A

Project Phase I report on

"IOT Based Source to Destination Power Factor Monitoring System"

Submitted to Savitribai Phule Pune University in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering (Electrical Engineering)

Submitted By

Tejas Wairagade
Poonam Vikhe
Vrushab Durve
Venkatesh Khandre

Under the guidance of
Prof. S. R. Desai

D Y PATIL
INSTITUTE OF
ENGINEERING &
TECHNOLOGY
AMBI PUNE

Dr. D.Y.Patil Educational Academy's
D.Y.Patil Institute of Engineering & Technology Savitribai Phule Pune University

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Dr. D.Y.Patil Educational Academy's
D.Y.Patil Institute of Engineering & Technology
Department of Electrical Engineering

CERTIFICATE

This is to certify that The Project Phase I report entitled

"IOT Based Source to Destination Power Factor Monitoring System"

Submitted by

Tejas Wairagade(71847677J)

Poonam Vikhe(71724246D)

Vrushab Durve(71937921M)

Vankatesh Khandre(71847670M)

is a bonafied work carried out by them under the supervision of Prof.Shweta R. Desai in partial fulfillment of the requirement of Savitribai Phule Pune University for the award of Degree of Bachelor of Engineering in Electrical Engineering.

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Approval Sheet

The project report entitled "**IOT BASED SOURCE TO DESTINATION POWER FACTOR MONITORING SYSTEM** "submitted by Mr. Tejas Wairagade (71847677J), Mr. Poonam Vikhe (71724246D), Mr. Vrushab Durve (71937921M), Mr. Vankatesh Khandre (71847670M) is approved for the partial fulfillment of the requirement forthe award of degree in Electrical Engineering.

Project Guide
[Prof. S. R. Desai]

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Place: DYPIET, Ambi, Talegaon Dabhade

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Abstract

Nowadays, many residential and commercial buildings that used electricity needs to take care the power factor to avoid penalty from the utility companies. A power factor that is close to one provides a good indicator for the overall power quality. Therefore, power factor improvement plays a significant role to reduce electricity consumption and more efficient system operation. In this paper, the design of power factor meter using Internet of Things will be discussed. Voltage and current sensors outputs were interfaced to Arduino, in which the real power and apparent power were calculated to determine the power factor. Results showed the effectiveness of our proposed device in measuring power factor. Moreover, the measured data points were logged in an cloud in webserver and can be accessed by computer and mobile using blynk application graphical user interface (GUI). In addition, IoT framework analysis for smart meter which can provide power factor improvement, remote monitoring, and data logging was further discussed in this paper.

Keywords – Smart Phones, Power Monitoring, IOT aided SG.

List of Abbreviation

IOT – Internet of Things
HVAC – Heating Ventilation and Air Conditioning
IC - Integrated Circuit
PCB – Printed Circuit Board
µC – Micro Controller
BJT - Bi-polar Junction Transistor*SPDT* - Single Pole Double Throw*NO* - Normally Open
NC - Normally Closed
COM – Common
LCD – Liquid Crystal Display*LED* - Light Emitting Diode *POT* – Potentiometer
AT – Attention Command
SMPS – Switch Mode Power Supply
RF – *R*adio Frequency
ISM – Industrial, scientific and medical
USB – Universal serial bus
SPI – Serial Peripheral Interface
I^2C – Inter-Integrated Circuit
GPIO – General Purpose Input Output
API – Application Program InterfacE

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CHAPTER 1. INTRODUCTION

Nowadays electricity is the main power generator that is needed to turn on most of the devices like electronics equipment. Electricity enables us to use various electrical appliances like television, oven, air condition, refrigerator and others. Generally, electric power can be generated using renewable and nonrenewable sources. Most electric companies charge either the highest kW (real power), or the highest kVA (apparent power), whichever is greater [1]. If the power factor is low, the measured kVA will be significantly higher than the kW. Therefore, improving the power factor through power factor correction, e.g. capacitor bank connected in parallel, will lower the kVA requirement thus lower the electricity bill. Several other advantages of power factor improvement, including increased load carrying capabilities in existing circuits, improved voltage, reduced power losses, and reduced carbon footprint [1].

Many research have been conducted on the development of smart meter as discussed in [2-4]. Due to its usage, smart meters are being developed and installed in many homes, school buildings, universities, and industrial premises around the world [5, 6]. The smart meter infrastructure, if used properly, can provide more than just recoding consumption of electricity, such as easier processing of billing, detection of energy losses due to possible fraud, early warning of blackouts, as well as precision real-time pricing schemes [7]. One of the advantages using the digital based power factor meter is that the read data by the device can be stored easily for other applications or analysis [8, 9]. One type of the analog circuit that used in the power factor measurement system is zero crossing detectors to convert and process the current and voltage signals, in which the output will be low if the difference is zero [10]. In [11], the firmware design can be used to calculate and record power consumption data and record five outage events with their interruption time, interruption durations and restoration time if an outage event occurred. Figure 1 shows various samples of power factor/smart meter.

Although many researches have been conducted on the power meter, but little research has focused on the power factor meter, especially for power factor improvement, remote monitoring, and data logging. In [12], the design of power factor meter was elaborated. The objective of this paper is to improve and extend the previous design by including simulation of power factor improvement, performance evaluation using several devices, remote monitoring, and data logging capability.

CHAPTER 2. LITERATURE REVIEW

2.1 Literature Review

IOT based power factor monitoring system based on IoT in which the smart bin was built on a platform which was based on Aurdino Uno board which was interfaced with a wifi modem and an Current sensor. The sensor was placed on the top of the bin. A threshold level was set as 10cm. As the garbage reaches the level of threshold, the sensor triggers the wifi modem which alerts the associated authority till the garbage in the bin is emptied. At the end a conclusion was made that various issues like affordability, maintenance and durability were addressed when these smart bins were designed. It also contributed towards a hygienic and clean environment in the process of building a smart city. The researchers suggests the method for garbage management which is as follows. The bin was interfaced with a system based on microcontroller which had IR wireless systems with a central system that showed the current status of the garbage in the bin. The status was seen on a mobile based web browser with a html page by using Wi-Fi. To reduce the cost, they only used weight based sensors and on the sender's side they only used a Wi-Fi module to send and receive the data. In the end the sensor could only detect the weight of waste present in the bin but not the level of waste. The author proposed a method for organizing the collection of the garbage in the commercial and residential areas of the cities. In this system, the level of garbage in the bin was detected by the ultrasonic sensor which will send the data to the control room using the GSM module. A GUI was also developed to check the information that was related to the garbage for different locations, GUI was based on MATLAB so it was different. Two units were present in the system, slave unit was in the bin whereas the master unit was there in the control room. The sensor will check the level of garbage and send it to the slave unit which will further send the data to master unit which at last will inform the authorities to clean the bin. This paper proposed Decision Support System which would be used for garbage collection in the cities. This system handled the ineffective waste collection in the inaccessible areas of the city. The cameras were placed in those parts of the cities which were facing the most 3 1234567890 14th ICSET-2017 IOP Publishing IOP Conf. Series: Materials Science and Engineering 263 (2017) 042027 doi:10.1088/1757-899X/263/4/042027 problems. The system worked in two parts, the first part was to find the companies that were involved in collecting the waste and owned trucks and who could also organize some drivers for collecting the garbage from various parts of the city in the truck and pass on the city dumps or the recycling organizations. The second part was to make a system which could handle all the communications of all the people involved and could also maintain the data which will be collected while working around in the city. Various bins were placed around the city which were provided with an embedded device which was low in price and helped in tracking the garbage level in the bins. A different ID was provided to each bin so that it could be easier to detect that which is bin is full and ready to be emptied. The project is divided into two sections one being the transmitter section and other the receiver section. The transmitter section consists of a

microcontroller and sensors which check the level of the garbage and the data is passed onto the system with the help of the RF Transmitter, then RF Receiver receives the data and sends it to the client associated so that the bin can be emptied quickly. Anitha et al (2016) proposed an home automation system using IOT uses raspberry for the implementation. Also proposed a model for cyber security systems using artificial system to have secured transactions

2.2 WIFI Modem:

- The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.
- This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.
- There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IOT (Internet of Things) solution!

2.3 Features:

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

CHAPTER 3. THEORY

We will need the following hardware to accomplish our project.

3.1 Arduino Uno.

3.2 Current sensor.

3.3 WIFI module

3.4 Connecting wires.

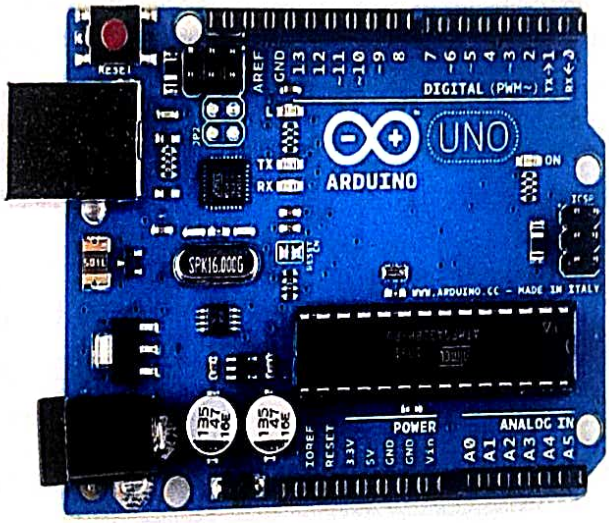


Figure 1: Arduino Uno Board

3.1 Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists ofboth a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

• The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package. The Arduino is a microcontroller board based on the ATmega8. It has 14 digital -input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC- to-DC adapter or battery to get started. The Uno differs from all preceding boards in thatit does not use the FTDI USB-to- serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter .Revision 2 of the Uno board has a resistor pulling the 8U2HWB line to ground, making it easier to put into DFU mode. Revision of the board has the following new features:

• Pin out: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board thatuses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin that is reserved for future purposes.

• Stronger RESET circuit.

• AT mega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform

3.1.1 Parameters For Arduino UNO Description

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32KB(ATmega328) of which 0.5KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16MHz

Length	68.6 mm
Width	53.4 mm
Weight	5 mm

Table 1. Specifications of Arduino

3.2 Current Sensor ACS712

ACS712 is an current sensor which is used for measuring the Current and voltage between the source transformer to destination load as the used electrical appliance.

Pin number	Pin name	Description
1.	VCC	The Vcc pin powers the sensor, typically with +5V
2.	Trigger	Trigger pin is an Input pin. This pin has to be kept high
3.	Echo	For 10us to initialize measurement by sending USwave. Echo pin is an Output pin. This pin goes high for a
4.	GND	Period of time which will be equal to the time taken for the US wave to return back to the sensor. This pin is connected to the Ground of the system.

Table 2: Pin Number and Function of Ultrasonic sensor

3.2.1 ACS712 Sensor Features.

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15ma
- Operating Frequency: 40Hz

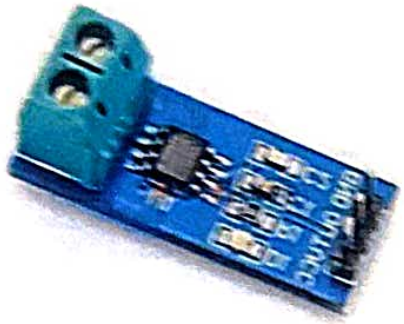


Figure 2: ACS712 Current Sensor

3.2.2 Current Sensor Working

The Current sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

$$\textbf{Distance} = \textbf{Speed} \times \textbf{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module.Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor

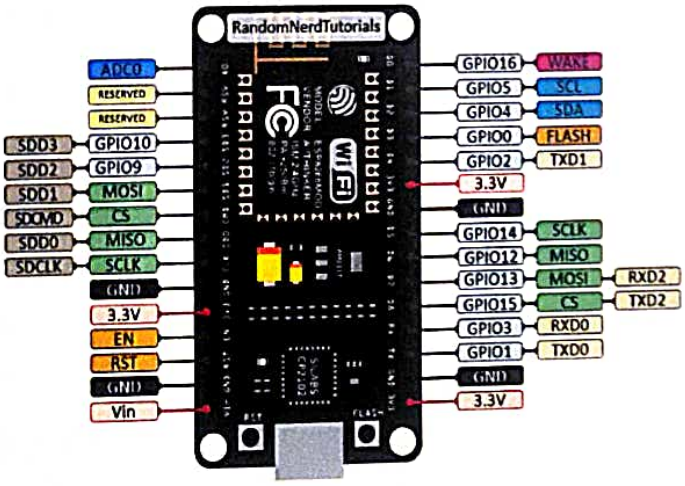


Figure 3: WIFI Module

3.3. WIFI Module

GSM/GPRS module is used to establish communication between a computer and a **GSM-GPRS system. Global System for Mobile communication (GSM)** is an architecture used for mobile communication in most of the countries. **Global Packet Radio Service (GPRS)** is an extension of GSM that enables higher data transmission rate.

GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a **SIM (Subscriber Identity Module)** card just like mobile phones to activate communication with the network. Also they have **IMEI** (International Mobile Equipment Identity) number similar to mobile phones for their identification.

A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs **AT commands**, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the **GSM and GPRS cellular network.**

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted intoone of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

3.3.1 A SIM card contains the following information:

- Subscriber telephone number (MSISDN)
- International subscriber number **(IMSI, International Mobile Subscriber Identity)**
- State of the SIM card
- Service code (operator)
- Authentication key

3.3.2 PIN (*Personal Identification Code*)

- PUK (*Personal Unlock Code*)
- Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, the following operations can be performed:
- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.

Voltage sensor:

Voltage and current is a Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability. The DHT11 Humidity and Temperature Sensor consists of 3 main components. A resistive type humidity sensor, an NTC (negative temperature coefficient) thermistor (to measure the temperature) and an 8-bit microcontroller, which converts the analog signals from both the sensors and sends out single digital signal. This digital signal can be readby any microcontroller or microprocessor for further analysis.DHT11 Humidity Sensor consists of 4 pins: VCC, Data Out, Not Connected (NC) and GND. The range of voltage for VCC pin is 3.5V to 5.5V. A 5V supply would do fine. The data from the Data Out pin is a serial digital data. DHT11 Sensor can measure a humidity value in the range of 20 – 90%of Relative Humidity(RH) and a temperature in the range of 0 – 50^{0}C. The sampling period of the sensor is 1 second. All the DHT11 Sensors are accurately calibrated in the laboratory and the results are stored in the memory. A single wire communication can be established between any microcontroller likeArduino and the DHT11 Sensor. Also, the length of the cable can be as long as 20 meters. Thedata from the sensor consists of integral and decimal parts for both Relative Humidity (RH) andtemperature.

3.3.3 Node MCU:

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266Wi- Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espress-if Non- OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

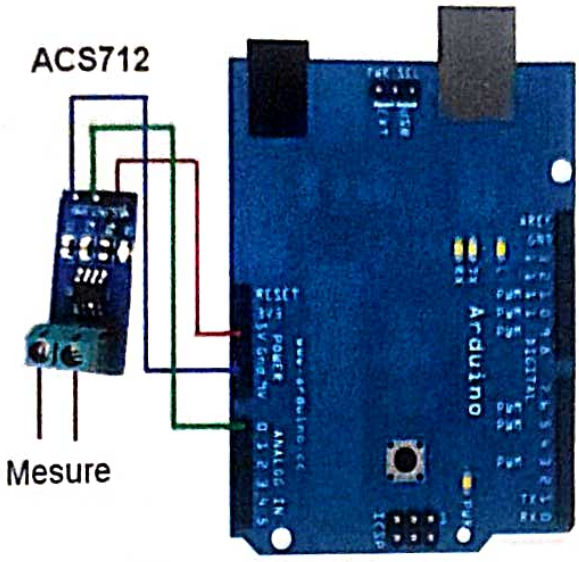
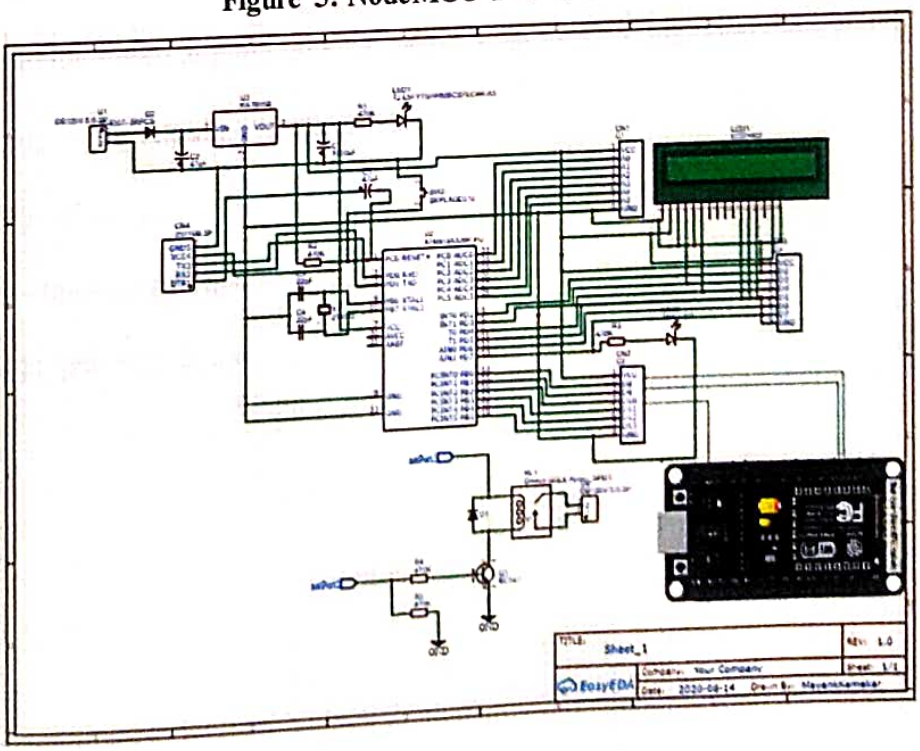


Figure 4:

Node MCU provides a way to connect different sensors to their controllers wirelessly via wifi. Since, it is an improved version of the ESP8266 it has better and easier programming, with better voltage stability and more reliability.

Figure 5: NodeMCU PINOUT



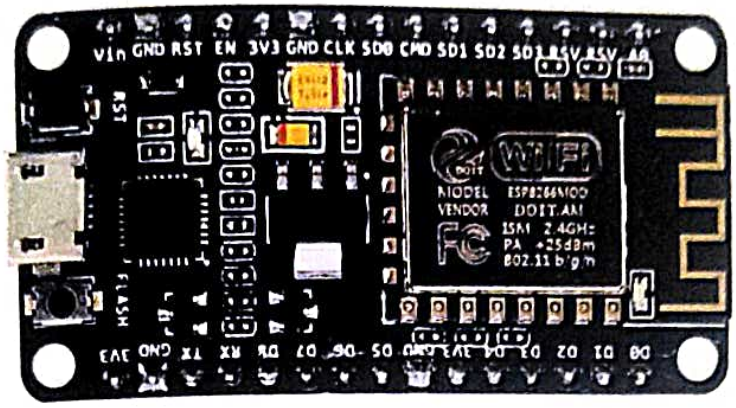


Figure 6: Node MCU

3.3.4 Design And Modelling

In this section we design structure of the system before implementation of circuit. we use advanced microcontroller called Arduino (ATmega8). It has in built with many components like analog to digital converter, clock of 16 MHz, shift registers.

In this project we put the ultrasonic sensor on top of the garbage bin/ dump. The output of the ultrasonic sensor is processed by the Arduino and the output is then sent to the GSM module which sends a text message to the concerned person. We have a threshold value of 5cm. Which means that if the distance of the sensor from the top of the garbage is less than 5cm, the output will come with a message that the basket is full. Also, a buzzer will ring if output is less than 5cm. The DHT11 sensor will show the temperature and the humidity.

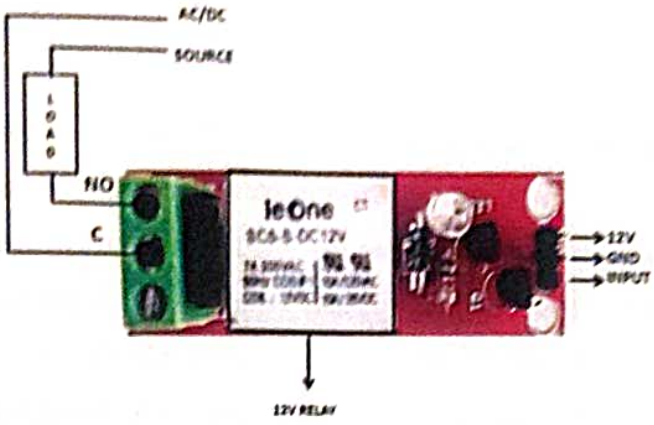


Figure 7: Relay Control diagram

3.3.5 Arduino Ide

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. The Arduino development environment contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.Software written using Arduino are called sketches. These sketches are written in thetext editor. Sketches are saved with the file extension .ino. It has features for cutting/pastingand for searching/replacing text. The message area gives feedback while saving and exportingand also displays errors. The console displays text output by the Arduino environmentincluding complete error messages and other information. The bottom right-hand corner ofthe window displays the current board and serial port. The toolbar buttons allow you to verifyand upload programs, create, open, and save sketches, and open the serial monito

1.4 Connecting Wires.

Connections of the ultrasonic sensor with the Arduino are very simple. Connect the VCC and the ground of the ultrasonic sensor to the 5V and the ground of the Arduino.

Then connect the TRIG and ECHO pin of ultrasonic sensor to the pin 11 and 12 of the Arduino respectively(you can use any other pin as well).Connect the RX pin of the arduino with the TX pin of the GSM module and the TX pin of the arduino with the RX pin of the GSM module. Connect the GND of the arduino to the ground of the module. Also,the GSM module needs an external 12v supply.

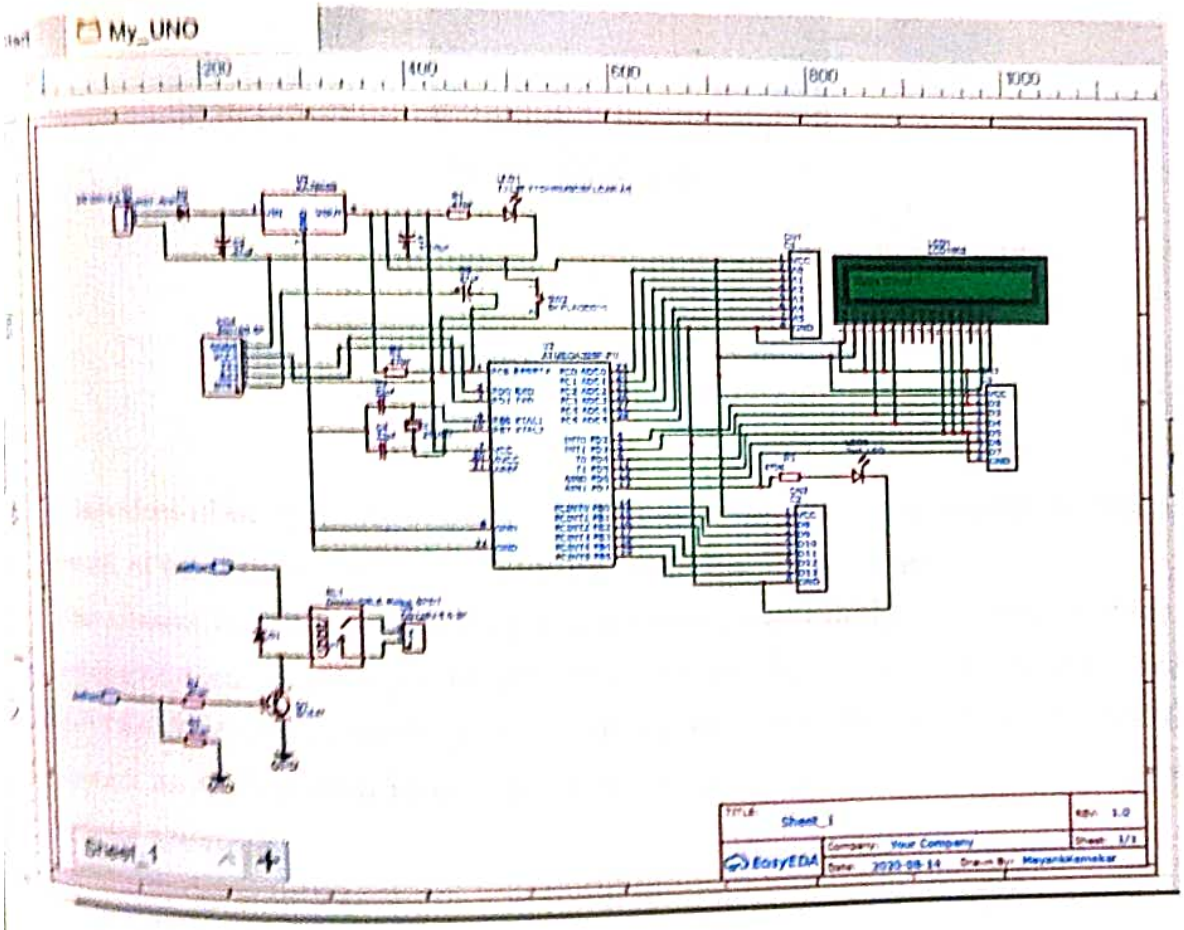


Figure 8: circuit diagram

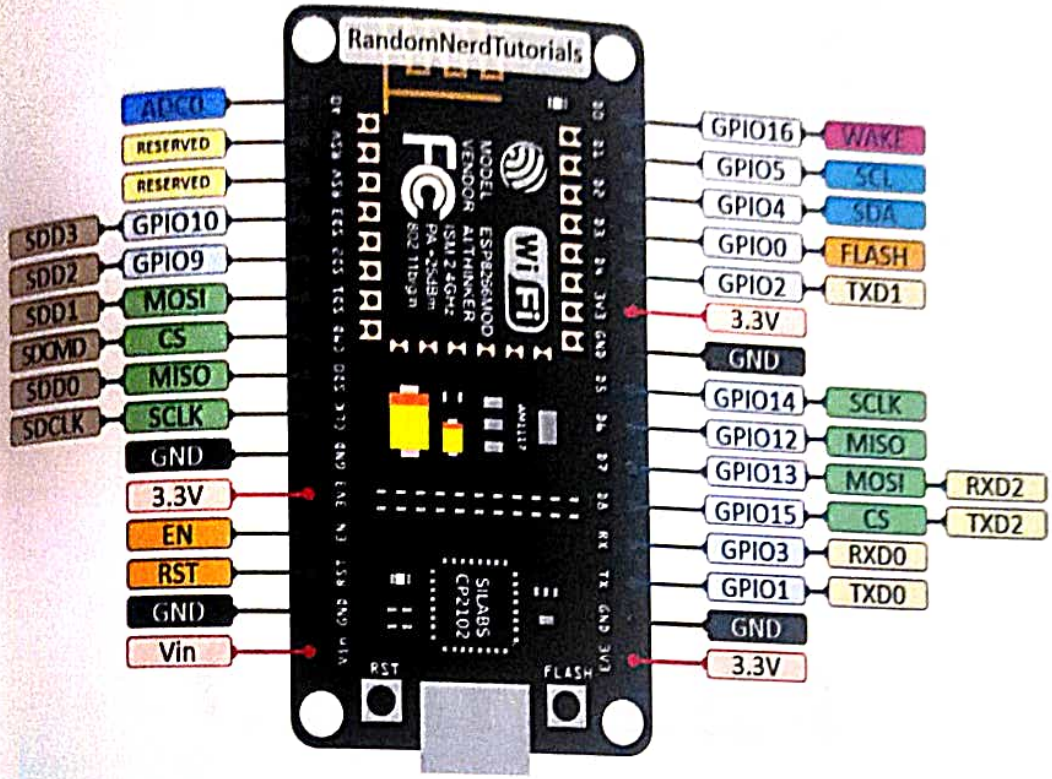


Figure 9: diagram of node MCU

Connections of the ultrasonic sensor with the Arduino are very simple. Connect the VCC and the ground of the ultrasonic sensor to the 5V and the ground of the Arduino.

Then connect the TRIG and ECHO pin of ultrasonic sensor to the pin 11 and 12 of the Arduino respectively(you can use any other pin as well).Connect the RX pin of the arduino with the TX pin of the GSM module and the TX pin of the arduino with the RX pin of the GSM module.

Connect the GND of the arduino to the ground of the module. Also,the GSM module needs an external 12v supply.

CHAPTER 4 METHADOLOGY

4.1 Methadology Of IOT Garbage Monitoring System

In light of IoT technology, waste management is an important service that is supported by IoT. In today's time, waste management is a collective issue in most countries, which needs uninterrupted importance for management. In traditional waste management systems, the rapid growth of garbage leaves the public places unhygienic and dirty. The unhygienic environment can cause various deadly diseases. The prior research focused on the centralized system for waste management that is managed by a central authority. In this study, we are proposing a smart waste management system for real-time monitoring of "trash bins" in order to take timely actions for cleaning the bins and maintaining a disease-free environment for the people. The proposed system is based on edge-nodes, that is, trash bins. In this system, a trash bin is working as an intelligent node in the entire processing of waste management. The smart bin mechanism is illustrated in the form of a block diagram in Figure 10.

Block diagram of a smart bin mechanism

The proposed SBM system is composed of three main entities, that is, trash bins (TB), trash collecting vehicle (TCV), and central database (CDB). These entities are part of SBM and their duties and characteristics are defined in the following subsections.

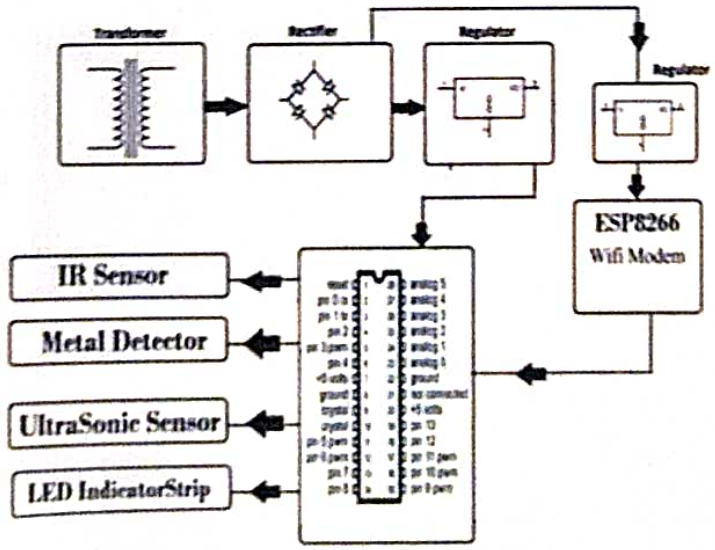


Fig no. 10. Block Diagram Of IOT Garbage Monitoring System

4.2 Iot power factor Monitoring System

This project IOT power factor Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins todetect the garbage level and compare it with the garbage bins depth. The system makes use of AVR family microcontroller, LED Strips, Wi-Fi modem for sending data and a buzzer. The system is powered by a 12V transformer. The LED Strip is used to display the status of the level of garbage collected in the bins.

Whereas a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins and highlights the garbage collected in color in order to show the level of garbage collected. The LED Strips shows the status of the garbage level. The system puts on the buzzer when the level of garbage collected crosses the set limit. Thus this system helps to keep the city clean by informing about the garbage levels of the bins by providing graphical image of the bins via a web page

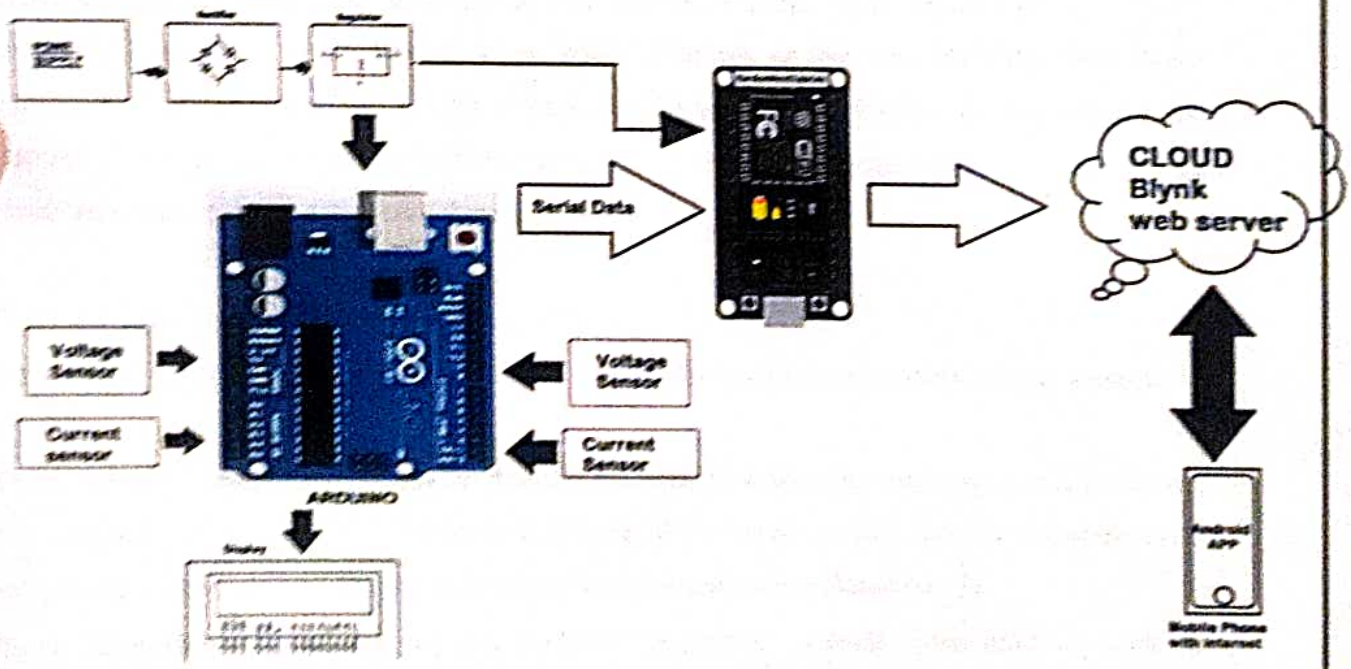


Fig.11. IOT Power factor Monitoring system

4.3 Hardware Description

- AVR family microcontroller
- Wi-Fi Modem
- LED's
- LED Strip
- 12V transformer
- Current sensors
- Relay Module
- Resistors
- Capacitors
- Diodes

4.4 Blynk app

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likesover the Internet.It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Piis linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet Of Your Things. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

There are three major components in the platform:

- **Blynk App** - allows to you create amazing interfaces for your projects using various widgets we provide.
- **Blynk Server** - responsible for all the communications between the smart phone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
- **Blynk Libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

4.5 Software Specifications

- Arduino compiler
- Blynk android app

MC Programming Language: Embedded C

4.6 Software Implementation.

The software required for it is the Arduino IDE.

Source Code

```
#include <WS2812FX.h>
#include <Servo.h>
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
BlynkTimer timer;

Servo servo;
#define LED_COUNT 50
#define LED_PIN 5 //D1
#define IR_SENSOR 4  //D2

#define FALL_SENSOR_PIN 13//D7
char auth[] = "EvcmLuSV39-r151ocxzMZXASThaSFUXm";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Priyanka";
char pass[] = "123456789";

int flag=0;
// defines pins numbers
const int trigPin = 2; //D4
const int echoPin = 0;  //D3

// defines variables
long duration;
int distance;

boolean State = true;
```

```
WS2812FX ws2812fx = WS2812FX(LED_COUNT, LED_PIN, NEO_GRB + NEO_KHZ800);

void setup()
{
 servo.attach(15); //D8
 pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin, INPUT); // Sets the echoPin as an Input
 Serial.begin(9600); // Starts the serial communication
 pinMode(IR_SENSOR,INPUT);
 ws2812fx.init();
 ws2812fx.setBrightness(255);
 ws2812fx.setSpeed(2000);
 ws2812fx.setColor(RED);
 ws2812fx.setMode(0);
 ws2812fx.start();

 Blynk.begin(auth, ssid, pass);
 // You can also specify server:
 //Blynk.begin(auth, ssid, pass, "blynk-cloud.com", 80);
 //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8080);
 pinMode(FALL_SENSOR_PIN,INPUT);
 timer.setInterval(500L,notifyOnFall);
}

void loop()
{
 Blynk.run();
 timer.run();
 State = digitalRead(IR_SENSOR);
  if(State == false)
  {
   Red();
  }
  else
  {
   Green();
  }
}

void Green(void)
{
  ws2812fx.setColor(GREEN);
  ws2812fx.service();
  if(GetDistance() < 10)
  {
```

```
    servo.write(260);//Upside
   }
   else
   {
    servo.write(70);//Down
   }
}

 void Red(void)
{
   ws2812fx.setColor(RED);
   ws2812fx.service();
   if(GetDistance() < 10)
    {
     servo.write(260);//Upside
    }
    else
    {
     servo.write(70);//Down
    }
   }

 int GetDistance(void)
 {
  // Clears the trigPin
 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);

 // Sets the trigPin on HIGH state for 10 micro seconds
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);

 // Reads the echoPin, returns the sound wave travel time in microseconds
 duration = pulseIn(echoPin, HIGH);

 // Calculating the distance
```

```
distance= duration*0.034/2;
// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
return distance;
}

void notifyOnFall()
{
 int FALL_SENSOR = digitalRead(D7);
 if(FALL_SENSOR == 1 && flag ==0)
 {
  Blynk.notify("Alert.....! Harmful Object detedcted ...!");
  flag=1;
 }
 else if (FALL_SENSOR == 0)
 {
  flag=0;
 }
}

/*
 * ////////////////////////////For UltraSonic Sensor//////////////////////
 *
#include <Servo.h>
Servo servo;
// defines pins numbers
const int trigPin = 2; //D4
const int echoPin = 0;  //D3

// defines variables
long duration;
int distance;

void setup()
{
 servo.attach(15); //D8
 pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin, INPUT); // Sets the echoPin as an Input
 Serial.begin(9600);  // Starts the serial communication
}

void loop()
{

if(GetDistance() < 10)
 {
 servo.write(260);//Upside
 delay(1000);
 }
 else
 {
 servo.write(70);//Down
```

```
  delay(1000);
  }
}

int GetDistance(void)
{
 // Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);

// Calculating the distance
distance= duration*0.034/2;
// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
return distance;
}
*/
```

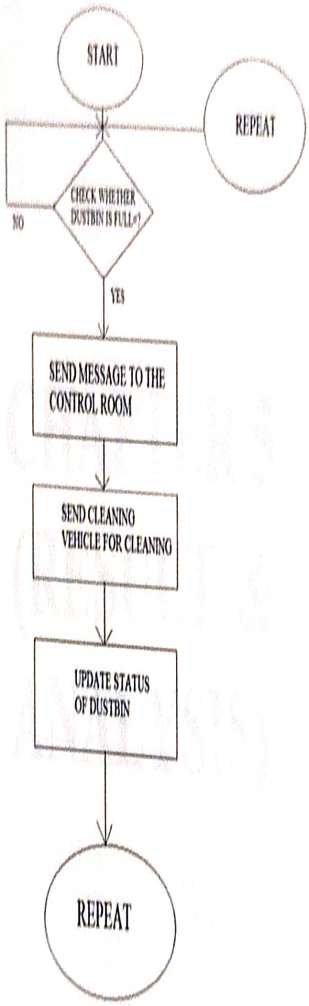


Figure 12: Flow chart of project

CHAPTER 5. RESULTS AND ANALYSIS

5.1 Result

The output of this project should have been the values of the voltage, current and control, which we were supposed to get via a text message. For, the WIFI Module to send data, the sensors must be working perfectly. This brings us to figure in which we see the text messages sent from the GSM Module. Also, the output in Blynk app is shown in figure, which shows the real time data on the app, via WIFI.

We will test the project in two stages: software and hardware. The software part is to be tested via the Arduino IDE, whereas the hardware part has to be tested physically. It is necessary to check whether the system is working properly or not. To check whether the readings are accurate, we will check the distance pointed out by the sensor by a meter tape.

5.2 Features to be tested

After building the whole circuit we test it, testing procedure is given in 5.1. This project should satisfy some features. Features to be tested as follows:

- The ultrasonic sensor should give proper output. To check whether the output is accurate or not, the output of the sensor will be checked against a meter tape.
- The arduino board should show the distance in the serial monitor. So should theNodeMCU.
- The GSM module should send messages after the specified delay. If the text messages are reaching the phone, that means the GSM module is working. It should make a small ringing sound, when it sends messages.
- The DHT11 sensor should work properly and show its output in the serial monitor.
- The blynk app should be checked.

5.3 Testing tools and environment

For testing of the project we require some tools, like to test Arduino program we require a software called Arduino IDE. Using this we can check the program that program is working properly or not. For hardware checking we require power supply and proper range of measurements and a meter tape. The garbage dump should have only solid waste.

The NodeMCU should connect to the Blynk app and the app should show the output.

For this ,theNodeMCU must connect first to the wifi hotspot.

5.4 Test cases

In this section we discuss about the inputs, expected output, testing procedure.

Inputs

This project requires three inputs:

1. Power supply:Power supply is the basic need of any electronic circuit. Here we use 5v dc battery to give power Arduino and sometimes we can give power directly from the computer. We also need a 12V power supply for the GSM module.
2. We can also power these circuits via two 9v batteries using a circuit divider.Distance, The distance will be the input of the Arduino circuit and will be gotten from the ultrasonic sensor.
3. The temperature and humidity from the DHT11 sensor.

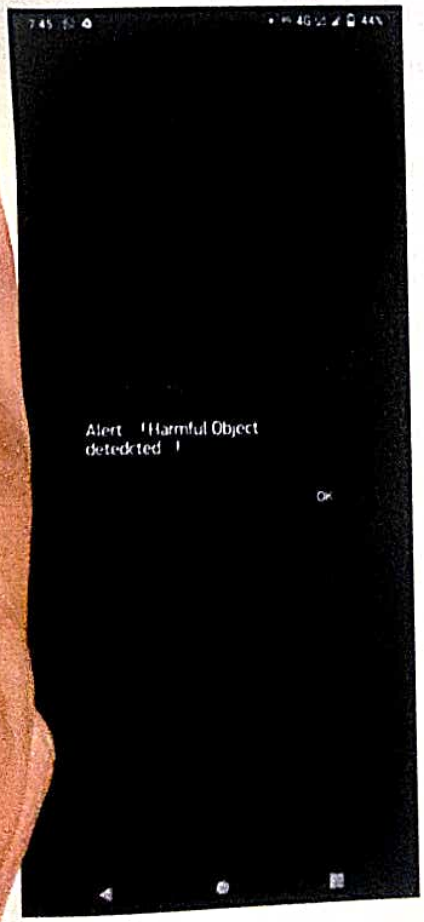


Figure 13: screenshot of output in Blynk

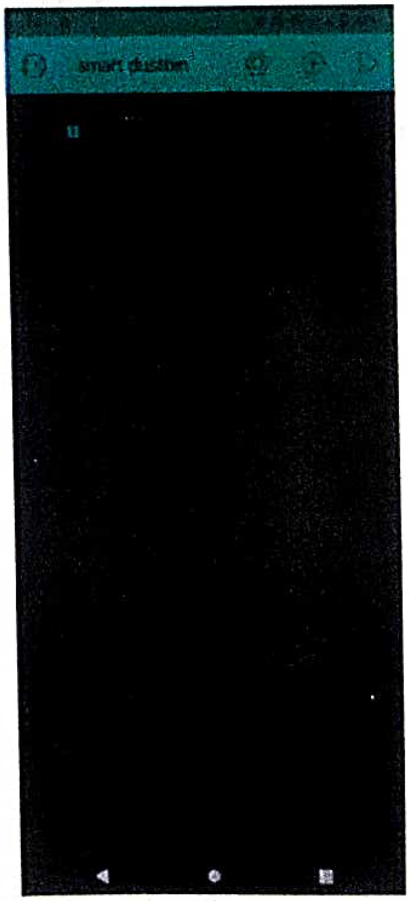


Figure 14: Output as a alart text message on phone.

5.5 Expected output

The expected output of this project should be a text message showing the distance to full. Also, it will also send the humidity and the temperature of the area. The output should also be seen on the serial monitor of the Arduino IDE. Also, the output should also be seen on the serial monitor and also on the Blynk app.

5.6 Testing procedure:

For testing first connect the circuit to the power supply is given to the Arduino using comp Outer and it can be done by using battery. In this way the whole testing circuit is built. Now we give input to the HC-SR04 by changing the level of solid garbage.. Change in garbage levels shouldbe messaged using GSM Module.

Summary of testing procedure:-

1) Connect the circuit according to the diagram
2) Give power to the system.
3) Vary garbage level for the ultrasonic sensor to give output.
4) Get the output from the DHT11 sensor.
5) Send message via the GSM module.

CHAPTER 6. ONCLUSION AND FUTURE SCOPE

We built an efficient power factor monitoring system which can be used to monitor the level of voltage and current in the dump. This data can be further used to plan data collection trips more efficiently, ultimately reducing overflowing bins and helping have better home sanitation.

6.1 Conclusion and Future Scope

The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living. By using this system we can constantly check the level of the garbage in the dustbins which are placed in various parts of the city. If a particular dustbin has reached the maximum level then the employees can be informed and they can immediately take certain actions to empty it as soon as possible. The employees can check the status of these bins anytime on their mobile phones. This can prove to be a very useful system if used properly. The system can be used as a benchmark by the people who are willing to take one step further for increasing the cleanliness in their respected areas. Ultrasonic sensor is being used 12 1234567890 14th ICSET-2017 IOP Publishing IOP Conf. Series: Materials Science and Engineering 263 (2017) 042027 doi:10.1088/1757-899X/263/4/042027 in this system to check the level of garbage in the dustbins but in future various other types of sensors can be used with the ultrasonic sensor to get more precise output and to take this system to another level. Now this system can be used in certain areas but as soon as it proves its credibility it can be used in all the big areas. As this system also reduces manual work certain changes can be done in the system to take it to another level and make it more useful for the employees and people who are using it. In future, a team can be made which will be in charge for handling and maintaining this system and also to take care of its maintenances.

6.2 Advantages:

- Very simple circuit.
- The HCSR04 sensor is very rugged.
- Helps monitor garbage levels.
- Uses very small amount of electricity.
- Ultimately helps in better planning of garbage pickups.
- Can help in reducing overflowing bins.
- Reduces trips to areas where the bins still have a lot of capacity.

- The advantages of IoT span across every area of lifestyle and business. Here is a list of some of the advantages that IoT has to offer
- **Improved Customer Engagement** – Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audiences.
- **Technology Optimization** – The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IoT unlocks a world of critical functional and field data.
- **Enhanced Data Collection** – Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

6.3 Disadvantages:

1. Cannot detect liquid waste.
2. Only detects the top of the garbage level. It wouldn't realize if there is space left.
3. GSM module needs a 12v source.

Though IoT delivers an impressive set of benefits, it also presents a significant set of challenges. Here is a list of some its major issues

- **Security** – IoT creates an ecosystem of constantly connected devices communicating over networks. The system offers little control despite any security measures. This leaves users exposed to various kinds of attackers.
- **Privacy** – The sophistication of IoT provides substantial personal data in extreme detail without the user's active participation.

Complexity – Some find IoT systems complicated in terms of design, deployment, and maintenance given their use of multiple technologies and a large set of new enabling technologies.

- **Flexibility** – Many are concerned about the flexibility of an IoT system to integrate easily with another. They worry about finding themselves with several conflicting or locked systems.

Compliance – IoT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

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