MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

Shri Vishweshwar Shikshan Prasarak Mandal's

Vishweshwarayya Abhiyantriki Padvika Mahavidyalaya, ALMALA

-: Project Report on :-
HOME AUTOMATION USING NODE MCU

ENROLL NO	STUDENT NAME
2010950139	Hydrabade Pranav Sudhir
2010950130	Deshmukh Avadhut Prakash
2010950198	Bevnale Pratik Tanaji
2010950127	Patne Sujal Vishal

-: Under the Guidance of :-
Mr. Kazi A.S.M.

DEPARTMENT OF COMPUTER ENGINEERING

Academic Year 2022-23

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION,

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ALMALA

Certificate

This is certify that **Mr. Hydrabade Pranav S. , Mr. Deshmukh Avadhut P. , Bevnale Pratik T. , Patne Sujal V.** students of Third Year **Computer Engineering** has successfully completed the project report on "**HOME AUTOMATION USING NODE MCU**" as a part of curriculum declared by Maharashtra State Board Of Technical Of Education, Mumbai**.**

For the partial fulfilment of **"Diploma in Computer Engineering"**during the **Academic Year 2022-2023.**

Guided By
Mr. Kazi A.S.M

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HOD
Mr. Kazi A.S.M.

.....

Principal
Mr. Dharashive P. S.

.....

Ext. Examiner

.....

.....

DECLARATION

We hearby declare that the project entited **"HOME AUTOMATION USING NODE MCU"** submitted for the 6th Semester Project work as per MSBTE Curriculum of Computer Engineering Course and the project has not formed the basis for the award of any degree, fellowship or any other similar titles.

1) Hydrabade Pranav S. **……....**
2) Deshmukh Avadhut P. **……**
3) Bevnale Pratik T. **……**
4) Patne Sujal V. **……....**

Place: Almala
Date: ……/04/2023

ACKNOWLEDMENT

We would regard this project as the culmination of efforts put by various persons during this academic year. We express the whole hearted thanks to our guide **Mr. Kazi A.S.M.** for such priceless and affectionate guidance throughout the project, without which this report would only be a dream. We also express our sincere thanks to Head of Department Computer Engineering, **Mr. Kazi A.S.M.** for providing all necessary prerequisites.We express our deepest regards towards the staff members and friends for their constant support.

1) **Mr.Hydrabade Pranav S.** …….
2) **Mr.Deshmukh Avadhut P.** …….
3) **Mr.Bevnale Pratik T.** …….
4) **Mr.Patne Sujal V.** …….

CONTENTS

PART 1

PROJECT INTRODUCTION

1.1 Project Introduction:

Home automation is a rapidly growing field in the realm of Internet of Things (IoT), where smart devices are used to control various household appliances and systems remotely for increased convenience, efficiency, and security. NodeMCU, a popular open-source firmware and development board, offers a cost-effective and versatile solution for building home automation systems.

The aim of this project is to design and implement a home automation system using NodeMCU, which allows users to remotely control and monitor various household appliances and systems such as lights, fans, temperature, and security devices using a web-based interface. The system will be designed to be scalable and modular, allowing for easy expansion and customization based on specific requirements.

This project will leverage the power of NodeMCU, which is based on the ESP8266 Wi-Fi module, to establish wireless communication between the home automation system and the user's mobile device or computer. The system will utilize various sensors, actuators, and relays to interact with the physical devices in the home, and a web-based user interface will be developed to provide a user-friendly control panel for managing the automation system.

1.2 Problem Statement:

Designing an intuitive and user-friendly web-based interface or mobile application for controlling home appliances and devices remotely, considering factors such as ease of use, responsiveness, and security.

Developing a robust and reliable communication protocol between the NodeMCU and home appliances/devices, ensuring seamless connectivity and efficient data exchange.

1.3 Scope of the project:

The scopes to this project are:

i. Control and Automation
ii. Customization and Flexibility
iii. Energy Efficiency
iv. Expandability and Scalability
v. Cost-Effectiveness

1.4 Requirement Specification :

The Feature of this alarm include the following:

- NodeMCU microcontroller with ESP8266 WiFi module
- Actuators (e.g., relays, motor drivers, dimmers)
- Mobile app or web interface for remote control and monitoring
- Power supply (e.g., DC adapter, battery backup)
- Internet connection for IoT connectivity
- User authentication and data encryption for security
- Automation and scheduling features for task automation
- Energy monitoring capabilities for optimizing energy consumption
- Expandability and customization options for future expansion and customization of the system.

1.4 Literature Survey:

NodeMCU-based home automation system for energy efficiency (2017): This study proposes a home automation system that uses NodeMCU to control lighting and electrical appliances based on user-defined schedules and environmental conditions. The system aims to optimize energy consumption and reduce energy waste in homes.

Voice-controlled smart home automation system using NodeMCU (2020): This research presents a voice-controlled smart home automation system that uses NodeMCU and voice recognition technology to control various devices in a home. The system allows users to control devices through voice commands, providing a convenient and hands-free way of interacting with smart home features.

Overall, the literature survey highlights the use of NodeMCU as a cost-effective and versatile platform for building home automation systems that provide remote control, scheduling, energy management, and other smart features to enhance the comfort, convenience, and security of homes.

PART 2

EXISTING AND PROPOSED SYSTEM

2.1 Modules:

Key differences between the already existing home automation systems and our project:

1. Cost: One of the main differences between the existing home automation systems and our project is the cost. Many of the existing systems on the market can be quite expensive, while our project using NodeMCU and other components is relatively low-cost and affordable.
2. Customization: Our project allows for a high degree of customization, as it is open-source and can be easily modified and adapted to fit the specific needs of the user. In contrast, many of the existing home automation systems on the market are proprietary and may not allow for as much customization.
3. Scalability: Our project is highly scalable, as it can be easily expanded to include additional sensors, actuators, and devices as needed. In contrast, some of the existing home automation systems may have limitations on the number of devices that can be connected.
4. Ease of installation: Our project is designed to be easy to install, as it uses simple and widely available components that can be easily assembled and connected. In contrast, some of the existing home automation systems may require professional installation or specialized knowledge.
5. Programming flexibility: Our project allows for a high degree of programming flexibility, as it can be programmed using a variety of programming environments such as the Arduino IDE or LuaLoader. In contrast, some of the existing home automation systems may have limited programming options.
6. Integration with other systems: Our project can be easily integrated with other systems and platforms, as it uses standard communication protocols such as MQTT and Wi-Fi. In contrast, some of the existing home automation systems may be proprietary and may not allow for as much integration with other systems.

2.2 Aim of system:

The aim of a home automation system using NodeMCU is to enable remote control, monitoring, and automation of various devices and appliances in a home using the Internet of Things (IoT) technology. The specific objectives may vary depending on the implementation and requirements of the system, but common aims include:

- Convenience and Comfort: The system aims to provide convenient and comfortable control of home devices, allowing users to remotely manage and automate tasks such as turning lights on/off, controlling appliances, adjusting thermostat settings, and managing security features.

- Energy Efficiency: Another aim of a NodeMCU-based home automation system is to optimize energy consumption and promote energy efficiency. The system may include features such as scheduling, automated sensors, and remote monitoring of energy usage, allowing users to effectively manage and reduce energy waste in their homes.

- Security and Safety: Home automation systems using NodeMCU can also incorporate security and safety features, such as remote monitoring and control of security cameras, door locks, and alarms. The system aims to enhance the security of homes by providing real-time monitoring, alerts, and control of security devices, which can improve the safety and peace of mind of the residents.

- Customization and Flexibility: The system may aim to provide customization and flexibility to users, allowing them to define their own automation rules, schedules, and preferences. This can enable personalized automation based on individual needs, preferences, and lifestyles, making the system adaptable to different users and home environments.

- Integration and Scalability: Home automation systems using NodeMCU may aim to provide integration with other smart devices and platforms, enabling interoperability and scalability.

2.3 Objectives of the system:

The objectives of this project are:

i. Remote control
ii. Automation and scheduling
iii. Energy management
iv. Enhanced security
v. Customization and personalization

2.4 Contraints:

In order to design a DIY project on home automation systems using NodeMCU, there are a few constraints that should be taken into consideration:

I. Budget: The project's cost should be taken into consideration to ensure that it stays within a reasonable budget.

II. Technical expertise: The project requires technical knowledge of programming, circuit design, and electronics. It is important to have the necessary skills and knowledge to complete the project successfully.

III. Time: The project requires time to research, design, and implement the system. It is important to allocate enough time to complete the project properly.

IV. Safety: Safety is a critical factor to consider in any project. The system should be designed and implemented in such a way that it does not pose any safety hazards to users.

V. Compatibility: The system should be compatible with the existing infrastructure of the house, such as the electrical wiring, devices, and appliances.

VI. Scalability: The system should be designed in such a way that it can be scaled up or down as needed. This allows for future expansion or modification of the system.

- **Following are the benefits or advantages of Home Automation System using NodeMCU:**
  - Cost-effective: DIY projects are typically more cost-effective than commercially available home automation systems. By building your own system, you can save money on installation and equipment costs.

- Customization: With a DIY home automation system, you have full control over the design and customization of the system. You can customize it to meet your specific needs and preferences.

- Scalability: As mentioned earlier, a DIY system can be scaled up or down as needed, making it more flexible and adaptable to your changing needs.

- Control: With a home automation system, you have greater control over your home's devices and appliances. You can remotely control your lights, thermostat, and other devices from your smartphone or tablet.

- Energy efficiency: Home automation systems can help reduce energy consumption by automating the control of lights and other devices. This can lead to lower energy bills and a more sustainable home.

- Convenience: With a home automation system, you can control your home's devices and appliances from anywhere, at any time, using your smartphone or tablet. This can save time and make life more convenient.

- **Following are the drawbacks or disadvantages of Home Automation System using NodeMCU:**

- Initial setup and complexity: Setting up a home automation system using NodeMCU may require technical expertise and knowledge of programming and electronics

- Reliance on internet connectivity: Most home automation systems using NodeMCU rely on internet connectivity for remote control and automation. If there is a loss of internet connectivity,

- Security concerns: As with any connected system, home automation using NodeMCU may pose security risks if not properly secured. Vulnerabilities in the firmware, software, or network configuration could potentially be exploited by malicious actors.

2.5 Complete system design and analysis:

Designing a complete home automation system using NodeMCU involves several steps. Here is a brief overview of the system design and analysis:

1. System requirements: The first step is to determine the system requirements. This involves identifying the devices and appliances that need to be automated and the desired functionality of the system.

2. Hardware selection: Once the system requirements have been determined, the next step is to select the hardware components. This includes selecting the NodeMCU board, sensors, and other necessary components.

3. Circuit design: After selecting the hardware components, the next step is to design the circuit. This involves connecting the hardware components and designing the necessary interfaces.

4. Software development: Once the hardware and circuit design are complete, the next step is to develop the software. This involves writing the code for the NodeMCU board and other components.

5. Testing: After the software development is complete, the system needs to be tested. This involves verifying that the system functions properly and meets the system requirements.

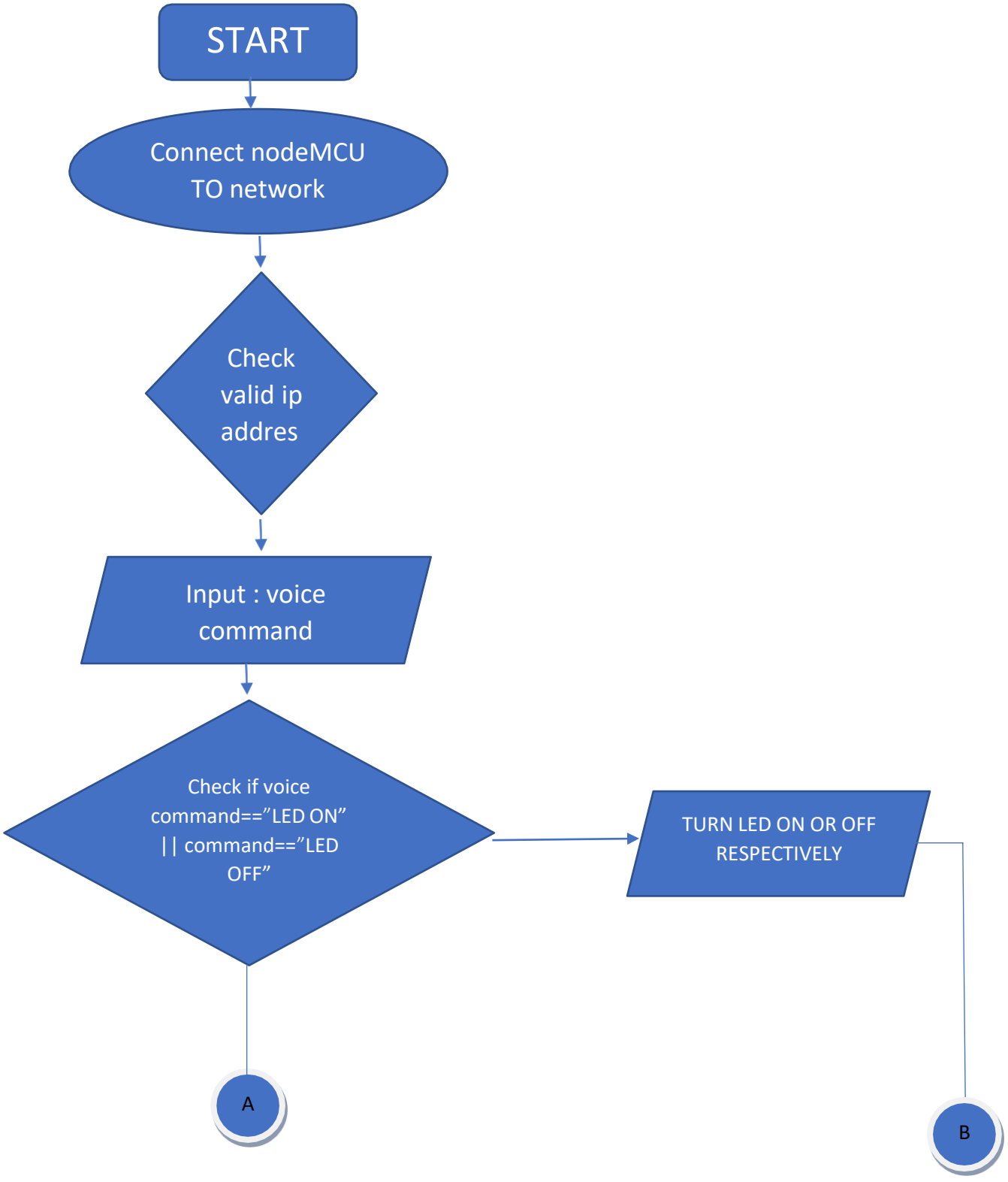
6. Implementation: Once testing is complete, the system can be implemented. This involves installing the hardware, setting up the software, and integrating the system with the existing infrastructure.

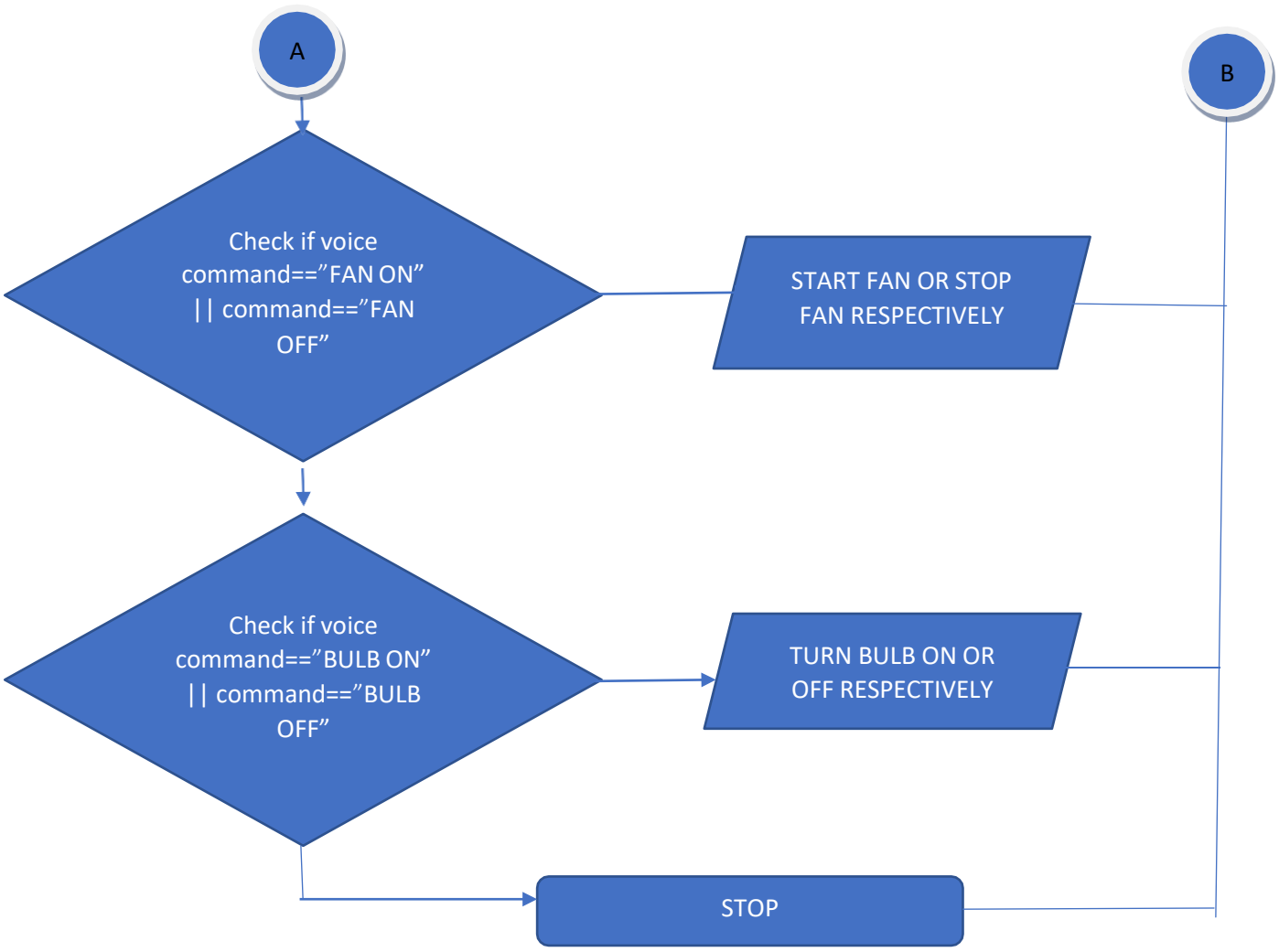
7. Maintenance: Regular maintenance is required to ensure that the system continues to function properly. This involves monitoring the system and making any necessary updates or repairs.

In terms of analysis, it is important to evaluate the system's performance and identify any areas for improvement. This can involve analyzing the system's energy efficiency, user-friendliness, and reliability. It is also important to consider the cost and scalability of the system, as well as any potential security or privacy concerns.

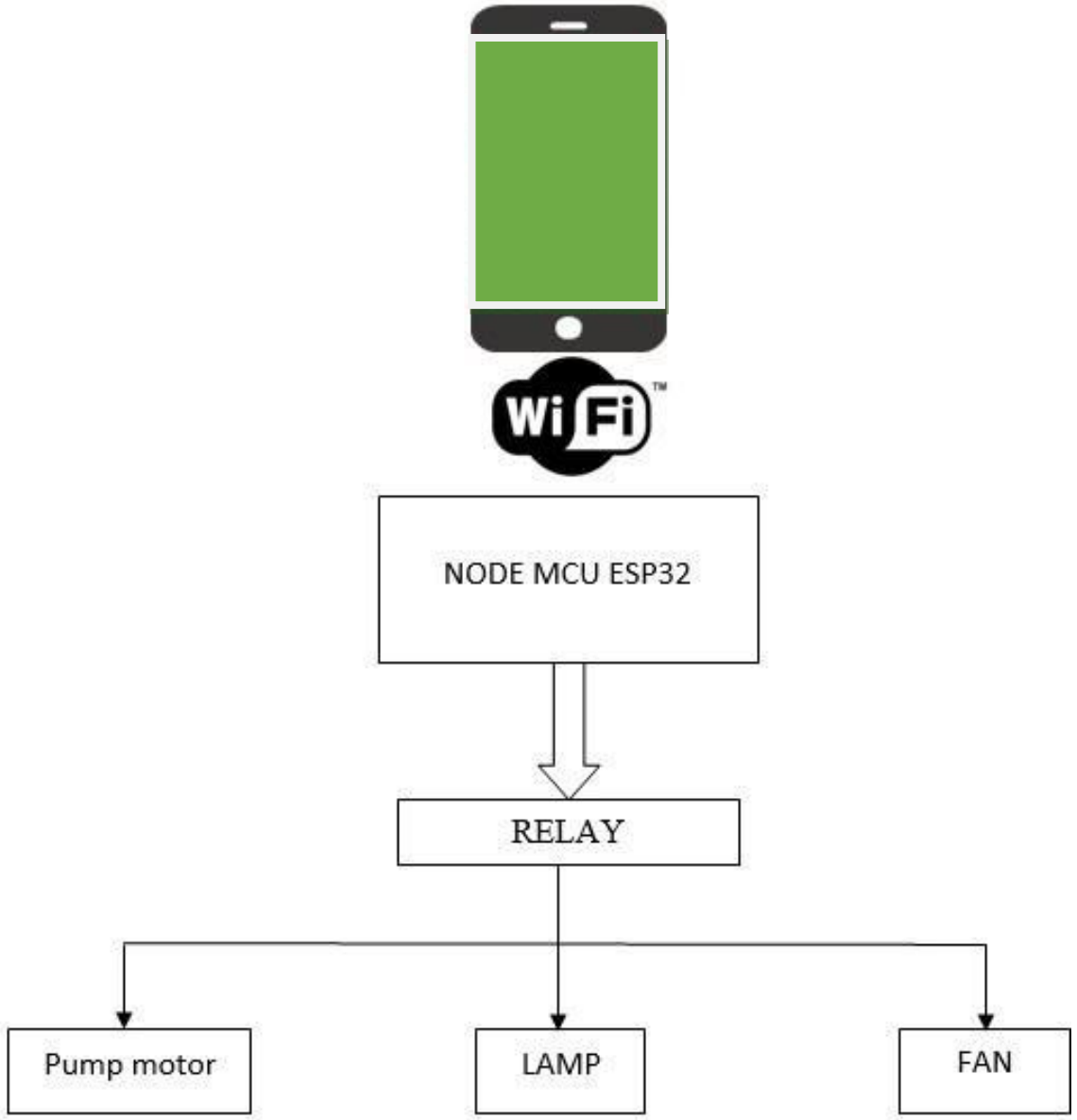
PART 3
SYSTEM DESIGN

3.1 Data flow chart:




A
B
Check if voice command==”FAN ON” || command==”FAN OFF”
START FAN OR STOP FAN RESPECTIVELY
Check if voice command==”BULB ON” || command==”BULB OFF”
TURN BULB ON OR OFF RESPECTIVELY
STOP

3.2 Data Flow Diagram:



PART 4

REQUIRMENT SPEACIFICATION

4.1 Hardware Requirement:

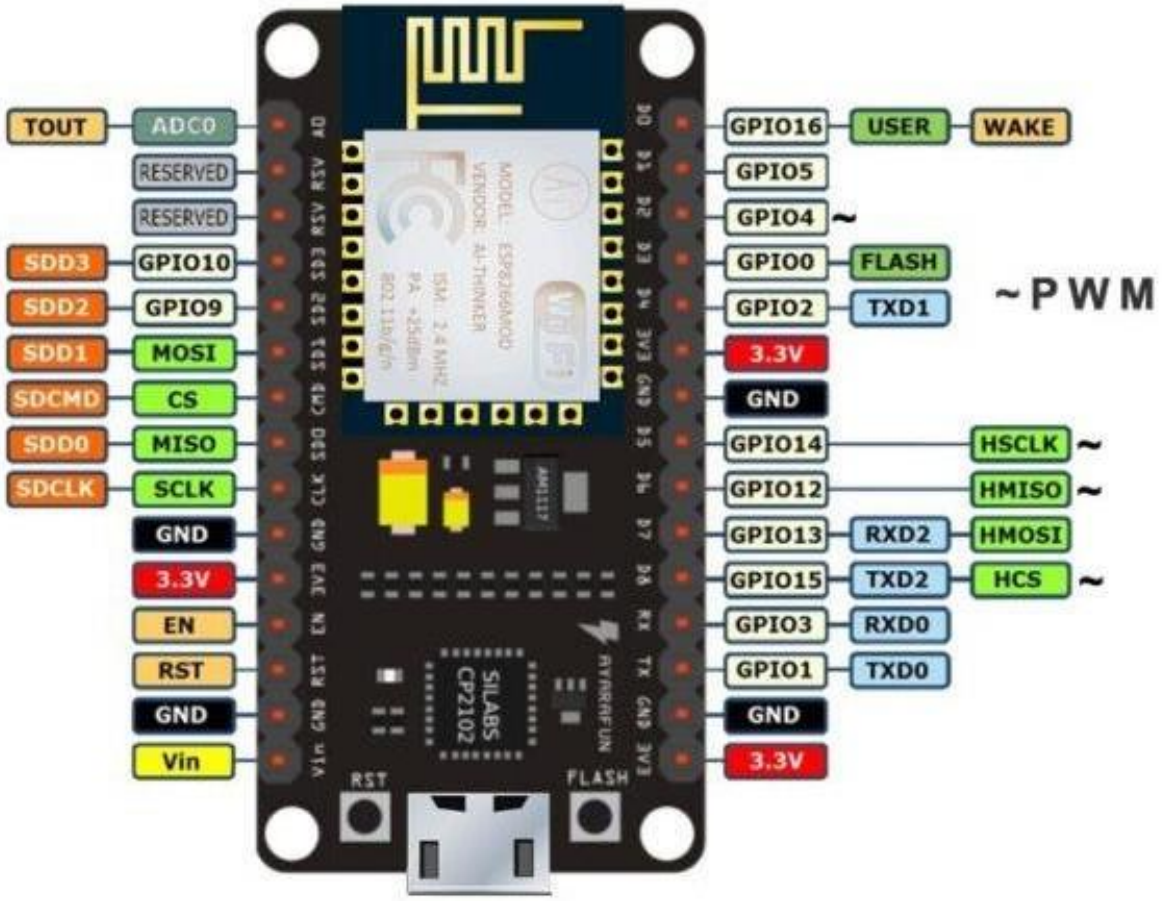
1) Node MCU:

NodeMCU is an open-source firmware and development board designed for the Internet of Things (IoT) applications. It is based on the ESP8266 WiFi microcontroller and Lua scripting language.

Here's everything you need to know about NodeMCU:

1. Features: NodeMCU comes with a number of features, including built-in Wi-Fi connectivity, low power consumption, and support for various communication protocols such as MQTT, HTTP, and TCP. It also has a USB-to-serial converter, making it easy to program and debug.
2. Lua scripting: NodeMCU uses the Lua scripting language, which is easy to learn and provides a simple and intuitive interface for controlling the microcontroller. Lua scripts can be uploaded to the NodeMCU board and executed directly on the board.
3. Development environment: There are several development environments available for NodeMCU, including the NodeMCU firmware itself, the Arduino IDE, and the LuaLoader software. These environments provide an easy way to develop and deploy code on the NodeMCU board.
4. Applications: NodeMCU is commonly used in IoT applications such as home automation, industrial automation, and smart agriculture. It can be used to collect and transmit sensor data, control devices remotely, and integrate with cloud services.
5. Limitations: NodeMCU has a limited amount of memory and processing power compared to more powerful microcontrollers. It also has limited input/output pins, which may limit its use in more complex projects. However, it is still a powerful and versatile tool for many IoT applications.

Overall, NodeMCU is a popular and versatile platform for developing IoT applications, with a wide range of features and applications. Its ease of use and low cost make it an ideal choice for hobbyists and professionals alike.



2) Relay Module:

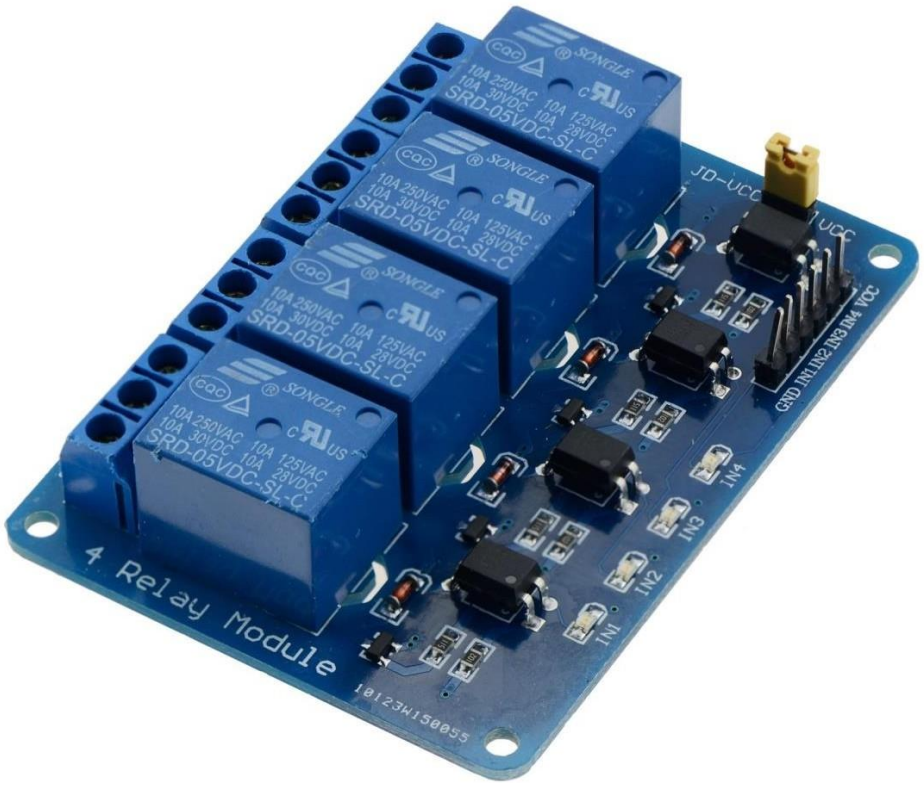
A relay module is an electronic device that allows you to control high voltage electrical appliances using low voltage signals. It consists of a relay, which is an electromechanical switch, and an associated control circuit. In the home automation system using NodeMCU project, a relay module is used to control the electrical appliances such as lights, fans, and other devices connected to it.

Here's everything you need to know about relay modules:

1. Types: There are different types of relay modules available, such as single relay module, double relay module, four relay module, etc. The type of relay module used in your project will depend on the number of appliances you need to control.

2. Working principle: A relay module consists of an electromechanical switch, which is activated by a low voltage signal from the NodeMCU board. When the signal is received, the relay module switches on and off the high voltage power supply to the connected electrical appliance.
3. Specifications: Relay modules have different specifications such as input voltage, contact rating, and switching capacity. It is important to select the relay module with the correct specifications for your project to ensure that it can handle the required electrical load.
4. Wiring: The relay module is wired to the NodeMCU board and the electrical appliance. The NodeMCU board sends a signal to the relay module, which activates the switch and turns on or off the electrical appliance.
5. Applications: Relay modules are commonly used in home automation systems, industrial automation, and other applications where remote control of high voltage electrical appliances is required.

Overall, a relay module is a useful component for controlling high voltage electrical appliances using a low voltage signal from the NodeMCU board. It is important to select the correct type and specifications of relay module for your project to ensure safe and reliable operation of the connected appliances.



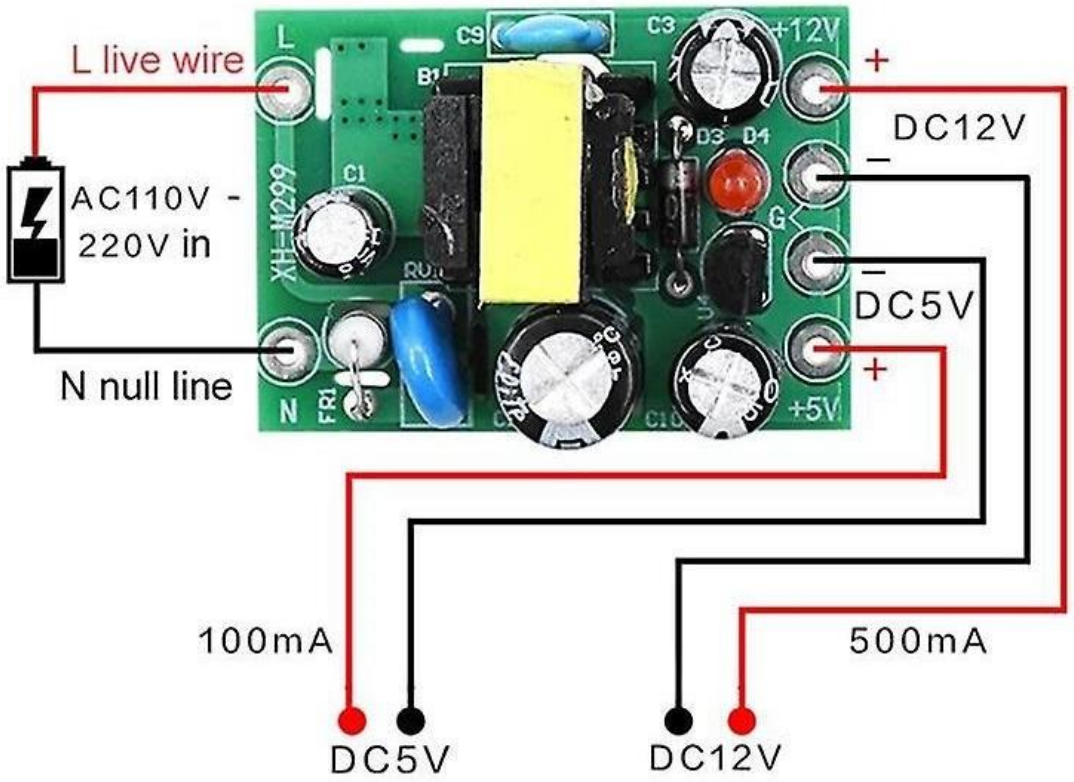
3) AC to DC converter:

An AC to DC converter is an electronic device that converts the alternating current (AC) voltage from a power source to a direct current (DC) voltage that is suitable for powering electronic devices. In the home automation system using NodeMCU project, an AC to DC converter is used to convert the high voltage AC power supply from the mains to a low voltage DC supply that can be used to power the NodeMCU board and other electronic components.

Here's everything you need to know about AC to DC converters:

1. Types: There are different types of AC to DC converters available, such as linear regulators, switching regulators, and transformer-based rectifiers. The type of converter used in your project will depend on the specific application and requirements.
2. Working principle: An AC to DC converter works by rectifying the AC voltage into a pulsating DC voltage and then smoothing the output using capacitors and other components to create a stable DC voltage. The output voltage is regulated using various techniques to ensure that it stays within a specified range.
3. Specifications: AC to DC converters have different specifications such as input voltage range, output voltage range, current rating, and efficiency. It is important to select the correct converter with the appropriate specifications for your project to ensure that it can handle the required power supply needs.
4. Wiring: The AC to DC converter is wired to the mains power supply and the NodeMCU board or other electronic components. Care must be taken to ensure that the wiring is done correctly and safely to prevent electric shock and other hazards.
5. Applications: AC to DC converters are used in a wide range of applications, including home automation systems, power supplies for electronic devices, and industrial automation.

Overall, an AC to DC converter is an important component for converting the high voltage AC power supply from the mains to a low voltage DC supply that can be used to power electronic devices such as the NodeMCU board. It is important to select the correct type and specifications of converter for your project to ensure safe and reliable operation.



AC to DC AC 110-220V to DC 5V/12V

4) Jumper Wires:

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the headerconnector of a circuit board, or a piece of test equipment.

There are different types of jumper wires. Some have the same type of electrical connecter at both ends, while others have different connectors. Some common connectors are:

- Solid tips – are used to connect on/with a breadboard or female header connector. The arrangement of the elements and ease of insertion on a breadboard allows increasing the mounting density of both components and jump wires without fear of short-circuits. The jump wires vary in size and colour to distinguish the different working signals.
- Crocodile clips – are used, among other applications, to temporarily bridge sensors, buttons and other elements of prototypes with components or equipment that have arbitrary connectors, wires, screw terminals, etc.

5) Super Debug USB to Micro USB Cable wire for NodeMCU:

The Super Debug USB to Micro USB Cable wire is a special type of cable that is used for programming and debugging NodeMCU boards. It allows you to connect your NodeMCU board to a computer and upload code, monitor output, and debug your projects.

Here's everything you need to know about the Super Debug USB to Micro USB Cable wire:

1. Design: The cable has a USB-A connector on one end, which connects to your computer, and a Micro USB connector on the other end, which connects to the NodeMCU board. The cable is designed to provide reliable and stable data transfer between the computer and the NodeMCU board.
2. Functionality: The Super Debug USB to Micro USB Cable wire provides a stable and reliable connection between the NodeMCU board and the computer, allowing you to

upload code and debug your projects. It also provides power to the NodeMCU board through the USB connection.

3. Compatibility: The cable is compatible with a wide range of NodeMCU boards, including the ESP8266 and ESP32 versions.
4. Usage: To use the cable, simply connect one end to your computer's USB port and the other end to the Micro USB port on the NodeMCU board. You can then use your preferred programming environment, such as the Arduino IDE or LuaLoader, to upload code and monitor the output.
5. Benefits: The Super Debug USB to Micro USB Cable wire provides a reliable and stable connection between the NodeMCU board and the computer, which is essential for programming and debugging IoT projects. It is a necessary tool for any NodeMCU-based project and can save time and effort by simplifying the development process.

Overall, the Super Debug USB to Micro USB Cable wire is an essential tool for programming and debugging NodeMCU-based IoT projects. Its reliable and stable connection can help streamline the development process and make it easier to create robust and reliable IoT applications.

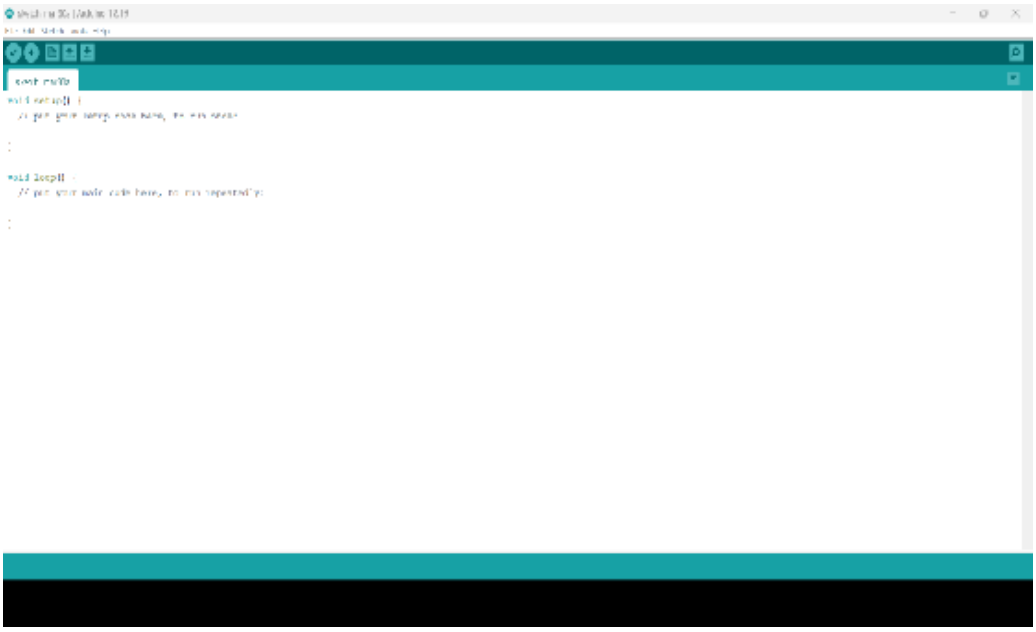
4.2 Software Requirement:

- **Arduino IDE**

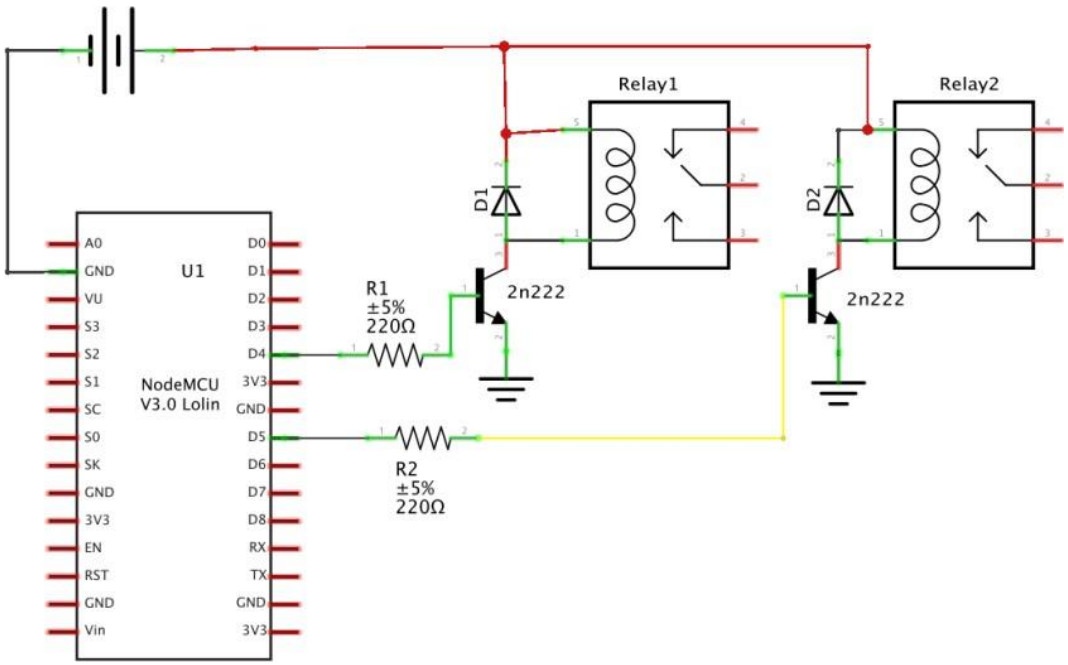
The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog.



4.3 Project Diagram



4.4 Circuit Diagram

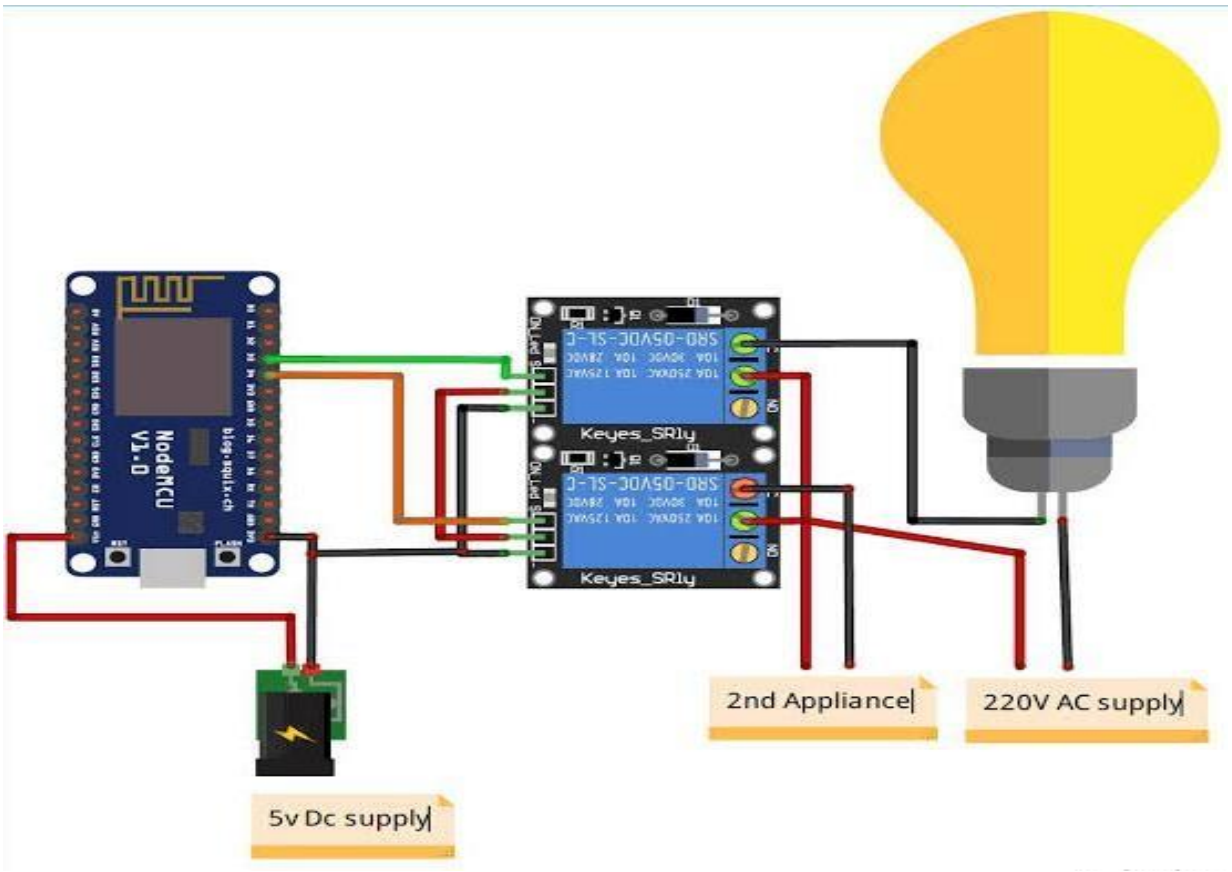


Fig: Circuit Diagram of home automation system using NodeMCU

PART-5

5. DEVELOPMENT AND TESTING

5.1 Development Process:

The development process of the home automation system using NodeMCU can be broken down into several key steps:

1. Planning: The first step in the development process is to plan the project. This involves defining the requirements and scope of the project, selecting the appropriate components and tools, and developing a timeline and budget.
2. Design: Once the project is planned, the next step is to design the system. This involves creating a schematic diagram of the circuit, selecting the appropriate programming environment, and developing the software architecture.
3. Component assembly: After the design is completed, the next step is to assemble the components. This involves connecting the NodeMCU board, relay module, and other components according to the schematic diagram.
4. Programming: Once the components are assembled, the next step is to program the NodeMCU board. This involves writing code to control the relay module, read sensor data, and communicate with other devices
5. Testing: After the programming is completed, the next step is to test the system. This involves verifying that the system functions correctly and reliably, identifying and resolving any issues, and optimizing performance.
6. Deployment: Once the system has been tested and validated, the final step is to deploy the system. This involves installing the system in the target environment and training the end-users on how to use the system.

Throughout the development process, it is important to maintain good documentation and version control, as well as to adhere to good coding practices such as commenting and error handling. By following a systematic and structured development process, the home automation system using NodeMCU can be developed in a timely and efficient manner while ensuring high quality and reliability.

5.2 Developing Testing Method:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Arduino Sketch

Arduino sketch is the name that Arduino uses for a program. It's the unit of code that is uploaded to, and run on an Arduino board. A basic Arduino sketch consists of two functions:

setup()

loop()

The purpose of these functions will be explained later in the tutorial.

For now, open the Arduino IDE and click on the File tab. Then, click on New (or press Control + N on your keyboard) to have a look at the two functions.

Arduino Sketch Program Flow

In an Arduino sketch, program statements (individual lines of code) are executed, i.e. run from top to bottom. This top-to-bottom execution of statements can be altered only by flow control statements.

void setup(): It is the function initialisation/declaration process of the function named setup(). As the function does not return any value, it is initialised with the keyword void, meaning empty.

Serial.begin(9600);

Serial.println("Hello World");

These statements are present in the setup function's body.

{ is the opening brace of the functions that tells that all statements starting from here are inside the fuctions.

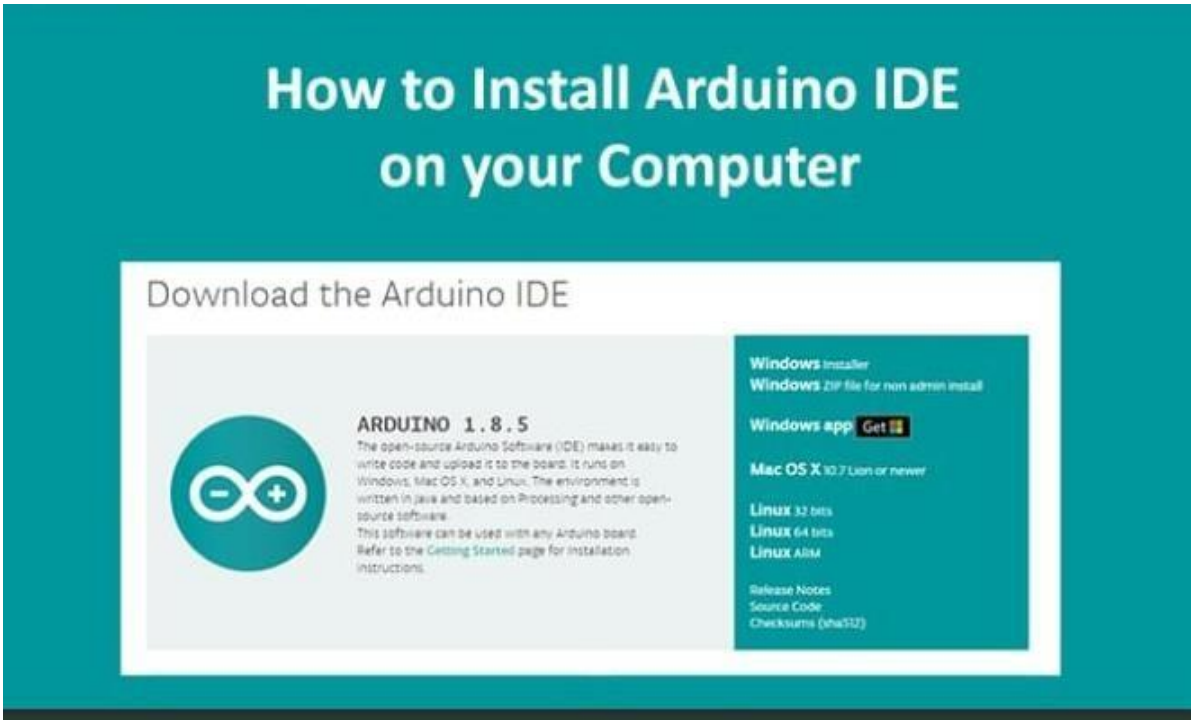
} is the closing brace of the function.

; is used to terminate the statement.

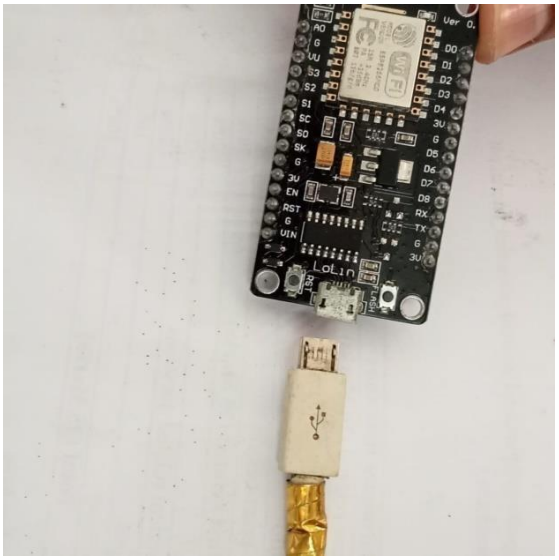
Step 1: Download the Arduino IDE:

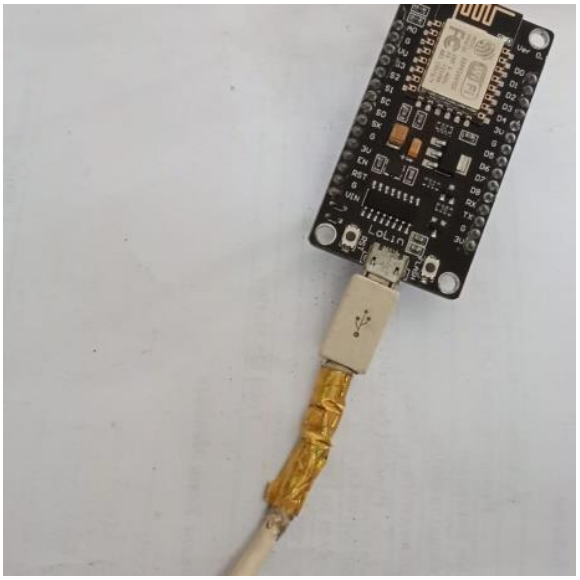
The latest version of the IDE can be download from the official websites.

Link:https://www.arduino.cc/en/software



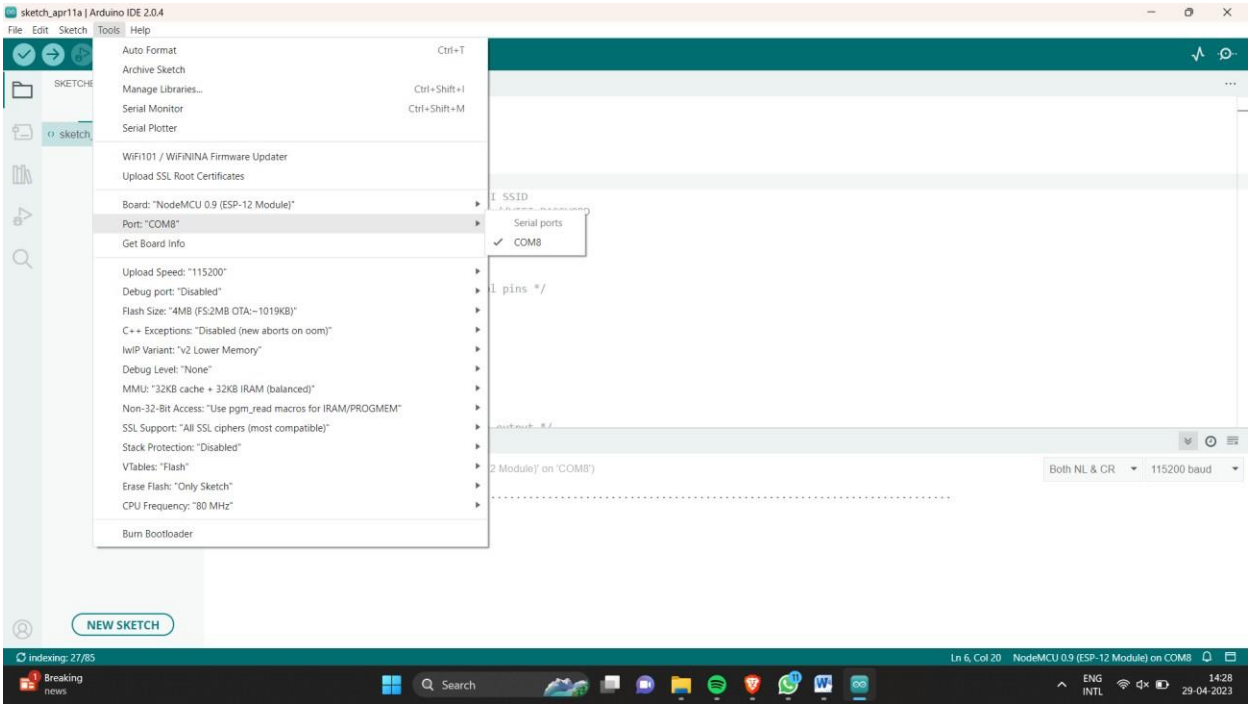
Step 2: connect USB cable to the Arduino:





Step 3: Verify if the device is detected or not :

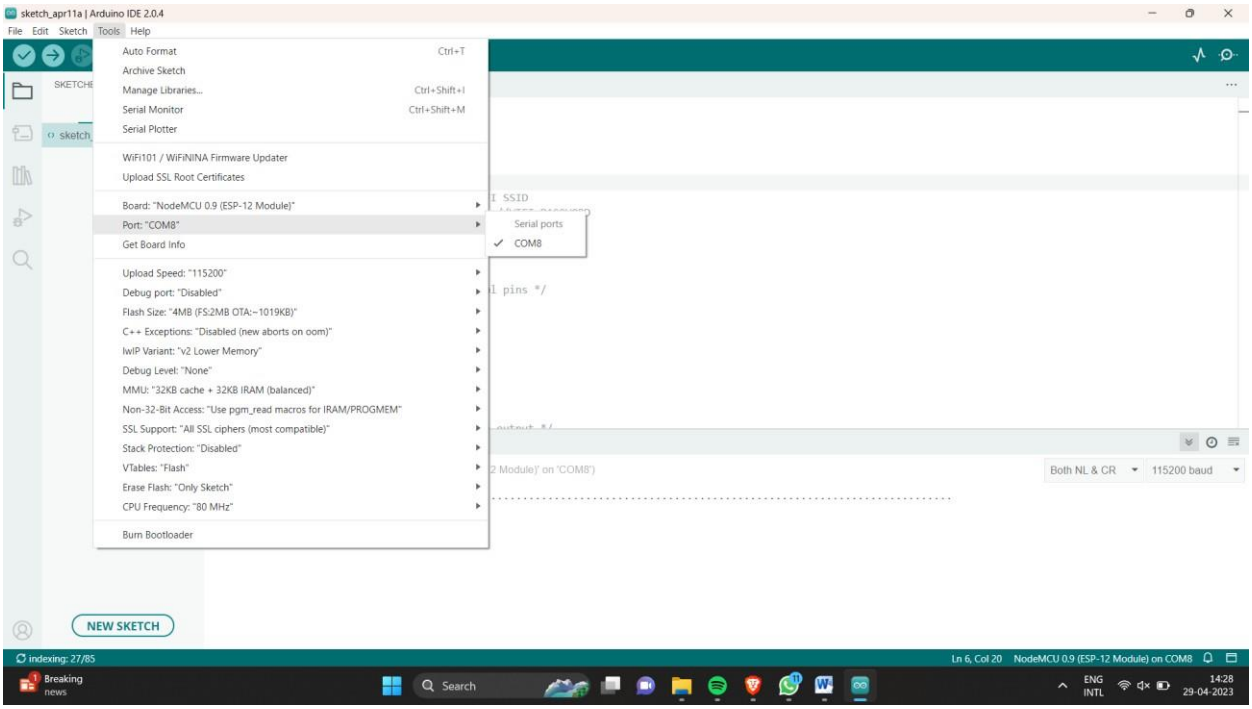
Open device manager in your pc and expand the ports,you should see that the Arduino Uno is detected ,if not you need to install the required drivers.



The serial number of an Arduino board differs depending to the mode the board is functioning on. For example, on bootloader mode the serial number presented to Windows' Device Manager is different to the serial number of the board when it is on application mode.

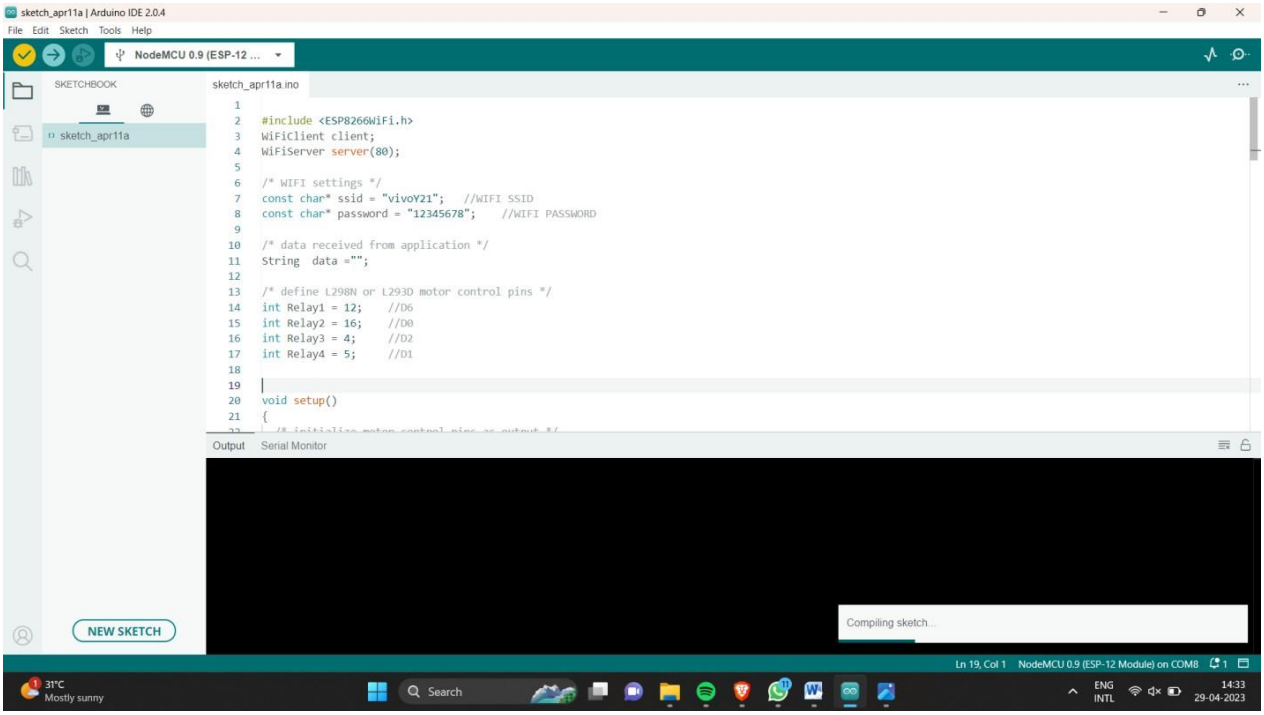
Step 4: Write your first sketch

- Open the Arduino IDE
- Open the tools menu from the menubar
- Select Arduino UNO for the board and select the assigned COM port.



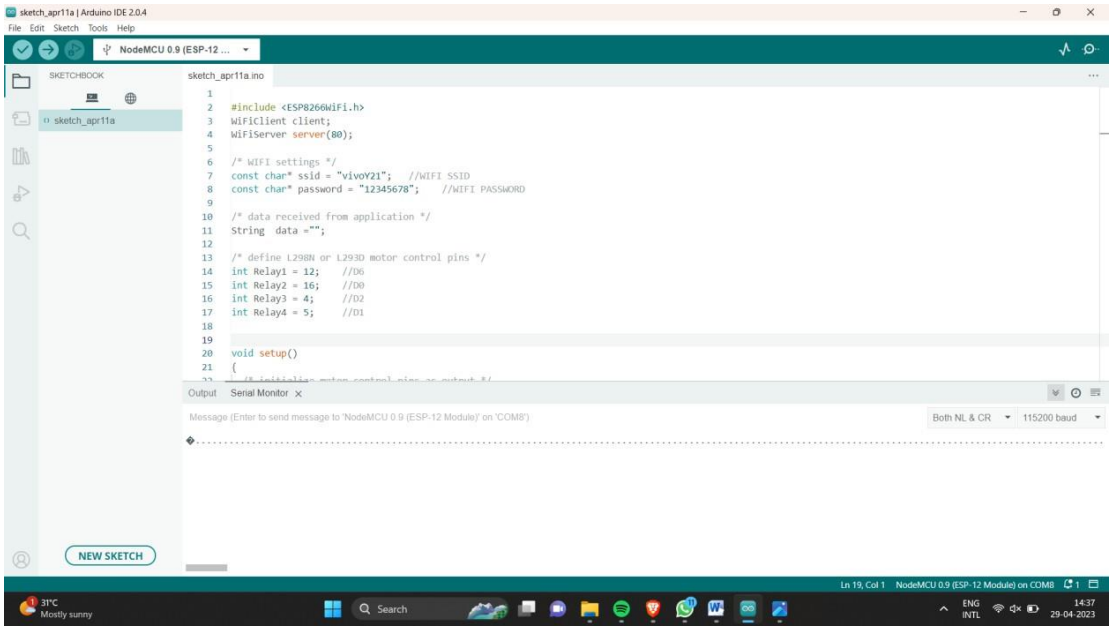
Step 5: Compile the Sketch

Hit the tick button in the top left corner of IDE,You should see that the code is compiled successfully without any errors



Step 6:Upload your first sketch

Hit the right arrow button to next the upload button now while the code uploads you should see the LED's next to Tx and Rx blinking indicating data transfer between the board and the computer.



PART 6

6. CODING

6.1 Source Code

```
#include <ESP8266WiFi.h>
WiFiClient client;
WiFiServer server(80);
/* WIFI settings */
const char* ssid = "vivoY21";  //WIFI SSID
const char* password = "12345678";    //WIFI PASSWORD
/* data received from application */
String  data ="";
/* define L298N or L293D motor control pins */
int Relay1 = 12;    //D6
int  Relay2  =  16;  //D0
int  Relay3  =  4;   //D2
int  Relay4  =  5;  //D1
void setup()
{
  /* initialize motor control pins as output */
  pinMode(Relay1, OUTPUT);
  pinMode(Relay2, OUTPUT);
  pinMode(Relay3, OUTPUT);
  pinMode(Relay4, OUTPUT);

  digitalWrite(Relay1,LOW);
  digitalWrite(Relay2,LOW);
  digitalWrite(Relay3,LOW);
  digitalWrite(Relay4,LOW);
```

```
  /* start server communication */
  Serial.begin(115200);
  connectWiFi();
  server.begin();
}
void loop()
{
    /* If the server available, run the "checkClient" function */
    client = server.available();
    if (!client) return;
    data = checkClient ();
Serial.print(data);
/******** Run function according to incoming data from application **********/
    if (data == "lighton")
    {
      digitalWrite(Relay1,HIGH);
      }
    else if (data == "lightoff")
    {
      digitalWrite(Relay1,LOW);
      }
    else if (data == "fanon")
    {
      digitalWrite(Relay2,HIGH);
      }
    else if (data == "fanoff")
    {
      digitalWrite(Relay2,LOW);
      }
```

```
    else if (data == "LEDon")
    {
      digitalWrite(Relay3,HIGH);
      }
    else if (data == "LEDoff")
    {
      digitalWrite(Relay3,LOW);
      }
    else if (data == "bulbactivate")
    {
      digitalWrite(Relay4,HIGH);
      }
    else if (data == "bulbdeactivate")
    {
      digitalWrite(Relay4,LOW);
      }
}
void connectWiFi()
{
  Serial.println("Connecting to WIFI");
  WiFi.begin(ssid, password);
  while ((!(WiFi.status() == WL_CONNECTED)))
  {
    delay(300);
    Serial.print("..");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("NodeMCU Local IP is : ");
  Serial.print((WiFi.localIP()));
```

```
}
/********** RECEIVE DATA FROM the APP ***********/
String checkClient (void)
{
  while(!client.available()) delay(1);
  String request = client.readStringUntil('\r');
  request.remove(0, 5);
  request.remove(request.length()-9,9);
  return request;
}
```

PART 7

7. PROJECT DESIGN IMAGES

- **Inner Look:**

- **Outer Look:**

PART

8. CONCLUSION

The home automation system using NodeMCU is a low-cost and customizable solution that provides users with an easy and efficient way to control their home appliances remotely. In this project, we have successfully developed a home automation system that can be controlled through a mobile application and can turn appliances on and off based on the user's preferences.

Through the use of the NodeMCU board, relay module, and Super Debug USB to Micro USB Cable wire, we were able to create a system that is highly scalable and customizable. The NodeMCU board allowed us to connect the system to the internet, while the relay module allowed us to control the appliances. The Super Debug USB to Micro USB Cable wire facilitated the programming of the NodeMCU board.

In addition, the use of the Blynk mobile application allowed for easy and convenient control of the home appliances from a distance. The application provided an intuitive and user-friendly interface that allowed users to monitor and control their appliances with ease.

Overall, this project has demonstrated the potential of low-cost and customizable home automation systems that can be easily deployed and controlled remotely. The system can be easily adapted and modified to fit the specific needs of the user, making it an ideal solution for a wide range of home automation applications.

As a conclusion, the development of this home automation system using NodeMCU has provided us with valuable insights into the potential of this technology, and has demonstrated the importance of low-cost and customizable solutions in the home automation market. The project has successfully achieved its objectives and has provided a solid foundation for further development and optimization of this technology.

PART

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Home Automation Using NodeMCU

Hydrabade Pranav Sudhir [1], Deshmukh Avadhut Prakash [2], Patne Sujal Vishal[3], Bevnale Pratik Tanaji [4], Prof. Mr. Kazi A.S.M.[5]

[1, 2, 3, 4] Dept of Computer Engineering

[5]Guide Head Of Department, Dept of Computer Engineering

[1, 2, 3, 4, 5] Vishweshwarayya Abhiyantriki Padvika Mahavidhyalaya,Almala,Maharashtra,India.

Abstract- *Home automation using NodeMCU is a rapidly growing trend in the field of home automation, Homeowners may remotely control and automate numerous equipment and appliances in their homes using a smartphone app or a web interface thanks to the fast expanding trend of home automation using NodeMCU. The ESP8266 Wi-Fi chip-based open-source development board NodeMCU provides a flexible and affordable option for creating home automation systems. This article provides a general overview of home automation using NodeMCU, outlining its goals, advantages, disadvantages, and implementation difficulties. The main elements of a NodeMCU-based home automation system, such as sensors, actuators, controllers, and user interfaces, are covered in this article, along with how they can be combined to produce a smooth and unique smart home experience. We also look at the various applications and use cases for NodeMCU-based home automation*

I. LITERATURE REVIEW

In the field of home automation and IoT (Internet of Things) applications, home automation with NodeMCU is a hot issue. Here is a quick review of the literature on the subject:

In their article "Smart Home Automation using NodeMCU and Google Assistant," writers Adil Hussain, Syed Muzamil Basha, and Mohammed Abdul Samiullah outline the creation of a smart home automation system utilising NodeMCU and Google Assistant. Users of the system can use Google Assistant to operate household equipment like lights, fans, and air conditioners by speaking commands. In a practical testbed, the authors show the system's viability and effectiveness.

The authors of "NodeMCU Based Home Automation System using Amazon Alexa," Hritvik Goyal and Aakanksha Pathak, suggest a home automation system that makes use of both NodeMCU and Amazon Alexa. Through Alexa, the system enables users to voice-command household appliances. The system's implementation and testing, as well as its hardware and software components, are all thoroughly described by the authors.

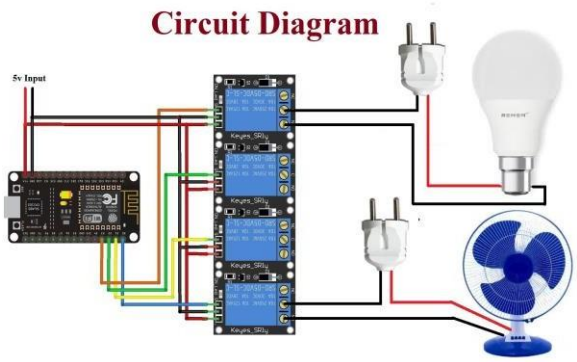
In their article "Home Automation Using NodeMCU and Mobile Application," authors Pavan Kumar G.V., Anitha K., and Mahadevappa M. outline a home automation system that makes use of NodeMCU and a smartphone application. Using a mobile app, the system enables users to operate home appliances including lights, fans, and curtains. In a practical testbed, the authors show the system's efficacy and usability.
The authors of "Implementation of a Smart Home Automation System Using NodeMCU and MQTT Protocol," Muhammad Khalid, Yasir Arfat, and Bilal Bashir, describe a smart home automation system that makes use of NodeMCU and the MQTT protocol. Through a web-based interface, the system enables users to remotely control home appliances. The system's usefulness is demonstrated in a practical testbed by the authors, who also assess the system's performance and efficiency.

In "Design and Implementation of a Smart Home System Using NodeMCU and Arduino," authors Ahmed Mahmoud, Ahmed K. Hassan, and Ahmed E. A. Ibrahim suggest an Arduino and NodeMCU-based smart home automation system. Users of the system can manage home appliances through a smartphone app or a web-based interface. The writers give a thorough explanation of the software and hardware the system's components, as well as how it was put into practise and tested.

Overall, these experiments show that employing NodeMCU in a variety of settings and applications, home automation is both practical and effective. They offer recommendations and insights for creating, implementing, and testing home automation systems that make use of NodeMCU and other IoT technologies.

CONSTRUCTION

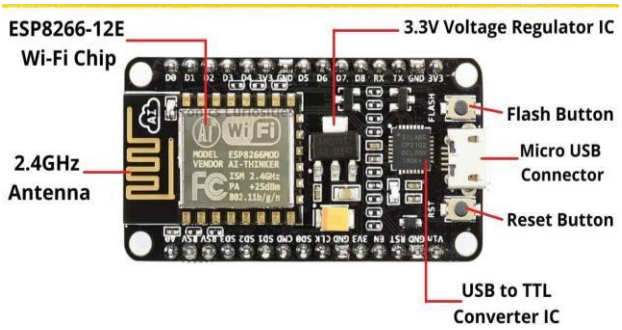
The creation of a home automation system utilising NodeMCU entails a number of procedures and elements, such as:



1.1 NodeMCU board:

Based on the ESP8266 Wi-Fi chip, the NodeMCU ESP8266 is a developer board. Espressif Systems unveiled the ESP8266, a low-cost Wi-Fi chip, in 2014. It has built-in Wi-Fi connectivity and is intended for Internet of Things (IoT) applications, making it simple to connect devices to the internet.

To make it simple for developers to create IoT applications utilising the ESP8266 chip, the NodeMCU ESP8266 board was created. It supports a variety of programming languages, including Lua, Arduino, and MicroPython, and has a USB interface for programming and debugging. Because NodeMCU is compatible with the Arduino IDE, beginning to work with the ESP8266 is simple for developers who are already familiar with Arduino.



Wi-Fi connectivity is already incorporated into the ESP8266 chip, making it simple to connect gadgets to the internet. It offers a variety of Wi-Fi security choices, including WPA/WPA2, WEP, and Open, and supports different Wi-Fi modes, including Access Point (AP) mode and Station (STA) mode.

A number of hardware functions, including as digital input/output pins, analogue input pins, PWM output pins, and a serial interface, are offered by the NodeMCU ESP8266 board. I2C, SPI, and UART are only a few of the communication protocols that are supported.

For IoT and do-it-yourself projects, such as home automation, smart lighting, environmental monitoring, and robotics, NodeMCU ESP8266 is frequently utilised. Because of its simplicity, adaptability, and low price, it is a well-liked platform among makers and hobbyists.

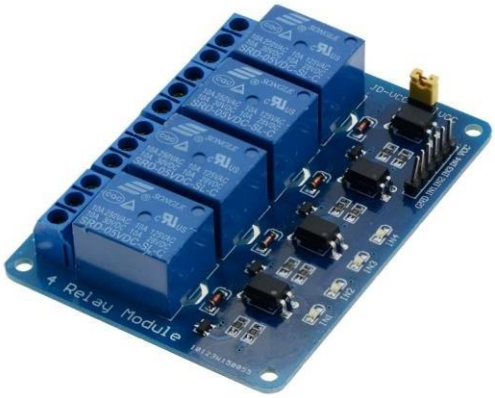
1.2 Relay Module

Relay modules are electronic devices that let you use low voltage signals to control high voltage electrical appliances. A relay, an electromechanical switch, and a related control circuit make up the device. A relay module is used in the home automation system using NodeMCU project to operate the electrical appliances such as lights, fans, and other connected devices.What you should know about relay modules is as follows:

Types: Relay modules come in a variety of varieties, including single, double, and multiple relay modules, among others. The amount of appliances you need to control will determine the sort of relay module you select.

Relay module operation: A low voltage signal from the NodeMCU board activates an electromechanical switch that makes up a relay module. The relay module turns on and off the high voltage power supply to the connected electrical device when it receives a signal.

Specifications: There are several specifications for relay modules, including input voltage, contact rating, and switching capacity. To make sure the relay module you choose can manage the necessary electrical load for your project, it's critical to choose the right specs.

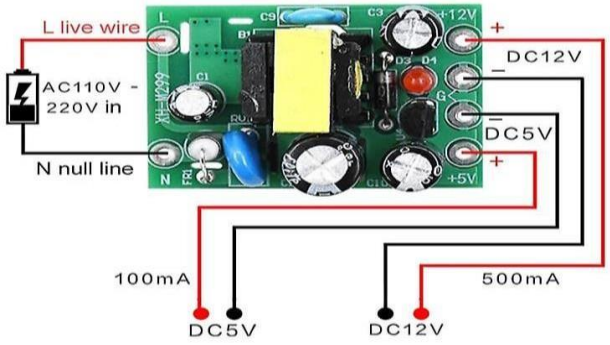


1.3 AC to DC converter:

An electronic device called an AC to DC converter transforms the alternating current (AC) voltage coming from a power source into a direct current (DC) voltage that may be

used to power electronic devices. Using an AC to DC converter, the high voltage AC power supply from the mains is transformed in the home automation system using NodeMCU project into a low voltage DC supply that can be used to power the NodeMCU board and other electronic components.

Different kinds of AC to DC converters are available, including linear regulators, switching regulators, and rectifiers that use transformers. The particular application and needs will determine the type of converter employed in your project.



1.4 Super Debug USB to Micro USB Cable wire for NodeMCU

A unique kind of cable is used for programming and debugging NodeMCU boards: the Super Debug USB to Micro USB Cable. You may upload code, check output, and debug your projects with the computer-connected NodeMCU board. Data transfer between the computer and the NodeMCU board is made reliable and steady by the cable's design.

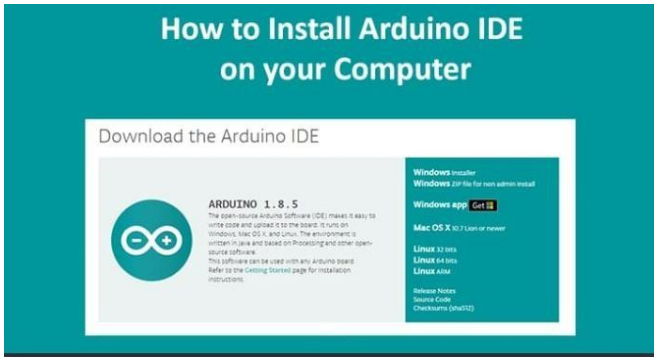
The NodeMCU board and the computer may be connected securely and reliably with the Super Debug USB to Micro USB Cable, enabling you to upload code and test your projects. Through the USB connection, it also powers the NodeMCU board.

1.4 Software Requirement:

Arduino IDE:

In addition to a text editor for writing code, a message area, a text console, a toolbar with buttons for frequently used operations, and a number of menus, the Arduino Integrated Development Environment, sometimes known as the Arduino Software (IDE), is also available. In order to upload programmes and communicate with them, it connects to the Arduino hardware.

Sketches are computer programmes created using the Arduino Software (IDE). These drawings are created in a text editor and saved as files with the.ino extension. The editor offers functions for text replacement and text searching. When saving and exporting, the message area provides feedback and shows errors. The console shows text generated by the Arduino Software (IDE), including error messages in their entirety and other data. The configured board and serial number are shown in the window's bottom right corner.



II. RESULT, CONCLUSION AND FUTURE SCOPE

1. Result

Implementing a home automation system with NodeMCU can lead to the following outcomes:

Enhanced convenience: Home automation enables users to manage all of their appliances and devices from a single interface, like a mobile app or voice command. By removing the need for manual control or switching between numerous devices, this can save time and effort.

Energy savings: By managing the lighting, temperature, and other devices based on occupancy, the time of day, and other variables, home automation can optimise the use of energy. This can lower electricity costs and reduce energy waste.

Enhanced security: By providing remote monitoring and control of security cameras, door locks, and other equipment,

home automation can improve the security of the house. This can provide homeowners peace of mind and serve to prevent burglars.

Increased usability and accessibility for those with impairments or limited mobility is possible with home automation. They may be able to use gadgets and appliances with ease and independence, without the need for manual assistance.

2. Conclusion

The NodeMCU home automation system is a cheap and adaptable option that gives users a simple and effective way to control their home appliances remotely. With the help of a mobile application, we have successfully created a home automation system that can turn appliances on and off in accordance with the preferences of the user.

We were able to build a very scalable and adaptable system using the NodeMCU board, relay module, and Super Debug USB to Micro USB Cable wire. We were able to operate the appliances thanks to the relay module and the NodeMCU board, which connected the system to the internet. The programming of the device was made easier with the Super Debug USB to Micro USB Cable.

3. Future Scope

Integration with AI and ML: NodeMCU-based home automation systems that have been integrated with AI and ML technologies are able to control home gadgets and appliances more intelligently and automatically. Based on user preferences and usage patterns, this may provide more individualised and adaptable control.

IoT ecosystem expansion: It is anticipated that NodeMCU-based home automation solutions will continue to be adopted and developed as the Internet of Things (IoT) ecosystem expands. This might result in additional features and functionality, as well as increased interoperability and compatibility with a larger selection of gadgets and appliances.

Voice control will be used more frequently in the future of NodeMCU-based home automation because it is getting more and more popular to use virtual assistants like Amazon Alexa and Google Assistant. Without the need for human input, this would make it possible to control home appliances and equipment in a more practical and straightforward way.

Smart homes and connected communities: More integrated and networked homes and communities, with shared infrastructure and resources, are predicted for the future of home automation utilising NodeMCU. This might open up new opportunities for things like community services, security, and energy management.

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