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IOT-BASED SMART HOME CONTROL DESIGN USING BLINK APPLICATION AND ESP8266 WI-FI MODULE

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Abstract

The swift progression of technology has significantly impacted contemporary human existence, leading to an escalating demand for tools that simplify daily tasks. Automation is viewed as a means to reduce time, enhance accessibility, and improve efficiency. Particularly, the adoption of Smart Home technology is becoming increasingly crucial in present times. This research endeavors to develop an innovative prototype for a home equipped with IoT capabilities. The prototype incorporates a range of sensors and components to fulfill various functions: a DHT11 sensor for monitoring room temperature, an MQ-2 sensor for detecting gas leaks, an ultrasonic sensor for object detection, an MC38 magnet sensor for door security, a relay to control lamp switches, and a buzzer for alarms, all managed by a microcontroller. Additionally, the system utilizes a NodeMCU with a Wi-Fi module ESP8266, facilitating communication and control through the Blynk App. The Research and Development (R&D) methodology was employed to create this IoT-enabled Smart Home prototype, aiming to enhance user convenience in daily living.

Keywords: *Smart home, IoT, Node MCU, Blynk App, ESP8266 WIFI Module*

1. Introduction

As time progresses, technology continues to advance rapidly. Even things that were once considered impossible can now be achieved with the help of technology. The current economic growth has led to an increasing demand for smart and secure homes, making the implementation of IoT-based Smart Home technology highly relevant (Yudhanto & Azis, 2019; Chattoraj, 2015; Sokop et al.,2016). With IoT-based Smart Home technology, it is hoped to provide convenience for homeowners in maintaining their homes and achieving efficiency in various activities.

Smart homes, also known as home automation, refer to the integration of technology and services in a residence through a home network to improve the quality of life. The concept of home automation is not new in the scientific community and has been around for a long time. It includes centralized control of lighting, temperature, appliances, and other systems to enhance comfort, convenience, efficiency, and security (Wicaksono, 2017; Nurdin et al., 2020). The term "Smart Home" first emerged alongside the invention of the remote control by Nikola Tesla in 1898. From 1901 to 1920, despite the absence of smart devices as we know them today, significant developments were made in temperature control and household appliances. (Nugraha, 2018; Anggara & Jammaluddin, 2018; Nugraha et al.,2018; Pradana et al., 2022)

From 1966 to 1967, ECHO IV and computers emerged as the first smart devices used to control home temperatures and regulate appliances, although they were never commercialized. Microprocessors then emerged in the 1970s. In the United States, in 1975, the first smart home model was developed with the concept of data transmission using radio waves (Budi et al., 2022; Anggara et al., 2022; Sholahudin et al.2022). The combination of gerontology and technology, known as Gerontechnology, began to be developed in the Netherlands in 1991, with the aim of facilitating the lives of the elderly and triggering research and development of new technologies in the field.

From 1998 to 2000, interest in smart homes increased, driving technological advancements in various aspects of smart homes. One of the technologies that is growing and utilizing internet connectivity is the Internet of Things (IoT), which was first introduced in MTT in 1999 by Kevin Ashton(Widodo et al., 2022; Ningsih et al., 2020; Nugraha et al.,2020). An application that allows control of Wi-Fi modules such as ESP8266 over the internet is the Blynk application.

Therefore, after discussing the concepts of IoT and Blynk, this research will focus on the control system in Smart Homes using Blynk via smartphones by utilizing the ESP8266 Module (Nugraha et al., 2020; Nugraha et al., 2020; Nugraha & Arifuddin, 2020).

2. Material and methods

The research method employed is the research and development method. According to Borg and Gall, the research and development method is a powerful strategy for enhancing practice (Nugraha & Arifuddin, 2020; Anggara & Priyambodo, 2020). It is used to design and validate educational products. The research and development method can be seen in Figure 1.

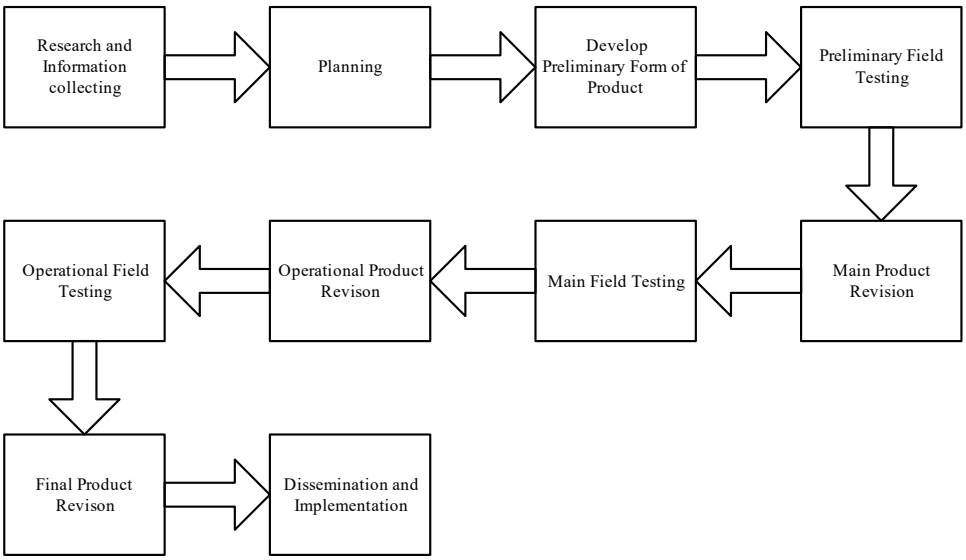

Figure 1. Research and Development Method

Research and Information Gathering

Researchers conduct preliminary studies or explorations to learn, investigate, and gather information. This step includes activities such as analysis, literature review, and initial observation of Smart Homes.

3. Results and discussion

The control system design for the IoT-based smart home utilizes the Fritzing application. The architectural design is presented in Figure 2.

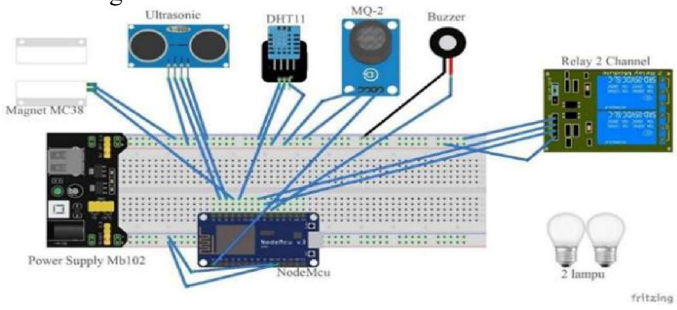

Figure 2. Control system

Sensor to detect room temperature, an MQ2 sensor to identify gas leaks, an ultrasonic sensor for object detection, and an MC38 magnet sensor for door security. Additionally, a relay is employed to manage the lamp switch's ON or OFF state, while a buzzer functions as the alarm, all integrated into the program and linked to the Blynk application. These functions become operational when assembled according to the scheme, and the device is programmed using the Arduino IDE software and the Blynk application figure 3.

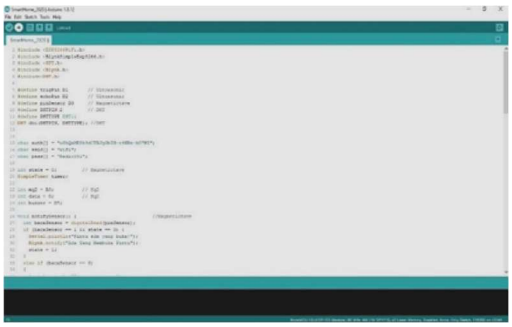

Figure 3. Programing code in Arduino IDE

To ensure the components or devices function as per the programmed instructions, they must be connected to the Internet. The initial step in the process is to program the NodeMCU to ensure that the components are calibrated and can communicate with each other seamlessly. The next step is to connect the NodeMCU to the internet so that it can communicate with the Blynk application software. This application allows for remote control over the internet to the device. Below is the interface of Blynk used in this research figure 4.

Figure 4. Interface blynk

In Figure 3, the initial display of the Blynk application is shown, which features various elements including measurement tools, ON/OFF buttons, and labeled value displays. Once the software and hardware are successfully connected and communicating with each other, the next step is to proceed with the creation of a replica or model of the smart home setup. Below is the miniature model of the house used in this research figure 5.

Figure 5. Miniature model of an IoT-based smart home control system.

3.1. Simulation testing model

To ensure that the program functions as expected, testing of the IoT-based smart home control system must be conducted after the system is powered on and connected to the Wi-Fi internet. If the internet connection is interrupted or the signal quality is poor, it will affect the system's performance. The tests are as follows:

a. Testing on DHT11
   Testing is conducted near a heat source. When the DHT11 sensor detects a temperature of 31°C or higher, a notification will appear along with a buzzer sound.
b. Testing on MQ-2
   Testing is performed by introducing a suitable gas around the MQ2 sensor, and when the gas level reaches 500 or higher, a notification will appear along with a buzzer sound.
c. Testing on Magnet M38
   Testing is carried out by opening the door of the smart home prototype. When the door is opened, a notification will appear.
d. Lamp control testing
   The testing is successful if pressing the button on the Blynk application turns the lamp on or off.

4. Conclusion

The conclusions drawn from the design of this smart home include:

1. The DHT11 sensor is used to detect room temperature. If the room temperature reaches 31 degrees Celsius or higher, a notification will appear on the smartphone. Additionally, a buzzer sound serves as a warning signal on the detector.
2. The MQ2 gas sensor reads gas levels. If the gas sensor reading is greater than or equal to 500, it is considered hazardous. Notifications are provided in the form of a buzzer sound.
3. The ultrasonic sensor serves as an object detector. If an object approaches within a distance of 2-8 cm, the sensor will react and provide a notification.
4. The MC38 magnetic sensor acts as a door protector, and the relay is used for lamp switches.

All components are connected to Arduino IDE, the Blynk application, and the Internet. It is hoped that the designed device can be applied and implemented, thus resolving issues. Through testing the sensor components in the system, it is determined that the IoT-based smart home control system works according to the design objectives..

Credit authorship contribution statement

Ananda Ismul Azam: Conceptualization, Writing – review & editing. **Rama Arya Sobhita**: Supervision, Writing – review & editing. **Anggara Trisna Nugraha**: Conceptualization, Supervision, Writing – review & editing. **Epyk Sunarno**: Conceptualization, Supervision, Writing – review & editing.

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