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INTELLIGENT MONITOR AND CONTROL OF RESIDENTIAL LOADS USING IOT

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ABSTRACT

This Paper presents the overall design of Intelligent monitor and control of residential loads using IOT with low cost and wireless system. It specifically focuses on the development of an IOT based home automation system that is able to control various components via internet or be automatically programmed to operate from ambient conditions. In this project, we design the development of a firmware for smart control which can successfully be automated minimizing human interaction to preserve the integrity within whole electrical devices in the home. We used Node MCU, a popular open source IOT platform, to execute the process of automation. Different components of the system will use different transmission mode that will be implemented to communicate the control of the devices by the user through Node MCU to the actual appliance. The main control system implements wireless technology to provide remote access from smart phone. We are using a cloud server based communication that would add to the practicality of this by enabling unrestricted access of the appliances to the user irrespective of the distance factor. We provided a data transmission network to create a stronger automation.The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. The status of the appliance would be available, along with the control on an android platform. This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home.

Keywords: Node MCU, Wireless Technology, IOT, Sinric Pro.

I. INTRODUCTION

Internet of Things (IOT) is a concept where each device is assign to an IP address and through that IP address anyone makes that device identifiable on internet. The mechanical and digital machines are provided with unique identifiers (UIDs) and the ability to transfer data over network without requiring human-to-human or human-to computer interaction. Basically, it started as the “Internet of Computers.” Research studies have forecast an explosive growth in the number of “things” or devices that will be connected to the Internet. The resulting network is called the “Internet of Things”(IoT). The recent developments in technology which permit the use of wireless controlling environments like, Bluetooth and Wi-Fi that have enabled different devices to have capabilities of connecting with each other. Using a WIFI shield to act as a Micro web server for the Arduino which eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet based home automation system for remote control and observing the status of home appliances is designed. Due to the advancement of wireless technology, there are several different type of connections are introduced such as WIFI. Each of the connection has their own unique specifications and

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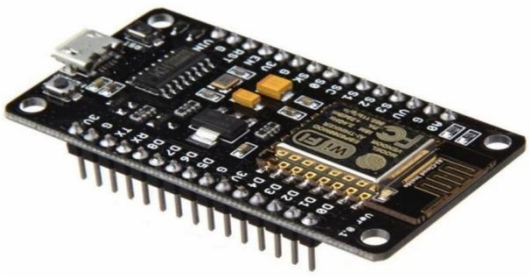
applications. WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

II. ESP8266 NODE MCU WIFI

The ESP8266 is the name of a small controller designed by Espress if Systems. The ESP8266 itself may be a selfcontained wireless local area networking resolution which provides a bridge from existing small controller to wireless local area network and is additionally capable of running selfcontained applications. This module comes with an inbuilt USB connection and a fashionable assortment of pin-outs. With a small USB cable, you will be able to connect Node MCU dev kit to your laptop computer and flash it with Arduino. Additionally it can be used in real time bread board. The chip has a WiFi and Serial transceiver. This makes it terribly convenient to use the ESP8266 chip

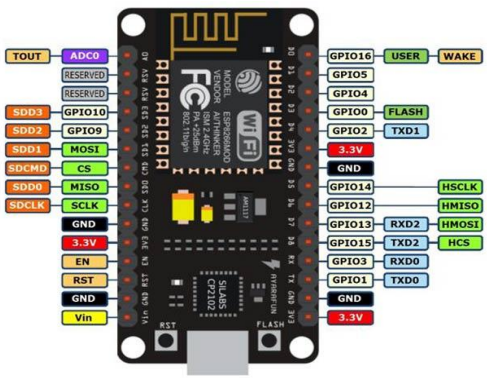
NodeMCU is an open source firmware for which open source prototyping board designs are available. The name “NodeMCU” combines “node” and “MCU” (micro-controller unit). The term “NodeMCU” strictly speaking refers to the firmware rather than the associated development kits.

III. NODE MCU PIN CONFIGURATION



The ESP8266 has **17 GPIO pins (0-16)**, however, you can only use 11 of them, because 6 pins (GPIO 6 - 11) are used to connect the flash memory chip. This is the small 8-legged chip right next to the ESP8266.

The ESP8266 NodeMcu has 16 GPIO pins and one analog input pin shown in the image below. However only 10 of these GPIO pins can be used for digital input and output operations.



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IV. WORKING OF IOT

- Control3relays with **Google Assistant, Alexa**,and **switches**.
- Create an account and add devices in **Sinric Pro**
- **Programming** the NodeMCU with Arduino IDE
- Connect SinricPro and add IoT devices with **Amazon Alexa App**.
- Connect Sinric Pro and add IoT devices with **Google Home App**.
- Control home appliances manually **without internet**.

The circuit is very simple, I have used the GPIO pins **D1, D2, D5 & D6** to control the 4 relays.

And the GPIO pins **SD3, D3, D7 & RX** connected with switches to control the 4 relays manually.

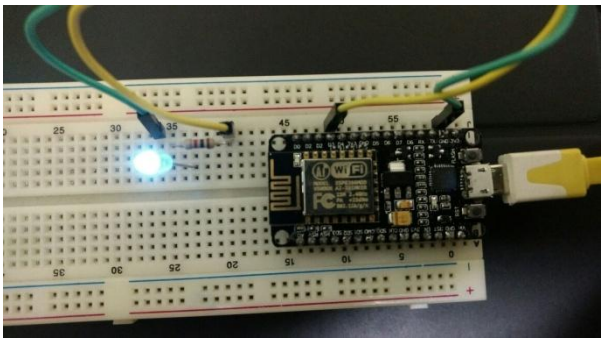
I have used the **INPUT_PULLUP** function in Arduino IDE instead of using the pull-up resistors

I have used a 5V mobile charger to supply the smart relay module.

Here, the D3 pin should not be connected with GND during the booting process of NodeMCU.

A.Control Relays With Google Assistant Using NodeMCU:

If the NodeMCU is connected with the WiFi, then you can control the home appliances from **Google Home** App and also from the manual switches.You can also ask **Google Assistant** to turn on and off the appliances.You can control, monitor the real-time status of the relays in the Google Home App from anywhere in the world. You don't need any Google Home Nest device for this home automation project.



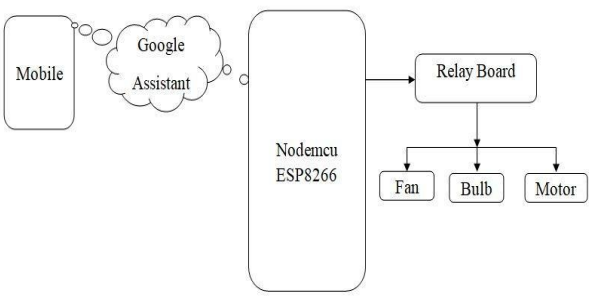
B.Control Relays With Alexa Using NodeMCU:

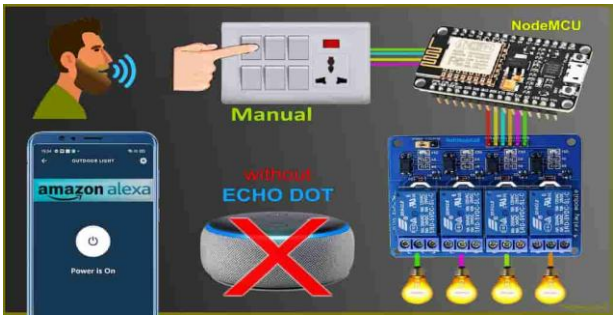
You can also control the home appliances from **Amazon Alexa App** if the **NodeMCU** is connected with the WiFi.

You can also ask **Alexa** to turn on and off the appliances.

You can also control the appliances from the manual switchesand monitor the **real-time feedback** of the relays in the Amazon Alexa App from anywhere in the world.

With this home automation project, you can control & monitor the real-time feedback of the relays in the Google Home and Alexa App from anywhere in the world. If the WiFi is available, the NodeMCU will automatically connect with the Wi-FI.





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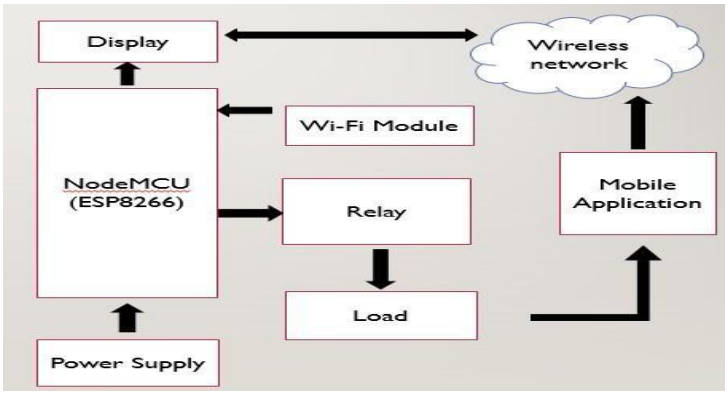
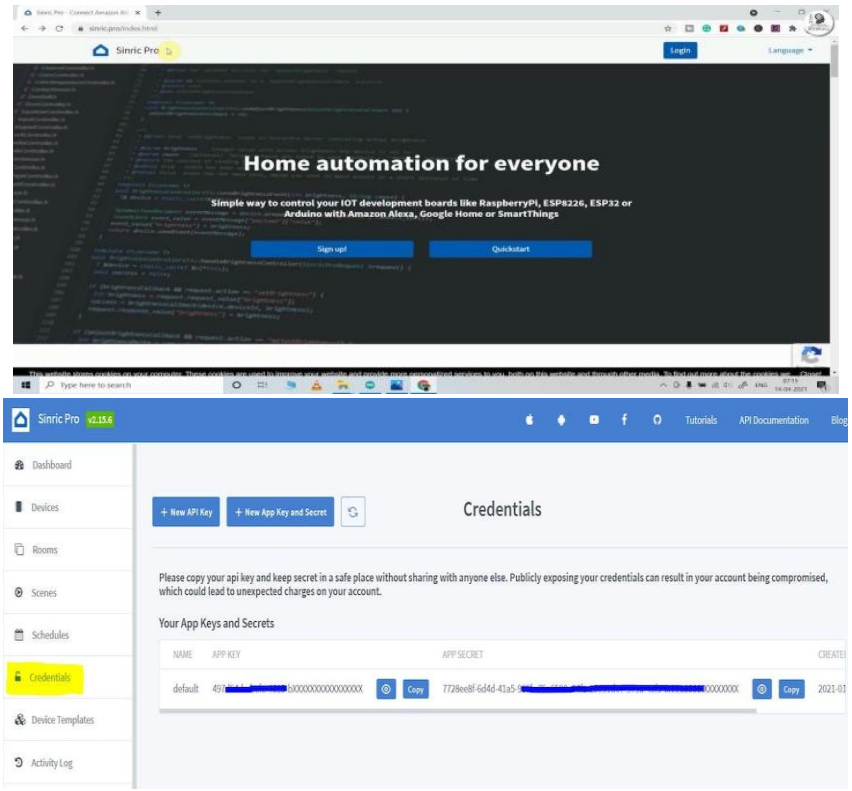
V. SYSTEM BLOCK DIAGRAM



VI. SOFTWARE REQUIREMENTS

A. **Create an Account in Sinric Pro:**



Then log in to Sinric Pro Account.

You will get an **APP KEY** and **APP SECRET** for the account, which will be required in the code.

Add Room in Sinric Pro account

After that add a room and give a nickname to that room (Ex: Living Room)

Add Devices in Sinric Pro account

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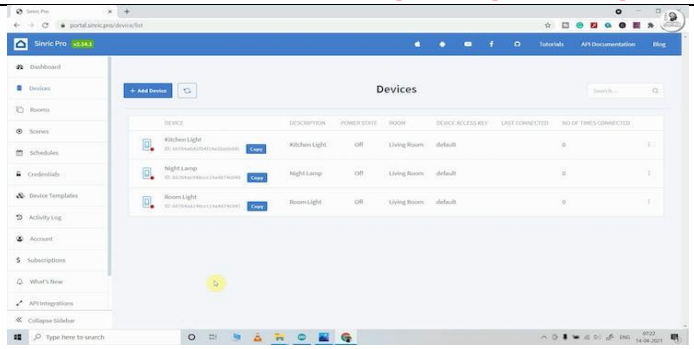
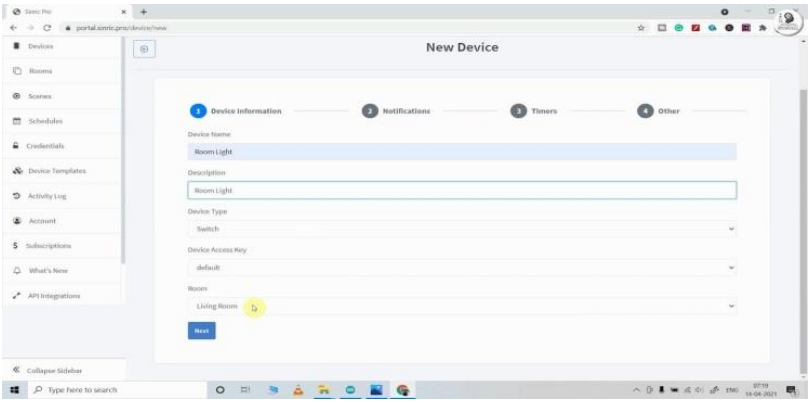
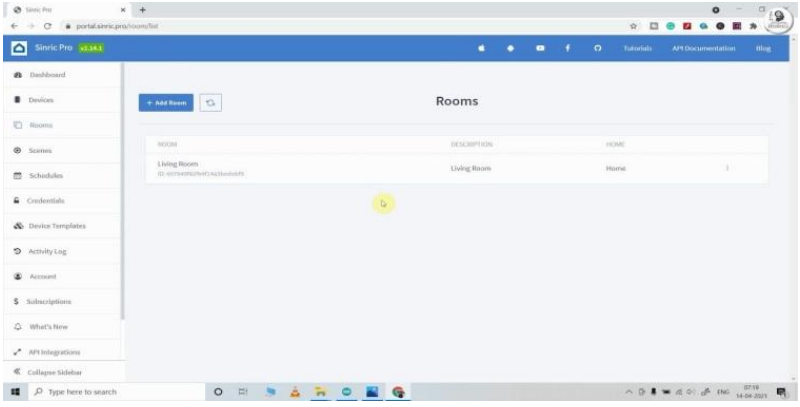


Then Add devices one by one and give the nickname for each device. Sinric will assign a unique device ID for each device.

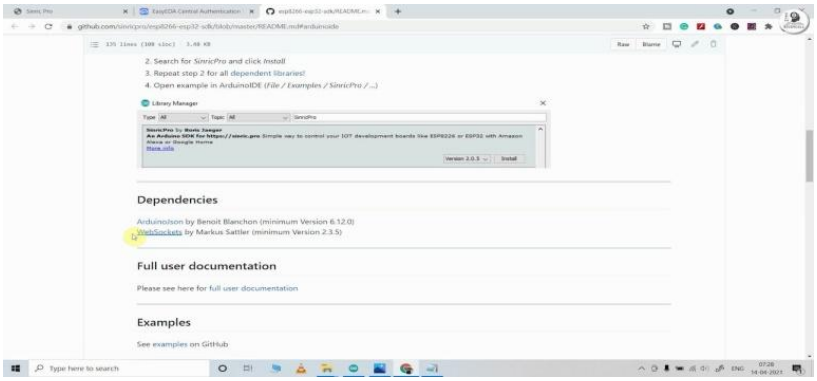


Here, I have used the free Sinric Pro account, so I can add a maximum of 3 devices for free.



B.

C. **Program NodeMCU Using Arduino IDE:**



First, download the code & install all the required libraries mention in the code.

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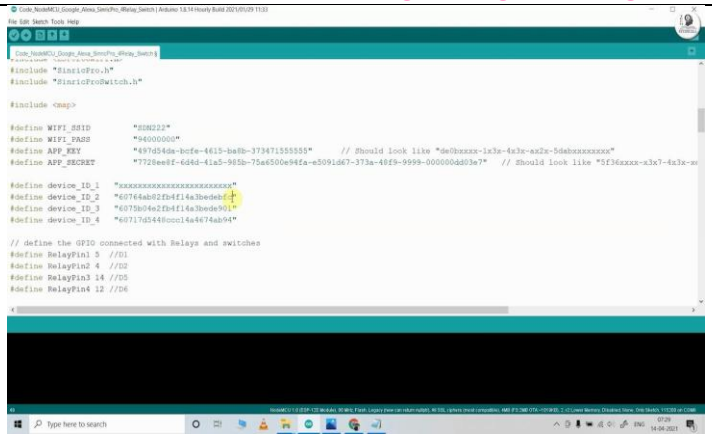


Then enter the **WiFi credentials**

```
#define WIFI_SSID "YOUR-WIFI-NAME"#define WIFI_PASS "YOUR-WIFI-PASSWORD"
```

Enter the **APP KEY** and **APP SECRET** from the **Sinric pro** account **Credential menu**.

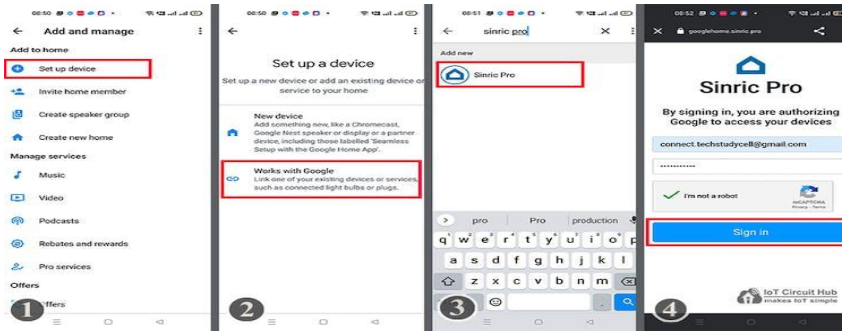
```
#define APP_KEY "YOUR-APP-KEY"#define APP_SECRET "YOUR-APP-SECRET"
```

Enter the **Device IDs** from the Sinric pro account Devices menu.

```
#define device_ID_1 "SWITCH_ID_NO_1_HERE"#define device_ID_2 "SWITCH_ID_NO_2_HERE"#define device_ID_3 "SWITCH_ID_NO_3_HERE"#define device_ID_4 "SWITCH_ID_NO_4_HERE"
```

After that select the NodeMCU 1.0 (ESP-12E Module) board and the PORT. Then click on the upload button

Connect Sinric Pro With Google Home App | Add Devices:



After creating the Home in the Google Home app, you can connect the Sinric Pro with the Google Home app.

VII. CONCLUSION

As the world is quickly moving towards the advanced technology, which is home automation or smart homes. As it is efficient and also cost effective .Today ,even people are concerned towardsIntelligent Monitor and Control of Residential Loads using 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 Home automation system that is controlled with the android application according to what is intended.IOT system can be cheaply made from low-cost locally available components and can be used to control multifarious home appliances the entire house lighting system.This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home.

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