# CHAPTER 5

# IMPLEMENTATION AND TESTING

## 5.1 Implementation

This project is using arduino IDE application software. This application is used to compile programs. Can be seen program below:

First, arduino program connect to wifi. After that, the arduino ask IP to router and the arduino will display the IP address. And then, the arduino connection status will read the sensors one by one and send data to the IoT thingspeak server.

```
char namawifi[] = "Android";
char sandi[] = "Qwerty123";
WiFi.begin(namawifi, sandi);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
```

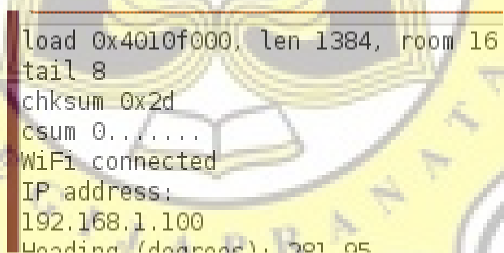


Illustration 5.1: Wifi connection status

The next step of this program is arduino will detect the existing sensor. Detection of the speed sensor if the rotating blades will get the RPM value in turn. For now it will run if there is a rotating generator and some will load it will be detected.

```
int encoder_pin = D8;
unsigned int rpm;
volatile unsigned int pulsa;
unsigned long waktu=0;
```

```
unsigned int hole = 20;
attachInterrupt(kecepatan_pin, jumlh, FALLING);
rpm = (60000 / hole )/ (millis() - waktu)* pulses;
waktu = millis();
pulsa = 0
void jumlh()
 {

   pulsa++;
 }
```

For the voltage and current measured from the generator when loaded will be detected.

```
#include <Adafruit_INA219.h>
float current_mA = 0;
current_mA = sensorArus.getCurrent_mA();
int adc = analogRead(A0);
tegangan= (adc*3.2/1023.0)*2.2;
```

After that, the compass sensor will be read every time following the wind direction and then show the name of the wind direction consisting of north, south, west, east. The data transmitted by the sensor will be taken to the IoT server sensor within 15 seconds.

```
#include <Adafruit_Sensor.h>
#include <Adafruit_HMC5883_U.h>
void sensorKompas(){
sensors_event_t event;
g.getEvent(&event)
float directionSensor =
atan2(event.magnet.y, event.magnet.x);
float deklaraasiSudut = 0.22;
directionSensor += deklaraasiSudut;
if (directionSensor < 0)directionSensor += 2 * PI;
dif (directionSensor> 2 * PI)
directionSensor -= 2 * PI;
derajat = directionSensor * 180 / M_PI;
```

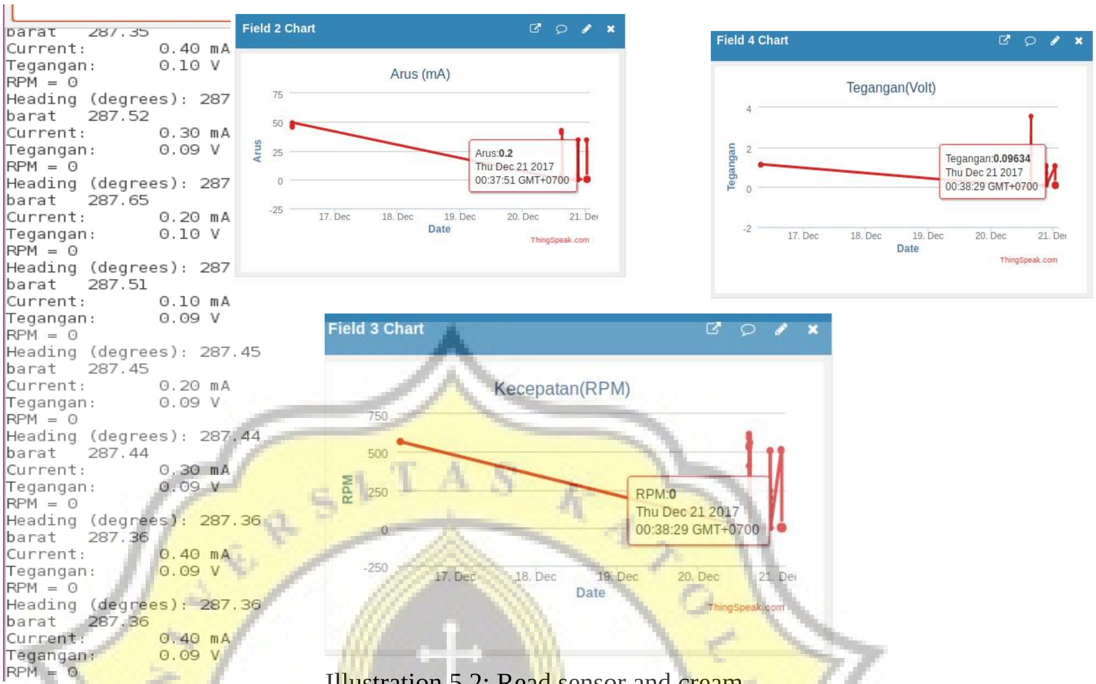


Illustration 5.2: Read sensor and cream thingSpeak

## 5.2 Testing

In the test below is to test how the experimental process on charging the battery that is switched from when the condition where the fan is turned on the indicator is on, the test where the current required for charging, then the highest current measurement test and the battery charging process empty until full condition.

The illustration below was not in the charging powerbank indicator powerbank off. Current display, voltage and RPM indicated zero (0). And the compass which only functions to read degrees and wind direction.

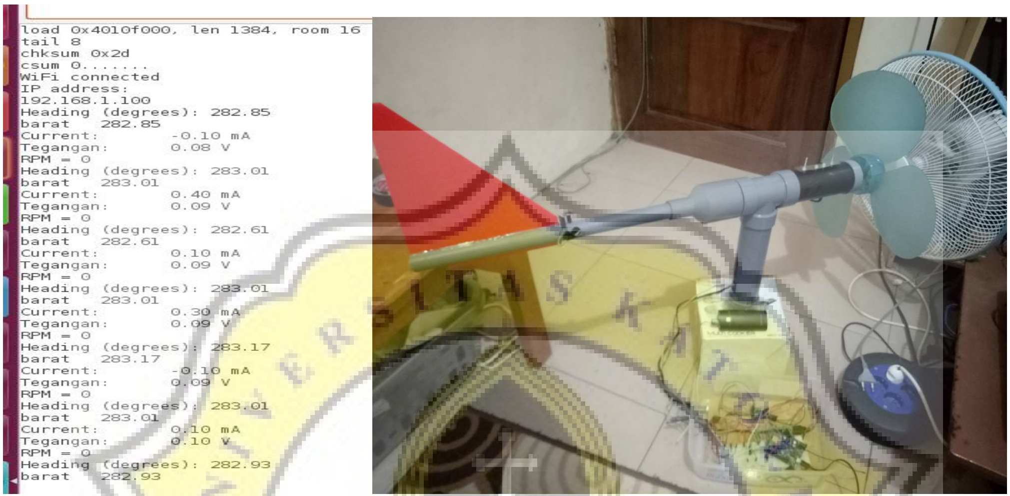


Illustration 5.3: The propeller is not spinning and there is no charging

Rotating the propellers and charging the power bank indicator will light up. The display below reads the current coming into the powerbank and the voltage of the DC generator along with the RPM.

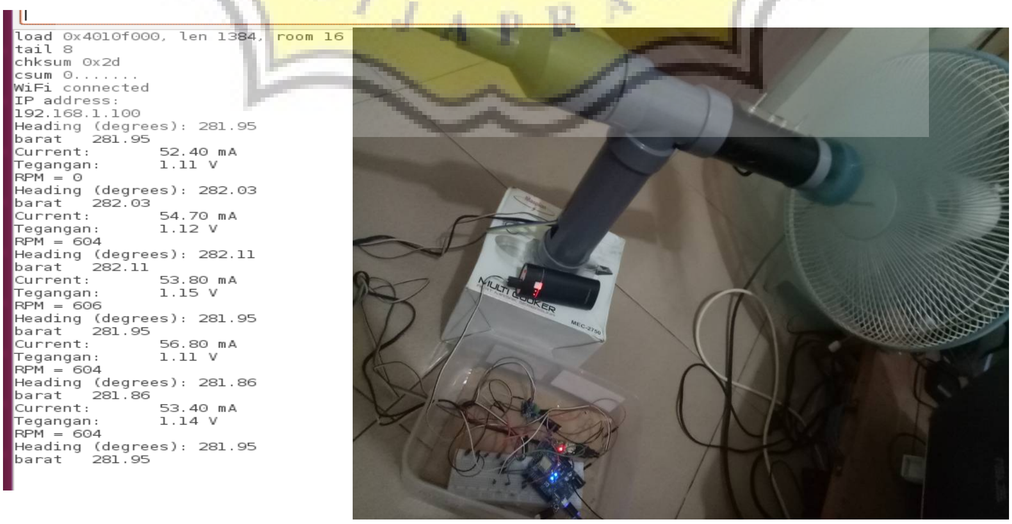


Illustration 5.4: The process of charging the powerbank and the sensor is working.

Saving of speed, current, voltage and compass in IoT server thingspeak.

Data speed, current, voltage and compass will be saving inside the IoT thingspeak server. Each sending data to the server every 20 second.

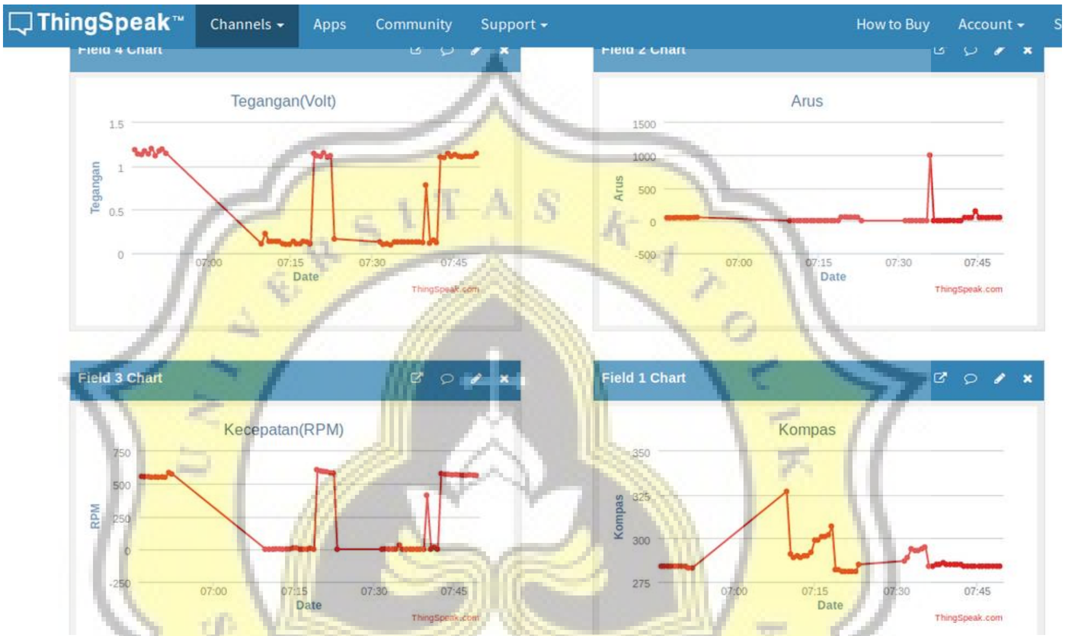


Illustration 5.5: Saving of rpm, current, volt and compass in IoT server

Table 5.1: Test result charging power bank

| No | Speed (rpm) | Current (mA) |
|---|---|---|
| 1 | 276 | 4.5 |
| 2 | 278 | 4.2 |
| 3 | 282 | 4.9 |
| 4 | 368 | 19.1 |
| 5 | 380 | 17.9 |
| 6 | 382 | 18.1 |
| 7 | 416 | 20.4 |
| 8 | 432 | 28.7 |
| 9 | 442 | 25.7 |
| 10 | 526 | 39.1 |
| 11 | 522 | 40.3 |
| 12 | 562 | 48.3 |

The battery charging project with a dc generator has the minimum required charging current. Where this test uses a fan. When viewed from the table above the speed of 278 RPM and 4.2 mA current where it can start to fill the required powerbank. This condition at the time of battery charging current changed. The highest test with the highest current obtained 48.3 with a maximum speed of 562 RPM. This tool comes with a step up USB regulator to raise the voltage.

Table 5.2: The result of full charging process on powerbank

| Speed (rpm) | Current (mA) |
|---|---|
| 546 | 44.9 |
| 548 | 43.8 |
| 550 | 41.9 |
| 526 | 38.9 |
| 528 | 41 |
| 522 | 38.1 |
| 514 | 39.3 |
| 510 | 40.3 |
| 520 | 40.7 |
| 518 | 39.1 |
| 516 | 2.2 |
| 562 | 1.9 |
| 588 | 1.8 |
| 578 | 2.1 |
| 574 | 2 |
| 568 | 2.1 |
| 566 | 2.1 |
| 564 | 2 |
| 556 | 2.1 |
| 560 | 2.1 |

The process of charging the battery can diliat table above 4.9mA current in charging will decrease into 1.8mA or it could be 0 mA because there is no potential voltage difference (potential difference is 0) so already in a state full battery can not automatically charge again. powerbank filling test results from blank power until full power takes 28 hours. Batrrey used is a standard power bank type 18650 with a capacity of 1200mAh.

Table 5.3: Results of current and voltage data retrieval on the sensor using fan

| Sampling | Rpm | Current (mA) | Voltage (Volt) | Miliwatt |
|---|---|---|---|---|
| 1 | 384 | 18.3 | 0.96 | 17.56 |
| 2 | 380 | 17.9 | 0.96 | 17.18 |
| 3 | 378 | 16.8 | 0.97 | 16.29 |
| 4 | 379 | 15.9 | 0.94 | 14.94 |
| 5 | 374 | 17 | 0.95 | 16.15 |
| 6 | 494 | 37 | 1.05 | 38.85 |
| 7 | 490 | 34.2 | 1.05 | 35.91 |
| 8 | 488 | 33.5 | 1 | 33.5 |
| 9 | 486 | 36 | 1 | 36 |
| 10 | 484 | 35.9 | 1.08 | 38.77 |
| 11 | 562 | 51.7 | 1.23 | 63.59 |
| 12 | 556 | 50.9 | 1.14 | 58.02 |
| 13 | 558 | 54.8 | 1.19 | 65.21 |
| 14 | 560 | 55.9 | 1.14 | 63.72 |
| 15 | 554 | 53.5 | 1.18 | 63.13 |
| Average | | 32.2 | 1.13 | 36.38 |

The above test results using a fan of speeds 1, 2, 3 are combined into one table. At the speed, current and voltage data generated by the dc generator. The voltage values obtained in the table are done by measuring the voltage coming out of the dc generator. While the current is taken from the load flowing into the powerbank. On each table will be calculated formula to find power. The formula for finding power as follows:

$$Calculation\,of\;power\,voltage = I\;x\,V$$

The conclusion of the table above is that the wind speed can lead to an increase of electric current and voltage. Here can be seen the average flow 32.2, voltage 1.13 and power 36.38 milliwatt. In the above data generated power plant is very small and impossible for charging kepowerbank. This tool has been using step up voltage USB with capacity 0.9v-5v 600mA. From the above data will be calculated long time charging on powerbank that is:

$$Calculation\ of\ battery\ charging\ time = \frac{Battery\ capacity\,(mAh)}{Current\,(mA)}$$

$\frac{1200\ mAh}{51.75\ mA} = 23.18 \times 60\ minutes = 1.390.8$ or 23 hours 10 minutes.