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Internet of Things Based Home Automation UsingBlynk Application.

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ABSTRACT
Internet of Things (IoT) has brought significant advancements to home automation, enabling users to control appliances remotely and enhance energy efficiency. Therefore, this study presentsthe design and implementation of an IoTbased home automation system using the Blynk platform. The system comprises hardware and the software development units. The hardware development involves the construction of the system circuitry modules, whereas the software development unit involves the design and development of theBlynkapplication to remotely monitor and control the home appliances.Four electrical appliances were utilized to determine the performance of the proposed study. Experimental results obtained showed that the developed system has an acceptable level of functionality, as it efficiently monitors and controls the status of the applied loads. Thus, empowers users to manage appliances from a smartphone application, thereby offering convenience and energy conservation.

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I. INTRODUCTION

The massive development in technology has resulted to the rise in demands for more comfort in our day to day activities. This comfort can be classified under various categories. Among these categories, the most paramount ones are the thermal comfort, visual comfort, and hygienic comfort(Satheeskanthet al., 2022). The thermal comforthas to do with ambient temperature and humidity, while the visual and hygienic comfortshave to do withthe environment colors, lightning and air quality. Monitoring and controlling such conditions can be achieved using automation system.

Automation systemis the process of managing electrical appliances automatically.Some of the areas of application include homes, hospitals, transportations, sports, and industries. Among the aforementioned areas, home automation has proven to be more beneficial due to its affordability, safety and security features. Nowadays, home automation has become more advanced and efficientin monitoringas well as controlling all the home appliances. In addition, home automation system provides energy efficient and highly approachable smart home technique as it involves basic features to maintain the user satisfaction and comfort(Rao et al., 2022).For example, home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise need caregivers or institutional care.

There exist various types of home automation techniques. These systems were typically designed and purchased for different purposes. In this regard, a smart home control and monitoring system using Arduino Uno was presented(Badabaji&Nagaraju, 2018). Thebasic idea of the study was to control different home appliances and provide security with the aid ofthe Arduino Uno controlled from a desktopapplication. The main function of the systemwas tomanage lighting, habitat security, and temperatureas well as humidity control. The authors used the desktop application to interact with the Arduino througha serial port. However, some of the setbacksof the existing systemsarelimitation in the range of interconnectivity, lack of remote based control operation, and design complexity.Therefore, this study presents the design and implementation of a simple IoT based home automation system usingBlynkapplication**.**

In this present study,Blynk IoT platform is designed to providereal time controlling and monitoring of the home appliances.Furthermore, the system is designed to cover long range of interconnectivity and providea user friendly interface on the host side, so that the devices can be easily setup, monitored and controlled.The rest ofthe paper is structured as follows: Section 2 presents the concept of IoT, materials and method used are presented in section 3, section 4 presents the experimental results, while conclusions are done in section 5.

II. CONCEPT OF INTERNET OF THINGS

The Internet of Things (IoT) relates the network of physical objects that are embedded with sensors, software and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. In addition, allows devices to be connected and remotely monitored across the internet(Yahya et al., 2023).

The IoT ecosystem as shown in Figure 1 consists of web-enabled smart devices that uses embedded systems, such as processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information gotten from one another. The devices do most of the work without human intervention(Nord et al., 2019).

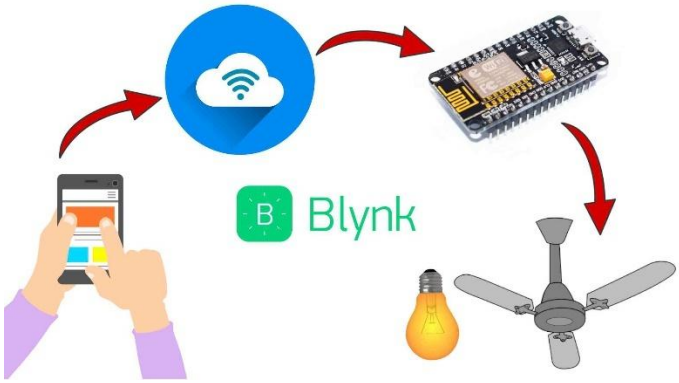

Figure 1: IoT System

III. MATERIAL AND METHODS

This section presents the materials used and the methodology followed for the realization of the proposed system.

3.1 Materials

In this section, the major materials utilized for the implementation of the proposed system are presented.

3.1.1 ESP 8266

An ESP 8266 was employed to serve as the central controller of the entire system. The ESP 8266 is a low-cost, low-power system on a chip microcontroller with integrated Wi-Fi and dual-mode Bluetooth. It can perform as a complete standalone system or as a slave device to a host microcontroller unit (Pravalika & Prasad, 2019). Figure 2 presents the diagram of the ESP 8266 microcontroller.

Figure 2:ESP 8266

3.1.2 **Relay**Module

The relay module is an electromechanical switch that open and close (On and Off), it controls a high voltage source using a low voltage source (Afzal et al., 2021). The relay completely isolates the low voltage source from high voltage source. However, it connects and disconnects two voltage sources using an electrical signal to control the electromagnet, which in turn connects and disconnects the voltage sources. Relay modules

are used for a wide range of application such as home automation, automobile, industrial applications, etc. Figure 3 shows a sample diagram of a relay module.

Figure 3:Relay Module

3.2 Proposed Methodology

This section present the step by step procedure followed in the design and implementation of the proposed system. The proposed system is carried out in two phases namely; the hardware implementation phase and the software implementation phase.

3.2.1 Hardware Implementation

This unit involves the implementation of the system circuitry modules. The overall hardware implementation of the proposed system is presented in Figure 4.

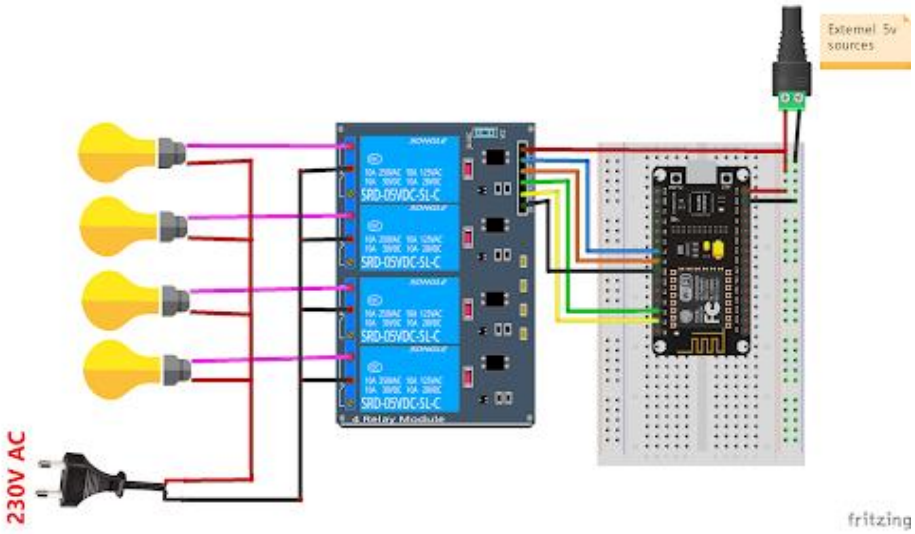

Figure 4:Hardware Implementation Circuit

Figure 4 presents the connections of the various components used for the realization of the hardware part of the system. The hardware component of the system consists of the ESP8266 microcontroller, which acts as the central processing unit (CPU) of the system. The ESP8266 is a low-cost, Wi-Fi enabled microcontroller that can be easily programmed using the Arduino IDE. The ESP8266 communicates with the home appliances using various protocols, such as Infrared (IR) or Radio Frequency (RF) communication. To control the appliances, the ESP8266 is connected to a four channels relay module that switches the appliances ON or OFF based on the user's commands.The relay module is then connected to the ESP8266 via GPIO pins, and the appliances are connected to the relay module output terminal.Furthermore, the overall system is been powered by a 5v power supply.

3.2.2 Software Implementation

The software component of the system involves the utilization of a Blynk application to develop a multi-platform application for controlling the appliances. TheBlynk application allows developers to create high-performance, visually attractive applications for both Android and other platforms. The application is designed to provide users with an easy-to-use interface for controlling the appliances. The user can turn ON or

OFF the appliances, set timers, and create custom schedules for the appliances. The application communicates with the ESP8266 using Wi-Fi, and the ESP8266 responds to the user's commands by switching the appliances ON or OFF. Figure 5 presents the user interface of the developed application.

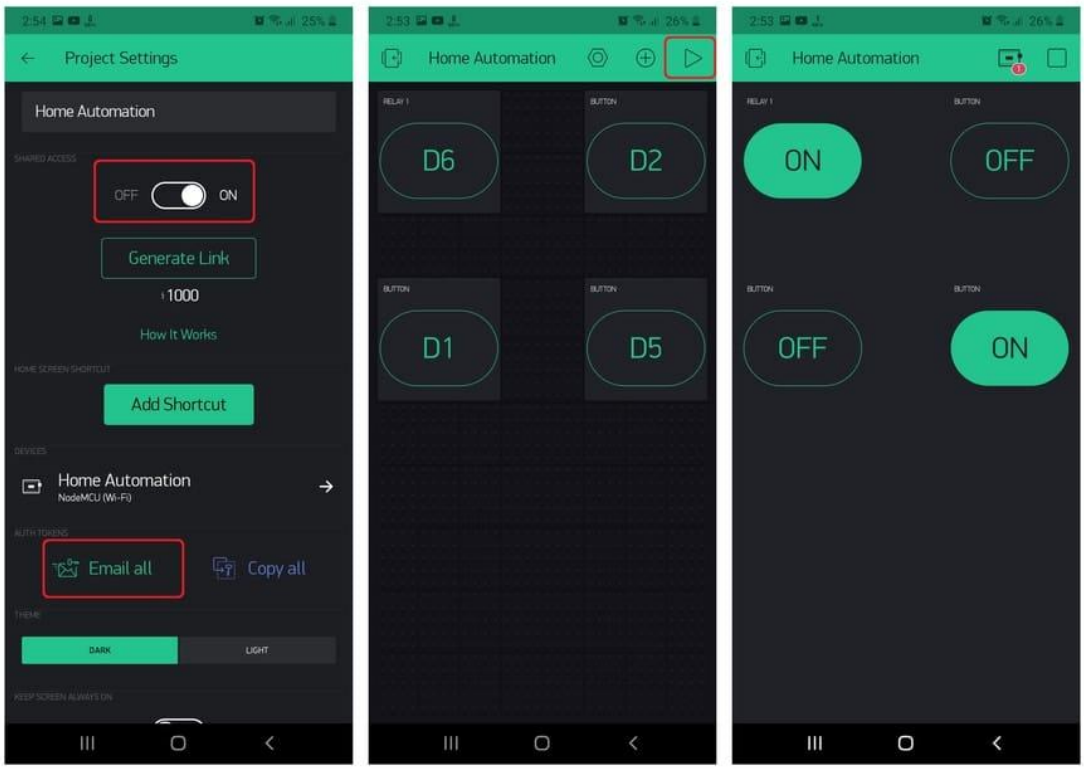

Figure 5:User Interface

IV. EXPERIMENTAL RESULTS

This section presents the experimental results obtained. Four loads were used to test the performance of the proposed system. Table1 presents the summary of the results obtained.

Table 1: Summary of Results

Appliance	Command	Response Time	Result
Load 1	Turn On	3 Seconds	Turned On
Load 2	Turn On	3 Seconds	Turned On
Load 3	Turn On	3 Seconds	Turned On
Load 4	Turn On	2 Seconds	Turned On

From table 1, it can be observed that the response time keeps varying between 2 – 3 seconds before the state of the load changes; this is as a result of network strength at the time of command.

V. CONCLUSION

In this study, an IoT based home automation system was developed and tested where household appliances can be controlled usingBlynk application.The system comprises mainly of ESP 8266, relay module, and 5v power supply. The ESP 8266 acts as the central processing unit (CPU) of the entire system. The relaymodulewas then connected to the ESP8266 via GPIO pins, which switches the appliances ON or OFF based on the user's commands. Furthermore, the Blynk application was designed to provide users with an easy-to-use interface for controlling the appliances remotely. The results obtained showed that all components and other features have an acceptable level of functionality. Therefore, this study presents an outstanding demonstrator of design, implementation and control capabilities that can be utilized to develop more advanced home automation systems in the future.

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