IOT Mini Project Report on
HOME AUTOMATION SYSTEM

MASTER OF COMPUTER APPLICATION

By

NITIN KUMAR

Roll no.39

Enrollment No. AJU/211546

Under the esteemed guidance of

Dr . Arvind Kumar Pandey
Dr. Arun Kumar Marandi

DEPARTMENT OF COMPUTER SCIENCE& INFORMATION TECHNOLOGY

ARKA JAIN UNIVERSITY, JHARKHAND

JAMSHEDPUR

2021-2023

IOT Mini Project Report on

HOME AUTOMATION USING NODE MCU

MASTER OF COMPUTER APPLICATION

By

Nitin Kumar
Enrolment No: AJU/211546

Under the esteemed guidance of

Dr. Arvind Kumar Pandey
Dr. Arun Kumar Marandi

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

ARKA JAIN UNIVERSITY, JHARKHAND

JAMSHEDPUR

2021-2023

CERTIFICATE

This is to certify that the project entitled, **"HOME AUTOMATION SYSTEM"**, is bonafide work of **NITIN KUMAR** bearing Enrollment No - **AJU/211546** submitted in partial fulfilment of the requirements for the award of degree of **MASTER OF COMPUTER APPLICATION (MCA)** from **ARKA JAIN University, JHARKHAND.**

Internal Guide **HOD**

Date: **University Seal**

Abstract

This project is all about IoT based Live Home Automation Using NodeMCU ESP8266. We will interface DHT11 Humidity & Temperature Sensor, BMP180 Barometric Pressure Sensor, and FC37 Rain Sensor with NodeMCU ESP8266-12E WiFi Module. We will measure humidity, temperature, Barometric pressure, and rainfall and upload the data to a web server. Once the code is uploaded you can find the IP address of NodeMCU in the serial monitor. With the same IP, you can go to any web browser and display the data in a beautiful widget format. The project is very interesting and can be used in remote areas or in a freezer where the data is to be monitored.
The internet of things (IoT) is connecting the devices and tools to the internet network
to be controlled by websites and smart phone applications remotely, also, to control tools and instruments by codes and algorithms structures for artificial intelligence issues. In case we want to create advanced systems using python algorithms, Wi-Fi or Ethernet connection is connected to our tools, equipment, and devices controlling them by smart phone applications or internet websites. That's actually the simplified definition of IoT. Farther than just using the IoT as a smart home to operate lamps or other home-use devices, it can be used as a security system or an industrial-use system, for example, to open or close the main building gate, to operate full automatic industrial machine, or even to control internet and communication ports. And more ideas can be done by using IoT technology. A huge industrial facility or governmental institutions have much of lamps. Employees sometimes forget to turn them off in the end of the day. This research suggests a solution that can save energy by letting the security to control lighting of the building with his smart home by Blynk application. The lamps can be controlled by switches distributed in the building and Blynk application at the same time with a certain electrical installation. This research presents a simple prototype of smart home, or the easy way and low cost to control loads by Wi-Fi connection generally.

Acknowledgement

It is a genuine pleasure to express my profound gratitude and deep regards to my Internal Guide "**DR. ARUN KR. MARANDI"** and our HOD **"DR. ARVIND KUMAR PANDEY"** for their exemplary guidance, monitoring and constant encouragement. I would like to express my special thanks to **ARKA JAIN UNIVERSITY** who gave me the golden opportunity to do this wonderful project on the topic **"HOME AUTOMATION SYSTEM"**, which helped me in doing a lot of Research and I came to know about so many new things.

Declaration

I hereby declare that the project entitled, "**HOME AUTOMATION SYSTEM"** done at **ARKA JAIN UNIVERSITY**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **MASTER OF COMPUTER APPLICATION** to be submitted as IoT mini project as part of our curriculum.

Nitin Kumar

Signature of the Student

Table of Contents

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

In this project, we have designed **Home Automation System** using **Node MCU 8266**. A load controlled by computer systems has many advantages compared with manual controlled loads. Nowadays there are many programs and applications help to control things better using codes or python algorithms in artificial intelligence projects. In order to save energy and make loads monitored easily, this research suggests smart home project based on IoT technology. This smart home is an Internet of Things (IoT) project that controls loads with internet connection via Wireless Fidelity WIFI connection. A smart phone connected to internet with Blynk application as a control panel, and NodeMCU microcontroller kit in other side as a controller that receives control commands via WIFI signal. NodeMCU kit is built with ESP8266 WIFI receiver that able to process and analyze WIFI signal to input the microcontroller. The WIFI receiver and microcontroller are built in one kit to be used as IoT project. It's called NodeMCU.

The NodeMCU is coded via Arduino Integrated Development Environment (IDE) with the Universal Serial Bus port (USB) to tell the Node MCU what to do, I want to make the NodeMCU controls two-channel relay kit by Blynk hand Android phone application

CHAPTER 2: PROPOSED MODEL

2.1. HOME AUTOMATION SYSTEM

This project is prepared based on the important steps that are done by orienting on the success indicators in connecting the NodeMCU ESP8266 module and other devices so that it can be used to solve multi-objective problems. To achieve these indicators, the stages of this research are as follows:

1. Analysis of the problem. Analyze the problems to be studied regarding smart home.
2. Analysis of needs. In this case all needs in researching both from journals, literature books, tools, and materials.
3. System design. Designing tools to be built using the NodeMCU ESP8266 module, and the sensors used.
4. System programming. Make a program using the Arduino IDE and the Blynk android application.
5. Testing tools. Testing tools with program codes created and internet connections.
6. Making reports and summarizing the results of the experiment. See system responsiveness to commands given to smart home.

2.2 Hardware Requirements

2.2.1. NODE MCU 8266

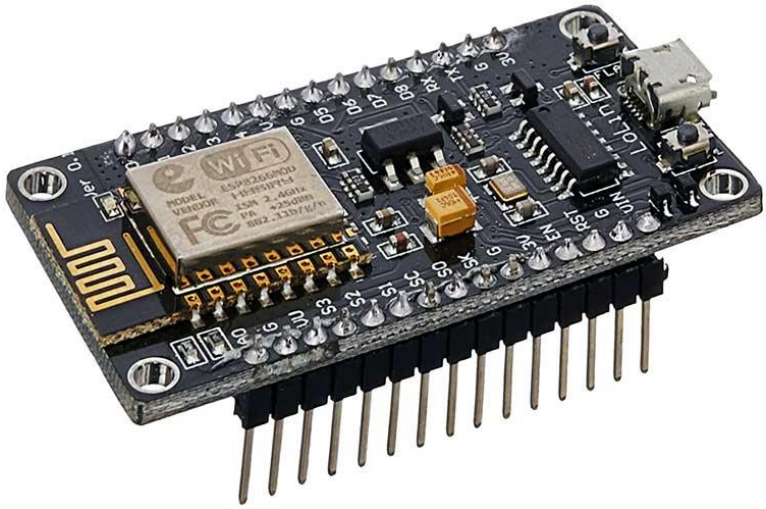

Fig. Node MCU

The NodeMCU (***N***ode ***M***icro***C***ontroller ***U***nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip.

Pins used:

1) Vin is connected to power supply output 5VDC.
2) GND is ground.
3) D1,D2,D3 and D4 are used as digital outputs.
4) A0 is used as analog signal input to input sensor signal

2.2.1. 2-channel Relay module

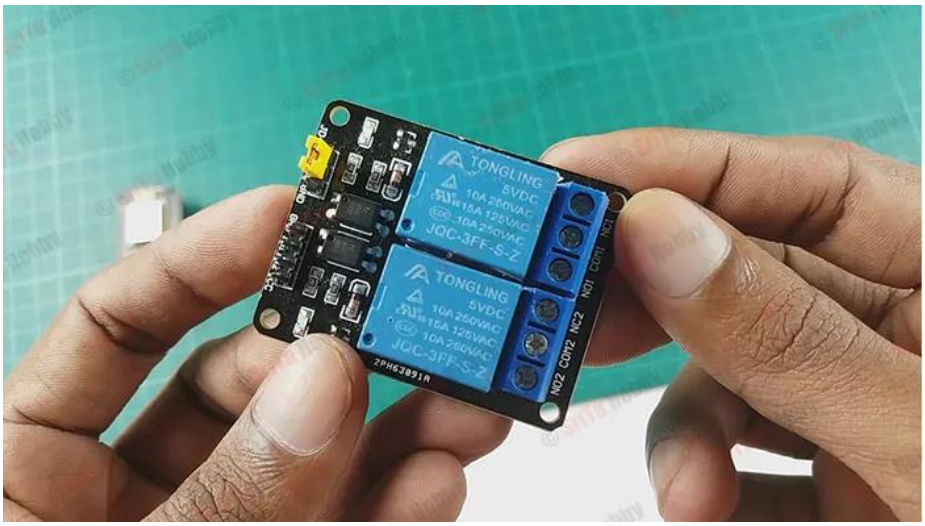

Fig. 2-channel relay module

A Relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

2.2.3. Jumper Wires

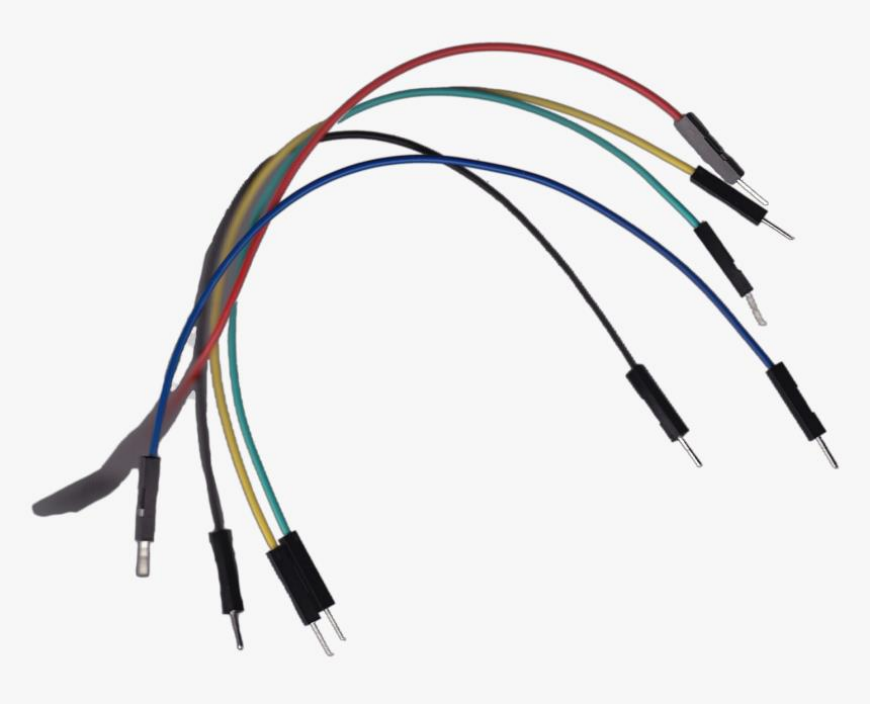

Fig. Jumper wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

2.2.4. Breadboard

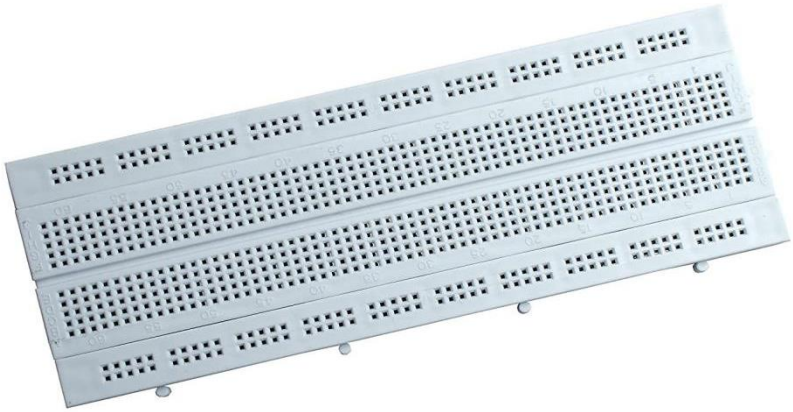

Fig. Breadboard

A breadboard is **a rectangular plastic board with a bunch of tiny holes in it**. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

2.3 Software Requirements

2.3.1. Arduino IDE 2.0

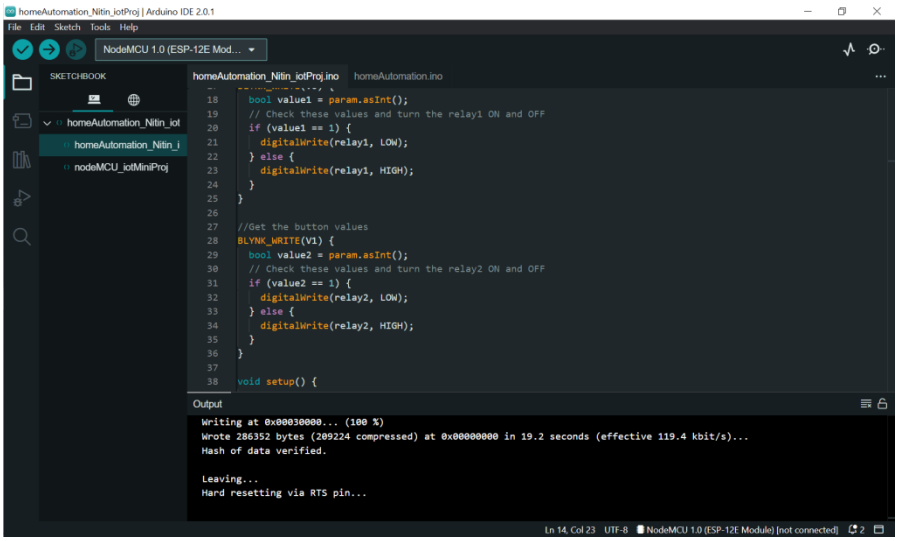

Fig. Arduino IDE

The Arduino IDE 2.0 is an improvement of the classic IDE, with increased performance, improved user interface and many new features, such as autocompletion, a built-in debugger and syncing sketches with Arduino Cloud.

The Arduino IDE 2.0 is a versatile editor with many features. You can install libraries directly, sync your sketches with Arduino Cloud, debug your sketches and much more.

2.3.2. Blynk IoT Android App

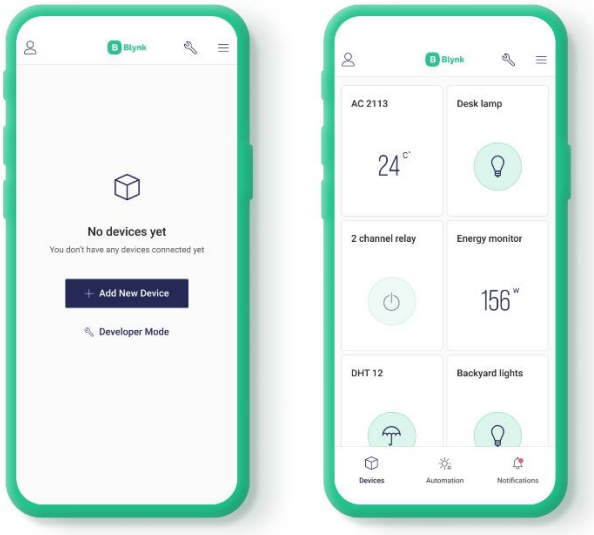

Fig. Blynk Android App

Everything you need to build and manage connected hardware: device provisioning, sensor data visualization, remote control with mobile and web applications, Over-The-Air firmware updates, secure cloud, data analytics, user and access management, alerts, automations and much much more. Blynk platform powers low-batch manufacturers of smart home products, complex HVAC systems, agricultural equipment, and everyone in between. These companies build branded apps with no code and get the full back-end IoT infrastructure through one subscription.

CHAPTER 3: WORKING PROCEDURE

The system is based on NodeMCU board as an internet of things system. The NodeMCU is connected to the internet from the hotspot of the smart phone via WIFI connection as the NodeMCU has ESP8266 circuit to connect with the internet.

3.1 Circuit Diagram

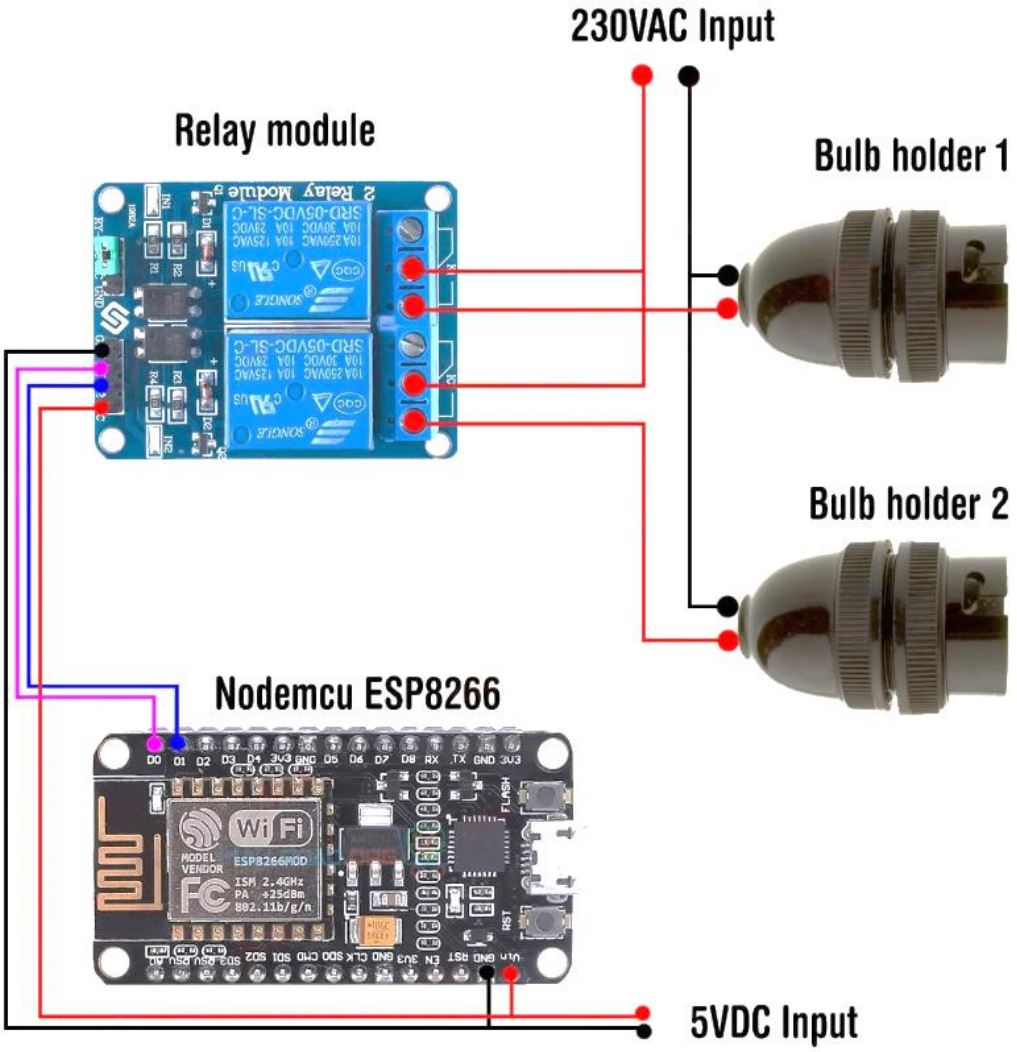

Fig. Circuit Diagram

NodeMCU to be connected to the hotspot of the smart phone, needs to be identified to the name of hotspot, the password and token code letting the server of Blynk connects them together. You may need the computer once to transfer code from Arduino IDE to the

NodeMCU kit to prepare the software part of the project. Figure 1 shows that the server of Blynk application will process the smartphone-NodeMCU connection. Blynk libraries are ZIP files can be downloaded from Github website to be imported to the Arduino IDE library. Blynk server will check for internet connection, NodeMCU with android hotspot, the NodeMCU code includes the token code, the name of hotspot and it's password.

3.2 Working

1. The system is based on NodeMCU board as an internet of things system. The NodeMCU is connected to the internet from the hotspot of the smart phone via WIFI connection as the NodeMCU has ESP8266 circuit to connect with the internet.
2. NodeMCU to be connected to the hotspot of the smart phone, needs to be identified to the name of hotspot, the password and token code letting the server of Blynk connects them together.
3. You may need the computer once to transfer code from Arduino IDE to the NodeMCU kit to prepare the software part of the project.
4. The server of Blynk application will process the smartphone-NodeMCU connection. Blynk libraries are ZIP files can be downloaded from GitHub website to be imported to the Arduino IDE library.

5. Blynk server will check for internet connection, NodeMCU with android hotspot, the NodeMCU code includes the token code, the name of hotspot and it's password.
6. The information included to the code must be match with the hotspot information to allow ESP8266 connect with the WIFI to be as a channel to exchange commands between smart phone and NodeMCU.
7. Remaining processes are just commands sent from Blynk application to NodeMCU to control loads those are connected to the relay kit.
8. And sensor output value is sent reverse to the Blynk application from NodeMCU kit.

CHAPTER 4: CODE

So here is a source code for designing Home Automation using NodeMCU 8266. Simply copy the code and upload it to your Arduino board using Arduino IDE. Then we will create the required program for this. We can see it below.

```
//Include the library files
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

//Define the relay pins
#define relay1 D0
#define relay2 D1

#define BLYNK_AUTH_TOKEN "KFrCJ07YkEY9myzVBtoMX08heq4P9pqN" //Enter your blynk auth token

char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "Anonymous";//Enter your WIFI name
char pass[] = "P@$$w0rD";//Enter your WIFI password

//Get the button values
BLYNK_WRITE(V0) {
  bool value1 = param.asInt();
  // Check these values and turn the relay1 ON and OFF
  if (value1 == 1) {
    digitalWrite(relay1, LOW);
  } else {
    digitalWrite(relay1, HIGH);
  }
}

//Get the button values
BLYNK_WRITE(V1) {
  bool value2 = param.asInt();
  // Check these values and turn the relay2 ON and OFF
  if (value2 == 1) {
    digitalWrite(relay2, LOW);
  } else {
    digitalWrite(relay2, HIGH);
  }
}

void setup() {
```

```
  //Set the relay pins as output pins
  pinMode(relay1, OUTPUT);
  pinMode(relay2, OUTPUT);

  // Turn OFF the relay
  digitalWrite(relay1, HIGH);
  digitalWrite(relay2, HIGH);

  //Initialize the Blynk library
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
}

void loop() {
  //Run the Blynk library
  Blynk.run();
}
```

CHAPTER 5: RESULTS & PROTOTYPING DESIGN

The Light Control Test is done by pressing the ON / OFF button widget on the Blynk Application on the respective Android smart phone for lights and fans. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is lost or bad signal, then it also affects system performance. Below picture shows the working.

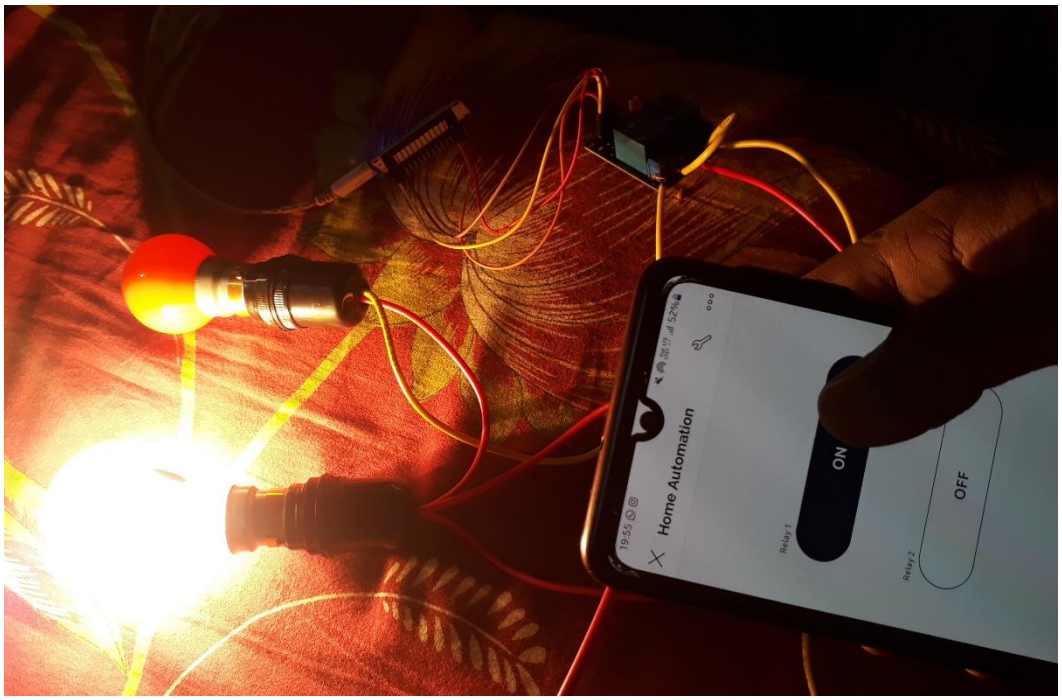

Fig 1. Bulb-1 ON

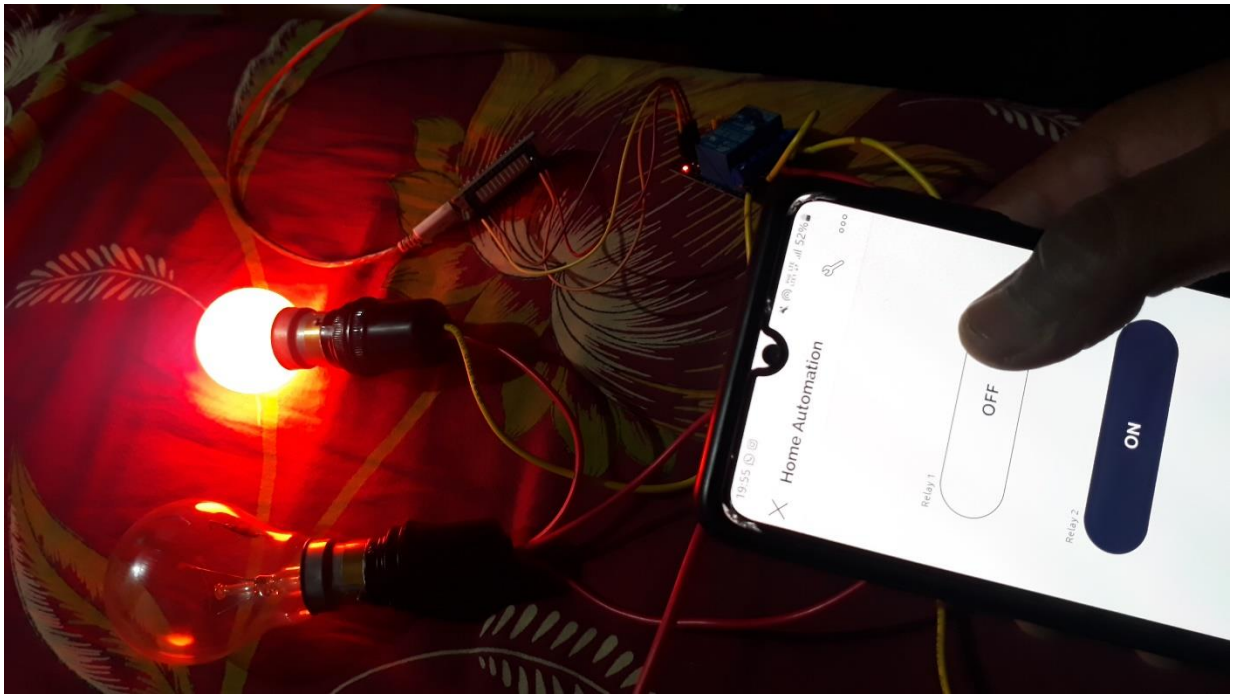

Fig 2. Bulb-2 ON

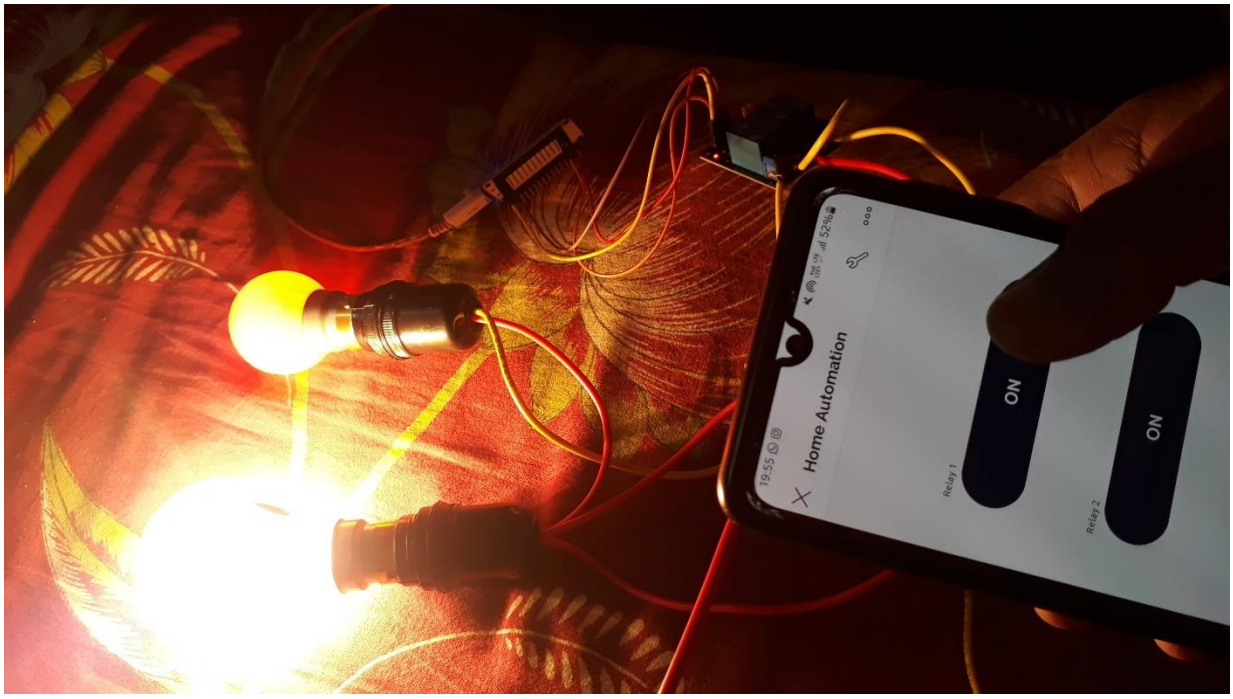

Fig 3. Bulb-1 & Bulb-2 ON

CHAPTER 6: APPLICATION & ADVANTAGE

6.1 Applications :

1. Controlled electrical fixtures such as lights and air conditioners
2. Simplified garden or lawn management
3. HVAC
4. Controlled smart home appliances
5. Enhanced safety and security at home
6. Water and air quality control and monitoring
7. Voice based home assistant supporting natural language
8. Smart locks and switches

6.2 Advantage :

1. Safety. The ability to control small appliances and lighting with your fingertips anywhere you are will add safety in your home. You can make sure appliances are off when it's needed to be off and on when it's needed to be on
2. Security. The ability to lock the door through your phone is one of the greatest benefits of home automation. This will give you peace of mind knowing that the door is close and not guessing. The fact that you can be alerted each time someone enters your home also allows you to monitor who is entering your home at all times, especially when you are not there.
3. Convenience. The ability to control everything with your fingertips is very convenient. With our smart phone always with us, we can easily monitor our home and control everything with just touch of a finger.
4. Saves Time. Since we are living in a very fast-paced environment, we don't even have time to worry about our home. With home automation, we can save time going back to our home and make sure everything is order.
5. Save Money. This is the biggest advantage of home automation. With the ability to control the light, whether dimming or turning on/off on specific time will saves home owner a great ton of money. You can save money through household temperature, with proper automation in window shades and automated thermostat.

CHAPTER 7: FUTURE SCOPE & CONCLUSION

Automation is not just a word but a requirement of everyone in the future. Technology made it possible to control your home appliances with the help of mobile application or voice assistant. People in India are quickly adopting this technology but still, this technology is new for most people. Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions. Smart Homes In the coming years, fully automated smart homes will surely become a reality as the home automation is developing rapidly. Due to good user convenience, smart homes are appealing a wide range of people all over the globe. The User can check for the electricity usage, the condition of his devices and get notification accordingly Smart Cities With increasing automation and IoT, devices can communicate with each other. This will help in building new and smarter cities. Cities that would be free form pollution, traffic accidents, etc. problems. Agriculture The proposed system can be used in Agriculture as well. The various devices used in fields can be operated from any remote location

7.1. CONCLUSION

Based on the results of analysis of all data obtained by testing the smart home with the Internet of Things based NodeMCU ESP6288 module, the following conclusions can be drawn: 1) Smart Home with Internet of Things (IoT) based NodeMCU ESP8266 Module can be designed with various components hardware and software support so that it can be arranged into a smart home system that is controlled with the Blynk android application according to what is intended. 2) The Smart Home with this Internet of Things (IoT) based NodeMCU ESP8266 Module can be implemented to control some of the home electronics performance including lighting controls, fan control, temperature monitoring, early warning systems and etc.

CHAPTER 8: REFERENCES

1. https://srituhobby.com/how-to-make-a-home-automation-system-using-the-nodemcu-esp8266-board-and-the-new-blynk-app/
2. https://github.com/esp8266/Arduino
3. https://www.youtube.com/watch?v=JgaKrPK4H-M
4. https://circuits4you.com/2019/01/05/connecting-esp8266-to-wifi-hotspot-example/#:~:text=NodeMCU%20ESP8266%20Arduino%20IDE%20Code%20Example&text=and%20call%20the-,WiFi.,to%20your%20Local%20Area%20Network
5. https://easyelectronicsproject.com/esp32-projects/home-automation-nodemcu-blynk-relay-1/
6. https://srituhobby.com/how-to-set-up-the-new-blynk-app-step-by-step-nodemcu-esp8266-with-blynk-app/
7. https://play.google.com/store/apps/details?id=cloud.blynk&hl=en_IN&gl=US