**IMPLEMENTATION OF SMART ENERGY HOME AUTOMATION SYSTEM USING NODE MCU AND INTERNET OF THINGS (IOT)*****¹Er. Deepika Bhagat, ²Er. Harjeet Singh and ³Dr.(Prof.) Gurpreet Singh**¹M.Tech CSE, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar.²Assistant Professor, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar.³Professor, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar.

Article Received on 04/12/2021

Article Revised on 24/12/2021

Article Accepted on 14/01/2022

Corresponding Author*Er. Deepika Bhagat**

M.Tech CSE, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar.

ABSTRACT

This research presents the design and implementation of Smart Home Controller wherein the user can control their devices using the Android Application running on a Smart Phone. The system employs client server architecture and Internet of Things (IOT) for communication. The controller is designed with the Arduino microcontroller (Node MCU) at the consumer end and is connected to the internet through Wi-Fi. In this system, every device is connected to the internet through

the IOT protocol and controlling is done through HTTP requests sent from the Android mobile application. The API (Application Programming Interface) connects the server and android application and allows it to interact and exchange data with the server. Whenever the user sends requests from android application, the API connects to the server and it sends request to the controller, further to which the controller performs ON/OFF function of the device based on the request received. Using this method, controlling home appliances is discussed in this research.

KEYWORDS: IoT, NodeMCU, Wi-Fi.

I. INTRODUCTION

The concept of smart homes is getting more attention in the present Indian power system scenario, which possesses the ability to turn ON/OFF the devices remotely. The smart phones add the advantage of making this process simpler and cheaper. The main purpose of doing this is to convert present devices into smart devices by connecting them to internet. There are numerous smart home controllers developed which work on Bluetooth technologies, GSM (mobile) based and Internet based technologies. But they all have their inherent drawbacks in terms of the cost, range of operation and number of devices that they can be connected to. Internet of Things (IOT) is a new Information and Communication Technology (ICT) evolution which connects any number of devices to the internet, and makes it highly scalable. Among the various applications of IOT, a smart home is a very important application. IOT provides the necessary communication infrastructure through This kind of system creates a smart environment for controlling devices through IOT. In case the user forgets to turn off his/her devices it can be done remotely from any part of the world, once connected to internet. The system referred to in this paper provides easy controllability of devices for elderly and physically challenged people as well. It has also been made cost effective enabling its real time implementation. The cost of the controller is reduced with the use of node MCU's and less complicated hardware. The said system is built for a cost of 900 Indian rupees and can control up to 8 devices. The cost can further be scaled down if mass production is done.

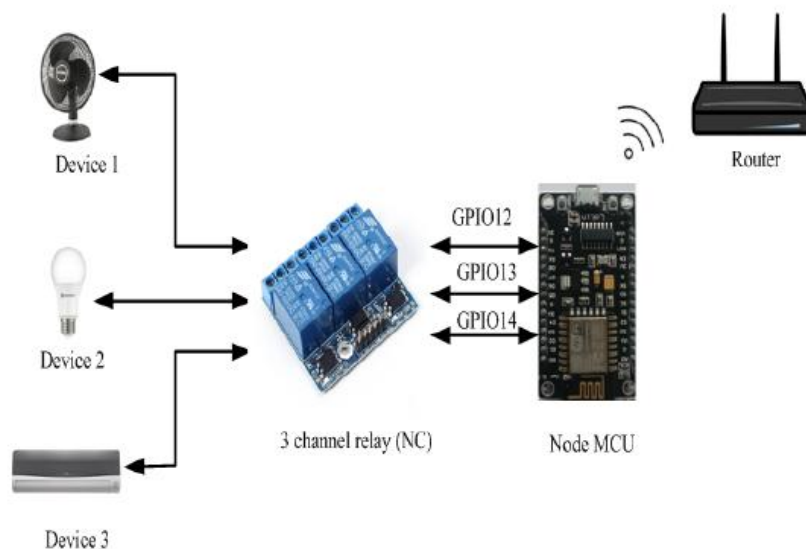


Fig. 1: Home Controller Design.

II. System Architecture and Working

The architecture of the system developed is based on the client server model. Here, the devices including smart phones and microcontrollers are treated as clients which are connected to central server. Figure 2 shows the broad client server architecture implemented. The architecture can be divided into 4 layers namely- Home appliance layer, control unit layer, server layer and client layer. The communication between the home appliance layer and control unit layer is through wired medium and that between the control unit and the server is either by LAN or Wi-Fi. The server is basically HTTP based and communicates with clients through API requests.

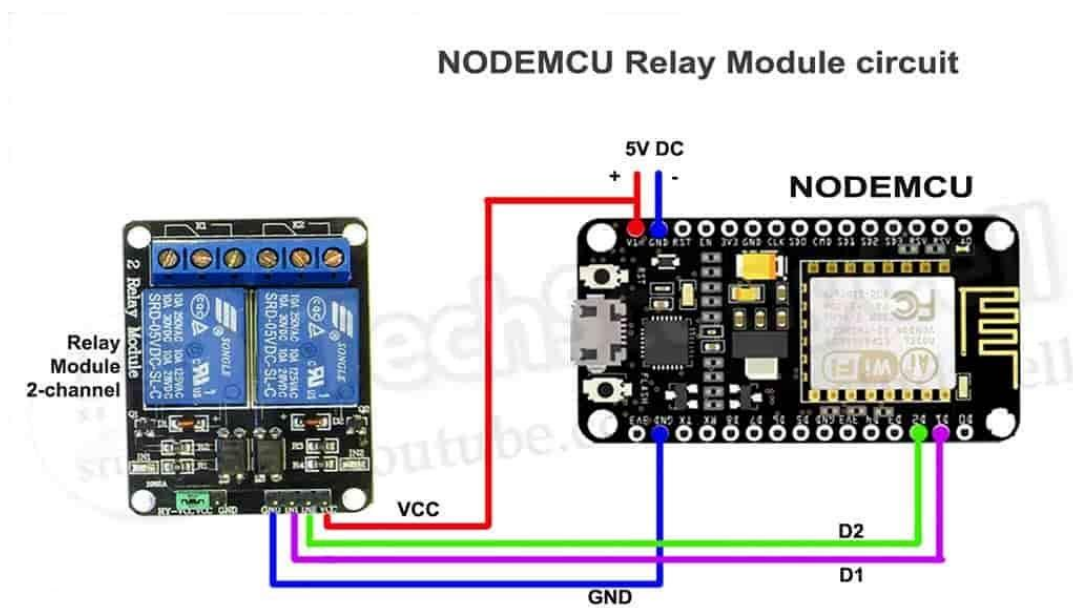


Fig. 2: Nodemcu Relay Module Circuit.

III. NODE MCU

IoT platform node MCU is open source. Language used in it is lua scripting language. It is based on the eLua research, and built on the ESP8266 SDK 0.9.5. It uses many open source researchs, such as lua-cjson, and spiffs. It includes firmware which runs on the ESP8266 Wi-Fi SoC, and hardware which is based on the ESP-12 module. NodeMCU was created shortly after the ESP8266 came out. In December 30, 2013, Espressif systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications. NodeMCU started in 13 Oct 2014, when Hong committed the first file of NodeMCU - firmware to GitHub.

IV. BLYNK APP

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your research by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things.

V. PROPOSED METHODOLOGY

Internet of Things permits us to manage connected devices from anyplace and exchange information over the devices. The house automation system controls home appliances mechanically and once this technique is connected to the internet it becomes a locality of IoT. There is a unit of three main generations of home automation. First is, the various wireless technology with proxy servers, second is computing (AI) controlled home automation and last robots that directly communicate with humans. Our research is that the 1st generation automation. Implementing the primary generation of the house automation appliances have to connect with the web, therefore, users will manage the system from any remote place. That's why IoT has become a desire for automation.

VI. OBJECTIVES OF THE STUDY

The objective of this research is as follows

- 1) To control home appliances and provide status of the home environment.
- 2) To develop system which controls home appliances based on monitoring the home environment with the help of sensors.
- 3) To utilize secure protocols over Wi-Fi and RF with the goal that different devices cannot control the appliances.
- 4) To implement an IOT based smart home controller and control it through the smart phones.

Vii. Flow chart of the proposed system

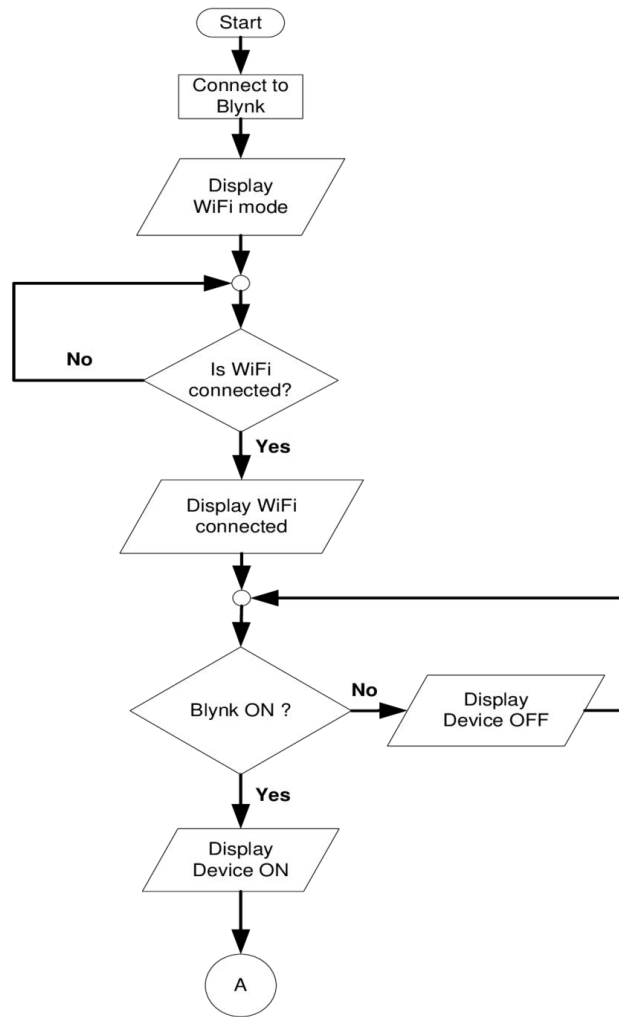


Fig. 3: Flow chart of the Proposed System.

VIII. Implementation

The home automation circuit is built around ESP8266, Blynk Android App, and a 4-channel relay board. The hardware set up should be according to the circuit diagram. AC mains appliances (Bulbs) will be connected to relays which are controlled by the ESP8266. Once Arduino IDE is installed on the computer, connect the board with the computer using the USB cable. Now open the Arduino IDE and choose the correct board by selecting Tools>Boards>NodeMCU1.0 (ESP-12E Module), and choose the correct Port by selecting Tools>Port. To get it started with the NodeMCU board and blink the built-in LED, load the example code by selecting Files>Examples>Basics>Blink. Once the example code is loaded into your IDE, click on the „upload“ button given on the top bar. Once the upload is finished, you should see the built-in LED of the board blinking. User has to install and configure the Blynk App as per the above instructions. NodeMCU to 4- Channel Relay Board Connect D0

pin of NodeMCU to D1 pin of 4- Channel Relay board, Connect D1 pin of NodeMCU to D2 pin of 4- Channel Relay board, Connect D2 pin of NodeMCU to D3 pin of 4- Channel Relay board, Connect D3 pin of NodeMCU to D4 pin of 4- Channel Relay board, Connect 3.3V of NodeMCU to Vcc pin of 4- Channel Relay board, Connect GND pin of NodeMCU to GND pin of 4- Channel Relay board. We are including ESP8266 WiFi library which provides ESP8266 specific WiFi routines and we are calling it to connect to the network. BlynkSimpleEsp8266 library establishes the communication between Blynk App and ESP8266.

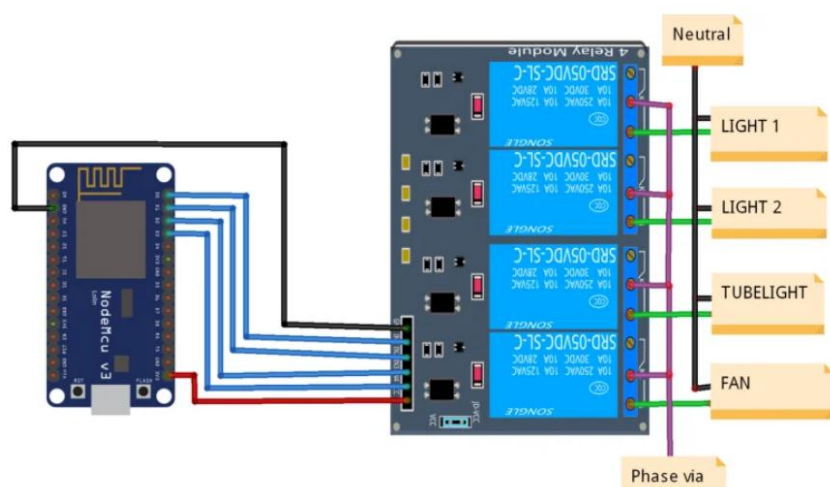


Fig. 4: Circuit Diagram of Proposed Technique.

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NodeMCU | Arduino 1.8.15
File Edit Sketch Tools Help

NodeMCU $
/* Comment this out to disable prints and save space */
#define BLYNK_PRINT Serial

/* Fill-in your Template ID (only if using Blynk.Cloud) */
//define BLYNK_TEMPLATE_ID "YourTemplateID"

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// You should get auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "XU-epLRpgefwah20t39NhlFocSlc_Y1a0";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "DangeetNet";
char pass[] = "saini$3077";

void setup()
{
  // Debug console
  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);
  // You can also specify server:
  
```

Fig. 5: Display the Proposed Program in Arduino IDE 1.8.16

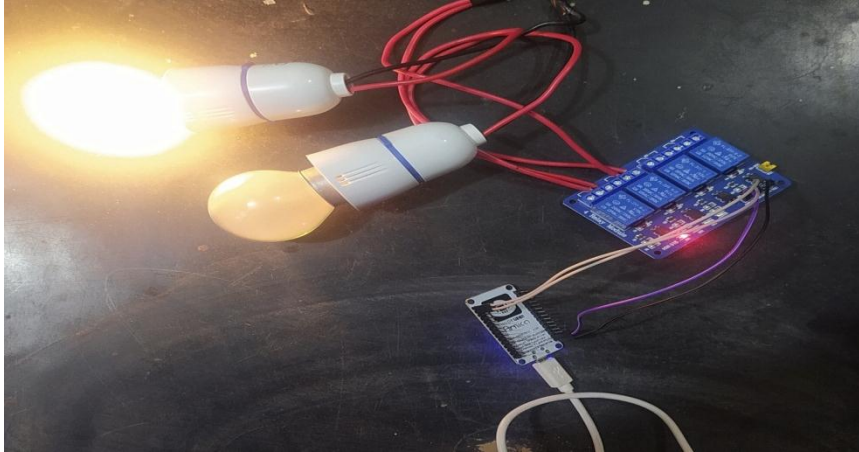


Fig. 6: Assembled NodeMCU ESP8266, Relay, WiFi Router, Laptop, Power Cables, Data Wires and Bulbs.



Fig. 7: Graphs shows the Live Run Time Environment of Implementation of Proposed Technique on Bulb1 and Bulb2 using IoT Devices.

IX. CONCLUSION AND FUTURE SCOPE

This research presented is a low cost and flexible home control and monitoring system using Node MCU Board with internet and various sensors remotely controlled by Android OS smart phone. In this, Node MCU micro controller is used as an interface between user and hardware components. It is programmed and connected to several components according to the requirements. A micro web server is used as an application layer for communication between remote users and home devices, security systems. This entire system communication is enabled through internet. Notifications are sent to user through the app BLYNK installed in smart phone.

User can operate wirelessly or home appliances can be automated by using several sensors more smartness can be added to this proposed technique for making this smart home highly automated by using artificial intelligence and IoT Concept.

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