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Design and Implementation of Home Security Using Telegram Botfather

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***Abstract*—Security is a condition where humans or objects feel protected from the danger that threatens or disturbs them, which will then cause a feeling of calm and comfort. Security can be obtained in several ways, one of which is by using and implementing technology. Today's application of security technology has developed very rapidly, ranging from conventional methods to high-tech. Therefore the author tries to design a home security system based on a microcontroller which is expected to be helpful, especially for people who often travel out of the house. One of the contributions made is to design and manufacture a home security device using the BOTFather telegram. This home security system uses internet technology to control devices remotely. Nodemcu esp8266, PIR sensor as a sensor used to detect infrared rays from an object, PIR sensor is passive, meaning that this sensor does not emit infrared light but only receives infrared radiation from outside. 4 channel relay is a switch that is entirely operated with electricity and is an electromechanical (electromechanical) component consisting of 2 parts, namely electromagnet (coil) and mechanical (separate lift contact switch/switch) which is used to turn on and off lights, and other devices. Arduino software is used to program Nodemcu Esp8266. PIR sensors, Lamp Relays and TELEGRAM are used as tools to send commands to devices in real-time.**

Keywords—Nodemcu esp8266 Arduino ide Telegram PIR sensor Relay 4 Chanel

I. Introduction

Along with the rapid development of technology, one of which is in electronic components that are applied to help the community facilitate their daily work by utilizing Internet of Things (IoT) technology that can be used in various industrial fields, one of which is security and lighting. It is a condition in which humans or objects feel protected from the danger that threatens or disturbs them, which will then cause a feeling of calm and comfort. Security and lighting can be obtained in several ways, one of which is by using and applying technology. Today's safety and lighting technology application has developed very rapidly, ranging from conventional methods to high-tech.

Therefore, the author tries to design a home security system using a microcontroller-based telegram bot father, which is expected to be helpful, especially for people who often travel out of the house. A home security system using telegram botfathers has been designed to detect suspicious movement and control lights remotely. Technology in this era of globalization has a huge role for the Indonesian nation, which is very minimal in technological development, especially in security and lighting. Therefore, innovation is needed so that this nation can compete in the international arena. The existence of technology that can help human work be more "efficient and effective" needs to be developed in the security and information sector.

Many examples of when the house is left travelling by the owner tend to be used by bad people to take things in the place. One of the main problems prone to theft in homes is the lack of security and lighting. The lack of tools that can be used to assist performance in critical times should be underlined with the development of technology in the field of electronics. It can help solve problems in terms of security and lighting, so from these existing problems, the authors try to design and create a tool for home security and lighting entitled “Design and Build a Home Security System Using BOTFather Telegram”. By utilizing internet of things (IoT) technology using the Arduino IDE and Telegram applications which are integrated with the Nodemcu esp8266 module equipped with a PIR (Passive Infra-Red) Sensor (passive infrared sensor), which functions as a motion detector based on PIR (Passive Infra-Red). This tool is equipped with a relay module that performs to turn on and off the lights, controlled via telegram.

II. Theoretical basis

A. Node MCU

NodeMCU is an electronic board based on the ESP8266 chip with the ability to run microcontroller functions and an internet connection (wifi). There are several I/O pins so that they can be developed into monitoring and controlling applications for IoT projects. The MCU node uses the Lua programming language, a package from esp8266. The Lua language has the same logic and programming structure as the C language, and only the syntax is different. If you use Lua, you can use the Lua loader and Lua uploader tools.

B. Relay 4 Channel

A relay is a switch that is entirely operated with electricity and is an Electromechanical component (Electromechanical) which consists of 2 parts, namely Electromagnets (Coil) and Mechanical (separately lift Contact Switch / Switch). Relays use the Electromagnetic Principle to drive the Switch Contacts so that a small electric current (low power) can conduct higher voltage electricity. For example, a Relay that uses 5V and 50 mA Electromagnets can move the Armature Relay (which functions as a switch) to conduct 220V 2A electricity.[13]

C. Sensor PIR

PIR sensor (Passive Infrared Receiver) is a sensor used to detect the presence of infrared rays. PIR (Passive Infra-Red) Sensor is passive, meaning that this sensor does not emit infrared light but receives infrared radiation from outside. PIR (Passive Infra-Red) This sensor is used in the design of motion detectors because all objects emit radiation energy. A motion will be detected when an infrared source with a specific temperature, such as a human, passes another infrared source with a different temperature, such as a wall. The sensor will compare the infrared radiation received every time so that if there is movement, there will be a change in the readings on the sensor.

D. Telegram

This telegram app has a BOT feature. The bot itself is another word for RobotRobot, where this RobotRobot will work to help facilitate us in sending messages. Creating your bot is very easy. We only need to add to the @BotFather account and enter information about the bot we will make. Later we will be given an API code that we will use for ESP8266 communication to the internet.

In short, API (Application Programming Interface) is a technology that becomes a communication bridge, which allows programmers to exchange data information through two or more different devices through the internet network. With this, devices that do not have a dedicated public IP for communicating with other devices only use the secret code API. For example, with this technology, we can use it to make an IoT (Internet of Things) based device to turn off and turn on relay lights using an ESP8266 device via the internet with the API from the telegram bot.

III. System planning

A. System General Design

A block diagram is needed in planning the Nodemcu-Based Security and Lighting System Design tool by utilizing the Telegram Messenger Application using PIR (Passive Infra-Red) Sensors, 4 Channel Relays and four lights to determine the working principle of the device. The block diagram is shown in the picture.

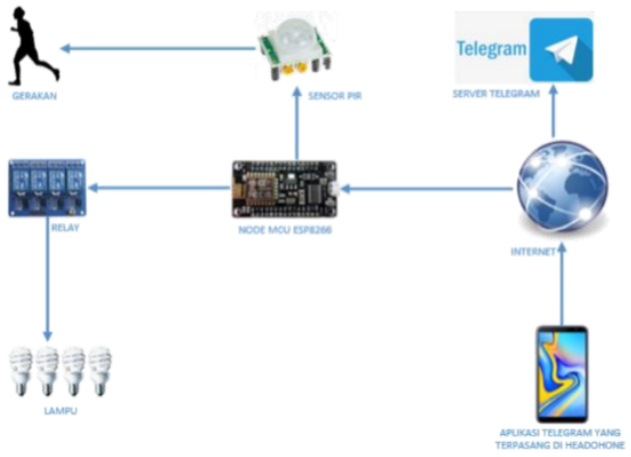

Figure 5. Block Diagram System

The PIR (Passive Infra-Red) sensor module used is of type esp8266. The sensor's output is in digital form so that it can be directly connected to the GPIO pin on the Nodemcu esp8266 module. The output pin on this sensor produces a voltage of 0 volts when it is not detecting motion and 3.3 volts when the sensor detects movement. The digital representation of a 0-volt voltage is digit 0, and a 3.3-volt voltage is digit 1. The 4 Channel relay is connected to the Nodemcu esp8266 port. The output pin on this relay produces a voltage of 0 volts when no voltage is input and 5 volts when it is turned on—a digital representation of 0 volts and 5 volts as digit 1.

B. Tool Design and Assembly

PIR (Passive Infra-Red) Sensor connection from nodemcu esp8266, PIR (Passive Infra-Red) Sensor ground connection connects to ground, output connects to D5, and VCC connects to 3V from nodemcu esp8266. And the relay connection four-channel Vcc connects to vv 5V from the MCU node, and ground connects to ground node MCU, in1, in2, in3, in, four connects to d0, d1, d2, d3. The 220V voltage goes to k1, k2, k3, k4, from k1, k2, k3, k4, and goes to lamps 1, 2, 3, and 4. And ground from the 220V voltage goes to ground lamps 1, 2, 3, and 4. After it connects nodemcu esp8266 to the computer using the USB cable.

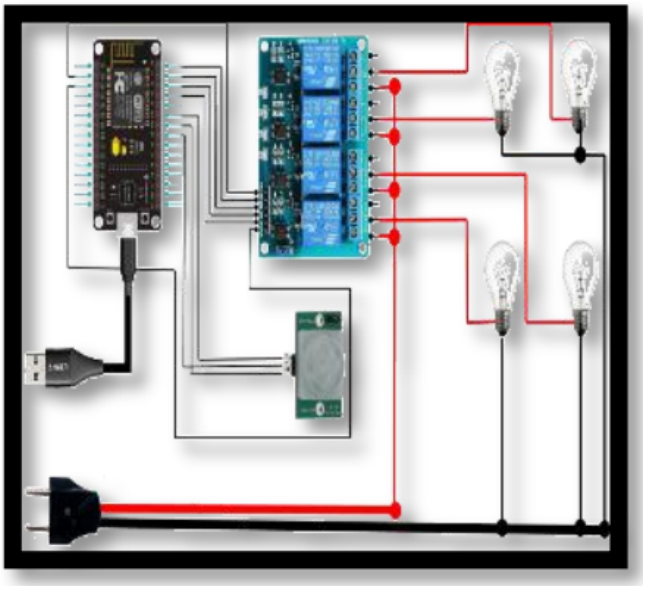

Figure 5. Block Diagram System

C. Application Interface Design

The design of this application interface is an essential part of the overall design because this interface is the part that users most often use to carry out the functions in this system. Therefore, this application interface is made, and procedures for monitoring and remote sensors are installed with the Nodemcu microcontroller and connected to the Telegram application.

IV. Tests and Results

A. PIR Sensor Range Testing

This test measures how far the PIR (Passive Infra-Red) Sensor can work to detect motion. Ten experiments were carried out at each predetermined distance to test the sensitivity of the PIR (Passive Infra-Red) Sensor. In Table 1 are the test results of the sensitivity of the PIR (Passive Infra-Red) Sensor to detect an object based on distance.

Table 2. Experiment Turning on the Lamp

Distance (Meter)	Test result										Success Percentage
	1	2	3	4	5	6	7	8	9	10	
1	B	B	B	B	B	B	B	B	B	B	100%
2	B	B	B	B	B	B	B	B	B	B	100%
3	B	B	B	B	B	B	B	B	B	B	100%
4	B	B	B	B	B	B	B	B	B	B	100%
5	B	B	B	B	B	B	B	B	B	B	100%
6	B	B	B	B	B	B	B	B	B	B	100%
7	B	B	G	B	B	B	B	G	G	B	70%
8	B	G	B	B	G	G	B	G	B	B	50%
9	G	G	G	G	G	G	G	G	G	G	0%
10	G	G	G	G	G	G	G	G	G	G	0%
										Rata-rata	5.5

Information :

B = Succeed

G = Fail

In Table 2. it can be concluded that the maximum distance PIR (Passive Infra-Red) Sensor can work to detect the presence of a movement is 6 meters. This is because, at a distance of 6 meters, the success rate of the PIR (Passive Infra-Red) Sensor is still at 100%. Likewise, at 7 and 8 meters, the PIR (Passive Infra-Red) Sensor can still detect movement. Still, the success rate is below 90%, and at a distance of more than 8 meters, the PIR (Passive Infra-Red) Sensor cannot detect any movement anymore.

B. PIR Sensor Sensitive Angle Test

The testing steps are carried out to determine the optimum angle of the PIR (Passive Infra-Red) Sensor in detecting horizontal and vertical motion. Objects, in this case, humans will cross the PIR (Passive Infra-Red) Sensor by forming angles that vary from 30o, 45o, 60o, 85o, 90o, 105o, 120o, 135o, and 150o. The object distance of the PIR (Passive Infra-Red) Sensor is 3-4 meters. This distance is still within the range of the PIR sensor. Following table 2. it is known that the sensor range is 6 meters. Measurements were carried out in a closed room and had Air Conditioner (AC). The temperature is set at 25 ° Celsius; the room temperature is formed using an analogue thermometer that shows the number 25 ° Celsius.

Table 3. Testing the PIR . Sensor Range Angle

Object position angle	**Experimental results**	
	Horizontal position	**Vertical position**
30^0	Not detected	Not detected
45^0	Detected	Not detected
60^0	Detected	Detected
75^0	Detected	Detected
90^0	Detected	Detected
105^0	Detected	Detected
120^0	Detected	Detected
135^0	Detected	Not detected
150^0	Not detected	Not detected

So the experimental table 3. above shows that the object detection test where the object is detected is not always the same at the end of the corner. This indicates that the pattern of object reading by the PIR (Passive Infra-Red) Sensor (PIR Polarization) is not circular but elliptical.

C. PIR Sensor Sensitivity to Room Temperature and Passing Objects

Testing the sensitivity of the PIR (Passive Infra-Red) Sensor to room temperature is done utilizing PIR (Passive Infra-Red). First, the sensor is placed in an air-conditioned room, and the temperature is set as desired by 18^o - 30^o C. Then, the room temperature is measured using an analogue thermometer that shows the desired number. Then the object (human) with an average body temperature of 36^o - 37^oC crosses the PIR (Passive Infra-Red) Sensor at 3-4 meters.

Table 4. PIR Sensor Test at Room Temperature

Temperature	**Detect**
18	Ya
19	Ya
20	Ya
21	Ya
22	Ya
23	Ya
24	Ya
25	Ya
26	Ya
27	Ya
28	Ya
29	Ya
30	Ya

Based on Table 4, in the experiment above, the room temperature of 18o -30o C has no significant effect on the success of the PIR (Passive Infra-Red) Sensor detects the presence of a movement of the object (human).

Table 5. Testing Time to Detect Motion

PIR Sensor Experiment	Sensor Detect
1	3
2	5
3	4
4	2
5	4
6	7
7	5
8	8
9	4
10	9

Testing the PIR sensor when it detects motion from 10 experiments with the PIR sensor detecting motion obtained different delays and averaged about 5.1 seconds.

D. Testing of 4 Channel Relays and Lights

Testing the sending time of turning on and off the light to the telegram application.

Table 6. Testing the Time of Sending Lights to the Telegram Application

Lamp Trial	Time	
	Turn on	Turn off
1	4	3
2	6	2
3	3	5
4	5	8
5	10	13
6	9	6
7	14	4
8	8	2
9	7	9
10	4	10
Average	7	6.2

From 10 experiments, different values were obtained when turning the lights on and off due to the unstable network and the long response time from the telegram. In this experiment, the Indosat network was used.

E. Overall Test

Testing the entire system started with PIR (Passive Infra-Red) Sensors detecting human movement, a four-channel relay as a switch for lights, Nodemcu esp8266 communicating with Telegram Messenger bots to send messages, and Telegram Messenger receiving messages received by users.

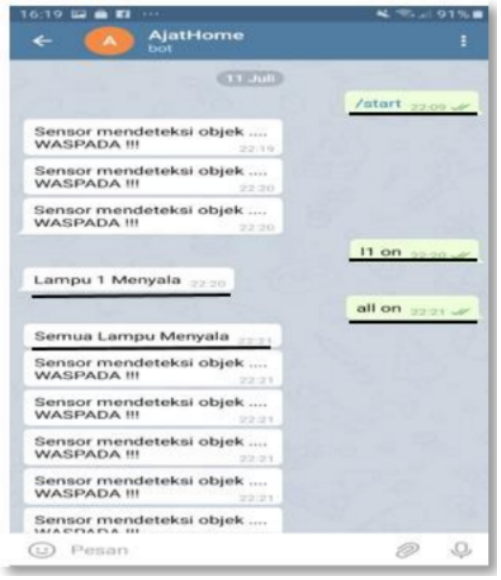

Figure 6. Tool Display in Telegram Window

In Figure 6, some results from the detection of the PIR sensor with the telegram application are given. For example, the word Sensor detects an object WARNING, so every time a thing is in the range of the PIR sensor, it will automatically get the message. Meanwhile, if we want to turn on or turn off the light, we must write the command according to the light we want to turn on or off.

V. Conclusion

From the results of the tests and analyzes that have been carried out, the following conclusions are obtained:

1. The maximum distance PIR (Passive Infra-Red) Sensor can detect the presence of an object movement is up to 6 meters. This means that the detected object will fail to be noticed at a distance of more than 6 meters.

2. Testing the relay with the lights running well, from lights 1, 2, 3, and 4, and all turning on and off with commands executed with the telegram application, with a time delay that varies depending on the speed of the internet network

3. The entire system is proven to work well in detecting, controlling, and sending the results to the user's telegram application.

4. From the test results and information on the recommended internet connection specifications for the implementation of this system, based on the delay obtained, the Internet of Things network: Home Security System Using Telegram Bots are used

5. The internet network used in this experiment is FTTH Indihome PT. Telkom with a minimum bandwidth specification of 10 Mbps. This is because the delay in sending object detection messages is 7.5 seconds, and 4G Indosat is 9.5 seconds

Reference

[1] Haribu Tempongbuka, Elia K. Allo, Sherwin RUA Sompie Rancang Bangun Sistem Keamanan Rumah Menggunakan Sensor Pir (Infrared

Pasif) Dan Sms Sebagai Notifikasi (2017) https://ejournal.unsrat.ac.id/index.php/elekdankom/article/view/9992

[2] Abidin, Z. (2014). Sistem Keamanan Dan Monitoring Rumah Pintar Secara Online Menggunakan Perangkat Mobile. Jurnal Teknik Komputer Universitas Komputer Indonesia, 3(2), 13–17. Retrieved from http://komputika.tk.unikom.ac.id/jurnal/sistem-keamanandan.13

[3] Alfirman. (2012). Penggunaan Port Paralel Komputer Dan Sensor Untuk Sistem Keamanan Rumah. Jurnal Teknologi Informasi & Pendidikan, 5(2), 91–101. Badan Pusat Statistik. (2016). Statistik Kriminal 2016. Jakarta. Retrieved from https://bps.go.id/website/pdf_publikasirg/Statistik-Kriminal-2016.pdf

[4] Kashimoto, Y., Fujiwara, M., Fujimoto, M., Suwa, H., Arakawa, Y., & Yasumoto, K. (2017). ALPAS: Analog-PIR-sensor-based activity recognition system in smart home. Proceedings -International Conference on Advanced Information Networking and Applications, AINA, (i), 880–885. https://doi.org/10.1109/AINA.2017.33

[5] Mekonnen, T., Harjula, E., Koskela, T., & Ylianttila, M. (2017). SleepyCAM: Power management mechanism for wireless video-surveillance cameras. In 2017 IEEE International Conference on Communications Workshops, ICC Workshops 2017 (pp. 91–96). https://doi.org/10.1109/ICCW.2017.7962639

[6] Nataliana, D., Anwari, S., & Akbar, M. S. (2017). Implementasi Prototype Sistem Home Security dengan Pemanfaatan Kode Akses berbasis Arduino Mega. Jurnal ELKOMIKA | Vol. 5 | No. 2 | Halaman 119 - 137 Juli - Desember 2017, 5(2), 119–137.

[7] Raspberry Pi Foundation. (2012). Raspberry Pi - Teach, Learn, and Make with Raspberry Pi. Retrieved from https://www.raspberrypi.org/

[8] Sutikno, T., Handayani, L., Stiawan, D., Riyadi, M. A., & Subroto, I. M. I. (2016). WhatsApp, viber and telegram: Which is the best for instant messaging? International Journal of Electrical and Computer Engineering, 6(3), 909–914. https://doi.org/10.11591/ijece.v6i3.10271

[9] Codepolitan edisi 19 maret 2016 Magazine. Invasi Internet Of things di tanah air. Diakses melalui https://www.codepolitan.com. Pada tanggal 25 maret 2018.

[10] Dhenny, R & Dkk (2017). Sistem Pemantau & Pengendalian Rumah Cerdas Menggunakan Infrastruktur Internet Messaging. Journal Link Vol 26/N0.1 .ISSN 1858-4667