A MINOR-PROJECT REPORT

ON

“HOME AUTOMATION SYSTEM”

Submitted to

KIIT, Deemed To be University

In Partial Fulfillment of the Requirement for the Award of

BACHELOR’S DEGREE IN

COMPUTER ENGINEERING

BY

YASH PODDAR, 1505088

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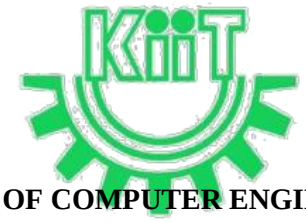
UNDER THE GUIDANCE OF

PROF. MR. PINAKI SANKAR CHATTERJEE



SCHOOL OF COMPUTER ENGINEERING

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY, Deemed To be University

BHUBANESWAR, ODISHA – 751024

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KIIT, Deemed To be University

School of Computer Engineering Bhubaneswar,

ODISHA 751024

CERTIFICATE

This is certify that the project entitled

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This is a record of bona fide work carried out by them, in the partial fulfillment of the requirement for the award of Degree of Bachelor of Engineering (Computer Science) at KIIT**,** Deemed To be University**,** Bhubaneswar. This work is done during year 2018-2019, under my guidance.

Date: / /

(PROF. SUBHASHREE DARSHANA)

Project Guide

Acknowledgements

We are profoundly grateful to Prof. Subhashree Darshana for his expert guidance and continuous encouragement throughout to see that this project rights its target since its commencement to its completion.

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ABSTRACT

The past decade has seen significant advancement in the field of consumer electronics. Various “intelligent” appliances such as cellular phone, air conditioners, home security devices, home theaters, etc., are set to realize the concept of a smart home. They have given rise to a Personal Area Network in home environment, where all these appliances can be interconnected and monitored using a single controller.

Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronic systems in a building. These include lighting, temperature control, etc.

This project demonstrates a simple home automation system which contains a remote mobile host controller and several client modules (home appliances). The client modules communicate with the host controller through a wireless device using internet, in this case, an android based Smart phone.

Contents

Chapter 1: Introduction

Although home automation today is not a new thing but most advanced home automation systems in existence today require a big and expensive change of infrastructure. This means that it often is not feasible to install a home automation system in an existing building.

1.1 PROBLEM

The original problem is to design and implement a ubiquitous computing project into a home environment: - **HOME AUTOMATION SYSTEM.**

Most advanced home automation systems in existence today require a big and expensive change of infrastructure. This means that it often is not feasible to install a home automation system in an existing building. Home Automation lets the user to control their home from their computing device, but it needs to be economically feasible too. It is containing the design process of the project, starting with brainstorming we had to get the final product idea and finishing with the prototyping within home alike environment.

1.2 ABOUT PROJECT

Home automation systems, or smart home technologies, are systems and devices that can control elements of your home environment- lighting, appliances, telephones, home security and mechanical, entry and safety systems. Home automation systems can be operated by electricity or a computer chip using a range of different types of switches. A simple device, such as a light can be activated by a signal from a mobile environment from any part of the world, or can be part of a computerized home automation system. As a very basic definition, we tend to refer to home automation as anything that gives you remote or automatic control of things around the home.

1.3 AIM

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 fulfill the needs in day to day life in all houses. Also, the smart home concept in the system improves the standard living at home.

1.4 SCOPE

WHAT CAN HOME AUTOMATION DO?

Home automation can:

- Increase your independence and give you greater control of your home environment.
- Make it easier to communicate with your family.
- Save you time and effort.
- Reduce your heating and cooling costs.
- Increase your home's energy efficiency.
- Alert you audibly and visually to emergency situations.
- Allow you to monitor your home while you are away.

THE PRIMARY ELEMENTS OF A HOME AUTOMATION SYSTEM:-

1. The operating system (for example, a computer, micro controller).

2. The device being operated (for example, a light or furnace)

3. The interface, or link, between the user and the device. An interface can be a button, a keypad, a motion sensor and soon.

Chapter 2: REVIEW OF LITERATURE AND EARLIER WORKS

The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first Internet-connected appliance, able to report its inventory and whether newly loaded drinks were cold. Mark Weiser's seminal 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as UbiComp and PerCom produced the contemporary vision of **IOT**. In 1994 Reza Raji described the concept in IEEE Spectrum as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories". Between 1993 and 1996 several companies proposed solutions like Microsoft's at Work or Novell's NEST. However, only in 1999 did the field start gathering momentum. Bill Joy envisioned Device to Device (D2D) communication as part of his "SixWebs" framework, presented at the World Economic Forum at Davos in 1999.

The concept of the Internet of things became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications. Radio-frequency identification (RFID) was seen by Kevin Ashton (one of the founders of the original Auto-ID Center) as a prerequisite for the Internet of things at that point. Ashton prefers the phrase "Internet for things." If all objects and people in daily life were equipped with identifiers, computers could manage and store them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

IEEE 802.15 is a working group of the Institute of Electrical and Electronics Engineers (IEEE). IEEE 802 standards committee which specifies wireless personal area network (WPAN) standards. There are 10 major areas of development, not all of which are active. The number of Task Groups in IEEE 802.15 varies based on the number of active projects. The current list of active projects can be found on the IEEE 802.15 web site.

Early home automation began with labor-saving machines. Self-contained electric or gas powered home appliances became viable in the 1900s with the introduction of electric power distribution and led to the introduction of washing machines (1904), water heaters (1889), refrigerators, and sewing machines, dishwashers, and clothes dryers.

In 1975, the first general purpose home automation network technology, X10, was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signaling and control, where the signals involve brief radio frequency bursts of digital data, and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.

Chapter 3: Report on the present investigation

3.1 Components Used

Following components are used in this project:

1. Smart phone
2. ESP8266 12E Chip(A Wi-Fi MCU)
3. Computer
4. Capacitors
5. Router
6. LEDs
7. Adaptor (12V)
8. Resistors
9. NPN Transistors (for switching)
10. 7805 Voltage Regulator
11. Bread Board
12. Connecting Wires
13. Fan

3.2 MAIN COMPONENT: ESP8266 12E Chip(A Wi-Fi MCU)

3.2.1 Features

- 802.11 b/g/n
- Integrated low power 32-bit MCU
- Integrated 10-bit ADC
- Integrated TCP/IP protocol stack
- Supports antenna diversity

• Wi-Fi 2.4 GHz, support WPA/WPA2

• Support STA/AP/STA+AP operation modes

• STBC, 1x1 MIMO, 2x1 MIMO

• A-MPDU & A-MSDU aggregation and 0.4s guard interval

• Deep sleep power < 5uA

• Wake up and transmit packets in < 2ms

• Standby power consumption of < 1.0mW (DTIM3)

• Integrated TR switch, balun, LNA, power amplifier and matching network

• Integrated PLL, regulators, and power management units

• Support Smart Link Function for both Android and iOS devices

• +20dBm output power in 802.11b mode

• Operating temperature range -40C ~ 125C

• FCC, CE, and ROSH certified

• SDIO 2.0, (H) SPI, UART, I2C, I2S, IRDA, PWM, GPIO

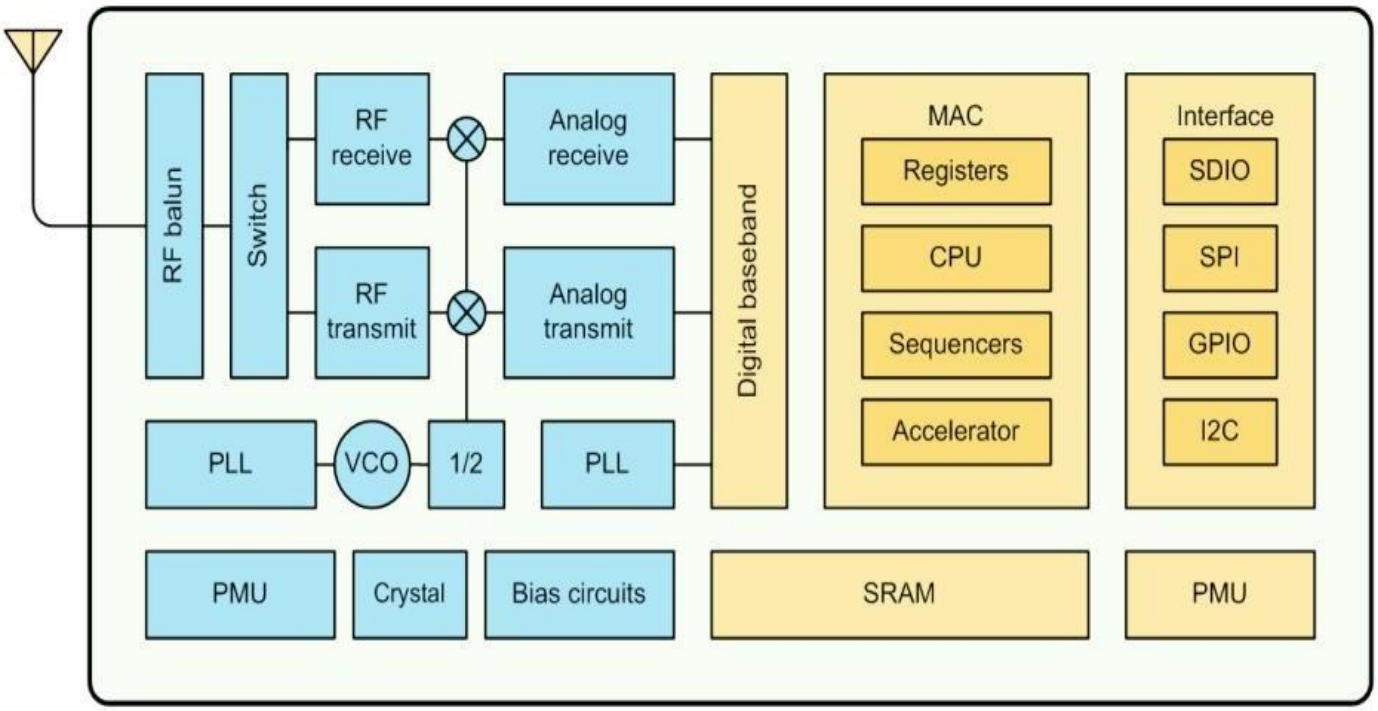
3.2.2 Description

ESP-12F WiFi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/RF/PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building separate network controller. ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems to function as a standalone application, with the lowest cost, and minimal space requirement.

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. In has integrated cache to improve the performance of the system in such applications.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any micro controller based design with simple connectivity (SPI/SDIO or I2C/UART interface).

ESP8266EX is among the most integrated WiFi chip in the industry, it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on chip SRAM, besides the Wi-Fi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; codes for such applications are provided in examples in the SDK

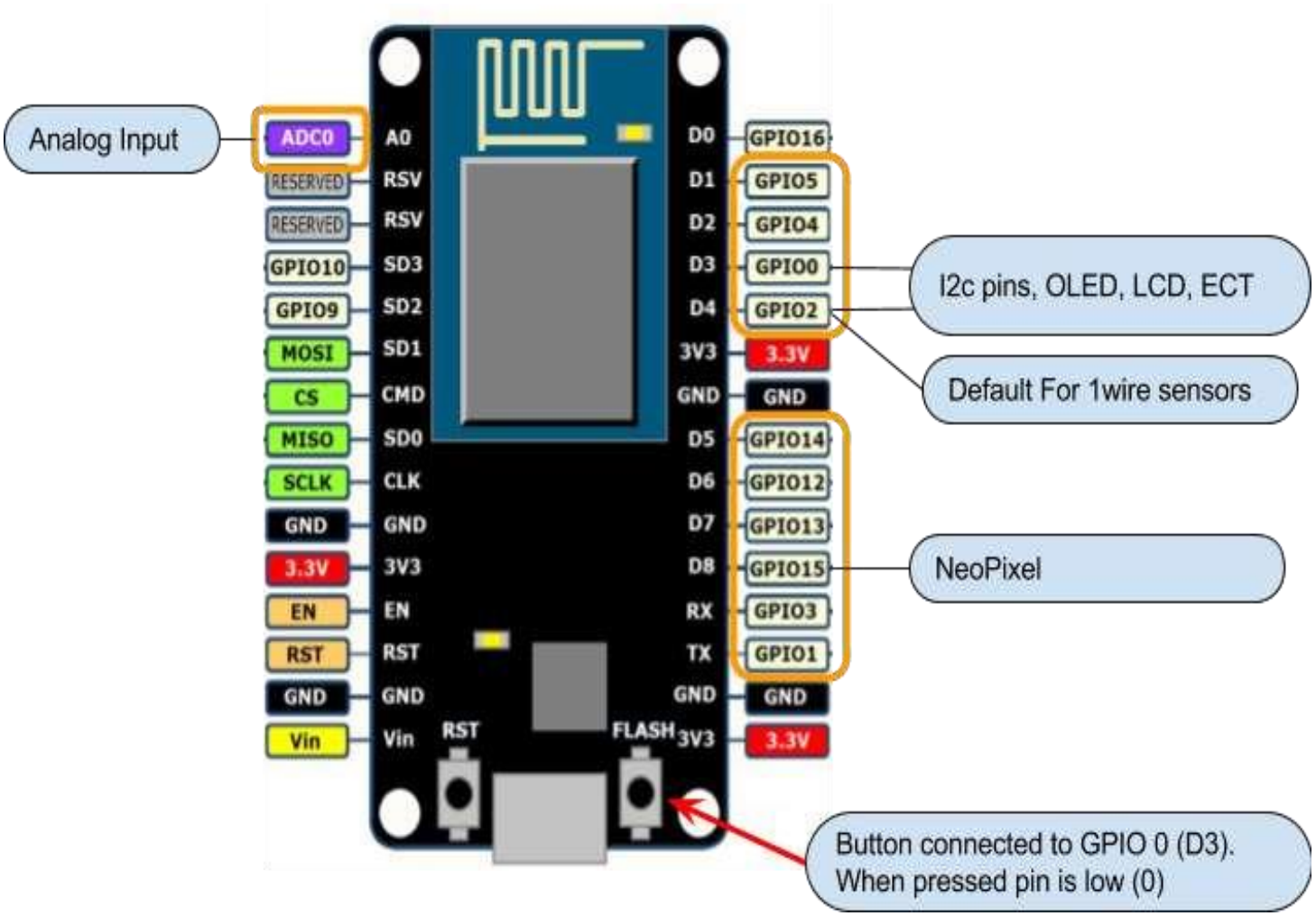


Categories	Items	Values
WiFi Paramters	Certificates	FCC/CE/ROSH
	WiFi Protocles	802.11 b/g/n
	Frequency Range	2.4GHz-2.5GHz (2400M-2483.5M)
Hardware Paramaters	Peripheral Bus	UART/HSPI/I2C/I2S/Ir Remote Contorl
		GPIO/PWM
	Operating Voltage	3.0~3.6V
	Operating Current	Average value: 80mA
	Operating Temperature Range	-40°~125°
	Ambient Temperature Range	Normal temperature
	Package Size	16mm*24mm*3mm
	External Interface	N/A
Software Parameters	Wi-Fi mode	station/softAP/SoftAP+station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network) / download and write firmware via host
	Ssoftware Development	Supports Cloud Server Development / SDK for custom firmware development
	Network Protocols	IPv4, TCP/UDP/HTTP/FTP
	User Configuration	AT Instruction Set, Cloud Server, Android/iOS App

Major Parameters

3.2.3 Pin Diagram

The ESP8266 NodeMCU has total 30 pins that interface it to the outside world.



3.2.4 Pin Description

PIN	Function	Description
1	RST	1) Reset Pin. Active low ; 2) NC Or External MCU control ;
2	ADC/TOUT	1) 10-bit ADC Analog Input 0-1V ;
3	EN	1) Module Enable. Active HIGH
4	GPIO16	1) GPIO (WEAK UP)
5	GPIO14	1) GPIO
6	GPIO12	1) GPIO
7	GPIO13	1) GPIO 2) UART2 RXD
8	VDD	1) Power supply . 3.3V IN ;
9	CS0	1) Chip selection of SPI interface.
10	MISO	1) MISO of SPI interface.
11	GPIO9	1) GPIO (Only available on ESP-12-D)
12	GPIO10-	1) GPIO (Only available on ESP-12-D)
13	MOSI	1) MOSI of SPI interface.
14	SCLK	1) Clock of SPI interface.
15	CND	1) Power Ground
16	GPIO15	1) GPIO 2) UART2 TXD
17	GPIO2	1) GPIO 2) WIFI status. Connection inside the module LED
18	GPIO0	1) GPIO
19	GPIO4	1) GPIO
20	GPIO5	1) GPIO
21	RXD0	1) UART0 RXD
22	TXD0	1) UART0 TXD

3.3 PROGRAMMING: THE SOUL OF OUR PROJECT

3.3.1 Procedure

The Software which we are using for the coding of embedded projects are:

- Arduino IDE
- IFTTT(If This Then That)

Arduino IDE

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

IFTTT

It is a free web-based service to create chains of simple conditional statements, called *applets*.

An applet is triggered by changes that occur within other web services such as Gmail, Facebook.

Steps

- Install Arduino IDE.
- Set board to NODEMCU 1.0 and Select ESP8266.
- Write the code and upload into the NODEMCU using USB cable.
- Login through blynk app and generate the token id.
- Write the web request code in IFTTT using the blynk token id to setup voice control.
- Either on /off the lights/fan using the blynk app or voice control through Google Assistant.

3.3.2 Code

i) Arduino IDE

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

// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "8b47329922c94b32acd987b659fdf627";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "HOMEAUTOMATION";
char pass[] = "PIYUSH009";

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

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

ii) IFTTT

- Open IFTTT site and login.
- Select new applet.
- Select Google Assistant
- Write the commands in the required field.
- Set the URL for the blynk server along with token id with the respective pin.
- Set for on and off respectively in new applets.
- Set [“1”] for on and [“0”] for off in each respective new applet.
- Select put method.

Light 1

URL: http://188.166.206.43/8b47329922c94b32acd987b659fdf627/update/D16

Light 2

URL: http://188.166.206.43/8b47329922c94b32acd987b659fdf627/update/D5

Light 3

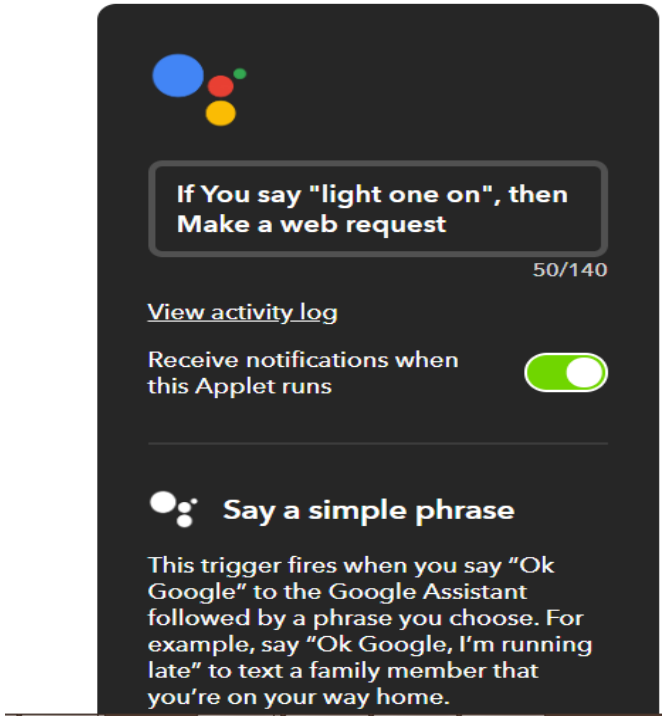
URL: http://188.166.206.43/8b47329922c94b32acd987b659fdf627/update/D4

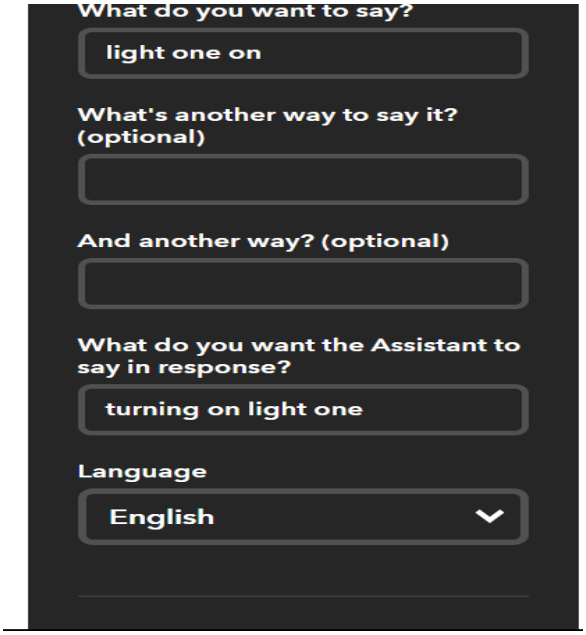
Fan

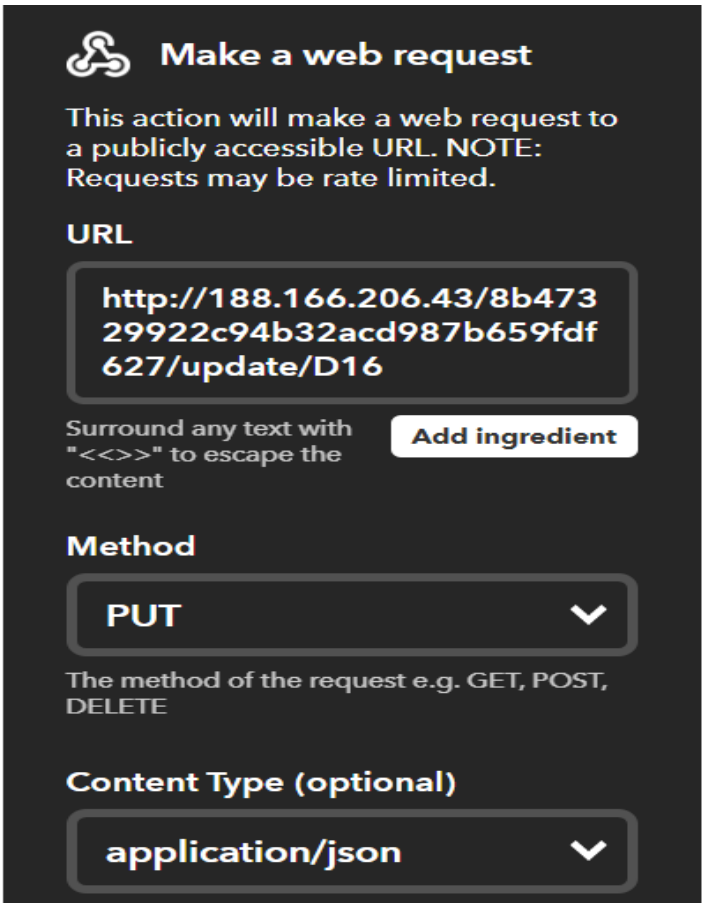
URL: http://188.166.206.43/8b47329922c94b32acd987b659fdf627/update/D0

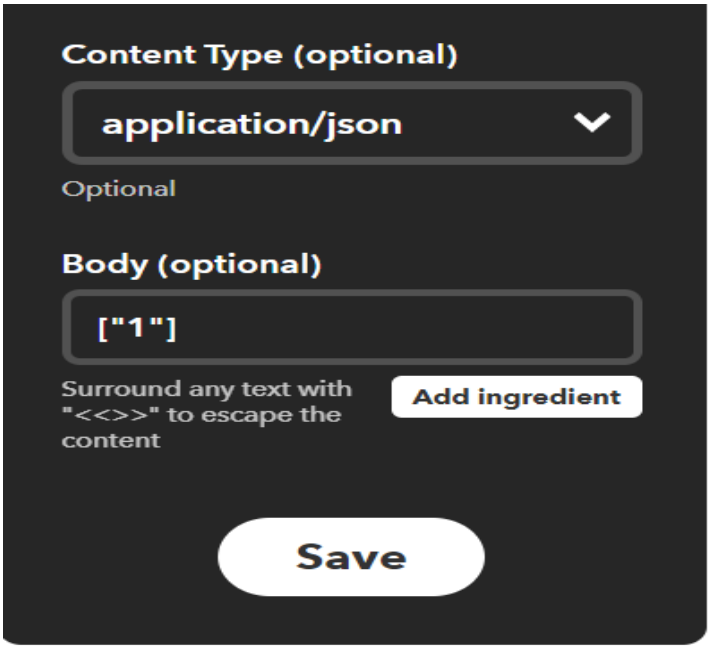
By doing this we can control our home automation system using voice control with the help of Google assistant in our mobile.

Configure

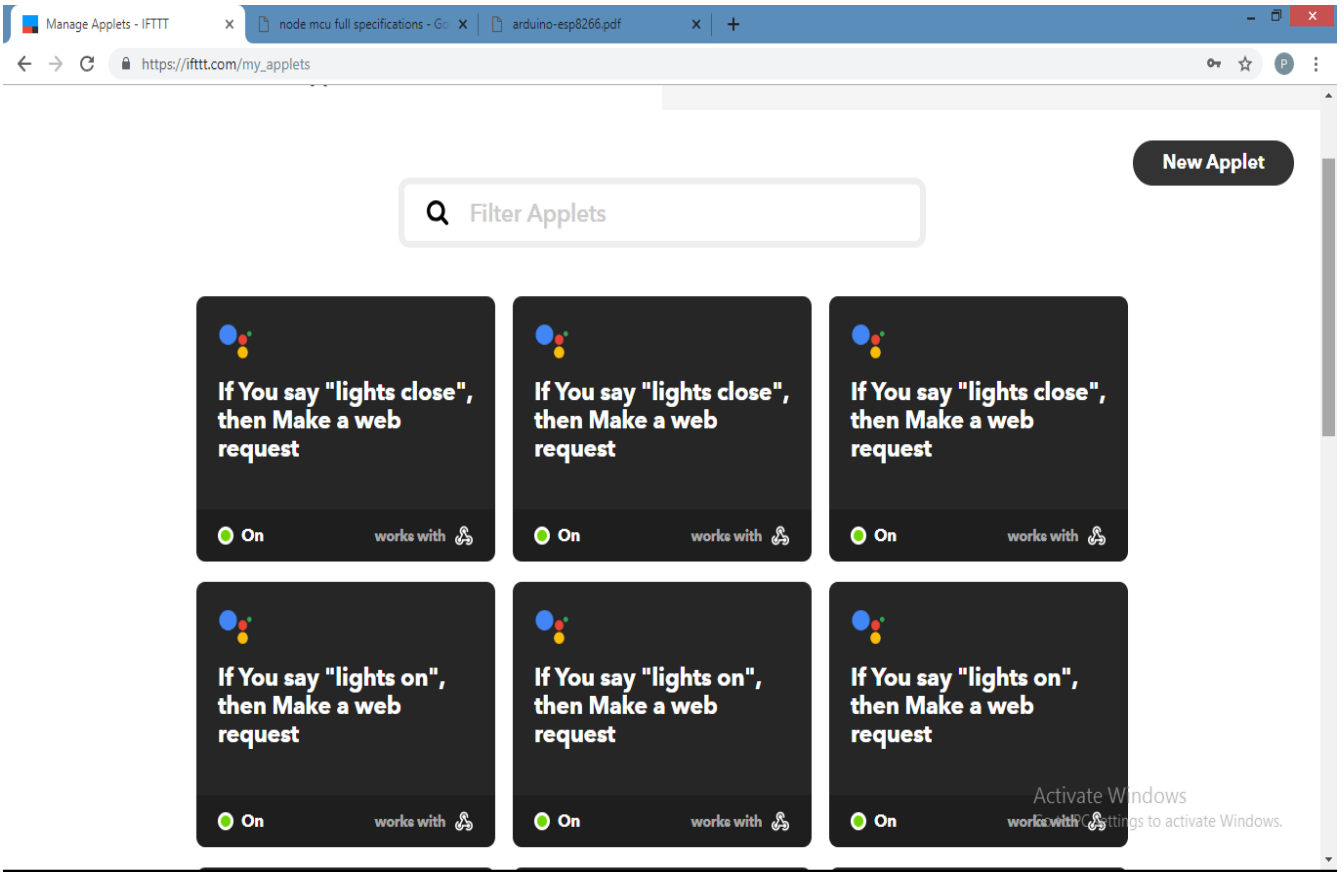

If You say "light one on", then Make a web request
50/140
View activity log
Receive notifications when this Applet runs
Say a simple phrase
This trigger fires when you say "Ok Google" to the Google Assistant followed by a phrase you choose. For example, say "Ok Google, I'm running late" to text a family member that you're on your way home.

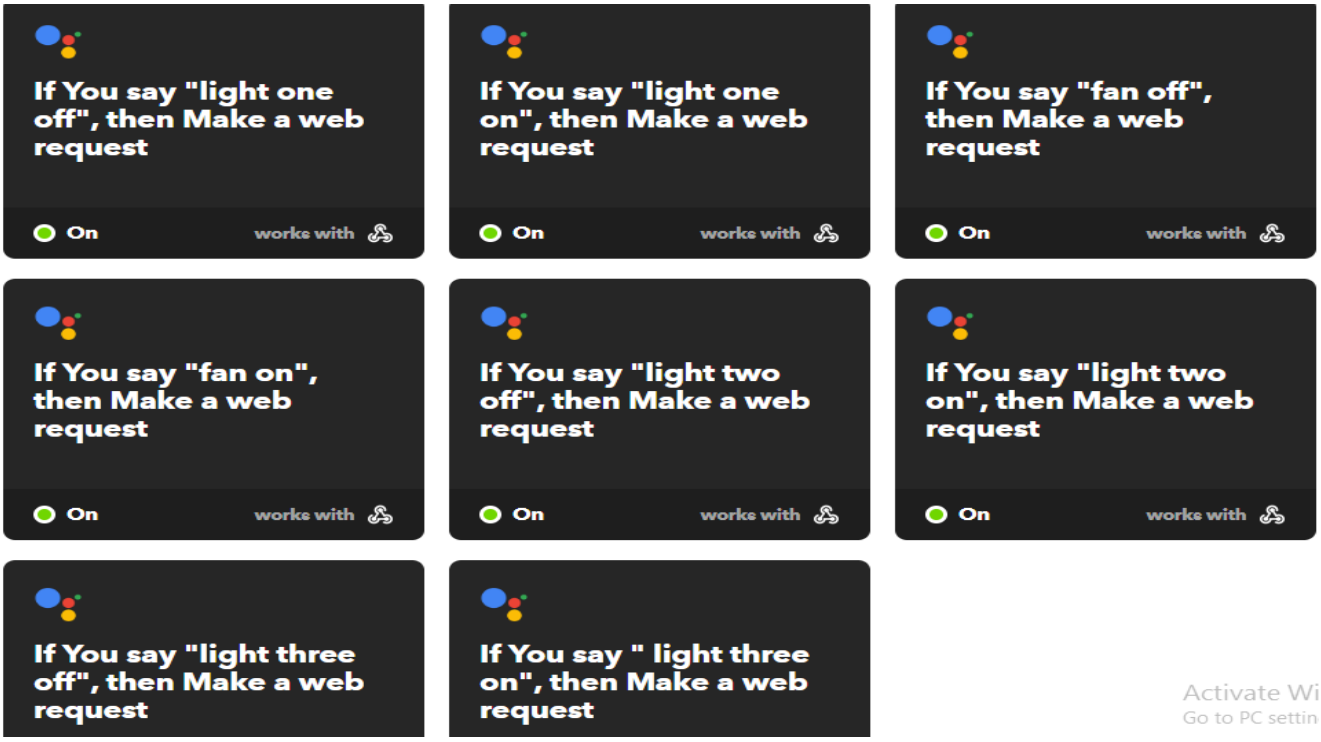

What do you want to say?
light one on
What's another way to say it? (optional)
And another way? (optional)
What do you want the Assistant to say in response?
turning on light one
Language
English


Make a web request
This action will make a web request to a publicly accessible URL. NOTE: Requests may be rate limited.
URL
http://188.166.206.43/8b47329922c94b32acd987b659fdf627/update/D16
Surround any text with "<<>>" to escape the content
Add ingredient
Method
PUT
The method of the request e.g. GET, POST, DELETE
Content Type (optional)
application/json


Content Type (optional)
application/json
Optional
Body (optional)
["1"]
Surround any text with "<<>>" to escape the content
Add ingredient
Save

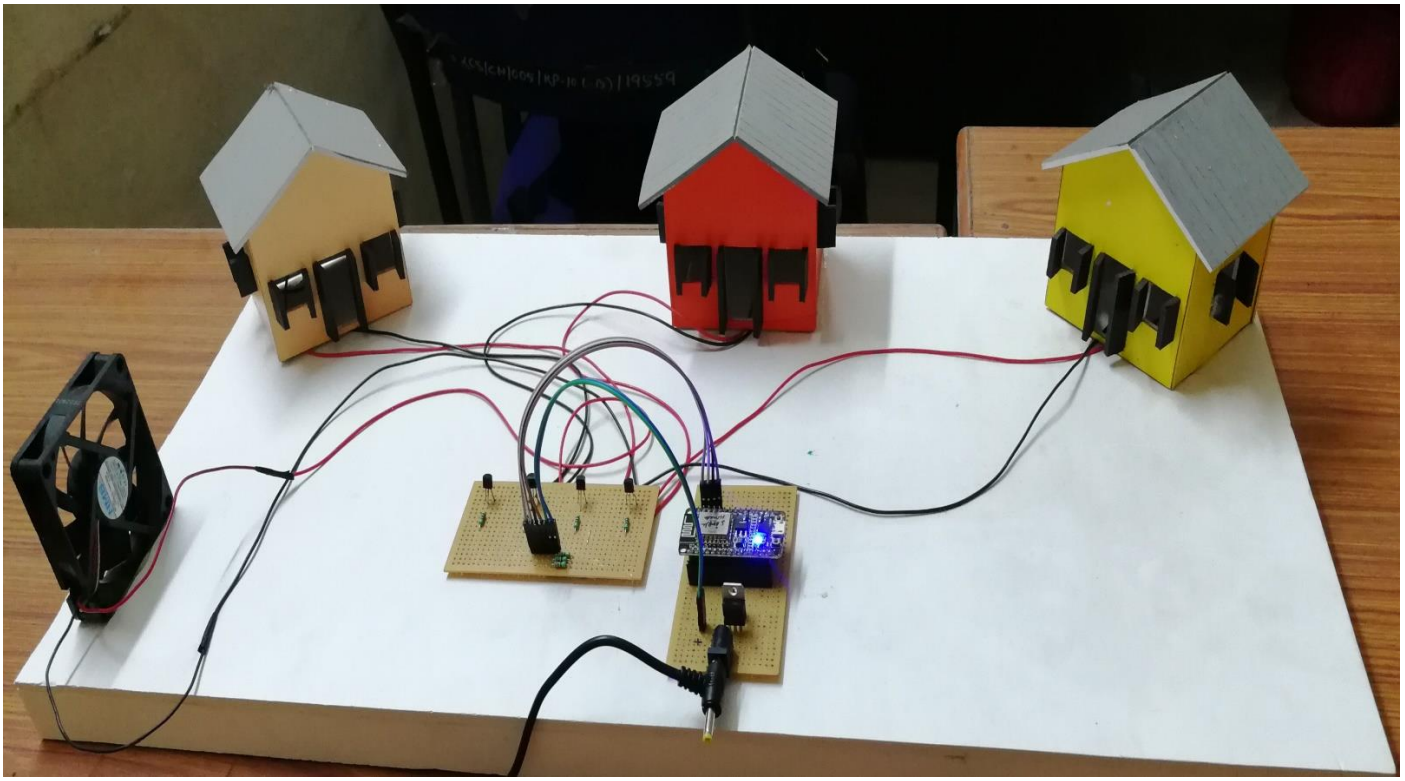
Delete


Manage Applets - IFTTT
node mcu full specifications - G
arduino-esp8266.pdf
https://ifttt.com/my_applets
New Applet
Filter Applets
If You say "lights close", then Make a web request
On
works with
If You say "lights close", then Make a web request
On
works with
If You say "lights close", then Make a web request
On
works with
If You say "lights on", then Make a web request
On
works with
If You say "lights on", then Make a web request
On
works with
If You say "lights on", then Make a web request
On
works with
Activate Windows
Go to PC settings to activate Windows.

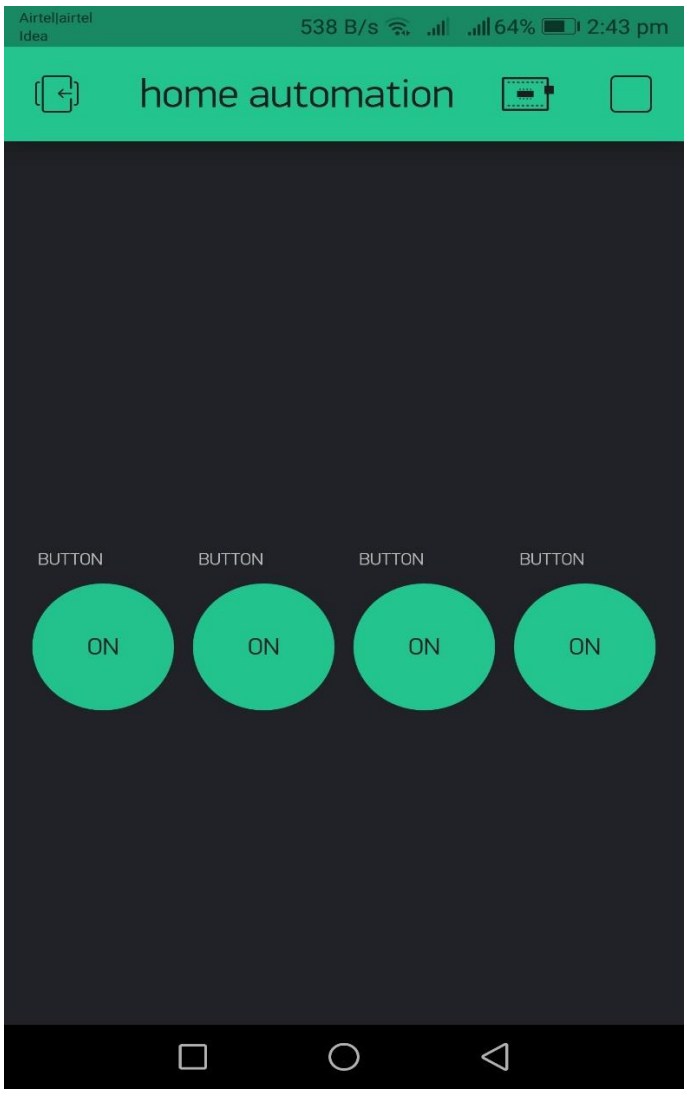

If You say "light one off", then Make a web request
On
works with
If You say "light one on", then Make a web request
On
works with
If You say "fan off", then Make a web request
On
works with
If You say "fan on", then Make a web request
On
works with
If You say "light two off", then Make a web request
On
works with
If You say "light two on", then Make a web request
On
works with
If You say "light three off", then Make a web request
If You say " light three on", then Make a web request
Activate Wi
Go to PC settin

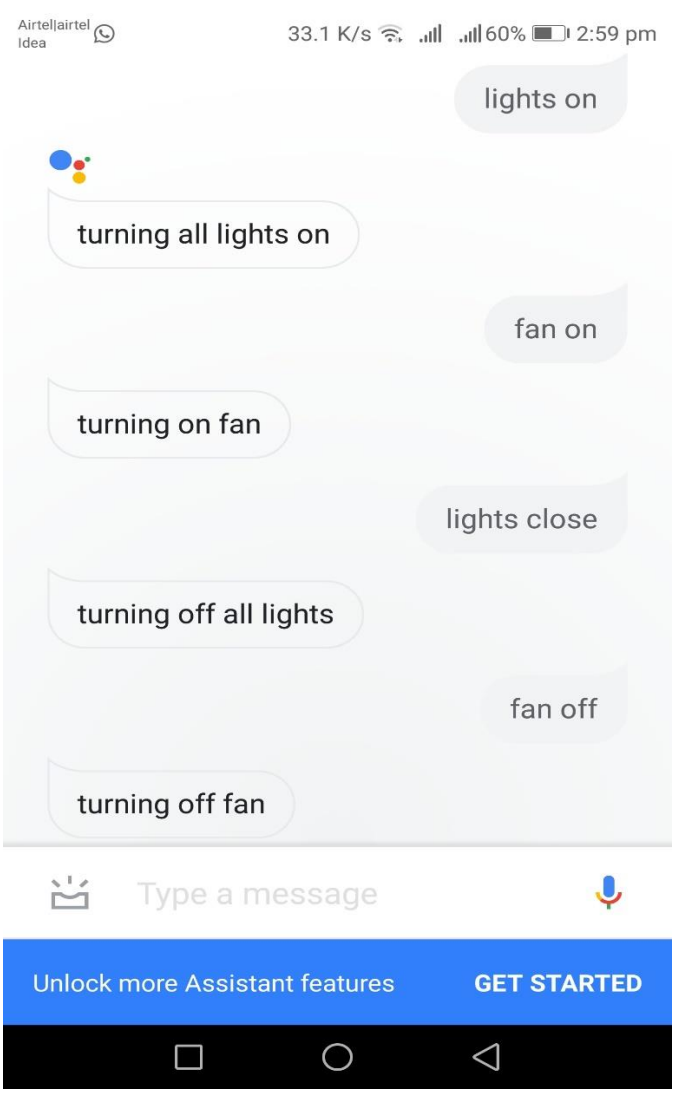
Chapter 4: Results

Using the methodology of computation of NODEMCU and other electronic components we have developed a working prototype of Home Automation System using IOT.

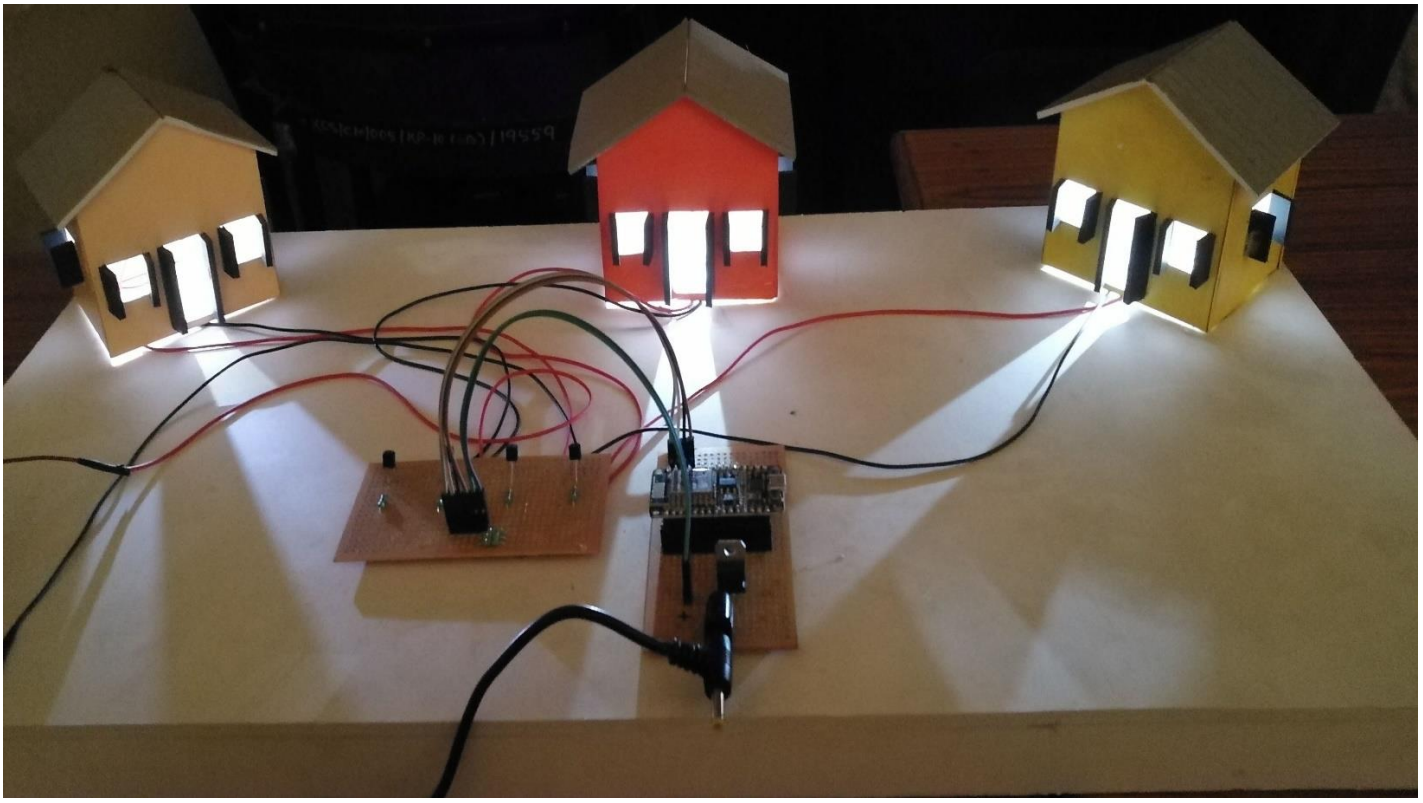


After installing Blynk app and connecting it through our WiFi using arduino programing , we can send the voice commands interpreted by Google assistant directly to the blynk app, the Blynk app can then forward those commands to the Node MCU. To power up the Node MCU you can use a normal phone charger or adapter, just make sure its voltage is not too high.





We can give the commands through Google assistant in our mobile or we can directly use the assigned buttons in the blynk app itself.



Chapter 5: Conclusion And Improvements

5.1 Conclusion

The home automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. The local client was successfully tested on a multitude of different mobile phones from different manufacturers, thus proving its portability and wide compatibility.

This project will not only provide convenience to the common man but will be a boon for the elderly and disabled.

5.2 Applications

The project designed is very practical in nature because everything can be controlled with the help of just a mobile phone which is widely available nowadays and also proves to be handy.

Also the project is feasible because it integrates with the existing devices in home environment without changing much of its configurations at relatively low cost.

5.3 Improvements

This project can be further developed by improving its efficiency. This can be achieved using Google Firebase, which decreases the response time thus improving the connectivity speed.
Also we can increase the security to the project using the Blockchain technology.

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[2] **Jump up^** *"Best Home Automation System - Consumer Reports". **www.consumerreports.org.** Retrieved 2016-02-14.*

[3] **Jump up^** *"5 Open Source Home Automation Projects We Love". **Fast** Company. 2014-12-01. Retrieved 2016-11-22.*

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Individual Contribution

1) Yash Poddar (1505088): Programming in Arduino IDE and applets in IFTTT.
2) Mohit Raj (1505119): Feasibility test and Circuit design.
3) Siddharth Anand (1505124): Review of literary materials and compilation of presentation materials.
4) Piyush Ranjan Majhi (1505127): Configuring the blynk app and applets in IFTTT.