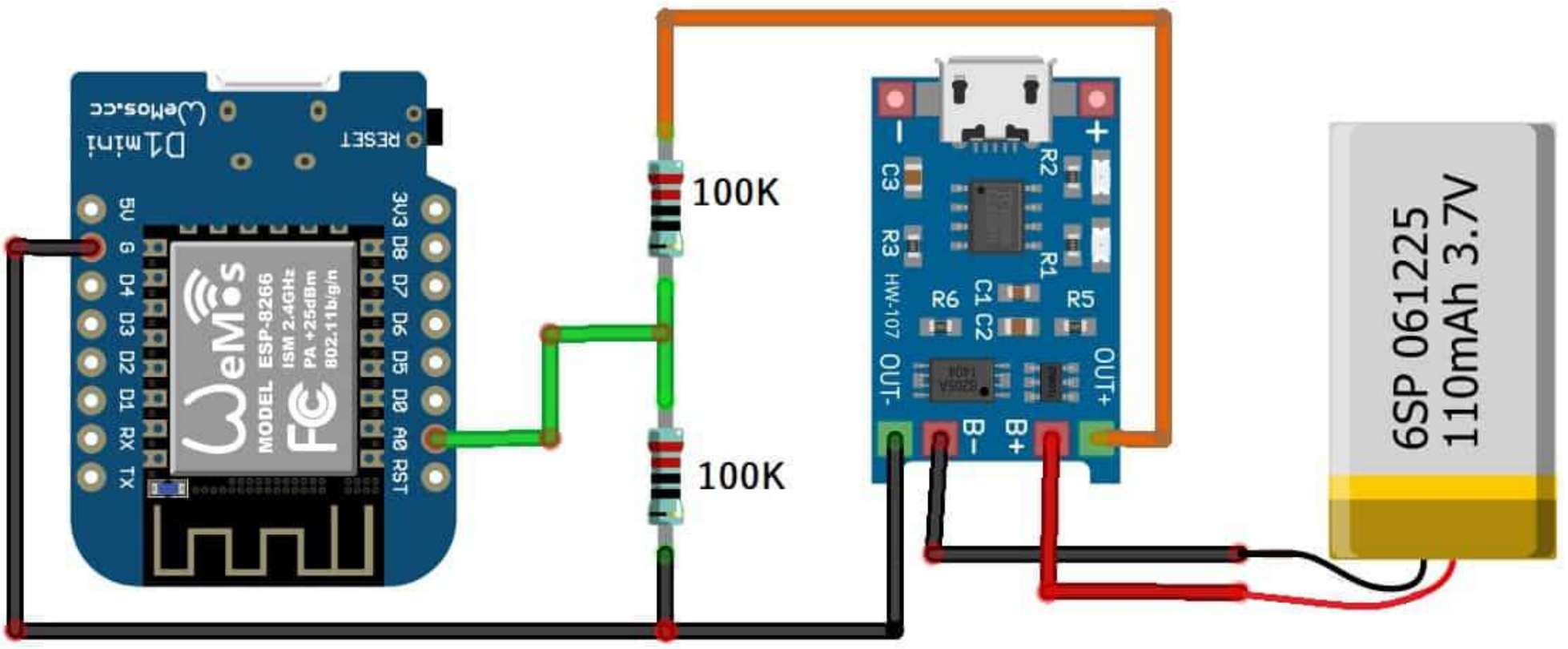
IoT Based Battery Status Monitoring System using ESP8266:



Overview:

We will build an **IoT based Battery Monitoring System** using ESP8266 where you can monitor the **battery charging/discharging** status along with **Battery Voltage** & **Percentage**.

As we know, the battery is the most important component for any device as it powers the entire system. So, it is important to monitor the **voltage level of the battery** as improper or excess charging/discharging may lead to damage to the Battery or System Failure. Most of the **electrical/electronic devices** has a separate system called **Battery Management System (BMS)**. The BMS monitors all the properties of the battery like the **voltage, current, temperature** & **auto cut-off system**. This ensures the safety and proper handling of **Lithium-Ion** or **Lithium Polymer** batteries.

Earlier BMS only monitors the condition of the battery and alarms the user via a **battery indicator**. But now due to the use of the **Internet of Things**, we can directly notify the users remotely. They can check the battery status on their smartphones or Computer dashboards from anywhere in the world.

In this **IoT-based Battery Monitoring System**, we will use **Wemos D1 Mini** with **ESP8266 Chip** to send the battery status data to **ThingSpeak cloud**. The Thingspeak will display the battery voltage along with the battery percentage in both the charging and discharging cases. A very precise version of this project can be checked at **DIY LiPo Charger with IoT Battery Voltage Monitor**, as this contains a

customized PCB board. In case you wanna monitor a Lead-Acid Battery, you can check 12V Battery Monitoring System project.

Lithium-Ion Batteries:

A **lithium-ion** battery or **Li-ion** battery is a type of **rechargeable battery**. Lithium-ion batteries are commonly used for portable electronics and electric vehicles.

In this battery, lithium ions move from the **negative electrode** through an electrolyte to the **positive electrode** during discharge, and back when charging. Li-ion batteries use an intercalated lithium compound as the material at the positive electrode and typically **graphite** at the negative electrode. The batteries have a high energy density, no memory effect and low self-discharge.

Nominal, Maximum & Cut-off Voltage:

I've been using several Lithium-Ion batteries for quite some time across multiple projects. Some of these batteries come with an attached Battery Management System Circuit, providing over-voltage protection, balanced charging, and short-circuit protection.

Typically, Lithium-Ion batteries have a nominal voltage of 3.7V. When fully charged, their maximum voltage can reach up to 4.2±0.5V. Manufacturer datasheets usually state the cut-off voltage to be around 3V, though this can vary based on the battery type and its specific applications. The battery I frequently use has a discharge cut-off voltage of 2.8V. However, there are also batteries available with a cut-off voltage as low as 2.5V.

Circuit & Schematic Designing

We will design a system to monitor this battery voltage along with charging and discharging status. For the microcontroller, we use **Wemos D1 Mini** which has an **ESP8266** Wi-Fi-enabled chip. You can also use the NodeMCU ESP8266 **ESP8266 Board**. This Wi-Fi chip can connect to the WiFi network and uploads the data regularly to the server.

You can use the **TP4056** module to charge the battery as its best suited for Battery Management Applications. The MCP73831 IC can also be used instead of TP4056.

The ESP8266 Chip can only support the input analog voltage of **3.3V**. But Battery voltage goes up to **4.2V**. Hence we have to form a voltage divider network to lower down the input voltage.

Voltage Divider Network Calculations:

The Battery Maximum voltage is 4.2V and the cut of voltage is 2.8V. Anything lesser than 3.3V will be easily supported by ESP8266 Analog Pin.

We have to first step down the upper voltage level. The **source voltage** is **4.2V** and there is a pair of **100K resistors**. This will give an output of **2.1V**. Similarly, the **minimum voltage** is **2.8V** as a cutoff voltage which steps down to 1.4V using the same voltage divider network. Hence, both the upper and lower voltage is supported by **ESP8266 Analog Pin**.