

PROTOTYPE OF SMART HOME AND MONITORING APPLICATION BASED ON INTERNET OF THINGS (IOT) USING ANDROID

Andika Fajar Isnanto¹, Atikah Surriani², Sri Lestari³, Unan Yusmaniar Oktiawati⁴

^{1,2,3,4} Departemen Teknik Elektro dan Informatika, Sekolah Vokasi, Universitas Gadjah Mada
andika.fajar.isnanto@mail.ugm.ac.id¹, atikah.surriani.sie13@ugm.ac.id², srilestari59@ugm.ac.id³,
unan_yusmaniar@ugm.ac.id⁴

Abstract – Smart Home is one of the popular technological advances and developed by researchers or academics because of its high potential to be implemented in various fields. Smart Home is an Internet of Things based technology, which means that by connecting to the internet everyone can connect whenever and wherever they are. With the presence of smart home, it can simplify human problems and limitations. This paper describes the design and prototype of smart Home based on Internet of Things Applications on Android. There is an android application that functions to control and monitor the smart home. By using NodeMCU, is used as a line communication device between user and smartphone. The use of databases in Firebase makes the data on the smart home always real time active because it is connected to Google servers. We also develop an android application; thus smart home can be controlled by its owner.

Keywords : Smart Home, Internet of Thing, Android, Firebase.

I. INTRODUCTION

For last decade issue about smart homes increase rapidly. Basically, smart home is a technology that used to control environmental system devices, but this technology has grown as this technology applied toward all electronic devices within the house [1]. The main idea of smart home is building an automated electronic features environment system, mainly at home, thus these features can be controlled and monitor. Applying this has a meaning to build a communication line that makes the devices can communicate to each other.

Internet of things, known as iot is a supporting technology to build smart home design. Iot defined as a network of physical objects [2]. This things and objects refer to the idea of things, objects, that are sensible, addressable through information using any devices, also can be controlled via the Internet. Internet of Things is a great improvement and application of the Internet. It aims to enable things to be communication yet connected anytime, anyplace, toward anything and anyone using any network and path.

The combination between smart home an iot technology can be used for many applications. One of it to make monitoring application. An electronic device is a device that is almost owned by everyone at home. The number of home devices that need to press a button or switch to turn it on, sometimes requires inefficient use of time. The use of a switch also requires an action from humans to get to where the switch is located, which requires more time and energy. Maybe for humans with normal physical conditions it is easy to do it, but if the human condition is not possible to carry out physical activities, such as for persons with disabilities and the elderly, this is something that is difficult to do. In Indonesia alone the number of persons with disabilities and the elderly is quite numerous. Table 1. Shows data on persons with disabilities and the elderly in Indonesia in 2017 conducted by the Ministry of Social Affairs.

Table 1. Data persons with disabilities and elderly on 2017 in indonesia [3]

Data	Total
Disability of vision	3.474.035
Physical disability	3.010.830
Hearing disability	2.547.626
Mental disability	1.389.614
Chronic disability	1.158.012
Elderly	23.660.000

With the development of technology, the limitations of persons with disabilities and the elderly in using electronic devices can be minimized, namely by utilizing the use of the internet and smartphones for electronic device controllers. For example, turning on or turning off the lights, seeing the state of the lights being turned on or off, even helping to maintain home security [4]. The internet is used as a transmission medium for setting up electronic devices. While smartphones are used as a remote to control electronic devices at home. Besides controlling, it can also be used to monitor whether the electronic device is active or not. This concept is commonly referred to as smart home or smart home based on Internet of Things (IoT). By paying attention to this kind of thing, it can help government programs that want to realize a 4.0 industrial revolution, especially in the smart city sector, where most of these systems are based on internet of things.

This paper will design of prototype smart home and make an android application based on IoT to manage it. This application is useful for controlling electronic devices such as lights, fans, water tanks, and there are anti theft alarms. The smart home system is made at an affordable cost and can integrate electronic devices from various brands. With this paper, it is expected to increase the ease and security of residents in using the house as a place to live or occupy, can take advantage of technological advances, and support the establishment of smart cities to help realize the industrial revolution 4.0.

II. DESIGN OF SYSTEM

A. Smart Home System

In Figure 1 explain that smartphones and nodeMCU are connected via the internet. The database is stored on the Firebase platform; this is where the commands sent by the smartphone are set. While for the HC-SR04 sensor it works to activate the buzzer when it detects movement. HC-SR04 sensor readings are sent to Firebase via nodeMCU.

The principle works is that when a user uses the smart home application on a smartphone, the command will be sent to the Firebase database via the internet network. When the command reaches the database then it is processed, then sent to nodeMCU which is already connected to the relay to control the connected electronic devices.

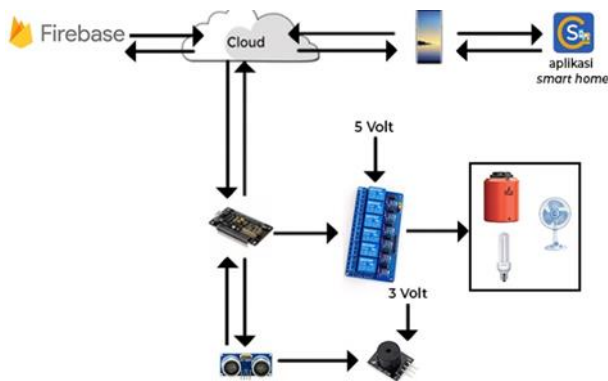


Fig. 1. Smart Home System

B. Electronic Circuit

In Fig 2 explain the schematic circuit of the whole system in the smart home circuit. NodeMCU works as an overall control center, the relay works as a liaison between nodeMCU and electronic devices connected to external voltage sources.

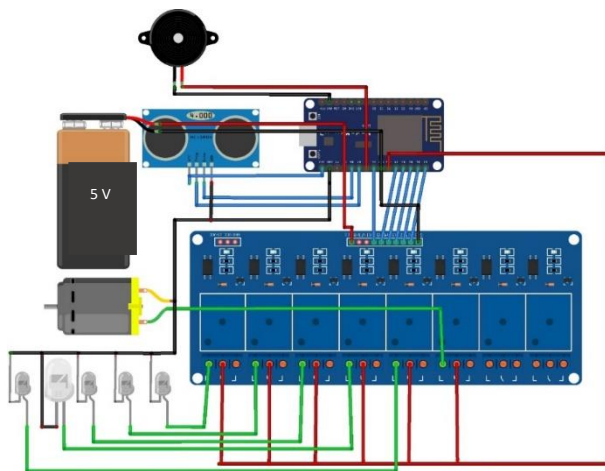


Fig. 2. Schematic Circuit

C. Design of Miniature

In fig. 3 display the shape of a miniature house that will be used as an analogy from the real house. This home miniature uses a 1:50 scale. In this miniature house will be installed LEDs, sensors, fans and water tanks.

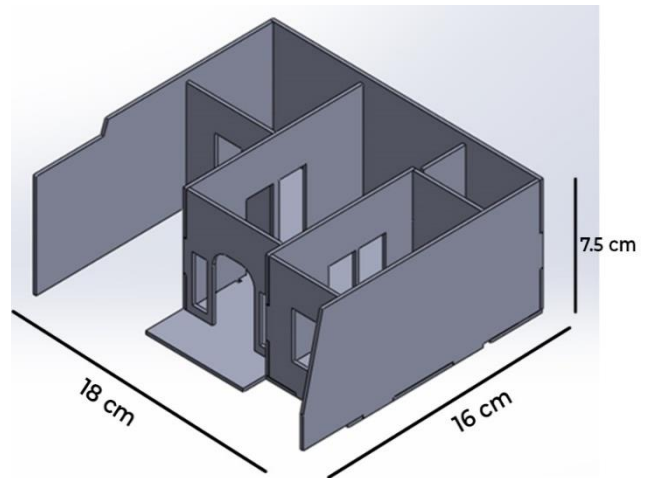


Fig. 3. Design of Miniature

D. Design of Smart Home Application

Android application is made using the Inventor app. displays the main page of the Swivel application that has 6 electronic icons and 1 condition icon. If the electronic icon is clicked it will change to color indicating that the device is on as shown in figure 4, while for the condition button it functions to see the state of the electronic device.



Fig. 4. Main of the User Interface

In fig. 5 shows the icon display that will be used to change the conditions in the database. When life or condition 1 will be colored, when it goes out or condition 0 will be black and white.



Fig. 5. Icons Condition

E. Design of App Inventor

In fig. 6 displays the program block on the main page, which controls input on Firebase. For an explanation of the program, if one of the icons is clicked it will send data to Firebase, then the icon changes the condition from on to off or vice versa.

For button4 it functions as a monitoring to see the state of the device whether it is on or off. The way is if the button is clicked, the application will call data from Firebase, then display it on the application.

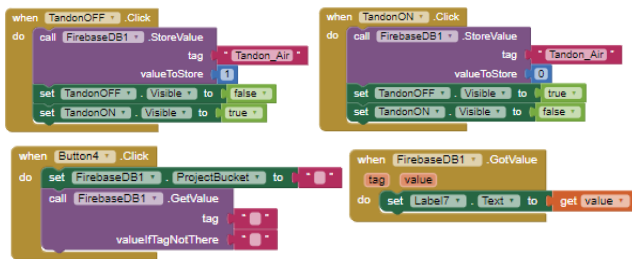


Fig. 6. Design of App Inventor

III. RESULT AND DISCUSSION

A. Testing of NodeMCU

NodeMCU testing is done to find out whether the module used can work properly. Fig. 7 shows the state of the LED in NodeMCU when running a blink program from Arduino IDE.

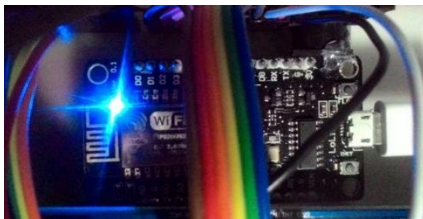


Fig. 7. NodeMCU

B. Testing of Relay 5 Volt DC

The 5 Volt DC relay is used to disconnect or connect LEDs with a voltage source. Testing is done by giving a value of 1 on each channel. In Figure 8 shows the state of each channel when it has logic 1.



Fig. 8. Relay Result.

C. Testing of Sensor HC-SR04

The HC-SR04 sensor is used to detect movement in a miniature house. Testing is done by matching the distance with the program on the Arduino IDE. In the program the maximum distance is set to 12 cm. In figure 9 shows the sensor detects objects around 12 cm indicated by a red LED indicator.

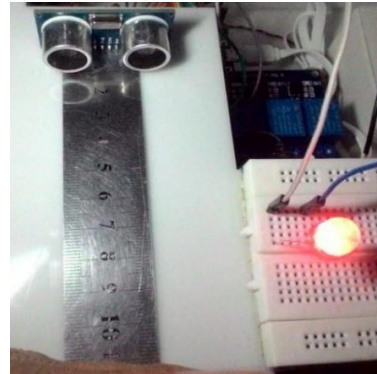


Fig. 9 . Sensor HC-SR 04

D. Testing of Firebase

In fig. 10 shows the data entered from the Arduino IDE program, which is in accordance with the contents of the program, both variable and variable value.

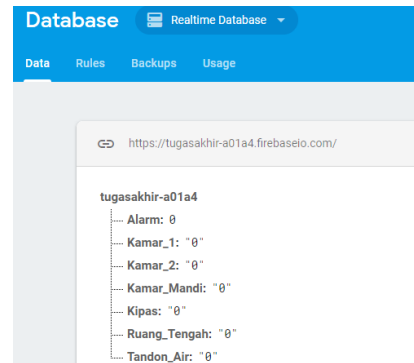


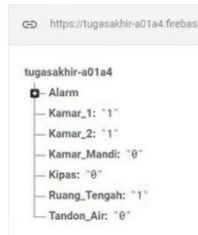
Fig. 10. Firebase Testing.

E. Testing of Smart Home Application

In Fig 11. show results that are as expected. When data from the application is input then sent to Firebase, then sent again to nodeMCU to control the DC relay. When clicking conditions for monitoring also corresponds to the data that is in Firebase and in miniature houses. The application displays data Kamar_1, Kamar_2, and Ruang_Tengah are on.



(a)



(b)



(c)

Fig. 11. (a) Display of Main User Interface, (b) Display of Firebase, (c) Result Smart Home

F. Testing Data Speed

Table II display the results of all three tests by comparing the quality and speed of the internet. In the first test using high-speed internet network get the fastest results, the second uses low-speed internet network, the results are longer. the third is in the third test when using two different networks.

Tabel 2. Testing data speed

Testing	On (second)	Off (second)
Testing 1	2,388	2,314
Testing 2	3,018	2,936
Testing 3	2,948	2,878

From the three experiments above, it can be concluded that the speed of smart home is influenced by the speed and quality of the internet used, the better the quality of the internet, the faster the data transmission.

G. Testing of Anti Theft Alarm

When there are objects in front of the HC-SR04 sensor about 10 cm, the buzzer is active and sends data to the application via Firebase. The buzzer will be active only if nodeMCU is connected to the internet. In figure 12 displays a condition worth 1 which means the buzzer has been active.



Fig. 12. Display Anti Theft Alarm

IV. CONCLUSION

This application successfully can work as switch to turn on and turn off electronic devices through an Android smartphone. Each relay can work and control the electronic device. The speed of sending data depends on the speed and quality of the internet used.

REFERENCE

- [1] V. Ricquebourg, D. Menga, D. Durand, B. Marhic, and L. Delahoche, "The Smart Home Concept : our immediate future The Smart Home Concept : our immediate future," no. January, 2007.
- [2] C. Salazar, "Internet of Things-IOT : Definition , Characteristics , Architecture , Enabling Technologies , Application & Future Challenges," no. January, 2019.
- [3] P. Arie, "Inklusi Penyandang Disabilitas di Indonesia," J. Refleks. Huk., vol. 1, pp. 1-4, 2017.
- [4] Arafat, "Desain Dan Implementasi Sistem Smart Home Berbasis Wi-Fi," Al Ulum Sains dan Teknol., vol. 2, no. 2, pp. 72-78, 2017