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Home Security Voice Notification System With Arduino Sensor, PIR based SMS Gateway

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***Abstract*— The level of crime that afflicts households such as theft and robbery is still common. Many thefts occur when the homeowner is away and the house is staying for a long time. Although some residential neighborhoods already have security officers, human limitations can be a gap for perpetrators of theft. To overcome this, we need a guard who is always there to monitor the house to avoid theft. In this case the risk of guards on duty to guard the house is very large, such as acts of theft accompanied by violence. The design and manufacture of this system uses the Network Development Life Cycle (NDLC) method. NDLC is a method that relies on previous development processes such as business strategy planning, application development lifecycle, and data distribution analysis. There are 6 stages in the Network Development Life Cycle (NDLC) namely Analysis, Design, Simulation Prototyping, Implementation, Monitoring, Management. The purpose of this research is Designing a home security system that can guard the house in real time and can be accessed remotely. The conclusion of this research is that the entire system is proven to be able to work in detecting, giving warnings, and making calls to the user.**
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Keywords : **Security, SMS Gateway, Arduino, PIR sensor**

I. INTRODUCTION

The level of crime that afflicts households such as theft and robbery is still common. Many thefts occur when the homeowner is away and the house is left for a long time. Although some residential neighborhoods already have security officers, human limitations can be a gap for perpetrators of theft. To overcome this, we need a guard who is always there to monitor the house to avoid theft. In this case the risk of guards on duty to guard the house is very large, such as acts of theft accompanied by violence. With current technological advances, these problems can be overcome by utilizing the SMS Gateway as a home security system. SMS Gateway is a system used to send, receive and even process SMS. This device is able to provide real time data information. So that when unexpected things happen, the user can handle it quickly in real time. Remote monitoring system can be used to monitor a room or place wirelessly. The home security system will be good, if every house in the neighborhood already has a good security system. This helps homeowners to monitor the house when it is empty, because it will reduce the space for crime in the neighborhood, so any crime can be detected early. Based on research conducted by Permata et al (2016), the home security system is a need for communication and security facilities and infrastructure. Due to the high level of human activity in meeting economic needs, it reduces the time for humans to be around the house, both to gather with family and to maintain the security of the residence.[1] While research conducted by Tempongbuka (2015), developments in the field of technology are designed to provide security, even protect assets owned. So it requires a security technology that has the characteristics of mobile technology, namely in getting information or accessing it using an easy way. An example of Mobile Technology is the discovery of mobile technology that suits human needs. That is able to communicate remotely wherever they are, one of which is through Short Message Service (SMS). Because with this facility one can send a message to the destination quickly, precisely, and at a low cost [2]. Research by Juniawan and Sylfania (2019) by building a prototype home security system that combines a PIR sensor and a magnetic switch based on a microcontroller and an SMS gateway [3]. Further research by Irawan, et al (2021) a security system can be used on a system where when the PIR sensor detects movement, the bell will ring, and the red LED lights up, the voice module will send the expected voice message and the GSM module will send a message to the cell phone number. homeowner [4]. Another study, Jalil and Matalangi (2021), stated that building a home security system based on object motion detection using Robot Operating System 2 (ROS2) and Raspberry Pi. ROS2 in this study is used to read and process camera data and to control buzzer sound [5]. Others by Wisjhnuadji and Widodo (2018), his research builds an automatic home security system that is able to provide notifications to homeowners via SMS gateways and is able to control the opening and closing of house gates automatically and provide warnings in the form of sound from the alarm buzzer [6][7]. This study aims to implement an SMS

Gateway in a home security system with Arduino which is integrated with the PIR sensor, GSM module, and buzzer alarm.

II. MATERIALS AND METHODS

In this research, the method used is the Network Development Life Cycle (NDLC) method. NDLC defines the process cycle or development of a computer network system [8][9].

A. *Needs Analysis*

a.1 Analysis of Hardware and Software Requirements.

The equipment or devices used in this study can be classified into two types, namely hardware (hardware) and software (software).

Hardware :

- Arduino.
- Sensor Passive Infrared Receiver (PIR): HC-SR501 E40.
- GSM Module 800L V2.
- Buzzer
- Project Board
- Jumper Cable
- Laptop/PC
- Mouse.
- Keyboard

Software:

- Programming Language : Arduino
- Application : Arduino IDE
- SMS

a.2.Data analysis

Based on the search results of related scientific journal articles, that the security system uses Arduino, PIR sensor, buzzer, and GSM module, many researchers have raised the case, what distinguishes this research is adding a power supply so that the system will stay alive. [10],[11],[12],[13],[14]. This study will implement a security simulation using Arduino, PIR sensor, and buzzer as a warning to strangers who enter the house and the GSM module to send notifications in the form of telephone calls to homeowners, so that it can make it easier for homeowners to take early prevention if something happens. crime.

a.3. Block Diagram Design

In making a home security system using a remote control, it must first be described using a block diagram of the configuration and wiring that will be applied, this will be very helpful in identifying errors and weaknesses in the event of a failure in the design of the system. In addition, block diagrams will also help to understand the system design that is being carried out. The design of block diagrams is intended to provide an overview of the tools to be designed starting from sensors to microcontrollers, microcontrollers to GSM modules, and from GSM modules to cellphones [15],[16]. For more details, see Figure 1 below:

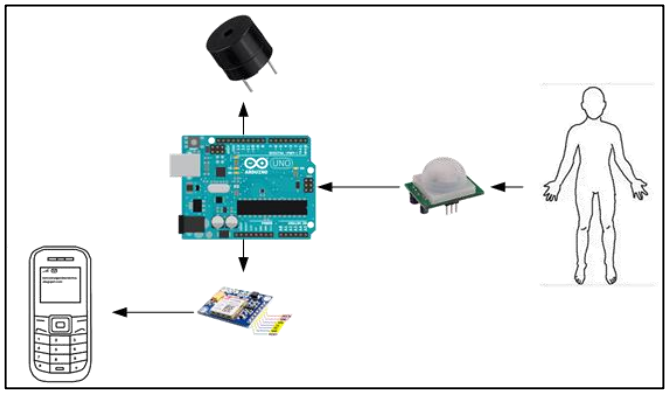

Figure 1 Block Diagram

a.4. System Flowchart

A flowchart is a general diagram that presents a flow of how the system works to show the steps taken by a program or tool in solving problems, as shown in Figure 2 below:

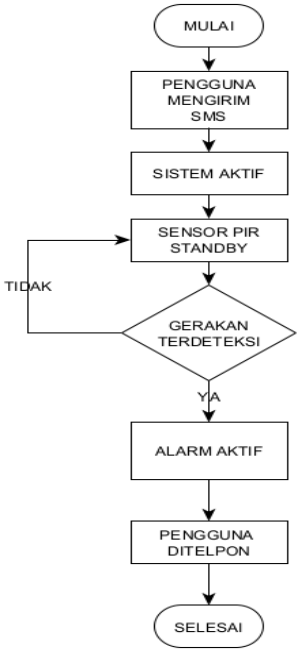

Figure 2. System Flowchart

a.5. Stage One Design

The first stage of the design starts from the installation process of the Arduino IDE application so that the device can be accessed by the author and the device can be connected to each other.

a.6. Stage Two Design

In the second stage of the design, the author configures the PIR sensor with Arduino to be able to detect motion. The sensor used in the design of a home security system based on SMS Gateway is a Passive Infrared Receiver. This sensor receives infrared radiation from the outside, where the data from the sensor is a single digital bit. Thus, if there is movement, the sensor will receive a different data reading than before. In the second stage of the design, it is described in Figure 3 below:

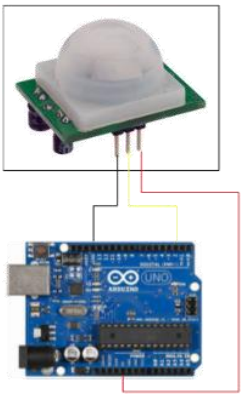

Figure 3. Connecting Sensors with Arduino

The initial stage is to connect the PIR sensor output pin sensor to pin no.2 on the Arduino, Connect the DC voltage pin on the PIR sensor to the 5 volt pin on the Arduino, connect the PIR sensor ground pin to the ground pin found on the Arduino.

a.7. Stage Three Design

In this third stage design, the author configures the PIR sensor, and the buzzer is connected to Arduino so that the buzzer can issue a warning when the PIR sensor detects movement. The buzzer used can be of various kinds

as long as the voltage required by the buzzer does not exceed 5v. While in this study the author of the buzzer, the buzzer was connected to Arduino using a male to female jumper cable. The process steps in doing the third stage design are as shown in Figure 4 below:

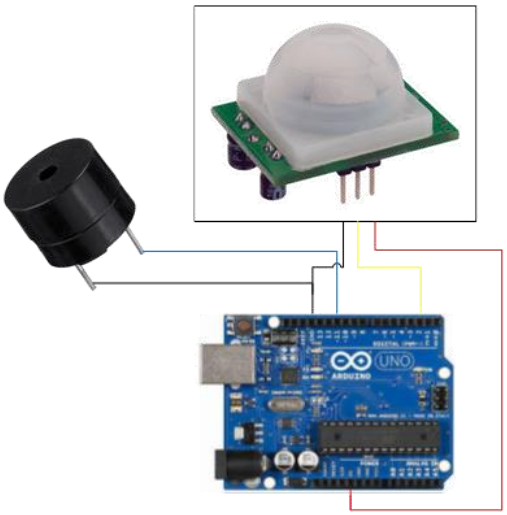

Figure 4. Connecting the pir sensor and buzzer with Arduino

The third step is to connect the positive (+) buzzer pin to Arduino via pin no 11, connect the negative(-) buzzer pin to the Arduino ground pin.

a.8. Stage Four Design

In the fourth stage of the design, the author integrates the PIR sensor, Buzzer and GSM Module which is connected to Arduino so that when the sensor detects movement it triggers the buzzer to make a sound, and makes the GSM module make voice calls. connecting the SMS Gateway with Arduino by making a sketch on the Arduino IDE application so that Arduino can respond to SMS commands sent by the user. The process steps in carrying out the fourth stage design are as shown in Figure 5 below:

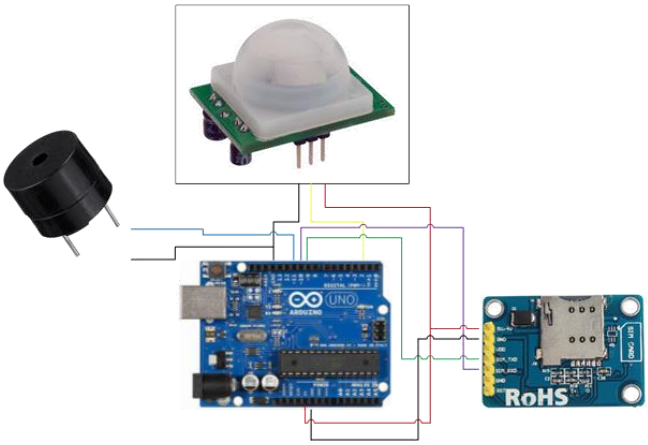

Figure 5. Connect the PIR Sensor, Buzzer and GSM module

III. RESULTS AND DISCUSSION

The initial step in testing this research requires the installation of the Arduino IDE application which can be downloaded from the official website for free via the link http://www.arduino.cc/en/software. After doing the installation by following the instructions given then we can take the next step, namely by integrating all the tools used.

3. Tool Integration

3.1. Arduino Integration with PIR Sensor

The first step is to integrate the PIR sensor with Arduino, a connecting cable between the sensor and Arduino is carried out, namely the male to female jumper cable. To connect it, 3 female cables are needed and then plugged into the 3 pins on the pir sensor, namely for VCC, Output, and GND

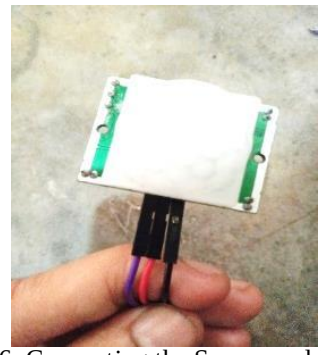

Figure 6. Connecting the Sensor and Jumper Cable

On the VCC pin the sensor is connected to pin 2 of the Arduino, then the output pin of the sensor is connected to the 5v pin and the GND pin of the sensor is connected to the GND pin of the Arduino.

3.2. GSM Module Integration on Arduino

To connect the GSM module with Arduino, the first step is to insert an active SIM card in the module, then connect the male to female jumper cable. 4 wires are required to connect the module on the arduino.

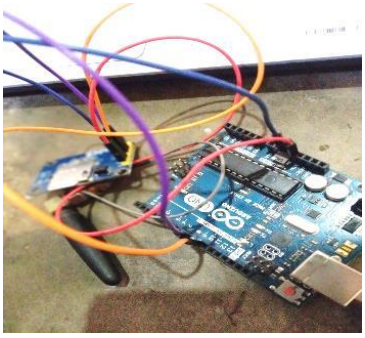

Figure 7. Connecting GSM Module with Arduino

The SIM_RXD pin is connected to analog pin 10 on the arduino then the SIM_TXD pin is connected to analog pin 9 on the Arduino, the 5v pin is connected to the 5v pin on the arduino, then the GND pin is connected to the GND on the Arduino.

3.3 Overall System Trial Analysis

The flow of testing the entire system is first carried out from the PIR sensor detecting the movement of an object (human), then the buzzer will sound and GSM will make a voice call to the home owner. The test conditions are carried out at a distance of 2 meters (2 meters is the distance that can still be read by the pear sensor because it is still below a distance of 5 meters, meaning that at a distance of 1 to 5 meters the pear sensor can still work well), with room temperatures ranging from 18 – 30 degrees Celsius. As shown in table 1 below :

Table 4.1 System Trial Analysis Results

Test to	Room Temperature Condition	PIR Sensor Condition	Detection Time Delay	GSM Condition	Call Received	Time of call received
1	18 dc	Detected	00:00-02.01	Active	B	00:00-02.18
2	19 dc	Detected	02:01-04.00	Active	B	02.18-04.37
3	20 dc	Detected	04:00-06.02	Active	B	04.37-06.25
4	21 dc	Detected	06:02-08.01	Active	B	06.25-08.39
5	22 dc	Detected	08:01-10.02	Active	B	08.39-10.30

6	23 dc	Detected	10:02-12.03	Active	B	10.30-12.49
7	24 dc	Detected	12:03-14.05	Active	B	12.49-14.30
8	25 dc	Detected	14:05-16.04	Active	B	14.30-16.30
9	26 dc	Detected	16:04-18.01	Active	B	16.30-18.17
10	27 dc	Detected	18:01-20.02	Active	B	18.17-20.41
11	28 dc	Detected	20:02-22.02	Active	B	20.42-22.30
12	29 dc	Detected	22:02-24.01	Active	B	22.30-24.17
13	30 dc	Detected	24:01-26.03	Active	B	24.17-26.30

Information :
B : Success
T: No

From the test results of the whole system, it can be concluded that from experiments 1-13 with different temperature conditions between 18-30 degrees Celsius, the pear sensor can detect movement, the delay when the pear sensor detects the next movement is 02.02 seconds. When the sensor detects movement it will trigger active GSM to then call the homeowner with an interval of 02.15 seconds.

IV. CONCLUSION

After designing and testing a home security system using Arduino, buzzer, PIR sensor, and GSM module, the following conclusions can be drawn:

1. The entire system is proven to be able to work in detecting, giving warnings, and making calls to users.
2. The maximum distance the pir sensor can detect the presence of an object's movement is 5 meters, meaning that objects that are more than 5 meters have less success.
3. The room temperature is lower than the human body temperature has no effect on the sensitivity of the sensor.
4. The process of making calls to users takes 2-3 seconds
5. The PIR sensor can detect from a distance of 5 meters and will be more sensitive at a closer distance and in reading the PIR sensor takes 2-3 seconds to detect motion.

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