MONITORING SMART METER REMOTELY AND ELECTRICITY SAVING SYSTEM

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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DHAKA, BANGLADESH
JANUARY 2021

APPROVAL

This Project titled **"MONITORING SMART METER REMOTELY AND ELECTRICITY SAVING SYSTEM"** submitted by Sourav Podder, ID: 151-15-5208, Md. Abir Mahmud Chowdhury, ID: 162-15-7687 and Yousuf Miah, ID: 143-15-4278 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 28.01.2021.

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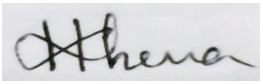

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DECLARATION

We declare that, this project has been accomplished by us under the supervision of **Mr. Raja Tariqul Hasan Tusher, Senior Lecturer, Department of CSE**. It is also declared that this project or any section of this project has not been submitted anywhere before for award of any degree.

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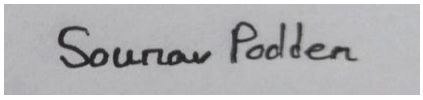

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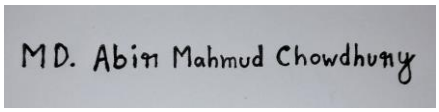

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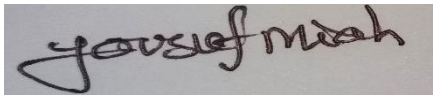

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ACKNOWLEDGEMENT

We manifest our heartiest gratitude to almighty God for His blessing that makes us successful to complete the final year project.

The means of discipline and hard work is the actual inspiration of achieving a goal. Without the cooperation, enthusiasm and assistance provided to us by some persons, We would not ever succeeded in accomplishing our task.

We would want to manifest our deepest gratitude to our supervisor **Mr. Raja Tariqul Hasan Tusher** (Senior Lecturer), BSc in CSE, Daffodil International University. His ceaseless patience, direction, gradual inspiration, diligent supervision, worthful advice , studying many coarse draft and fixing them at all situations have made it successful to accomplish this project. We are thankful to our respectable teachers.

We want to express our soulful thanks to **Professor Dr. Touhid Bhuiyan**, Head, Department of CSE, for his assistance to complete our project and we would also want to agree with much appreciation the conclusive conduct of the staff of Daffodil International University (DIU), who granted us the consent to access all types of library components to gain knowledge and to cleanse our perception. We have to praise the indication given by the supervisors and lecturers who has assisted us to go ahead and created a concern and importance of accomplishing the project report successfully with preserving good learning and quality. We would like to thank our whole course mate in Daffodil International University, who took part in any conversation regarding the project.

Finally, we must acknowledge with due respect the firm assistance and patience of our parents.

ABSTRACT

In this present generation, the usage of wireless automation in almost all the sectors of power and the technology of electronic metering has gone through quick technical growth evolution. So in regards to that need for a reliable and cost efficient automatic meter reading system has also enlarged. In present day Bangladesh an worker of Electricity board that is known as line man voyages house to house take the meter reading manually to ready the bill. It is both time consuming and expensive at the same time and the error rate is higher there are many occurences where a consumer is billed more than what he/she is consumed and the bill paying process is also very time consuming and nasty . Although e-bill paying system is introduced in our country the use of this is very low among the people.

The main objective of this project was to build a system that eradicate the huge production and maintenance costs in the present meter reading technology. Smart meter will be connected to web server by means of Internet. Smart meter will contain Esp8266 microcontroller chip and to monitor a smart phone etc. The ESP8266 is used to transfer the meter reading to our web servers and our mobile app in which consumers can monitor their electricity usage, monthly bill and they can also pay the bill with assistance of the app. This system is also theft proof.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

An energy meter is a gadget that figure the measure of intensity devoured by a neighborhood home, industry or an electrically power gadget. In the current framework, an individual from electrical dispersion organization needs to go to every home and industry to take the perusing from each meter which is tedious and furthermore requests parcel of labor. The primary goal of this venture is to present and progressed electrical metering innovation that can impart remotely to choose workers update meter rating and bill continuously and will open to both gathering, implies in this task the supplier and shopper both can screen the utilization of intensity progressively and furthermore consumer can take care of the bill from whenever and anyplace. Installation and development cost of this proposed system is lower than any other of its competitor system because of pre-installed meter a small chip is needed to adjusted with the meter and this system is ready to run which is far more better and cost efficient then installing new meters and develop new technology.

The proposed framework is reasonable for Industries, fabricating plants, business structures or any positions where power is burned-through. Our energy meter checking framework protects the government energy observing and control. This Management System brings about investment funds in the general expense. These investment funds might be begun from numerous areas like better arrangement of labor, upgrading cost, reserve funds in the force utilization and so forth This likewise guarantees a non-breakdowns in framework. The proposed smart energy meter contains customary energy meter and a microcontroller (esp8266). The proposed smart energy meter is equipped for giving all the metering and charging administrations like computing the burned-through energy, handover the produced bill just as the security offices. Honestly at present-day, the metering and charging arrangement of our nation is absolutely regular and it is significantly moderate, flawed and tainted, so our proposed framework merits some thought for National usage.

1.2 Objectives

The goal of this project is to construct a meter rating monitoring system where a microcontroller nano chip is associated to a ordinary digital meter which will connect the energy meter to the server. Which will eradicate the require of man power.ESC8266 chip which has underlying wireless capabilities will refresh the meter rating to the servers in every 30seconds , so basically consumers can see their consumption and decrease extra consumption and wastage of electricity also reduce the errors in our billing process by making it automated .

1.3Application of This Project

In our usual everyday life, some application of this project is asserted below:

- Smart power utilization and power saving.
- Electronic bill paying process.
- Real time consumption observing.
- Theft protection.
- Fully digitized.
- Low maintenance energy metering system.
- Low expense smart energy meter.

CHAPTER 2

LITERATURE REVEW

2.1 Introduction:

The suggested idea of this project is convenient for idea of digital Bangladesh. In the past study up till now, energy meter reader goes to each home and notes reading by hand then produces the bill. But in this system, chances of fault happening is very big by not giving accurate meter rate, To resolve this problem smart monitoring and billing system is initiated also it can further be upgraded by implementing same technology on prepaid meter. But in that way consumer has to pay previously to use electricity. Automatic metering monitoring s can produce data at real time, daily and monthly as demanded. This is suggested for decreasing the required manpower, reading gathering time, theft of electricity also avoids late bill payment. It is more useful than conventional billing system.

There are many faults in conventional billing. There is a phase “to err is human” means where there is system utilized my humans there will be errors. Evaluating the normal billing system some usual errors are stated below:

- It's a very time consuming system.
- There is no way authenticate and justify the meter reading and also inspect the balance.
- There always a possibility of human error during rating collection procedure manually.
- Chance of corruption and error is very big.
- Needs extra workers.
- Consumers and never told about their consumption.
- Consumers may not get their bill slip in time.

On the other hand, our smart meter is wirelessly connected to the supplier that ensures the accurate data reading always so there is no require of anyone to note the reading. Smart meters can work in many ways, including using wireless mobile phone to provide data. Some usefulness of smart meter is stated below

I. Our smart energy monitor system shows us how much energy we are using in money .that means you receiving correct data of your usage by the minute. Knowing more about usage we help us to use our power more conveniently

II. Smart meter sends data about your consumption automatically, so the bills will be more accurate and no require of submitting bills by hands.

III. If the meter is required to be changed in some points of time smart meter reading auto synchronized with the servers.

The proposed system consists of an energy meter and a micro controller attached by an Optocoupler. The usage of power is shown in the LCD display of the meter and also it is updated in the servers and the app .when 0.005kwh power is used and the indicating led blink once, optocoupler send that reading to ESP8266 and it compute the bill and update it to server and app. Unit's price can be changed by supplier very easily in the server.

2.2 Block Diagram.

Our smart metering system is embedded automated version of usual metering system. Normal energy meter is attached to ESP8266 which is connected to server and app and thus it makes a cycle. Energy usage is computed by the meter and with the help of Optocoupler Esp8266 updates the rating first to the server, servers compute the bill and send back the data to the microcontroller then it updates the bills and units to the app for the users to observe.

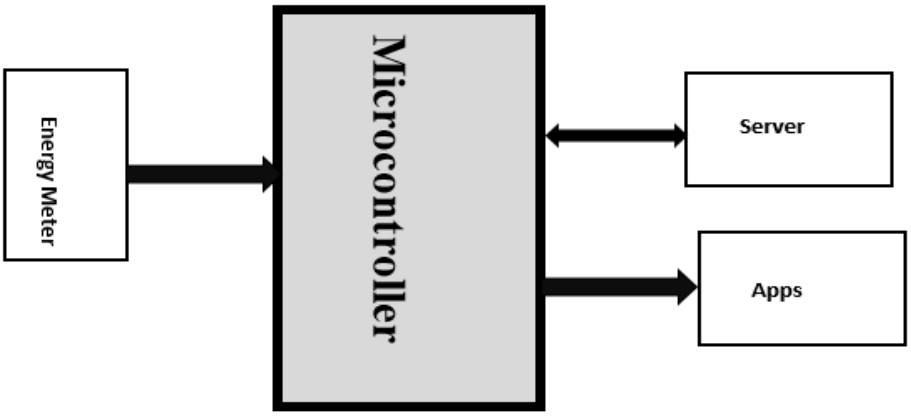


Figure 2.2: BLOCK DIAGRAM

2.3 Circuit Diagram.

Circuit diagram of our project is comparatively easy .It is given below power source coming from energy meter is attached to Vcc and Gnd pins of Esp8266 and data line is attached to Gpio pin.

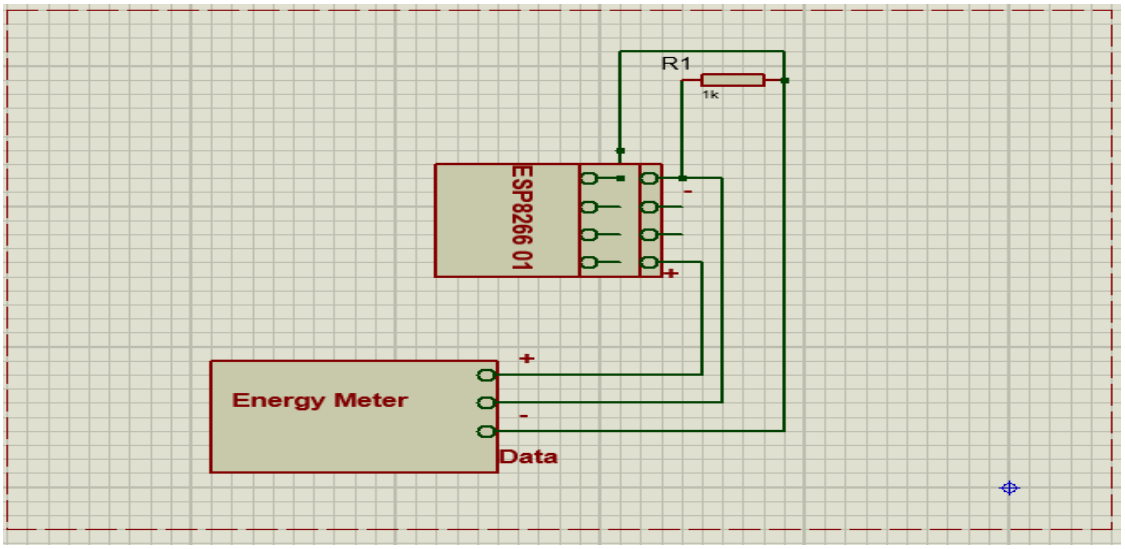


Figure 2.3: CIRCUIT DIAGRAM

2.4 Hardware Requirements.

In this sections we discuss about the hardware needed to complete this project.

- ESP8266
- Digital energy meter
- Battery 3.7v
- Mobile phone.

(For additional purpose)

- Lights
- Switch
- Wires
- Circuit board.

2.5: Over View Of Hardware Used:

In this section we will learn more about the hardware we used in our project their details structure and also the cause of using them.

2.5.1: ESP8226

Esp8266 is a low cost microcontroller chip with built in Wi-Fi capabilities reason for us to select this chip over other micro controller like Arduino because of this tiny footprint and small cost and also its higher and more accurate data transfer ability.

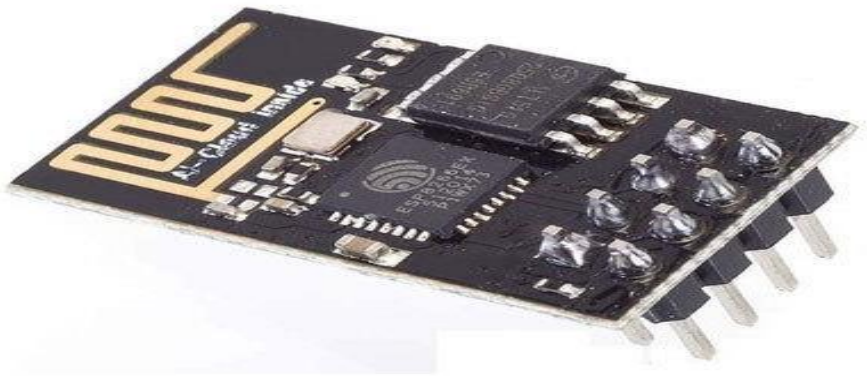


Figure 2.5.1: ESP8226

The ESP8266 chip holds built in SOC with included TCP/IP protocol stack that easily can provide any microcontroller easy approach to any selected network. It's able either hosting an application or offloading all Wi-Fi networking functions from another application.

Every esp8266 chip comes pre-loaded with an AT command set firmware which means, we can attach it to any devise and receive easy access to the web. It Wi-Fi module is relatively new then its competitor chips but it is receiving more and more identification due its abilities and reduced cost properties.

2.5.1.1 Pinout

- VCC (The power input pin it can take up to 3.3v to 3.6v voltage larger then that will damage the chip)
- GND(The ground pin of the micro controller)
- TX(Also known as data transfer pin it transmit data wirelessly)
- RX(Also known as receiver pin receives data)
- RST(Rest pin of the microcontroller)
- RST(Rest pin of the microcontroller)
- GPIO.2(General purpose input pin 1)
- GPIO.0(General purpose input pin 00)

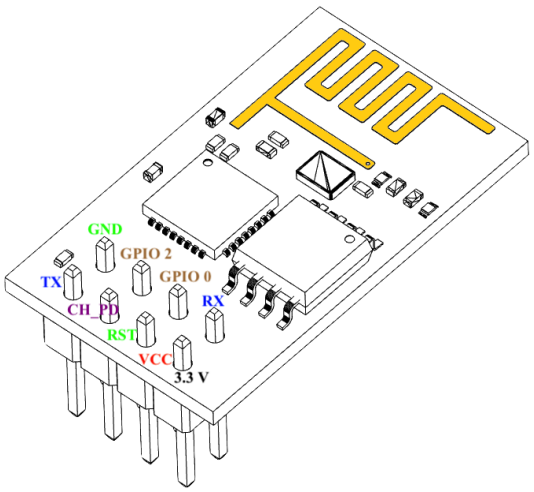


FIG 2.5.1.1 Pinout

2.5.2: Digital Energy Meter

An energy meter is a gadget that compute the amount of electrical energy consumed by a user or a business or an electrically monitored device. It is installed at consumer's residence for bill calculating purpose. Electrical energy meter basically compute bills in per unit, per unit usually consists of 1kilowatt hour (kWh). Each unit read once in per billing time .Some digital energy meter is capable to calculate maximum demand rate. "Time of day" metering allows electric charges to be reformed in a day, to record consumption throughout peak high-cost phases and off-peak, lower-cost, phases. Also some more advance meter contains relays which can produce controlled load shading during peak load period.

Figure 2.5.2: DIGITAL ENERGY METER

2.5.3 Battery

A battery is a device consisting of one or more electrochemical cells with external connections which provide power to electronics devices. A battery has to 2 polar opposite sides, positive side is stated as cathode negative side is stated as anode. For our project we used 3.3V dc battery to start our micro-controller.

Figure 2.5.3: Battery

2.5.4 Smart Phones

Smart phones are branch of mobile or cell phones that are multipurpose calcuating device. In our project smart phone is used as output displaying device from which consumers can control and observe there meter.

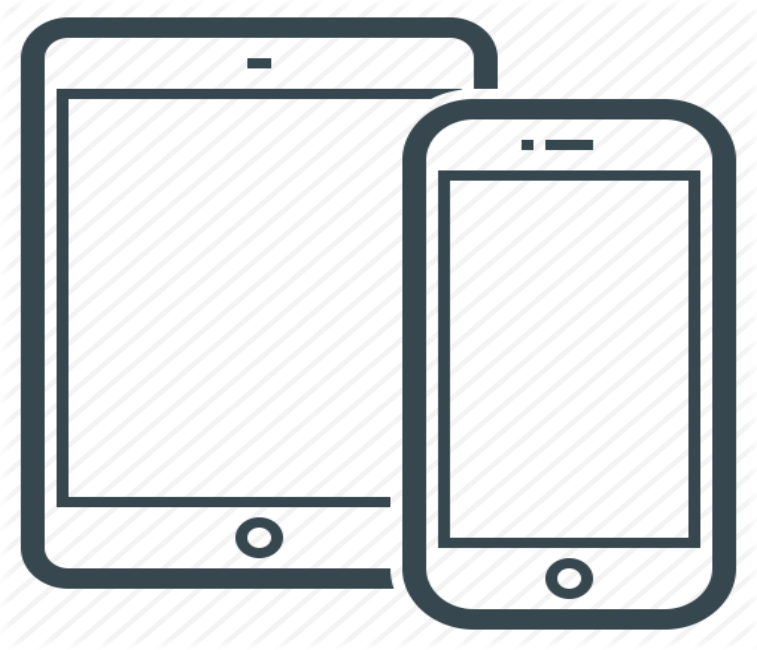


Figure 2.5.4: SMART PHONE

2.5.5 Lights

An light bulb, is an electric light which have a wire filament heated to such an extraordinary heat that it luminosities with noticeable light The filament is safe from oxidation by a glass or merged quartz bulb that is inhabited with inert gas or a vacuum.

The light bulb is given with electric current through terminals or wires implanted in the glass. Most bulbs are used in a socket which delivers mechanical support and electrical attachments.

Figure 2.5.5: LIGHTS

2.5.6 Switch

An electronic switch is gadget that is used to interrupt the flow of electricity, it is utilized to close or open the circuit.

Figure 2.5.6: SWITCH

2.5.7 Plug

Electrical plugs attach the electrical elements to the AC power supply in a building and other areas. A plug might be two pin or three leaning on the socket.

Figure 2.5.7: PLUG

2.5.8 Circuit Board

A circuit board supports and electrically connects electronic elements or electrical components using conductive paths, pads and other features imprinted from one or more sheet covering of copper layered onto and/or among sheet cverings of a non-conductive element. Components are normally soldered onto the CB to both electrically attach and mechanically connect them to it.Circuit boards are rendered in all but the modest electronic products. They are also given in some electrical elements,as like switch boxes.

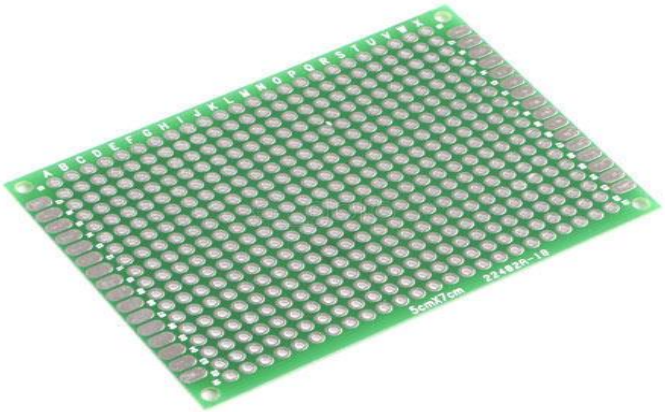


Figure 2.5.8: CIRCUIT BOARD

2.5.9 Jumper Wires

A jumper wire is an electrical wire, or many of them in a cable, which has a pin on there every end jumper wires normally used for testing and making template project. Singular jump wires are stable, by implanting their "end connectors" into the openings layed in a breadboard, or a part of test apparatus.

Figure 2.5.9: JUMER WIRES

CHAPTER 3
COMPUTER PROGRAMMING CODE

3.1: Code
Source code for our project

```
#include <BlynkSimpleEsp8266.h>
char auth[] = "hIOaHdpROMLJ1zWD-OBMUKwSfYBWwW6B";

char ssid[] = "project";
char pass[] = "project123";
bool check;
float Wattage ;
float unit;
float tk;
#include <ESP8266WiFi.h>
#include <FirebaseArduino.h>


#define FIREBASE_HOST "digital-energy-meter.firebaseio.com"
#define FIREBASE_AUTH "5r2wYAdB1BnNP4FGcpBN1YlznYv6kwRXIjSZpu35"
#define WIFI_SSID "project"
#define WIFI_PASSWORD "project123"
double datap;
const int sensorIn = A0;
int mVperAmp = 185; // use 185 for 5A, 100 for 20A Module and 66 for 30A Module
int k=0;

double data1,data2,avg;
double Voltage = 0;
double VRMS = 0;
double AmpsRMS = 0;




BlynkTimer timer;



void showData() {


if(Wattage>0)
```

```
{
   Blynk.virtualWrite(V0, datap);


   Blynk.virtualWrite(V1, Wattage  );
     Blynk.virtualWrite(V2, datap*tk );
}




  }




void setup(){
pinMode(A0, INPUT);
Serial.begin(115200);

WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
Serial.print("connecting");
while (WiFi.status() != WL_CONNECTED) {
Serial.print(".");
delay(500);
}
Serial.println();
Serial.print("connected: ");
Serial.println(WiFi.localIP());
Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);


delay(10);
Serial.println(F("Init...."));
datap=Firebase.getFloat("meter1/unit");
tk=Firebase.getFloat("meter1/tk");

Serial.println(datap);



 Blynk.begin(auth, ssid, pass);

  timer.setInterval(100, showData);
}
```

```
void loop(){



if(k<=5)
{
data1+=AmpsRMS;

  k++;

  if(k==5)
  {
     data2=data1/5;
    Serial.println("Divided");
    Serial.println(k);
    Serial.println(data1);
    Serial.println(data2);



  }
}

Voltage = getVPP();
VRMS = (Voltage/2.0) *0.707; // sq root
AmpsRMS = (VRMS * 1000)/mVperAmp;
//Observed 18-20 Watt when no load was connected, so substracting offset value to
get real consumption.
Wattage = (220*(AmpsRMS)-6)*2.40);


check=false;


if((AmpsRMS-data2)>0  && 0.02<(AmpsRMS-data2) && k>=5 && Wattage>0)
{
  check=true;
Wattage = (((220*(AmpsRMS-data2)-6)*2.45)-3);
Serial.println(data2);
  Serial.print(AmpsRMS-data2);
Serial.println(" Amps RMS ");
Serial.print(Wattage);
Serial.println(" Watt ");

float unitt=(Wattage/3600000);
datap+=unitt;
   Firebase.setFloat("meter1/unit",datap);
```

```
    Firebase.setFloat("meter1/watt",Wattage);
    Firebase.setFloat("meter1/tk",datap*tk);
Serial.println("-----------------+++++-");
Serial.println(AmpsRMS);
Serial.println(Wattage);
Serial.println(unitt,6);
Serial.println(datap,6);


Serial.println("-----------------+-");




}

if(check==false)
{
Wattage=0;
   Blynk.virtualWrite(V1, Wattage  );
  Firebase.setFloat("meter1/watt",Wattage);
}


 Blynk.run();
  timer.run();
}

float getVPP()
{
float result;

int readValue; //value read from the sensor
int maxValue = 0; // store max value here
int minValue = 1024; // store min value here

uint32_t start_time = millis();

while((millis()-start_time) < 1000) //sample for 1 Sec
{
readValue = analogRead(sensorIn);
// see if you have a new maxValue
if (readValue > maxValue)
{
/*record the maximum sensor value*/
maxValue = readValue;
```

```
}
if (readValue < minValue)
{
/*record the maximum sensor value*/
minValue = readValue;
}
/* Serial.print(readValue);
Serial.println(" readValue ");
Serial.print(maxValue);
Serial.println(" maxValue ");
Serial.print(minValue);
Serial.println(" minValue ");
delay(1000); */
}

// Subtract min from max
result = ((maxValue - minValue) * 5)/1024.0;

return result;
}
```

3.2 Software Used

3.2.1 Firebase

Firebase is a web additionally android application development platform occupied by google. It contains 20 products that is used by 2 million applications. Firebase come up with a real-time database in form of a facility. The service renders application developers an interface that grants application data to be combined among clients and kept on Firebase's cloud. The company renders client libraries that permits with Android iOS and other application. Developers utilizing the simultaneous database can assure their data by using the company's server-side-applied reliability regulations .Also, Firebase Storage provides us the choice of safe file uploads and downloads for Firebase apps. Firebase Storage is controlled by google so, without any hesitation it could be told that for a idea like our proposed system firebase is the best choice because of its free real time database and storage options.

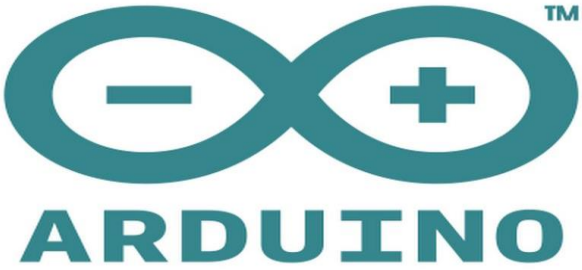
3.2.2 Blynk

Blynk is a platform that lets us rapidly make interfaces for supervising and observing our projects from our Android device or iOS. Downloading the app, anyone can make a project sway panel and muster buttons, sliders, charts etc. We can use the button for controlling our project like turn on and off switch or display ta sensor data.

In most of the instances building the hardware version of our project is trouble-free, inspite of that constructing the software interface is complicated. But With Blynk, the software side is even less complicated than hardware side. So we find out that blynk is the most worthy software for us to easily showcase our innovation and our projects output.

3.2.3 Arduino Ide

It is an open source software that is required to upload codes to any Arduino or Esp micro controller boards.



CHAPTER 4

RESULT AND DISCUSSIONS

4.1 Introduction

Main goal of our project was to take the meter reading and transfer it to user's smart phones. we have succeeded in doing that our chip transfers the data in real time but sometimes there is a 30 sec delay because of network problems and also sometimes cause of not having a proper server and app. Though the delay time so little that is rarely observable. The delay can be easily settled with proper allocated servers and proper connection of the internet.

If we consider 1 unit or 1kwh costs us 20tk and by the time of our test it should be mentioned that price can change by updated whenever by the supplier and database will auto sync by it.

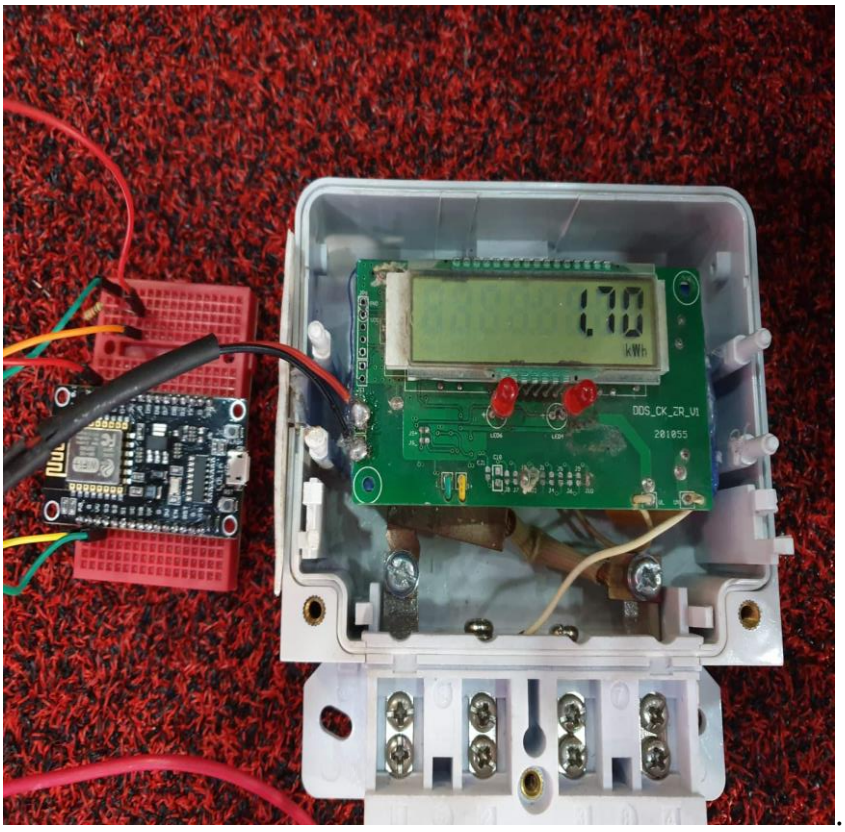


Figure 4.1: ACTUAL PROJECT

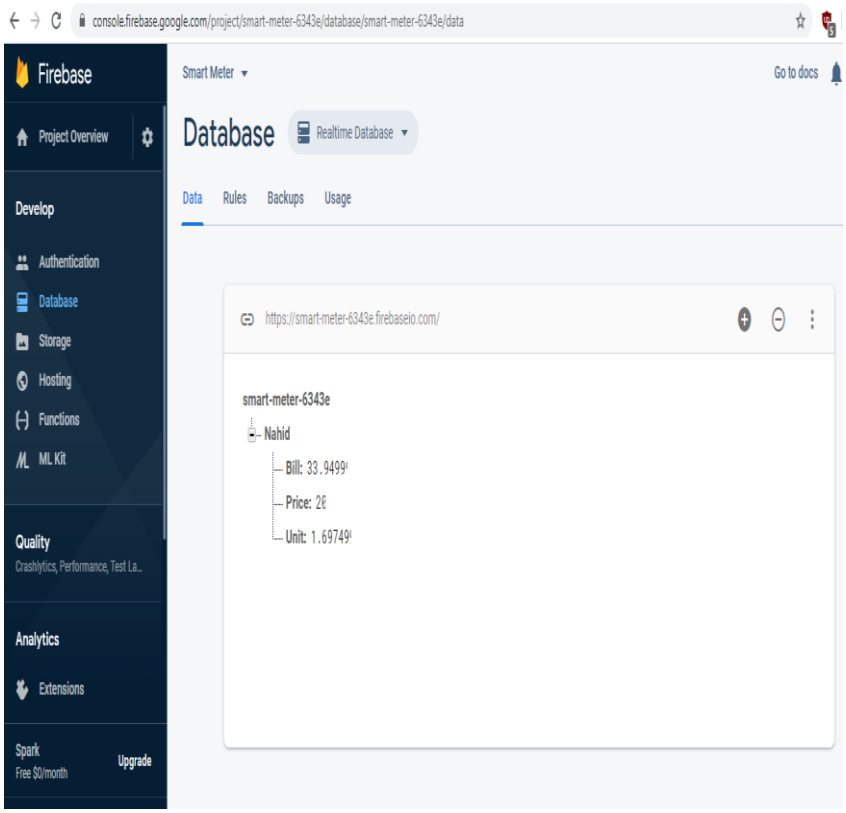


Figure 4.2: DATABASE

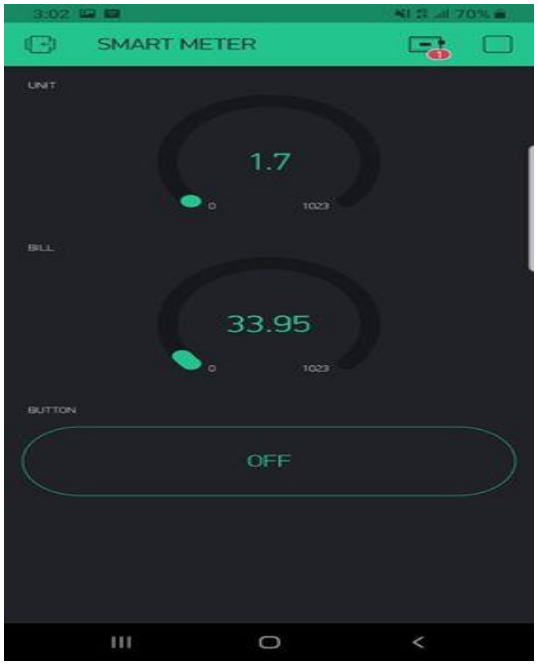


Figure 4.3: APP

4.2 Cost

TABLE 4.2: COST OF OUR PROJECT

NAME	COST
Energy Meter	900tk
Esp8266	300tk
Plug	15tk
Socket	15tk
Blub	50tk
Wires	50tk
Circuit board	10tk
Total cost	1340tk

CHAPTER 5

CONCLUSION

5.1 Conclusion

Our system will render safe and cost efficient method for electricity computations. The present meter reading policy is manual which requires man power bigger labor rate and is not cost and time efficient. But our offered system will resolve all of that cons. This system observes rate of consumption of electricity so possibility of stealing and cheating is next to none also if our chip got detached from the meter it will notify the respected power distribution company . It is our concern that our offered system will provide the smart and secure infrastructure and a smart digitalized metering and billing system.

5.2 Future Scope

Our system is just in its prototype face and it requires lots of worked we have thought some out and after using sometimes more things can be attached

- Install a relay device to auto discontinue the power if bill is due.
- Improve app and server prepare it more available for everyone.
- Provide the devise its interior internet connection.
- Prepare it well matched with prepaid meters.

5.3 Limitations:

- Main problem faced on our project was deficiency of proper resources and deficiency of info concerning meter technology.
- Our micro controller requires network connection although is needs a small amount but it needs it continually, so we have to provide outward internet connection.
- Deficiency of proper servers to operate.

References

[1]https://en.wikipedia.org/wiki/esp8266

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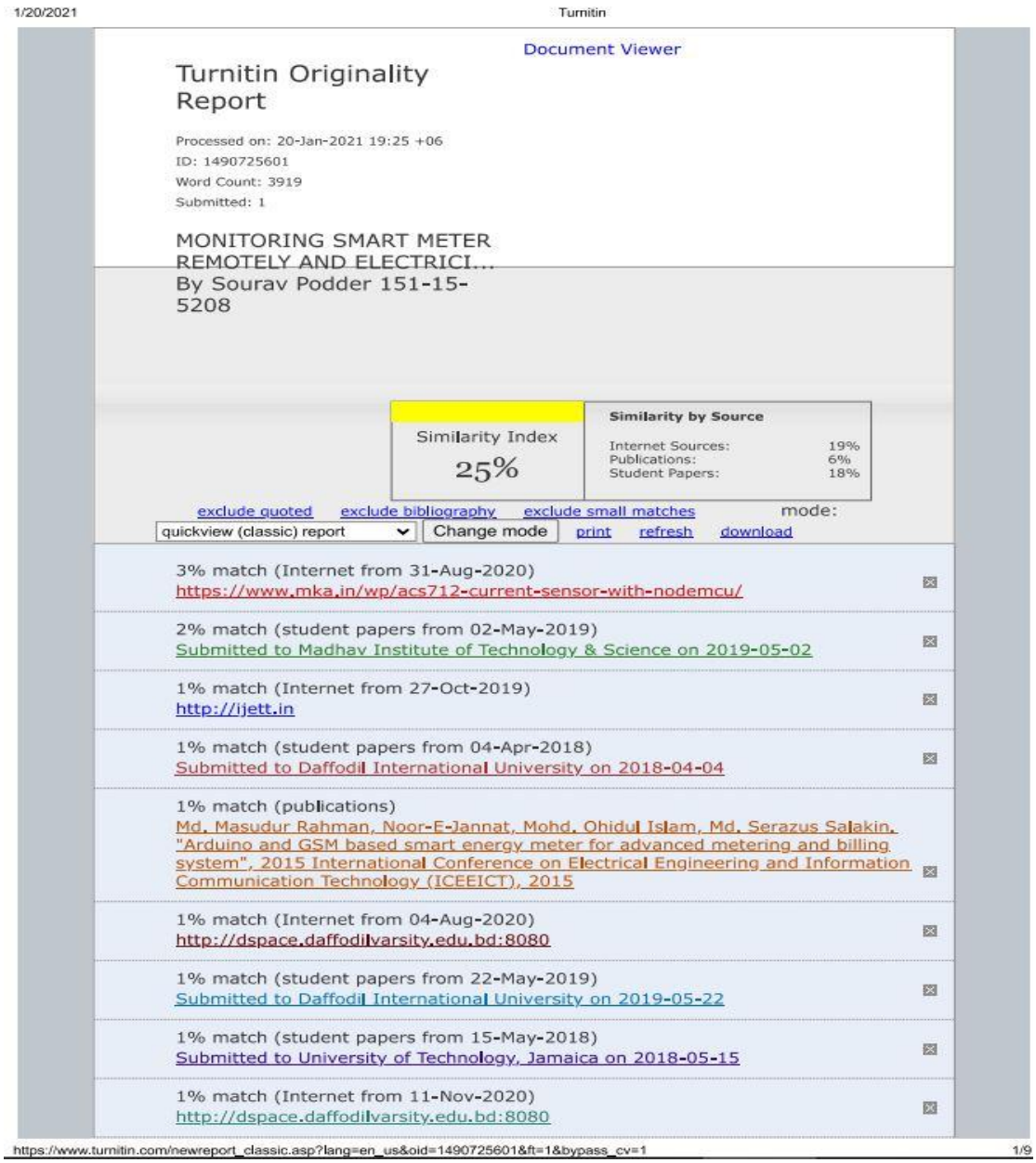

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