IOT Based Home Automation System

Submitted in partial fulfillment of the requirements

for the degree of

Bachelor of Engineering

Synopsis Report - Stage-I

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Certificate

This is to certify that the project entitled **IOT Based Home Automation System** is a bonafide work of **Ahir Chinmay Kailas (Roll No. 01)**, **Patil Manthan Sanjay (Roll No. 18)**, **Patil Harshal Shyam (Roll No. 17)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Under-graduate** in **DEPARTMENT OF INFORMATION TECHNOLOGY**.

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Examiners

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Abstract

The Internet of Things (IoT) has ushered in a new era of home automation, offering an extensive array of interconnected capabilities for households. An IoT-based home au- tomation system brings together a diverse range of devices, including lighting, heating and cooling systems, security cameras, door locks, and entertainment appliances, all ac- cessible through an internet connection. This system leverages sensors to gather data on environmental conditions and the status of devices, while actuators execute commands to control these devices. The central hub acts as the system's control center, processing data from sensors and sending control commands to actuators. This hub is typically linked to a user-friendly interface, which can be a mobile app or a web-based dashboard, allowing homeowners to manage their connected devices remotely.

The advantages of an IoT-based home automation system are multifaceted. Users can fine-tune the thermostat, adjust lighting, lock or unlock doors, and receive real-time alerts for various events, such as intrusions, leaks, or smoke detection, providing enhanced security and peace of mind. Moreover, automation and scheduling features enable energy savings and increased comfort by optimizing device usage. The system's ability to collect and analyze data also offers the potential for further customization and optimization of device settings based on usage patterns and preferences.

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Chapter 1

INTRODUCTION

1.1 Introduction

The Internet of Things (IoT) has catalyzed a transformative wave in the way we interact with our homes. IoT-based home automation systems have emerged as the vanguard of this technological revolution, offering homeowners unprecedented control and management of their living spaces. These systems enable the integration of various household devices and appliances, from lighting and climate control to security and entertainment systems, into a unified, interconnected network. By harnessing the power of the internet and smart technology, IoT-based home automation systems provide an advanced and intuitive solution for enhancing convenience, energy efficiency, and security within the modern household.Inthis age of digital connectivity, the home is evolving into a smarter and more responsive environment. An IoT-based home automation system leverages a myriad of sensors, actuators, a central hub, and user-friendly interfaces to create a seamless ecosystem. Sensors collect data on the surroundings and device status, while actuators execute commands to control and adjust these devices. The central hub acts as the control center, processing data and facilitating communication between devices, while users interact with the system through a user-friendly interface, often via a mobile app or a web-based dashboard.

1.2 Objectives

- Enable remote control of household devices for user convenience.
- Streamline daily tasks such as adjusting lighting, temperature, and security.

- Provide real-time monitoring and control of energy-consuming devices.
- implement automation and scheduling to optimize energy usage.
- Create a personalized and adaptable home environment.
- Gather data on device usage, user preferences, and environmental conditions.
- Develop intuitive and user-friendly interfaces, such as mobile apps and web dashboards.

1.3 Problem Statement

In today's fast-paced world, the demand for smarter and more efficient living spaces is on the rise. While IoT-based home automation systems offer great potential for enhancing convenience, energy efficiency, and security, several challenges persist in their implementation and use. The problem lies in ensuring the seamless integration of a diverse range of devices, maintaining robust security and privacy standards, addressing interoperabil- ity issues, and providing user-friendly interfaces. Additionally, as these systems become increasingly complex, there is a growing need for clear and comprehensive data handling practices to safeguard user information. Thus, the problem to be addressed is to develop and implement IoT-based home automation systems that are highly efficient, secure, user-friendly, and capable of seamless device integration, all while prioritizing user data privacy and providing a reliable and adaptable user experience.

1.4 Purpose andScope

The description of Purpose, Scope are given below:

1.4.1 Purpose

The purpose of an IoT-based home automation system is to provide homeowners with advanced control, convenience, and efficiency in managing their living spaces. This technology aims to streamline daily tasks, optimize energy usage, enhance security, and improve comfort by enabling remote control and automation of various household devices and systems. Additionally, it collects and analyzes data to offer insights for further customization, contributing to sustainability and creating a smart and connected living environment.

1.4.2 Scope

The aim is to design a prototype that establishes wireless remote control over a network of home appliances. The application is designed to run on android device providing features like, switch mode control, voice command control and a provision to view the status of the devices on the application itself. Considering its wide range of application, following are the scope of this prototype. The system can be implemented in homes, small offices and malls as well, being in-charge of control of the electrical appliances. For remote access of appliances in internet or intranet. The appliances in the above mentioned environment can be controlled in intra-network or can be accessed via internet. The development of technology friendly environment. The system incorporates the use of technology and making HAS. By the use of day to day gadgets we can utilize them for a different perspective.

Chapter 2

LIRERATURE SURVEY

"Smart Energy Efficient Home Automation System using IOT", by Satyendra K. Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra. This paper presents a step-by-step procedure of a smart home automation controller.It uses IOT to convert home appliances to smart and intelligent devices, with the help of design control. An energy efficient system is designed that accesses the smart home remotely using IOT connectivity. The proposed system mainly requires, Node MCU as the microcontroller unit, IFTTT to interpret voice commands, Adafruit a library that supports MQTT acts as an MQTT broker and Arduino IDE to code the microcontroller. This multimodal system uses Google Assistant along with a web based application to control the smart home. The smart home is implemented with main controller unit that is connected with the 24-hour available Wi-Fi network. To ensure, that the Wi-Fi connection do not turn off, the main controller is programmed to establish automatic connection with the available network and connected to the auto power backup

"IOT Based Smart Security and Home Automation", by Shardha Somani, Parikshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Laturkar.
This paper focuses on a system that provides features of Home Automation relying on IOT to operate easily, in addition to that it includes a camera module and provides home security. The android application basically converts Smartphone into a remote for all home appliances. Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of house entrance in real time. This notification will be received by the owner of the house via internet such that app can trigger a notification. So owner can raise an alarm in case of any intrusion or he/she can toggle the appliances like opening the door if the person is a guest. The system

uses Raspberry Pi, a small sized computer which acts as server for the system. The smart home consist two modules. Home automation that consists; fan light and door controller, and security module that consists; smoke sensor motion sensor and camera module.

"A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System", by Tui-Yi Yang, Chu-Sing Yang, Tien-Wen Sung.

This paper proposes an optimization of home power consumption based on PLC (Power Line Communication) for an easy to access home energy consumption. This also proposes a Zigbee and PLC based renewable energy gateway to monitor the energy generation of renewable energies. ACS and DDEM algorithm are proposed for the design of an intelligent distribution of power management system to make sure ongoing power supply of home networks. To provide efficient power management the power supply models of home sensor network are classified groups viz. main supply only, main supply and backup battery, rechargeable battery power and non-rechargeable battery power. Devices with particular features are assigned to these groups. It targets to establish real time processing scheme to address variable sensor network topologies.

"Enhance Smart Home Automation System based on Internet of Things", by Tushar Churasia and Prashant Kumar Jain.

This paper proposes a system that develops a model to reduce the computation overhead in existing smart home solutions that uses various encryption technologies like AES, ECHD, hybrid, etc. these solutions use intermediate gateway for connecting various sensor devices. The proposed model provides a method for automation with sensor based learning. The system uses temperature sensor for development but other sensors can also be used as per requirement. These smart home devices with sensors can configure themselves autonomously and can operate without human intervention. This work minimizes encryption decryption and focuses on authentication and automation of smart home devices with learning. The system bypasses local gateway mentioned in existing system to provide better security for smart home devices and sensor data and save computation overhead. The real time broker cloud is directly connected with smart home and manages all incoming and outgoing request between users and devices. The main purpose to use real time brokercloud is save time of cryptographic operations.

Chapter 3

REQUIREMENTS

3.1 Hardware Requirements

3.1.1 NodeMCU

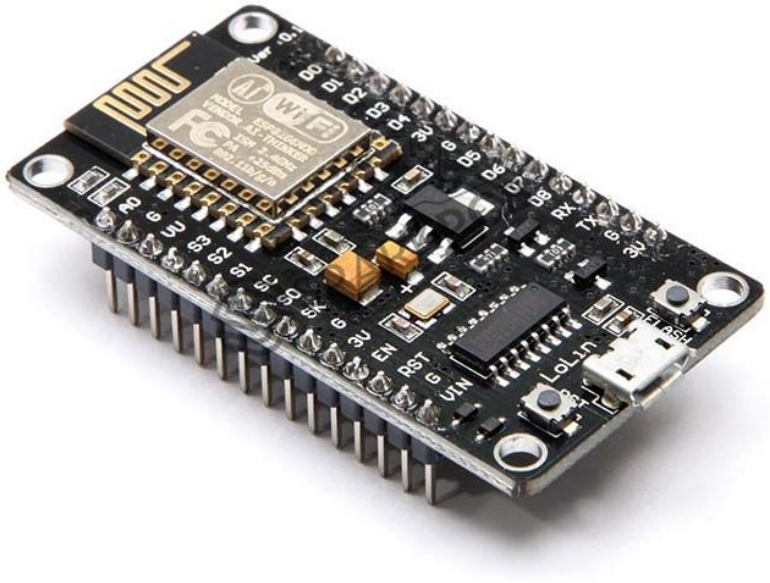

FIGURE 3.1: NodeMCU

3.1.2 4 channel 5v relay

FIGURE 3.2: 4 channel 5v relay

3.1.3 Jumper wires

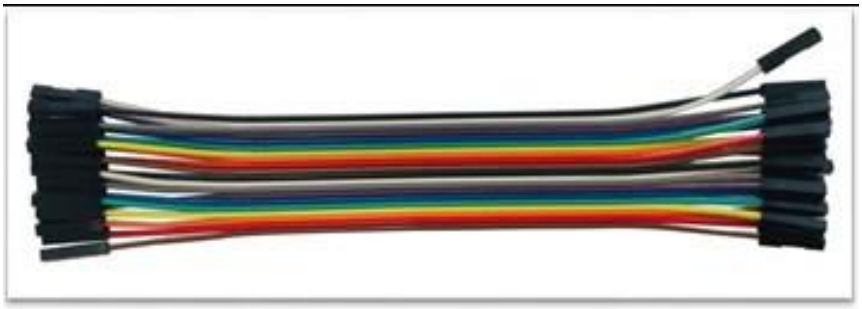

FIGURE 3.3: Jumper wires

3.1.4 Bulb

FIGURE 3.4: Bulb

3.1.5 Bulb holder and wire pin

FIGURE 3.5: Bulb holder and wire pin

3.2 Software Requirements

3.2.1 Blynk

FIGURE 3.6: Blynk

Chapter 4

THEORY

4.1 HARDWARE THEORY

4.1.1 NODEMCU/ESP8266

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires,with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the “computer” on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students whowant to experiment with it in their own IoT projects.

But, what about Arduino? The Arduino project created an open-source hardware design and software SDK for their versatile IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, LED lights, and standard data pins. It also defines standard interfaces to interact with sensors or other boards. But unlike NodeMCU, the Arduino board can have different types of CPU chips (typically an

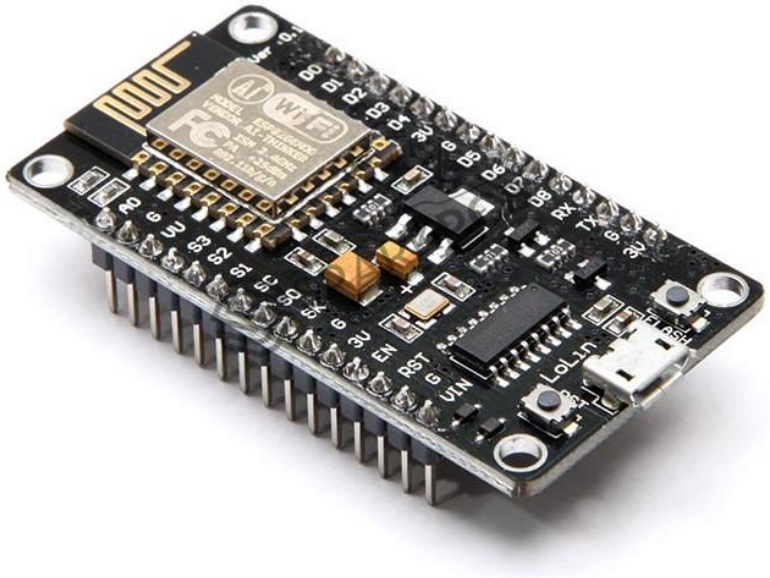

FIGURE 4.1: NodeMCU

ARM or Intel x86 chip) with memory chips, and a variety of programming environments. There is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant variations across different vendors. For example, most Arduino boards do not have WiFi capabilities, and some even have a serial data port instead of a USB port.

4.1.2 Specifications in NodeMCU

- There are four power pins. VIN pin and three 3.3V pins. VIN can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on VIN is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the VIN pin 3.3V pins are the output of the onboard voltage regulator and can be used to supply power to external components.
- GND are the ground pins of NodeMCU/ESP8266

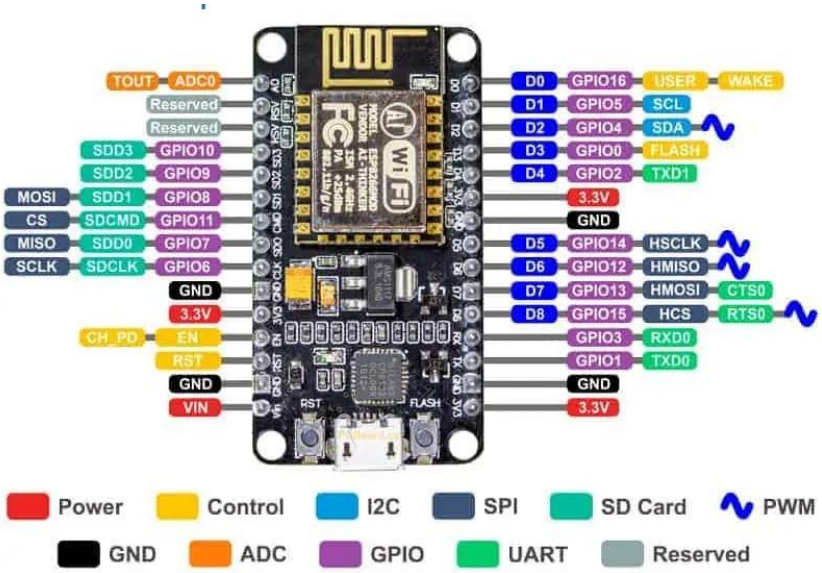

FIGURE 4.2: Specifications in NodeMCU

- I2C Pins are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

- GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.

- ADC Channel The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

- UART Pins NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communi- cate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.

- SPI Pins NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features: 4 timing

modes of the SPI format transfer Up to 80 MHz and the divided clocks of 80 MHz Up to 64-Byte FIFO

- SDIO Pins NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.
- PWM Pins The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 s to 10000 s (100 Hz and1 kHz).
- Control Pins are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin. EN: The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power. RST: RST pin is used to reset the ESP8266 chip. WAKE: Wake pin is used to wake the chip from deep-sleep.

4.1.3 5V Four-Channel Relay Module

FIGURE 4.3: 5V Four-Channel Relay

The four-channel relay module contains four 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections. There are two terminal blocks with six terminals each, and each block is shared by two relays. The terminals are screw type, which makes connections to mains wiring easy and changeable.

The four relays on the module are rated for 5V, which means the relay is activated when there is approximately 5V across the coil. The contacts on each relay are specified for 250VAC and 30VDC and 10A in each case, as marked on the body of the relays.

The switching transistors act as a buffer between the relay coils that require high currents, and the inputs which don't draw much current. They amplify the input signal so that they can drive the coils to activate the relays. The freewheeling diodes prevent voltage spikes across the transistors when the relay is turned off since the coils are an inductive load. The indicator LEDs glow when the coil of the respective relay is energized, indicating that the relay is active. The optocouplers form an additional layer of isolation between the load being switched and the inputs. The isolation is optional and can be selected using the VCC selector jumper. The input jumper contains the main VCC, GND, and input pins for easy connection using female jumper wires.

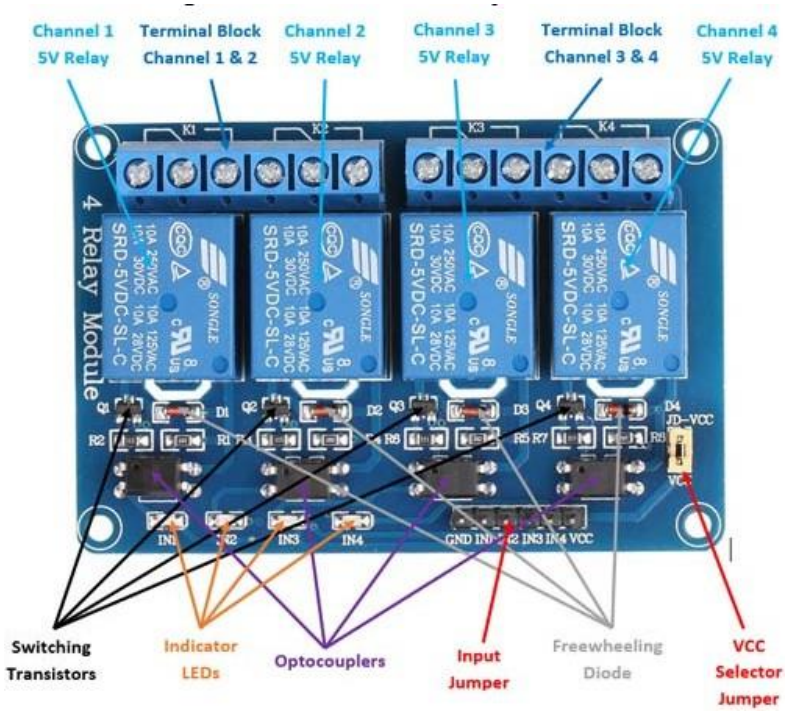

FIGURE 4.4: Specifications in 4channel 5v relay

4.1.4 Specifications in 4channel 5v relay

supply voltage – 3.75V to 6V

Trigger current – 5mA

Current when the relay is active - 70mA (single), 300mA (all four)

Relay maximum current – 10A

Relay maximum contact voltage – 250VAC, 30VDC

4.2 SOFTWARE THEORY

4.2.1 Blynk

FIGURE 4.5: Blynk

Blynk is a comprehensive software suite that enables the prototyping, deployment, and remote management of connected electronic devices at any scale. Whether it's personal IoT projects or commercial connected products in the millions, Blynk empowers users to connect their hardware to the cloud and create iOS, Android, and web applications, analyze real-time and historical data from devices, remotely control them from anywhere, receive important notifications, and much more Blynk.Console is a feature-rich web application catering to different types of users.

Chapter 5

SYSTEM DESIGN

5.1 Architecture design

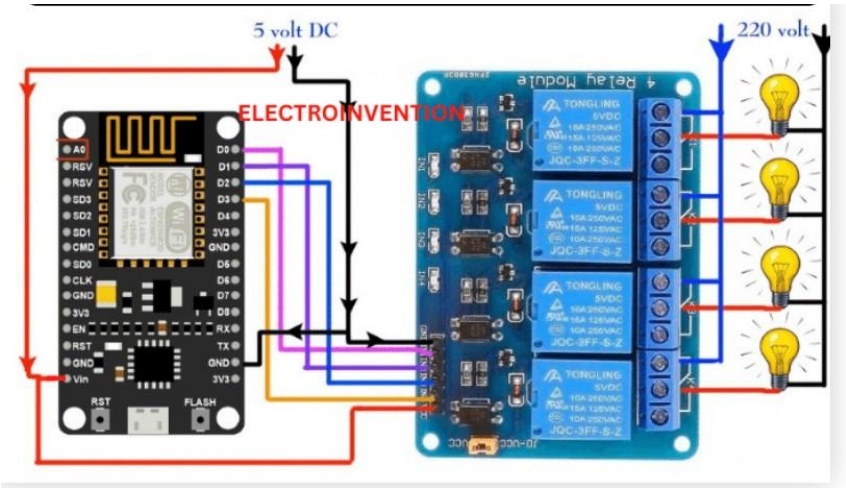

FIGURE 5.1: Architecture design

5.2 Block diagram

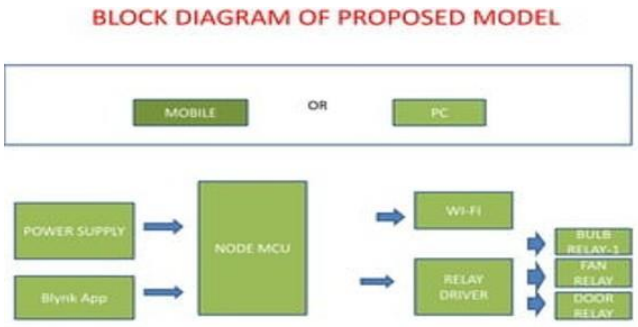

FIGURE 5.2: Block Diagram

5.3 Use case diagram

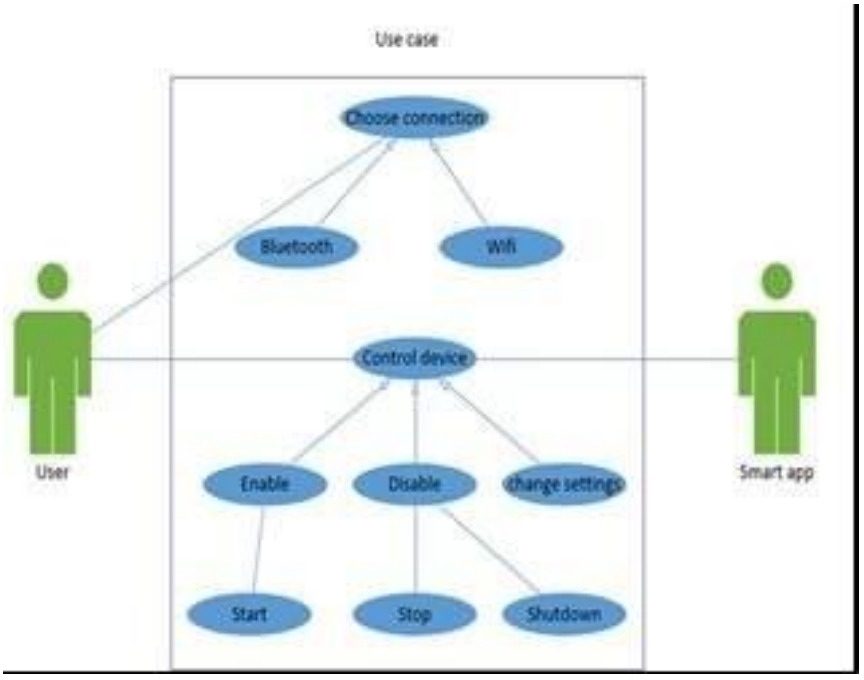

FIGURE 5.3: Use case diagram

5.4 UI Design

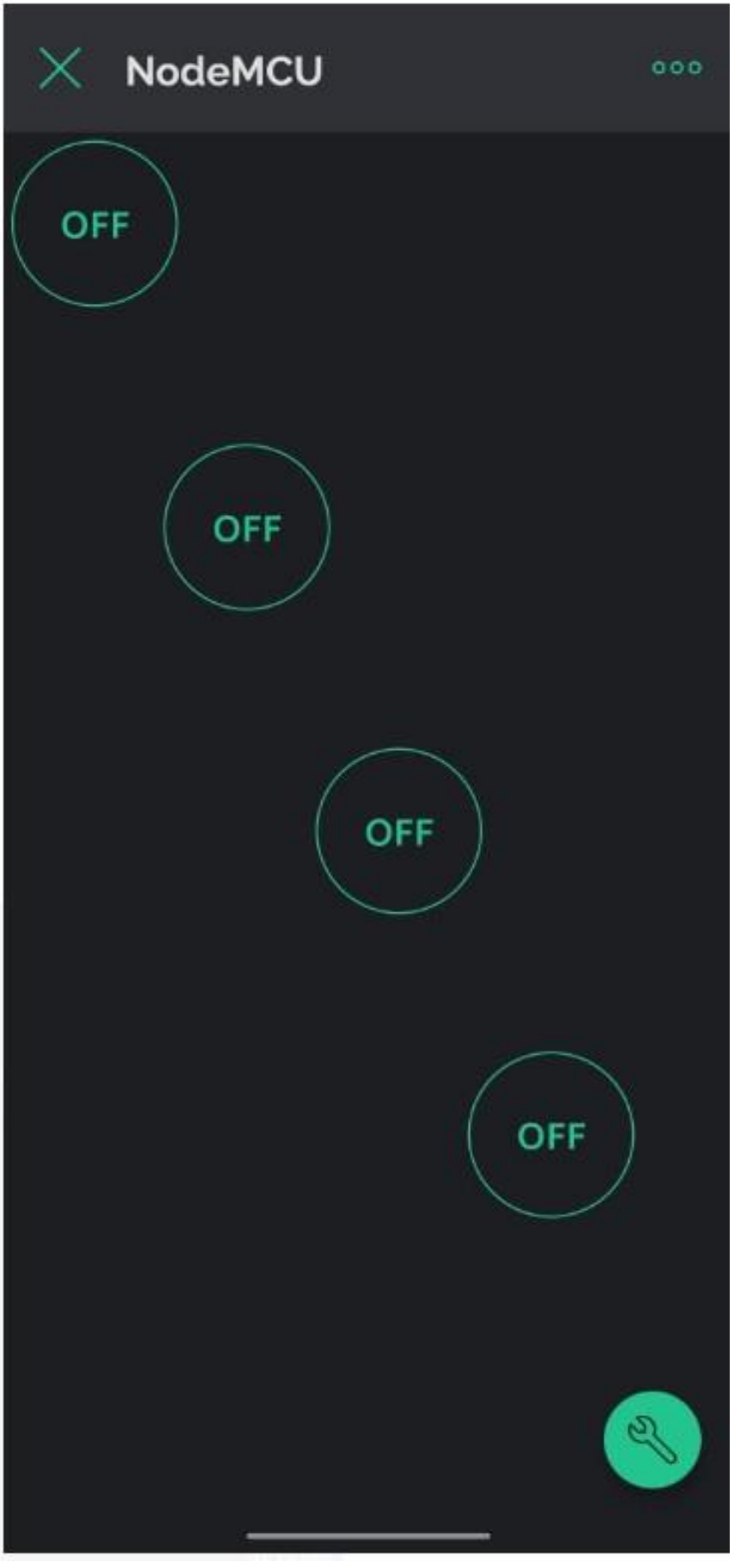

FIGURE 5.4: UI Design

5.5 Result

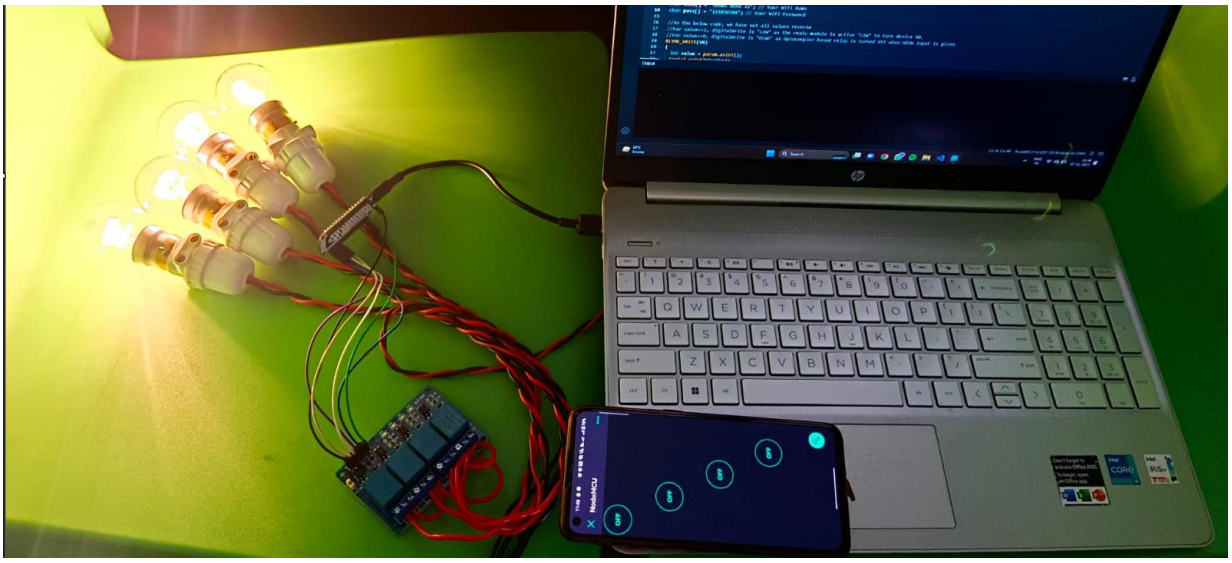

Figure 5.5 Result

Chapter 6

FUTURE ENHANCEMENTS

The future of IoT-based home automation systems holds a promise of remarkable enhancements. These include AI integration for intelligent decision-making and personalization, energy harvesting technologies for self-sustaining systems, voice and natural language processing for more intuitive interactions, edge computing to reduce latency and enhance responsiveness, health and wellness monitoring for occupant safety, integration of smart appliances and furniture, environmental sustainability features for eco-friendly living, blockchain for robust security, 5G connectivity for faster data transfer, AR and VR integration for immersive experiences, interoperability standards for seamless device integration, enhanced privacy controls, novel human-machine interaction modes, multi-modal interfaces, global integration for remote property management, and more. These advancements collectively aim to create a future where homes are not just smart but increasingly adaptable, secure, and tailored to the unique needs and preferences of their residents.

Chapter 7

CONCLUSIONS

7.1 Conclusion

In conclusion, the combination of NodeMCU and Blynk in IoT-based home automation systems represents a powerful and accessible way to bring smart functionality to our homes. NodeMCU's compatibility with Blynk, a user-friendly mobile app platform, offers a cost-effective and flexible solution for controlling and monitoring various devices remotely. Whether it's controlling lights, monitoring temperature, or ensuring home security, this dynamic duo empowers homeowners to create a connected and responsive living environment.

The ease of use and extensive library support of NodeMCU make it an ideal choice for IoT enthusiasts, while Blynk's intuitive interface simplifies the process of creating custom user interfaces and interaction with IoT devices. Moreover, the cloud-based nature of Blynk allows homeowners to manage their homes from anywhere with an internet connection, offering convenience and peace of mind.

As technology continues to advance, NodeMCU and Blynk's compatibility will open the door to even more sophisticated home automation projects. With enhancements such as AI integration, enhanced security, and expanded device compatibility, the future of IoT- based home automation systems using NodeMCU and Blynk promises to be even more exciting and accessible. It will enable homeowners to lead more connected, efficient, and secure lifestyles while enjoying the convenience of remote control and monitoring.

Chapter 8

BIBLIOGRAPHY

- "Smart Energy Efficient Home Automation System using IOT", by Satyendra K. Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra.
- "IOT Based Smart Security and Home Automation", by Shardha Somani, Parikshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Laturkar.
- "A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System", by Tui-Yi Yang, Chu-Sing Yang, Tien-Wen Sung; in 2016 Third International Conference on Computing Measurement Control and Sensor Network.
- "Enhance Smart Home Automation System based on Internet of Things", by Tushar Churasia and Prashant Kumar Jain; in Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019) IEEE Xplore Part Number:CFP19OSVART; ISBN:978-1-7281-4365-1