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15ECE387 – OPEN LAB

VOICE RECOGNISATION HOME AUTOMATION

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CHAPTER 1

INTRODUCTION

1.1 Overall background and system

"Home automation" refers to the automatic and electronic control of household features, activities, and appliances. The utilities and features of our home can be easily controlled via Internet. The idea behind Google assistant-controlled Home automation is to control home devices with voice. In this project, the Google assistant requires voice commands. Adafruit account which is a cloud based IoT web server used to create virtual switches, is linking to IFTTT website abbreviated as "If This Than That" which is used to create if else conditional statements. The voice commands for Google assistant have been added through IFTTT website. In this home automation, as the user gives commands to the Google assistant, Home appliances like Bulb, Fan and Motor etc., can be controlled accordingly. The commands given through the Google assistant are decoded and then sent to the microcontroller, the microcontroller in turn control the relays connected to it. The device connected to the respective relay can be turned On or OFF as per the users request to the Google Assistant. The microcontroller used is NodeMCU (ESP8266) and the communication between the microcontroller and the application is established via Wi-Fi (Internet).

In this trending world, Internet of Things is being given extreme importance. In that, Automation, leads to have less effort and much efficiency. By using IoT, we are successful in controlling the appliances in various areas, in which one of them is to control the home automation by using Node Microcontroller.

many people today prefer smart devices which can be controlled remotely by the Internet rather than the manual control to improve the standard of living. The home appliances are expected to fully automatic and Internets of Things (IoT) is projected to provide dramatic improvements in smart home appliances. The internet technology is growing day by day and the internet connection is accessible everywhere conditioning unit.

The IoT is going to rule the world within a few years. It presents an Internet of Things based real-time home automation and security system using Node MCU and ESP8266 Wi-Fi module which makes the system cost- effective and portable. It is used for controlling and monitoring home appliances (Fans, Lights, etc.) from anywhere in the globe over the Internet.

The major concept using in the Google assistant-controlled Home automation is the Internet of Things. The Internet of Things (IoT) can be connecting various types of objects like smart phones, personal computer and tablets to the internet, which brings new-fangled type of communication between things and things, and things and people.

1.2 Objective

The foremost aim of the technology is to increase the efficiency and to decrease the effort. It mainly helps the physically disabled and elderly persons. People come home exhausted after a long hard-working day. Some are way too tired that they find it hard to move once they land on their couch, sofa or bed. So, any small device/technology that would help them switch theirs lights on or off, etc. on a go with their voice with the aid of their smart phones would make their home more comfortable.

Moreover, it would be better if everything such as warming bath water and adjusting the room temperature were already done before they reach their home just by giving a voice command. So, when people would arrive home, they would find the room temperature, the bath water adjusted to their suitable preferences, and they could relax right away and feel cozier and rather, feel more homely.

1.3 Methodology

The methodology of this project design includes implementation of the proposed method. There are some basic steps involving in the Methodology of the product. We divided this project into two parts, software implementation and hardware implantation.

In software implementation we focused on the programming of the Node microcontroller using Arduino IDE, IFTTT (if this then that) and adafruit web service.

In hardware implementation we have the following components –

- NodeMCU – 32-bit ESP8266
- 4-Relay module
- GSM module
- Tube light
- Fan
- Iron box
- Connecting wires
- Smart phone

We will be connecting the hardware components according to the circuit diagram. After connecting the hardware components, we connect the software and hardware to complete the project.

1.4 Outcome

We can control the home appliances with a command through the google assistance from anywhere in the world. For example, if we say “turn on light” then the light will be turned on and if we say “turn off light” then light will turn off. There is no need to go near the switch. It saves the time of the user and is very useful.

CHAPTER 2

DESCRIPTION OF TOOLS

2.1 Software components

2.1.1 Adafruit IO

The first major step is setting up the Adafruit IO. Adafruit IO is a website used to create virtual switches which will be turned ON or OFF depending on the commands given to the Google assistant. Adafruit IO is used to connect projects to Internet. It can handle and visualize multiple feed of data. Adafruit IO is used to control and react to the user's data. It is a platform designed to display, respond, command and interact with project's data. It can handle and visualize multiple feed of data. Dashboards are a feature integrated into Adafruit IO which allow users to chart, graph, gauge, log, and display our data. Users can view their dashboards from anywhere in the world. Adafruit IO is used to control and react to the user's data. It is a platform designed to display, respond, command, and interact with project's data. It also keeps our data private and secure for us.

Specification –

- Display your data in real-time, online.
- Make your project internet-connected: Control motors, read sensor data, and more.
- Connect projects to web services like Twitter, RSS feeds, weather services, etc.
- Connect your project to other internet-enabled devices.

Since it can be accessed from a web browser, it makes it the ideal hub for monitoring and controlling all of various IOT projects.

2.1.2 Google assistant

The Google Assistant is an Artificial Intelligence based Virtual assistant software which allows its users to control all the apps in their device. It allows the users to control and command most of the apps in their devices using voice commands. This provides more convenience to the people as they

only have to command the google assistant thorough voice command. Google Assistant is an artificial intelligence-powered virtual assistant developed by Google that is primarily available on mobile and smart home devices.

Specification –

- Control your devices and your smart home.
- Access information from your calendars and other personal information.
- Find information online.
- Play content on your Chromecast or other compatible devices.
- Make appointments and send messages.
- Open apps on your phone.
- Real-time spoken translations.

2.1.3 IFTTT (IF THID THEN THAT)

If This Then That, also known as IFTTT is a web-based service to create chains of simple conditional statements, called applets. An applet is triggered by changes that occur within other web services. Here, IFTTT is used to use google assistant service and Adafruit service in chain. So, Google assistant is used to control light of my home by saying Ok google, turn the light ON or OFF. Then IFTTT interpret the message and can send it to Adafruit's dashboard as an understandable command to the created feed.

Specifications –

- Services are the basic building blocks of IFTTT. They mainly describe a series of data from a certain web service. Services can also describe actions controlled with certain APIs, like SMS.
- Each service has a particular set of triggers and actions.
- Triggers are the "this" part of an applet. They are the items that trigger the action.
- Actions are the "that" part of an applet. They are the output that results from the input of the trigger.
- Applets are the predicates made from Triggers and Actions.

2.1.4 Arduino IDE

The Arduino integrated development environment (IDE) is a cross platform application that is written in the programming language. It is used to write and upload programs to Arduino compatible boards. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Technical specifications –

- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14
- Analog Input Pins: 6
- SRAM: 2 KB
- EEPROM: 1 KB

Pin functions -

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino board when it is using an external power source
- **5V**: This pin outputs a regulated 5V from the regulator on the board.
- **3V3**: A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino board provides the voltage reference with which the microcontroller operates.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

2.2 Hardware components

2.2.1 NODE MCU (ESP8266)

NodeMCU is an open source IoT platform, includes firmware which runs on the ESP8266 Wi-Fi Module 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. NodeMCU firmware was developed so that AT commands can be replaced with Lua scripting making the life of developers easier. The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack.

FEATURES OF NODE MCU (ESP8266):

- Open-source
- Interactive
- Programmable
- Low cost
- Simple, Smart
- WI-FI enabled
- USB-TTL included and Plug & Play

SPECIFICATIONS OF NODE MCU (ESP8266):

- Developer: ESP8266 Opensource Community
- Type: Single board microcontroller
- Operating system: XTOS
- CPU: ESP8266
- Memory: 128kBytes
- Storage: 4MBytes
- Power By: USB
- Power Voltage: 3v ,5v
- Code: Arduino Cpp
- IDE Used: Arduino ID

ADVANTAGES OF NODE MCU (ESP8266):

- Low energy consumption
- Integrated support for WIFI network
- Reduced size of the board
- Low Cost

2.2.2 Relay module

A 4-Channel Relay interface board allows us to control various appliances, and other equipment's with large current. It can be controlled directly by Micro-controller (Arduino, Node MCU). A relay is an electromagnetic switch. It is activated when a small current of some microampere is applied. Normally, a relay is used in a circuit as a type of switch, an automatic switch. There are different types of relays and they operate at different voltages. When a circuit is built the voltage that will trigger it has to be considered. In this system the relay circuit is used to turn the appliances ON/OFF. The high/low signal is supplied from the NodeMCU microcontroller. When a low voltage is given to the relay of an appliance it is turned off and when a high voltage is given it is turned on.

Specifications –

- 4-Channel Relay interface board, and each one needs 15-20mA Driver Current.
- Both controlled by 12V and 5V input Voltage.
- Equipped with high-current relay, AC250V 10A; DC30V 10A.
- Standard interface that can be controlled directly by microcontroller.
- Opto-isolated inputs.
- Indication LEDs for Relay output status.

Advantages –

- Relays can switch AC and DC.
- Relays can high voltages.
- Relays are a better choice for switching large currents(>5A).
- Relays can switch many contacts at once.

Pin Name	Description
GND	Ground reference for the module
IN1	Input to activate relay 1
IN2	Input to activate relay 2
IN3	Input to activate relay 3
IN4	Input to activate relay 4
V_{cc}	Power supply for the relay module
V_{cc}	Power supply selection jumper
JD-V_{cc}	Alternate power pin for the relay module

2.2.3 GSM module

GSM (Global System for Mobile Communication) module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network.

a GSM modem duly interfaced to the MC through the level shifter IC Max232. The SIM card mounted GSM modem upon receiving digit command by SMS from any cell phone sends that data to the MC through serial communication. While the program is executed, the GSM modem receives the command 'STOP' to develop an output at the MC, the contact point of which are used to disable the ignition switch. The command so sent by the user is based on an intimation received by him through the GSM modem 'ALERT' a programmed message only if the input is driven low.

The features of the GSM module include the following.

- Improved spectrum efficiency
- International roaming
- Compatibility with integrated services digital network (ISDN)
- Support for new services.
- SIM phonebook management
- Fixed dialling number (FDN)
- Real-time clock with alarm management
- High-quality speech
- Uses encryption to make phone calls more secure
- Short message service (SMS)

Advantages of GSM –

- More suitable network with robust features.
- Worldwide connectivity and extensive coverage.
- SAIC and DAIC techniques used in GSM provide very high transmission quality.
- GSM signals don't have any deterioration.
- Easy to integrate GSM with other wireless technology such as CDMA and LTE.
- It has the ability to use repeaters.
- Because of the pulse nature of transmission talk time is generally high.

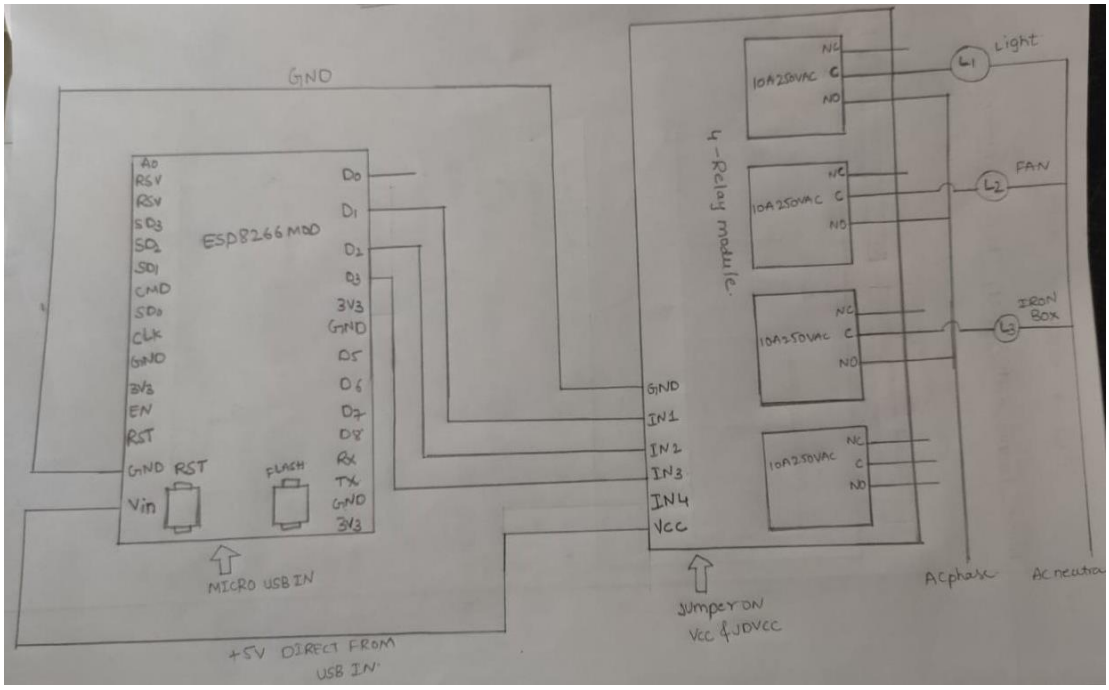
CHAPTER 3

DESIGN AND DEVELOPMENT

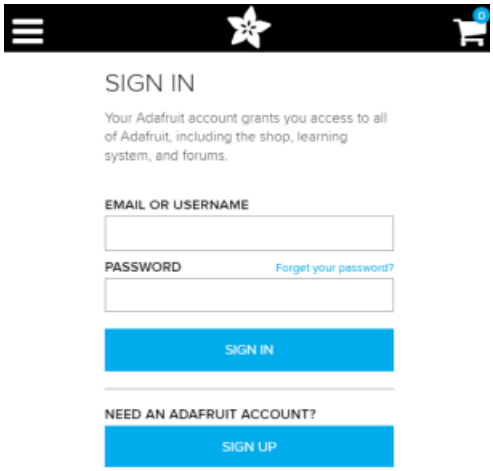
Block diagram –

This is the block diagram.

CIRCUIT DIAGRAM -

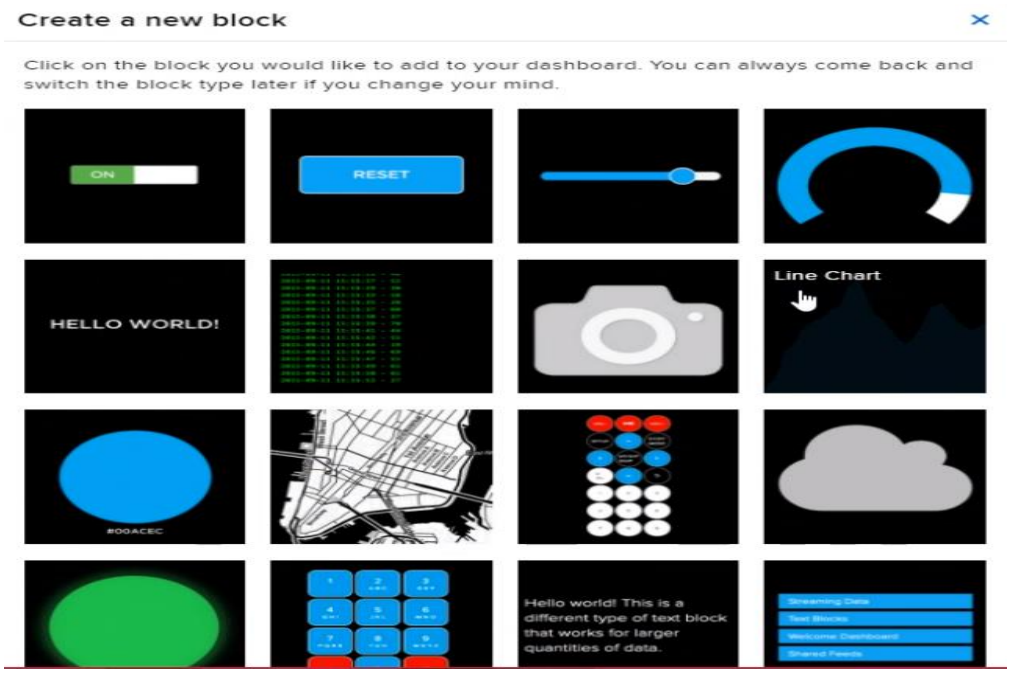


First, create account at www.Adafruit.io



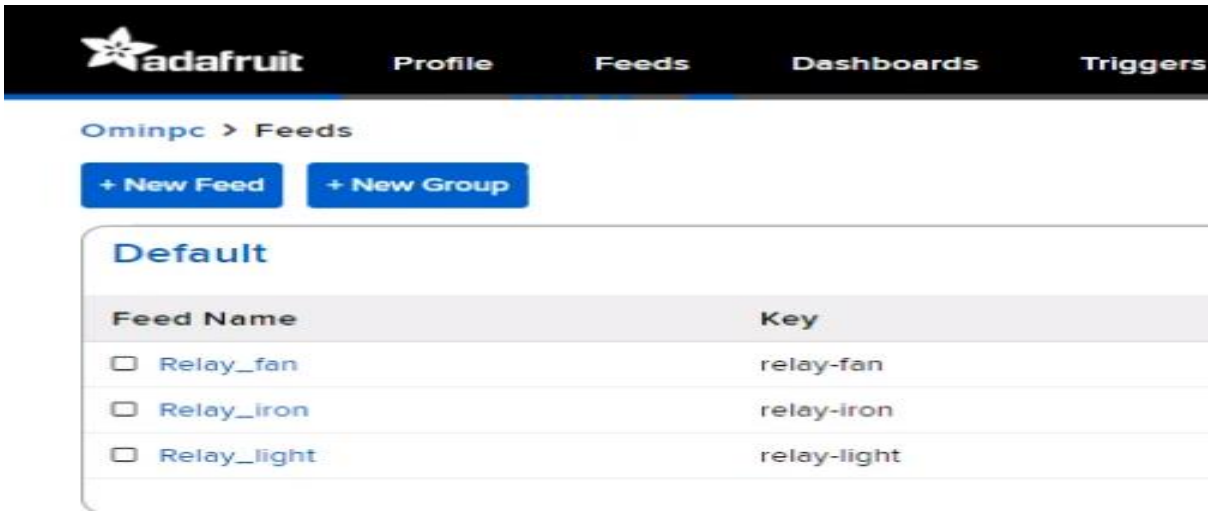
Now, create dashboard at Adafruit. This dashboard is a user interface to control things remotely. provide name to the dashboard and save it.

Now, create feed (user interface) to control light On-Off. To create it, just click on '+' symbol and select toggle feed



Enter name of our feed and create it. After creation, select the created feed and then click on Next step.

Here, 0 is used as (ON) and 1 is used as (OFF) text for button and then click on create. This will create toggle button on your dashboard which can be used to control things remotely. Now, dashboard is ready for IoT application like home automation.

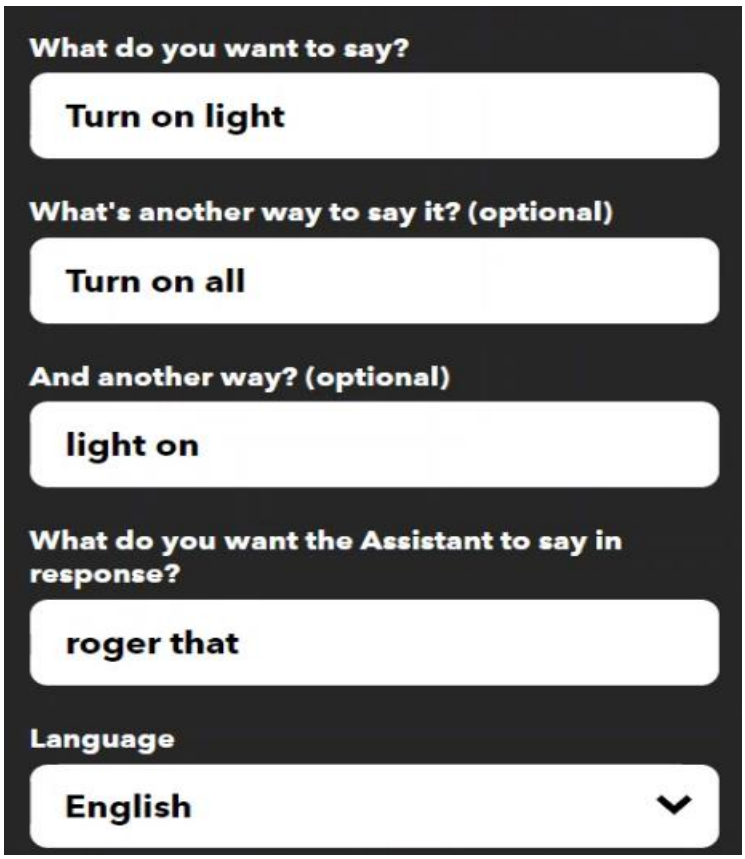


Next step is creating account on IFTTT.

Note: Create account on IFTTT by using same e-mail id which have been used for Adafruit.

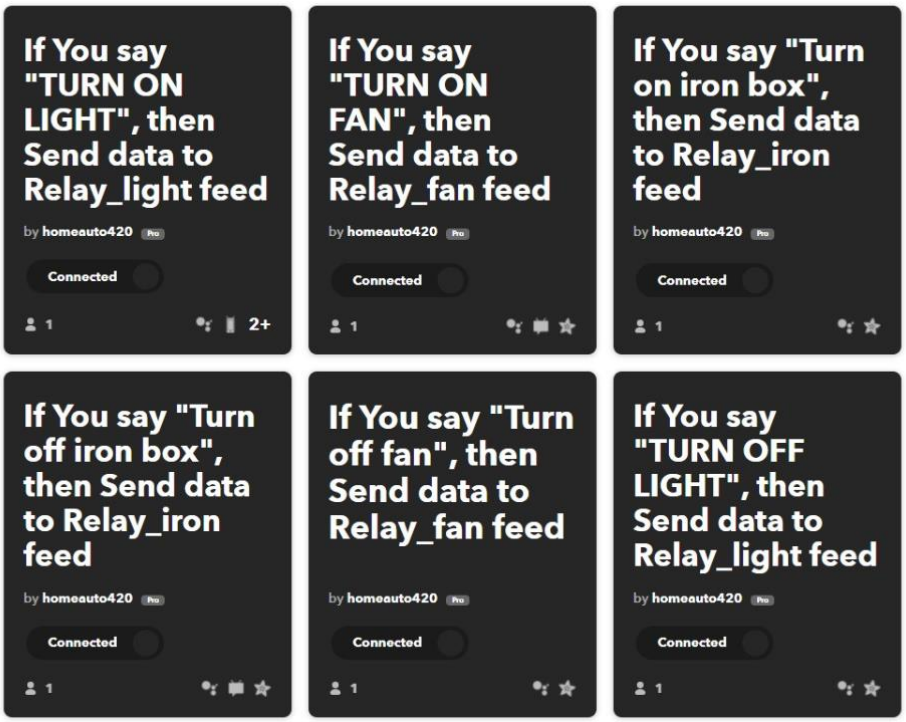
After account creation, click on My Applets and then select New Applet. After selecting a new applet, we get a new page in which we should click on to “IF”

Then search for Google Assistant and select it. Now, enter voice phrases which will be used as a command for google assistant.



Now, another page will be shown in which user have to click on that option which is used to connect Google Assistant with Adafruit. After selecting Adafruit, choose action. Now enter what data needed to send to which feed of Adafruit dashboard. Click on Create Action.

After creating IFTTT, we get this applet. Similarly, we have created applet for fan and iron box.



So, when Google Assistant is used on my mobile. This will trigger the event on Adafruit dashboard which is continuously monitored by the microcontroller (here NodeMCU). This microcontroller will take action as per the data change on the Adafruit dashboard.

PROGRAMMING NODE MCU:

Install the current upstream Arduino IDE at the 1.8 level or later. The current version is at the Arduino website. Start Arduino and open Preferences window. Enter https://arduino.esp8266.com/stable/pac kage_esp8266com_index.json

into Additiona l Board Manager URLs field. You can add multiple URLs, separating them with commas.

After Completion,

- Data Cable of your Mobile Phone. Used in To Connect ESP8266 MCU NODE with PC.
- After Install Drivers if Needed.
- Check Which Number Is Assigned To your Board.
- Open Arduino IDE.

- Open Boards Manager from Tools > esp8266 Module's platform And Select NodeMCU 1.0(ESP-12E Module) board from Tools.
- Upload Using: Serial
- CPU Frequency: 80Mhz
- Flash Size: 4M
- Upload Speed: 115200
- PORT: Select Assign Port Only.
- Upload Code.

Code –

After uploading the code connect the hardware components as shown in the circuit diagram. We connect NodeMCU to the relay module and from relay module to the required household appliances.

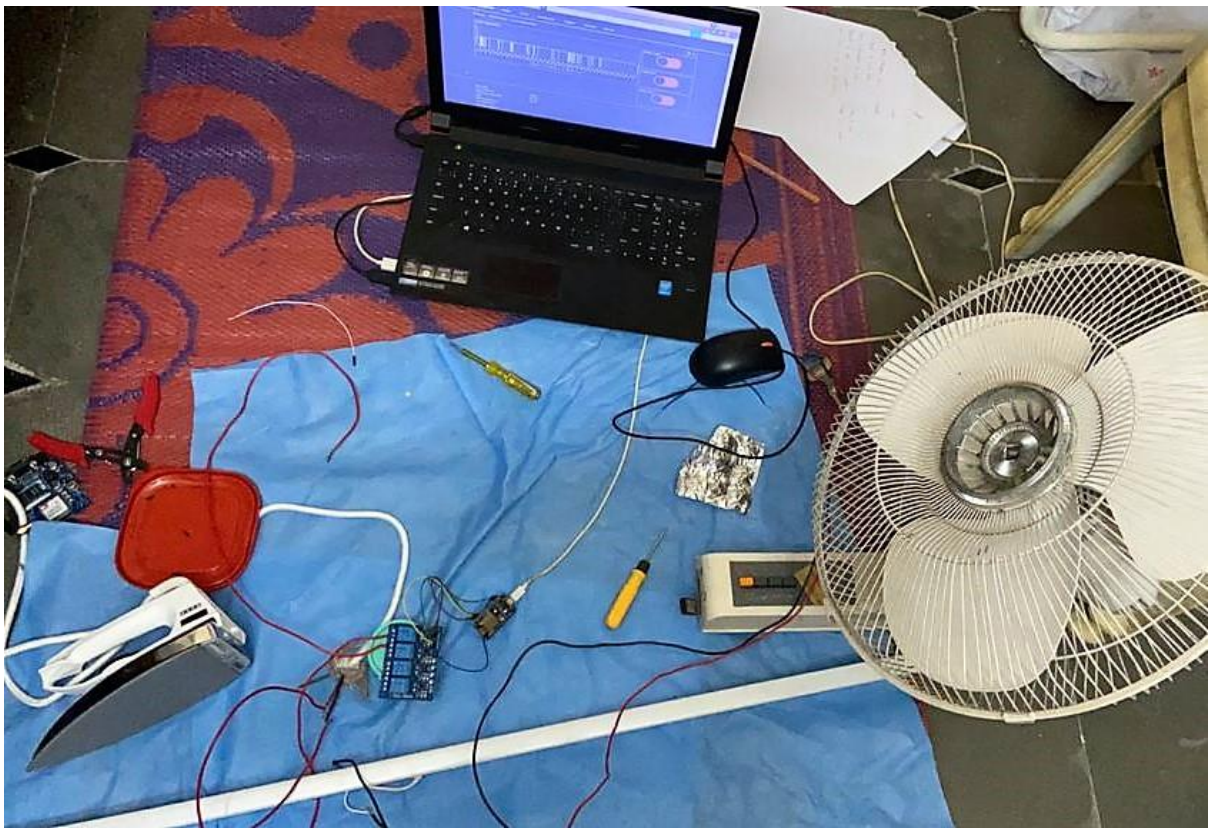
The design and development of the project is done.

CHAPTER 4

DEMONISTRATION/EVALUATION AND RESULT

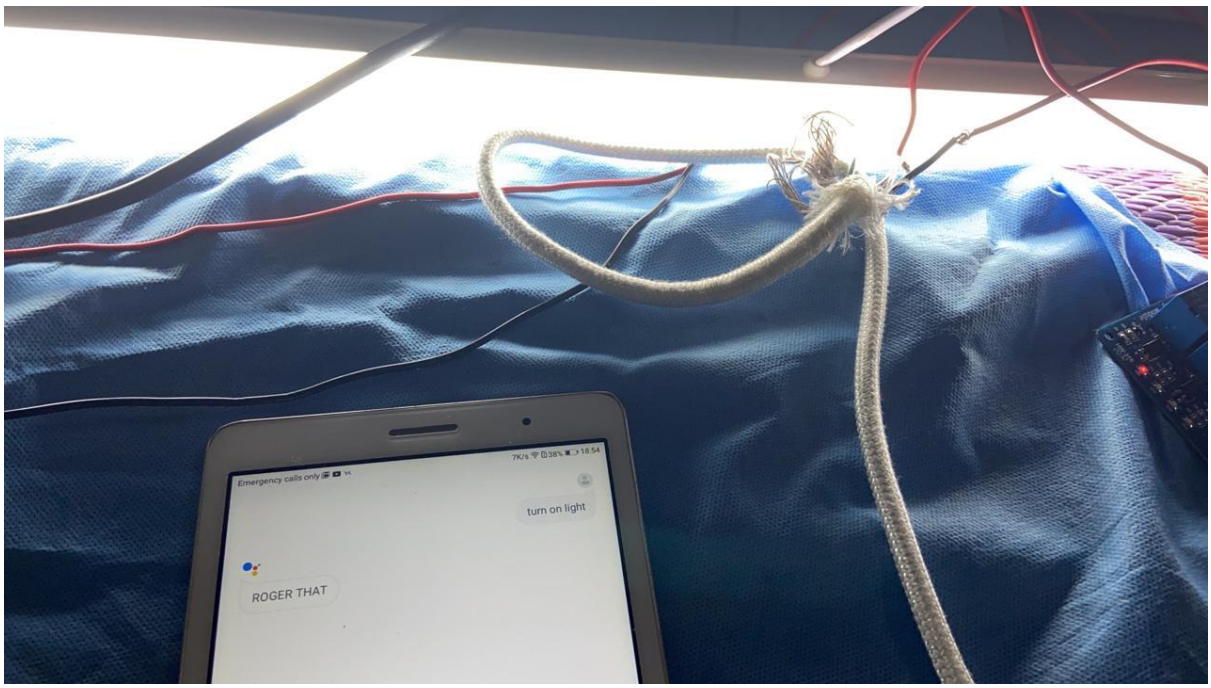
The output for Google assistant-controlled home automation is shown below.

This is the complete prototype implementation of the proposed system.

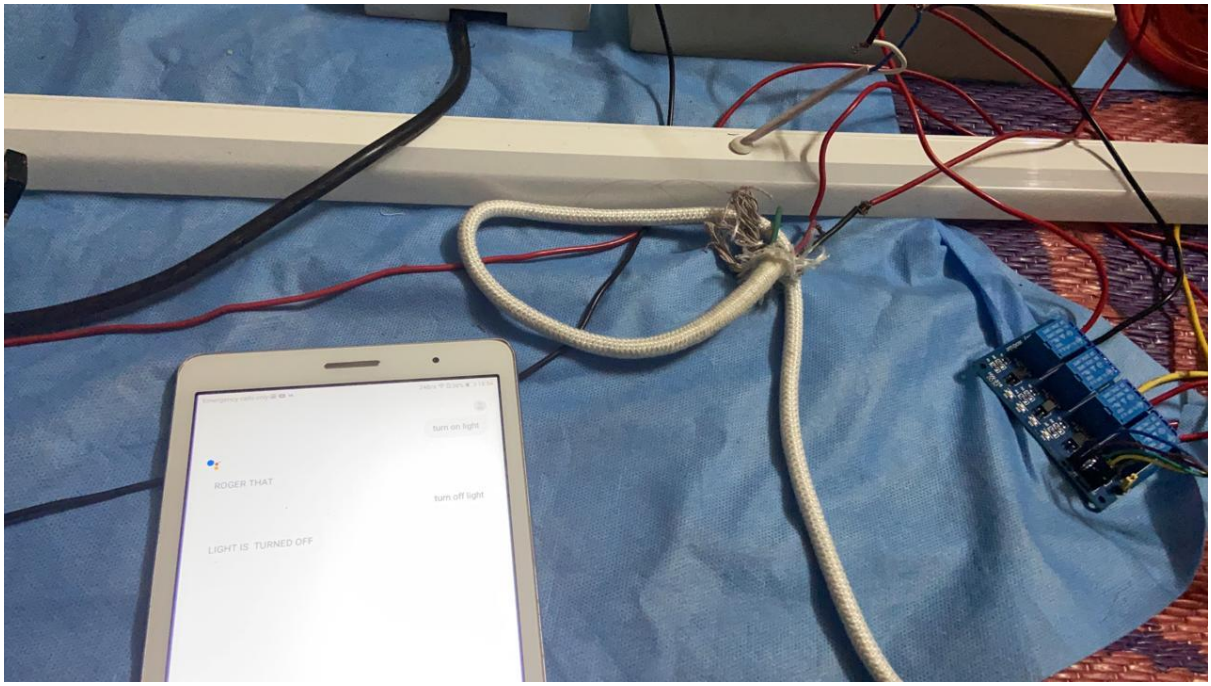


Here the relay module is connected to the appliances. In this images all the appliances are off.

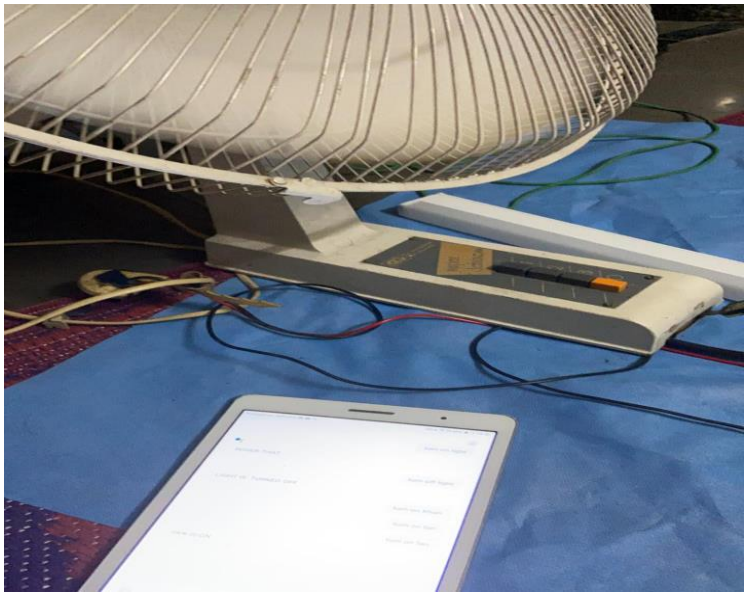
Here when the command is given from google assistant to turn on the light the light is turned on.



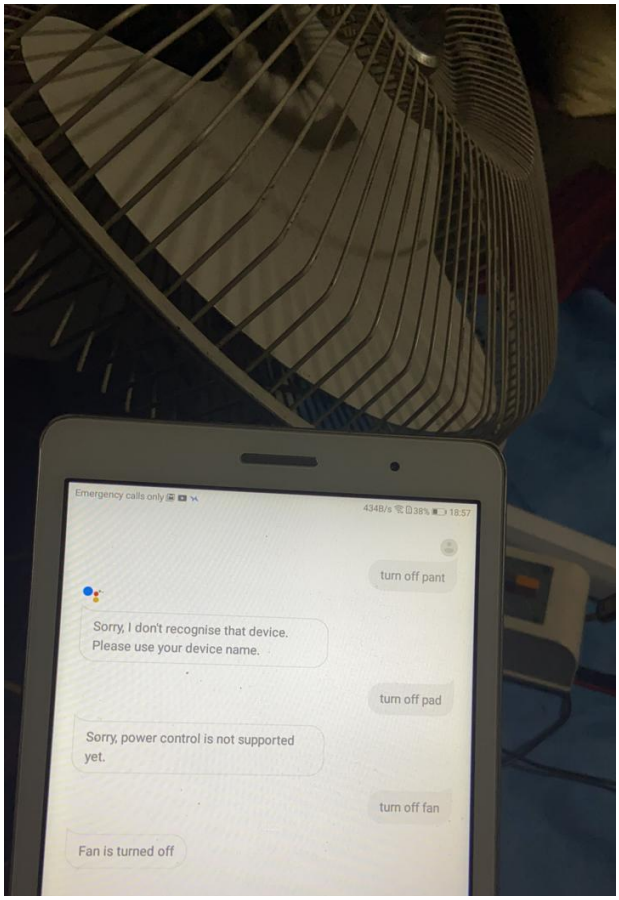
Turn off light –



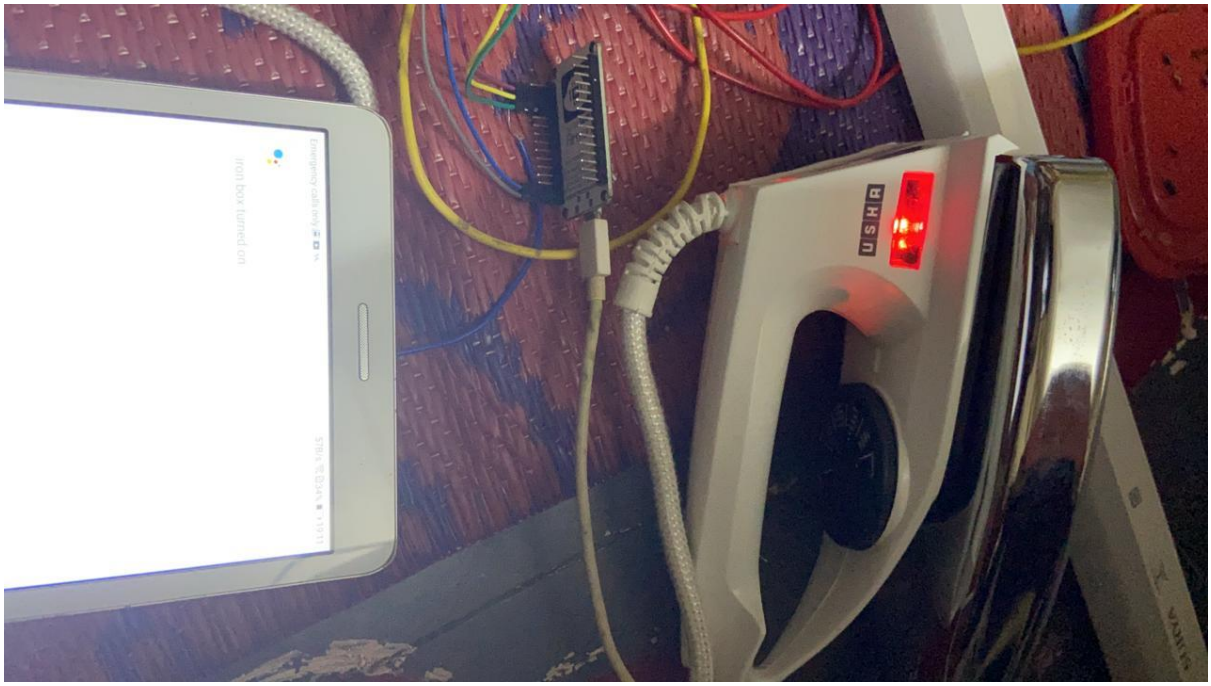
Turn on fan –



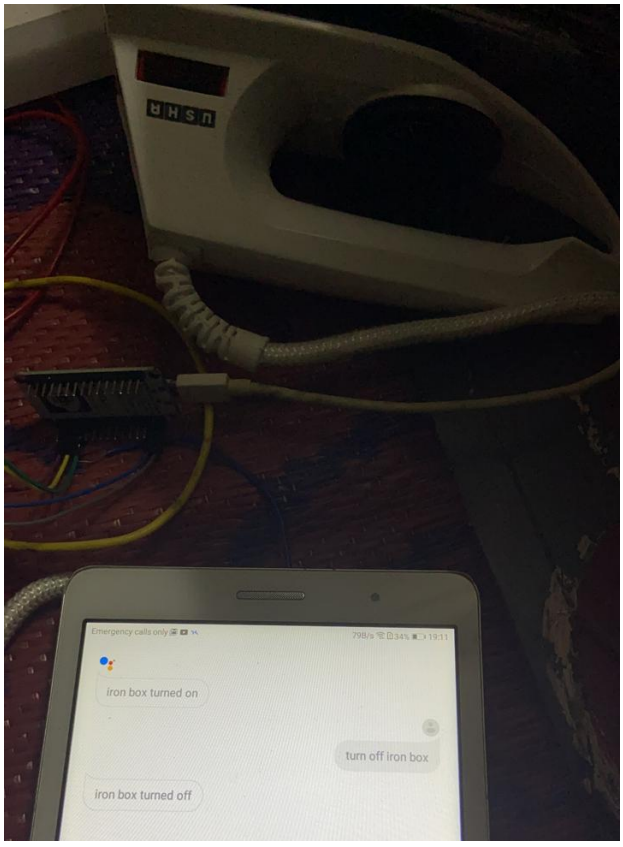
Turn off fan –



Turn on iron box –



turn of iron box –



CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

In this project, voice commands are given to the Google assistant. The voice commands for Google assistant have been added through IFTTT website and the Adafruit account is also linked to it. In this home automation, user have given commands to the Google assistant. Home appliances like Bulb, Fan and Motor etc., are controlled according to the given commands. The commands given through the Google assistant are decoded and then sent to the microcontroller and it control the relays. The device connected to the respective relay turned On or OFF as per the users request to the Google Assistant. The microcontroller used is NodeMCU (ESP8266) and the communication between the microcontroller and the application is established via Wi-Fi (Internet). This project is about wireless home automation using Android mobile helps us to implement such a fantastic system in our home at a very reasonable price using cost-effective devices. We used gsm module to send the status of the appliances by connecting to the home automation network.

6.2 Future work

There are a variety of enhancements that could be made to this system to achieve greater accuracy in sensing and detection. There are a lot of other sensors that can be used to increase the security and control of the home like pressure sensor that can be put outside the home to detect that someone will enter the home. Changing the way of the automated notifications by using the GSM module to make this system more professional.

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