A NodeMCU Based Home Automation System

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***Abstract*— A smart home means a simple home setting where electrical appliances and devices can be automatically controlled remotely anywhere via an internet connection using a mobile phone or other network devices. The Internet of Things is made up of unique and interdisciplinary materials. It simply connects and monitors various devices and sensors via the Internet. This paper uses Cloud and Web Browser to control custom-made switches. The cloud server is designed for the area where the switches are installed. Switches connected to the Node MCU with built-in Wi-Fi. It can use this to enable or disable switches. The user communicates with the processor through a Web Browser. The processor then controls the switches based on instructions received by the user and also updates the user about the status of the switches after the control operation is done in the cloud. Light intensity, fan speed, and other features can be controlled using the Web Browser.**

***Index Terms*— Smart Homes, Arduino UNO, Internet of Things, Blynk, Node MCU(ESP8266), Relay, Wi-Fi and Smartphones.**

I. INTRODUCTION

This project proposes a successful implementation of IoT (Internet of Things) used to monitor and control household appliances through the World Wide Web. The home automation system uses portable devices such as smartphones, laptops, etc. as a visual interface for the user. They can connect to the home automation network via the internet gateway, using low power communication systems like ZigBee, Wi-Fi etc. This project aims to control household appliances via a mobile application using Wi-Fi as a communication protocol and the MCU node as a server system.

Node MCU is an open source IoT platform. The user here will navigate directly to the system via a web-based connection to the web, while home appliances such as lights, fan, etc. they are remotely controlled by the simple interaction provided by the website / application. The server will be connected to a portable computer circuits that control home electrical appliances. The server communicates with the corresponding relays.

II. Smart Home Automation System

Now a day automation system has spread to a few industries by playing an important role in managing many process-related tasks. We live in a world of changing things where most of the systems are now automated, such as industrial automation, automotive and other business sectors. Home automation systems are evolving into operational systems where minimal human effort is required by machines to control multiple systems in homes. It includes automatic control of household appliances using completely different technologies and controls over desktops, laptops, smart phones or tablets.

III. Hardware Requirement

A. Node MCU (ESP8266)—

1) Introduction: NodeMCU (Node Microcontroller Unit) is an open source software and environment for the development of computer hardware built near an inexpensive System-on-a-Chip (SoC) called ESP8266. ESP8266 is designed and manufactured by Espressif Systems, contains key computer features: CPU, RAM, network (Wi-Fi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

2) Specifications & Features:

a) Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
b) Operating Voltage: 3.3V
c) Digital I/O Pins (DIO): 16
d) Analog Input Pins (ADC): 1
e) Flash Memory: 4MB
f) SRAM: 64 KB
g) WiFi Built-In: 802.11 b/g/n

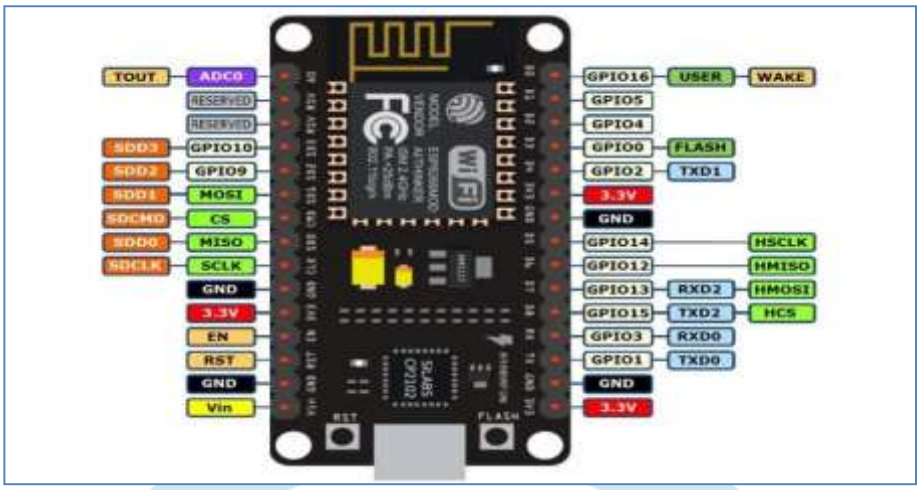

Figure 1: NodeMCU esp82866

B. Arduino UNO—

1) Introduction: Arduino Uno is known as an open-source development board as it allows you to use this board to interact withreal-world things by uploading programs on this board. It is a microcontroller board developed by Arduino.cc and is based onAtmega328 Microcontroller. Arduino UNO is a very valuable addition in electronics that consists of a USB interface, 14 digital I/Opins(of which 6 Pins are used for PWM), 6 analog pins and an Atmega328 microcontroller. It also supports 3 communicationprotocols named Serial, I2C and SPI protocol.

2) Specifications & Features:

a) Microcontroller: ATmega328
b) Operating Voltage: 5V
c) Input Voltage (recommended): 7-12V
d) Input Voltage (limits): 6-20V
e) Digital I/O Pins: 14 (of which 6 provide PWM output)
f) Analog Input Pins: 6
i) Flash Memory: 32 KB of which 0.5 KB used by boot loader
j) SRAM: 2 KB (ATmega328)

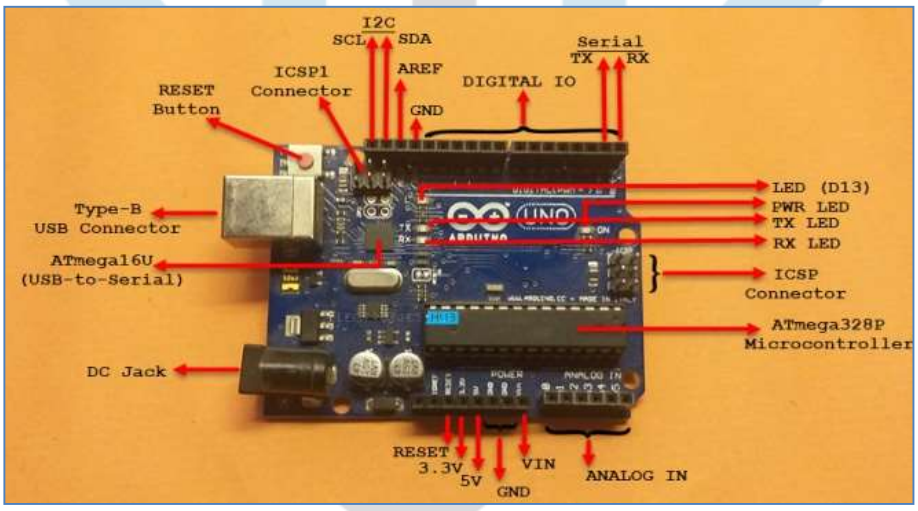

Figure 2: Arduino UNO

C. Relay—

1) Introduction: Relay is a simple electromechanical switch. While using standard switches to turn on or off the circuit manually, the Relay is also a switch that connects or cuts two circuits. But instead of manual operation, the relay uses an electrical signal to control an electric magnet, which connects or disconnects another circuit.

2) Specifications & Features:

a) Supply voltage – 3.75V to 6V
b) Trigger current – 5mA
c) Current when relay is active - ~70mA (single), ~140mA (both)
d) Relay maximum contact voltage – 250VAC, 30VDC
e) Relay maximum current – 10A

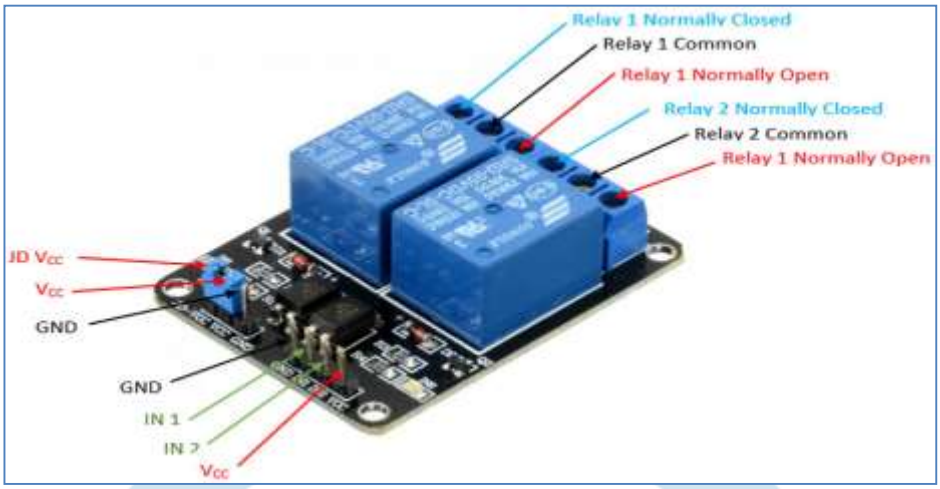

Figure 3: Dual-Channel Relay Module

IV. Software Requirement

A. Blynk Application:

The Blynk App provides a platform for the user to design your own application linked to the Blynk server which provides a way to transfer and host between an advanced project (kit) and User Representation for every project using the Blynk mobile app. This Blynk app can be downloaded by the user. The user must register in that app to view the status of all household appliances and to manage all household appliances with this app. This is similar to a visual connector that allows the user to see the status of devices and control them. All Blynk operations are performed in 3 sections.

The Blynk app is responsible for creating user interaction by providing a dashboard where the user works. Apparently, hardware is connected to this app and this connection between these is enabled by the Blynk server. Such hardware can communicate with a server using a command given to Blynk libraries.

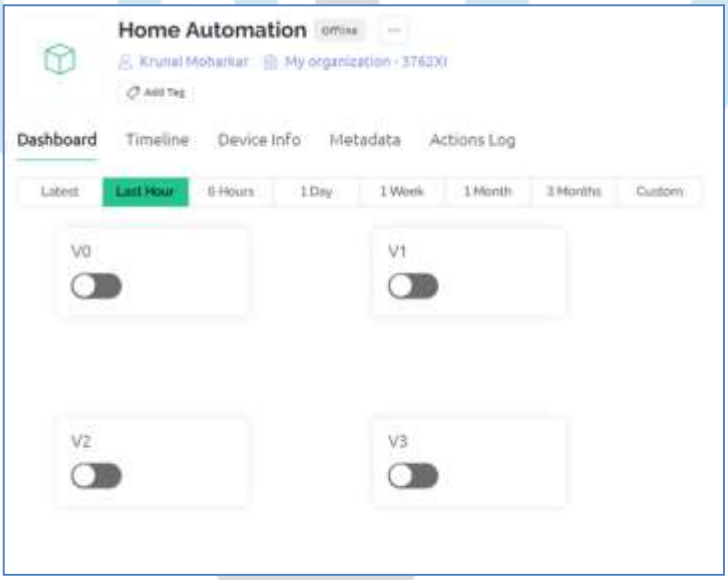

Figure 4: Blynk Cloud Dashboard

B. Custom Website:

In this project we also developed our own website for controlling devices. The website is fully developed using HTML, CSS, and JavaScript. We added functionality by using the API provided by Blynk Cloud Server. Using this APIs we can interact with our home devices using our custom website. The following figure shows our custom web application for our project.

Figure 5: Web Application

V. Implementation

A) Block Diagram Description:

This block diagram consists of various components like Node MCU, relay, power supply and smartphone having proper internet connectivity.

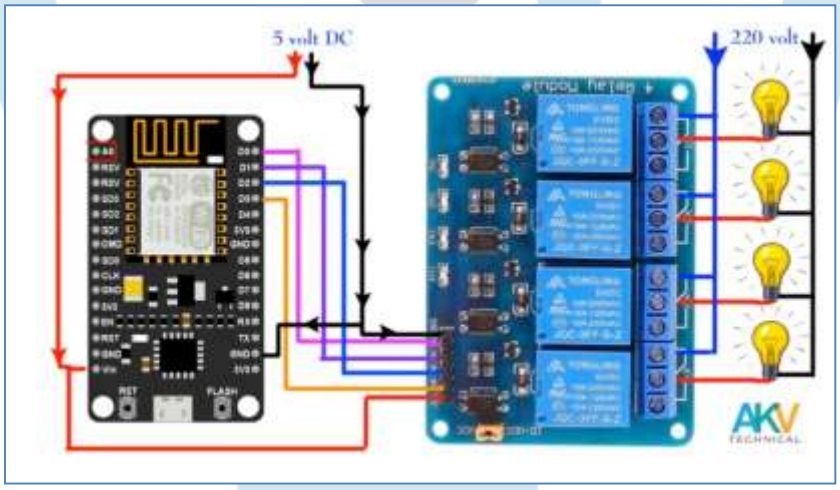

Figure 6: Block Diagram

B) Circuit explanation

The circuit diagram consists of main microcontroller that is Node Mcu, 4 set of relay with four household appliances and proper 220 volts supply for load and 5v supply for NodeMCU and 4-Channel Relay Module required.
Whenever the signal passes towards the relay module it activates the load and supply the current and load starts working

C) Hardware implementation

The complete components NodeMCU(esp8266), Arduino, 4-Channel Relay, and the other hardware required for this project is shown below.
For programming the node MCU we are using ARDUINO IDE. After proper connection and implementation
The working model looks like:

Figure 7: Hardware Implementation

VI. Working

1) There is need to start an internet connection to reach your smart home. One can access his smart home through the Android Blynk app or custom web application.
2) After a successful connection, users will be able to access smart home appliances using the Interface of blynk app or custom web application.
3) Whenever we supply the current to our project model, node MCU try to connect to the wi-fi using SSID and password listed in code.
4) As soon as node MCU connected to the wi-fi, it access the internet and connected to the Blynk cloud server to a specific dashboard.
5) The dashboard or the device metadata is hardcoded in code so that it cannot be access by any unknown person or application.
6) The dashboard contains virtual pins. Using these virtual pins we can send 1/0 to on/off home devices connected to NodeMCU.
7) When we send 1/0 through virtual pins, it is receives by node MCU and according to instruction it communicate with relay and relay perform action of Switching the circuit on/off.
8) The system becomes platform independent due to the use of a web application. It can be operated from any location by just opening the IoT platform web application. The web application also serves as a platform for managing the devices and the data.

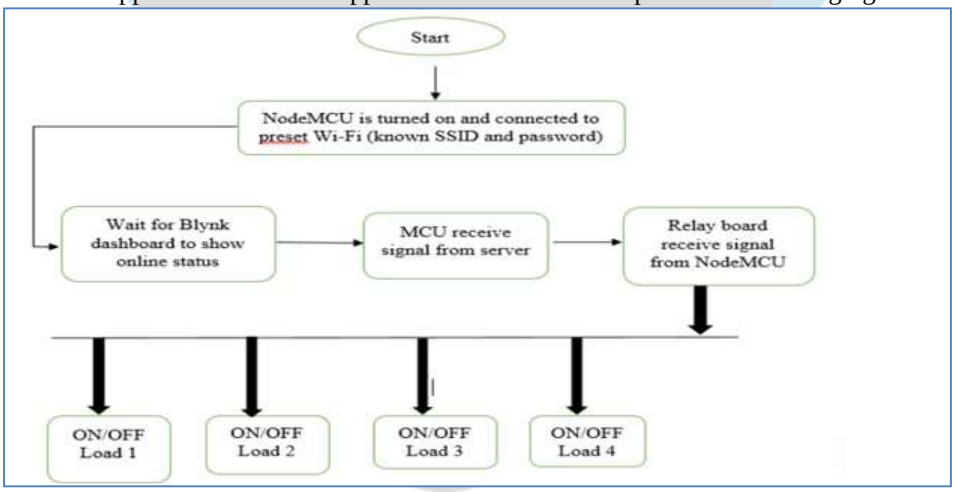

Figure 8: Working Model Block Diagram

VII. Result

From this research we are able to find the way to use the appliances of home in an efficient ad smart way. Previously we are using outdated method to switch on/off the devices by mechanical switch which are not automatic but in case of automation we are using voice command mode using blynk app which are working perfectly. So we can say that it can save our electricity bill and time. Following figure shows the resulting working model of our project.

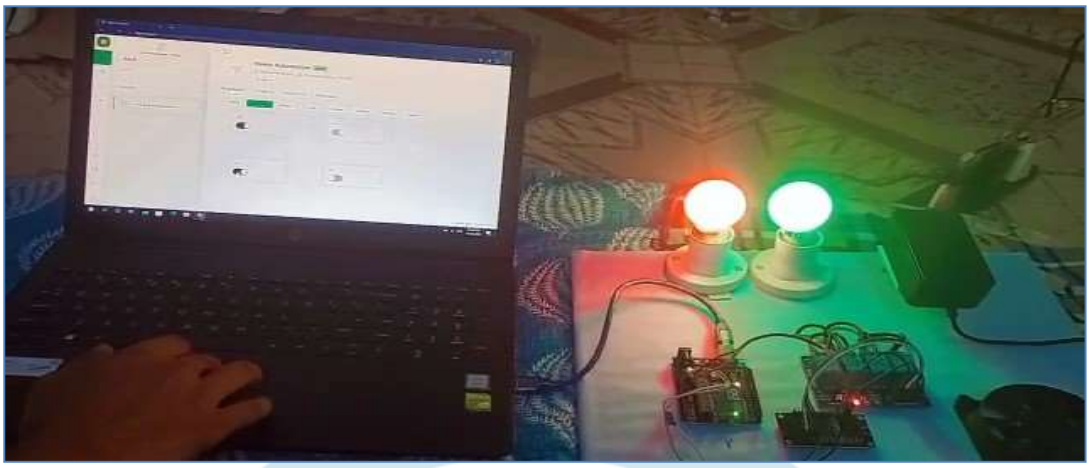

Figure 9: Result

VIII. Future scope

A) Smart Homes

In the coming years, fully automated smart homes will surely become a reality as the home automation is developing rapidly. Due to good user convenience, smart homes are appealing a wide range of people all over the globe. The User can check for the electricity usage, the condition of their devices and get notification accordingly.

B) Smart Cities

With increasing automation and IoT, devices can communicate with each other. This will help in building new and smarter cities. Cities that would be free form pollution, traffic accidents, etc. problems.

C) Agriculture

The proposed system can be used in Agriculture as well. The various devices used in fields can be operated from any remote location.

IX. Conclusion

A major obstacle to the adoption of flexible home appliances is currently its high cost. This paper has read and reviewed the available home automation system. These systems require additional network devices such as operating hubs, and also increase their cost. With the use of the Node MCU and the IoT platform, these devices can be made less expensive. Above all, it will provide good user comfort as it will be able to control devices from a remote location. By using a web page or application, the system has been created a standalone platform. There is no need for any type of operating system to run this program. The program will provide good results.

X. References

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