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Design and Build Internet of Things Based Home Automation System With Telegram

Yohanes Prasetiya[1)*], Rino[2)]

[1)2)3)]*Universitas Buddhi Dharma*
Jl. Imam Bonjol No.41, RT.002/RW.003, Karawaci, Kec. Karawaci, Tangerang, Indonesia

[1)]yohanesprasetiya@gmail.com

[2)] rino@ubd.ac.id

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Abstract

The purpose of this research is to design an application to automate electronic devices so that they can turn on and off automatically and to create a home security application with access and proximity sensors in the form of RFID. The method used in this study is a home automation system based on the internet of things with telegram. The results in this study are that using an internet of things-based home automation system can improve home security with entry access. By using a home automation system based on the internet of things, it can make it easier to control home electronics through applications and the results of the answers to the questionnaire respondents are above 50% on average in choosing the answer "Agree". These results indicate that this application is easy to use and in accordance with user needs.

I. INTRODUCTION

In recent times power is a significant requirement and is a source of energy use that is made little by little. Energy use is also growing which is the main reason and counter-activity to highlight the problem of energy use that must be brought to every place before resources are closed. An organized IoT framework will help reduce energy wastage by consistently monitoring and controlling electrical equipment. Savvy Homes or home robotization can bring development to the home environment that is used to provide authenticity and confidence to its residents. By using the development of information obtained is the actual contract arrangement, structure, and other things that are embedded with gadgets, programming, sensors, actuators, and organizational frameworks. Shrewd Home Automation is an individual enhancement of building mechanization and combines the control and robotization of lighting, fans, machinery, and security [1]. Electrical devices are generally supposed to be shredded. The web allows us to find a quick and precise solution to a problem and is also ready to communicate from a remote focus which adds to the reduction of general costs and energy usage. The web can be used in home computing which offers several options of moderate energy use. For additional help, affirmation and security. Undoubtedly, even unusual partitions so that clients can screen and handle their home entrances, various devices on and off garden lights, house lights, entrances and fans. In home computing, sensors are used for data collection, data transmission and after that sensors are sent from servers and segments for information checking. In the association of the skeleton in the middle, the actuators and sensors are clearly characterized. In the proposed framework, IoT conditions are used [1]. Telegram is a chat medium similar to whatsapp but does not yet have the facility to call friends. Telegram has several advantages, including being supported by 3 versions of the application, namely mobile, desktop, and web. The 3 versions of the telegram application are synchronized, meaning that when you open it on the desktop, the web. or mobile, the chat data displayed is the same without you having to log out of the telegram mobile application [2]. With the existence of IoT, it is hoped that it will be easier to access electronics used at home by simply sending commands via the Telegram application, because Telegram has a bot feature and can be connected to the Arduino IDE, making it easier to create automation system applications. The Arduino Uno microcontroller is an electronic kit or electronic circuit board in which the main component is a microcontroller chip [3].

* Corresponding author

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II. METHODS

2.1 NodeMCU ESP32

The open source device platform enables rapid prototyping and faster time to market for new IoT applications. The purpose of this book is to provide a brief introduction to the use of IoT hardware - the ESP32 board. The ESP32 is, in fact, a small development board with a microcontroller that supports the ESP32 IoT, the successor to the famous ESP8266 microcontroller from Espressif. The ESP32 is a very powerful Wi-Fi and Bluetooth enabled SoC with a very large number of GPIOs, and a development board that demonstrates strength in the design of highly accessible IoT modules. The ESP32 is a planned 2.4 GHz Wi-Fi and Bluetooth single-chip combination with 40 nm TSMC super low innovation. It is intended to achieve the best in RF power and execution, demonstrating power, flexibility and assisting different power applications and situations [4].

2.2 RFID RC522

RFID is the identifiable evidence of an individual or item using a radio frequency transmission. Radio repeat ID (RFID) utilizes radio frequencies to use data from a small device called a tag or transponder (Transmitter + Responder). The RFID tag will feel itself when it distinguishes the sign from the worthy contract, especially the RFID user (RFID Peruser). Radio repeat ID (RFID) is basically an innovation that is able to distinguish and recognize an item through data communicated via radio recurrence. A non-essential framework requires tags (what capabilities as a transponder), a client (what capabilities as a specialist), and a receiving cable (what capabilities as a connecting device). One of the important components of Radio repeat ID. (RFID) is data transfer. Data transfer occurs when there is a connection between the tag and the client, known as coupling, through a connecting cable either connected to the tag or to the client. Coupling on most Radio Repeat ID (RFID) frameworks uses either an inductive (inductive) or electromagnetic (backscattering) strategy. This technique is used based on the value, size, speed and range of readings and accuracy. Inductively coupled RFID systems have a short range, which is usually on an inch-demand basis. This type is generally used as an access control that only requires a short range. As a rule, the correspondence between the tag and the client occurs through the original rule known as backscattering changes. In this cycle, the client relays a message (which is essentially electrical energy) to the tag, and the name responds by reflecting some of this energy back to the client. The contraction of the charge resembles a capacitor, which is encased in the tag, allowing the tag to reflect the return mark. When the tag gets a mark, it means the capacitor is in a state of charging electrical energy, while when the label reacts, it means the capacitor is in a state of surrender.Another important component in a Radio Repeat ID (RFID) system is the repetition of activity between the tag and the client. The determination of repeatability is driven by application prerequisites, for example, speed, accuracy and ecological conditions, which may also include guidelines and principles governing application. For example, the application of Radio Repeat Conspicuous evidence (RFID) for naming animals or the application of Radio Repeat ID (RFID) introduced to creatures, mostly work using the 135 KHz repetition band [5].

2.3 *Ultrasonic* HC-SR04

The HC SR ultrasonic sensor is a 40 KHz sensor. The HC-SR04 is an ultrasonic sensor that can be used to measure the distance between an obstacle and the sensor. HC-SR04 has 2 main parts as its constituent, namely ultrasonic and ultrasonic transmitters. The capacity for ultrasonic discharge is to transmit ultrasonic waves with a repetition of 40 KHz and then send ultrasonic ultrasound to an item. The ultrasonic wave development season to get to the receiver is relatively twice the distance between the sensor and the distance estimation field using the ultrasonic sensor HC-SR04 is, the point where the knock triggers on the sensor, the transmitter will emit ultrasonic waves, simultaneously the sensor will give an up-progress TTL result shows the sensor starts to calculate the estimated time, after getting the results made by an item then the estimated time will come by giving TTL down-change results [6].

2.4 Sensor LDR

The LDR (Light Dependent Resistor) sensor is one type of resistor that can experience resistance adjustments when faced with bright or dim conditions. The guideline for the function of the LDR sensor is that if the LDR (Light Dependent Resistor) sensor is illuminated by light, the resistance will decrease and if the LDR (Light Dependent Resistor) sensor is not exposed to light, the resistance will increase. The LDR (Light Dependent Resistor) sensor has the following attributes: "if in a blunt state the resistance of the LDR (Light Dependent Resistor) sensor switches from many ohms (2) while in a bright state the opposition LDR (Light Dependent Resistor) the sensor can arrive at a few Uber Ohm (MS) and on the type of sensor LDR (Light Dependent Resistor) [7].

2.5 *Relay*

A relay is a part used to control a large current increase through a small voltage. Transfer is an interesting switch. When the exchange loop is activated, it pulls the arm switch, which is called the anchor. The contact point on the armature will close or open as indicated by its base position. The starting position refers to the contact position before the solenoid is turned on. For the most part there are open (NO) and normally closed (NC) movements. In the vehicle, the Relay is arranged in a case and it is recommended, to work with maintenance. A hand-off is an electrical regulator or regulator that is limited by different things, e.g. wonder charm, cooling, start lock, etc. Transfer allows small current circuits to control higher current circuits. Some relay plans in use today combine 3-pin, 4-pin, 5-pin, and 6-pin, with one burst or two kicks [8].

2.6 *Internet of Thing*

One of the limitations of mechanical progress in the present and future is the dominance of the Parcel field. The Web of Things is an idea where certain items can move information over a wifi organization, so this cycle doesn't expect human-to-human or human-to-PC cooperation. Everything goes according to the program. The Web of Things is usually referred to as Sections. In addition, this innovation is growing rapidly starting from remote innovation, miniature electromechanical frameworks (MEMS) and the web [9].

2.7 *Smart Home*

Smart home is a mechanical idea that is constantly evolving so it is possible to apply it in ordinary people's lives. The meaning of Brilliant Home Overall is an electronic organizational innovation that is coordinated between electronic gadgets and home machines so that the whole house can be controlled freely as a gadget. A smart home or smart home is a technology-based residence so that all of your home appliances can be managed and centralized in one place so you can control them both remotely and close. Smart home is equipped with a home management system with sophisticated technology so that you can control various electrical and electronic equipment with the help of the internet. This smart home system will provide convenience and comfort for you [10].

2.8 *Software Arduino*

Arduino because for beginners even individuals who do not have a basic programming language at all use the C++ language that has been developed through the library. Arduino uses dealing with programming which is used to enter projects into Arduino. The treatment itself is a mix of C++ and Java[11].

2.9 *Telegram*

Telegram is a chat medium that is similar to WhatsApp but does not yet have the facility to call friends. Telegram has several advantages, including being supported by 3 versions of the application, namely mobile, desktop, and web. The 3 versions of the telegram application are synchronized, meaning that when you open it on the desktop, the web. or mobile, the chat data displayed is the same without you having to log out of the telegram mobile application. Telegram application provides username facility. So, if you don't know your friend's phone number. You can still chat as long as you know the telegram username [12].

2.10 Black Box Testing

Black box testing is a type of testing that treats programming whose appearance is not clear. So the analyst sees the product as an insignificant "Discovery" about the item, but is very familiar with the testing system outwardly. This kind of testing only looks at the product as far as the specifications and requirements have been determined at the beginning of the plan. For example, if there is a product that is a stock dataframe in an organization. So in this type of white box testing, the product will try to unload the program posts and then use the method described earlier. Whereas in the black box type of testing, the product will be executed and then try to determine whether it has met the client's needs from the start without dismantling the posting program [13].

III. RESULTS

3.1 *Flowchart Hardware*

The following is a flowchart of the hardware that will be made:

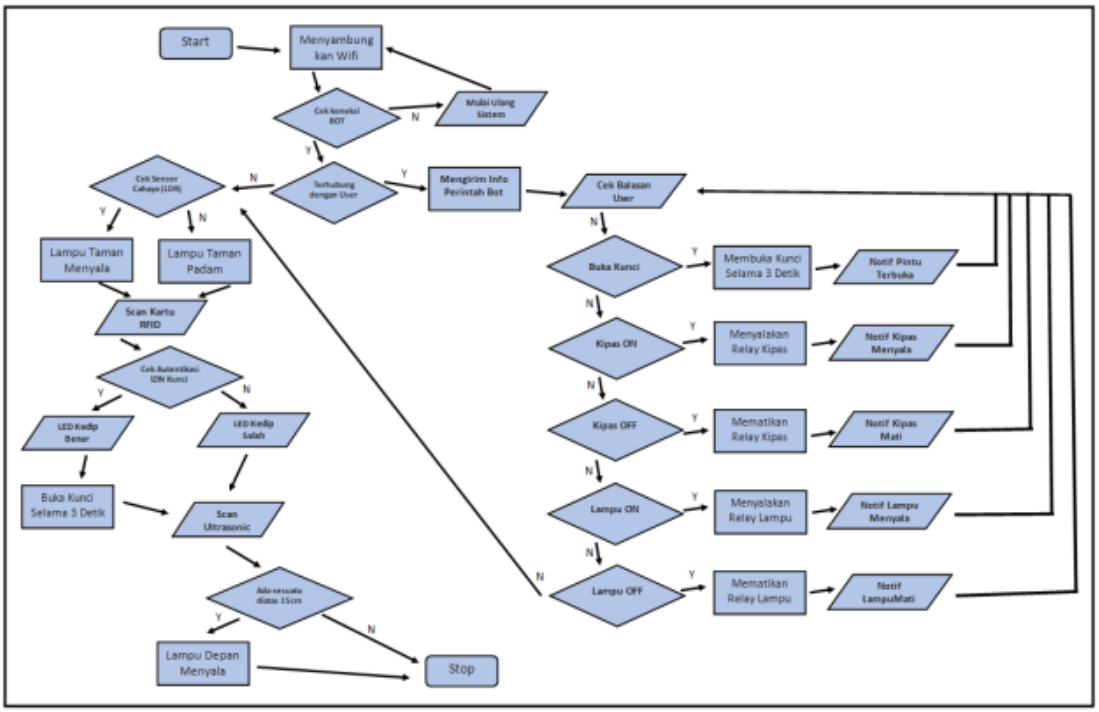

Fig. 1 Hardware Flowchart of Home Automation System Based With Telegram

3.2 Tool Connection Circuit Design

The following is a design tool / tools that will be used is described as follows:

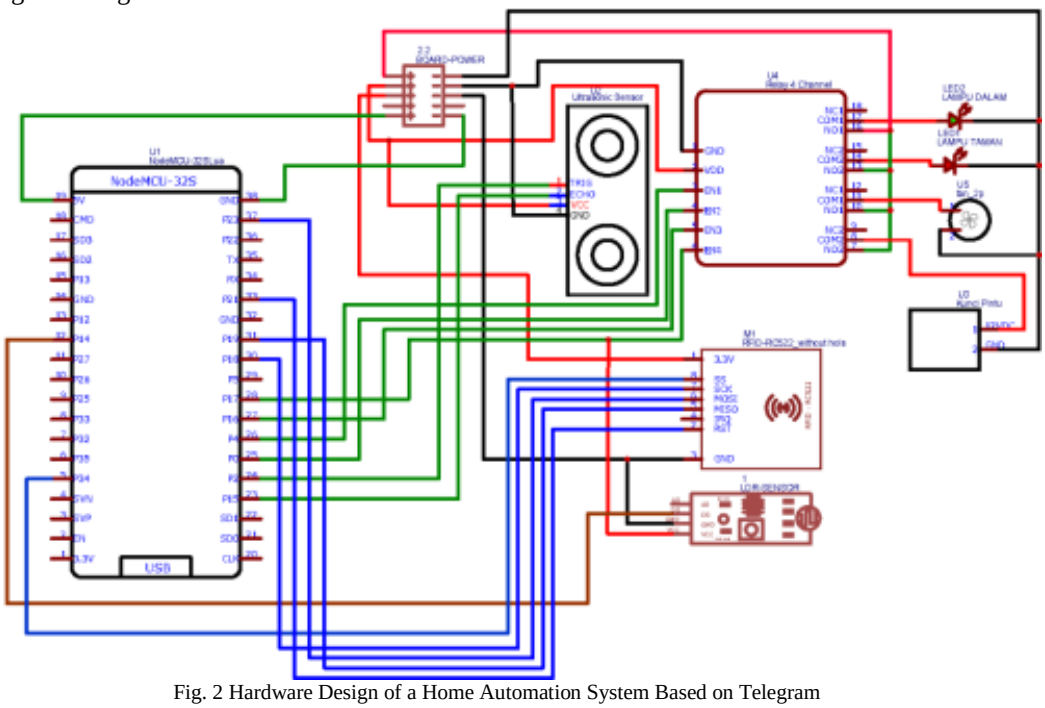

Fig. 2 Hardware Design of a Home Automation System Based on Telegram

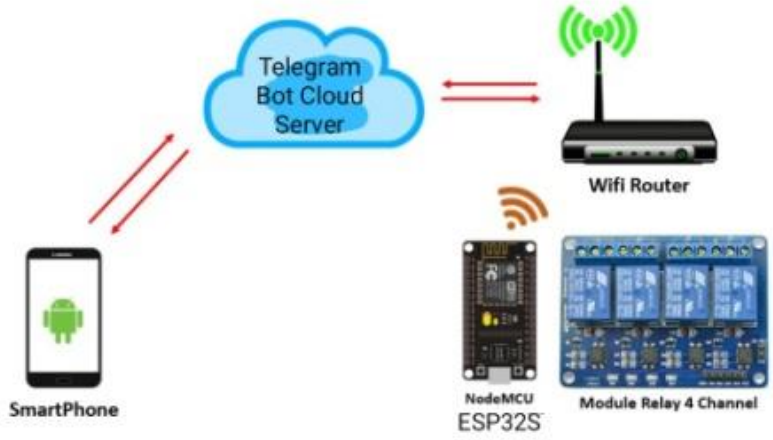

Fig. 3 Schematic Design of a Home Automation System Network Based With Telegram

3.3 Screen Design

The following is the design of the application and the buttons depicted by the storyboard as follows:

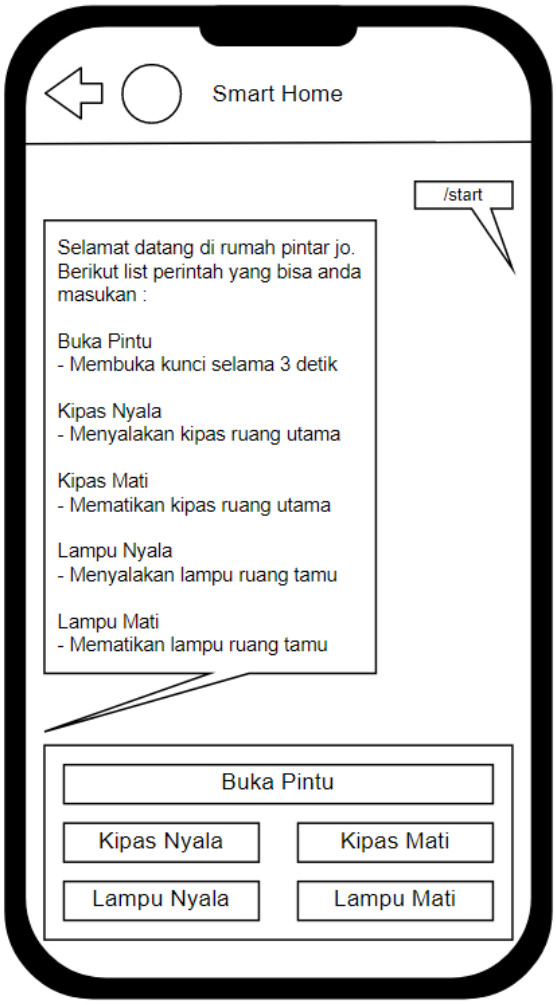

Fig. 4 Storyboard of Home Automation System Based on Telegram

3.4 Program View

On the screen display and this menu can be created through the Arduino IDE Application. Here's what the program looks like:

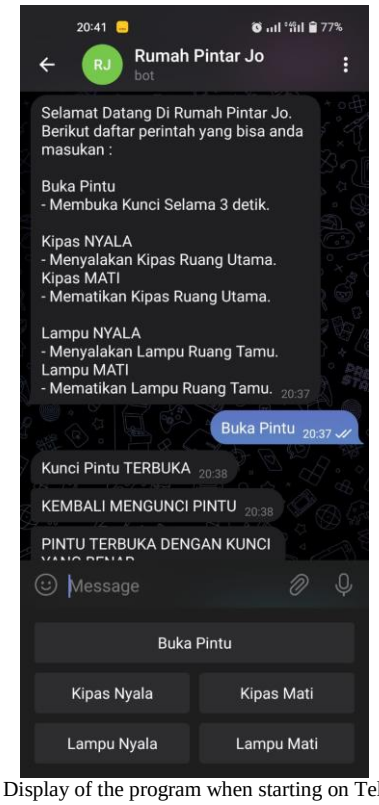

Fig. 5 Display of the program when starting on Telegram

Fig. 6 Program Display When Running Commands on Telegram

The following is a display of the interface of the tools in the design of a home automation system based on the internet of things with telegrams such as the displays of a series of tools used in the design.

Fig. 7 Appearance of the Tool from the Outside

Fig. 8 Appearance of the Tool from the Inside

3.5 Testing Black Box Testing

Black Box Testing is carried out to test the success of the series of tools in this design. Here are the test results:

TABLE I
BLACK BOX TESTING OF INTERNET OF THINGS-BASED HOME AUTOMATION SYSTEM WITH TELEGRAM

No	Test	Expected Results	Test Result	Information
1	NodeMCU ESP32	NodeMCU ESP32 can connect properly without causing errors	Suitable	Valid
2	RFID RC522	RFID RC522 can be used properly without causing errors	Suitable	Valid
3	*Ultrasonic* HC-SR04	Ultrasonic HC-SR04 can measure distances from 2 - 450 cm	Suitable	Valid
4	Sensor LDR	The LDR sensor can work well without causing errors	Suitable	Valid
5	*Relay*	The relay can be connected properly without causing an error	Suitable	Valid
6	*Arduino* IDE	Arduino IDE can work well without errors and bugs	Suitable	Valid
7	*Telegram*	Telegram can work well without errors and bugs	Suitable	Valid
8	CTbot *Library*	CTbot Library can connect with arduino IDE and telegram	Suitable	Valid
9	Automatic garden light	Garden lights can turn on and off automatically	Suitable	Valid
10	Open the door	The door can be open for 3 seconds using RFID	Suitable	Valid
11	Fan On	The fan can turn on automatically without pressing the fan button with the telegram app	Suitable	Valid
12	Fan Off	The fan can turn off automatically without pressing the fan button with the telegram app	Suitable	Valid
13	Light on	The light can turn on automatically without pressing the light button with the telegram app	Suitable	Valid
14	Lights off	The light can turn on automatically without pressing the light button with the telegram app	Suitable	Valid

3.6 Results of Questionnaire Data Processing

Based on the results of the collection of questionnaires obtained from 10 respondents from users which contains 10 questions are as follows:

1. Does this application meet the needs?

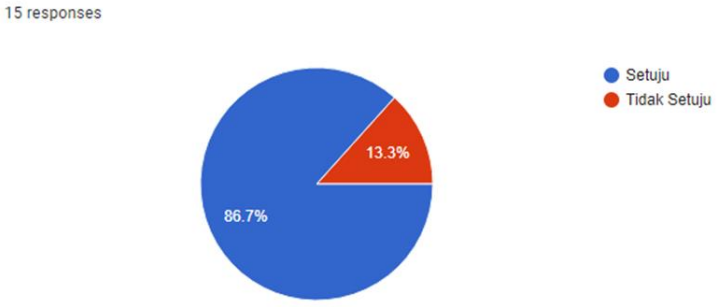

Fig. 9 Graph of Questionnaire Column Question Number 1

Based on the results above, it can be concluded that most of the respondents said the application was in accordance with the needs.

2. Is the application easy to operate?

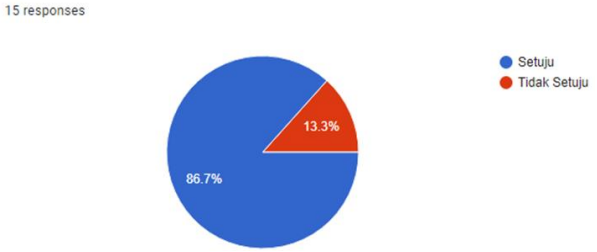

Fig. 10 Graph of Questionnaire Column Question Number 2

Based on the results above, it can be concluded that most of the respondents said the application is quite easy to operate.

3. Is the application comfortable to use?

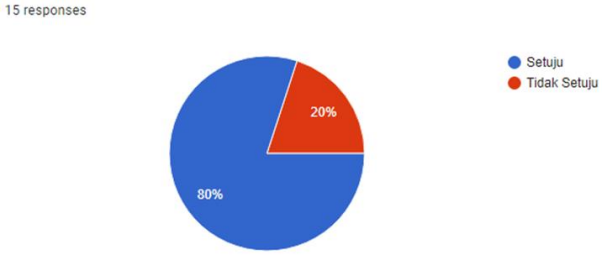

Fig. 11 Graph of Questionnaire Column Question Number 3

Based on the results above, it can be concluded that most of the respondents said the application was quite comfortable to use.

4. Is the application useful for users?

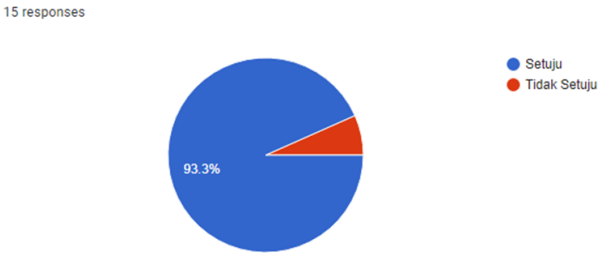

Fig. 12 Graph of Questionnaire Column Question Number 4

Based on the results above, it can be concluded that most of the respondents said the application is useful for users.

5. Is this application easy to use?

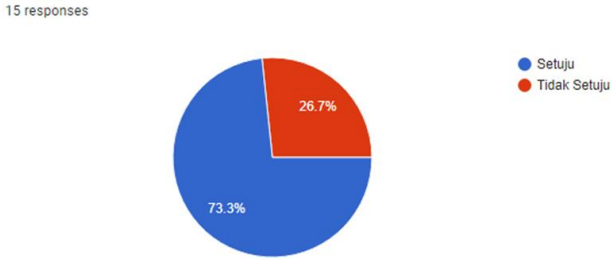

Fig. 13 Graph of Questionnaire Column Question Number 5

Based on the results above, it can be concluded that most of the respondents said the application was easy to use.

6. Is the menu in the application complete enough?

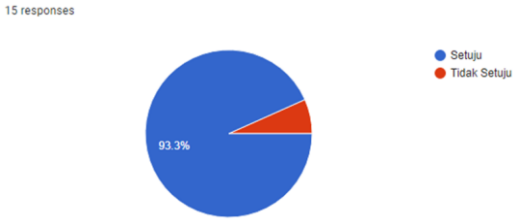

Fig. 14 Graph of Questionnaire Column Question Number 6

Based on the results above, it can be concluded that most of the respondents said the application has a fairly complete menu.

7. Is the information provided by the application easy to understand?

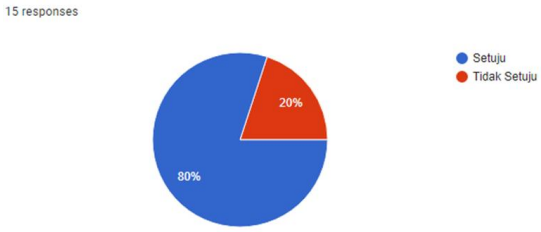

Fig. 15 Graph of Questionnaire Column Question Number 7

Based on the results above, it can be concluded that most of the respondents said that the information application information was easy to understand.

8. Is the use of the menu or menu application features easy to use?

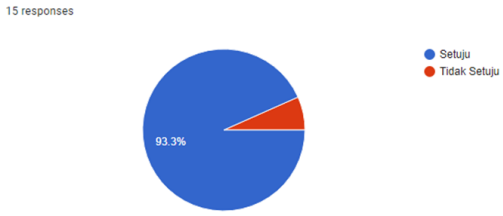

Fig. 16 Graph of Questionnaire Column Question Number 8

Based on the results above, it can be concluded that most of the respondents said that the use of menus or application features was easy to use.

9. Are the results displayed by the application in accordance with your needs and desires?

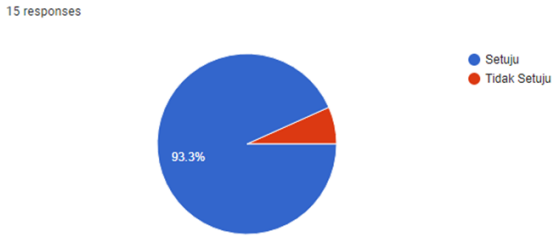

Fig. 17 Graph of Questionnaire Column Question Number 9

Based on the results above, it can be concluded that most of the respondents said the application was in accordance with their needs & desires.

10. Overall, is the use of this application satisfactory?

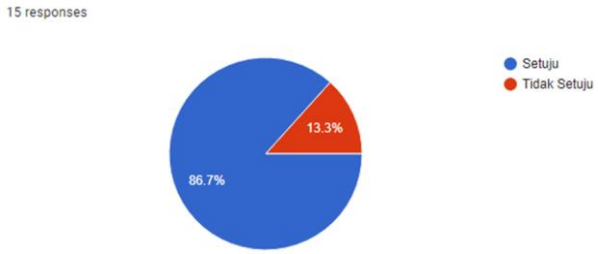

Fig. 18 Graph of Questionnaire Column Question Number 10

Based on the results above, it can be concluded that all respondents said the use of this application was quite satisfactory.

After the respondents answered all the questions in the questionnaire. Then the results obtained in the form of answers from all respondents. The following is a graph of the results of all respondents' answers to the questionnaire:

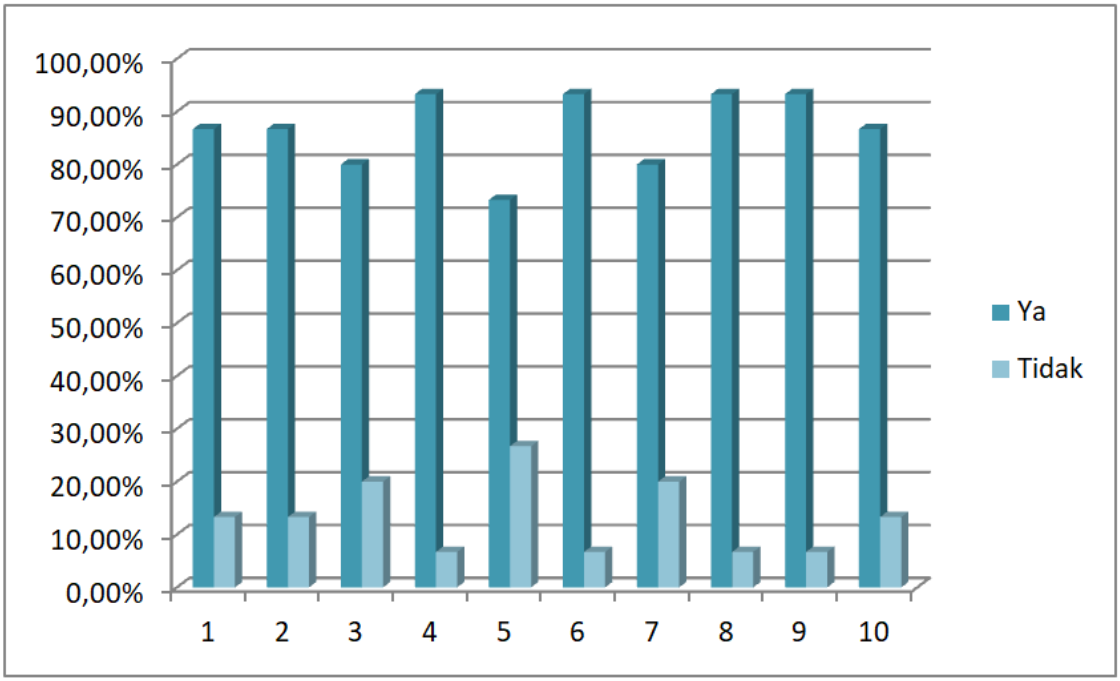

Fig. 19 Graph of Questionnaire Answer Results for All Respondents

Based on the picture above, it can be concluded that this application can be well received. Judging from the results of the respondents' answers, the average is above 50% in choosing the answer "Agree".

IV. CONCLUSIONS

Based on the results obtained in writing this thesis, the following conclusions are obtained:

1. Using an internet of things-based home automation system can improve home security with access.
2. By using an internet of things-based home automation system, it can be easier to control home electronics through applications.
3. The results of the respondents' answers to the questionnaire are on average above 50% in choosing the answer "Agree". These results indicate that this application is easy to use and in accordance with user needs.

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