



Designing An IOT-Based Smart Home Control Using Blink Application and ESP8266 Wi-Fi Module

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Abstract

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The very rapid development of technology has a significant impact on human life today. The aids of facilitating human work are starting to be in great demand. Automation of tools is thought to shorten the time, be more accessible and be faster. Smart Home is one's technologies applications needed today. This study aims to designs an IoT-based innovative home prototype. The resulting intelligent home prototype uses the DHT11 sensor at a room temperature detector, the MQ-2 the sensor as a gas leak detector, an ultrasonic sensor as the object detector, the MC38 magnet sensor as door security, a relay as ON or OFF the lamp switch, buzzer as an alarm, and using a microcontroller. A nodemcu with a Wi-Fi module ESP8266 controlled via Blynk App. Research and Development (R & D) method were research method used. It is hoped that the IoT-based Smart Home technology will be provided convenience to its users in everyday life.

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

Abstrak

Perkembangan teknologi yang sangat pesat memberikan dampak yang signifikan bagi kehidupan manusia saat ini. Bantuan untuk mempermudah pekerjaan manusia mulai banyak diminati. Otomatisasi alat dianggap mempersingkat waktu, lebih mudah diakses dan lebih cepat. Smart Home merupakan aplikasi teknologi yang dibutuhkan seseorang saat ini. Penelitian ini bertujuan untuk merancang prototipe rumah inovatif berbasis IoT. Prototipe rumah cerdas yang dihasilkan menggunakan sensor DHT11 pada pendeteksi suhu ruangan, sensor MQ-2 sebagai pendeteksi kebocoran gas, sensor ultrasonik sebagai pendeteksi objek, sensor magnet MC38 sebagai pengaman pintu, relay sebagai ON atau OFF saklar lampu, buzzer sebagai alarm, dan menggunakan mikrokontroler. Sebuah nodemcu dengan modul Wi-Fi ESP8266 dikendalikan melalui Blynk App. Metode Penelitian dan Pengembangan (R&D) adalah metode penelitian yang digunakan. Diharapkan dengan adanya teknologi Smart Home berbasis IoT ini dapat memberikan kemudahan bagi penggunaanya dalam kehidupan sehari-hari.

Kata-kata kunci: Rumah pintar, IoT, Node MCU, Aplikasi Blynk, Modul WIFI ESP8266



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1. Introduction

As time goes by, technology overgrows. Even things that were previously considered impossible can now be done with the help of technology. The current economic growth made of indictment to smart and safe homes increases, so the application of IoT-based Smart Home technology is very relevant. With IoT-based Smart Home technology, later it can make it easier for the owner to maintain and provide convenience or efficiency [1]. The smart home is known as home automation, which makes household chores or household activities easier. It usually defines a residence that integrates technology and services through a home network to improve the quality of life. Home automation is not a new term to the scientific community and has been around for a long time. Home automation includes centralized control of lighting, temperature, appliances and other systems to provide increased comfort, convenience, efficiency and safety [2]. The term Smart home originated from the invention of the remote control by Nicole Tesla in 1898. From 1901 to 1920, although there was no intelligent device yet, in 1907, a device known as a vacuum was created.

Moreover, there are many other electrical appliances for household use. From 1966 to 1967, the ECHO IV and computers emerged, which were intelligent devices used to control house temperatures and turn on and turn off equipment, even though these products were never traded. The microprocessor appeared in 1970. In 1975 in the USA, the first intelligent home model was developed and made with the concept of transmitting data using radio waves. , Combines gerontology and technology are Gerontechnology, was developed in the Netherlands in 1991 which is thought to make citizens' lives so much easier, so that new research and technology has emerged in the field. From 1998 to 2000, the interest in smart homes began to increase. It has led to the emergence of technology from various smart homes. One technology that utilizes internet connectivity is the Internet of things (IoT). IoT itself was introduced at MTT in 1999 by Kevin Ashton. The application used to control the Esp8266 Wi-Fi module or the like via an internet connection is the Blynk application. After reviewing IoT and Blynk, this study will discuss the control system on Smart Home using Blynk via Smartphone utilizing ESP8266 Module by using several other supporting devices.

2. Method

a. Material

1) Microcontroller

The four main components of the computer system are input components, processing equipment components, storage components and output components. The CPU that regulates the microcomputer's working system is built by the microprocessor. The memory consists of EEPROM to stores programs and RAM to store data. The i / o system connects to external devices, such as speakers and monitors depending on the application. If the CPU, memory and I / O system is made into a semiconductor chip, this is what is called a microcontroller [3].

b. NodeMCU

NodeMCU is an open-source IoT platform consisting of hardware in the form of a System on Chip ESP8266. It's made by Expressive Systems, which use the Lua scripting programming language. The firmware in the kit specifies the term NodeMCU.

When programming the ESP8266, it requires some cable techniques and a USB module to download the program. NodeMCU was integrated an ESP8266 into the board with various features such as a microcontroller and abilities to access Wi-Fi like a USB to serial communication chip. [4] So to program it only requires an extension of the USB data cable, which is used as a data cable and charging cable for Android smartphones. NodeMCU presented in the [Figure 1](#).



[Figure 1](#) . NodeMCU

c. Ultrasonic

The ultrasonic sensor is a detector rule that functioning to convert a sound and sound into electrical quantities and vice versa. This sensor works by using ultrasonic waves, which have a principle of reflected sound waves so that they can be used to interpret their existence. (the distance) of the object with a specific frequency [5]. Ultrasonic sensor presented in the [Figure 2](#).



[Figure 2](#). Ultrasonic

d. MQ-2 sensor

The MQ-2 sensor is a device that was used to the detecting of flammable gases in air and smoke and can read as an analogue voltage. In the MQ-2, the smoke a gas sensor can be directly adjusted by turning the trim pot. This sensor used to detect gas leaks at home and in the industry includes LPG, isobutane, propane, methane, alcohol, hydrogen, and smoke. It was also very suitable for emergency tools, like gas leak detection, smoke detection, fire prevention, and others [2]. Physical form MQ-2 presented in the [Figure 3](#).



[Figure 3](#). MQ-2

e. DHT11

DHT11 sensor is series of sensor and controller IC components that are packaged in one package. There are DHT11 sensors that have four pins in addition to there are also three pins. Inside the blue or white sensor body, there is a resistor with the NTC type. This type has a characteristic where the resistance value is inverse to the temperature increase. It means that the higher the body temperature, the smaller the NTC resistance value. Conversely, the resistance value will increase when the temperature decreases. In addition, there is a humidity sensor with resistant characteristics changes on the water content in the air. Data from these two sensors are processed in the controller IC. This controller IC will output data in the form of a single wire bi-directional [6]. Physical form DHT11 presented in the [Figure 4](#).



[Figure 4](#). DHT-11

f. Buzzer

The buzzer is an electronic component included in the transducer family, which can convert electrical signals into sound vibrations, another name for this component is called beeper [7]. Physical form buzzer presented in the [Figure 5](#).



[Figure 5](#). Buzzer

g. Arduino IDE

Arduino IDE is software to program Arduino. The C programming language is used in Arduino. We call it the Arduino for beginners, and the Arduino programming has been changed from the original language. In Arduino itself, there is a microcontroller IC that was planted with a program called Bootloader. The function was to mediate between the Arduino compiler and the microcontroller. Arduino IDE is integrated from the JAVA programming language, which has a C language library / C++ library, making the input/output process easier [8]. Physical form Arduino IDE presented in the **Figure 6**.



Figure 6. Arduino IDE

h. Blynk application

Blynk is a platform for IOS or ANDROID, which controls Arduino, Raspberry Pi, Wemos and similar modules via the Internet. This application is straightforward to use for people who are still laymen [9]. This application has many features that make it easy for users to use it. How to do a project in the application is by drag and drop. We can control anything remotely wherever we are with a note connected to the Internet from this application. It is what is called the IoT (Internet Of Things)[10]. Logo's blynk application presented in the **Figure 7**.



Figure 7. Blynk application

b. Method

The research method used is the method of research and development. The definition of development research according to Borg and Gall, research and development is a powerful

strategy for improving practice. It is used to designing and validating an educational product [11]. The method of research and development method can be seen in **Figure 8**.

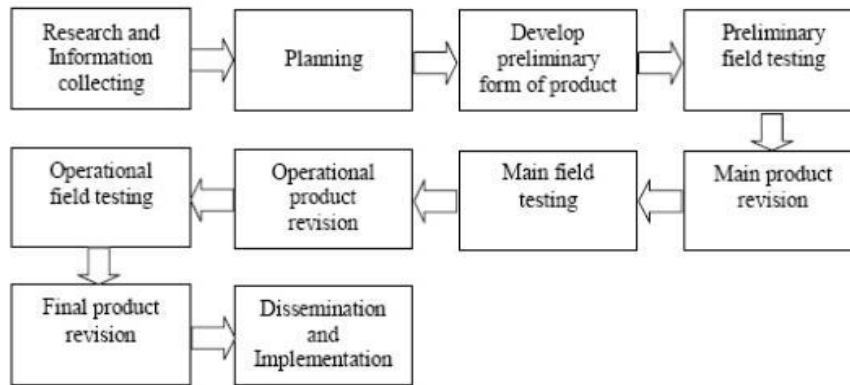


Figure 8. Research and development methods

1) Research and Information Collecting

Research and the information Collecting Researchers conduct preliminary or exploratory studies to study, investigate and gather information. This step includes activities such as the analysis, literature review, and an initial observation about Smart Home.

2) The Planning

The researcher makes a product developments design plan. Essential aspects of the plan include what the product is, its purpose and benefits, who is the user of the product, why the product is considered necessary, where is the location to develop the product, and how is the development process.

3) Develop Preliminary Form of Product

Researchers begin to develop the initial product form that is temporary (hypothesis)—products that are made complete and as good as possible, such as the completeness of program components.

4) Preliminary Field Testing

Researchers conducted limited trials on initial products, including testing components, connections between parts and software.

5) Main Product Revision

Conducting the first stage of the revision, namely repairs and enhancements to the main product, and is carried out if the components are not well-connected and error notification appears in the application.

3. Results and Discussion

The design of the control system on this IoT-based smart home uses the Fritzing application. Architecture design presented in [the Figure 9](#).

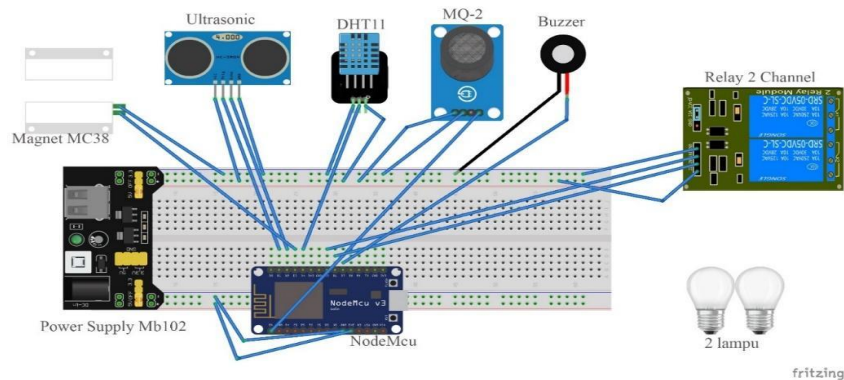


Figure 9. Architectural Design

How Technology Works

The methodology of this tool is based on a block and a circuit scheme. There is a DHT11 sensor as room temperature detector, the MQ2 sensor as gas a leak detector, ultrasonic sensor as object detector, and mc38 magnet sensor as door security. Relay as ON or OFF the lamp switch and buzzer become an alarm is set to the program and linked Blynk Application. All the functions will work if assembled to the scheme and tools have been programmed through the Arduino IDE software and the Blynk application. The components or devices to function according to the program being made must be connected to the Internet.

- a. Connect Nodemcu with the USB of the laptop. The blue LED will flash a sign connected with the power supply and the other components connected to Nodemcu. Nodemcu connected by USB to a laptop presented in the [Figure 10](#).



Figure 10. Nodemcu Connected by USB To A Laptop

- b. Enter the coding in the Arduino IDE software when nodemcu is connected to a USB laptop. Programming the Arduino IDE software presented in the [Figure 11](#).



Figure 11. Programming the Arduino IDE software

- c. After the coding is finished, it is uploaded to nodemcu to assemble all the components. Components after assembling presented in the Figure 12.



Figure 12. Components After Assembling

- d. The initial display of the blynk application before connecting to the IoT-based smart home control system. The Blynk application is not connected yet presented in the Figure 13.

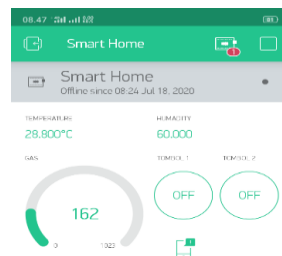


Figure 13. The Blynk application is not connected yet

- e. The display after the blynk application is connected to the smart home control system based on IoT. The Blynk application has been connected presented in the Figure 14.

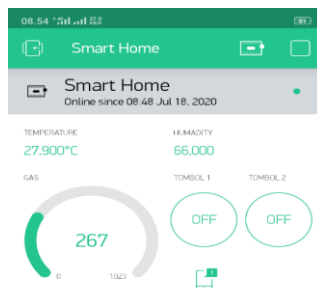


Figure 14. The Blynk Application Has Been Connected

- f. Display labelled value in the Blynk application to display room temperature information. Display labeled value can be seen in the **Figure 15**.

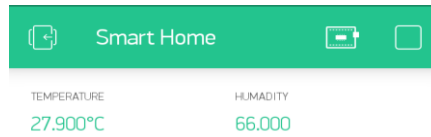


Figure 15. Display Labeled Value

- Display gauge on the blynk application to display information on gas conditions in the room. Display of gauge presented in the **Figure 16**.

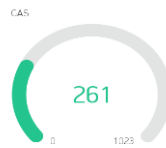


Figure 16. Display of Gauge

- g. Display button on the blynk application to switch on or off the light. Display button switch can be seen in the **Figure 17**.



Figure 17. Display Button Switch

- h. The notification will display on the blynk application for notification functions from the sensor, DHT11, MQ2 sensor, Ultrasonic sensor, and MC38 Magnet sensor. Display button notification can be seen in the **Figure 18**.



Figure 18. Display Button Notification

- i. A complete view of miniature IoT-based smart home control system can be seen in the **Figure 19**.



Figure 19. Miniature IoT-based Smart Home Control System

Testing Simulation Model

For the program made by the expectations, the IoT-based test smart home control system must be carried out after the system is turned on and connected to the Wi-Fi internet. If the Internet is disconnected or the signal is in bad condition, it will affect system performance. The tests are as follows:

a. Testing DHT11

The test carried out close to the source of the fire. When the DHT11 sensor detects a 31 °C or more temperature, a notification will appear along with the buzzer sound. DHT sensor test presented in the [Table 1](#).

Table 1. DHT11 Sensor Test

Second to-	Temperature°C	Notification	Buzzer sound
1	28.8	No	No
25	29.2	No	No
29	29.3	No	No
30	29.7	No	No
37	29.8	No	No
39	30.1	No	No
45	30.8	No	No
50	31.4	Yes	Yes
54	32.0	Yes	Yes
60	32.6	Yes	Yes

b. Testing MQ2

Testing is carried out by giving a matching gas delivered around the MQ2 sensor, and when it reaches the gas value of 500 or more, a notification will appear and together with the buzzer sound. MQ2 sensor tes presented in the [Table 2](#).

Tabel 2. MQ2 Sensor Test

Gas	Notification	Buzzer Sound
< 500	No	No
>=500	Yes	Yes

c. MC38 Magnet Testing

Testing is done by opening the door on the smart home prototype that has been made. When the door is opened, a notification will appear. MC38 magnet sensor test is presented in the **Table 3**.

Table 3. MC38 Magnet Sensor Test

Door	Notification
Open	Yes
Close	No

Ultrasonic sensor test is presented in the **Table 4**.





Table 4. Ultrasonic Sensor Test

Object Distance	Notification
2 Cm	Yes
3 Cm	Yes
4 – 8 Cm	Yes
8 Cm s/d etc.	No

d. Testing lamp control

The test is successful if you press the button on the Blynk application, the light turns on or turn off. Lamp control tes presented in the **Table 5**.

Table 5. Lamp Control Test

Caption	Lamp 1	Lamp 2
	Off	Off
	On	Off
	On	On
	Off	On

From testing the sensor components on the system, it is known that the IoT-based smart home control system works by the design objectives.

4. Conclusion

The conclusions obtained from designing this smart home include: the DHT11 sensor is used to detect room temperature. If the room temperature reaches 31 or more, a notification will have appeared on the smartphone. And the sound of a buzzer as a warning sign on the detector. The MQ2 sensor gas leak reads the gas sensor. If the gas sensor is ≥ 500 , then this is considered dangerous. The notification that appears is the sound of a buzzer. The ultrasonic sensor becomes an object detector. If an object was approaching with a distance of 2-8 cm, the sensor will react and give notification, MC38 magnetic sensor as door protector, Relay for light switches. All components connected to Arduino IDE, the Blynk application, and the Internet. It is hoped that this tool designed can be applied and implemented, and then the problem can be resolved.

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