiotprojects.com/esp8266-monitor-its-own-battery-level-using-iot, the iot projects.
2. https://www.synopsys.com/glossary/what-is-a-battery-management-system.html, synopsys.
3. Bharath s.h, nithin reddy, Dinesh, ram gopal, iot based battery monitoring system for ev, vol.12 no.13,turkisk journal of computer and mathematics education.
4. Electronics projects Filed Under Electronic Projects
https://www.engineersgarage.com/nodemcu-battery-voltage-monitor/