GPS VEHICLE TRACKING DEVICE USING ARDUINO AND SMARTPHONE

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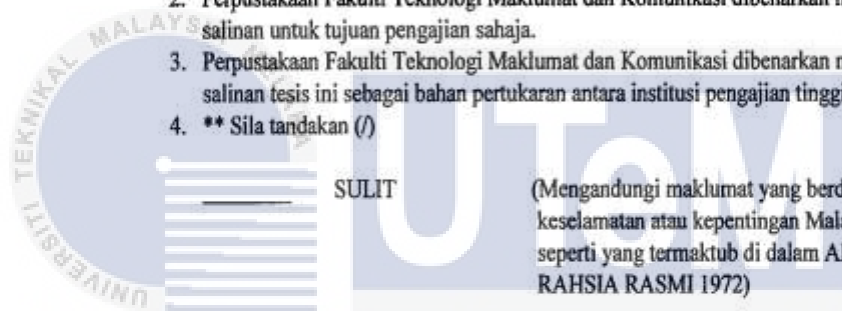
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SUPERVISOR : _____   DATE: 25 August 2016

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At last I would like to thank all my batch mates for their constant support and guidance.

ABSTRACT

This project is using Arduino Uno and three more module that is GSM Module, GPS Module and Magnetic door sensor. This product will help user to search vehicle in large area if stolen. Before we start this project, we already make a few list of problem statement that is this system will enable users to keep their car current locations by referring to their mobile devices and alarm system that already has not enough to secure our vehicle. GPS works by provide the information on exact location and it also can track the movement vehicle.

The result from this project is can help owner vehicle to know current location vehicle when a user put this product in car. Using GSM module, we can sent a message to arduino and arduino will reply a message. As example if car stolen, we can sent message to arduino and arduino will reply that arduino location. The benefit of this project is help people to know where they vehicle location if stolen. This product also have door notification function using magnetic door sensor. When door is open, Arduino will sent notification through SMS for user.

ABSTRAK

Projek ini menggunakan Arduino Uno dan tiga lagi modul iaitu GSM modul, modul GPS dan sensor pintu magnet. Produk ini akan membantu pengguna untuk mencari kenderaan di kawasan yang besar jika dicuri. Sebelum kita memulakan projek ini, kita sudah membuat senarai beberapa pernyataan masalah iaitu sistem ini akan membolehkan pengguna untuk menyimpan lokasi semasa kereta mereka dengan merujuk kepada peranti mudah alih mereka dan sistem penggera yang sudah mempunyai tidak cukup untuk menjamin kenderaan kami. GPS kerja dengan menyediakan maklumat mengenai lokasi sebenar dan ia juga boleh mengesan kenderaan pergerakan itu.

Hasil daripada projek ini adalah boleh membantu kenderaan pemilik tahu kenderaan lokasi semasa apabila pengguna meletakkan produk ini di dalam kereta. Menggunakan modul GSM, kita boleh menghantar mesej kepada Arduino dan arduino akan membalas mesej. Sebagai contoh jika kereta dicuri, kita boleh menghantar mesej kepada Arduino dan arduino akan membalas bahawa lokasi arduino. Manfaat daripada projek ini adalah membantu orang ramai untuk tahu di mana mereka lokasi kenderaan jika dicuri. Produk ini juga mempunyai fungsi pemberitahuan pintu menggunakan sensor pintu magnetik. Apabila pintu dibuka, Arduino akan menghantar notifikasi melalui SMS kepada pengguna.
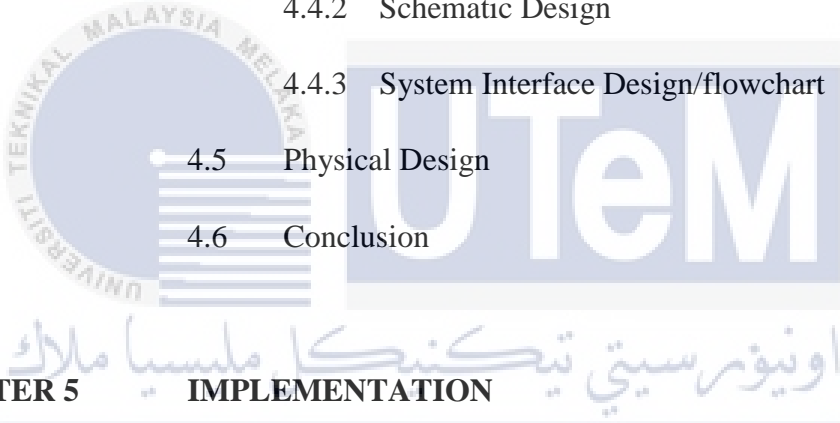
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INTRODUCTION

1.1   Project Background

Global Positioning System tracking are method of working out exactly. GPS tracking system as example on a cell phone that may be placed in a vehicle or on special GPS devices, that can either beportable unit or fixed. GPS works by provide the information on exact location and it also can track the movement of a person orvehicle.

A GPS tracking device can work in various ways. GPS devices can generally used to record the position of vehicles if missing. Some systems will store the data within the some send the information to a centralized database or system via a modem within the GPS system unit on a regular or 2-Way GPS and GPS tracking system itself.

By the end of 2015, more than 7.2 million motor vehicles worldwide were identified as stolen so it's very important to protect your vehicle from theft. Just leave your arduino and GSM Module in your vehicle and track it anywhere in the world. With a very simple arduino code , you will be able to track your vehicle and find its current location.

1.2   Problem Statement

Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS1	The GPS integrated with mobile devices is the solution and answers to the above problem. The system will enable users to keep their car current locations by referring to their mobile devices.
PS2	Alarm system that already has not enough to secure our vehicle.
PS3	Location vehicle can be located using GPS.

1.3   Project Question

Table 1.2: Summary of Project Question

PS	PQ	Project Question
PS1	PQ1	How can we use Arduino, GPS Module and GSM Module technology for locating the vehicle?

1.4   Project Objective

Table 1.3: Summary of Project Objective

PS	PQ	PO	Project Objective
PS1	PQ1	PO1	The objective in this project is tracking and routing in a large area environment and smartphone.
		PO2	To provide a solution that can avoid vehicle stolen and using GPS is best way to decrease stolen vehicle.
		PO3	Develop simple GPS tracking applications using Arduino, GPS Module and GSM Module

1.5   Project Scope

The project will be focused on:

a) To help search vehicle if has stolen.

b) Tracking and routing vehicle in a large area environment.

c) Focus for user who want secure vehicle.

d) Run in large area using phone prepaid.

e) One GSM on use for one user.

f) This product always on.

1.6   Expected Output

The result from this project is a product that can help owner vehicle and also perform when a user put arduino uno and GSM module in car. With using GSM module we can sent a message to arduino and arduino will reply a message. As example if car stolen, we can sent message to arduino and arduino will reply that arduino location. The benefit of this project is help people to know where they vehicle location if stolen.

1.7   Thesis Organization

Chapter 1: Introduction

This chapter will discuss about the explanation the background of this project why we need to develop this system. In this chapter also will include problem statement about this project and the objective to achieve when doing this project. Furthermore, in this chapter will be discuss the scope of this project and an explanation about the scopes. So, in the Chapter 1 will be a briefing about the background this project.

Chapter 2: Literature Review

In this chapter will be study about at least 3 articles from other people that already do research about this project. We need to discuss issues that related to our project for example its platform, architecture, algorithm and others. Compare the article about their methodology used to complete the research. The hardware, software, parameters and the attribute also need to do some comparison between the 3 articles that related to our title.

Chapter 3: Methodology

Chapter 3 will discuss more in the method that we used to develop the project for an example the software that we needed to develop it. This also will determine what approaches we need to use to complete the project within the time. Milestones about our project need to be prepared in this chapter. Explain every stage on the milestone. This is all about in chapter 3.

Chapter 4: Analysis and Design

Chapter 4 will discuss about the requirement analysis and the design of the project. This will also include describe current system situation and the problem analysis that need to investigate and. For the requirement analysis, we need to specify the functional, data requirement and non-functional requirement. The detailed about design of user-interface, database and system architecture. Software and physical design also will be including in this chapter.

Chapter 5: Implementation

Implementation briefly describe activity involved in this phase and what is expected output need to be achieved after complete this phase. The software development environment setup will explain in this chapter. There can be implementation status and software configuration management also in this chapter.
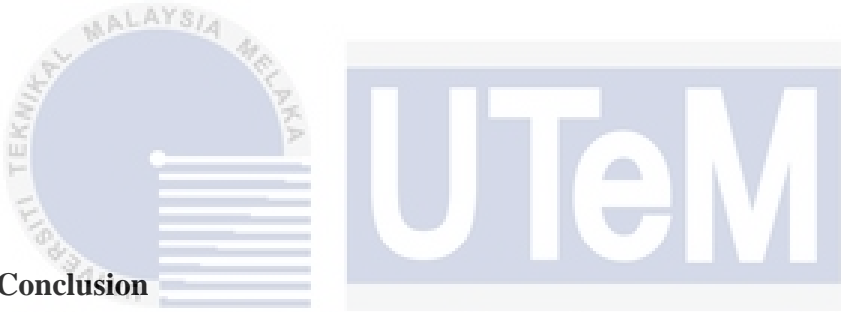
Chapter 6: Testing

Briefly describe the activity that involved in testing phase and testing strategy to be adapted in your project. The test plan and test design need to be explain more in this chapter. After explain the test design and plan we need to discuss more about test results and analysis in this chapter.

Chapter 7: Project Conclusion

In this chapter will conclude all the project summarization, the project limitation and project contribution. Project summarization will be described how the objective has been achieved by integrating the information that we have reported in implementation and testing phase. State also the project contribution to the university/faculty/company/individual. Project limitation is needed to state the limitation while doing this project until the progress was done.

1.8   Conclusion

For conclusion, this chapter explain the background of this project and state the problem faced until this project need to be developed. The objective need to achieve after finished this project also need to state. Scope and project significant tells what project benefits for user. Expected output is to show what this product can help people. Next activities need to be developed for next chapter is literature review about others article that related to our project.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter it all about literature review that related published information with this project. In this chapter we will analysis of current problem for this project, collecting analyze processes, related data and make a conclusion based on product situation. The process in this project involves are reading, researching, planning and analyzing for all the resources. This chapter also has simple summarization there is comparison for this product like what multicontroller use, what combination use and what difference with this product. A synthesis and summary based on the key findings relevant to this project. A critique and comparison is evaluates the advantages and disadvantages to this project.

2.2   Related work/previous work

Based on the Jayeshsukumaran (2012) in his project " Real Time GPS Tracker with Integrated Google Maps" describes on how to create a real time GPS tracker project using google Maps. Main for this project is to have a solution and integrating all the different pieces of hardware. This project works using GPS chip that is outputs of the position information that will transferred over GPRS and link to mobile operator and then remote server over TCP connection. The JavaScript will run in user browser and MySQL database will receive the positional information in every second. Google Maps will integrates this information through Google Maps API which has display in the position map.
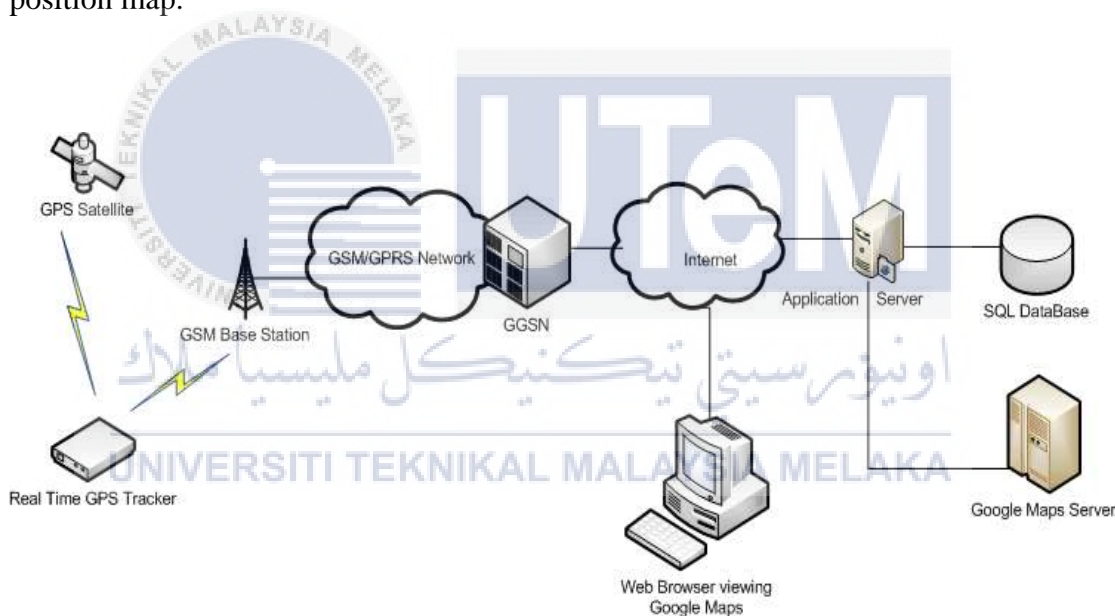
Figure 2.2.1: Physical diagram

From the W1bmw from www.instructables.com (2014) project that is "Arduino GPS/GSM Tracker". The purpose from this project is to allow tracking any vehicle using SMS. This project using Arduino Uno R3, SeeedStudio GPRS shield V2, Adafruit Ultimate GPS Breakout and 3D printed enclosure. For this project, the hardware using is simple because its only needs few steps to complete this project. This project will

complete with using simple coding for Arduino. For operation to this project also simple, this project will require a SIM card and phone number to assign by your carrier.

Ameerpet and Dilsukhangar (2013) in their project that is "GPS and GSM based Vehicle Tracking System" using microcontroller, GPS receiver, GSM modem, LED and local alarm. This project use automotive localization system. This system can connect with car alarm system and sent an alert to owner using smart phone. GPS receiver will get the location from satellites in latitude and longitude. The function of microcontroller is sent process information to user using GSM modem. It also can send the speed from the vehicle. This system also can immediately alert the police if anything happen to the vehicle. All component use in this project is low cost.

Abid Khan and Ravi Mishra (2012) in their project "GPS-GSM Based Tracking System". The component use from this project is GPS modem, GPS receiver and Microcontroller. The purpose from this project is to tracking unit in global positioning system to precise location using GSM modem and GSM modem will transmit the information to user. This project also use SMS message to inform the user location of the vehicle. These systems also provide real time control. The current system can provide monitoring from anywhere.
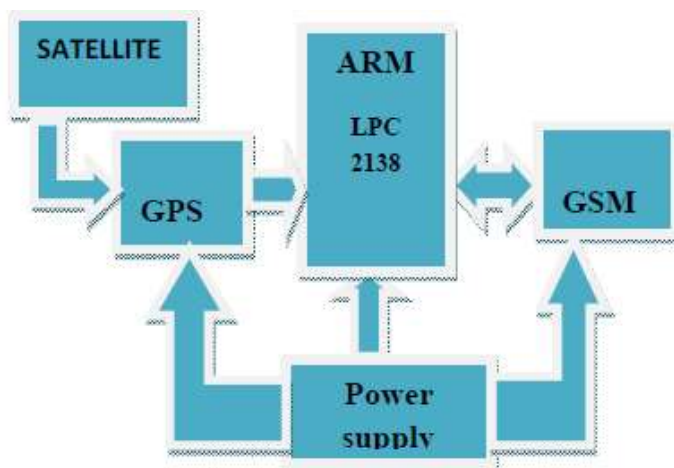
Figure 2.2.2: Block diagram of Tracking System

Kommineni Rakesh (May 2014) his project "Vehicle Tracking and Accident Alert System". The purpose for this project is to give security to all vehicles. This project also can track vehicle if stolen. When vehicle stolen, location data from tracking system will be use to find the vehicle. This project also provide accident alert system, it will detect the accident and location and sent to mobile phone. Hardware uses in this project is GSM Modem, GPS Modem, Shock sensor, Microcontroller, power supply, LED and Fire Detector.
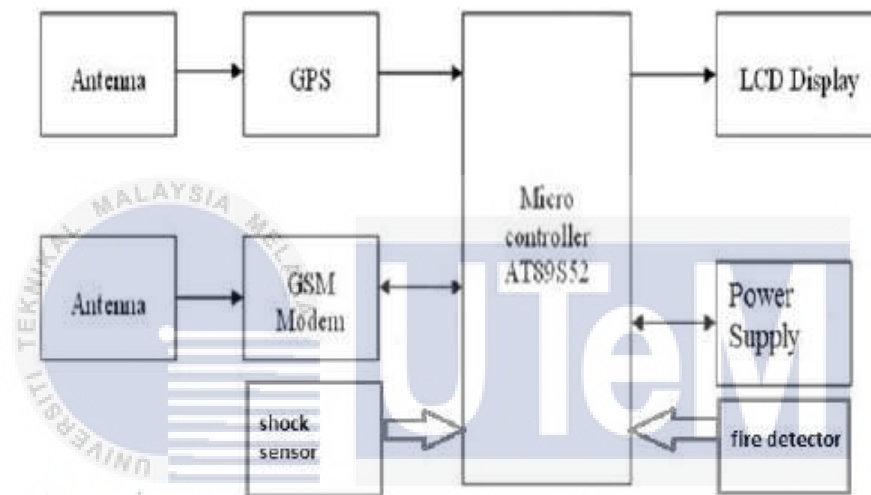
Figure 2.2.3: Block Diagram

2.3   Critical Review of Current Problem and Justification

Table 2.1: Critical Review of Current Problem and Justification

Research Title/Product	Author/Company	Purpose	Description	Platform/Range Price
Real Time GPS Tracker with Integrated Google Maps	Jayeshsukumaran (2012)	how to build a real time GPS tracker through google Maps	Main of this project is integrating all the different pieces of hardware and software to have a solution.	GSM Modem and GPS Modem around RM100 - RM 150
Arduino GPS/GSM Tracker	W1bmw from www.instructables.com	The purpose from this project is to allow tracking any vehicle using SMS.	The hardware using is simple because its only need few step to complete this project	Arduino Uno R3, SeeedStudio GPRS shield V2, Adafruit Ultimate GPS Breakout and 3D printed enclosure around RM200-RM250.
GPS and	Ameerpet	To track	This system can	Microcontro

GSM based Vehicle Tracking System	and Dilsukhangar (2013)	vehicle using automotive localization system	connect with car alarm system and sent an alert to owner using smart phone	ller, GPS receiver, GSM modem, LED and local alarm around RM200 – RM250
GPS-GSM Based Tracking System	Abid Khan and Ravi Mishra (2012)	The purpose from this project is to tracking unit in global positioning system to precise location using GSM modem and GSM modem will transmit the information to user	This project also use SMS message to inform the user location of the vehicle. These systems also provide real time control. The current system can provide monitoring from anywhere.	GPS modem, GPS receiver and Microcontroller around RM150 – RM200
Vehicle Tracking and Accident Alert System	Kommineni Rakesh (May 2014)	The purpose for this project is to give security to all vehicles.	This project also can track vehicle if stolen. When vehicle stolen, location data from tracking system	GSM Modem, GPS Modem, Shock sensor,

			will be use to find the vehicle	Microcontro ller, power supply, LED and Fire Detector around RM250 – RM300

2.4   Proposed Solution/ Further Research

Based on W1bmw from www.instructables.com (2014) with his project "Arduino GPS/GSM Tracker". The purpose from this project is to allow tracking any vehicle using SMS that want to show implementation of tracking system by using Arduino Uno R3 which similar to the project. The similarities this project to my project is this two project using GPS module and GPRS module to know location vehicle. Another similarity is we use SMS as a road to know the location vehicle. Arduino will send the coordinate vehicle through SMS and we will detect the location using android application. The current problem for this project is if we know the location vehicle but we still don't know who steal that vehicle.

However, my project will solve this problem because my project we will provide camera to capture picture if the person touch the sensor in vehicle. As simple meaning if anyone want drive the vehicle, camera will capture picture that person who drive that vehicle. It also have tracking system which we can know the location vehicle if stolen using SMS. For operation to this project also simple, this project will require a SIM card and phone number to assign by your carrier.

2.5   Conclusion

In conclusion for this chapter, we can able to identifying an advantages and disadvantages in previous work. Critically summarize is the current knowledge in the area under investigation. It helps to collect any information that related to this GPS project and to identify the purpose for this product. Besides it also can helps in critical that valid research for this project.

CHAPTER III

PROJECT METHODOLOGY

3.1   Introduction

In chapter 3 discusses about the milestone and project methodology used in this project. This chapter very important this project starts because in this chapter we will plan and time starts.

In this project, the methodology use is waterfall method. Waterfall methodology use is requirement, design, implementation, verification and maintenance for this project. The methodologies used because it can help to define time constraints, the scope of the project and what resources are available.

Milestones also discuss in this chapter and tool used in project management to know critical. A significant that help development event or accomplishment in plan on attack.

3.2   Methodology

The method is use to achieve the objective of the project that will accomplish a perfect result. In order to evaluate this project, the methodology based on Waterfall model generally five major steps, which is requirement, design, implementation, verification/testing, and maintenance. The simplest software development life cycle model is the waterfall model, which states that the phases are organized in a linear order.

Requirement

In this phase is to analyze the system, gather requirements and understand them like information about Arduino, GPS module, GPRS module, Camera and Sensor. Also the software and hardware needed. Also at this phase everything has been planed are obtained so it can be proceed to the next phase.

Design

This phas describe developed for this project. After the requirements specifications are determined, problem solving and planning will take place. Design need to approve first before we can proceed to next phase. In this phase simple circuit, gantt chart, flow chart and milestones also are design. This can be work according to the flow that has been design.

Implementation

Implementation phase will be develop session. In this phase, the Arduino, GPS module, GPRS module, Camera and Sensor are already installed and develop. All need to be set up based on the design that has been planed. Be sure that the implementation is on the right time based on the milestone so that the time will not exceed.

Testing

In this phase, the early the system based GPS Vehicle Tracking Device using Arduino and Smartphone will test either the system can be use or not without any problem. We also will test the security for this project that is good or not. We will put the camera to check who will drive that car and also we can find out the location the vehicle if has been stolen.

Maintenance

Maintanence phase is to ensure that the system always working to test the eitherthe system can be use or not without any problem. Also to make sure that this product will far from any problem so that the system can working smoothly. All need to be check from time to time because that there will be no error or malfunction to this system.
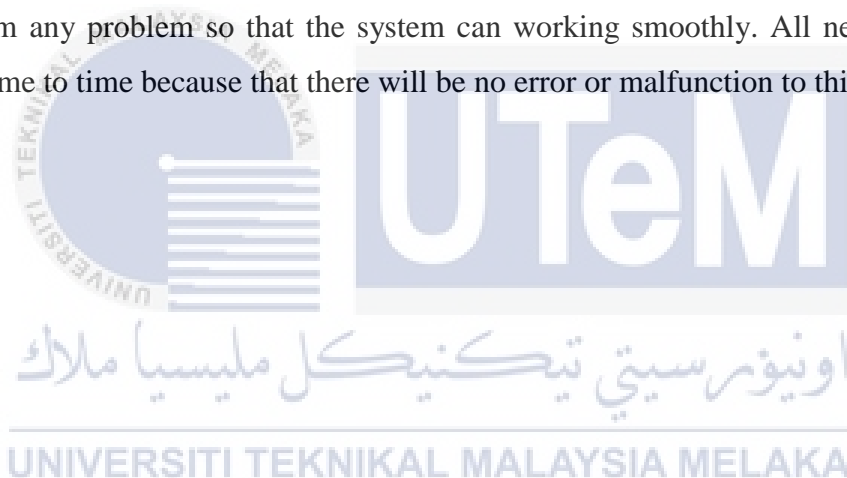
3.3 Project Milestones

A flowchart is a formalized that represents an algorithm, similar formalized structure, workflow or process, work or manufacturing process, and their order by connecting them with arrows. Purpose for this flowchart is to provide person with a common language. Flowcharts use in simple symbols designing, analysing, documenting or program in various or fields managing a process.

Figure 3.1 : Flow Chart

A Gantt chart is a type of bar chart independently by Henry Gantt in the 1910s that illustrates a project. Terminal summary and elements comprise the work breakdown structure of the project. Gantt charts illustrate the start and finish dates of the terminal summary and elements of a project. Gantt charts common use in tracking project schedules. It is very useful to show information about task for the project like how tasks relate to each other, progress the project.

The gantt chart of this system is as follow:

Table 3.1: Gantt Chart

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Identify Problem and Define Objective	▓	▓													
Study And Research			▓	▓											
Design The Project					▓	▓	▓								
Develop The Project								▓	▓	▓	▓				
Testing												▓	▓		
Maintenance The Project														▓	
Document All The Project	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓

Below is the milestones that has been made for this system:

Table 3.2: Milestones

| Task Name	Duration	Start	Finish	Predecessors
Final Year Project Development	**80 days**	**Mon 22/2/16**	**Fri 10/6/16**	
Proposal	**5 days**	**Mon 22/2/16**	**Fri 26/2/16**	
Research on selected topic	1 day	Mon 22/2/16	Mon 22/2/16	
Proposal writing	3 days	Tue 23/2/16	Thu 25/2/16	2
Proposal submission and presentation	1 day	Fri 26/2/16	Fri 26/2/16	3
Chapter 1	**10 days**	**Mon 29/2/16**	**Fri 11/3/16**	
study about arduino	3 days	Mon 29/2/16	Wed 2/3/16	
study about gsm module	3 days	Thu 3/3/16	Mon 7/3/16	6
study about android application	3 days	Tue 8/3/16	Thu 10/3/16	7
Chapter 1 progress meeting	1 day	Fri 11/3/16	Fri 11/3/16	8
Chapter 2	**10 days**	**Mon 14/3/16**	**Fri 25/3/16**	
Gathering required hardware	2 days	Mon 14/3/16	Tue 15/3/16	
Assembling the hardware	3 days	Wed 16/3/16	Fri 18/3/16	11
Installing the software	3 days	Mon 21/3/16	Wed 23/3/16	12
Basic testing of the software	1 day	Thu 24/3/16	Thu 24/3/16	13
Chapter 2 progress meeting	1 day	Fri 25/3/16	Fri 25/3/16	14
Chapter 3	**10 days**	**Mon 28/3/16**	**Fri 8/4/16**	
Device testing and obtaining data (1)	3 days	Mon 28/3/16	Wed 30/3/16	
Analzing data(1)	2 days	Thu 31/3/16	Fri 1/4/16	17
Device testing and obtaining data (2)	3 days	Mon 4/4/16	Wed 6/4/16	18
Analying data (2)	1 day	Thu 7/4/16	Thu 7/4/16	19
Chapter 3 progress meeting	1 day	Fri 8/4/16	Fri 8/4/16	20
mid sem break	5 days	Mon 11/4/16	Fri 15/4/16	
Chapter 4	**10 days**	**Mon 18/4/16**	**Fri 29/4/16**	
Device testing	5 days	Mon 18/4/16	Fri 22/4/16	
Device finalization	4 days	Mon 25/4/16	Thu 28/4/16	24
Chapter 4 progress meeting	1 day	Fri 29/4/16	Fri 29/4/16	25
Project demo	**20 days**	**Mon 2/5/16**	**Fri 27/5/16**	
Project demo for progress 1	5 days	Mon 2/5/16	Fri 6/5/16	

Project demo for progress 2	5 days	Mon 9/5/16	Fri 13/5/16	
Project demo for progress 3	5 days	Mon 16/5/16	Fri 20/5/16	
PSM report writing	4 days	Mon 23/5/16	Thu 26/5/16	28,29,30
PSM report progress meeting	1 day	Fri 27/5/16	Fri 27/5/16	31
Final presentation	**5 days**	**Mon 30/5/16**	**Fri 3/6/16**	
Final presentation	5 days	Mon 30/5/16	Fri 3/6/16	
Correction	**5 days**	**Mon 6/6/16**	**Fri 10/6/16**	
Correction draft report based on supervisor's and evaluator's comments during the final presentation session.	5 days	Mon 6/6/16	Fri 10/6/16	

Based on the Waterfall model that has been select, this is the figure as shown below:
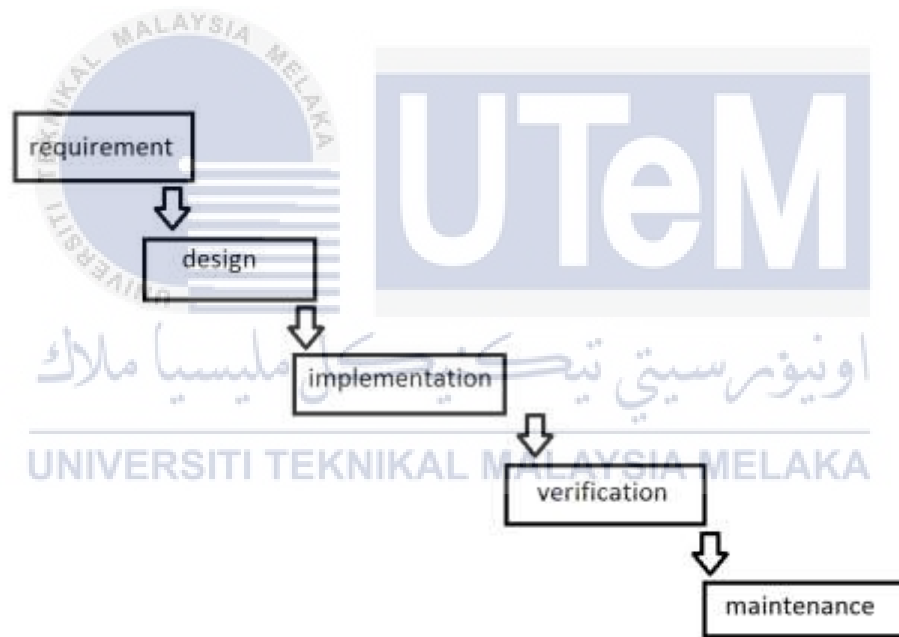
Figure 3.2: Methodology (Waterfall)

3.4   Conclusion

The conclusion of this chapter is that the project methodology and milestone is important to develop a system. We easily known how this project planned and organizes based on the time that has been given. Surely it will work efficiently and smoothly if everything is followed. The methodology that has been choosing to develop this system is the Waterfall Model and the project milestone developed will make this project make this project success in time given.

CHAPTER IV

ANALYSIS AND DESIGN

4.1   Introduction

In this chapter we will discuss about problem analysis, requirement analysis, high-level design and flowchart for this product. Detail designs will mainly concern of this project. Idea will needed to develop this project include detail design of the system. Also, for the implementation approaches that is the influence of the feature process flow to analyze the threshold selection. The viewer physical design for tracking system and notification used in the project are defined specifically and being explained. Identifying the project required to complete the project will help in this chapter.

4.2   Problem analysis

The current system is basically depends on only to the alarm car. This will lead to a problem if the car is missing or have been stolen. Common tracking system is more expensive for installation and hard to use it.

4.3   Requirement Analysis

4.3.1   Data Requirement

The input of this system is that the user will send request message to Arduino and Arduino will reply the coordinate where car have been stolen. Arduino will reply the message using GSM Module that contains a sim card. For the coordinate, we will use GPS Module that we have put with Arduino. GPS module will detect where the car and GSM Module will send data longitude and latitude with SMS.

The output of the system is that we will know where our vehicle using coordinates from GPS Module that has longitude and latitude from our phone only. This project also provide magnetic door sensor that will alert user if vehicle door is open.
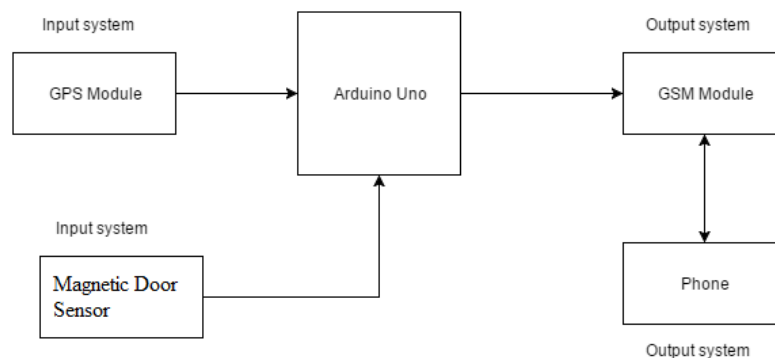
Figure 4.1: Block Diagram for Tracking System

4.3.2 Functional requirement
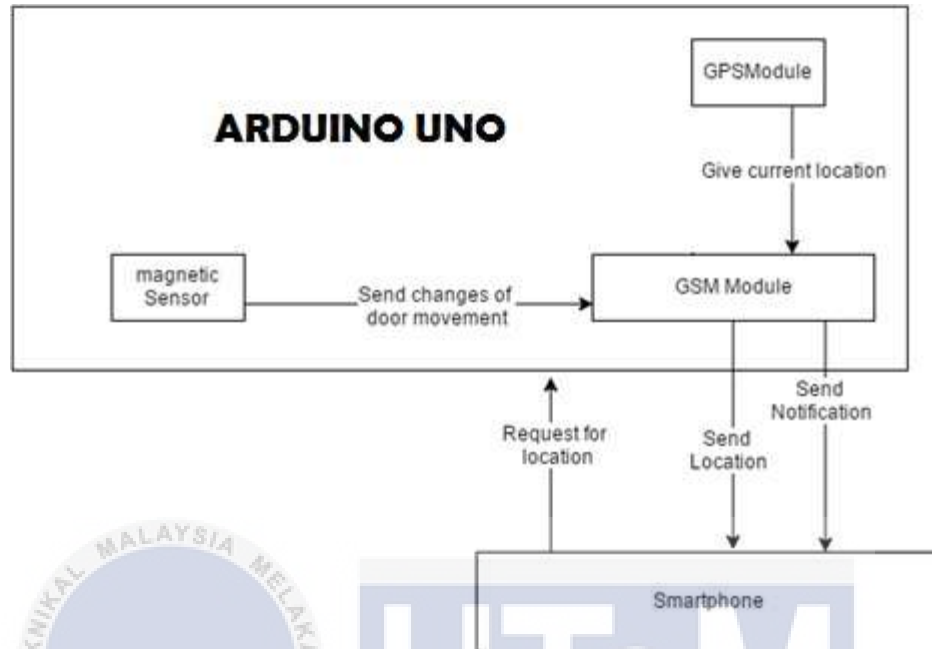
Figure 4.2: Context Diagram of Tracking System

In this project, the input of the system is user will know vehicle door is open when magnetic door sensor turns on by notification SMS to user. When steering in use, the wire will off and we will know someone have driven our car and Arduino will send notification to phone. In tracking the car, user are needed to request the tracking function from the Arduino. The output of this system is when the Arduino sends the information to user smartphone via GSM Module. Next, the GPS Module will collect the current location and then send it to user smartphone when being requested. Theses output or information will be through GSM module which are via sms.

4.3.3   Other Requirement

4.3.I.1 Hardware Requirement

i.   **Breadboard**

Breadboard used is connecting the board and are wired together. This use for this board is creating models in view of the circuit format plan. The attachment of the board makes the board simpler to use to attempt and mistake their circuit or investigate if there any issue happens.

ii.   **Wire Jumper**

Jumper wires utilized to the breadboard for exchange electrical signs to section to another part upon the circuit format that has been planned. Jumper wires different in shading and size on the grounds that every hop wire has a particular.

iii.   **Arduino Uno Board**

The Arduino UNO is a microcontroller board in light of the ATmega328 (datasheet). It has 14 computerized input/output pins (of which 6 can be utilized as PWM output), 6 simple inputs, a 16 MHz fired resonator, a USB association, a force jack, an ICSP header, and a reset catch. It contains everything expected to backing the microcontroller basically associate it to a PC with a USB link or forces it with an AC-to-DC connector or battery to begin.

iv.   GSM Module SIM900A

GSM/GPRS Module-RS232 is built with Dual Band GSM/GPRS engine-
SIM900A and it works on frequencies 900/ 1800 MHz. The Module is come
with RS232 interface that is which allows connect to the PC as well as
microcontroller with RS232 Chip (MAX232). It is suitable for SMS, Voice as
well as DATA transfer application in M2M interface. The on board Regulated
Power supply allows you to connect wide range unregulated power supply.
Using this modem, you can make audio calls, SMS, Read SMS; attend the
incoming calls and internet through simple AT commands.

v.   GPS Module GY-NEO6M

This module has features with the u-blox NEO-6M GPS module that
conclude with antenna and built-in EEPROM. This is also compatible
with the flight controller boards that designed to work with a GPS
Module. It also has ceramic antenna and EEPROM for save configuration
data when off power.

vi.   Magnetic Door Sensor

This sensor is essentially a reed switch, encased in an ABS plastic shell.
The other half is a magnet. When the magnet is less than 13mm (0.5")
away, the reed switch closes. They're often used to detect when a door or
drawer is open, which is why they have mounting tabs and screws. It also
can pick up some double-sided foam tape from a hardware store to mount
these that work well without needing screws. Normally the reed is 'open'
(no connection between the two wires).

vii.   **SIM CARD**

A SIM card, also known as a subscriber identity module, it also smart cards that stores data for GSM cellular telephone subscribers. Such data includes user identity, location and phone number, network authorization data, personal security keys, contact lists and stored text messages. GSM Module need sim card to active. Security features include authentication and encryption to protect data and prevent eaves dropping.

4.3.3.2 Software Requirement

i.   **The Integrated Development Environment (IDE)**

The Arduino IDE use to open, change sketches and create Arduino that calls programs "sketches". IDE use the two words interchangeably in this book. User can use the buttons at the top of the IDE. Arduino IDE version use 1.6.10.

4.4   High-Level Design

4.4.1   Sketch Circuit Design

In chapter three, we already explained develop a circuit design on this project that software requirement chose. We use fritzing software tools to create simulation breadboard design. Figure 4.13 shows the circuit design.
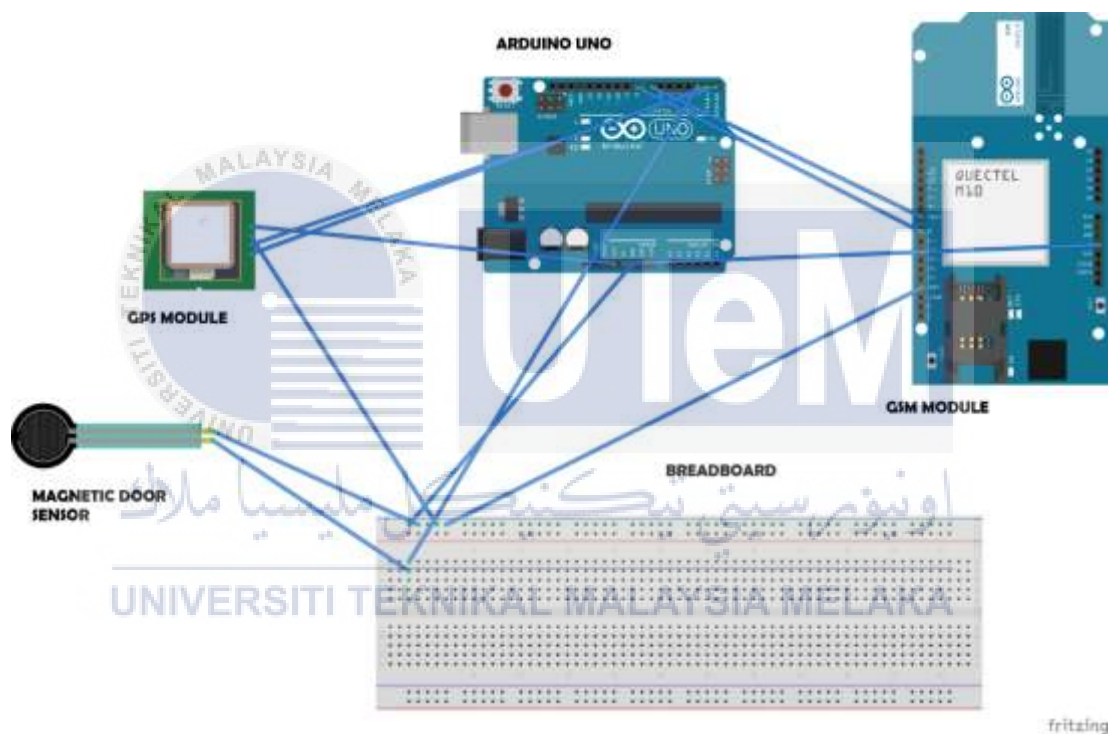
Figure 4.3: Simulation Circuit Design

4.4.2 **Schematic Design**
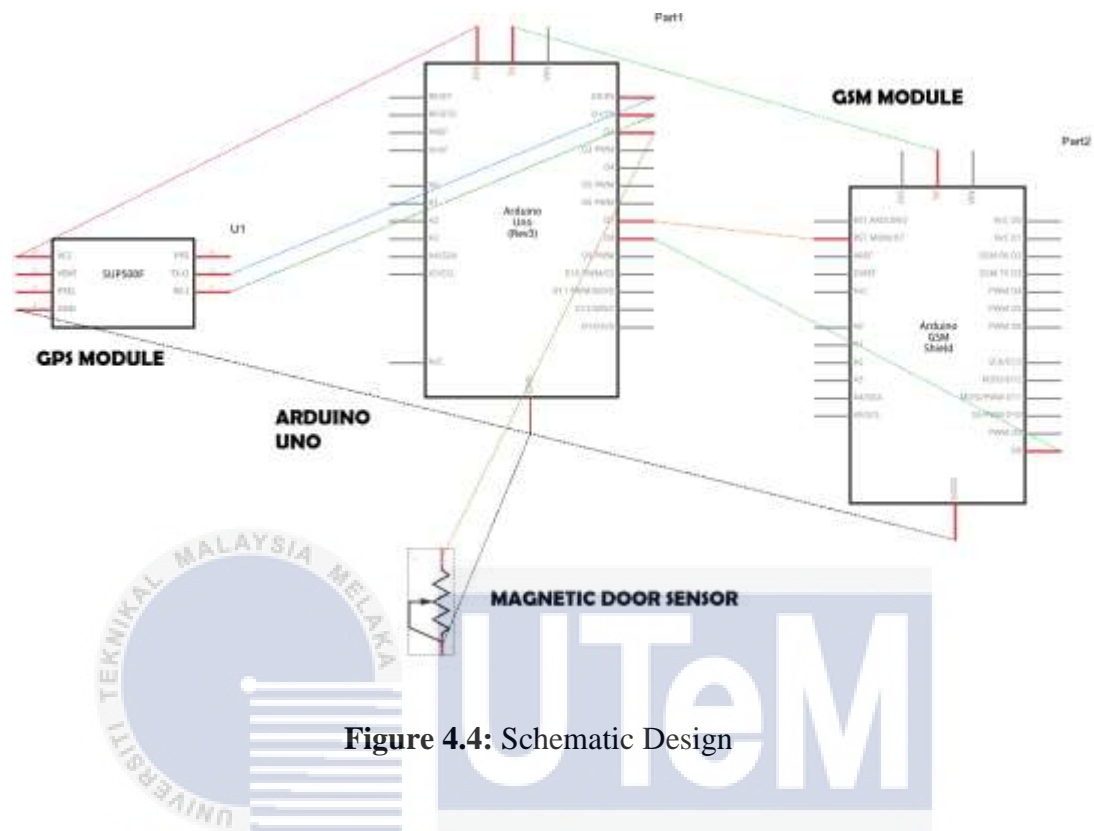
Figure 4.4: Schematic Design

4.4.3   System Interface Design

i.   **User Interface (Tracking)**

Figure 4.5: User Interface (Request of location)

ii.   User Interface(Notification)
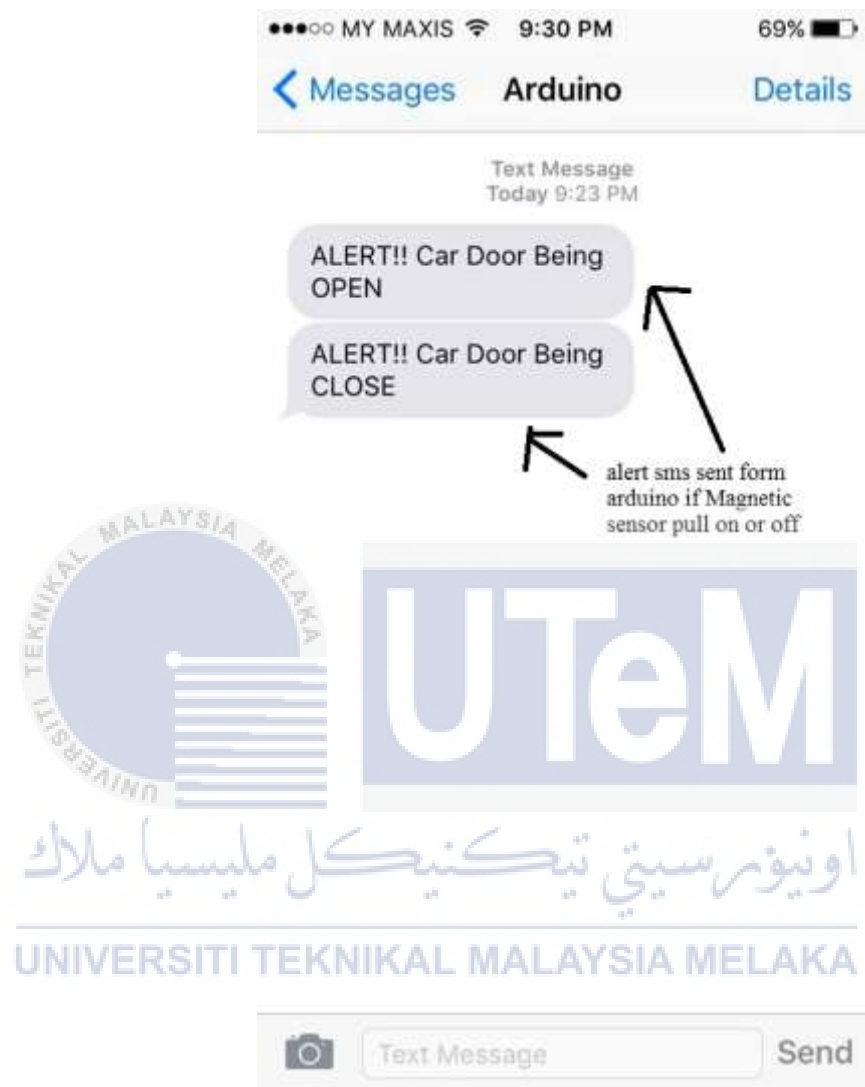
Figure 4.6: User Interface (current location)

i.   **Flow Chart**
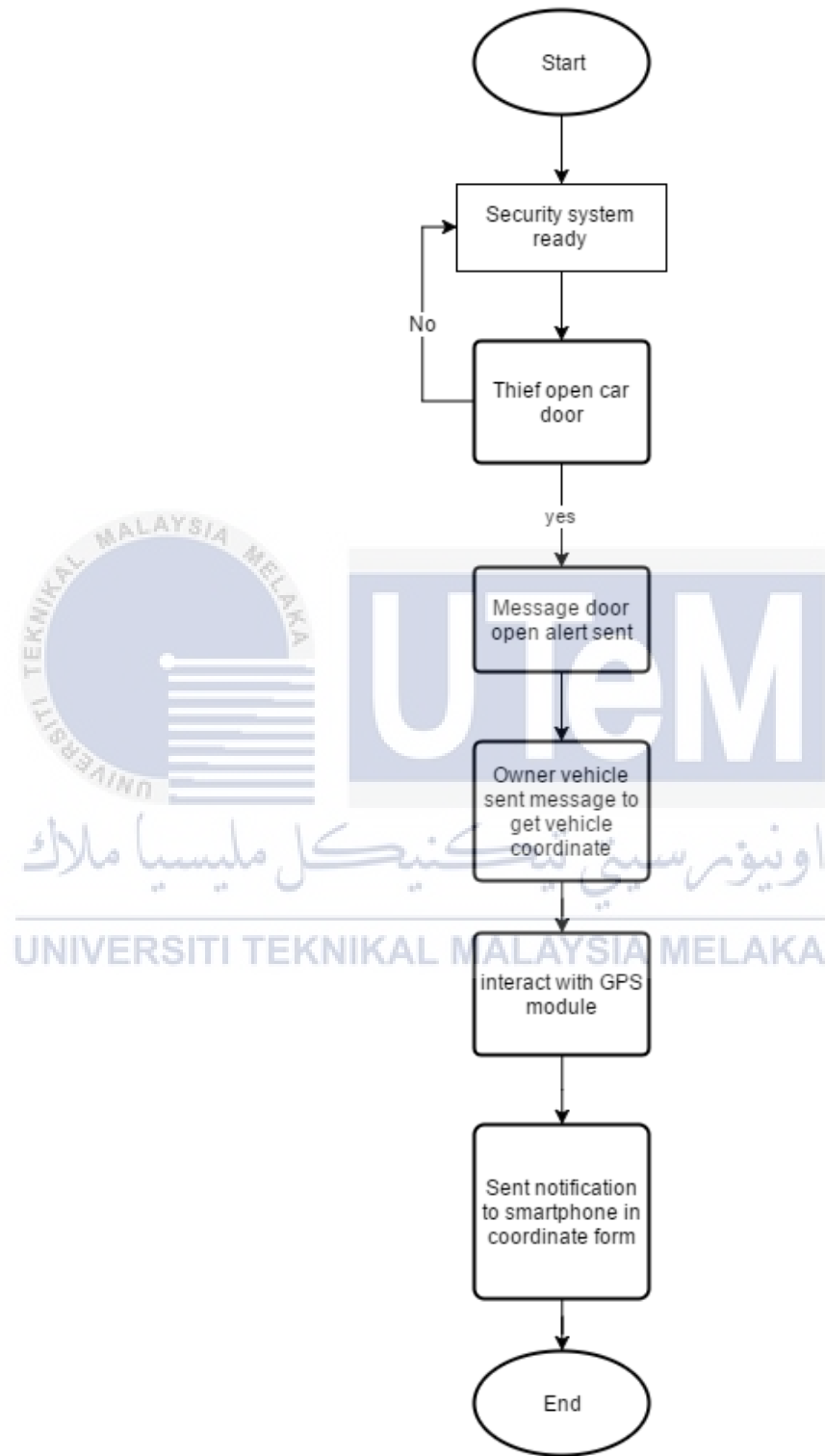
Figure 4.7: Flow chart door notification and sent coordinate

4.5   Physical Design
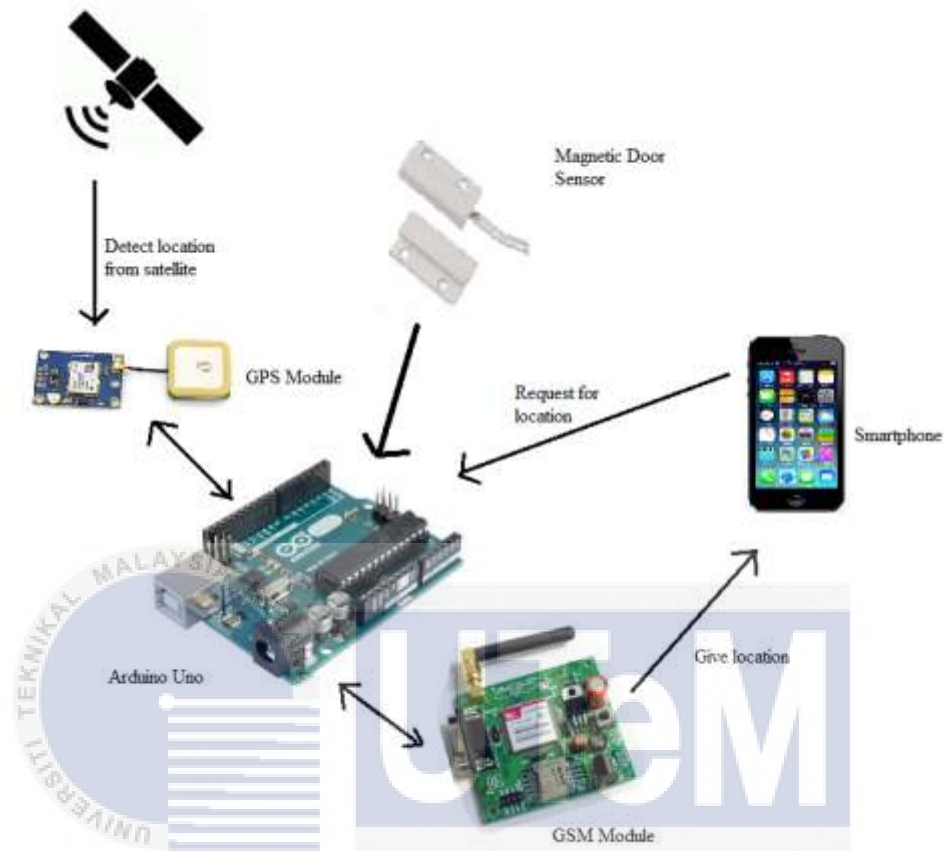
Figure 4.8: Physical Design of Tracking System

4.6   **Conclusion**

Analysis and design phase very important before any implementation have done, to get overall system flow and to show clearly the ideas on how project developed. Design this project is already been approve and will proceed in the implementation activities for Module that use for this product.

CHAPTER V

IMPLEMENTATION

5.1. Introduction

This chapter will discuss about implementation for this project. Based on the phase that has been discussed before, we will know environment setup for this project. This process will discuss about how use Arduino to make it work. The environment setup will list and explain how to make the project work.

5.2.   Environment Setup

5.2.1   Workflow progress

Component and Software Installation

- All the components that are listed in Chapter 4, needed to be installed exactly the same like figure 5.1 below. The software that is needed for program platform such as Arduino software v1.6.10 is installed in personal laptop in order to make the programming and to make sure the product is fully function.

Implement Source Code

- Arduino software v1.6.10 is used throughout the project to implement the source code for the product function. Source codes section are described at table 5.1 with it purpose

Upload Source code

- After all the source code needed is implemented at Arduino software v1.6.10, it then need to be uploaded to Arduino Board Kit to test whether the source codes that we implemented function or not. Any changes can be made later to overcome all the drawbacks in order to achieve project objectives.

Test product

- Since all the source codes needed has been implemented, this step is quite important as it need to be fully functions as supposes. Any drawbacks will be not down and it will be used later for next step process in hardware configuration will be repeated until the product achieved its objective.

Improvise Product

- These steps need to refer the jot down drawbacks which is needed to be improvised or else, the product will not function as planned.

5.2.2 Hardware Setup

In this project, an Arduino UNO board was use for the first step when implementing the component based from design that has been created because UNO board is a main to generate this product for stored data.

Figure 5.1: Environment Physical Circuit

1. Connect GPS Module, GSM Module to Arduino Uno using jumper wire. Make sure the USB power cable is connected with Monitor or laptop.

Figure 5.2: Combine Arduino Uno GPS Module and GSM Module

Figure 5.3: Connect power with laptop

2. Note that GSM Module is attached to pin 7 8 at Arduino and GPS Module attached to pin 3 4 at Arduino. Need to use Breadboard because need to use 4 ground pin and 2 pin RX 2 Arduino.

3. Use Magnetic Sensor connects to port ground and port RX 2 Arduino for open close door function.
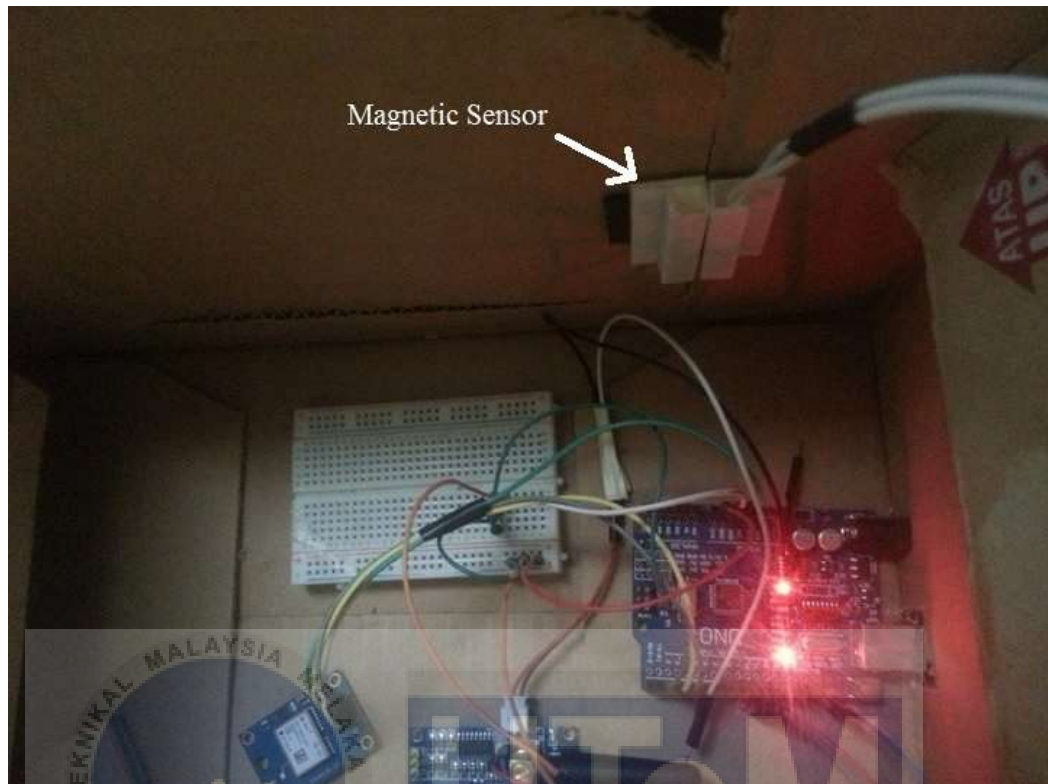
Figure 5.4: Connect Magnetic Sensor to Arduino

Figure 5.5: Magnetic Sensor Door open

5.2.3   Software Setup

i.   Source Code for Arduino

Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. The users need only to define two functions to make an executable cyclic executive program:

- Setup (): a function run once at the start of a program that can initialize settings
- Loop (): a function called repeatedly until the board powers off

Table 5.1: Sources Code Table

Source Code	Purpose
Notification process	
| ```cpp
#include <SoftwareSerial.h>

SoftwareSerial GPRS(7, 8);
boolean state, lastState;

void setup()
{
  pinMode(2, INPUT_PULLUP);
  state = digitalRead(2);
  lastState = state;

  GPRS.begin(9600);
  Serial.begin(9600);

  GPRS.println("AT+CMGF=1");

  delay(1000);
}
``` | This code section is needed to know the library used for the Arduino code. It's also to know which pin were used |
| ```cpp
void loop()
{
  while(GPRS.available()) {
    Serial.write(GPRS.read());
  }

  lastState = state;
  state = digitalRead(2);

  if ( state != lastState ) {
    sendSMS();
  }

  delay(500);
}
``` | This code will do the loop process as long as the Arduino is switch on. |

| ```
void sendSMS() {
  Serial.print("ALERT!! Car Door Being ");
  Serial.println(state ? "OPEN" : "CLOSE");

  GPRS.println("AT+CMGS=\"+60107187784\"");

  delay(500);

  GPRS.print("ALERT!! Car Door Being ");
  GPRS.println(state ? "OPEN" : "CLOSE");
  GPRS.write( 0x1a ); // ctrl+Z character

  delay(500);
}
``` | This code are the code where the notification to the user happen, the movement of Magnetic door switch will be trigger and the message to user number will be done |
| **Tracking process** | |
| ```
#include            <Arduino.h>
#include            <avr/pgmspace.h>
#include            <SoftwareSerial.h>
#include            <TinyGPS++.h>

const bool          debugDefault   = false;
const unsigned int  textScanTimeout = 15UL;

bool                debugMode      = debugDefault;
TinyGPSPlus         gps;
char                s[80];
SoftwareSerial      ssGprs(7, 8);
SoftwareSerial      ssGps(4, 3);
``` | This is the code for the Arduino Library |

``void delOldSms();
void doGpsIo();
void doSmsMsg();
void gpsTest();
void powerUpSms();
int8_t sendAtCmd(
char*   atCmd,
char*   matchStr,
unsigned int   timeout
);```	The method of the code
``void delOldSms(
) {

if (debugMode)
    Serial.println("@delOldSms");

if (sendAtCmd("at+cmgda=\"DEL ALL\"","OK",5000) == 0)
    if (debugMode)
        Serial.println(" delete failed.");
void doGpsIo(
) {
      char c;

 (ssGps.available() > 0) {
    c = ssGps.read();
    Serial.print(c);
    gps.encode(c);
    }
    }``` | This code section is to delete the older message that have inside the serial |
| ```void doSmsMsg(
) {

if (debugMode)
    Serial.println("@doSmsMsg");

if (sendAtCmd("at+cmgl=\"ALL\"", "+CMGL:", 5000) == 1) {
    if (debugMode)
        Serial.println(" new SMS msg found");
    sendCoord();
    delOldSms();
    }
else {
    if (debugMode)
        Serial.println(" no new SMS msg found");
    }``` | This source code are for the Arduino to ready to send message to the user |

| ```
Serial.print(F("; "));

if (gps.speed.age() > 5000)
    Serial.print(F("xxx"));
else
    Serial.print(gps.speed.mph(), 0);
Serial.print(F(" MPH;"));

Serial.print(F("Course: "));
if (gps.course.age() > 5000)
    Serial.print(F("xxx"));
else
    Serial.print(gps.course.deg(), 0);
Serial.println(F(";"));

if (debugMode) {
    Serial.print(F("  Sentences that failed checksum="));
    Serial.println(gps.failedChecksum());
}

if (ssGps.overflow())
    Serial.println(F("ssGps buffer overflowed"));

void gpsTest(
    ) {
if (!gps.location.isValid()) {
    Serial.println("no GPS location fix");
    return;
    }

if (gps.charsProcessed() < 10) {
    Serial.println(F("WARNING: No GPS data.  Check wiring."));
    return;
}
Serial.print(F("https://www.google.com/maps/?q="));
if (gps.location.age() > 5000)
    Serial.print(F("xxx.xxxxxx,xxx.xxxxxx"));
else {
    Serial.print(gps.location.lat(), 6);
    Serial.print(",");
    Serial.print(gps.location.lng(), 6);
    }
``` | This sources code section is for the GPS Module to get the location from the satellite. |
| ```
void sendCoord(
    ) {

int8_t              answer;

if (debugMode)
    Serial.println(F("@sendCoor"));

if (debugMode)
    Serial.println(F("  Connecting to the network..."));

while((sendAtCmd("AT+CREG?", "+CREG: 0,1", 500) ||
        sendAtCmd("AT+CREG?", "+CREG: 0,5", 500)) == 0) {}

if (debugMode)
    Serial.println(F("  Setting SMS mode..."));

sendAtCmd("AT+CMGF=1", "OK", 1000);
if (debugMode)
    Serial.println(F("  Sending SMS..."));
``` | This is the code where GSM Module will send the coordinate that have been received from GPS Module. The coordinate will be sent to user telephone number in form of message. |

```
answer = sendAtCmd("AT+CMGS=\"+60107187784\"", ">", 2000);

if (answer == 1) {
    ssGprs.print(F("https://www.google.com/maps/?q="));
    ssGprs.print(gps.location.lat(), 6);
    ssGprs.print(F(","));
    ssGprs.print(gps.location.lng(), 6);
    ssGprs.print(F("; "));
    ssGprs.print(gps.speed.mph(), 0);
    ssGprs.print(F(" "));
    ssGprs.print(F(" "));
    ssGprs.print(gps.course.deg(), 0);
    ssGprs.println(F(";"));
    ssGprs.write(0x1A);
    answer = sendAtCmd("", "OK", 20000);
    if (answer == 1)
        Serial.println(F("  SMS Sent"));
    else
        Serial.println(F("  SMS Send Error"));
    }

if (debugMode)
    Serial.println(F("  returning to listening to GPS"));
```

| | This code are the setup for Arduino tracking process |

```
void setup(
    ) {

unsigned long          debugTimer;

Serial.begin(9600);

Serial.print(F("gsmGpsSmsDemo. "));
Serial.print(F(" Compiled: "));
Serial.print(F(__DATE__));
Serial.print(F(" "));
Serial.print(F(__TIME__));
Serial.print(F("."));
Serial.println();

debugTimer = millis() + 4UL * 1000UL;
Serial.println(F("Press <CR> to enable debugging; otherwise wait 4 secs."));
while (millis() < debugTimer) {
    if (Serial.available()) {
        debugMode = true;
        Serial.println(F("debugging enabled"));
        break;
    }
    } // while


ssGprs.begin(9600);
ssGps.begin(9600);                          // SMS baud rate

ssGprs.listen();                            // listen to GPRS rx pin
powerUpSms();                               // wait for GPRS to power on
delOldSms();                                // delete any waiting SMS msgs
ssGps.listen();                             // listen to GPS rx pin
```

```
void Loop{
  | []

  char              c;
  unsigned long     timeout          = 0UL;

  Serial.println("Press 'T' to send coordinates via Text.");

  while (true) {
    if (Serial.available()) {                    // did user hit 'T' key to force text?
      c = Serial.read();
      while (Serial.available())                 // flush buffer
        Serial.read();
      if (c == 'T' || c == 't') {
        ssGprs.listen();                         // listen to GPRS while we send coordinates
        sendCoord();                             // send coordinates as SMS msg
        ssGps.listen();                          // go back to listening to GPS
      }
    }

    doGpsIo();                                   // decode next GPS character
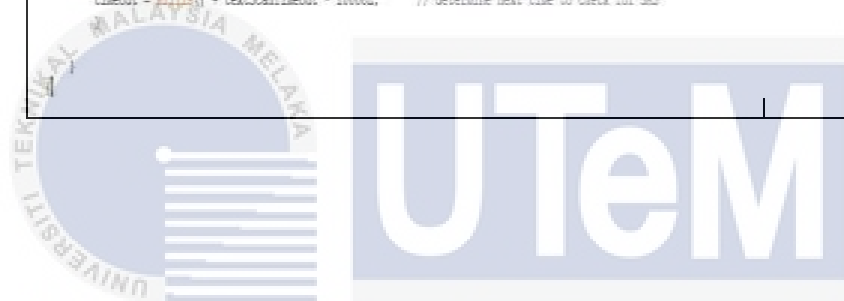
    if (millis() > timeout) {                    // ever <timeout> secs,  check for SMS
      if (debugMode)
        gpsTest();
      ssGprs.listen();                           // start listening to GPRS
      doSmsMsg();                                // check for incoming SMS and respond w/ coordinates
      ssGps.listen();                            // go back to listening to GPS
      timeout = millis() + textScanTimeout * 1000UL;  // determine next time to check for SMS
    }
  }
}
```

The code where allow the process to be loop.

5.3   Conclusion

In conclusion, we can know how to make this project work and also we can know how to combine these module to Arduino, the environment setup of this project that list will explain all the process involved making this project done.

CHAPTER VI

TESTING

6.1   Introduction

This phase discuss about testing product if all component are completely done. So basically, the product is implemented exactly the same like being stated in Chapter IV which is referring to the Sketch Circuit figure and the Physical Design of the product to be developed. Hence, after all the components are soldered and connected as supposes, then Testing Phase for this product will be undergoes in order to ensure that the product has achieved its objectives.

6.2   Result and Analysis

6.2.1   Test Plan

A test plan is needed in this project because when planning for the testing phase, the test organization and the test environment are very important to ensure that the project developer know how the testing phase will be conducted. The hardware and software that will be used is explained in the test environment. Besides that, any system error can identify effectively for the hardware and software if any problem occurred. This

test schedule is used to give a layout activity how the system will be tested.

6.2.2 Test Organization

Organization that is a group of people which testing the system through testing process. To producing a very good quality of system, it needs to be tested from any different background of people which have a lot of experiences in information technology.

Table 6.1: Test Organization

Tester ID	Title / Position	Responsibilities
Tester 1	System Developer	Develop, document, manage and testing the system. He/she will ensure the system will run smoothly and systematically based on the requirement before delivered the system to the end user.
Tester 2	Project Supervisor	Act as end user for staff and administrator of the system and give their feedback. All the responses will be a guide to enhance the system.

6.2.3 Test Strategy

Test strategy is the steps that will be done by to get the best outcome from the system. Test strategy will be divided into two groups that are functional and structural. The implementation phase is the biggest part in planning the strategy. The overall approach that is used in the project such as techniques, method and tools that used can be identified.

Table 6.2: Test Strategy

Black-box testing
Testing the application based on its behaviour
Also known as "Behavioural Testing"
Testers involve in this type of testing

6.3 Classes of Test

6.3.1 Hardware Testing

For the hardware testing, the developer will test the hardware circuit board which contains all the components that will be used for this system. The components itself are assemble first during the implementation phase to the printed circuit board. This part of testing is very important after all steps are been measured. This will be the prototype board that will be considered for the actual implementing of this project in the future. The

error or drawback of the system will be identified during the testing. The hardware testing such as:

   i.   Arduino UNO
  ii.   GSM Module
 iii.   GPS Module
 iv.   Magnetic Door Sensor

Table 6.3: Hardware Testing

Component	Type Testing	Result
Arduino UNO	Hardware Testing	When plug Arduino power to computer Arduino LED will light out.
GSM Module	Connection Testing	GSM module LED will light out when pin from GSM Module connect to pin Arduino. It also needs to insert sim card to use it.
GPS Module	Hardware Testing	GPS module LED blinking (depends on the location)
Magnetic Door Sensor	Connection Testing	Message will sent when magnetic door was open.

6.3.2 Project Application and Circuit Board

All the components that be used in the project are all connecting to the board. The positioning of the component on the board is based on the design that has been created first in the simulation software

Figure 6.1: Component Used In This Project

1. First, the Arduino board must be connecting to personal laptop or computer to upload the coding for running all of it function. We use this system need to power supply 5v and 3.3v to Arduino to use this system.

2. GSM Module, GPS Module and Magnetic sensor will connect to Arduino using jumper wire by using pin port at these modules.

3. The user must first apply their phone number into the Arduino.

4. The testing process will start when thief open the vehicle door.

5. When the door was open, Magnetic sensor will interact with GSM Module and it will sent notification function to mobile phone.

6. When the user gets the notification from GSM Module, user can track vehicle coordinate using GPS Module.

7. To test the GPS function, user need to send a message to the sim card inside the Arduino.

8. User will receive the coordinate vehicle from Arduino via message in latitude and longitude.

6.4 **Test Design**

Test can be run in a specified amount of time, that will be demonstrate that the project have meet or exceed a given reliability depends on its confidence level. Test design involves test description and test data for this project. All this tests are required for project to meet requirements and reliability.

Table 6.4: Arduino IDE Test Case

Test	Arduino IDE
Test Purpose	To check an error of Arduino coding
Test Environment	Windows 10
Test Step	Run Arduino terminal and open the client file. Verify the program and upload to Arduino board. **Positive testing** The coding run without error **Negative testing** The coding show an error
Expected Result	Coding will run without any error

6.5   Functionality test

Table 6.5: Component and their Functionality

Component	Type Testing	Status	Remark	Tester
Smartphone	Connection Testing	✓	The platform to user use the system that indicator with the Arduino	Project Supervisor
Arduino Uno	Connection Testing	✓	Sent data from smartphone to Arduino board. Smartphone can connect the Arduino	Project Supervisor
GSM Module	Connection Testing	✓	Use to send notification and coordinate message to user.	Project Supervisor
GPS Module	Connection Testing	✓	Detect coordinate vehicle if stolen	Project Supervisor
Magnetic Sensor	Connection Testing	✓	Help to alert user if user vehicle door is open and it will interact with GSM Module then user will receive notification door was open.	Project Supervisor

6.6   Conclusion

Conclusion, testing need to be conducted in order to ensure implementations suggested will determine the objective of the project. Therefore, monitoring and analysis conducted on results gained from the testing phase, it showed that some data will be different according to the environments. We will test module to know these module working or not to Arduino.

CHAPTER VII

PROJECT CONCLUSION

7.1. Introduction

This chapter will explain about the project conclusion. We will discuss overall of this project, to whom to contribute this project, the limitation of this project and the future works of this project that needed to improve this product.

7.2. Project Summarization

The objective of this project that has been identified was listed as below:

    i.   Tracking and routing in a large area environment and smartphone. To achieve this objective, we have been study about developing a GPS tracking using Arduino. Many previous works have

been identified and based on the result; developing a GPS tracking device using Arduino can be done.

ii.   Avoid vehicle stolen and using GPS is best way to decrease stolen vehicle.

The objective can be done and the GPS tracking device using the Arduino have been done properly.

iii.   Develop simple GPS tracking applications using Arduino, GPS Module and GSM Module.

This objective can be done because range price for these Module is cheaper around RM100-RM150.

Table 7.1: Price Comparison

Research Title/Product	Range Price
Real Time GPS Tracker with Integrated Google Maps (Jayeshsukumaran, 2012)	GSM Modem and GPS Modem around RM100 - RM 150
GPS-GSM Based Tracking System(Ameerpet and Dilsukhangar, 2013)	Microcontroller, GPS receiver, GSM modem, LED and local alarm around RM200 – RM250
Arduino GPS/GSM Tracker(Abid Khan and Ravi Mishra, 2012)	GPS modem, GPS receiver and Microcontroller around RM150 – RM200
Vehicle Tracking and Accident Alert System(Kommineni Rakesh, 2014)	GSM Modem, GPS Modem, Shock sensor, Microcontroller, power supply, LED and Fire Detector around RM250 – RM300

7.2.1   Project Weakness and Strength.

7.2.1.1 Project Weakness:

     i.   The system is vulnerable, it must be handle carefully because it just using an Arduino.

    ii.   Hard to detect coordinate vehicle if vehicle on building or place that hard GPS to detect. To improving the satellites signal, the antenna has to be in a place with a clear sky view.

    iii.   Need prepaid to send message.

    iv.   Don't have permission for user to stop sending message from Arduino if users open the vehicle door.

    v.   Arduino not enough power to support many module.

7.2.1.2 Project Strength:

     i.   The prototype is small and can be put at anywhere

    ii.   The cost for these Modules is reasonable cheap based on its performance and functions compared to the common tracking device.

    iii.   The project easy to use only uses smartphone.

7.3.   Project Contribution

This project was developed to help user to search vehicle if has stolen. Besides, this product is suitable for all user because this product cheaper than other tracking product. This product also easy to use only use smartphone and we can track our car anywhere. With this product our vehicle has more security not only depend on car alarm device.

7.4 Project Limitation

This project has used cheaper Module so this product has low performance than other GPS tracking. Furthermore, GPS Module Hard to detect coordinates vehicle if vehicle on building or sparse coverage, reception can be poor and that hard GPS to detect. Maps on GPS devices are not updated in real time. The limitation of the knowledge in tracking device has made this project difficult to develop. Coverage for GSM Module also need to strong signal because SMS can't be send if no have signal. Arduino also cannot support many module because power Arduino not to strong.

7.5 Future Work

This project can be upgrade for a better performance and function. The future works that can be considered are:

i.   Add buzzer for open vehicle door as second alarm.
ii. Use motion sensor for detect owner or thief so GSM no need send message for user. We also can use another module that is Bluetooth Module to stop buzzer if owner open vehicle door.
iii. Add camera for more security.
iv. Make android application to control on off Arduino.
v.   Use high quality equipment to improve tracking device.

7.6 Conclusion

As the conclusion, this project successfully meets the objectives that have been identified earlier when start this project. Hopefully, the GPS tracking using Arduino can help people add more security for vehicle and also can find vehicle if has stolen. With the cost that reasonable and the performance of the GPS tracking using Arduino, so that this project can be commercialize.

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APPENDICES

GPS TRACKING USING ARDUINO AND SMARTPHONE

User Manual

1. First, the Arduino board must be connecting to personal laptop or computer to upload the coding for running all of it function. We use this system need to power supply 5v and 3.3v to Arduino to use this system.

2. GSM Module, GPS Module and Magnetic sensor will connect to Arduino using jumper wire by using pin port at these modules.

3. The user must first apply their phone number into the Arduino.

4. The testing process will start when thief open the vehicle door.

5. When the door was open, Magnetic sensor will interact with GSM Module and it will sent notification function to mobile phone.

6. When the user gets the notification from GSM Module, user can track vehicle coordinate using GPS Module.

7. To test the GPS function, user need to send a message to the sim card inside the Arduino.

8. User will receive the coordinate vehicle from Arduino via message in latitude and longitude.