SPEECH RECOGNITION TO CONTROL HOME AUTOMATION SYSTEM

J Component Project Report for the course

ECM1004SIGNALS AND SYSTEMS

by

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Certificate

This is to certify that the Project work titled "**SPEECH RECOGNITION TO CONTROL HOME AUTOMATION SYSTEM**" is being submitted by ***Rufus Sam John ImmanuvelJ* (19BLC1031),*Sunil Kumar GV*(19BLC1055)**and***Srihari P*(19BLC1120)**for the course **Signals and systems**, is a record of bonafide work done under my guidance. The contents of this project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University

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ABSTRACT

This project presents the overall design of Home Automation System (HAS) with low cost and wireless system. This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home. . The switch mode and voice mode are used to control the home appliances. The main control system implements wireless technology to provide remote access from smart phone. The design remains the existing electrical switches and provides more safety control on the switches with low voltage activating method. The switches status is synchronized in all the control system whereby every user interface indicates the real time existing switches status. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation.

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CHAPTER 1

Introduction

Background The “Home Automation” concept has existed for many years. The terms “Smart Home”, “Intelligent Home” followed and has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity in creating new fields in engineering, and Computing. HASs includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to provide improved comfort, energy efficiency and security system. HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and elderly due to their complexity and cost, do not always accept these systems. Due to the advancement of wireless technology, there are several different of connections are introduced such as GSM, WIFI, and Bluetooth. Each of the connection has their own unique specifications and applications. Among the four popular wireless connections that often implemented in HAS project, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

1.1 Objective

The following are the objectives of this project:

Controlling Home Appliances via Application (Switch and Voice Mode) To develop an application that includes the features of switches and voice mode application. Switch Mode or Voice Mode can be used to control the switches of home appliances.

Secure Connection Channels between Application and ARDUINO Use of secure protocols over Wi-Fi so that other devices cannot control the appliances. Options for secure connection is SSL over TCP, SSH

Controlled by any device capable of Wi-Fi (Android, iOS, PC) To make the home appliances flexible in control, any device capable of Wi-Fi connectivity will able to control the home appliances from remote location.

Extensible platform for future enhancement The application is to be highly extensible, with possibility of adding features in the future as needed.

1.2 Scope

The project aims at designing a prototype for controlling the home appliances that can be controlled wirelessly via an application that provides the features of speech recognition, and switch mode. An application is run on android device. The system can be used in wide range of areas.

The system integrated with different features can be applied in the following fields.

- ✓ The system can be used in home, small offices to the big malls The system can be used from home to offices to control the electrical appliances

- ✓ For remote access of appliances in internet or intranet. The home/office appliances can be controlled in intra-network or can be accessed via internet.

- ✓ For the development of technology friendly environment The system incorporates the use of technology and making smart home automation. By the use of day to day gadgets we can utilize them for different prospective.

CHAPTER 2

Design/Implementation

2.1 Introduction

The Project is 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.

2.2 Design Approach

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. 4 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. 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. Remaining processes are just commands sent from Blynk application to NodeMCU to control loads those are connected to the relay kit as shown in Figure 2.1. And sensor output value is sent reverse to the Blynk application from NodeMCUkit.WE also used python for voice recognition and converted sound signal into text fosrmat and used it to control relay module

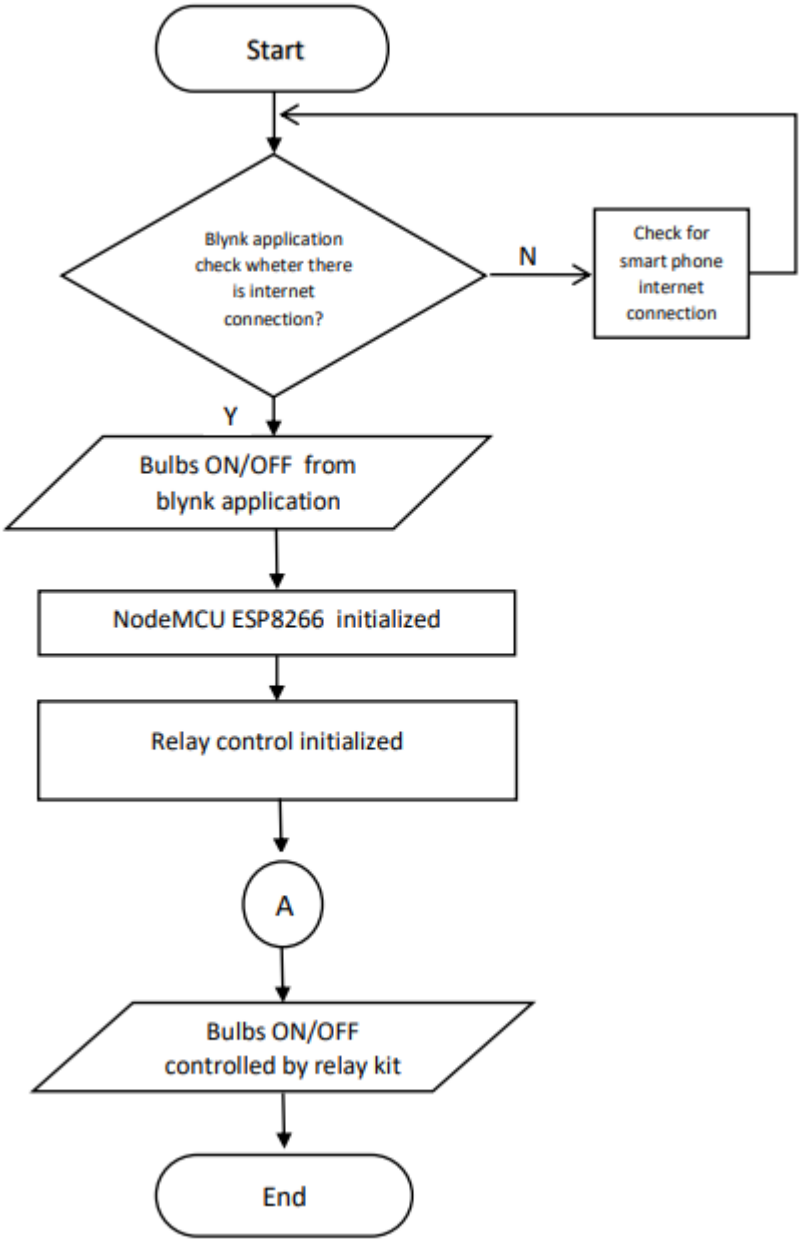


Figure 2.1 Flowchart of how the a project works

2.3 Proposed System

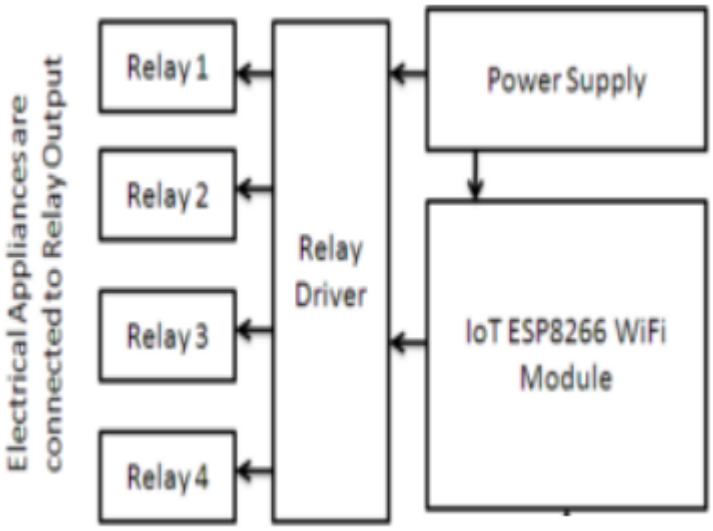


Figure 2.2 Block Diagram

Figure 2.2 shows the system block diagram. The Power Supply will provide energy to the system through the relay and NodeMCU ESP8266 modules, so that all equipment can work and function properly. NodeMCU ESP8266 will change by giving the logic "HIGH" or "LOW" on certain pins by relay to regulate the on / off of the home lights. Cloud (internet) by utilizing Wi-Fi becomes the central connection between Blynk application and NodeMCUproject.it can also be controlled by voice command from the device

2.4 Overview of software

This project uses Arduino IDE for program. In the Arduino, we use Blynk library to connect to the android app.

2.5 Hardware Specification

1. Hi-Watt 9V battery specifications:

- Model Number: 9V 6F 22.
- Battery Type: Zinc Carbon.
- Size: 6F22 006P.
- Jacket: Metal.
- Single Battery Dimensions (mm): L- 26. 5, H - 48. 5, W - 17. 5 (Max)

- Nominal Voltage (V):9V.
- Discharge Resistance (Ω): 620.
- Cut-off Voltage(V): 5.4
- Max charge current 0.7C 2A
- Microphone

2. ESP8266 NodeMCU specifications:

Categories	Items	Parameters
	Certification	Wi-Fi Alliance
	Protocols	802.11 b/g/n (HT20)
	Frequency Range	2.4 GHz ~ 2.5 GHz (2400 MHz ~ 2483.5 MHz)
	TX Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
	Rx Sensitivity	802.11 b: –91 dbm (11 Mbps)
		802.11 g: –75 dbm (54 Mbps)
		802.11 n: –72 dbm (MCS7)
	Antenna	PCB Trace, External, IPEX Connector, Ceramic Chip
	CPU	Tensilica L106 32-bit processor
	Peripheral Interface	UART/SDIO/SPI/I2C/I2S/IR Remote Control
		GPIO/ADC/PWM/LED Light & Button
	Operating Voltage	2.5 V ~ 3.6 V
	Operating Current	Average value: 80 mA
	Operating Temperature Range	–40 °C ~ 125 °C
	Package Size	QFN32-pin (5 mm x 5 mm)
	External Interface	-
	Wi-Fi Mode	Station/SoftAP/SoftAP+Station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network)
	Software Development	SupportsCloudServerDevelopment/FirmwareandSDK for fast on-chipprogramming
	Network Protocols	IPv4, TCP/UDP/HTTP
	User Configuration	AT Instruction Set, Cloud Server, Android/iOS App

3. Relay Module specifications:

- Trigger Voltage (Voltage across coil) : 5V DC
- Trigger Current (Nominal current) : 70mA
- Maximum AC load current: 10A @ 250/125V AC
- Maximum DC load current: 10A @ 30/28V DC
- Operating time: 10msec Release time: 5msec
- Maximum switching: 300 operating/minute (mechanically)

2.6 Software Requirements

Arduino IDE – C++ Programming.
Python programming

2.7 Summary

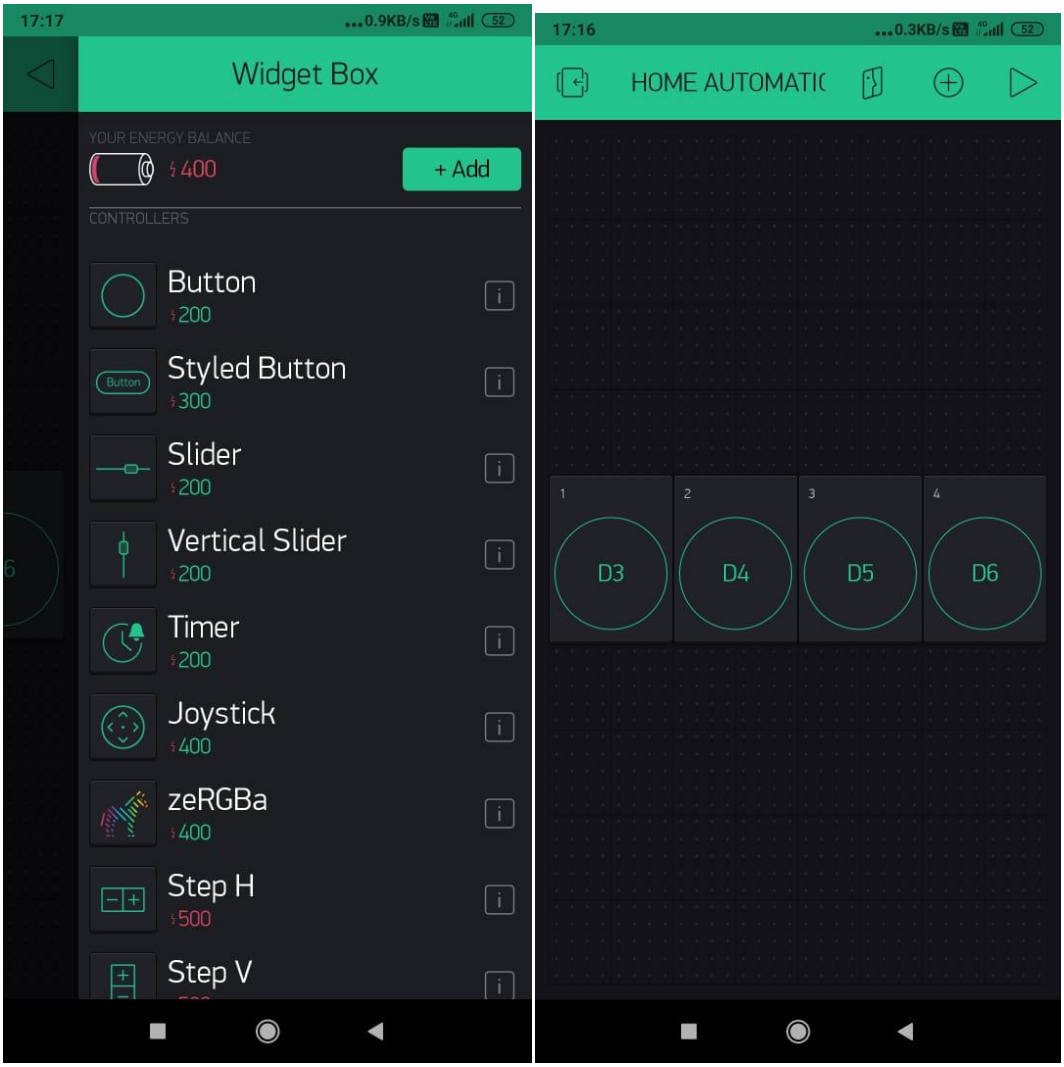
This project was to build a home automation system so that the householder could dial into their house with a modem, from the office or even the other side of the world using simple voice commands, and control their home appliances.The Project is based on the important steps that are done by orienting on the success indicators in connecting the NodeMCU ESP8266 module and other devices so that it can be used to solve multi-objective problems.

CHAPTER 3

Result and Analysis / Testing

3.1 Blynk application and Arduino IDE Preparation and Running

This project is running by Blynk application. Down load the application to a smart phone from Google play store and then create a project on it with four switches. Set buttons to be switches on D3, D4, D5 and D6. Figure 3.1 shows screenshots from Blynk application**.**



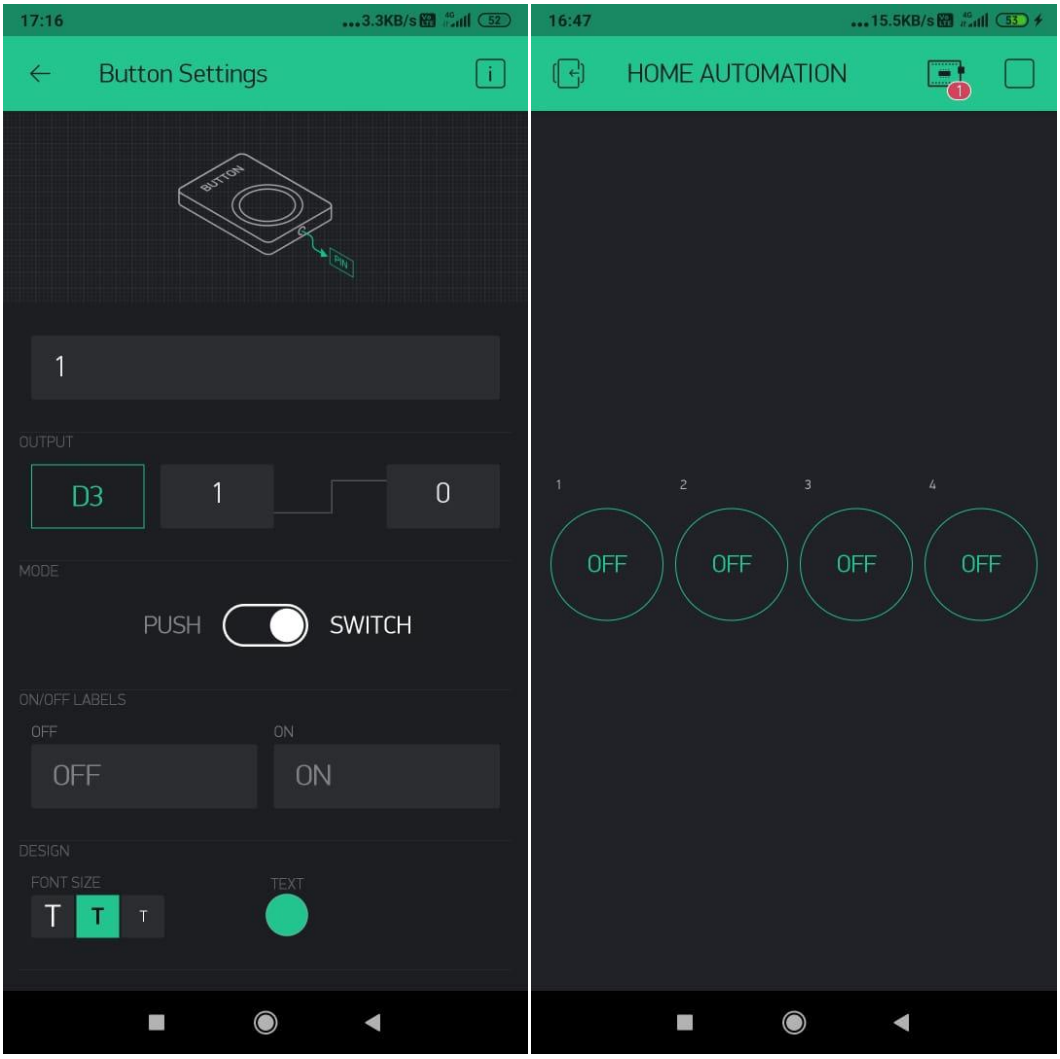


Figure 3.1. Screenshots from Blynk Application

3.2 NodeMCU Code via Arduino IDE

To code NodeMCU via Arduino IDE, the NodeMCU needs to be added to Arduino IDE library first by adding this address to Arduino IDE preferences. After this reference is added to Arduino IDE, download nodeMCU to boards manager and then select NodeMCU 1.0 (ESP12E Module). After nodeMCU is added to Arduino IDE library, upload this code with changing hotspot name and password also token code. Shown in figure 3.2

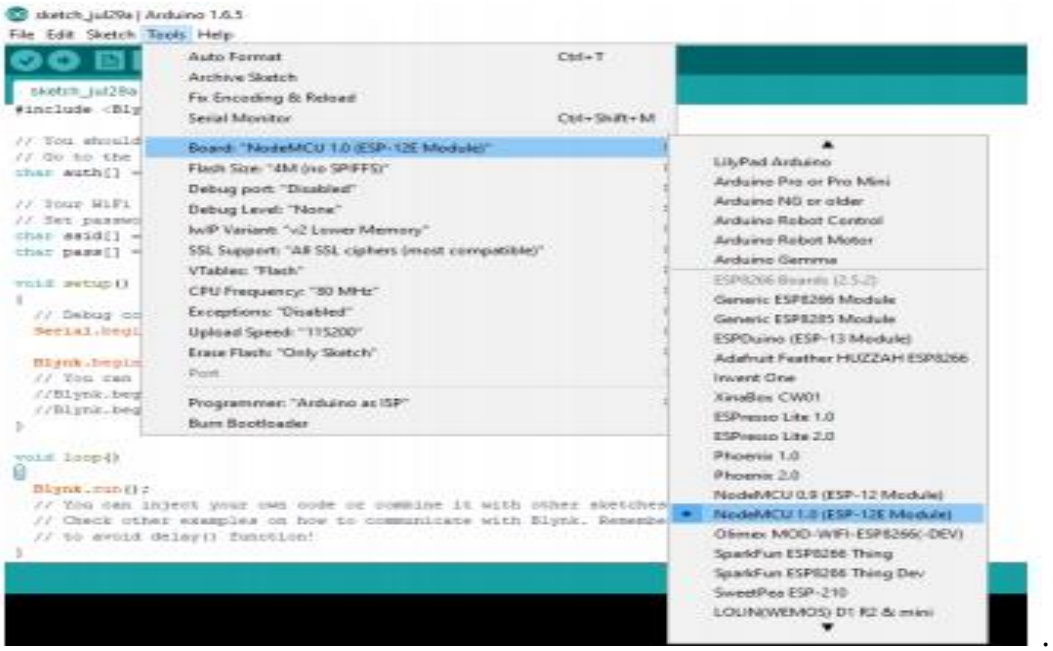


Figure 3.2 Setting up NodeMCU in Arduino IDE

Figure 3.3 shows the NodeMCU code. The code includes the hotspot name and password match with the android. The code does not need to identify the relay input, as it is included in 8 [Blynk.run();]. When auth (autho token) is given by Blynk application sent as email and SSID is the name of smart phone hotspot.

Figure 3.3. Setting up NodeMCU in Arduino IDE

3.3 The Hardware of the System

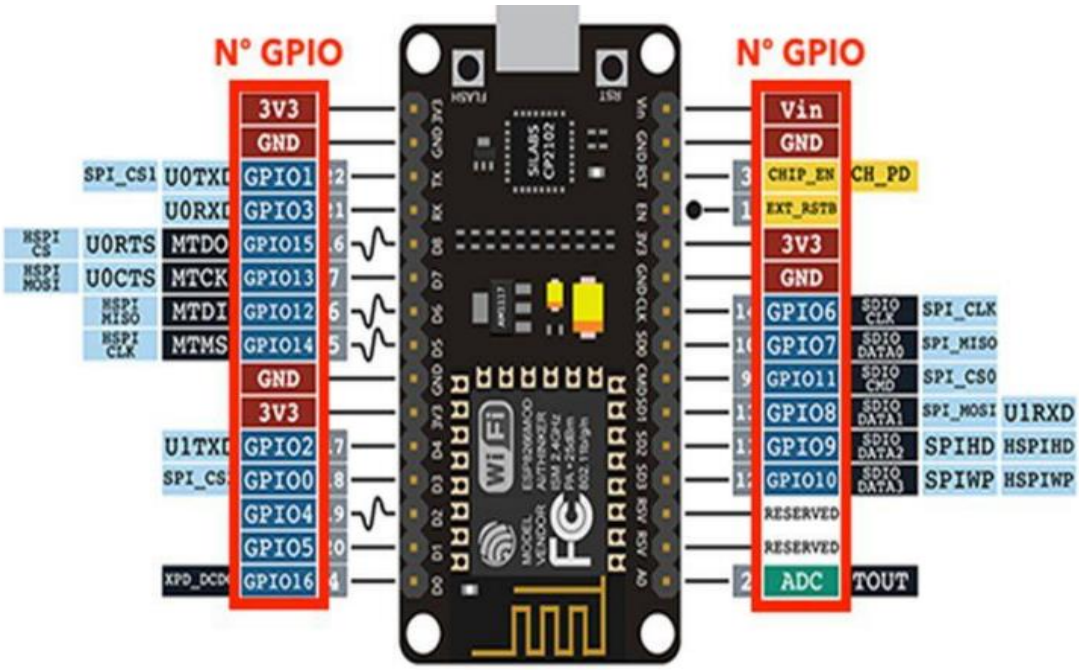


Figure 3.4.NodeMCUPinout

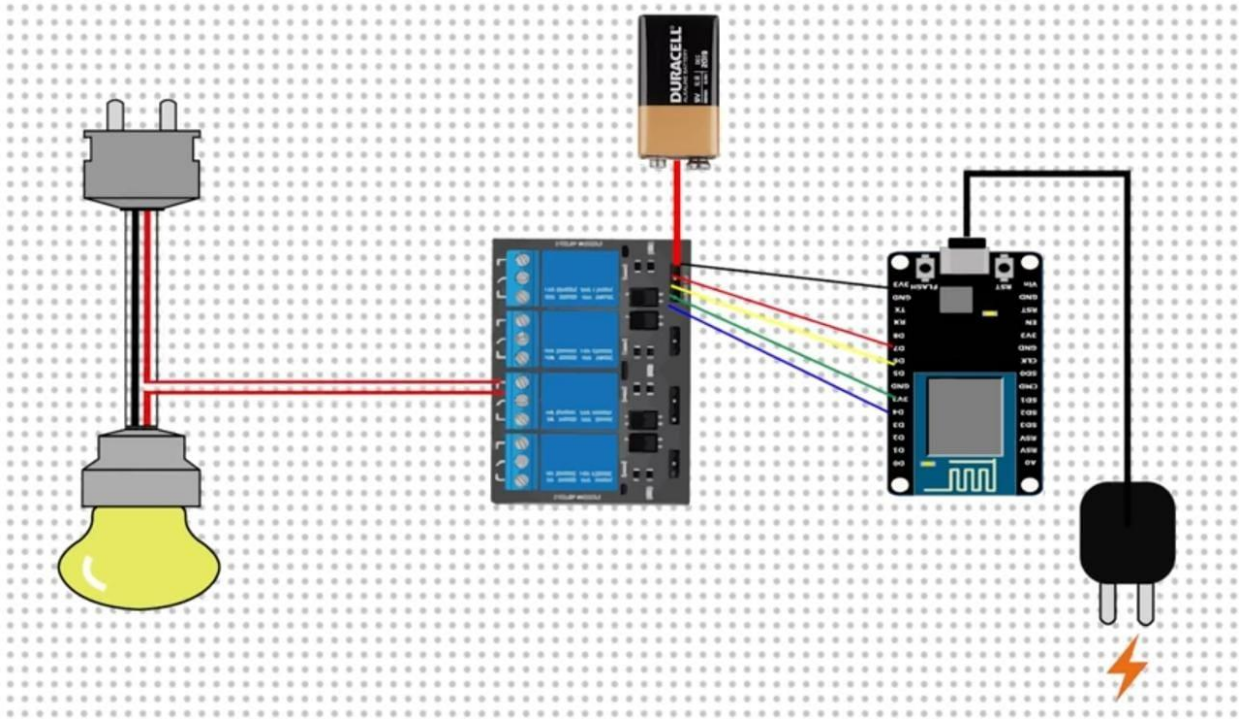


Figure 3.5 Connecting NodeMCU and Relay.

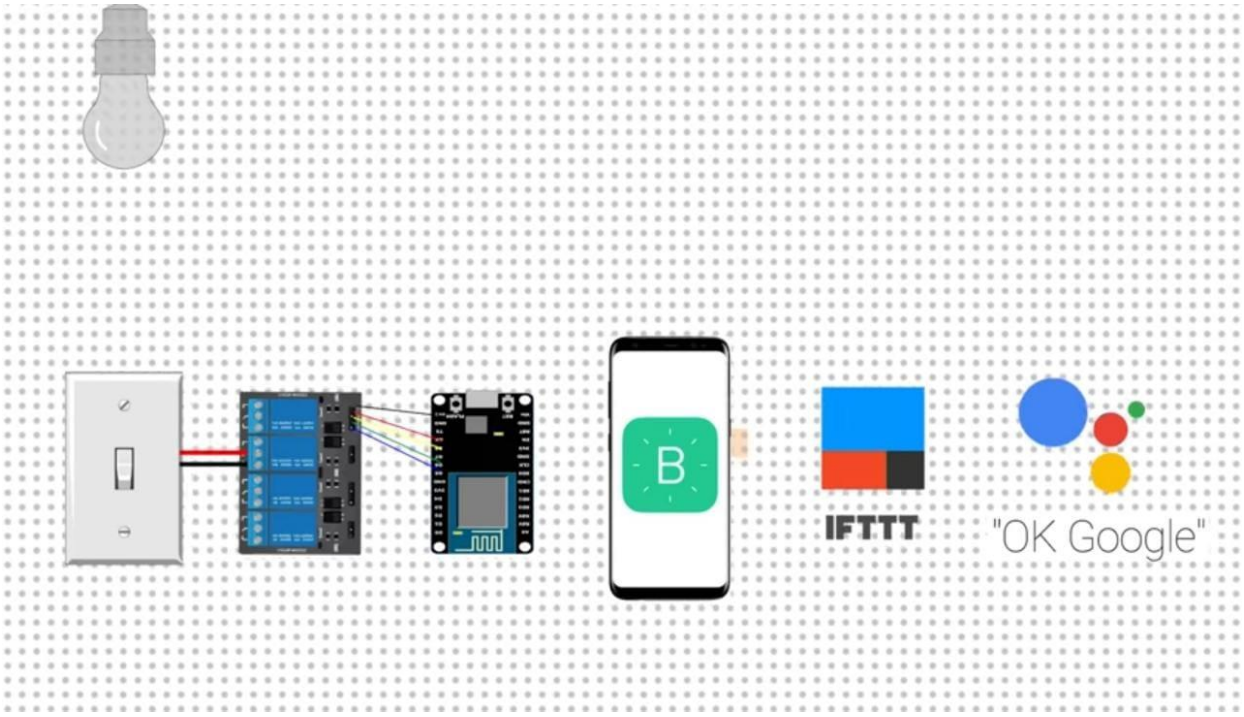


Figure 3.6 The whole project included with Voice automation.

NodeMCU and Relay module should be connected to 5V DC power supply.

Pins used:
1)Vin is connected to power supply output 5VDC.
2) GND is ground.
3) D3,D4, D5 and D6 are used as digital outputs.

Relay Module

Relay module is being connected directly to digital circuits including microcontroller kits easily to control big loads by a microcontroller. The inputs IN1, IN2, IN3 and IN4 operate four relays with voltage between 3-5 volts DC. Input and output circuits are separated by Opt couplers to protect digital circuits in case connection mistakes happened or short circuits.

3.4 System Analysis

From testing the entire system above, the smart home works according to what is the purpose of this research. Comparison of this research with previous studies, namely this study uses temperature sensor and control buttons, thus increasing the diversity of the smart home system itself. Also, used a microcontroller that is different from previous studies that is the NodeMCU ESP8266 module which has advantages compared to other microcontrollers. The smart home has been successfully built with hardware arranged in such a way that it can achieve results that are

as expected. In this case the hardware that plays a very important role as the main device is the NodeMCU ESP8266 module. The advantages of using the NodeMCU ESP8266 are more practical than buying various components and then assembling them by yourself.

3.4 Summary

Using components and materials mentioned above. Figure 12 shows the project that's used as an (IoT) system controlled by Blynk application is running. Loads used in this project are bulbs, they can be changed with other devices by changing bulbs with AC plugs to connect home-use devices or equipment.

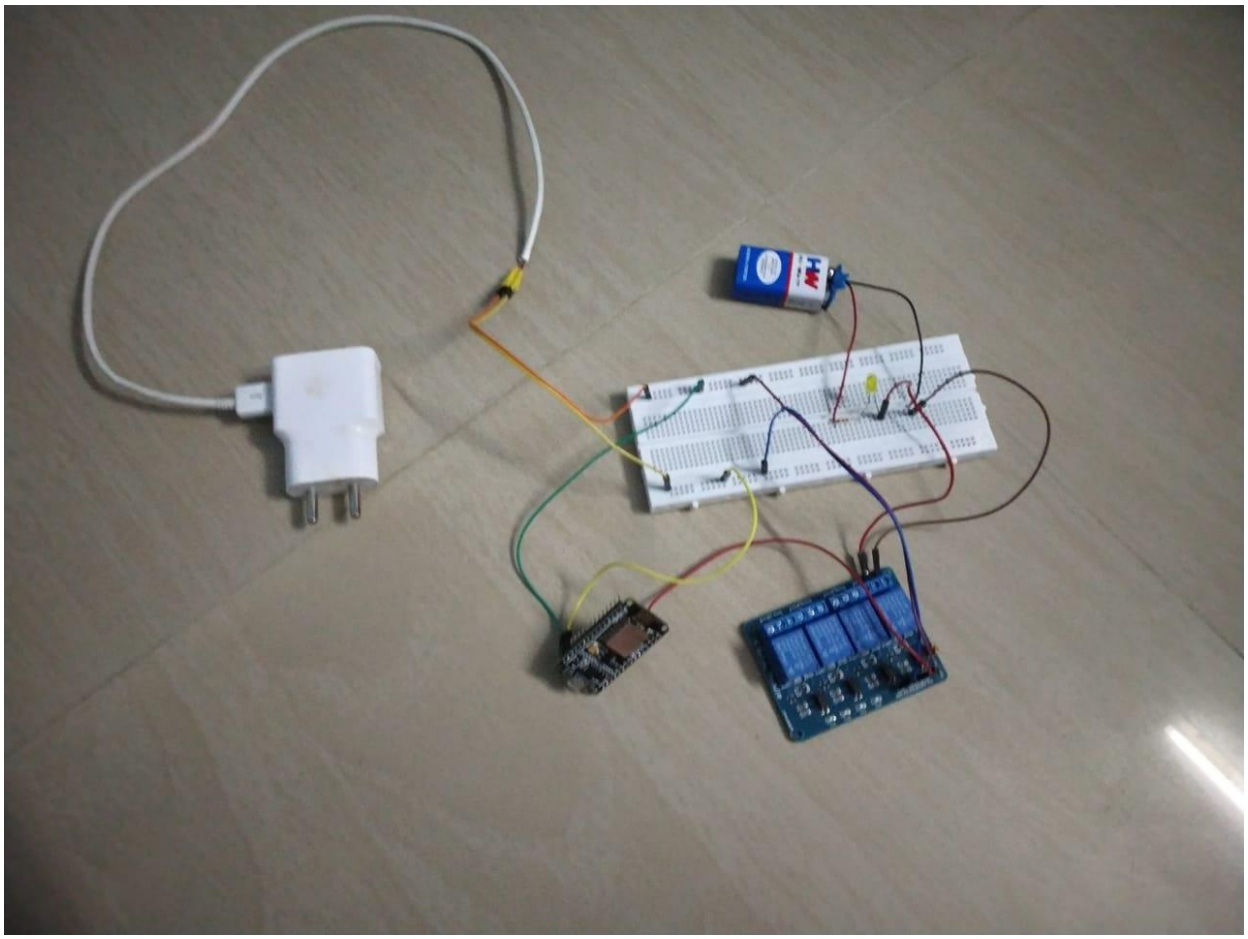


Figure 3.7 Project Test

CHAPTER 4
CONCLUSION AND FUTURE ENHANCEMENT

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:

- ✓ 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.
- ✓ 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.

Future Enhancements:

In the design and manufacture of this final project there are still deficiencies that need to be corrected in order to perfect this final project, including: 14

- ✓ Optimizing the power control consumption of the NodeMCU ESP8266 module to be further developed in wireless-based technology application, considering the current technology prioritizes low cost but efficient.
- ✓ The development of an internet-based smart home system of things needs to be tested on other electronic devices in everyday life.

APPENDIX

Arduino Code:

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

charauth[] = "";

charssid[] = "";
char pass[] = "";

void setup()
{
Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
}

void loop()
{
Blynk.run();
}
```

Speech recognition python code

```
importspeech_recognition as sr
import serial
mic_name = 'Microphone (Realtek(R) Audio)'
sample_rate = 48000
chunk_size = 2048
r = sr.Recognizer()

mic_list = sr.Microphone.list_microphone_names()

for i, microphone_name in enumerate(mic_list):
ifmicrophone_name == mic_name:
device_id = i

ser=serial.Serial('COM4',9600)
while True:
    i = input()
if i=='start':
withsr.Microphone(device_index = device_id, sample_rate = sample_rate, chunk_size =
chunk_size) as source:
r.adjust_for_ambient_noise(source)
print ("Say Something")
audio = r.listen(source)
try:
text = r.recognize_google(audio)
print ("you said: " + text )

if text=='turn on light':
print(1)
ser.write('1'.encode())
elif text=='turn off light':
print(0)
ser.write('0'.encode())

exceptsr.UnknownValueError:
print("Google Speech Recognition could not understand audio")

exceptsr.RequestError as e:
print("Could not request results from Google  Speech Recognition service; {0}".format(e))
```

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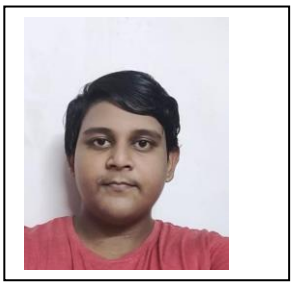

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