

Dept. of Electronics and Telecommunication Engineering.

S.Y Micro project 2021-2022

Project topic: **Home automation Using WI-FI module nodemcu**

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ABSTRACT

The internet of things (IoT) is connecting the devices and tools to the internet network to be controlled by websites and smart phone applications remotely, also, to control tools and instruments by codes and algorithms structures for artificial intelligence issues. In case we want to create advanced systems using python algorithms, Wi-Fi or Ethernet connection is connected to our tools, equipment, and devices controlling them by smart phone applications or internet websites. That's actually the simplified definition of IoT. Farther than just using the IoT as a smart home to operate lamps or other home-use devices, it can be used as a security system or an industrial-use system, for example, to open or close the main building gate, to operate full automatic industrial machine, or even to control internet and communication ports. And more ideas can be done by using IoT technology. A huge industrial facilities or governmental institutions have much of lamps. Employees sometimes forget to turn them off in the end of the day. This research suggests a solution that can save energy by letting the security to control lighting of the building with his smart home by Thingspeak application. The lamps can be controlled by switches distributed in the building and Thingspeak application at the same time with a certain electrical installation. This research presents a simple prototype of smart home, or the easy way and low cost to control loads by Wi-Fi connection generally.

Keywords: Thingspeak, Ethernet, IoT, Wi-Fi.

INTRODUCTION

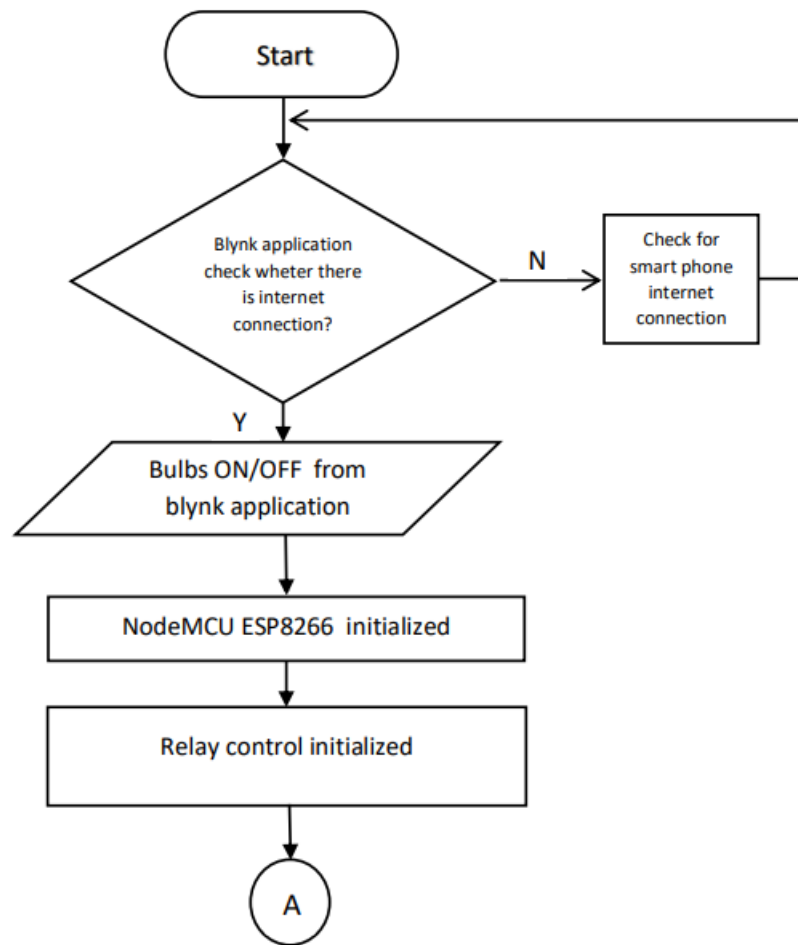
A load controlled by computer systems has many advantages compared with manual controlled loads. Nowadays there are many programs and applications help to control things better using codes or python algorithms in artificial intelligence projects. In order to save energy and make loads monitored easily, this research suggests smart home project based on IoT technology. This smart home is an Internet of Things (IoT) project that controls loads with internet connection via Wireless Fidelity WIFI connection. A smart phone connected to internet with Thingspeak application as a control panel, and NodeMCU microcontroller kit in other side as a controller that receives control commands via WIFI signal. NodeMCU kit is built with ESP8266 WIFI receiver that able to process and analyse WIFI signal to input the microcontroller. The WIFI receiver and microcontroller are built in one kit to be used as IoT project. It's called NodeMCU. To connect the system to the Internet, needs a Wi-Fi receiver. In my case I used ESP8266 that is connected as built-in in the NodeMCU board that contains a firmware runs with the ESP8266. The firmware is a low-level control computer software. The NodeMCU is coded via Arduino Integrated Development Environment (IDE) with the Universal Serial Bus port (USB) to tell the NodeMCU what to do, I want to make the NodeMCU controls four-channel relay. Parts used to create the project:

- 1) NodeMCU board. Open source internet of things platform.
- 2) AC-DC step down converter. Switch mode power supply to provide the project with power. This project needs 5 volts.
- 3) DC-DC step down converter as a regulator to convert the 12 V output of the power supply into regulated 5 V.
- 4) Four-channel relay kit. To drive loads from digital NodeMCU output pins.
- 6) Computer with Arduino (IDE) program installed to code the NodeMCU once.
- 7) Android smart phone with Thingspeak application installed to be used as control panel.

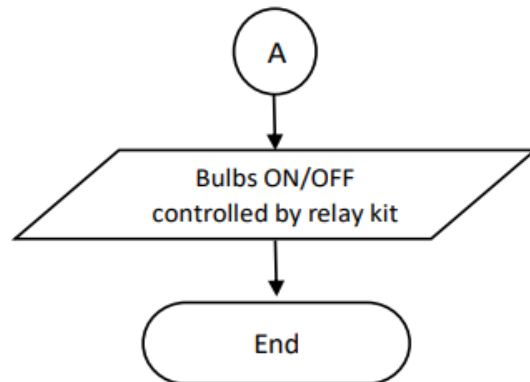
OBJECTIVES

- 1) Analysis of the problem. Analyse the problems to be studied regarding smart home.
- 2) System design. Designing tools to be built using the NodeMCU ESP8266 module, and the sensors used.
- 3) System programming. Make a program using the Arduino IDE and the Thingspeak android application.
- 4) Mainly building a smart home device which can be used to control the home appliances via internet.
- 5) Ease the daily life by increasing the user comfort.

FLOWCHART

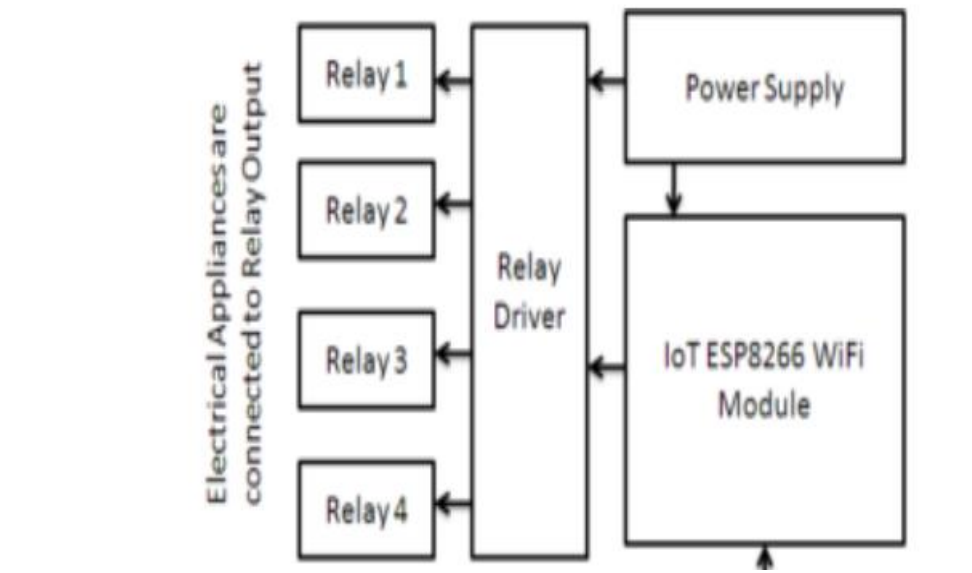


Flowchart for load on/off:



BLOCK DIAGRAM

The Block Diagram of the System

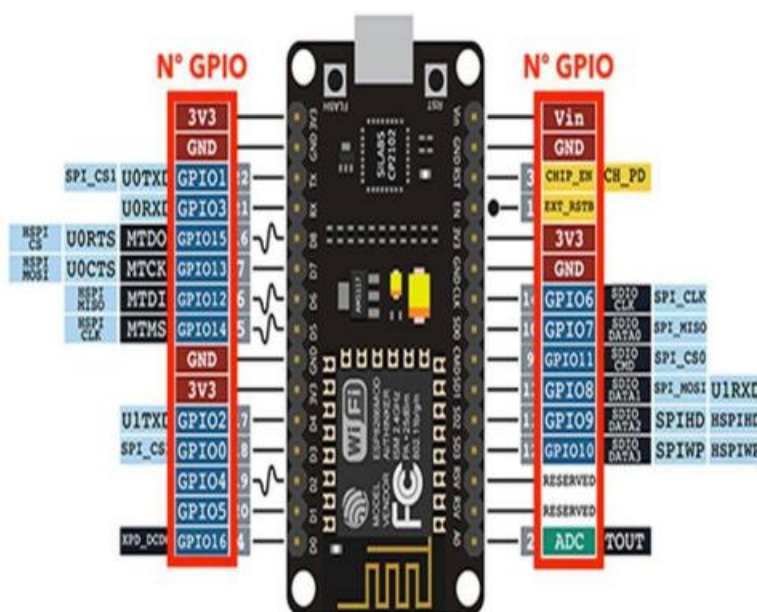


IMPLEMENTATION

Thingspeak application and Arduino IDE Preparation and Running: This project is running by Thingspeak application. Down load the application to a smart phone from Google play store and then create a project on it with four switches and one gauge to be as a temperature scale. Set buttons to be switches on D1, D2, D3 and D4. Then set gauge on A0 because the sensor output is on A0 in NodeMCU board

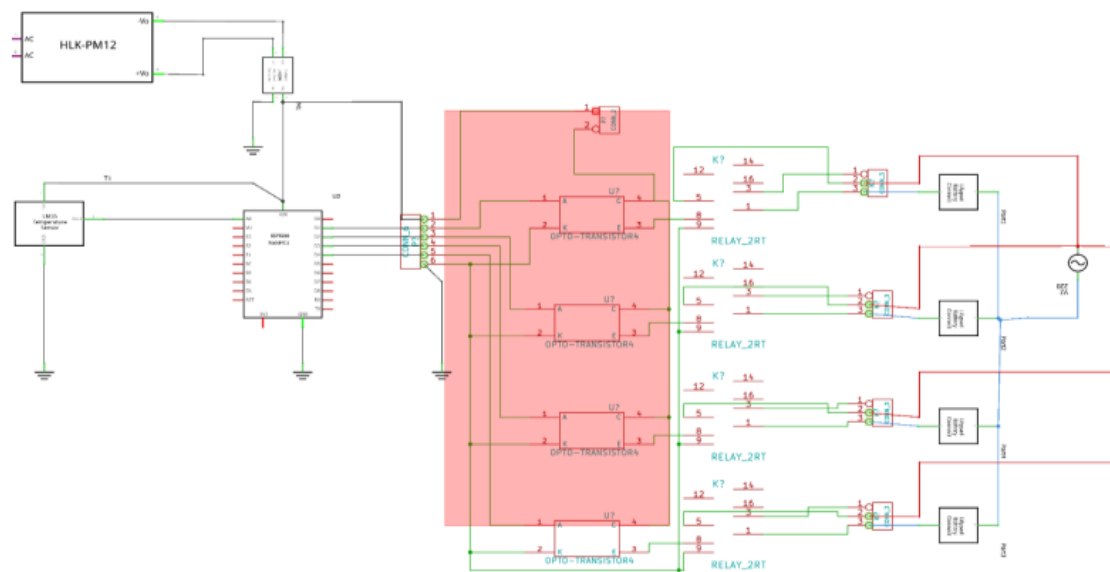
NodeMCU Code via Arduino IDE: To code NodeMCU via Arduino IDE, the NodeMCU needs to be added to Arduino IDE library first by adding this address to Arduino IDE preferences. After this reference is added to Arduino IDE, download NodeMCU to boards manager and then select NodeMCU 1.0 (ESP12E Module). After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

The Hardware of the System: As mentioned above, components used to build the circuit, NodeMCU needs 5VDC as a supply voltage Vin pin, AC-DC step down converter 12V and DC-DC step down converter 5V, in case using AC-DC step down converter 5V, no need to use DC-DC converter. Output voltage of the power supply is connected to Vin NodeMCU, Vcc of relay kit and VCC of LM35 temperature sensor. When the ground is common. D1,D2,D3 and D4 are outputs and A0 is an analog signal input is connected to the temperature sensor . Using Fritzing software to draw and simulate the circuit



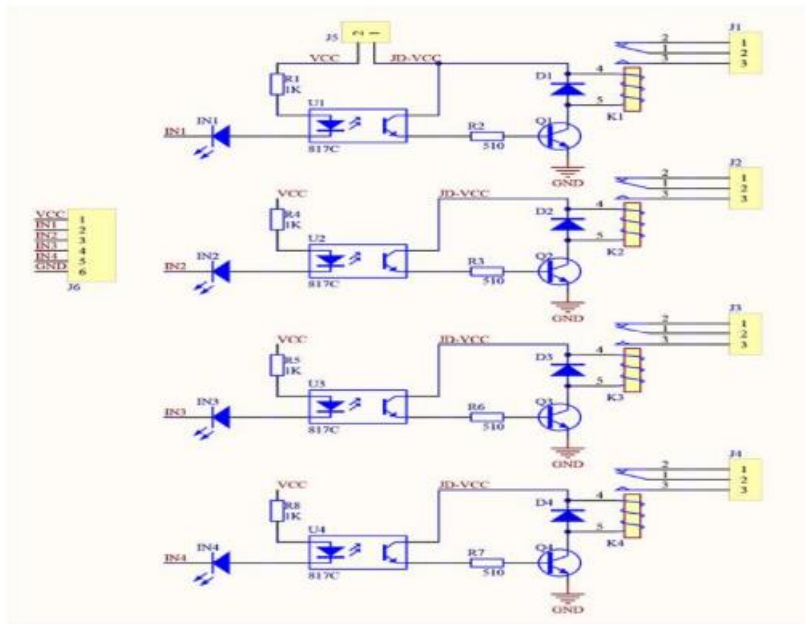
PIN OUT OF NODEMCU

CIRCUIT DIAGRAM:



RELAY MODULE:

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



CODE:

```
#include "ThingSpeak.h"
```

```
#include <ESP8266WiFi.h>
```

```
//Replace your wifi credentials here
```

```
const char* ssid = "realme X3";
```

```
const char* password = "saksham@123#";
```

```
//change your channel number here
```

```
unsigned long channel = 1765030;
```

//1,2 and 3 are channel fields. You don't need to change if you are following this tutorial. However, you can modify it according to your application

```
unsigned int led1 = 1;
```

```
unsigned int led2 = 2;
```

```
unsigned int led3 = 3;
```

```
WiFiClient client;
```

```
void setup() {
```

```
    Serial.begin(115200);
```

```
    delay(100);
```

```
    pinMode(D1, OUTPUT);
```

```
    pinMode(D2, OUTPUT);
```

```
    pinMode(D3, OUTPUT);
```

```
    digitalWrite(D1, 0);
```

```
    digitalWrite(D2, 0);
```

```
    digitalWrite(D3, 0);
```

```
    // We start by connecting to a WiFi network
```

```
    Serial.println();
```

```
    Serial.println();
```

```
    Serial.print("Connecting to ");
```

```
    Serial.println(ssid);
```

```
    WiFi.begin(ssid, password);
```

```
    while (WiFi.status() != WL_CONNECTED) {
```

```
        delay(500);
```

```
        Serial.print(".");
```

```
}

Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
Serial.print("Netmask: ");
Serial.println(WiFi.subnetMask());
Serial.print("Gateway: ");
Serial.println(WiFi.gatewayIP());
ThingSpeak.begin(client);

}

void loop() {

    //get the last data of the fields
    int led_1 = ThingSpeak.readFloatField(channel, led1);
    int led_2 = ThingSpeak.readFloatField(channel, led2);
    int led_3 = ThingSpeak.readFloatField(channel, led3);

    if(led_1 == 1){
        digitalWrite(D1, 1);
        Serial.println("D1 is On..!");
    }
    else if(led_1 == 0){
        digitalWrite(D1, 0);
        Serial.println("D1 is Off..!");
    }
}
```

```
}
```

```
if(led_2 == 1){
```

```
    digitalWrite(D2, 1);
```

```
    Serial.println("D2 is On..!");
```

```
}
```

```
else if(led_2 == 0){
```

```
    digitalWrite(D2, 0);
```

```
    Serial.println("D2 is Off..!");
```

```
}
```

```
if(led_3 == 1){
```

```
    digitalWrite(D3, 1);
```

```
    Serial.println("D3 is On..!");
```

```
}
```

```
else if(led_3 == 0){
```

```
    digitalWrite(D3, 0);
```

```
    Serial.println("D3 is Off..!");
```

```
}
```

```
Serial.println(led_1);
```

```
Serial.println(led_2);
```

```
Serial.println(led_3);
```

```
delay(5000);
```

```
}
```

RESULTS AND DISCUSSION

Light Control Test Results:

The Light Control Test is done by pressing the ON / OFF button widget on the Thingspeak application on the respective Android smart phone for lights and fans. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is lost or bad signal, then it also affects system performance.

ADVANTAGES

Convenience:-

How about managing all the appliances from one place and through a single app? Home automation solutions offer enormous convenience. All you need to use a mobile app, and you can do many functions with different devices throughout your home from a remote place. When it comes to making a home management easier with excellent functionality, home automation is the best choice.

More Flexibility:-

If you want to add new devices and appliances, then smart home solutions are flexible enough to enable you to do so. Technology advances at a rapid pace and even the state-of-the-art appliances of today will become obsolete tomorrow.

But, with flexible home automation solutions, you can always add and integrate the new suite of devices in line with the latest lifestyle technology.

Enhanced Security:-

When you leave your house, you can lock the entire house and turning off the lights with a single tap on your smartphone. You can also turn on the security camera and monitor your house.

What's more, even if you forget to turn off the appliances and turn on the camera, you can readily do it during driving or after reaching the office.

You can also select to receive security alerts on various devices to remain vigilant. By providing real-time and live information, home automation solutions offer enhanced security.

Complete Control:-

You can have a complete control of devices and appliances even from a distance. The thermostat control facilitates you to keep your house cooler before you come during the hot summer days.

Your control of appliances enables you to turn off them after leaving the house. You can also check the lights on your way, and switch them off if you forget. In a way, home automation solutions offer you a complete control over various operations at home.

Energy Efficiency:-

You can make your space more energy-efficient by using smart-home technology. Apart from precise control on HVAC (Heater, Ventilator, and Air Conditioning), you can program lights and motorized shades on an evening mode.

It can turn on the lights as the sun sets and turn off the lights at the sunrise. Also, you can set lights in a way that they turn on automatically when you enter the house or room, and turn off as you leave.

Improved Functionality:-

Smart homes have appliances with a better functionality as compared to other homes. It is because of the real-time operations or processes with the help of tailored home automation solutions.

All your major appliances are connected with the automation technology, and this connectivity improves the effectiveness of appliances. All you get is more efficient and enjoyable life at home!

Better Home Management:-

Intelligently designed home automation solutions can enable you to tap into insights on home-based operations. You can easily get the data about your daily activities and manage your home in a better way. You can also analyze your daily habits and behavior to improve the lifestyle and increase the living standards.

In a nutshell, you can manage your home in more secure and efficient way with the help of IoT-based home automation technology.

DISADVANTAGES

1. Security Issues:

As with all computing devices, security will become a greater issue as more people use smart home devices. Certainly there will be a range of security concerns that arise and a subsequent mushrooming of smart home security software and devices.

a) App security:

Smart home devices are usually linked to companion apps that can be used to control the devices. However, to do this they are granted a range of permissions that influence the functionality of the device, such as being able to open and close a smart lock that is securing your home.

If hackers gain access to these apps then it could have considerable security implications, as they will be able to control access to your home. The best way to mitigate against this is to ensure your smart home apps are as up-to-date as possible and that you install any software & security updates that become available for the apps.

b) Wireless security:

Almost all smart devices derive their functionality from some form of wireless communication (Wi-Fi or Bluetooth). As with all digital communications, there is potential for hackers to intercept wireless communications and use this to gain access to your smart home devices. Wi-Fi is one of the most common ways to connect to smart home devices, so it is important that you protect your home Wi-Fi router as well as you can.

c) Integrated systems:

Some manufacturers offer integrated smart home systems, where one system is used to control all of the smart home devices. The obvious risk here is if hackers gain access to the system then they can control everything in your smart home.

2. Cost: Extremely expensive:

Although a lot of smart home devices are now affordable for many, but still it is extremely expensive to fully equip a home with smart devices. However, most computing technology becomes progressively more powerful & less expensive and

this will be undoubtedly applicable for smart home devices as well.

3. Greater acceptance:

A lot of new technology can sometimes be seen as unnecessary & some people may currently view smart home devices in this way. But in the same way that, over the years, we have seen devices such as washing machines, microwave ovens & TV remote controls become indispensable in the home, it is probable that in a few years, no one will question the fact that they control their lights with a voice command or

clean their home with a robotic vacuum cleaner.

Attacks on smart home devices are not unheard of, but they are relatively rare. It is a personal choice to weigh up the security & financial risks against the range of benefits that smart home devices offer.

Components and costing :

Components	Cost
Node MCU WiFi	530
PCB relay driver unit	1000
Adaptor	300
Thinkspeak Platform subscription	1000
Dc bulbs	70
Wires	50
Total	3270

CONCLUSION

Based on the results of analysis of all data obtained by testing the smart home with the Internet of Things based NodeMCU ESP6288 module, the following conclusions can be drawn:

- 1) Smart Home with Internet of Things (IoT) based NodeMCU ESP8266 Module can be designed with various components hardware and software support so that it can be arranged into a smart home system that is controlled with the Thingspeak android application according to what is intended.
- 2) The Smart Home with this Internet of Things (IoT) based NodeMCU ESP8266 Module can be implemented to control some of the home electronics performance including lighting controls, fan control, temperature monitoring, early warning systems and etc.

REFERENCES

- 1) Arduino Temperature Sensor Using LM35. Groups of Electronics Hobbyist, Robotist. We Developed Electronics Project Tutorials Make Open for Everyone.
- 2) BOHORA, Bharat; MAHARJAN, Sunil; SHRESTHA, Bibek Raj. IoT Based Smart Home Using Thingspeak Framework. Zerone Scholar, [S.l.], v. 1, n. 1, p. 26-30, dec. 2016. ISSN 2542- 2774. google scholar.
- 3) DC-DC Step Down Converter Power Supply Provides Regulated 5VDC Output with Range Input of 10-32VDC, Model GTD21088L-1505-T2.
- 4) Home Automation Using Internet of Thing 2016 IEEE 7th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON) Published: 2016. Google Scholar.
- 5) Internet of Things in Home Automation and Energy Efficient Smart Home Technologies Simon G. M. Koo Department of Computer Engineering, Santa Clara University, CA 95053, USA
- 6) Low Cost Implementation of Smart Home Automation Ravi Kishore Kodali Department of Electronics and Communication Engineering National Institute of Technology, Warangal , 506004 India

7) Mobile based home automation using Internet of Things (IoT) 2015 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT) Published: 2015

8) NodeMCU Features and Pinout. A Brief Tutorial on the Introduction to NodeMCU V3.

9) Yoyosteven in Circuits Microcontrollers. NODEMCU 1.0 (ESP8266) CONTROLLED RELAY USING THINGSPEAK (OVER THE WEB).

10) 5V 4-Channel Relay Interface Board, Standard Interface that can be Controlled Directly by Microcontroller.

11) 15-17 March 2018 U. Venkanna IoT Based Smart Home Automation System Using Sensor Node. Google Scholar.