

# Artificial Intelligence Based Chatbot for Appliance Control

<sup>1</sup>Millerjothi N K, <sup>2</sup>Shameer M S, <sup>2</sup>Vijay Ram G and <sup>4</sup>Hariharan D

Department of Mechanical Engineering,

Sri Eshwar College of Engineering, Coimbatore, India

<sup>1</sup>millerjothi@gmail.com, <sup>2</sup>shameer.ms2021mech@sece.ac.in, <sup>3</sup>vijayram.g2021mech@sece.ac.in,

<sup>4</sup>hariharan.d2022mech@sece.ac.in

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**Abstract**-Now a days, numerous uses of artificial intelligence are found in the healthcare industry. Building advanced devices that can detect diseases and identify cancer cells uses AI applications. In order to ensure early diagnosis, artificial intelligence can assist in analyzing chronic illnesses with lab and other medical data. In this study, an IoT based home management and monitoring system with cheap cost and flexibility is presented. Using the Facebook Messenger app, users may access and remotely operate gadgets and appliances using smart phones. In contrast to prior systems, the proposed system provides a communication protocol to monitor and control the home appliances with the Messenger app in smart phones. The intelligent networking of common place devices like smart phones, Internet TVs, sensors, and actuators to the Internet is known as the Internet of Things (IoT). New forms of communication between objects and humans as well as between things and other things are made possible by this. Now that everyone, from anywhere, can have connectivity for anything, In this project, the Facebook Messenger and the ESP8266-12E NodeMCU are used to operate electrical home appliances. Chatfuel is the tool used to build Facebook AI chatbots. IFTTT and Adafruit IO are also used by the project for back-end assistance.

**Keywords**-TheChat box, The House Assistant, The Human-Robot Interaction Module(HRIM)

## I. INTRODUCTION

House automation, sometimes known as "smart homes," is the integration of technology to the home environment to offer its residents ease, comfort, security, and energy efficiency. Home automation research and implementation are becoming more and more popular as a result of the Internet of Things. Different wireless technologies, including Bluetooth, WI-Fi, RFID, and cellular networks, have been used to embed different levels of intelligence in the home. The gadgets are physically linked to a Bluetooth sub-controller, which the smart phone may access and control using built-in Bluetooth connectivity.[1] Home gateways have also been used by researchers to try and enable network compatibility and remote access for household appliances and gadgets. In this project, the Facebook Messenger and the ESP8266-12E NodeMCU are used to operate electrical home appliances. Chatfuel is the tool used to build Facebook AI chatbots. IFTTT and Adafruit IO are also used by the project for back-end assistance. It's a terrific project for fusing AI with the IoT. Separately created IoT and chatbots are combined to create the final chatbot. By using this AI based chatbot we can communicate by messaging in any language in the world, and it can operate any appliances. We can use our smart phones to operate smart home appliances like lights, switches and fans.

## II. MATERIALS AND METHODS

This project is made using the following integrations of components and softwares. The hardware circuit diagram is shown in the **Fig 1**. In this project, two types of integration takes place which are

- Hardware Integration
- Software Integration

### Hardware Setup

This project makes use of Lolin's NodeMCU ESP8266 - 12E. NodeMCU is connected with the 1 channel 5V relay module. The Relay module acts as a switch and it is connected with the phase of the current and the neutral is directly given to the appliances. [2] When the NodeMCU is connected to the Wi-Fi and we send a message through the chatbot created with Facebook Messenger and it sends the output to IFTTT through JSON API URL which has been Integrated

in Chatfuel and then the value passes to NodeMCU through Adafruit IO and then the NodeMCU sends a signal to the relay and hereby the appliance is controlled using the chatbot. The Hardware experimental setup is shown in **Fig 2**.

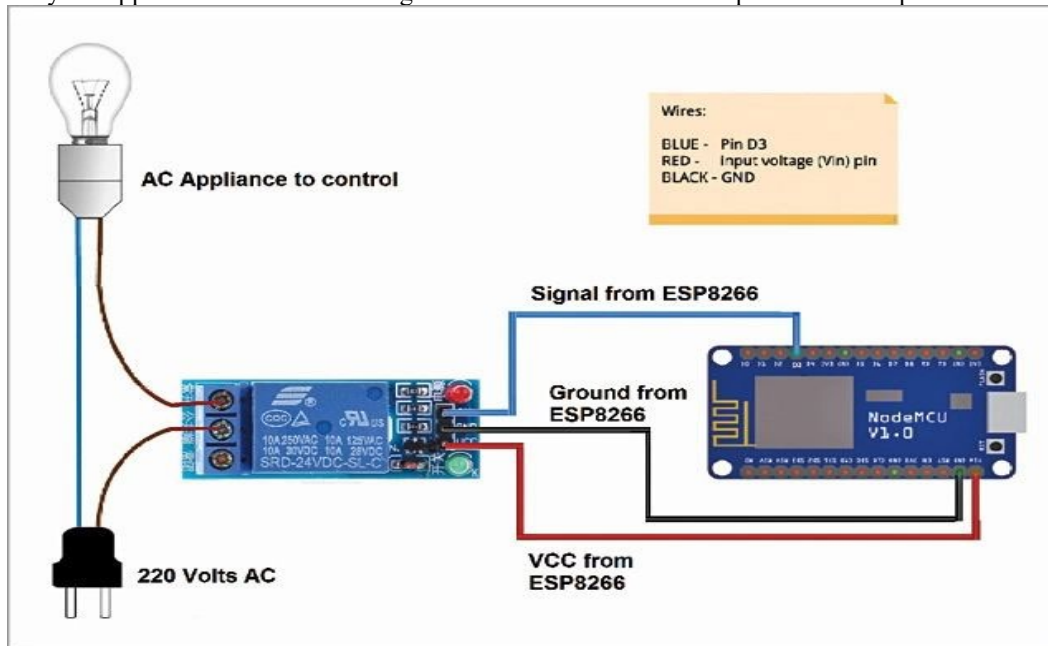


Fig 1.Circuit Diagram.

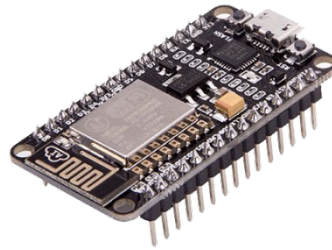


Fig 2.Experimental Setup.

### Components

#### NodeMCU

NodeMCU is an open-source firmware and development board that is based on the ESP8266 Wi-Fi module. It allows developers to build Internet of Things (IoT) applications with the Lua scripting language. The NodeMCU development board features an ESP8266 module, which provides integrated Wi-Fi connectivity, as well as GPIO pins for connecting sensors, actuators, and other peripherals. [3-9] The board also has an onboard USB-to-serial converter, which makes it easy to program and communicate with the device. NodeMCU can be programmed using the Lua scripting language, which is easy to learn and widely used in the IoT community. Lua scripts can be uploaded to the device using a USB cable and a programming tool such as the NodeMCU Flasher. Node MCU can be used to build a wide variety of IoT applications, including home automation systems, environmental monitoring devices, and more. Its open-source firmware and development board make it a popular choice for hobbyists and professional developers alike. The NodeMCU is shown in the **Fig 3**.



**Fig 3.** NodeMCU.

#### *Relay Module*

A 1-channel 5V relay module is an electronic device that allows you to control a high-voltage circuit using a low-voltage signal. The relay module typically consists of a relay, a control circuit, and a set of screw terminals for connecting to the high-voltage circuit. The relay module is shown in the **Fig 4**.



**Fig 4.** Relay Module.

The 5V in the name refers to the voltage required to power the control circuit. This voltage can typically be supplied by a microcontroller or other low-voltage device. The 1-channel in the name indicates that the module has a single relay that can be controlled by the input signal. When the control signal is applied, the relay switches its contacts from one position to another, allowing or blocking the flow of current through the high-voltage circuit. This can be used in a wide range of applications, including home automation, industrial control, and robotics.[10-15]

#### *Jumper Cables*



**Fig 5.** Jumper Cables.

Jumper cables, also known as jumper wires, are used to connect different parts of a circuit board together. They can be used to create connections between different pins on a microcontroller, connect sensors or other devices to a circuit board, or to connect components on a breadboard. Jumper cables come in various lengths, colors, and sizes. They are typically made from copper wire and have a male pin on one end and a female pin on the other end. The male pin is inserted into a hole on the circuit board while the female pin is used to connect to another component. Jumper cables can be purchased in pre-made sets or you can make your own using wire and male/female pins. When making your own jumper cables, it's important to use the appropriate gauge wire for the application and ensure that the pins are securely attached to the wire. The jumper cables are shown in the **Fig 5**.

#### *Electrical Components*

The Electrical components used are Bulbs, Bulb Holders, Switches, Plugs, Plug Points. These are the basic components we use in our day to dayflies. The electrical components are shown in the **Fig 6**.



**Fig 6.** Electrical Components.

### III. SOFTWARE INTEGRATION

#### *Messenger*

Messenger is a facebook messaging platform. Facebook Messenger is MQTT-based. MQTT is specifically made to use bandwidth and batteries sparingly for tasks like transmitting telemetry data to and from space probes. My opinion of the MQTT protocol is that it is really fundamental, and Facebook chose it because it makes it simple for them to construct and continue customising their protocol. [16-20] We really want a Virtual human to visit with. For this, we will make a Facebook Page. To make a Facebook Page. Fill your Page name and Class you wish, you could in fact add a Profile Picture and Cover Page to it. You should likewise conceal your Page name and do settings so your page isn't accessible openly.

#### *Chatfuel Setup*

For the chatbot to effectively understand and respond to user requests, users can set the rules of the discussion via the Chatfuel dashboard. An adaptable chatbot that can serve as an event assistant, customer service adviser, or sports team informant can be created by users using Chatfuel.

Using Chatfuel, anyone without any programming experience may develop their own Facebook Messenger bot. It offers capabilities like uploading content cards and instantly sharing it with your followers, collecting information inside Messenger chats with forms, and allowing users to interact with your bot by pressing buttons. People prefer speaking over choosing selections from a chatbot because it is more comfortable[7]. Additionally, it offers AI technology for scripting interactive discussions and use AI to recognise user responses and deliver the right response. From here, go to Chatfuel Platform, then click "Create from Template" and "Blank Bot" on the Dashboard.. You can now begin using the AI component of the chatbot. Edit the Welcome message by altering the user's first name in automate. Next, select the Default Response and make the same changes. For commands that are not written into your chatbot or for any unanticipated errors, the default response is provided.

We now begin adding Blocks. Blocks are the methods used in will carry out chat commands. To include these blocks, click the plus sign (+). The IFTTT server's APIs will be hit by these functional blocks. This Text Card can be modified to reflect your preferred response. Set the Relay Off with Light Off message's settings similarly. Relay On and Relay Off are two blocks that you should make and rename. Add a Text card to the Relay On block that you have chosen. This text card serves as our Chatbot's response when you complete this particular block. Now pick + ADD AI RULE from the menu and fill out the AI by clicking Set Up AI. This is how its AI is primarily put up. Create its AI rules by listing all phrases that are acceptable for a user to speak and responding with Blocks Then add the relevant block. Simply enter the sentence after typing it to add it. We'll stop it here. After IFTTT is configured, additional settings will be made. The message box from chatfuel is shown in **Fig 7**.

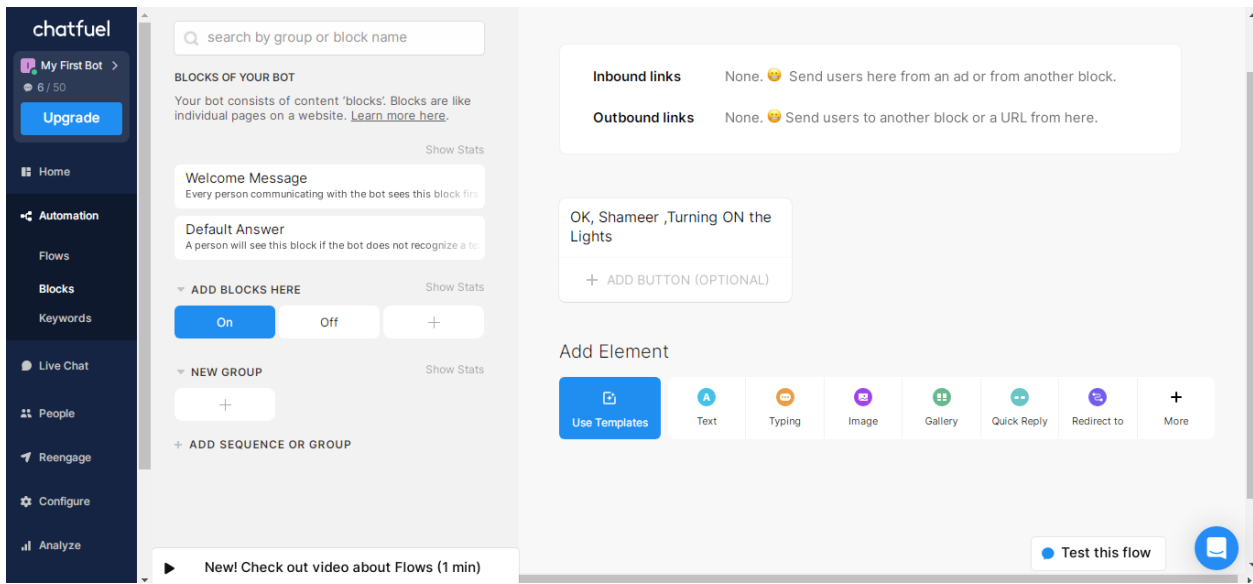


Fig 7. The Chatfuel Complete Setup.

### Setup of Adafruit IO

Adafruit IO is the IoT end in the setup with Adafruit. Here, our ESP8266 connects to its server and issues the command we want. Visit Adafruit IO now. Register an account with Adafruit IO or log in. You must be sent to the Adafruit Home Screen after establishing Adafruit. Next, choose Feeds from the hand menu and then click Action and then Create a New Feed. We came up with the name "on-off," but you can call it whatever you want. Navigate to Build a New Dashboard under Dashboards and then go to Actions now. I gave this one the same name as well, "Light Automation". To add a new block, click "Blue +" in the top right corner of your Dashboard. Choose Block "Toggle". [20-28] Choose your feed and press "Next Step" at this time. "Create the Block" after filling out the block options. "Create the Block" after filling out the block options. The Adafruit io complete setup is shown in the following Fig8.

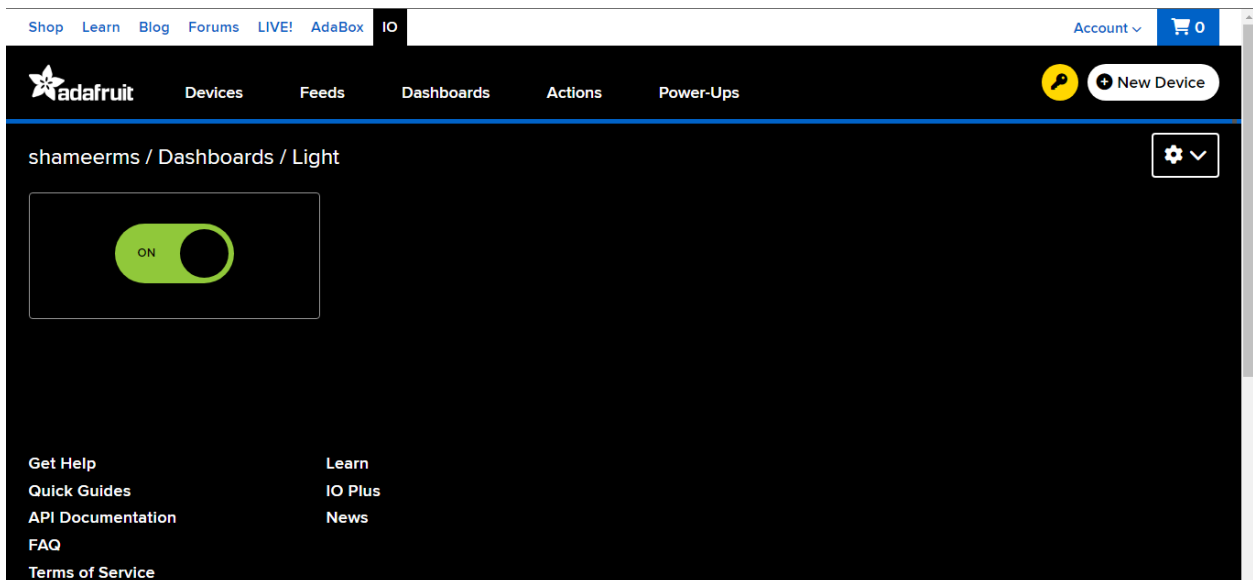


Fig 8. The Adafruit IO Complete Setup.

### MQTT

Message Queue Telemetry Transport, also known as MQTT, is a very simple communication protocol created by IBM. MQTT uses a publish/subscribe architecture for machine communication (M2M). MQTT is employed as a message transfer binding protocol in this project. Clients and brokers make up MQTT. A subscriber or publisher to or of a certain topic is referred to as a client. A publisher delivers value to the server, whereas a subscriber listens to the server. Adafruit Service is utilised as the MQTT broker and NodeMCU is the client for the prototype. The cloud platform and a

management dashboard are both provided by Adafruit. The terms client, subscriber, and publisher are defined during programming. In contrast to the sensor, relay and dc motor are subscribers that wait for external commands from the server (photocell) as it reads data and releases it to the server, is the publisher.

### IFTTT

IFTTT is also known as “If This Then That”. IFTTT is a free web application that enables users to build applets-chains of straight forward conditional statements. Changes made in other web services like Gmail, Facebook, Telegram, Instagram, or Pinterest can start an applet. The following steps takes place in the integration of IFTTT.

- By signing up using the same Google Account that you use for your phone, you may create an account on IFTTT.
- Go to My Applets > New Applet > and then select "+ this." Look for and choose the service Webhooks.
- Choose Request a Web Service, enter the event name, then click Create Trigger.
- The Action Service must be filled after the Trigger has been created. Click on + that for that. Now look for and choose the Action Service Adafruit.
- This will request your Adafruit Login Credentials for the first time. There, enter the information for your Adafruit IO account.
- By selecting your "Feed name" and "Data to Save" as Value 1 in Add Ingredient, fill the Action form with the "Send data to Adafruit IO" action. Click "Create Action" then "Finish."
- Now look for and choose the Action Service Adafruit. This will request your Adafruit Login Credentials for the first time. There, enter the information for your Adafruit IO account.
- By selecting your "Feed name" and "Data to Save" as Value 1 in Add Ingredient, fill the Action form with the "Send data to Adafruit IO" action.
- Click "Create Action" then "Finish." Go to My Applets (1), choose the applet you created there, and then click Webhooks (3).
- We now require the JSON API URL for setup of chatfuel with IFTTT. It is accessible through Webhooks Settings. Hence, select Settings. Take a note of this URL and save it for later use. The IFTTT setup is shown in the Fig 9.

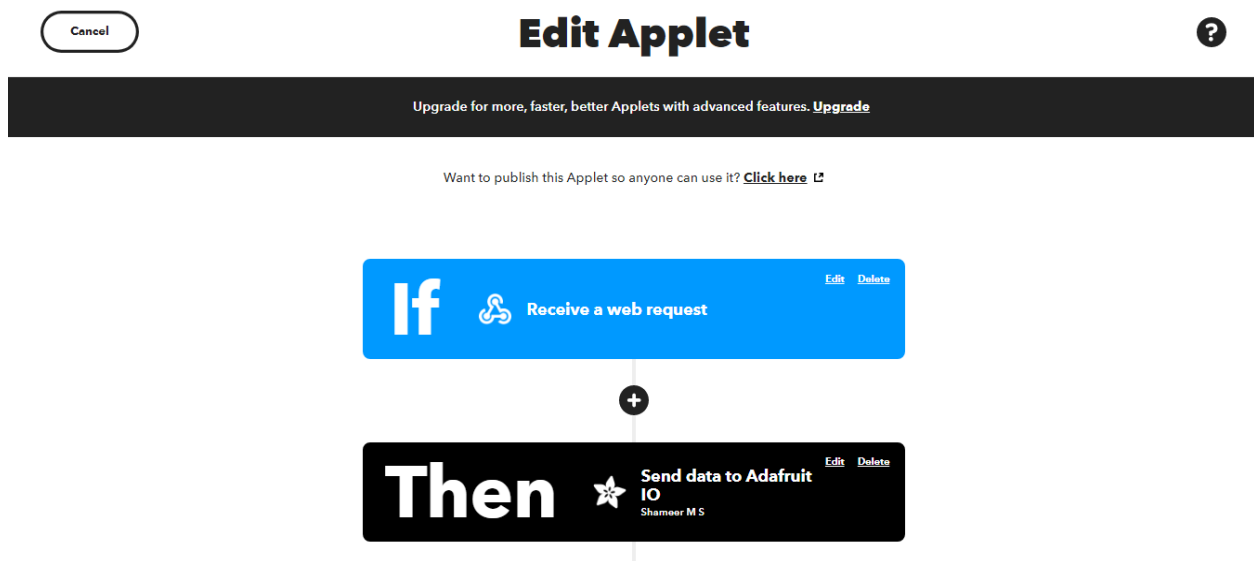


Fig 9. The IFTTT Complete Setup.

### JSON API Link Setup

Make two connections for light on and light off from this URL.

For Light On, the connection is <https://maker.ifttt.com/trigger//with/key//?value1=1>

For Light Off, the connection is <https://maker.ifttt.com/trigger//with/key//?value1=0>

Duplicate and save these connections for Chatfuel mix. Test the connections by populating these in the Internet browser and checking Flip Switch made at Adafruit IO server.

Allow us to incorporate everything now.

Open Hand-off On and Transfer Off blocks made in Chatfuel stage. Add JSON APIs to these. Select + sign in Add a Card menu of Hand-off On block. Click on JSON Programming interface from Chatfuel Modules menu (Fig. 10). Select sort as Post and enter the connection made for Light On. Glue it in the URL Tab, as displayed in Fig10.

**Fig 10.** JSON API link Setup.

In this project we modify the Arduino IDE Software for programming Node MCU. Adafruit IO supports the MQTT protocol for device communication, often known as message queue telemetry transmission. You can publish and subscribe to a feed to send and receive feed data using a MQTT library or client. You will want a MQTT client library in order to use the MQTT API that Adafruit IO offers. The following steps are followed for the modification of the Arduino IDE software for programming NodeMCU:

1. Start the Arduino IDE. Choose File > Preferences.
2. In "Other Board Manager URLs," type `http://arduino.esp8266.com/stable/package_esp8266com_index.json`. Click "OK" to continue.
3. Access Boards Manager by going to Tools > Board.
4. Install "esp8266 by Esp8266 community" by selecting the ESP8266 board menu from the scroll-down menu.
5. Under Tools > NodeMCU 1.0, choose your ESP8266 board (ESP12E Module).
6. Start the Arduino IDE again.

#### IV. DEVELOPMENT OF CODE

In this project we modify the Arduino IDE Software for programming Node MCU. Adafruit IO supports the MQTT protocol for device communication, often known as message queue telemetry transmission. You can publish and subscribe to a feed to send and receive feed data using a MQTT library or client. You will want a MQTT client library in order to use the MQTT API that Adafruit IO offers. The following steps are followed for the modification of the Arduino IDE software for programming NodeMCU:

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3. Access Boards Manager by going to Tools > Board.
4. Install "esp8266 by Esp8266 community" by selecting the ESP8266 board menu from the scroll-down menu.
5. Under Tools > NodeMCU 1.0, choose your ESP8266 board (ESP12E Module).

#### *Code Implementation*

Programming code (`facebook_chatbot.ino`) is written in Arduino programming language. Prior to accumulating and transferring to NodeMCU board, roll out certain improvements in the code. Place your Wi-Fi accreditations as demonstrated inside twofold statements displayed beneath in code announcement. `ESP8266WiFi.h` library helps run the elements of Wi-Fi in Arduino IDE.

```
#include //Adafruit MQTT Libraries
#include //
#include //ESP8266 Wi-Fi libraries
#define relayPin D3 //declare the relay pin
```

```

#define WLAN_SSID "xxxxxxx" //enter your
WiFi network name within the double quotes &
#define WLAN_PASS "xxxxxxx" //password here
#define AIO_SERVER "io.adafruit.com"
#define AIO_SERVERPORT 1883 // use 8883 is used for SSL
#define AIO_USERNAME "xxxxxxxxxx" //User name of Adafruit IO (for this click the Golden Key in Adafruit IO
Dashboard)
#define AIO_KEY "xxxxxxxxxx" //key of
Adafruit IO (for this click the Golden Key in Adafruit IO Dashboard)
Enter your feed name to subscribe to MQTT server. For more details on MQTT, visit http://mqtt.org/
Subscribe to MQTT. It is done in the code in Void Setup() as shown below.
void setup()
{
pinMode(relayPin, OUTPUT);
digitalWrite(relayPin, LOW);
Serial.begin(9600);
delay(10);
Serial.println();
Serial.println();
Serial.print("Connecting to "); //
Connect to WiFi access point.
Serial.println(WLAN_SSID);
WiFi.begin(WLAN_SSID, WLAN_PASS);
while (WiFi.status() != WL_CONNECTED)
{
delay(500);
Serial.print(".");
}
Serial.println();
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
mqtt.subscribe(&onoffbutton); // Setup
MQTT subscription for onoff feed.
}
RelayPin is set as result, which is at first low. This result is characterized in Void Circle(), as displayed below.
void loop()
{
// Ensure the connection to the MQTT server is alive (this will make the first
// connection and automatically reconnect when disconnected). See the MQTT_connect
// function definition further below.
MQTT_connect();
// this is our 'wait for incoming subscription packets' busy subloop
// try to spend your time here
Adafruit_MQTT_Subscribe *subscription;
while ((subscription = mqtt.readSubscription(5000)))
{
if (subscription == &onoffbutton) {
Serial.print(F("Got: "));
Serial.println((char *)onoffbutton.
lastread);
String response = (char *)onoffbutton.
lastread; //converts the received 1
or 0 to string to compare in the if-
else statement
if (response == "1")
{
digitalWrite(relayPin, HIGH);
}
}
}
}

```



```

else
{
digitalWrite(relayPin, LOW);
}
}
}
}
}
}
}

```

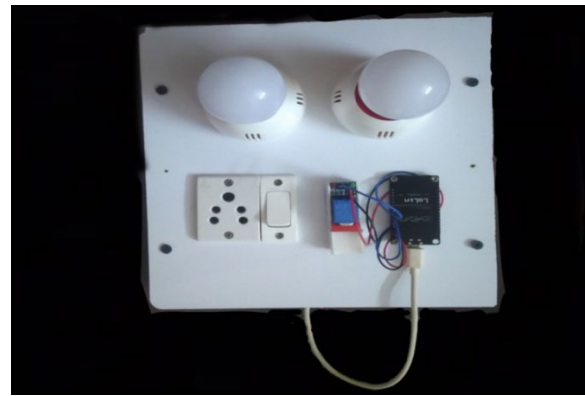
Save the code and transfer it through USB link. Remember to choose the COM port from Apparatuses menu in Arduino IDE prior to transferring the code.

## V. RESULT ANALYSIS

At First when we open the messenger application and type the message “Turn on the light” or “Switch on the light” and send the message and when the message is delivered it sends the value 1 to the JSON API link which we generated by the IFTTT(IF this then That) platform, Then it triggers the Event Name “Light” and the value 1 is sent to the Adafruit IO platform where we created a “Dashboard” with the Name “On/Off Switch Block”. Then it is sent the value 1 to the NodeMCU in which we have already stored the Adafruit name and Key in the Program and it subscribes to the MQTT server. The AI Chatbot is connected to an MQTT broker, which acts as a message hub for all connected devices and clients. Each appliance that the Chatbot can control is also connected to the MQTT broker as a client, and subscribes to a specific topic on the broker. The user interacts with the Chatbot through a chat interface, and requests that the Chatbot perform a certain action (e.g. turn on the lights). The Chatbot receives the user's request, and publishes a message to the MQTT broker on the appropriate topic (e.g. "lights/on"). The appliance that subscribes to the "lights/on" topic receives the message, and performs the requested action (i.e. turns on the lights). The appliance can also send messages back to the Chatbot through the MQTT broker, for example to report its status (e.g. "lights are now on"). When the NodeMCU connects with the WiFi of which the details are already stored in the Code of the NodeMCU. Then the signal from the pin D3 is sent to the relay module input pin whereas relay module is an electro-mechanical switching device. In a relay, we can control switching AC or DC appliances digitally by providing input to relay input pins. Here we have used a 1-channel relay operating on 5 Volts. Then relay module provides the electricity to the appliance to be controlled. When the value is 1 the power is directly supplied to the Circuit as shown in the **Fig 11**. When the value is 0 the power is directly cut of from the Circuit as shown in the **Fig 12**.



**Fig 11.** Power Supply into Circuit.

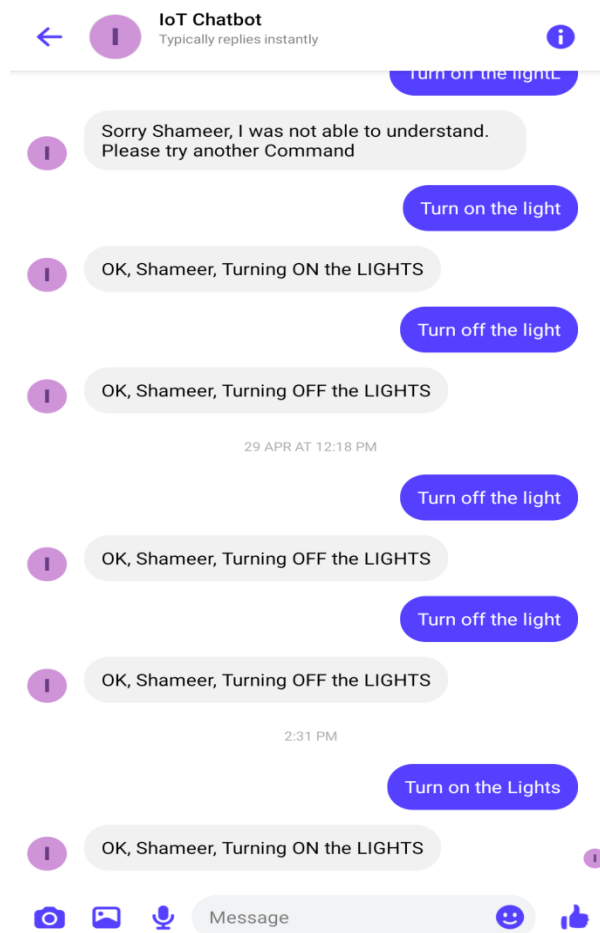


**Fig 12.** Poweroff into theCircuit.

## VI. CONCLUSION

In conclusion, an artificial intelligence-based chatbot for appliance control can be a highly beneficial and convenient solution for home automation. With the use of natural language processing and machine learning algorithms, the chatbot can interpret user commands and control various appliances in the home, such as lights, thermostats, and smart devices. This type of chatbot can provide users with a more streamlined and intuitive way of interacting with their home appliances, eliminating the need for complex user interfaces and multiple apps. Additionally, with the ability to learn from user behavior and preferences, the chatbot can offer personalized recommendations and suggestions for optimizing energy usage and improving overall home comfort. While there may be some challenges in terms of accuracy and security, these can be addressed with careful design and development. Overall, an artificial intelligence-based chatbot for appliance control has the potential to revolutionize the way we interact with our homes, making them more efficient, convenient, and comfortable. The system suggested in this paper is a clever way to incorporate electrical appliances into daily life.

The study suggests employing AI in conjunction with IoT, but it also demonstrates a strategy for the emerging Social Internet of Things (SIoT), where social networking principles can be combined with IoT to allow for the direct integration of a physical device into a social platform. The resulting paradigm may enable cutting-edge networking services and IoT applications in more effective, efficient, and secure ways. The formation and administration of social interactions between things can be facilitated by technology in a way that makes the resulting social network navigable in the same way that people connect on social media. The report also outlines a potential IoT architecture that has the features needed to incorporate items into social networks. The formation and administration of social interactions between things can be facilitated by technology in a way that makes the resulting social network navigable in the same way that people connect on social media. The report also outlines a potential IoT architecture that has the features needed to incorporate items into social networks. The outcome (chatbot) of this project is shown in the Figure given below. This project is made using C++ programming language and the softwares like Chatfuel, Adafruit IO, IFTTT (If This Than That), and hardwares like NodeMCU and Relay Module has been used. The Completed output of the chatbot is shown in the **Fig13**



**Fig 13.** The Chatbot for Appliance Control.

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