CHAPTER 4

ANALYSIS AND DESIGN

4.1. Analysis

In this program, a test is carried out to analyze several distances from the nearest route using the Haversine algorithm with the array method, if the program detects movement, the program will send a notification along with the minimum distance.

4.2. Design Analysis Hardware NODEMCU ESP8266

In this study, I used the NODE MCU ESP8266 module as a module to send notifications. So that by using the ESP8266 module there is no need to use Arduino Uno anymore, because the ESP8266 module also has pins to connect the sensors used in this study, and another advantage of this ESP8266 module is that it does not require a phone sim card such as the SIM800l or SIM900l module, because to send notifications the ESP8266 module only uses a WiFi network connection. Because the ESP8266 module uses a WiFi connection network so there are no problems with the IMEI, in contrast to the SIM800l which always has problems with the IMEI.

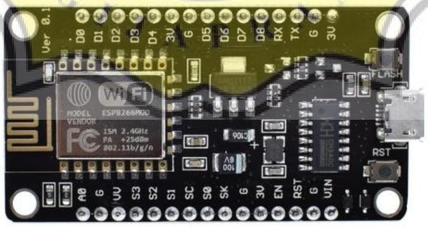


Figure 4.1 NODEMCU ESP8266

4.3. Motion Sensor PIR HC-SR501

The sensor used in this study is a PIR sensor which functions to detect human movement. Because this study discusses the home security system by detecting human movement, so the most appropriate sensor to use is the PIR sensor, because the way this PIR sensor works is to detect human movement, because the human body emits heat energy in the form of infrared radiation. When the infrared detected in the sensor range changes rapidly, the sensor will send output to indicate movement. This PIR sensor is very effective to use because it uses low voltage power.

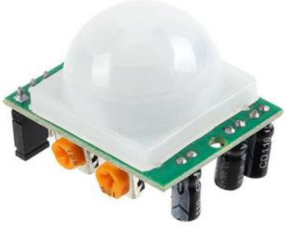
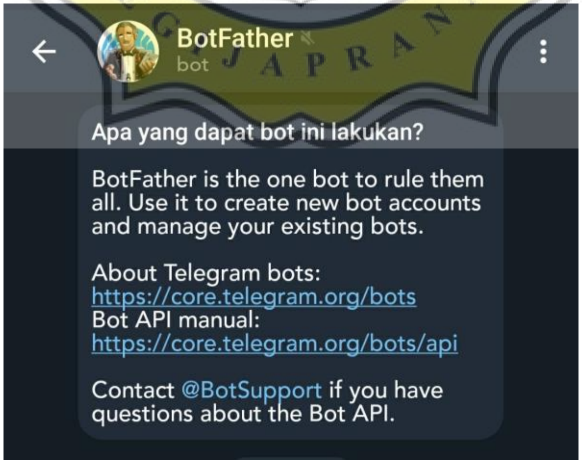


Figure 4.2 Motion Sensor PIR HC-SR501

4.4. Design Analysis Application BOT Father Tellegram

The application software used in this study is BOT Tellegram which functions to receive output in the form of messages or notifications. The convenience of using the Tellegram BOT is only by creating a BOT API and BOT ID, after that the API and ID that have been obtained are directly placed in the ESP8266 program so that Tellegram can receive notifications when the sensor detects movement.



Apa yang dapat bot ini lakukan?

BotFather is the one bot to rule them all. Use it to create new bot accounts and manage your existing bots.

About Telegram bots:
https://core.telegram.org/bots
Bot API manual:
https://core.telegram.org/bots/api

Contact @BotSupport if you have questions about the Bot API.

Figure 4.3 BOT TELLEGRAM

4.5. Haversine Algorithm

This research is to find the shortest distance between 2 points using the haversine method. By converting latitude and longitude to distance Basic calculations using trigonometric formulas with latitude and longitude coordinates as calculated numbers. By using the haversine method, we can find the distance of 2 straight points that have the closest distance.

$$\mathrm{d} \; = \; 2\mathrm{r}.\arcsin\left(\sqrt{sin\left(\frac{Lat2 - Lat1}{2}\right)^2 + cos(Lat2) \cdot cos(Lat1) \cdot sin\left(\frac{Lon2 - Lon1}{2}\right)^2}\right)$$

4.6. Design Program

In this research program the problem to be solved is to determine the location of the closest distance, the first process is to detect the movement of human objects using a PIR sensor that is connected to the ESP8266 microcontroller and has also been connected to the Telegram BOT API which has been created as an output receiver in the form of notification messages.

The next stage is the process of using the Haversine algorithm. The process in the Haversine algorithm uses coordinate point data for each location that has been measured manually using google maps, if the algorithm program has found the closest distance then when the sensor detects movement it will also send the minimum distance.

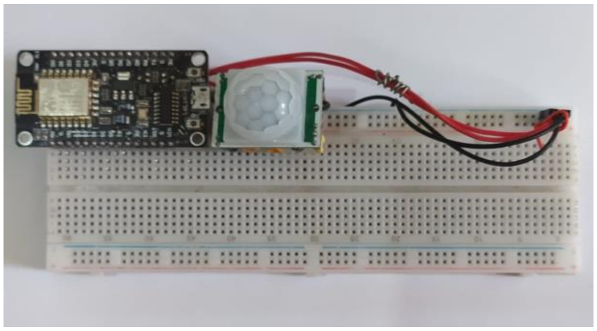


Figure 4.4 Design Hardware

4.7. Design Flowchart Program

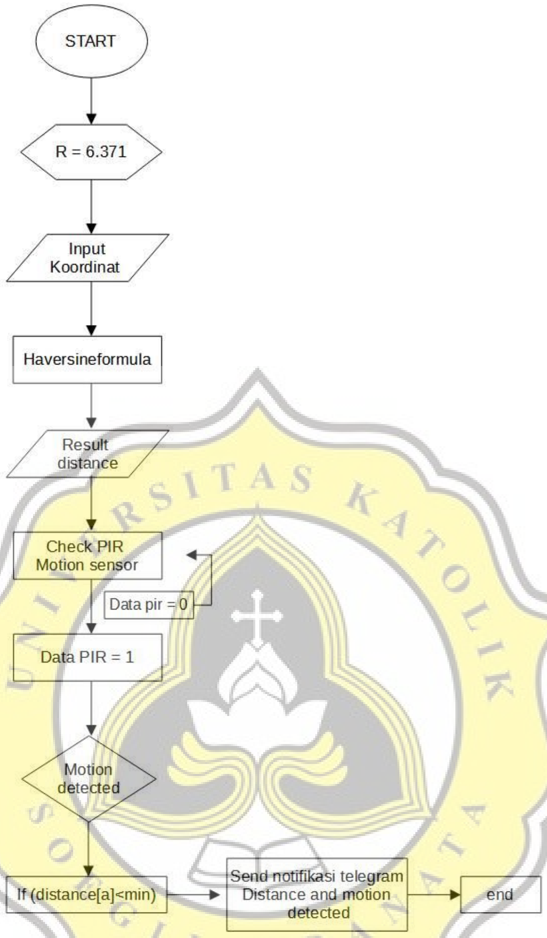


Figure 4.5 Design Flowchart

The flowchart above begins with the haversine method process to find 2 straight line points at each coordinate point that has been inputted and converted into distance, using the haversine formula so that the distance for each location is obtained which is then made into an array. Furthermore, the PIR sensor detects a movement, if the data is pir = 0 then there is no movement so that the notification is not sent, whereas if the data is pir = 1 then movement is detected. when motion is detected the sensor will send a notification along with the minimum distance to the location of the nearest security post