**UNIVERSITY OF MUMBAI**

A PROJECT REPORT ON

# IOT HOME AUTOMATION

Submitted in partial fulfillment of the requirements

of the degree of

**THIRD** year of Bachelor of Engineering

By

*"Brijesh Verma (15104B0009)*

*Pritam Gadhari(15104B0011)*

*Pranali Tajane (15104B0014)*

*Shahjahan Ansari(15104B0022)"*

Under the Guidance of

*Prof. Pravin Patil*


Department of **Electronics and Telecommunication** Engineering

Vidyalankar Institute of Technology, Wadala (E), Mumbai

2017-2018

# CERTIFICATE

This is to certify that

*"Brijesh Verma (15104B0009)*

*Pritam Gadhari(15104B0011)*

*Pranali Tajane (15104B0014)*

*Shahjahan Ansari(15104B0022)"*

Have successfully completed the project titled

# IOT HOME AUTOMATION

The project was undertaken as a part of the curriculum in partial fulfillment of **T.E.** Degree in **Electronics & Telecommunication** Engineering.

(University Of Mumbai)

For the Academic year **2017-2018**

Internal Examiner

External Examiner

# MINI Project Approval for THIRD year of Bachelors of Engineering

This project entitled **IOT BASED HOME AUTOMATION** by *"BrijeshVerma(15104B0009) ",PritamGadhari(15104B0011),Pranali Tajane (15104B0014) Shahjahan Ansari(15104B0022)"* is approved for the degree of **THIRD year of Bachelors of Engineering in Electronics and Telecommunication**.

Examiners

1. _____

2. _____

Supervisors/ Guides

1. _____

Head of Department

1. _____

Date:

Place: Mumbai

# ACKNOWLEDGEMENT

We take this opportunity to express our profound gratitude and deep regards to our guide **Prof. Pravin Patil** for his exemplary guidance, monitoring and constant encouragement throughout the course of this project work.

We also take this opportunity to express a deep sense of gratitude to Professor **Sanjay Singh Thakur** HOD of E.X.T.C. Dept. for his cordial support, valuable information and guidance, which helped us in completing this task through various stages.

We are obliged to staff members of **Vidyalankar Institute of Technology**, for the valuable information provided by them in their respective fields. We are grateful for their cooperation during the period of our project work.

Lastly, we thank almighty, our parents, our family and friends for their constant encouragement.

Brijesh Verma (15104B0009)

Pritam Gadhari(15104B0011)

Pranali Tajane(15104B0014)

Shahjahan Ansari15104B0022)

# ABSTRACT

Automation is an efficient method to use in every filed such that to reduce manpower, energy usage and also for improving the quality and efficiency of any system

HOME AUTOMATION system is one of the automation system ,which is used for controlling home appliances automatically with the help of various control systems.

IOT or internet of things is an upcoming technology that allows us to control hardware devices through the internet. Here we propose to use IOT in order to control home appliances, thus automating modern homes through the internet. This system uses three loads to demonstrate as house lighting and a fan. Our user friendly interface allows a user to easily control these home appliances through the internet. For this system we use arduino.

# List of Figures:



.

.

# List of Table

# CONTENTS

# Chapter 1

# Introduction

# Chapter 1 Introduction

Automation in today's world is playing a vital role in energy saving. The replacement of humans with technology is everywhere. It is impacting our day-to-day lives, usually in ways we barely notice. Home automation system achieved great popularity in the last decades and it increases the comfort and quality of life. Nowadays most home automation systems consist of a smartphone and microcontroller or Arduino. A smart phone application is used to control and monitor the home appliances using different type of wireless communication techniques such as Zigbee, Wi-Fi, Bluetooth.

So , **HOME AUTOMATION** is the process of controlling home appliances automatically using various control system techniques. The electrical and electronic appliances in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques.

## Wireless Home Automation using IOT (Internet of Thing)

Wireless home automation using IOT is an innovative application of internet of things developed to control home appliances. It is a techniques to control home appliances using Arduino and WiFi through android apps from any smartphone.

# Chapter 2

# Literature Survey

# Chapter 2 Literature Survey

## 1. Bluetooth Controlled Electronic Home Appliances

Bluetooth Controlled Electronic Home Appliances is a simple project ,where different electrical Appliances and electronic devices can be controlled using an Android device with the help of Bluetooth Technology. The proposed system controls the electrical loads based on the data transmitted by the Android device . An Android application should be installed in user's mobile or tablet to control the Electrical loads . Using this Android application user can send the command s to the Bluetooth module to control the electrical loads . Wireless technology used in this project is Bluetooth .It can Also be called as "Bluetooth Controlled Electronic Home Appliances" or" Android based Home Automation System"

**Disadvantag** :- 1.Bluetooth has small range

2. Also Bluetooth is disconnected app , disconnects and reconnecting Bluetooth is a task.

## 2.GSM Based Home Automation

The project aims at a system allowing user to control home based appliances through sms along With acknowledgements .Here user need not switch home appliances on and off manually. This system allows user to operate the devices through sms , also the status weather the device Is switched on or off is sent to user via a return sms .This can be used by domestic users and Company users to operate as well as check status of home and company appliances from Anywhere in the world.

**Disadvantage**:- 1.In case of GSM, SIM cards, individual authentication keys of the users are stored in the authentication centers. Any person with the rights and qualifications to access to authentication center can manipulate these to impersonate that mobile user.

### 3.DTMF Controlled Home Automation System

The main principle of this system is to control appliances like light and fan using DTMF Technology .DTMF encoder is present in your mobile and decoder is HT9107BIC .When a button Is pressed from mobile It generates a Tone which is decoded by the decoder Can then sent to ATMEGA8 controller .Controller then checks for input and i t produces the output according to the Code written to it.

**Disadvantage**:- 1.Lack of security. Anyone can control the appliances by connecting to the mobile connected to DTMF module.
2.Number of appliances is limited as our mobile can generate only 16 tones.

### 4.HOME AUTOMATION USING IOT

In IOT based home automation home appliances are controlled using a mobile app through WiFi module.

Hence after analysing all the home automation techniqes is was found out th t IOT based home automation is more beneficial than other systems

.

# Chapter 3

# System Development

# Chapter 3 System Development

## BLOCK DIAGRAM

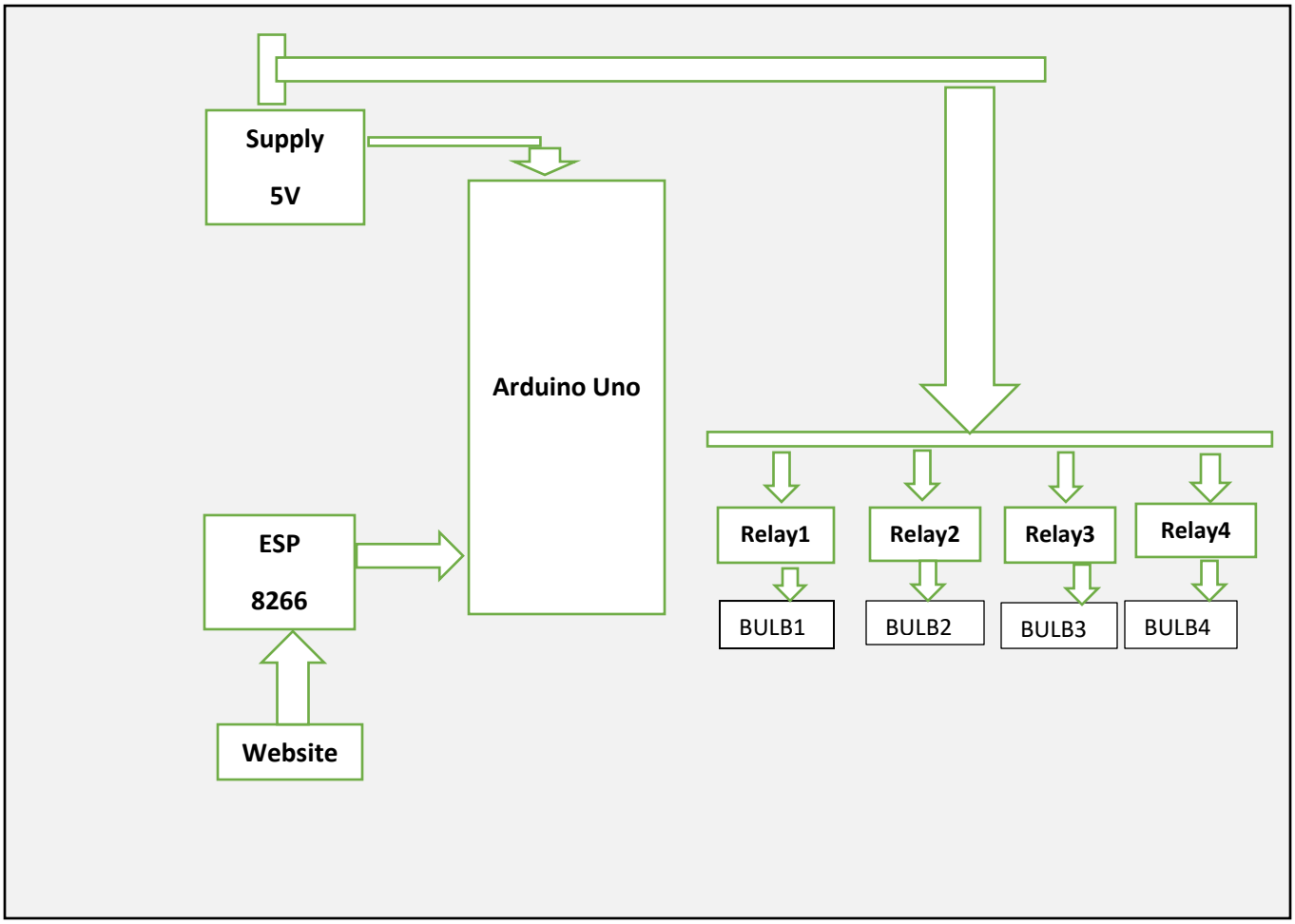


**Figure 1**

The basic block diagram of home automation using IoT as shown in figure. This consists of: -

1. Arduino Uno
2. ESP 8266
3. Power Supply
4. Relay
5. Bulb

.

## Arduino Uno: -

Here for this project we are using Arduino Uno which is an open source platform for programming. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

## ESP 8266:-

ESP8266 is a 3V Wi-Fi module very popular for its Internet of Things applications. ESP 8266 maximum working Voltage is 3.6V. ESP8266 has 8 pins, namely

- **RX,VCC,GPIO 0,RESET ,CH_PD ,GPIO 2,TX ,and GND**
- **VCC** and **GND** are powering pins**. RX** and **TX** are used to communicate
- **CH_PD** ( enable/power down, must be pulled to 3.3v directly or via resistor).

## Power Supply: -

Here we will use a 5 V DC battery for supply to arduino and relay and 230v ac will be given bulb. Supply of 3.3v from arduino will be given to esp8266

## Relay Modul(4 channel,5v)

A relay is an electrically operated switch of mains voltage. It means that it can be turned on or off, letting the current go through or not.In is a 5V 4-channel relay , each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It has a standard interface that can be controlled directly by microcontroller

1. **It has three pins**

**VCC:** Positive supply voltage
**GND:** Ground
**IN1--IN4:** Relay control port

## 2. In relation to mains voltage, relays have 3 possible connections:

- **COM**: common pin
- **NO (Normally Open):** there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and supply is provided to a load
- **NC (Normally Closed):** there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to a load.

**BULB:-**

15 watt bulbs are used

# Chapter 4

# Circuit diagram and Circuit explanation

# Chapter 4: Circuit diagram and Circuit explanation

**CIRCUIT DIAGRAM: -**

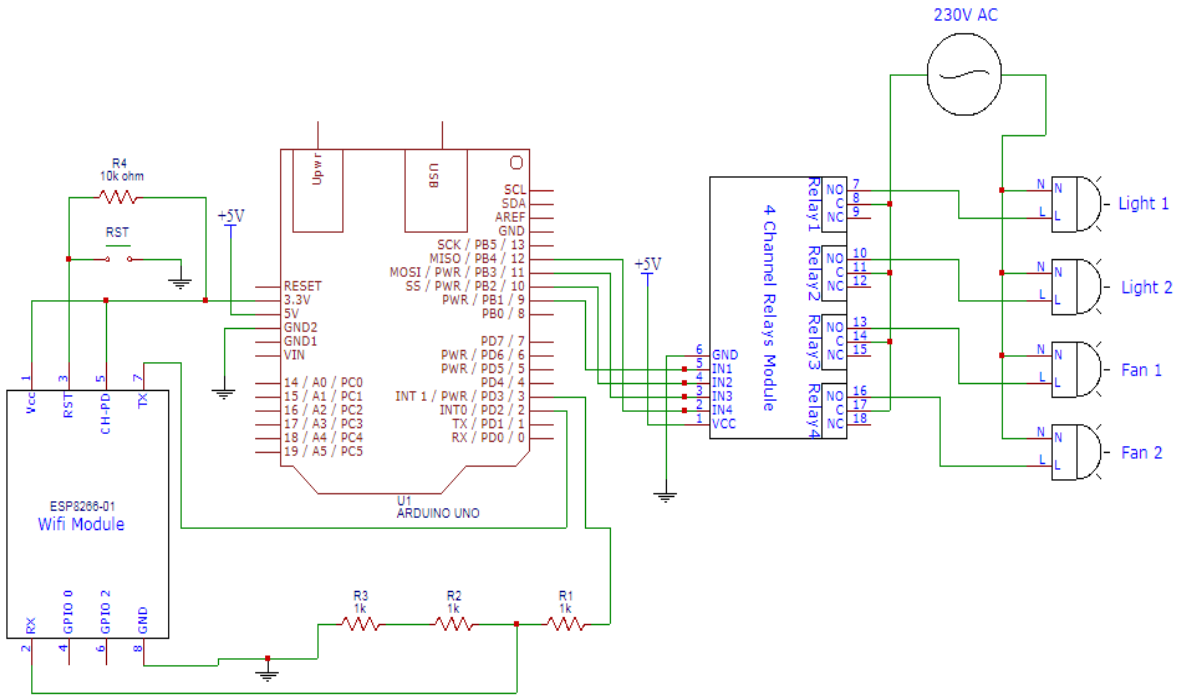


**Figure 2**

**EXPLAINATION: -**

The figure shown above is the circuit for IOT based home automation.

ESP8266 is a wi-fi a module with 6 terminals the Vcc terminal is connected to 3.3v pin of Arduino, RST(pin no 3) is pin is connected push button and Tx(pin no 7) is connected to Rx of arduino and Rx(pin no 2) is connected to Tx o pin of Arduino.(pin no 4 and 6) i.e GPIO 1 and GPIO 2 are not used.

The resistor R1,R2,R3 forms voltage divider circuit and it drop voltage to 3.3v which is supplied to Rx of ESP8266. Resistor R4 is used as pullup resistor.

The 4 channel relay has three pins Vcc terminal is connected to 5v supply,and IN1,IN2,IN3,IN4 is connected to pin no 9,10,11,12 of digital section of arduino respectively.NO and C of relay is connected to bulb. Bulbs operates on 230v ac supply

## WORKING: -

### PART 1

The reconnect application installed in mobile controls the various appliances connected to arduino and relays .when the toggle buttons on application are pressed , signals(data) from android phone is sent to a server called thing space ,which has created it's own home automation channel andis used to store all the data . each device will have a different field

When the light1 is turned on value of field is 1 and hence 1 will be sent to thingspeak server and

When the light1 is turned off value of field is 0 and hence will be sent to thingspeak server

## Part 2

Arduino will read data from thingspace server throghh ESP module for each field

If the field is 1 If for light 1 then arduino will get to know that light 1 is on and accordingly is will on off the relay.

.

# Chapter 5

# IMPLEMENTATION DETAILS

# Chapter 5: IMPLEMENTATION DETAILS

## Hardware details:

| SR NO | COMPONENTS | PRICE |
|---|---|---|
| 1 | Arduino | 450 |
| 2 | 4 Channel Relay | 150 |
| 3 | ESP 8266 | 100 |
| 4 | 3Resistor(1K),1Resistor(10K) | 5 |
| 5 | Jumper Wires | 100 |
| 6 | Breadboard | 45 |
| 7 | Copper Clad PCB | 60 |
| 8 | Push Button | 2 |

**Table 1**

## Arduino Uno

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet).It has14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and are set button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip start over again. "Uno"means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0.The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

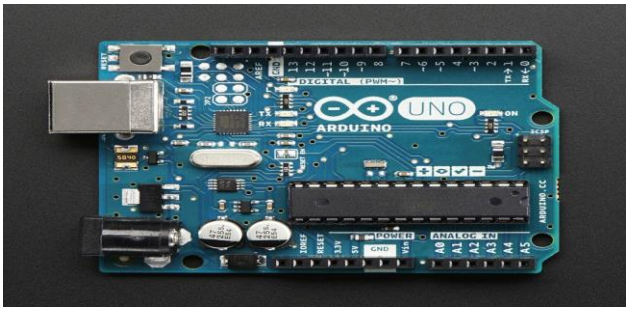


**Figure 3**

# RELAY

A relay is an electrically operated switch of mains voltage. It means that it can be turned on or off, letting the current go through or not.In is a 5V 4-channel relay , each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It has a standard interface that can be controlled directly by microcontroller

## 1.It has three pins

**VCC:** Positive supply voltage
**GND:** Ground
**IN1--IN4:** Relay control port

## 2.In relation to mains voltage, relays have 3 possible connections:

- **COM**: common pin
- **NO (Normally Open):** there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and supply is provided to a load
- **NC (Normally Closed):** there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to a load.


**Figure 4**

## 4.FEATURES

- Size:- 75mm (Length) * 55mm (Width) * 19.3mm (Height)
- Weight:- 61g
- PCB Color:- Blue
- There are four fixed screw holes at each corner of the board, easy for install and fix. The diameter of the hole is 3.1mm
- High quality Songle relay is used with single pole double throw, a common terminal, a normally open terminal, and a normally closed terminal
- Optical coupling isolation, good anti-interference.
- Closed at low level with indicator on, released at high level with indicator off
- VCC is system power source, and JD_VCC is relay power source. Ship 5V relay by default. Plug jumper cap to use

- The maximum output of the relay: DC 30V/10A, AC 250V/10A

## ESP8266

ESP8266is among the most integrated Wi-Fi chip, 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. The Wi-Fi functionalities. ESP8266 is often integrated with external sensors and other application specific devices through its GPIOs.

ESP8266 is a 3V Wi-Fi module very popular for its Internet of Things applications. ESP 8266 maximum working Voltage is 3.6V. ESP8266 has 8 pins, namely

- **RX,VCC,GPIO 0,RESET ,CH_PD ,GPIO 2,TX ,and GND**
- **VCC** and **GND** are powering pins**. RX** and **TX** are used to communicate
- **CH_PD** ( enable/power down, must be pulled to 3.3v directly or via resistor).

## 1.FEATURES

- Low cost, compact and powerful Wi-Fi Module
- Power Supply: +3.3V only
- Current Consumption: 100mA
- I/O Voltage: 3.6V (max)
- I/O source current: 12mA (max)
- Built-in low power 32-bit MCU @ 80MHz
- 512kB Flash Memory
- Can be used as Station or Access Point or both combined
- Supports Deep sleep (<10uA)Supports serial communication hence compatible with many development platform like Arduino

**2.PIN DISCRIPTION:-**The ESP8266-01 is the smallest ESP8266 module and only has 8 pins.

| Pin Number | Pin Name | Alternate Name | Normally used for | Alternate purpose |
|---|---|---|---|---|
| 1 | **Ground** | - | Connected to the ground of the circuit | - |
| 2 | **TX** | GPIO – 1 | Connected to Rx pin of programmer/uC to upload program | Can act as a General purpose Input/output pin when not used as TX |
| 3 | **GPIO-2** | - | General purpose Input/output pin | - |
| 4 | **CH_EN** | - | Chip Enable – Active high | - |
| 5 | **GPIO – 0** | Flash | General purpose Input/output pin | Takes module into serial programming when held low during start up |
| 6 | **Reset** | - | Resets the module | - |
| | | | | |
| 7 | **RX** | GPIO - 3 | General purpose Input/output pin | Can act as a General purpose Input/output pin when not used as RX |
| 8 | **Vcc** | - | Connect to +3.3V only | |

**Table2**

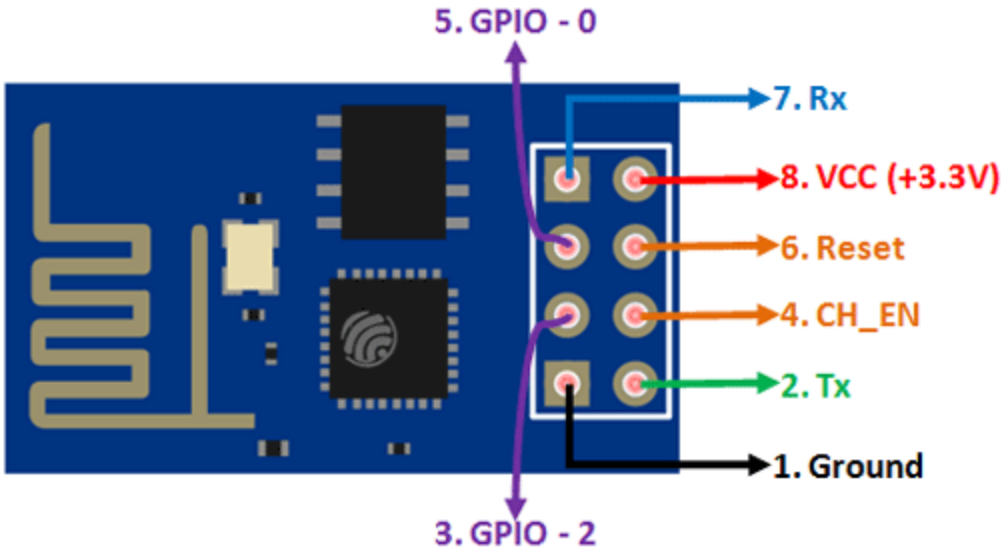


**Figure 5**

## Software implementation

```
#include <SoftwareSerial.h>

SoftwareSerial wifiSerial(2,3);     // RX, TX of arduino

String ssid="D-Link_DIR-600M";            // Wifi network SSID
String password ="wifi1234";             // Wifi network password
String host ="api.thingspeak.com";  // host server
#define RELAY1 9                    // Light 1
#define RELAY2 10                   // Light 2
#define RELAY3 11                   // Light 3
#define RELAY4 12                   // Fan

int responseTime = 500;            //communication timeout
int state=0;                        // variable to store state of relay

void setup()
{
  pinMode(RELAY1,OUTPUT);                   //  Pins 9,10,11 and 12 made as
output pin for relays
  pinMode(RELAY2,OUTPUT);
  pinMode(RELAY3,OUTPUT);
  pinMode(RELAY4,OUTPUT);
```

```
  digitalWrite(RELAY1,HIGH);               //  All relays turned OFF
initially
  digitalWrite(RELAY2,HIGH);
  digitalWrite(RELAY3,HIGH);
  digitalWrite(RELAY4,HIGH);

  Serial.begin(9600);
  while (!Serial) {
     Serial.println(".");  }           // wait for serial port to connect.
  Serial.println("Serial started");

  wifiSerial.begin(9600);
  while (!wifiSerial) {
      Serial.println(".");    }         // wait for serial port to connect.
  Serial.println("esp connected");

  sendToWifi("AT",responseTime);
  sendToWifi("AT+CWMODE=1",responseTime);                                  //
configure as Station mode
  sendToWifi("AT+CWJAP=\""+ssid+"\",\""+password+"\"",responseTime);  //
connect to wifi
  delay(10000);
  sendToWifi("AT+CIFSR",responseTime);                                     // get
ip address
  sendToWifi("AT+CIPMUX=0",responseTime);                                  //
configure for single connections

  Serial.println("Wifi connection is running!");

}


void loop()
{
  state=deviceStatus(1);                                  // Check status of
device 1
  if(state==1) { digitalWrite(RELAY1,LOW);}               // RELAY1 ON
  if(state==0) { digitalWrite(RELAY1,HIGH);}              // RELAY1 OFF

  state=deviceStatus(2);                                  // Check status of
device 2
  if(state==1)  {digitalWrite(RELAY2,LOW);}               // RELAY2 ON
  if(state==0)  {digitalWrite(RELAY2,HIGH);}              // RELAY2 OFF

  state=deviceStatus(3);                                  // Check status of
device 3
  if(state==1)  {digitalWrite(RELAY3,LOW);}               // RELAY3 ON
  if(state==0)  {digitalWrite(RELAY3,HIGH);}              // RELAY3 OFF

  state=deviceStatus(4);                                  // Check status of
device 4
  if(state==1)  {digitalWrite(RELAY4,LOW);}               // RELAY4 ON
  if(state==0)  {digitalWrite(RELAY4,HIGH);}              // RELAY4 OFF

}

int deviceStatus(int r)
```

```
{
  String getStr="GET /channels/448312/fields/";
  getStr+=r;
  getStr+="/last.txt\r\n\r\n";
  String len="";
  len+=getStr.length();

  sendToWifi("AT+CIPSTART=\"TCP\",\""+host+"\",80",responseTime);       //
Start TCP connection with api.thingspeak.com at port 80

  sendToWifi("AT+CIPSEND="+len,responseTime);                           //
gives the String length to be sent

  String result=sendToWifi(getStr,responseTime);                        //
HTTP GET request to get a particular data from thingspeak server

  if(find(result,"OK"))
  {    if(find(result,"IPD,1:1"))
          {  Serial.print(r);   Serial.println(" ON");   return 1;   }
       else
          {  Serial.print(r);   Serial.println(" OFF");  return 0;   }
  }
  else
     {   Serial.println("ERROR");      return (-1);       }
}

boolean find(String string, String value)                     // function to
check if a particular string is a part of
{                                                             // another
string or not
  if(string.indexOf(value)>=0)
    return true;
  return false;
}

String sendToWifi(String command, const int timeout)      // function for
sending data to esp8266
{
  String response = "";
  Serial.println("\nSEND TO WIFI");
  Serial.println(command);
  command+="\r\n\r\n";
  wifiSerial.print(command);               // send command to the esp8266
  long int time = millis();
  while( (time+timeout) > millis())
  {
    while(wifiSerial.available())
    {
    char c = wifiSerial.read();       // read the next character.
    response+=c;
    }
  }
  Serial.println("\n\nWIFI RESPONSE-----------------------------");

    Serial.println(response);        // The esp has data so display its
output to the serial window
```

```
  Serial.println("-----------------------------------------------");
  return response;                 //  return the data received from esp8266
}
```

# Chapter 6

# Testing and results

# Chapter 6: Testing and results

## PCB SCHEMATIC DIAGRAM

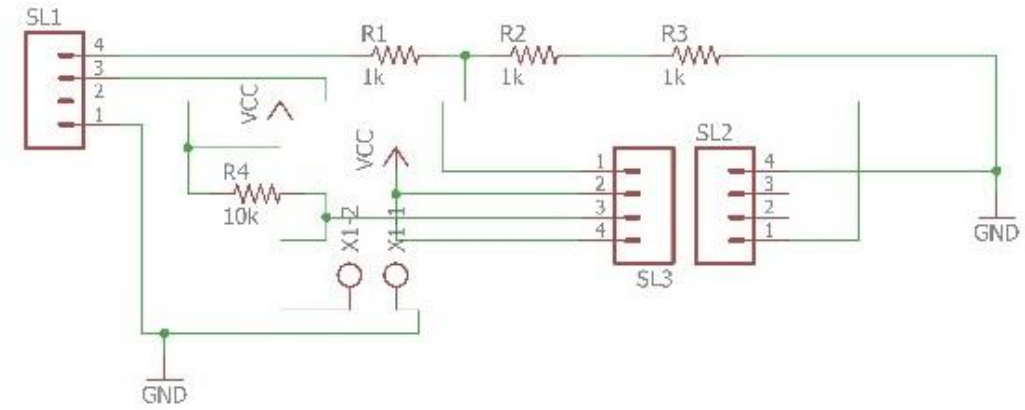


**Figure 6**

## PCB LAYOUT

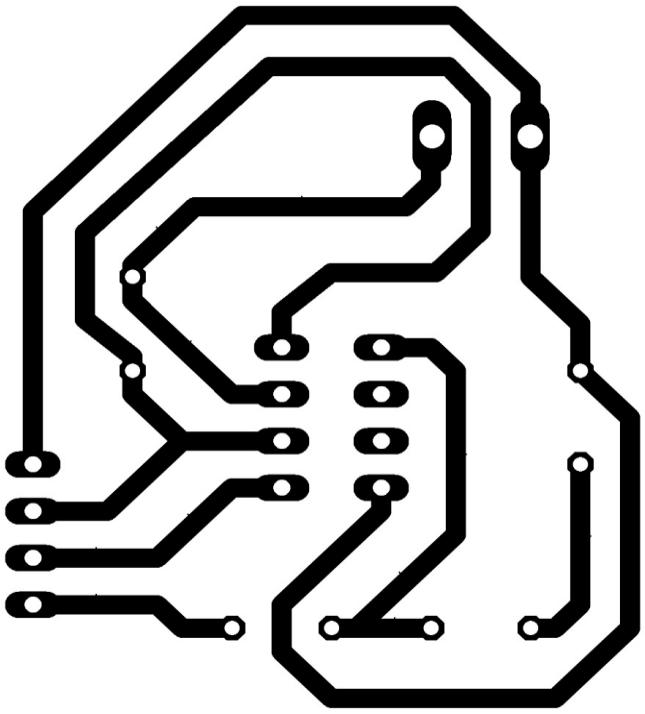

**Figure 7(a)**

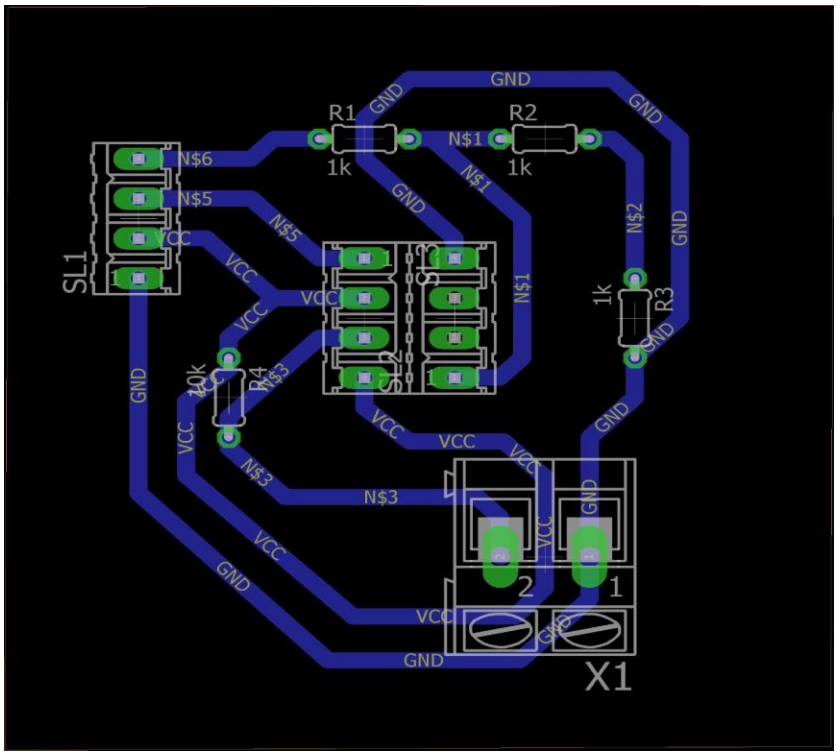


**Figure 7(b)**

**FINAL PCB**

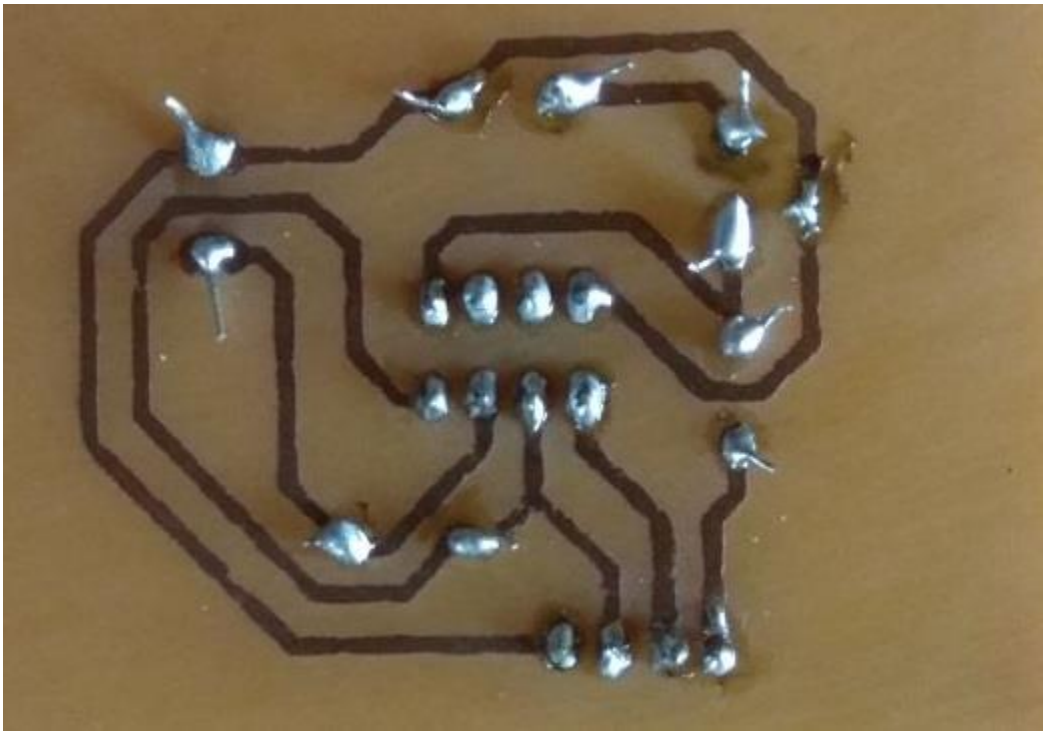

**Figure 8**

Final project

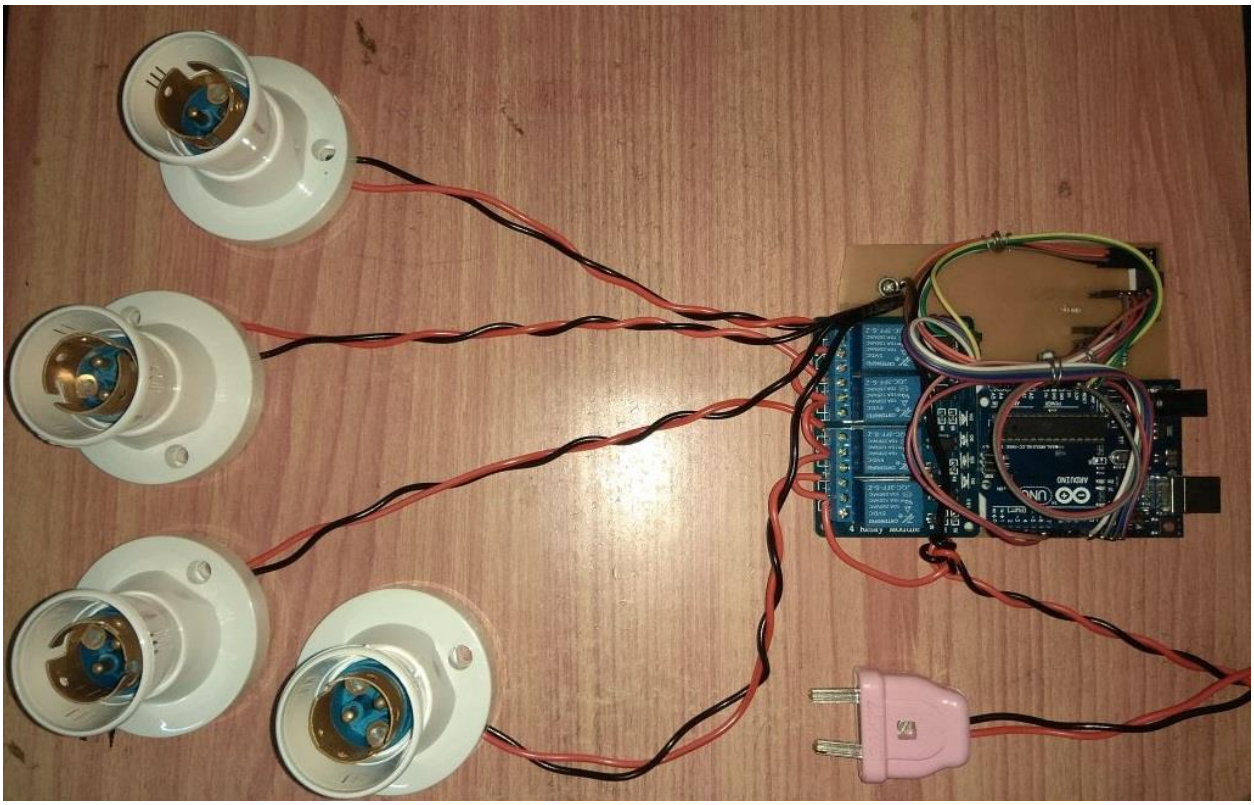

**Figure 9**

# Chapter 7

# Summary

# Summary

Thus a project with automated system is developed, that can control home appliances from anywhere using a mobile app. Basic idea is to save electricity, manpower and also for improving the quality and efficiency of any system.

In This System The Arduino will read data from server through esp and accordingly wil on off relay.

The loss of power can be reduced and manpower required for home automation is very less compared to conventional.

We can manage all our home devices from one place**.** The convenience factor here is enormous. Being able to keep all of the technology in your home connected through one interface is a massive step forward for technology and home management. Theoretically, all you'll have to do is learn how to use one app on your smartphone and tablet, and you'll be able to tap into countless functions and devices throughout your home. This cuts way back on the learning curve for new users, makes it easier to access the functionality you truly want for your home.

# Chapter 8

# Conclusion and Future scope

# Chapter 8: Conclusion and Future scope

## Conclusion

The proposed system home automation using IOT is used to control home appliannces from anywhere outside the home through an mobile app. This has helped us to develop an automated system to save electricity, manpower and also for improving the quality and efficiency of any system.

HomeAutomation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these HomeAutomation . We think this product have high potential for marketing in the future.

## Future scope

The next phase for the Home automation market will occur based on a few key improvements in the technology available in Automation, such as improvement in Wireless Automation solutions as well as lowering of price points as the market begins to accept Home automation usage in larger volumes.

As with any industry, as Automation for residences become common place, the market will eventually be crowded with several players, multiple product offerings and competitive pricing.

The project can be further expanded to a smart home automation system by including some sensors like light sensors, temperature sensors, safety sensors etc. and automatically adjust different parameters like room lighting, air conditioning (room temperature), door locks etc. and transmit the information to our phone.

# Chapter 9: References


1. http://www.instructables.com/id/ESP8266-Wifi-Tutorial/
2. https://arduino.stackexchange.com/questions/23348/retrieve-value-from-thingspeak-using-esp8266-with-arduino-setup
3. https://www.electronicshub.org/esp8266-arduino-interface/
4. https://alselectro.wordpress.com/2015/05/05/wifi-module-esp8266-1-getting-started-with-at-commands/