SEAN INSTITUTE
http://infor.seaninstitute.org/index.php/infokum/index
JURNAL INFOKUM, Volume 10, No.4, October 2022 ISSN : 2302-9706

# PROTOTYPE OF ELECTRONIC EQUIPMENT CONTROL SYSTEM BASED ON INTERNET OF THINGS (IOT)

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**Abstract**

Article Info
Received, 1/10/22
Revised, 7/10/22
Accepted, 12/10/22

Every household has several electronic devices, such as lights, fans, water heaters, and other devices. However, most of these devices cannot be accessed and controlled at all times remotely. One way to access and control it is to use the internet to access it anywhere and anytime. The design and manufacture of this prototype are done by inputting data into the Blynk application on an Android smartphone. The inputted data is in the form of serial data, sent to the NodeMCU V3 microcontroller, then translated into parallel data, and then forwarded to a relay with an LED indicator that shows the condition of the electronic equipment. The relay will execute data from NodeMCU V3 to turn on or turn off electronic equipment. The system is capable of working with hotspot connectivity with NodeMCU V3 connected at a maximum distance of 12 m in a closed room and 17 m in an open space. Based on testing from five different locations, the system could remotely control the lights, fans, and water heaters. In testing the delay of electronic equipment, the average delay value is 2.8 seconds.

Keywords: Internet of Things, NodeMCU V3, Electronic equipment, Android

## 1. INTRODUCTION

The high activity of individuals outside the home can cause the house to be empty. This will make it difficult for homeowners to monitor electronic equipment in their homes [1]. The remote location between the house and the place of work and outdoor activities sometimes makes the residents forget and ignore the status of the electronic equipment in their homes. For example: is it still on or off? This condition is very dangerous when the house is empty for a long time, such as when the occupants are on vacation to their hometown. This is very dangerous in the event of theft or fire [2]

In every citizen's house, usually, several electronic devices can be found, including TL lamps, fans, heaters, and so on [3]. However, most of this electronic equipment does not yet have the features or facilities to be accessed remotely and at any time[4][5]. One way to access the equipment is through internet technology [6]. Internet of things or abbreviated as IoT, is an idea where all objects in this world can communicate with one another as part of an integrated system using the internet network as a liaison. One application of IoT technology is controlling electronic equipment remotely with the internet [7][8].

Research on various electronic equipment has previously been carried out, including home lighting controllers and indoor fans that use Raspberry Pi technology and are equipped with a web GUI [9][10]. In addition, there is also a fan controller based on the ATmega16 microcontroller via Android [11][12]. and fan control using an Arduino mega 2560 microcontroller and an android-based DHT22 sensor [13]. In addition, there are also television controllers and fans using IoT [14].

Based on this, improvements will be made to the tool compared to the ones made in previous studies. The device is designed to function to be able to connect to the internet network, making it easier for residents of the house to control electronic equipment in the home remotely, and more than one user can also access it.

## 2. METHOD

### 2.1. Flowchart Diagrams

The design of the electronic equipment control system is carried out in several stages: Creating a prototype design concept for indoor temperature and humidity control systems that can be controlled remotely via the internet. Conducting literature studies from e-books, journals, or books related to drafted designs[15]. Next, prepare the tools and materials used in the design. Then, designing the hardware according to the concept that has been made. The next stage is testing the hardware. As seen in Figure 1.

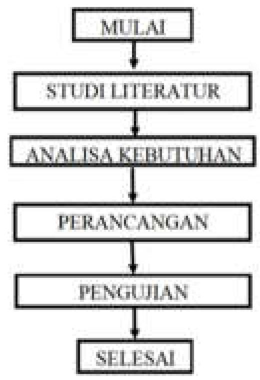


Figure 1. Research Stage Flowchart

### 2.2. System Design

System design consists of hardware and software design.

a) Hardware Design

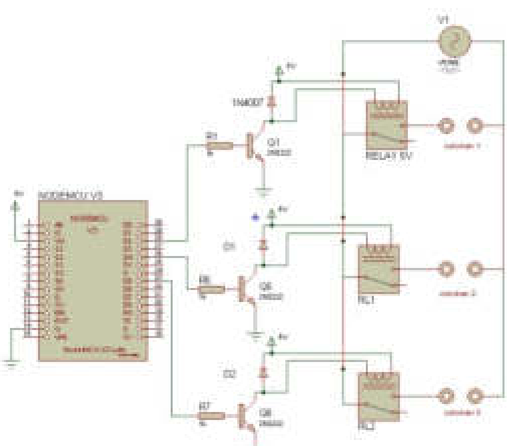

Figure 2. The Relay Driver Circuit Uses A 2n2222 Transistor

Figure 2 shows some components used, such as NodeMCU v3, transistors, 5V relays, and others. Based on the NodeMCU V3 datasheet, it is known that when the digital pin is high, the voltage read is 3.3 V, so i = 3.3 is obtained. Meanwhile, from the Songle SRD relay datasheet, it is known that the relay will be active when the current flowing is 89.3 mA, so that = 89.3 is obtained.

b) Software Design (Software)

Software design begins with creating a program on the Arduino IDE application using its programming language, similar to the C language. The program used will be made based on the hardware scheme that has been designed, either to control or run the sensors used. After all the devices can be run with the program created, a function call is made from the NodeMCU V3 microcontroller to Blynk.

Programming for NodeMCU V3 can be done using the Arduino IDE software. The flow diagram of the program can be seen in Figure 3.

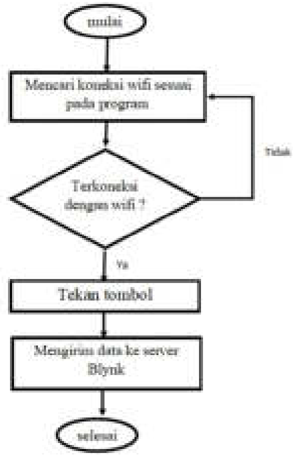


Figure 3. NodeMCU V3. Program Flowchart

2.3. System Test

The testing phase is divided into several parts: Blynk Application Testing, Distance Testing on Electronic Equipment Controllers, and Testing of Various Devices.

a) Blynk Aplikasi Application Testing

Testing the Blynk application aims to determine whether the applications that have been made can be used and work according to their respective functions. And this is done by testing whether the menus created in the Blynk application can be used and work.

b) Distance Testing on Electronic Equipment Controller

In general, the principle of indoor and outdoor distance testing can be seen in Figures 4 and 5.

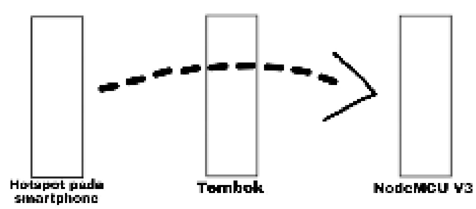


Figure 4. Indoor Distance Testing Scheme

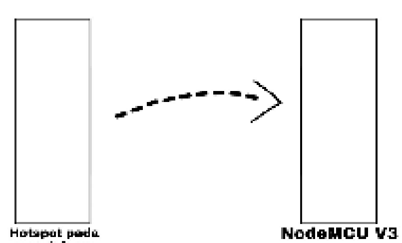


Figure 5. Schematic Of Outdoor Distance Testing

Testing the effect of distance on the performance of electronic equipment controllers aims to determine the distance of the connected internet connection from the hotspot on a smartphone with NodeMCU V3. And this is done by testing the internet connection that is connected using a hotspot on a smartphone that is already connected to NodeMCU V3 and controlling it from a closed room and an open room.

c) Testing from Multiple Devices

Testing of various devices aims to be able to control electronic equipment by more than one user. And this is done by granting access to other desired users by installing the Blynk application on the other user's Android smartphone and sending a QR code via email or other social media. Then test whether the created system is accessible and works equally well from different places.

## 3. RESULTS AND DISCUSSION

3.1 Hardware Results

The results of the design of an IoT-based remote control system for electronic devices can be seen in Figure 6. There is a NodeMCU V3 which functions as a microcontroller or as the brain of programming, a relay driver that functions as an electrical switch or switch. The lamp serves to illuminate when low light. The lights connected to the relay can be controlled via a menu created in the Blynk application. A fan that functions for air conditioning or room freshener. The fan connected to the relay can be controlled via a menu created in the Blynk application. The water heater is used to heat or boil water. The water heater connected to the relay can also be controlled via a menu created in the Blynk application.


Figure 6. Hardware Design Result

3.2. Software Results

The results of the software design of this controller system can be seen in Figure 7. The interface of the software design consists of several widgets with respective functions and uses to make it easier to control the hardware.


Figure 7. Electronic Equipment Control System Interface

The control widget functions to help users when they want to turn on or off the lights, fans, and water heaters automatically through their Android smartphones. This feature makes it easy for users to control lights, fans, and water heaters whenever and wherever they want.

3.3. Hotspot Connectivity Test Results with NodeMCU V3

Testing the distance of hotspot connectivity with NodeMCU V3 on electronic equipment controllers can be divided into two tests, namely closed and open spaces.

The connectivity test results when the room is closed can be seen in Figure 4, where when the distance of 13 meters, the hotspot is disconnected with NodeMCU V3. When tested from various distances in a closed room, it can be seen in Table 1.

Table 1. Results of Testing the Distance of Hotspot Connectivity with NodeMCU V3 in a Closed

| No. | Distance (meters) | Condition |
|---|---|---|
| 1 | 1 | Connection |
| 2 | 2 | Connection |
| 3 | 3 | Connection |
| 4 | 4 | Connection |
| 5 | 5 | Connection |
| 6 | 6 | Connection |
| 7 | 7 | Connection |
| 8 | 8 | Connection |
| 9 | 9 | Connection |
| 10 | 10 | Connection |
| 11 | 11 | Connection |
| 12 | 12 | Connection |
| 13 | 13 | Not Connection |

From the table above, it can be seen that the electronic equipment controller in a closed room is capable of connecting to the internet network at a maximum distance of 12 meters. When the electronic equipment control system is at a distance of 13 meters from the hotspot, the internet connection from the hotspot on the smartphone is disconnected with NodeMCU V3 due to the weak signal received.

The results of connectivity testing when open space can be seen in Figure 5, where the hotspot is disconnected at a distance of 18 meters with nodeMCU V3. And when tested from various distances in an open room, it can be seen in table 2.

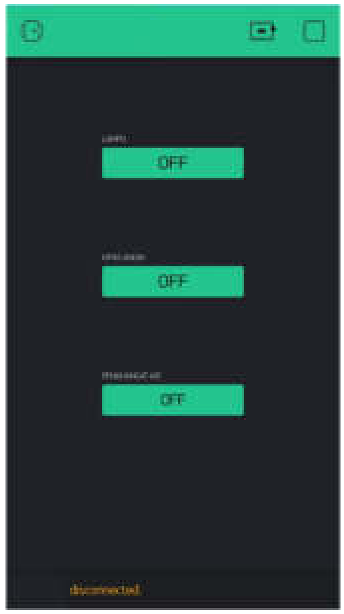


Figure 8. Connectivity Test In The Open Room

Table 2. Testing Results of Hotspot Connectivity Distance with NodeMCU V3 in Open Space

| No. | Distance (meters) | Condition |
|---|---|---|
| 1 | 1 | Connection |
| 2 | 2 | Connection |
| 3 | 3 | Connection |
| 4 | 4 | Connection |
| 5 | 5 | Connection |
| 6 | 6 | Connection |
| 7 | 7 | Connection |
| 8 | 8 | Connection |
| 9 | 9 | Connection |
| 10 | 10 | Connection |
| 11 | 11 | Connection |
| 12 | 12 | Connection |
| 13 | 13 | Connection |
| 14 | 14 | Connection |
| 15 | 15 | Connection |
| 16 | 16 | Connection |
| 17 | 17 | Connection |
| 18 | 18 | Not Connection |

From table 2, it can be analyzed that the electronic equipment controller in a closed room is capable of connecting to a hotspot at a maximum distance of 17 meters. When electronic equipment is connected at a distance of 18 meters, the hotspot connection on the smartphone is disconnected from the NodeMCU V3 because the received signal is too weak.

3.4. Test Results from Various Device

The test results of various devices on electronic equipment controllers can be seen in Table 3.

Table 3. Test results from various devices at different locations.

| No | User | Location Distance | Electronic Devices | | |
|---|---|---|---|---|---|
| | | | Fan | Lamp | Water Heater |

| | | | | | |
|---|---|---|---|---|---|
| 1 | User 1 | ± 60 km | succeeded | succeeded | succeeded |
| 2 | User 2 | ± 5 km | succeeded | succeeded | succeeded |
| 3 | User 3 | ± 50 km | succeeded | succeeded | succeeded |
| 4 | User 4 | ± 30 km | succeeded | succeeded | succeeded |
| 5 | User 5 | ± 40 km | succeeded | succeeded | succeeded |

Referring to Table 3, it can be seen that electronic device control can be carried out by various users and from various locations as long as the user is given access by the primary user located in Kuripan Lombok Barat to be able to control electronic equipment through their respective Android smartphones, as well as the user's smartphone. Already connected to the internet network to be able to access the Blynk application and control the electronic equipment that has been set.

3.5. Test Resut of Electronic Equipment Controller Delay

Table 4. Results Of Delay Testing From Various Locations

| No | User | Location (km) | Average Delay (second) |
|---|---|---|---|
| 1 | User 1 | ± 50 | 3 |
| 2 | User 2 | ± 15 | 2,4 |
| 3 | User 3 | ± 40 | 3,4 |
| 4 | User 4 | ± 20 | 2,6 |
| 5 | User 5 | ± 30 | 2,6 |

From Table 4, it can be seen that to be able to determine the delay in controlling electronic devices is carried out by various users and from various locations as long as the user gives the user access to control electronic equipment via a smartphone. Different electronic equipment controller delay values are obtained at each location due to differences in the internet speed of each user.

## 4. CONCLUSION

The nodeMCU V3 equipment can be connected at a distance of 12 m in a closed room and 17 m in an open space using a hotspot connection. Based on testing from five different locations, the system can control electronic equipment from various devices with a delay value of 2.8 seconds.

## REFERENCES

[1] H. B. Santoso, P. O. H. Putra, and F. F. H. S. Febrian, "Development & Evaluation of E-Learning Module Based on Visual and Global Preferences Using a User-Centered Design Approach," Int. J. Emerg. Technol. Learn., vol. 16, no. 15, pp. 139–151, 2021, doi: 10.3991/ijet.v16i15.24163.
[2] M. F. Wicaksono and M. D. Rahmatya, "Implementasi Arduino dan ESP32 CAM untuk Smart Home," J. Teknol. dan Inf., vol. 10, no. 1, 2020, doi: 10.34010/jati.v10i1.2836.
[3] B. Basri, Akhmad Qashlim, and Suryadi, "Relay Kontrol Menggunakan Google Firebase dan Node MCU pada Sistem Smart Home," Technomedia J., vol. 6, no. 1, 2021, doi: 10.33050/tmj.v6i1.1432.
[4] F. Ilhami, P. Sokibi, and A. Amroni, "Perancangan Dan Implementasi Prototype Kontrol Peralatan Elektronik Berbasis Internet Of Things Menggunakan Nodemcu," J. Digit, vol. 9, no. 2, pp. 143–155, 2019.
[5] A. Minariyanto, M. Mardiono, and S. W. Lestari, "Perancangan Prototype Sistem Pengendali Otomatis Pada Greenhouse Untuk Tanaman Cabai Berbasis Arduino Dan Internet Of Things (IoT)," J. Teknol., vol. 7, no. 2, pp. 120–134, 2020.
[6] A. S. Bakhri, K. Suhada, and K. Kamaludin, "Perancangan Sistem Doorlock Menggunakan Aplikasi Blynk Berbasis IoT Studi Kasus Pada Rumah Tempat Tinggal Pribadi," Pros. Semin. Nas. Inov. dan Adopsi Teknol., vol. 1, no. 1, 2021.
[7] A. Rdiansyah, "Monitoring Daya Listrik Berbasis IoT (Internet of Things)," Univ. Islam Indones., 2020.
[8] R. Muzawi and W. J. Kurniawan, "Penerapan Internet of Things (IoT) Pada Sistem Kendali

Lampu Berbasis Mobile," J-SAKTI (Jurnal Sains Komput. Dan Inform., vol. 2, no. 2, pp. 115–120, 2018.

[9] W. Al Qorni, A. Azhar, and E. Yuniarti, "Perancangan Sistem Kontrol Otomatis Berbasis Web Menggunakan Raspberry Pi 3 pada Smarthome," Al-Fiziya J. Mater. Sci. Geophys. Instrum. Theor. Phys., vol. 1, no. 2, 2019, doi: 10.15408/fiziya.v1i2.9501.

[10] B. Eryawan, A. E. Jayati, and S. Heranurweni, "Rancang bangun prototype smart home dengan konsep internet of things (iot) menggunakan raspberry pi berbasis web," Elektrika, vol. 11, no. 2, pp. 1–5, 2019.

[11] P. Asmaleni, D. Hamdani, and I. Sakti, "PENGEMBANGAN SISTEM KONTROL KIPAS ANGIN DAN LAMPU OTOMATIS BERBASIS SAKLAR SUARA MENGGUNAKAN ARDUINO UNO," J. Kumparan Fis., vol. 3, no. 1, 2020, doi: 10.33369/jkf.3.1.59-66.

[12] S. R. Mursyid, "Alat Pengendali Kipas Angin Otomatis Menggunakan Smartphone Android Berbasis Mikrokontroller Atmega16." Universitas Negeri Padang, 2017.

[13] R. Ordila, Y. Irawan, Yulanda, and Putra, "Penerapan Alat Kendali Kipas Angin Menggunakan Microcontroller Arduino Mega 2560 dan Sensor DHT22 Berbasis Android," Riau J. Comput. Sci., vol. 06, no. 02, 2020.

[14] A. B. Lasera and I. H. Wahyudi, "Smart Home System dengan Kontrol Daya Listrik berbasis IoT," Elinvo (Electronics, Informatics, Vocat. Educ., vol. 5, no. 2, 2021, doi: 10.21831/elinvo.v5i2.34261.

[15] Sugiyono, Metode penelitian: Pendekatan Kuantitatif, Kualitatif, dan R&D. Bandung : Alfabeta, 2015, 2017.