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"IoT BASED HOME AUTOMATION SYSTEM: ENHANCING COMFORT AND EFFICIENCY"

Tapan Kumar Kanaujia[1], Virendra Nishad[2], Rajat Mishra[3], Nishant Yadav[4],Rajesh Kumar Verma[5], KM Shalini[6], Amit Kumar Verma[7]

[1,2,3,4,5,6]Scholar Student, [7]Assistant Professor

[1,2,3,4,5,6,7]Department of Electrical Engineering, Department of ElectricalEngineering.

Babu Sunder Singh Institute of Technology and Management,Lucknow, Uttar Pradesh

ABSTRACT

This paper deals with the study of an intelligent smart home automation system that uses IoT technology to make life easier and smarter. Various devices can be controlled automatically and remotely to manage things like lights, fans, and home security. Through the integration of IoT technologies, the smart home automation system enhances convenience, energy efficiency, and overall comfort for the resident. The automation system offers remote use of wireless technology from a smartphone. The status of the device is shown on the Android platform. This system is specially developed to assist and provide help to fulfill the needs of the elderly and disabled people living at home. Also, the smart home automation concept improves the standard of living at home.

KEYWORDS – home automation system, Internet of Things (IoT), smart home, remote control, smart technology, IoT devices

1. INTRODUCTION

In today's digital age, the concept of smart home automation, where devices and appliances are interconnected and can be controlled remotely, is becoming popular. This trend is due to rapid advancements in Internet of Things (IoT) technology. A smart home automation system that is based on the Internet of Things (IoT) can be an efficient way to manage your home appliances, and the devices that are to be controlled are connected via the internet and servers. The home automation system is a mobile web-based application and should also provide a user-friendly interface on the user side so that devices can be easily set up, controlled, and monitored.

The main reason for developing this system is to save time and manpower. In this paper, we will explore

how IoT, or the Internet of Things, is making homes smarter and more convenient. By the end, you will develop a better understanding of how home automation systems work and why they are becoming popular. This is how an automated system proves useful to people in providing them with security, comfort, and easily accessible.

2. LITERATURE SURVEY

There are several types of research related to home automation systems using the IoT. The research on IoT has been made along with the study of various applications of the Internet of Things.

Ahmed El Shafee (2012)

This paper presents a design and prototype execution of a home automation system that works on Wi-Fi technology.

Hence, the author concluded that the goal and objectives that were required have been achieved. In this paper, the system design and its architecture were discussed, and remote monitoring has been implemented.[1]

Anurag Tiwari et al. (2017)

The authors reviewed the challenges and ongoing research for IoT. IoT systems are most common and spread over a wide area. Therefore, chances of security and privacy problems have become regular, due to which devices connected to the internet may face safety issues, and the IoT could not establish itself as a reliable technology.[2]

Neha Malik (2017)

The author discusses the various smart home automation systems and technologies. The main focus was on the home automation concept, where the controlling and monitoring are done by smart devices.[3]

Shaikh Amreen (2017)

In this review, the author discussed the architecture of the home automation system and also explained how the Internet of Things is used for monitoring and controlling different devices.[4]

Raju et al. (2019)

In this, the author describes the overall ideas of the IoT-based sensing and monitoring system for implementing home automation. A Node MCU board has been used in the proposed prototype, along with a smartphone through which it will be remotely controlled.[5]

Pujari et al. (2020)

The author suggested a multifunctional, low-cost, and flexible system for smart home control and monitoring. This work is implemented with the help of a node MCU known as ESP8266 and an internet connection through which it will be controlled.[6]

Pandey et al. (2021)

This author recommended the system with the help of different types of wireless communication techniques such as ZigBee, Wi-Fi, Bluetooth, etc., and this will give user access to remotely handle the applications.[7]

3. IoT TECHNOLOGY AND PROTOCOLS

Various technologies and protocols are used on the Internet of Things (IoT). Some of the major communication protocols that are commonly used are Bluetooth, Wi- Fi, LTE-A, radio protocols, etc. Thus, these IoT communication protocols providea functional requirement for an IoT system.

3.1 Bluetooth

Bluetooth's protocol is a wireless technology standard that is used for exchanging data over short distances (typically less than 10 meters), using short-wavelength UHF radio waves. It was developed to support simple wireless communications

between telephones, computers, and other devices and use cases, such as wireless audio and music streaming.

3.2 Zigbee

Zigbee is identical to Bluetooth and is mostly used for industrial purposes. It has some significant advantages in complex systems offering low power operations, and high security, and it is well positioned to take advantage of wireless control in IoT applications. The latest version of Zigbee is 3.0, which was recently launched.

3.3 Wi-Fi

Wi-Fi connectivity is one of the most popular IoT communication protocols and is the obvious choice for many developers, and can be accessed via LAN's. Currently, the most common Wi-Fi standard used in homes and businesses is 802.11n, which offers a range of hundreds of megabits per second, which is fine for file transfer but consumes too much power for various IoT devices.

3.4 Cellular

Every IoT application that requires operation over longer distances can use GSM/3G/4G cellular communication. Cellular communication can send high quantities of data, especially for 4G, and the cost and power consumption will also be high for many devices.

3.5 LoRaWAN

LoRaWAN is one of the popular IoT technologies which uses wide-area network (WAN) applications. The LoRaWAN is designed to provide low-power WAN's with features especially needed to support low-cost mobile secure communication in IoT, smart cities, and industrial applications. It supports large

networks with millions of devices and offers data ranging from 0.3 Kbps to 50 Kbps.

4. ARCHITECTURE OF THE PROPOSED SYSTEM

The node MCU unit is the microcontroller or the main controlling unit of the system. The user uses the mobile application to set commands for the functioning of the appliances. The mobile application interprets the command form in user invoice or switch mode and sends a signal to the node MCU unit, over a wirelessnetwork established by Wi-Fi communication. Hence, the Wi-Fi module (actually

built into the node MCU), helps the microcontroller establish Wi-Fi communication with a device and take commands from an application over a wireless network. The node MCU on further receiving the signal then turns on/off the appliance with the help of a relay. The node MCU, relay, and other devices are physically connected. The microcontroller is powered using a power source and a relay.

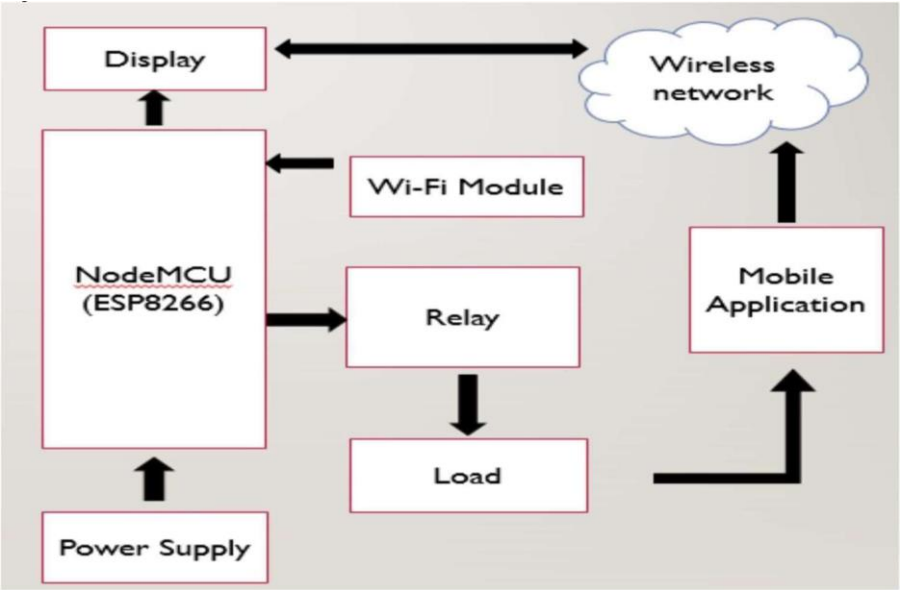

Figure 1. Block diagram of the Proposed system

4.1 PROPOSED SYSTEM

The Android operating system provides a flexible way to use open source. The in-built sensors can be accessed easily. The application which is used to control the system has vast features. Android Phones act as a clients and data is sent via source programming. The application takes commands from the user in two different modes.

4.1.1 Switch Mode

The home appliances that are controlled via switch mode use radio buttons. The status of the switch is shown via radio buttons.

4.1.2 Voice Mode

Voice Mode is used to control home appliances using voice commands. Using the built- in microphone of the Smartphone, the application creates an intent that fetches the speech data to the Google server, which responds with a string of data.

4.2 MAIN FEATURES OF THE PROPOSED SYSTEM

- The proposed system works by establishing a wireless remote switching system for home appliances.
- The system uses Wi-Fi to establish wireless control, which is given by a router or personal hotspot.
- The command is given to the system by using an Android application viasmartphones.
- Voice control can also be implemented if someone wants to control the appliance via voice mode.
- Control over home appliances is obtained over secure connections, such as SSL over TCP, and SSH.
- The active status of the device is shown on the application through whichthe system is controlled.

4.3 SETTING UP THE SYSTEM

For setting up the system to control the appliances via IoT, the following steps are preferred: -

Step 1: The first step is to install the Blynk Android app from the Google Play Store.

Step 2: - After installing the application, one has to sign up using their Gmail ID, and his ID is used whenever we log in.

Step 3: - After logging in, we have to create a new project named home automation.

Step 4: - After this, an authentication token is generated, and this token will be used to identify the hardware in the Blynk server.

Step 5: - After the authentication token is generated, we have to customize the interface as per our requirements, and thus the application setup is completed.

Step 6: - After application setup, we have to install drivers and packages in the Arduino IDE application, which is used to program hardware to be controlled.

Step 7: - After driver and package installation, one has to upload source code for establishing a connection between devices and hardware.

Step 8: - The source code contains programming in which one has to enter the generated authentication token, including the Wi-Fi SSID and Password. Further, this SSID and password are used to communicate between various devices connected to the system.

5. RESULT

The Prototype of the IoT system was made as per the circuit diagram and the results were as expected. The home appliances could be remotely used via a Wi- Fi network. Both the switch mode and the voice mode control methods were achieved successfully. The Blynk application was also successful in displaying the status of every device connected to the system.

6. FUTURE SCOPE

The future scope of smart homes is really favourable. Smart homes will become more intelligent, convenient, and personalized with advancements in IoT, artificial intelligence, and connectivity. The limitation of controlling only several devices can be removed by extending the automation of all other home appliances. Energy management will be optimized, using renewable sources and grid integration. Enhanced security and privacy measures will ensure the protection of user data and devices. Health monitoring, sustainability practices, and integration with smart cities will further enhance the smart home experience. The scope of this project can be expanded to many areas by not restricting it to only homes but to small offices.

7. CONCLUSION

Home automation, which uses the Internet of Things, has been experimentally proven to work fine by connecting simple appliances to it, and the appliances were successfully controlled remotely via the internet. The designed system monitors sensor data like temperature, gas, light, and motion sensors and activates a process according to requirements. This will help the user analyze the condition of various parameters in the home anytime and anywhere.

In the future, this project may have high marketing potential. Further, it can be demonstrated from a computer instead of mobile phones for controlling appliances in any large place, like industries, hospitals, institutions, etc. centrally.

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