

Build

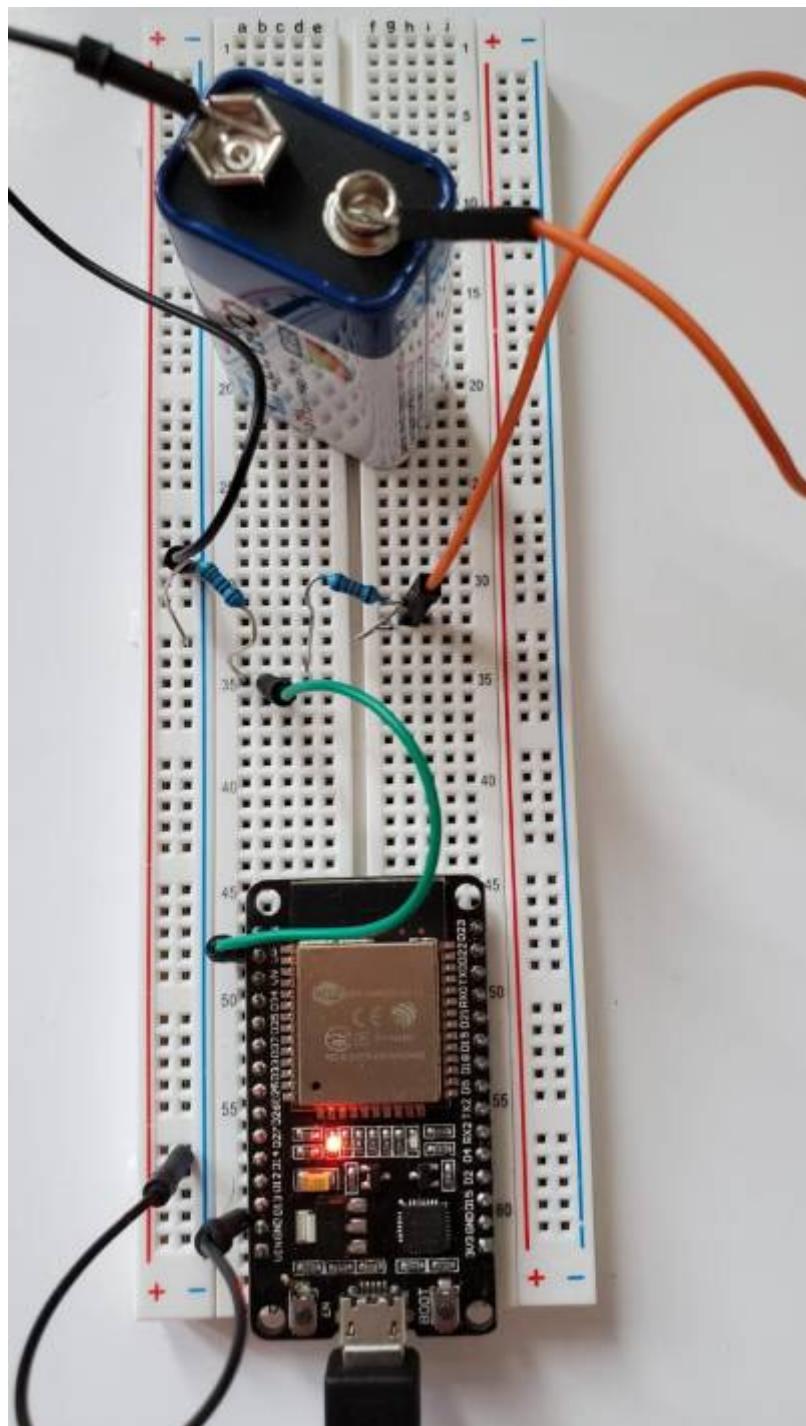


figure 5.1 Setup showing the connections for battery voltage reading on ESP32

Schematics

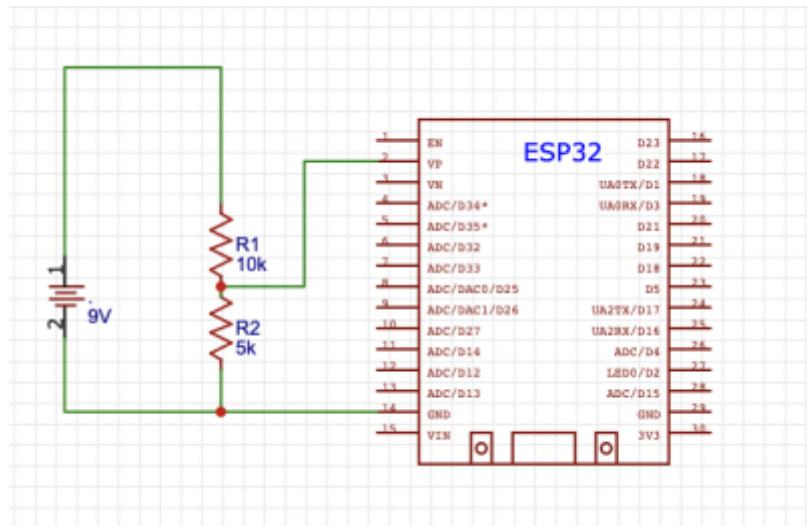


figure 5.2 Schematic for battery voltage reading

Code & Description

```


$$\text{Voltage} = \frac{\text{potValue}}{4095} \times 3.3$$


$$\text{Battery Percent} = \frac{\text{Voltage}}{2.73} \times 100$$


```

/*Reading of voltage is done by the Analog Pin reader.
 /*Because the max input voltage on the pins is 3.3 V we cant directly read
 the 9V battery voltage.

```

int potPin = A0;           // Analog pin has to be ADC 1, because ADC 2 are  

used by wifi and wont work
int potValue;
float voltage = 0;          // float because its a decimal number not integer
float battery_percent;

void setup() {

  Serial.begin(115200);

  {

    potValue = analogRead(potPin);
    float voltage = (3.3/4095.0) * potValue * 2.73;

    /*Resistors and other components can have a varying number of outputs,  

  although they are usually minimal
  /*additional calibration has to be done in order to get accurate readings
  /*We have found that the use of a multimeter will help in determining the  

  values that will provide best outcomes
  /*Because we have different boards, resistors and setups, the final code  

  could have alterations in the calibrating numbers

  Serial.print("potValue:");
  Serial.print(potValue);
}

```

```
*//While the serial monitor output can be changed, we are more interested is
in the overall result which is transmitted
*//to Grafana for easy access

Serial.print(" Voltage:");
Serial.print(voltage);
Serial.println("V");

battery_percent = mapfloat(voltage, 3.0, 9.0, 0, 100); // min value cut
off at 6V and maximum voltage is 9V

if (battery_percent > 100)
{
    battery_percent = 100;
}
if (battery_percent < 0)
{
    battery_percent = 0;
}

*//For the conversion between the actual Analog reading to a percentage we
use a mapFloat function
*//It uses the input range from the analog sensor to produce another set of
useful values
*//float values will allows to get decimal numbers and a more accurate
reading
*//We use a the min voltage value, then max voltage value, and min
percentage and max percentage
*//Then we ask the program to give us the corresponding percentage value
within the parameters

Serial.print("Battery Percentage = ");
Serial.println(battery_percent);

if (voltage > 7.0 && voltage < 8.2) // THIS VALUES HAVE TO
CHANGE ACCORDING TO SOURCE
    {Serial.print("Low bat"); // USE VOLTMETER TO FIND
    THE ACCURATE VOLTAGE
    }
    if (voltage < 6.5) //cut-off value is at 5.4V
according to specification , we use 6V
    {Serial.print("Replace Battery");
```

```

}

delay(1000);

/*We have included a notification that will tell us what is going on with
the voltage and overall battery status
/*We include a parameter that will produce 2 warning signs:
/* LOW BAT means that our battery is within 7 to 8.2V
/* REPLACE BATTERY means voltage has dropped below 6.5V, number obtained
from data sheet

}

}

float mapfloat(float x, float in_min, float in_max, float out_min, float
out_max)
{
    return (x - in_min) * (out_max - out_min) / (in_max - in_min) + out_min;
}

/*here we include the parameters and equation that will serve as the
backbone for the mapFloat function above.

void loop()
{
}

/* NO LOOP NEEDED,,, ONE VALUE WITH WARNING SHOULD BE DISPLAYED ON GRAFANA

```

Issues & Characteristics

The actual voltage will not be 100% accurate because the ADC pins have a non-linear behavior. This means according to the Figure # down below that, above a certain threshold the reading will produce equal inputs, thus we consider that from 3 to 3.3V the battery is at a 100% charge.

Additionally we can see that the discharge behavior of the battery we are using, which is a model 6F22 is a curve that has a specific equation, we could find the curve's equation and use it to better represent the discharge values, however since we plan to upgrade our battery system we purposely used a simpler version in our code to achieve good enough results.

■ Typical Discharge Curve

6F22

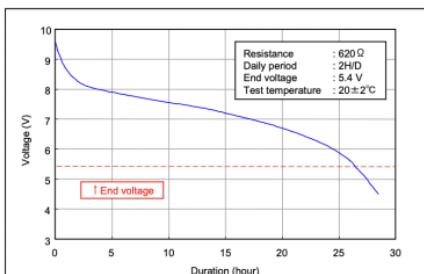
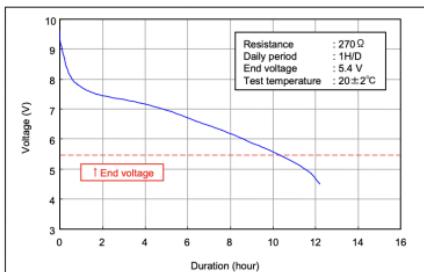


figure 5.3 Graph depicting battery discharge for battery model 6F22 9v
Source:https://www mega-piles com/im/PANASONIC-6F22-9V-CARBONE-ZINC_550 pdf

figure 5.4 Graph depicting ADC voltage VS reading behavior for ESP32 micro controller.
Source:<https://microcontrollerslab com/adc-esp32-measuring-voltage-example/>

Results

```

FFL0f ZF = 04FF
SF SpotValue:0 Voltage:0.00V
Battery Percentage = 0.00
Replace Battery
ets Jun 8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1344
load:0x40078000,len:13516
load:0x40080400,len:3604
entry 0x400805f0
potValue:2566 Voltage:5.65V
Battery Percentage = 44.09
Replace Battery
ets Jun 8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1344
load:0x40078000,len:13516
load:0x40080400,len:3604
entry 0x400805f0
potValue:0 Voltage:0.00V
Battery Percentage = 0.00
Replace Battery
ets Jun 8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1344
load:0x40078000,len:13516
load:0x40080400,len:3604
entry 0x400805f0
potValue:2557 Voltage:5.63V
Battery Percentage = 43.76
Replace Battery

```

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