

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1 Overview**

Project Fire Detection consists of 5 main parts:

1. Fire detection part.
2. The location determination part (GPS receiver).
3. Wireless data connection to the server.
4. SMS server Gammu.
5. The nearest fire station search section.

More details of the overview that will be used to create this project, are required as follows:

##### **3.1.1 Fire Detection part**

This section is useful for detecting fire. How to use it is by connecting the fire sensor with Arduino Uno microcontroller.

##### **3.1.2 The location determination part (GPS receiver)**

This section is useful for obtaining the location of latitude and longitude points. This module uses a satellite signal transmitter so that it is more effective if not many obstructions such as walls. How to use it is by connecting this GPS module with Arduino Uno microcontroller.

##### **3.1.3 Wireless data connection to the server.**

This section is useful to connect internet using ESP8266 module. How to use it is by connecting this ESP8266 module with Arduino Uno microcontroller.

### **3.1.4 SMS server Gammu**

This section is useful for sending sms to a cell phone. Using the Wavecom USB modem because it is directly connected as a modem. How to use it is by using XAMPP and Gammu.

### **3.1.5 The nearest fire station search section**

This section is useful to find the distance of the location of the house with the nearest fire extinguisher. Using the method of Haversine Formula to calculate the distance of Latitude and Longitude. How to use it is by using PHP and XAMPP.

## **3.2 Detail Method**

More details of the method that will be used to create this project, are required as follows:

### **3.2.1. Fire detection section**

This section discusses the design process and how the fire sensor module works. Where has the function to detect fire prone to fire, especially in the kitchen contained LPJ gas and cooking stove. Here used the fire sensor KY026 and in the process of designing it by connecting it with an Arduino Uno using a jumper and breadboard.

### **3.2.2. The location determination part (GPS receiver)**

This section discusses the process of designing and working the GPS module that serves to search the point of the house location in the form of latitude and longitude by using satellites. But it is more effective when outside the room or room that is not much barrier like wall. Here used the Ublox Neo-7M GPS module and to connect it is used an Arduino Uno using jumper and breadboard.

### 3.2.3. Wireless data connection to the server

This section discusses about the design process and how the wifi module works to connect to the internet so that the transmission of data by way of wireless or connect to the internet to the server then the data that has been sent will be stored by the server. Here use the Thingspeak web server service. Used wifi module ESP8266 and to connect it used an Arduino Uno using jumper and breadboard.

### 3.2.4. SMS server Gammu

This section discusses the type and manner of SMS server work to send sms or short messages via Gammu server to a mobile phone. Used a Wavecom Q2406B USB modem connected to the computer and XAMPP to store data to a database.

### 3.2.5. The nearest fire station search section

This section discusses how PHP works. Here using PHP that serves to perform data retrieval from Thingspeak kemudian do the calculation of point two locations by using the formula Haversine Formula as follows:

$$x = (\text{lon}2 - \text{lon}1) * \cos((\text{lat}1 + \text{lat}2) / 2);$$

$$y = (\text{lat}2 - \text{lat}1); d = \text{sqrt}(x * x + y * y) * R$$

Information:

x = Longitude (Latitude)

y = Latitude (Longitude)

d = Distance

R = Earth Radius = 6371 km

1 degree = 0.0174532925 radian



### 3.4 Testing

There are two testing in this project. The testing are :

1. The first testing is to test functional of each module. The purpose of this test is to see if each module is working properly. The indication used to see the module's functionality is the behavior / flame pattern of the led lamp.
2. The last testing is performance test, the aim of the test is to measure the sensitivity of the fire sensor. How many time needed by the system to connect from arduino to thingspeak to send data. How fast PHP will calculate using haversine formula and send warning sms using Wavecom sms gateway gammu.

