Node MCU enabled Smart Home Automation for Security enhancement System

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ABSTRACT:

The development of technology has been raised the utilization of power required locally and globally which lead to a dramatically increases in demand for electric power. Common issues include inefficient energy use, peak demand challenges, environmental effects, and limited incorporation of the sustainable resources. The problem statement for smart home automation using Node MCU revolves around optimizing energy consumption in residential settings. Traditional energy distribution systems lack the flexibility and efficiency that is needed to adapt to the dynamic energy demands of modern homes. This research presents a comprehensive solution that optimize energy consumption in smart homes by operating them either through application or manually. Key components include sensors and IOT devices for data collection, advanced data analytics and machine learning for insights, automation of appliances and lighting systems, combine energy storage solutions. This integrated approach enables thereby enhance energy efficiency and easy accessing of appliances. This study deals with the implementation of smart home automation system with numerous advantages. It considerably reduces energy waste, leading to cost savings for homeowners while minimizing environmental impact that reduces the risk of blackouts during peak demand. Moreover, the system fosters energy independence by integrating renewable sources, and simplifies the regular life through automations such as home appliances operatedusing smartphone. The proposed smart home automation system using Node MCU addresses long-standing issues in residential energy management, offering a transformative solution that benefits the homeowners, the environment. This research contributes to a more sustainable and efficient energy future for homes worldwide.

Keywords: IOT (Internet of Things), App-Based Automation,Local automation.

I. INTRODUCTION:

Internet of Things (IOT) technologies has revolutionized several aspects of daily life, with smart home automation being a prominent application. IoT devices has the ability to interchange contents based on function control in a predetermined way. IOT networks have the advantage of being able to create and separate information by managing, extracting, filtering, and marking data [1]. This paper introduces a novel approach to smart home automation using node MCU, an open-source IOT platform based on the ESP8266 WI-FI module which describes the numerous

possibilities of connecting small devices and make it easier to human life. Relays are used to control high voltage loads by using the low voltage supply. Through internet connectivity, IOT virtually contributes to the creation of smart surroundings. The proposed system aims to provide users with enhanced convenience, efficiency, and control over their home environment through seamless integration of IOT devices and intelligent automation[2].

The advantages of smart home automation are as follows:

1. **Convenience:** Users can control their home appliances from anywhere with an internet connection enhancing convenience and flexibility.
2. **Wireless connectivity:** Utilizing Node MCUs built-in wi-fi capabilities to connect and control various smart devices within the home network.
3. **Energy efficiency:** Automation and scheduling can help optimize energy usage leading to potential cost savings and environmental benefits.
4. **Remote monitoring:** Users can remotely monitor the status of their home appliances providing peace of mind and enabling quick troubleshooting if issues arise.
5. **Security:** Implementing security measures to protect the smart home system from unauthorized access or cyber-attacks such as encryption and authentication protocols.

The Software that is required for this project is "Blynk App" which is used to control the appliances remotely through the smart phone by using this app. Here the smart phone is connected through the internet via Node MCU[3].

II. RELATED WORK

Advanced Technology is a major factor in the automation of human life. Humans are being manipulated by automated devices and the internet these days. Smart homes mean not only the communication between the hardware and software through internet but also the security systems which include the safety linking between the appliances. We have done good research on the smart home automation system previous papers and came with this ideology and developing this project. Here is the some of the previously existed papers related to this project.

One of the works is by "Vinay Sagar K. N" described two methods for implementing home automation: Bluetooth and Ethernet. Several gadgets may be programmed and controlled with Arduino. For short-range communication, use Bluetooth. Therefore, with a smart home with Bluetooth integrated, one can only control the equipment from within 10 to 20 meters of their home. The following architecture has used Ethernet to get around this restriction. This study did not address security features; it merely covered how to use mobile apps to control various electronic gadgets in the home[4]. Another project, "Urvi Singh" in their work, described how they implemented a project that involved the arrangement of sensors to measure a range of factors, including temperature and moisture content, as well as to detect levels of CO and NO2 gases to monitor the environment in parks and gardens[5]. "Tushar Chaurasia" their paper explored several Android apps that can be used to connect a variety of devices to the Internet, as well as the manual and automatic ways of operation[6]. We came up with an approach that is implementing the smart home automation using Node MCU i.e., the appliances can be operated through the app or either by manually through switches[7]. whenever the loads are operated manually then the data is updated in the web of the application. Here in this project, we have added one IR sensor which is used to operate the load automatically by detecting the object.

III. PROPOSED WORK

This section provides information on how a household automation works. This paper proposes internet of things (IOT) project which utilizes a Node MCU to create an IOT-based project which is automating your home with the aid of software Blynk app and four channel relays. The system can operate several

household gadgets via smartphone or in the event the internet is unavailable, manual switches are utilized. It consists of several components including loads, Node MCU, IR sensor, four channel relays and the Blynk app. In this suggested project loads could be of lightbulbs, fans & additional household loads. A) Manual-based home automation B) App-based household automation are two ways the household gadgets can be operated.

A. Manual Based Automation:

It is a one method of operating household gadgets through switches. It can be utilized both in situations when internet access is unavailable and in situations where it is with this method a person cannot remotely manipulate or manage household gadgets. This project involves an incorporation of Manual & App-based home control with a single infrared sensor this allows for the automatic management of a single load through the sensor and the updating of web data anytime when an appliance is manually managed.

B. App-Based Automation:

It is an alternate way to use Blynk app to automatically operate andcontrolhousehold appliances through Node MCU. The appliances and smartphone are linked wirelessly reducing power consumption is possible by remotely operating the household gadgets via smartphone. Four channel relays are utilized to control high voltage equipment by taking low voltage input.

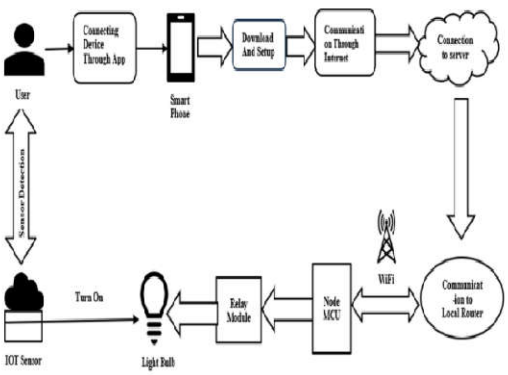

Figure 1 *Block diagram ofNode MCU enabled Smart Home Automation for security enhancement system*

a) System functions:

The required hardware components for this project are:

1. Node MCU (ESP8266)
2. 4 channel 5v Relay Module
3. Switches or Push Buttons
4. IR Sensor
5. Smart Phone
6. Node MCU Baseboard
7. Lamp Loads
8. 12v DC supply
9. Connecting wires

i. Node MCU Specifications:

1. **Microcontroller:**ESP8266operating at 2.4GHz.
2. **Voltage:** It operates at voltage of 3.3V.
3. **Memory:**4 MB of Flash memory and 64 KB of RAM.
4. **I/O Pins:** It has 1 Analog pin and 17 GPIO/PWM pins.
5. **Speed:** It operates with the clock frequency of 80MHz.
6. **Wi-Fi:** Speed of wi-fi in ESP8266 is 2Mbps.

ii. Relay Module Specifications:

1. **Supply voltage:**4V to 6V
2. **Relay active current:** ~70mA
3. **Passive current**: 2mA
4. **Relay maximum current:**9 - 10A
5. **Relay maximum contact voltage:** 250VAC / 30VDC

iii. IR Sensor Specifications:

1. **Model/Type:**LM393
2. **Working voltage**: 3.3 to 5V DC
3. **Working Current:**~23 mA to~43mA
4. **Perception range**: 2cm – 30cm

5. **Active output level:**The output is "0" (Low) when an obstacle is detected.

IV. RESULTS AND DISCUSSION

The mainobjective of this smart home system is utilize a smartphone to remotely control household electronics including fans, lights, air conditioners, and more. Anyone can remotely operate electronic gadgets in their home by utilizing the Blynk app on their android device. Everyone in the family can share the Blynk app, which will notify the other members when someone turns on a lamp, fan, or other appliance and make them aware of how to use it.

The Node MCU itself connects to the Blynk cloud. Whenever a Wi-Fi presents anyone able to manage relay modules from any position throughout the world via internet & can be able to observe the real-time changes in Blynk IOT application.

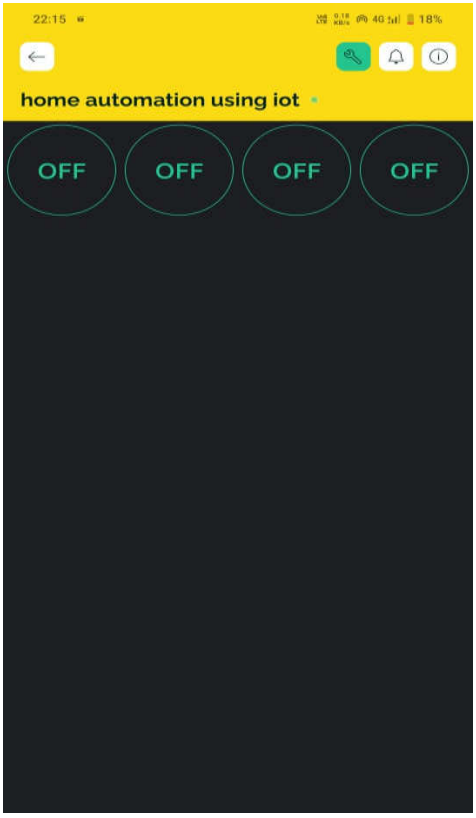

Figure 2: Blynk app Layout

The above figure 2 represents that the Blynk app with four switches which are initially OFF condition. Through thisapplication we can control/manage the loads even remotely.

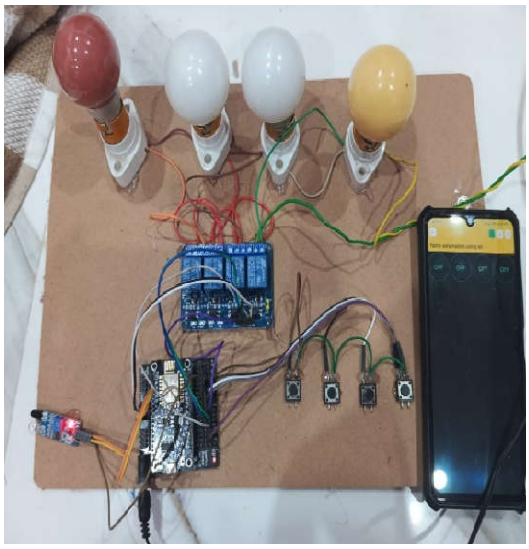

Figure 3: Loads in OFF condition

Figure 3 gives the information about the project with four loads in OFF conditions. IR sensor is used to detect the condition of the load i.e., whether the load is ON/OFF.

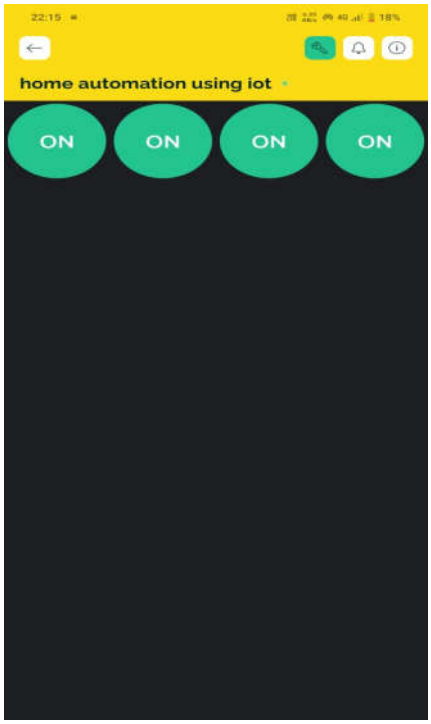

Figure 4: Loads are activated as ON in Blynk

The above figure 4 represents that whenever the switches are operated as ON conditionthen the loads are got ON as thoseare controlled by the user through Blynk App.

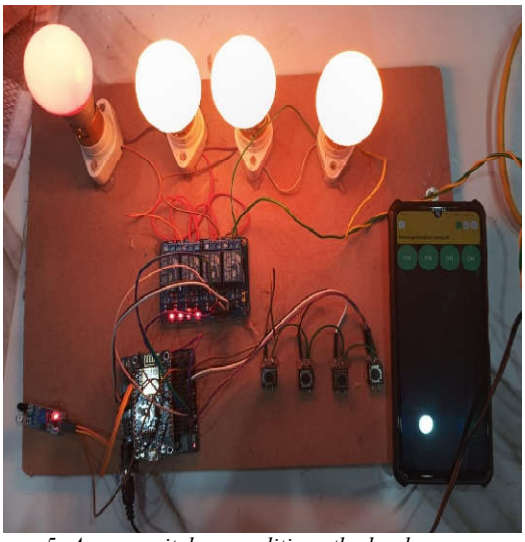

Figure 5: As per switches conditions the loads are operated

As the switches related to the loads are operated in the Blynk server app by the user the loads get controlled. Since all loads are ON in the Blynk app hence all theload gets ON automatically, is shown in the above figure 5.

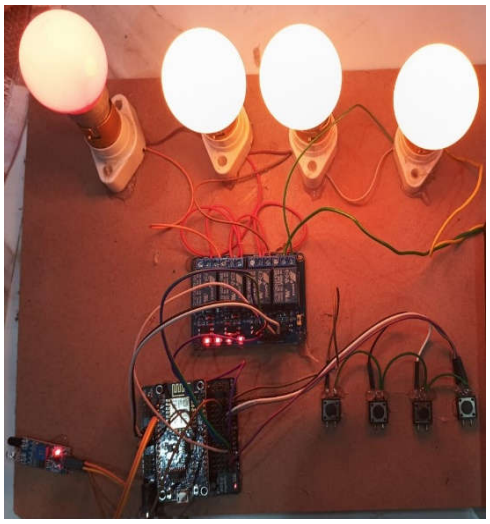

Figure 6: Operated loads manually through switches

Even in this project we have added that when the switches are operated manually then the information changed will be updated in the Blynk server app which means that if any of the load is switched ON manually when the switch is in OFF condition initially is sensed by the IR sensor and then the load button related tothat load in Blynk app will be updated to ON.

The updated data is shown in the above figure in above figure i.e., since all the loads are switched ON hence all the buttons are updated to ON condition.

V. CONCLUSION

This project uses Node MCU board with internet ability and a variety of sensors that can be controlled remotely by an android OS smartphone to create a flexible and affordable household control and monitoring system. In this user interface hardware equipment are connected by the Node MCU micro-controller. It is configured and linked to several elements based on the specifications. A tiny web server called an application layer allows remote users to communicate with home gadgets like security systems. The internet is used to enable communication throughout the entire system. The user can identify information in the Blynk application on their smartphone. Home gadgets can also be controlled wirelessly or automatically through numerous sensors like temperature sensors and LDRs.

VI. FUTURE SCOPE

Smart Home Automation can be able to monitor/ observe what happens in once house even when they are away from their house by using smartphone/ tablet via Blynk app.

In 21st century, most of the houses are having luxurious devices like Televisions, Air Conditioners, Fans etc.

In previous days, to control these devices human interaction is required. Later changes in the technology smart homes came into exist which means household gadgets are operated by the smartphone through internet which is the project discussed above.

As a future scope, the household appliances like smart locking, loads control, etc., can also be controlled through remote and can also be controlled through the voice of the user.

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