

CAR SECURITY SYSTEM BY ARDUINO AND SMARTPHONE



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CAR SECURITY SYSTEM BY ARDUINO AND SMARTPHONE

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This report is submitted in partial fulfillment of the requirements for the Bachelor of
Computer Science (Computer Networking)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA 2007

JUDUL: CAR SECURITY SYSTEM BY ARDUINO AND SMARTPHONE

SESI PENGAJIAN: SEM 3 2015/2016

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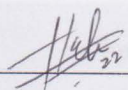
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DECLARATION

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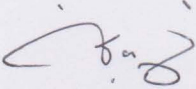


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I hereby declare that I have read this project report and found
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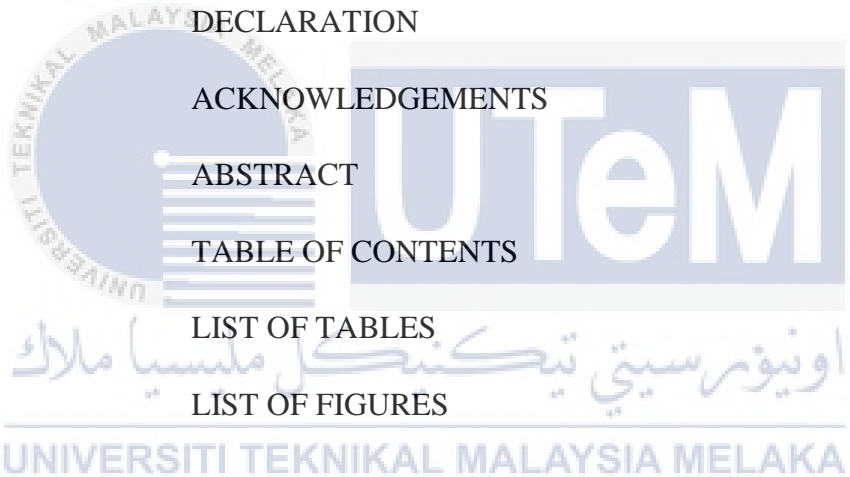
ABSTRACT

This project is purposely to implement a product which is Car Security System by using microcontroller; Arduino Uno and Smartphone. This project using Arduino Uno system that including a few modules that work on Arduino Uno itself. The Magnetic Sensor Module will sense the changes of door position and than it will send the notification to the user through GSM Module. This notification will be in form of alert (message) so that the user can know what happen to their car. Other than that, the project also includes tracking device which allow the user to track their own car. This system using the GPS Module, the user will send a message too the Arduino and it will reply the current location (in form of coordinate) to the user smartphone, this process will involves GSM Module. By using this product, it will reduce the cost for car security system and also could help to track easier. The product that exist nowadays in market are expensive, it also could not notify user directly. Moreover, the product are complicated to use.

ABSTRAK

Tujuan utama projek ini dilaksanakan adalah bertujuan untuk mencipta sebuah produk iaitu sistem keselamatan kereta dengan menggunakan pengawal micro, Arduino Uno dan telefon pintar. Dengan menggunakan beberapa modul, sistem ini dibentuk dengan bagi berfungsi dengan Arduino Uno itu sendiri. Sensor pintu bermagnet akan mengesan perubahan kedudukan pintu dan kemudiannya akan menghantar pemberitahuan kepada pengguna melalui modul GSM. Pemberitahuan tersebut akan dihantar dalam bentuk amaran(mesej) supaya pengguna tahu keadaan yang berlaku terhadap kereta mereka. Selain daripada itu, projek ini juga memasukkan fungsi peranti pengesanan yang mana membenarkan pengguna untuk mengesan kereta mereka. Untuk menggunakan fungsi pengesanan menggunakan modul GPS, pengguna akan menghantar sesebuah mesej kepada Arduino dan seterusnya ia akan membalas lokasi semasa (dalam bentuk kordinat) kepada telefon pintar milik pengguna. Proses pengesanan ini juga menggunakan modul GSM. Dengan menggunakan produk ini, kos bagi sistem keselamatan kereta dapat dikurangkan selain dapat membantu mengesan kereta dengan lebih mudah. Produk yang telak wujud dipasaran kini adalah mahal, ia juga tidak mampu untuk memberi tahu pengguna secara terus. Tambahan pula, produk tersebut sangat sukar untuk digunakan.

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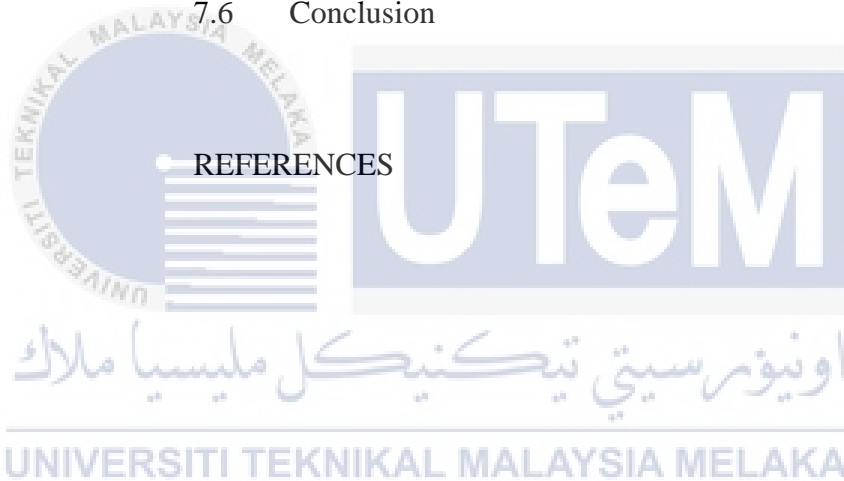
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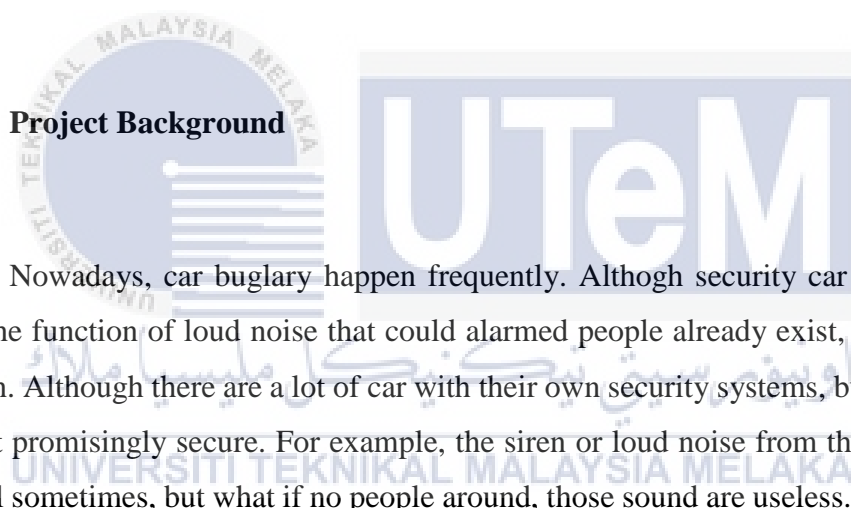
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CHAPTER 1

INTRODUCTION

1.1 Project Background



Nowadays, car burglary happen frequently. Although security car system already have the function of loud noise that could alarmed people already exist, it still not good enough. Although there are a lot of car with their own security systems, but those devices are not promisingly secure. For example, the siren or loud noise from the car itself, it is helpful sometimes, but what if no people around, those sound are useless. This is because not everyone parks their car near to their house, for example, for a person that lived at apartment and on the 15th floor, how do they know their car that being noisy on the parking lot. Some parking lot also are far from the place people passing by, so the car can be robbed easily and although the can produce loud noisy, nothing can be done. Next, the car alarm when the user is looking for it as give the same result. What happen when the user looking for his/her car on noisy environment?

Next, the product that i want to produce will working on the alarmed system, it will send notification to the user smartphane whenever their can being open by forced. This alarm will work automatically with the car door system which means anytime the

door forcibly open, the magnetic sensor will detect the movement of its pole and send the notification to the user. This product also will provide a simple gps system where the user can find their car easily.

1.2 Problem Statement

The most problem that occur on car security system nowadays are the user will not have the notification when their car alarm ringing from far away. Some car user also is hard to find their car when they forgot where they parked the car or when the car being stolen.

This project will help on giving notification to the user. It also giving the car's location. All these notifications will be sent towards user's smartphone.

Table 1.1: Project Problem

No.	Problem Statement
PS	The current alarm system which is install in all cars is sometimes not effective and user need to track the location of their car when stolen

1.3 Project Question

There are many question that occur while doing this project, and those question are based on the problem statement stated.

Table 1.2: Project Questions

	PQ	Project Question
PS	PQ1	How to develop a security system for car thief?
	PQ2	Can a smartphone be used to get notification and location tracking of a stolen car?

1.4 Project Objective

This project is mainly to help car's user by developing a notification system that can intergrate with smartphone. This notifying system will help on increasing the level of awareness for car security system

Table 1.3: Project Objectives

	RQ	PO	Project Objective
PS		PO1	To study the process of making a security system of a car.
		PO2	To have a car security system (notification and tracking) that work with smartphone with the lowest cost

By performing the project, there are project objective that could be achieved. Below is the expected result by archieving project objective based on Table 3.

For Project Objective 1 (PO1), the requirement for some system to become a complete and working security system will be studied. Other that that, the tracking, notifying and alarm system will be implement as a security system.

For Project Objective 2 (PO2), the integration between a security system and a smartphone will be developing in this project.

1.5 Scope

This project is focusing on certain area which will make the objective clearer. Other than that, it also helps this project to become more specified.

- i. Security system that have notifying, alarm and locating system.
- ii. Smartphone that compatible with Arduino uno

1.6 Expected Output

Every project should have the expected result while performing it. For this project, there are also a few expected output that will be stated below

- i. To have a security system that can notify, locating and alarm the user
- ii. To have a security system that can integrated with smartphone.

1.7 Project Contribution

By doing this project, the output of the product will be helpful to any car user, this is because the car user is most likely to use the more secure security system for their car. Next, the project is hopefully will produce a security system that can work with any smartphone, by doing so, the proposed product will helpfully secure a car while the cost for a security system will be reduce.

Table 1.4: Project Contribution

		PO	PC1	Project Contribution
PS	RQ	PO1	PC2	Proposed a security system that can notify, alarm and locate a car
		PO2	PC3	Proposed a car security system that work with smartphone.

1.8 Report Organization

Chapter 1: Introduction

This chapter will focus on introduction, project background, research problem research question, research objective, scope, project significant and report organization.

Chapter 2: Literature review

This chapter will thrive more on the explanation and details of this project, supported with reading materials and conference paper. In this section, other related projects will also be included.

Chapter 3: Methodology

This chapter will explain the method that will be used in this project. The method that is used in this project is the waterfall method. This will ease the task for implementing and organizing the project.

Chapter 4: Design and implementation

In this chapter, software and hardware are coordinated to be used in implementing the project.

Chapter 5 : Testing and analysis

In this chapter, the expected product will be test all of its function. After that an analysis regarding the product will be done.

Chapter 6 : Conclusion

In this chapter, all project summarization, project contribution and project limitation will be explained. All the steps that have been made and that have been developed for this project will be listed briefly. In this last chapter also explain on additional work can be done in future

1.9 Conclusion

As the conclusion, at the end of the project, the security system of a car will be deeply understanding. Other than that, the method of combining multi function into a single device will be studied and understandable.

CHAPTER II

LITERATURE REVIEW



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2.1 Introduction

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This chapter will discuss about literature review of the related published information with this project. As for my project, I will review the past project that related to any security system that using micro-controller (either Arduino or Raspberry Pi) and the project are intergrated with smartphone. The literature review is done by find that information in the library and on the internet. The past project that being reviewed will then be compared to my current working project.

2.2 Related work/previous work

Based on **Saddam Khan (2015)** research and posted about the project of Medicine Pillbox Reminder. It also one of the project that made by UTEM student: **Medicine pillbox reminder**. In this project, they are using arduino uno as the main component. By using arduino and GSM module, they create a device where it will notify the user to take the medicine pill. This project focus on notification function. The notification including when to take the pill and if the user already takes the medicine. For example, person A need to take the pill, and person B is the son, the device will notify person A to take the pill while person B will get the notification if the box being opened or not.

Next, **Md. Nasimuzzaman Chowdhury, Md. Shiblee Nooman, Srijon Sarker (November 2013)**. They are working on Controlling Door and Home Security by using Raspberry Pi. The project is implemented by accessing through the internet. The different on their project are based on the cost since they are using Raspberry Pi as the device platform. In their paperwork, the door is controlled by using web, thus it can be access from any place. Next, the project also gives a funtion of taking image, this function act when the user wants to know who on the front door. The camera will take the picture and send the user Email or tweet on twitter. This function also focuses on when the user is not available at home. Moreover, the image taken will work as database which means the data of image will be the confirmation as an approved guest. The guest also can send any message to the user through the screen that provided outside the door.

Witura Corporation Sdn Bhd was working on “GSM Gate Opener” product. For their product, they are using cell phone as the controller. These controller work as gate’s control such as close, open, and timer for the gate. The concept of this product are by using SIM card into GSM switch and then applied it onto the gate, garages or electric door. The switch then will be connected to any cellular phone from the family members. The phone, which work as remote will call the unit (GSM switch) and then it will be check either the number listed inside the white list. If it is listed, the call will be rejected then the gate will be opened. The system will not answer the call, it just checks the caller ID. These

products mostly use the caller ID validation, if the number is listed on the system, the next function then can be go through such as opening the gate.

Project from **PushingBox**, the “Notifications for your Internet of Things devices”. They are using Application Program Interface (API) to react or send the notification to the user. In this product, the main scope that they are using are onto the door system. The product is specified on the down side of the door where the pet’s owner going through in and out the house. The main platform used on the product are Arduino, the Arduino (including Sensor Module) will sense the movement of the part of the door. The sensor then will send the notification through the twitter as the user applied. Some of the notification will send to the email. This product will allow the API to be trigger by HTTP request. Other than that, the **PushingBox** also produce the product where including Camera Module, this product also being applied onto the door system. The camera will send an image to the cloud or twitter as requested by the user.

The project “RFID Car Lock/Unlock” by **Instructables: thematthewknot (2010)**. In his project, the focus is on lock and unlocking the car door by using Radio-frequency identification (RFID). By using Arduino, the car is being setup by being assign with certain tag to be scan by the user. After the tag being scan, it is then sent to the micro-controller. Micro-controller act as verification to the tag that legal to open the door; while the right tag being verified, the invalid will be ignored. The valid tag will have the micro-controller to sends a signal to unlock the car. In the project, the car door will be automatically lock after a few second as set by the owner. While doing this project, he is having some hard time when doing the wiring onto thae car door. The project is done by using an old car that have a broken security system. Rather than buy the new security system that cost a lot of money, **thematthewknot** using an initiative by build his own security system which is cost less. The project also will be upgraded in the future which will be using bluetooth to replace RFID system.

The literature review studied are summarized in Table 2.1

Table 2.1: Summarization of studied literature review

Research Title/Product	Author/ Company	Purpose	Description	Platform/Range Price
Medicine Pillbox Reminder	Saddam Khan / UteM Student	To create a product to reminding the user to take the medicine	The product will send the notification to the user for them to take medicine or if the box are being opened The product also consist of timer.	Arduino Uno The cost for Arduino is around RM80-100
Controlling Door and Home Security By using Raspberry Pi and Internet	Md. Nasimuzza man Chowdhury, Md. Shiblee Nooman, Srijon Sarker	To implement a security door system that can be use by Raspberry Pi through the internet.	The project are developpe by applying the door with access control system(Raspberry Pi) and it can be controlled through the internet.	Raspberry Pi. The cost for Raspberry Pi is around RM100-200

GSM Gate Opener	Witura Corporation Sdn Bhd	Using cellular phone act as a remote control to do such work such as open and close automatic gate, garages, electric door, roller shutter by using mobile phone.	Concept of the product is simple, insert a SIM card into GSM switch, connect the GSM switch to automatic gate or any other places, and validating the cellular numbers inside the unit. The methodoly used are prototyping	Smartphone, GSM. The price is around RM 400-500
Notifications for your Internet of Things devices	PushingBox	Using API system to send notification to the user.	Using API system to send notification to the user. It can be applied in many situasion and places.	

RFID Car Lock/Unlock	Instructables : thematthewk not	To unlocking and locking door by using RFID system	The can will be unlocking when the code being verified onto the car door. The car door then automatically lock after the time reach the timer that being set.	RFID. The cost is around RM 100-200
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2.2.1. Additional Research

An additional research regarding the cost of the product has been done. Below are the table for the cost for the product. All the cost study was made on the internet. The study only shows the result. These product can be reference by searching their title or product name

Table 2.2: Study on product cost

Research Title/Product	Range Price
Car Security By using Raspberry Pi	Raspberry Pi: RM 200 Other Module : RM 100-200 Total: RM 300 - 400
Eclipse 360 Degree Vehicle Surveillance System	Cost : RM 1000
Viper 5806V 2-way Security System w/Remote	Cost : RM 700 - 800

'RFID Lock/Unlock' thematthewknot.	Car by	Arduino UNO : RM 80 - 100 RFID : RM 100 – 200 Total : RM 180 - 300
--	-----------	--

2.3 Critical Review of Current Problem and Justification

The review of current exist project are summarizing on table 2.3 below

Table 2.3: Critical Review of Current Problem and Justification

Project	Techniques Used	Software/Hardware
Medicine Pillbox Reminder	Door concept sensor. Notification techniques	ArduinoUno. smartphone. magnetcode.
RFID Car Lock/Unlock	Fingerprint, Microcomputer integrated with smartphone	RFID Smartphone
GSM Gate Opener	Control gate by using smartphone through GSM switch	GSM Switch Smartphone

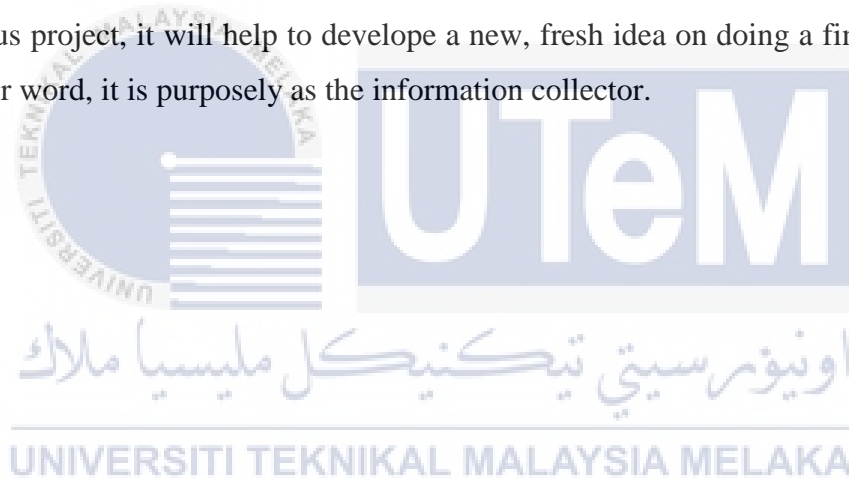
2.4 Proposed Solution/ Further Research

Based on **Instructables: thematthewknot (2010)**, it shows the using of other platform to create a new security system. Thus, I would like to use that project as one of my reference while doing my project. As for Final Year Project level, I will be including

a few more system onto the device so that it can become a multifunction project. The difference between the project and my proposed project are, they are focusing on unlock and locking the door only while using RFID while mine are combining alarm, notifying and gps system. These function will make the security system more secure. The similarity between these projects is both are using arduino as the medium to control the system.

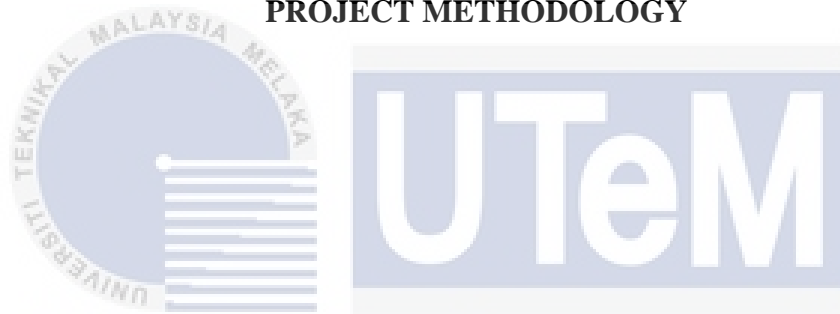
2.5 Conclusion

As the conclusion, the literature review part while doing this project will help to gain a few knowledge regarding the project itself. By combining a few article of the previous project, it will help to develop a new, fresh idea on doing a final year project. In other word, it is purposely as the information collector.



CHAPTER III

PROJECT METHODOLOGY



3.1 Introduction

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The project methodology and milestone regarding this project will be discussed in this chapter. This process will be helping on planning the project, from where it starts until the prediction end. This chapter also important because it will help smoothing the flow of project. With this the course will not go on the wrong track because everything has already planned.

Based on my project, the methodology is systematic when being applied in the project studied. The project will be entering every phase that needed from the beginning which is Planning, until Documentation while going through other phase, Requirement, Design, Implementation, Testing, and Maintenance.

3.2 Methodology

Based on Waterfall Model, the progress that should be done are flowing steadily downwards. Those flow must be through a few process or phase which are Planning, Requirement, Design, Implementation, Testing, Maintenance and Documentation. This process is to make sure that the development of the project become more smoothly. Other than that, regarding to my project, the flow of the phase is very exact which will help me on complete the developing of my product.

3.2.1 Planning

Any problem regarding Arduino Uno, GPS Module, and GSM Module are being listed in this phase. Also plan what are the tools need to make the project. The requirement to develop a product including software and hardware are also being listed in this phase. Before starting the project, everything that necessary are being planned earlier

3.2.2 Requirement

All information about Arduino Uno, GPS Module, and GSM Module are being obtained in this phase. It also including the hardware and the software needed. Also at this phase everything that has been planed are obtained so that it can be proceed to the next phase.

3.2.3 Design

This phase will describe how this project developed. The design done must be approved before proceed to the next phase. In this phase the simple circuit, simple coding, gantt chart, flow chart and milestones also are design. Everthing will be following the flow in this phase.

3.2.4 Implementation

Implementation phase also can be known as a develop session. In this phase, Arduino Uno, GPS Module, and GSM Module are already installed and develop. All has

been 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.

3.2.5 Testing

For this phase, Security Car system will be tested based on the current project studied, for example, it will be followed the Medicine PillBox Remainder techniques. The project will be tested on how the notification will be receive by smartphone after interated between arduino uno, GPS Module and GSM module are done. The security affectness will be test out.

3.2.6 Maintenance

This phase will ensure that the system will be run smoothly without any problem. Other than that, this phane will working on build the product perfectly. For my project, this phase will do process where all the function will be combined as one perfect and useful device that required by car security system.

3.2.7 Documentation

In this phase, all step will be documented as a report. It will help to keep on tracking the project either it is done or not. Other than that, it is to ensure that everthing that needed are already done by review the report.

Based on the Waterfall model that has been made, here is the figure as shown below:

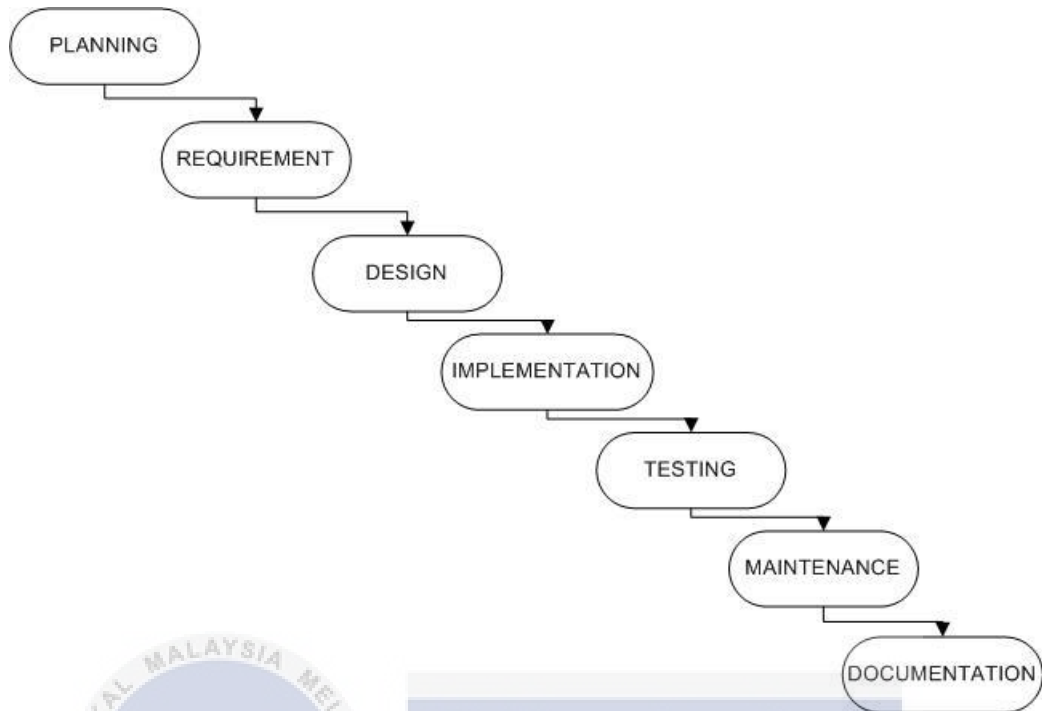


Figure 3.1: Methodology (Waterfall)

3.3 Project Milestones

A project milestone will show the time taken to complete this project. As for my project, all the duration for each every part has been made. The project was started at 22 February where the topic and the objective of the project being discuss. All the process which is including researching, design , developing , testing ,maintanence and documentation has been done in PSM 1 which is ended at 10 June 2016.

As for PSM II, the troubleshooting of PSM 1 project were made,. At that time, every problem that occur is corrected, it is to ensure the project is done perfectly. The PSM II start at 12 July 2016 until 28 August 2016.

Table 3.1 show the milestones that has been made for this system:

Table 3.1: Milestones

	Duration	Start	Finish
Identify Problem and Define Objective	2 weeks	22 February 2016	4 March 2016
Study And Research	2 weeks	7 March 2016	18 March 2016
Design The Project	3 weeks	21 March 2016	8 April 2016
Develop The Project	4 weeks	11 April 2016	6 May 2016
Testing	2 weeks	16 May 2016	27 May 2016
Maintenance The Project	1 week	30 May 2016	3 June 2016
Document All The Project	15 weeks	22 February 2016	10 June 2016
Troubleshoot PSM 1 Problem Process	6 weeks	12 July 2016	21 August 2016
Final Presentation and Report Submission (PSM II)	1 weeks	21 July 2016	28 August 2016

3.4 Project Gantt Chart

The project Gantt Chart show the flow of the project in date and time form. It will help summary the start until the finish project. The Gantt Chart show the relationship between all the activites. Other than that, it also shows the schedule status that should be done.

Table 3.2 show that every part of the project are taken list down. Every activities while doing this project has its own specific time. The gantt chart of this system is as follow:

Table 3.2: 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 shown the Table 3.3 which is specifically for PSM 2 milestone. The milestone is continuing from the PSM date and day. The time taken for completing the PSM 2 is around 7 weeks.

Table 3.3: PSMII Gantt Chart

	16	17	18	19	20	21	22
Troubleshoot PSM 1 Problem Process							
Final Presentation and Report Submission (PSM II)							

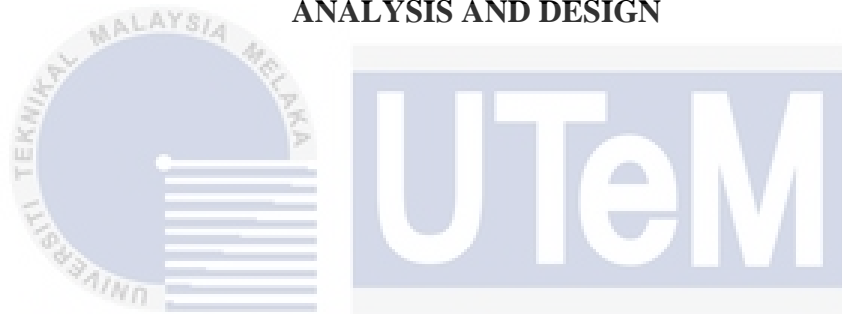
3.5 Conclusion

As the conclusion, the methodology phase is important because it will help tracking the project's milestone on developing a system. This are needed because by the time given, this project can be work as a well planned and organized system. As the flow of the project are being followed, this project is hopefully will be work as perfect and efficient system. The next chapter which is Design, will discuss about the design of this system.



CHAPTER IV

ANALYSIS AND DESIGN



4.1 Introduction

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In this chapter, the design of the Security Car System will be shown. The detail of every related design including the circuit design of this project that will be developed. Next, this chapter will help on explaining the implementation that occur including the process flow. This will help in identifying the project required to complete the project. This phase need a lot of attention since the project are regarding wiring and coding which the design will effect the whole system. Any system might not be working finely if those design are not generated carefully. Other than that, this chapter will help on explaining the equipment and requirement needed which include hardware and software to completing the project's system.

4.2 Problem analysis

The current system of car security system is not very effective, for alarm it just and alarm, user dont know what happening to their own car. Other than that, the price for current security product are quite expensive. Other than that, the process of tracking car nowadays quite difficult. Based on the problem statement on previous chapter. user wont gets any notification when car alarm being ringing Thus my project will be giving a new feature where user will receive a notification and also can tracking their car easily.

4.3 Requirement Analysis

4.3.1 Data Requirement

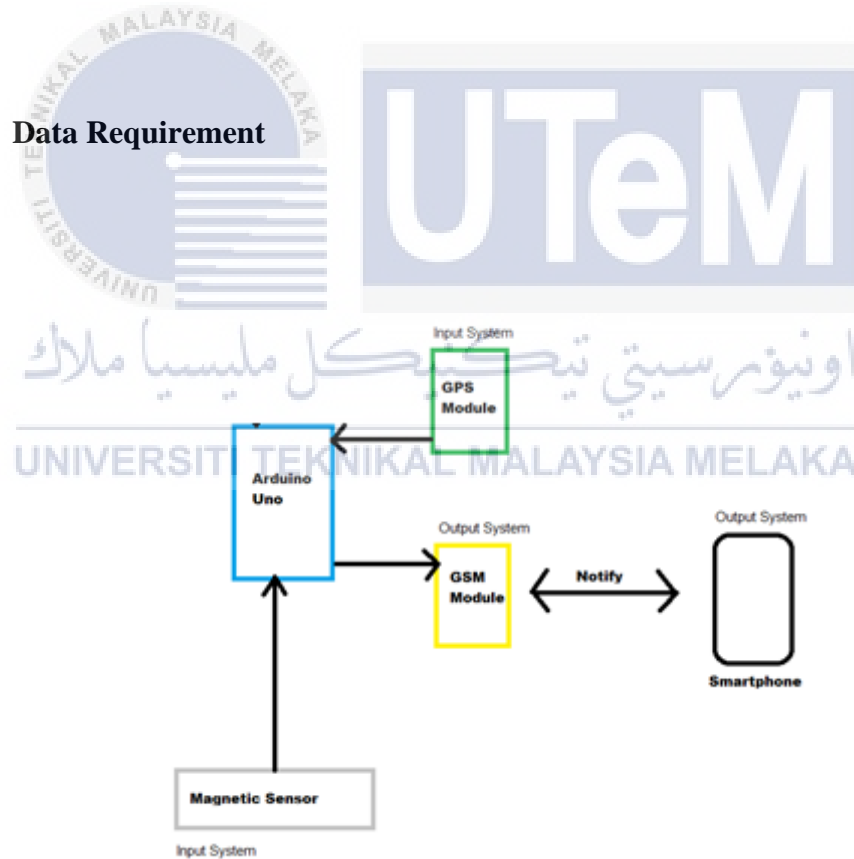


Figure 4.1: Block Diagram of Security Car System

In this project, the data input that occur in this system are sensor and requested message. The sensor will detect by magnetic sensor which will effect whenever the door being opened forcefully or without authorization. The output is in form of message.

4.3.2 Functional requirement

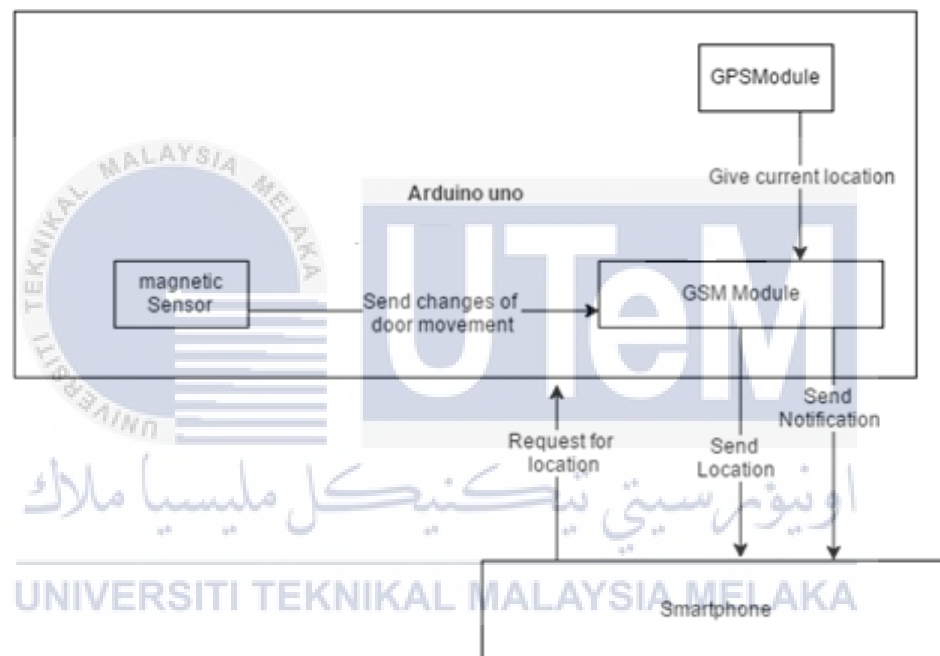


Figure 4.2: Context Diagram of Security Car System

In this project, the input of the system is when the user door is being opened forcedly, the input will be detected by magnetic sensor. Other than that, while tracking the car, user is needed to request the tracking function from the arduino. The output of this system is when the magnetic sensor 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. These output or information will be through GSM module which are via sms.

4.3.3 Other Requirement

As we know, by development a system based project, there are life cycles, the information collecting process are also needed to be done. The hardware and software needed will also need to be gathered in this phase

4.3.3.1 Hardware Requirement

i. Breadboard

A plastic board that can hold an electrical circuit. In this project, it will function on providing a new source of ground (GND) and power (VCC) that not available in the Arduino itself. The function of breadboard also to make the project arranged. Other than that, the breadboard also the preferable product when doing a prototype project. It can hold from simple circuit to a complex type of circuit. It also can hold resistor which will reduce the power level for the certain module.

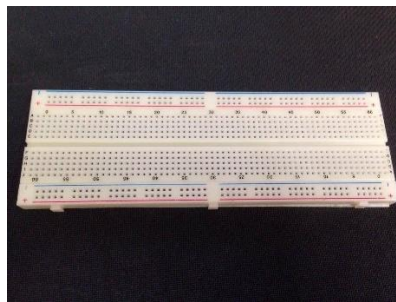


Figure 4.3: Breadboard Top views show connecting holes

ii. Jumper Wire

A wire that can flow the electrical energy. This wire will be connected into the Arduino's port, breadboard or the Modules that use in this project. There are two types of jumper wire that being used in this project, Male to Female and Male to Male cable wire. These cables will help to make the wiring process of completing the product become easier.

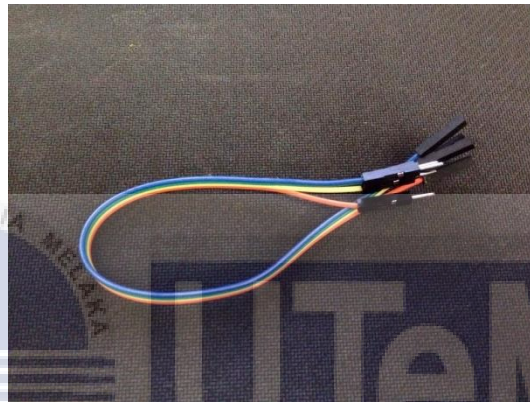


Figure 4.4: Jumper cable wires (Male to Female)



Figure 4.5: Jumper cable wires (Male to male)

iii. Arduino Uno Board

The Arduino UNO is a microcontroller board than can do a lot of function when it is connected with any other module. The Arduino board consist of 14 digital input/output pins. The Arduino Uno is one of the product that can be used to develop a new system other than Raspberry Pi. It has almost the same function as Raspberry Pi but less cost and the language use to sketch the board is C.



Figure 4.6: Arduino Uno Board

iv. GSM Module

A module that compatible with Arduino Uno. It has the GSM/GPRS function. It functions as the establisher between a computer and GSM/GPRS system. It als an architecture used for any mobile communication worldwide. The GSM Module contain GSM/GPRS modem, power supply circuit and communication interfaces for computers. For this project, the GSM Module will hold a SimCard for replying and notifying the user smartphone. The output will be in form of message or sms.

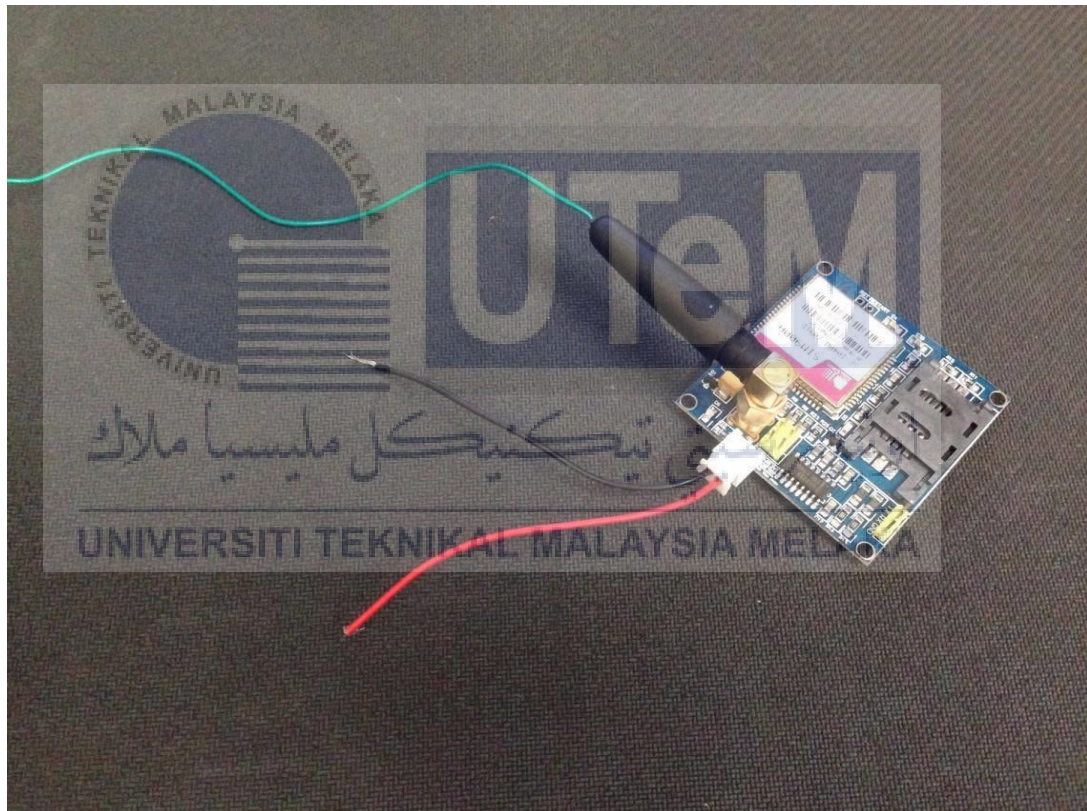


Figure 4.7: GSM Module

v. Power input voltage from USB port to BR-600 cable

A cable that will powered up the arduino. The arduino will be connected to PC through this cable so that the arduino board can be sketch. The power average for this cable is 6-9 volt. It is USB connector to BR-600 printer type connector.



Figure 4.8: USB Power Cable

vi. GPS Module

A module that also work with Arduino Uno. The main function of GPS Module is for the navigation. It has antenna that allow satelit to detect it s location. In this project, after the user request for the location of their car, the GPS Module will di his job, it will locate its coordinate and then send the coordinate to the GSM Module so that it can be forward to user smartphone via sms.



Figure 4.9: GPS Module

vii. Magnetic Sensor

A sensor that will be placed onto the car door. This sensor will detect the changes of magnetic field whenever the car door being open or close. The sensor will be connected to arduino and any changes of door position will be send to GSM module. It will be then send to user via sms.



Figure 4.10: Magnetic Sensor

viii. SimCard

A subscriber identification module (SIM) that contain circuit chip which are unique. It also contains a number that can be contact. In this project, the SimCard will be placed inside GSM Module. The SimCard also need to have credit which will allow the GSM Modlu to send sms to the user.



Figure 4.11: SimCard

ix. Smartphone

A device that support GPRS where it can recieve sms and has maps application or can open browser. This function is needed so that it can be functional with the tracking system. The system will send the location via sms to the phone and then user open the location in type of web browser or maps application.



Figure 4.12: Smartphone

4.3.3.2 Software Requirement

i. The Integrated Development Environment (IDE)

The Arduino IDE on the computer to create, open, and change sketches Arduino calls programs “sketches”. This software stores a coding which will call as sketches. Sketches define what the board will do. The activities inside the software can be selected at the top menu of the bar. The IDE is using the C language.

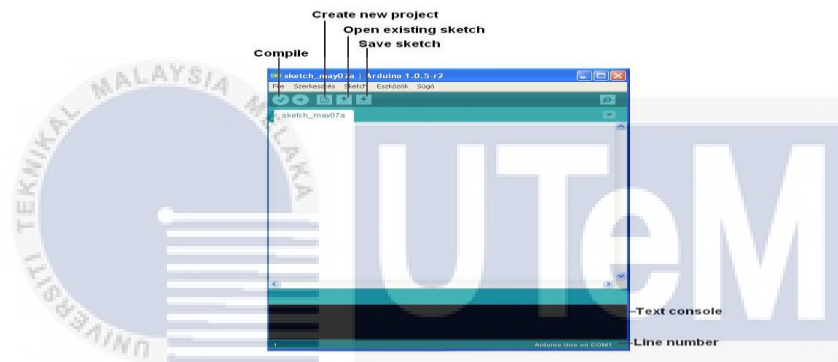


Figure 4.13: Arduino Software IDE

ii. Fritzing

A software that use to simulate the use of electronics in a project. Without a further knowledge about electrical and mechanical, this software could help by giving out tutorial and example inside the software itself. Figure 4.15 below show the interface of fritzing.

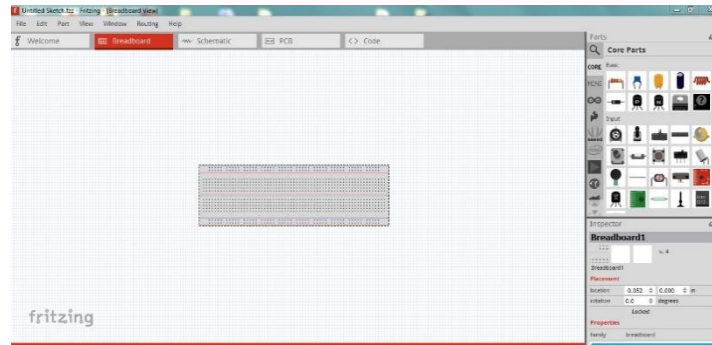


Figure 4.14: Fritzing Software Interface

4.4 High-Level Design

For the further system of this project, the additional of this project are combining all those function into one device. Other than that, the product should become easier to use and less complicated.

4.4.1 Sketch Circuit Design

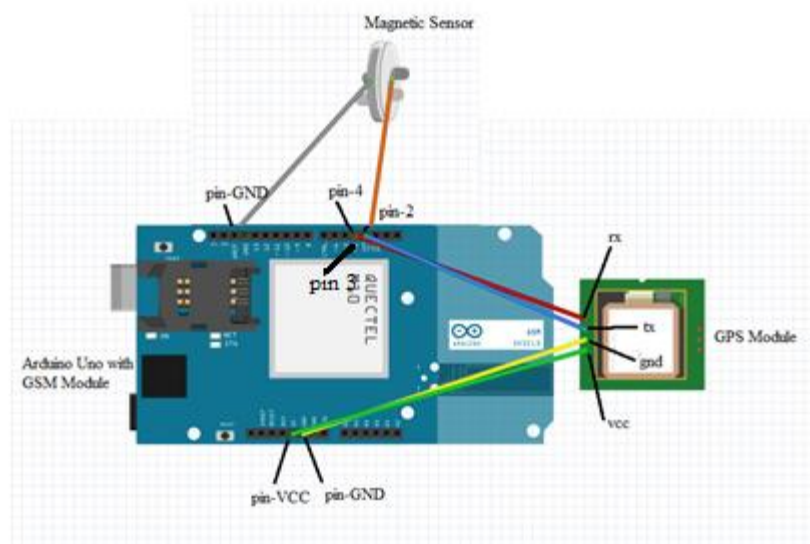


Figure 4.15: Simulation Circuit Design (Overall)

4.4.2 Schematic Design

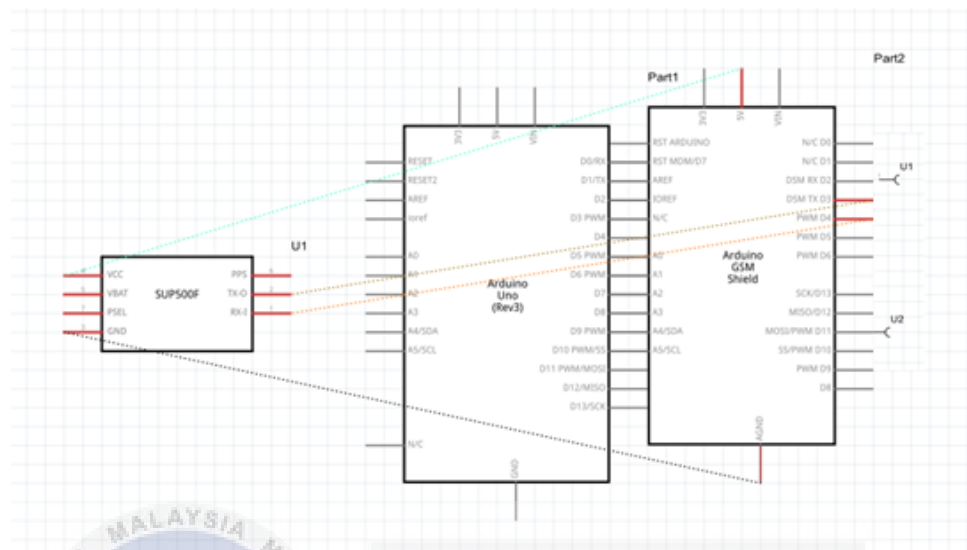


Figure 4.16: Schematic Design(Overall)

4.4.3 System Interface Design

i. User Interface(Tracking)



Figure 4.17: User Interface (Request of location)



Google

Figure 4.18: User Interface (maps Apps)



Figure 4.19: User Interface (current location)

ii. User Interface(Notification)

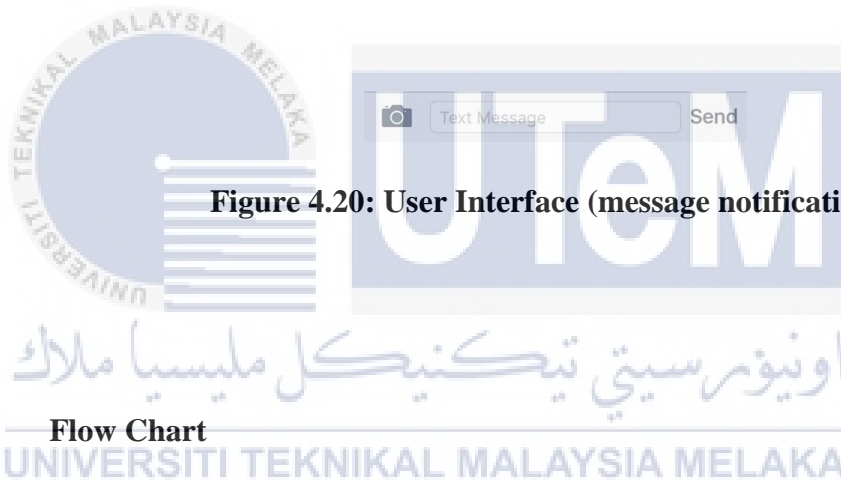
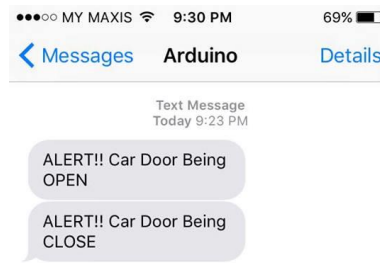


Figure 4.20: User Interface (message notification)

i. — Flow Chart

The flow chart below shows the function of the product in this project. Since there are two different on the main functions, it is separated by two different flowcharts.

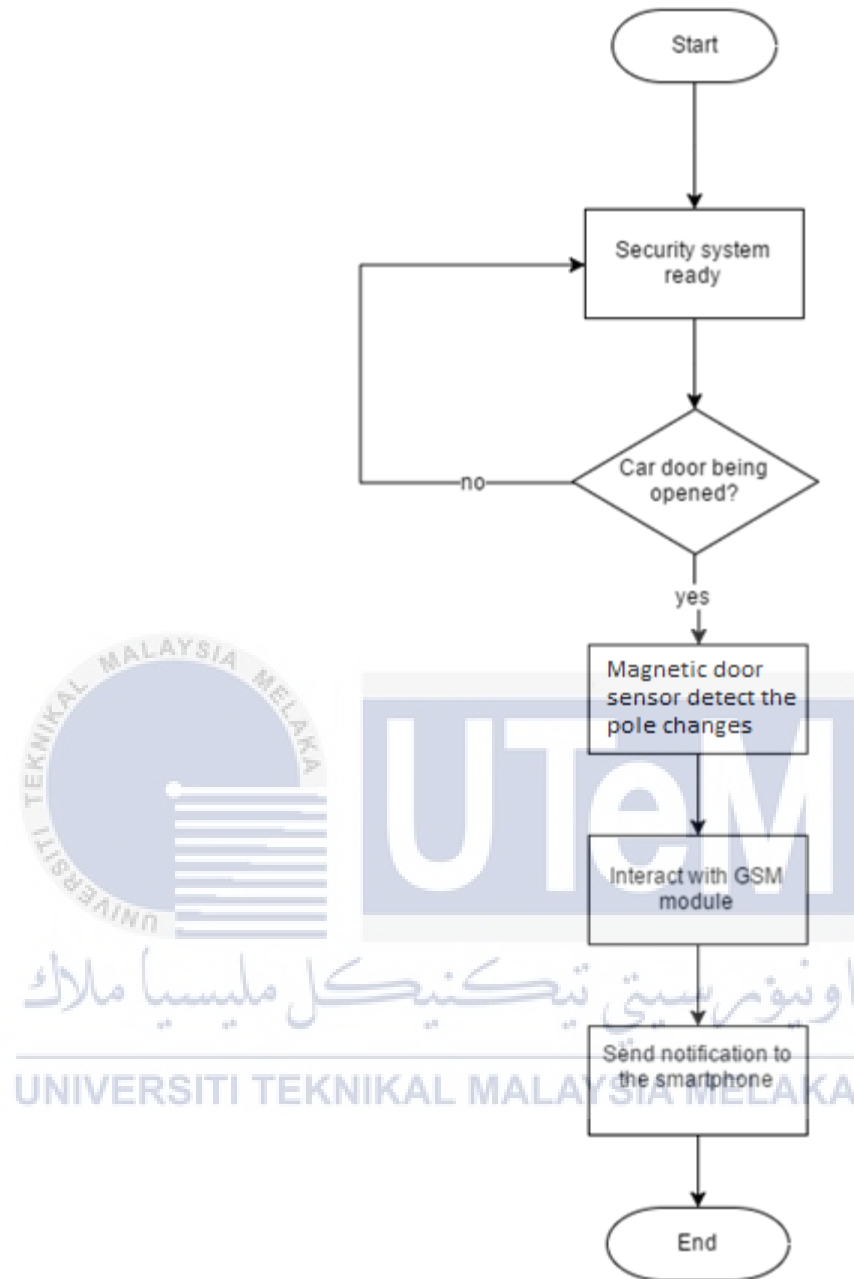


Figure 4.21: Flow Chart of Security Car System(Notification)

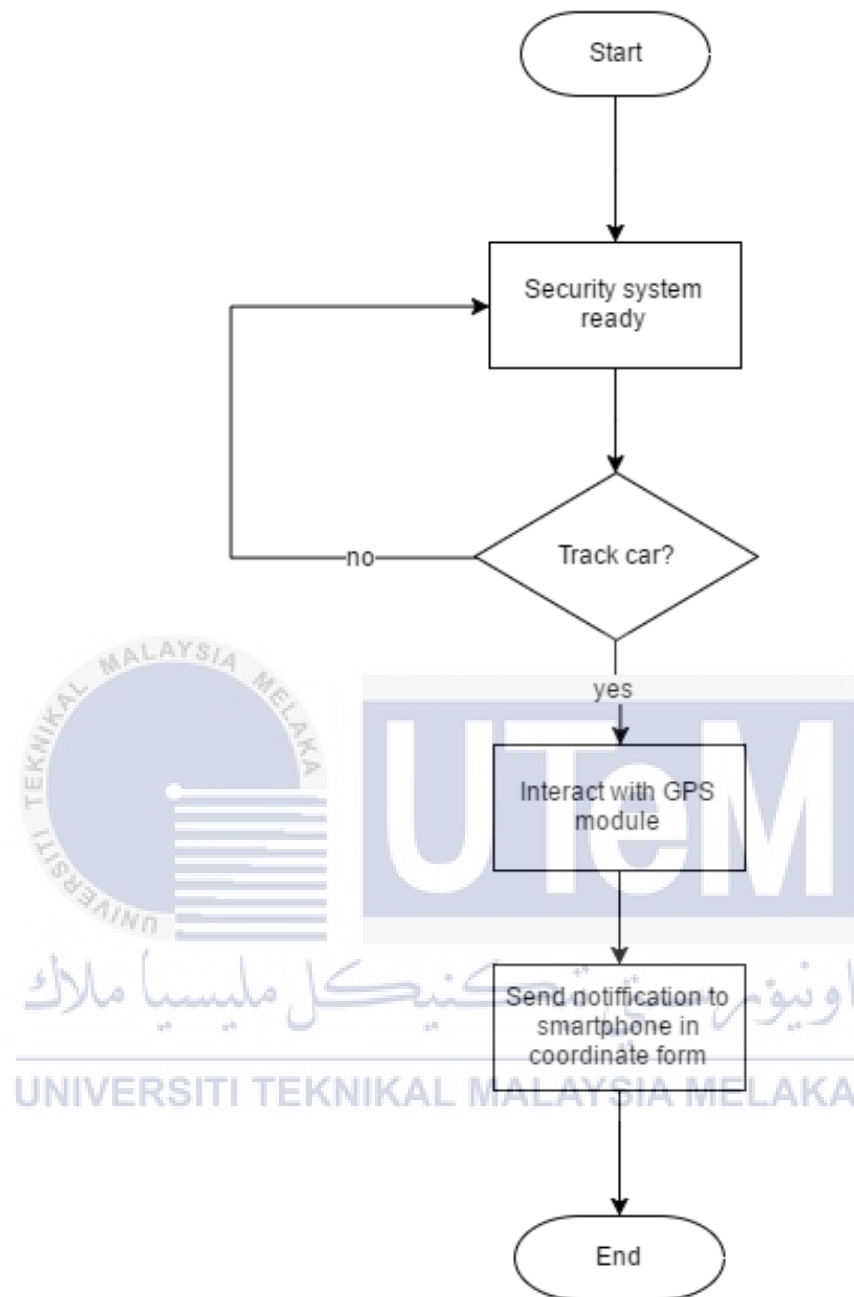


Figure 4.22: Flow Chart of Security Car System(Tracking)

4.5 Physical Design

The physical design shows how the flow of the functions in this project. The design is using the exact image of the product. Figure 4.26 and Figure 4.27 show the physical design of the security car system.

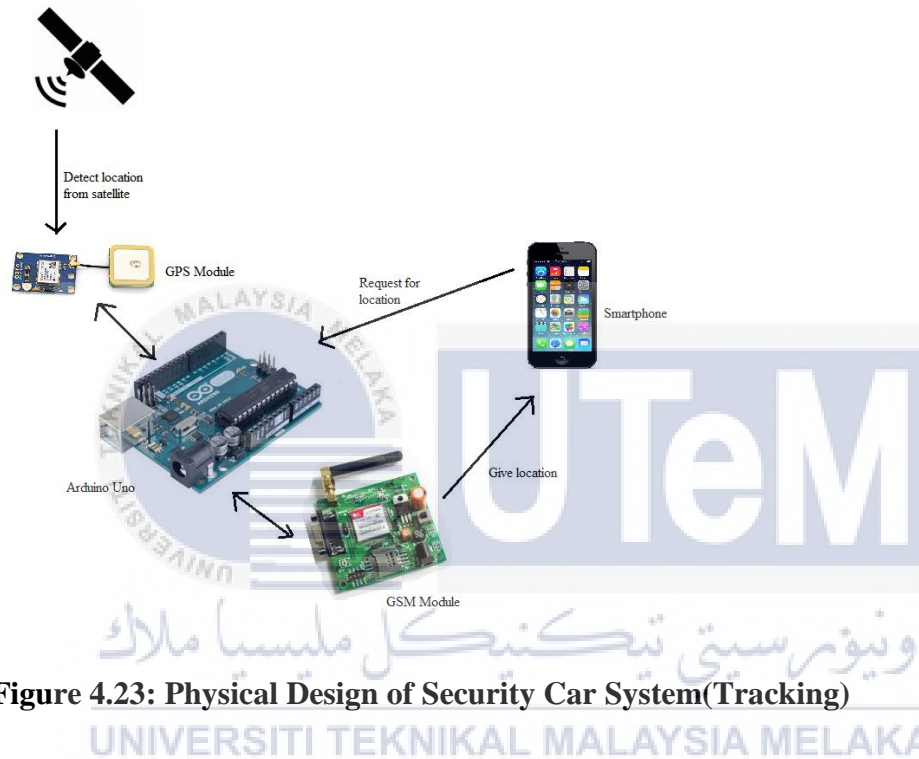


Figure 4.23: Physical Design of Security Car System(Tracking)

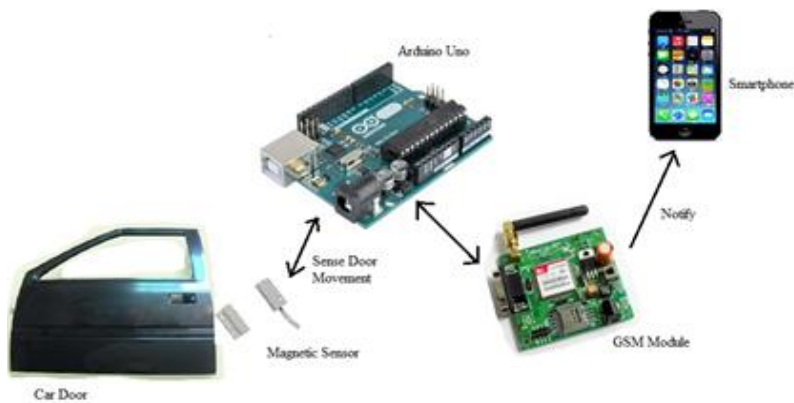


Figure 4.24: Physical Design of Security Car Door System(Notifying)

4.6 Conclusion

As the conclusion, the analysis and design phase are one of important phase before entering the next phase or the implementation is done. This will help on getting the flow of the project become arranged. It also will show the clear idea on developing the project. Next, in this phase, all the design is shown so that in can be approve. Thus, the next step on developing this project can be continuing as soon as possible. Other than that, the next step, which is Testing of the product will be done.



CHAPTER V

IMPLEMENTATION



5.1. Introduction

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On this chapter the implementation of Car Security System project will be explained. Based on the previous phase that has been discussed before, now it is time to do the implementation of the project. The explanation of how the project works and how it will be implement on the real life will be discussed. The environment setup will be listed 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 to become a complete device. The software that is needed for program platform such as Arduino software is installed in personal laptop in order to make the programming and to make sure the product is fully function. When all the components successfully installed, next process is procede.

Implement Source Code

Arduino software 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, 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 used as the first step when implementing the component based on the design that has been created because UNO board is a main to generate this product for stored data

1. Plug in the used Module and sensor onto Arduino UNO Board.

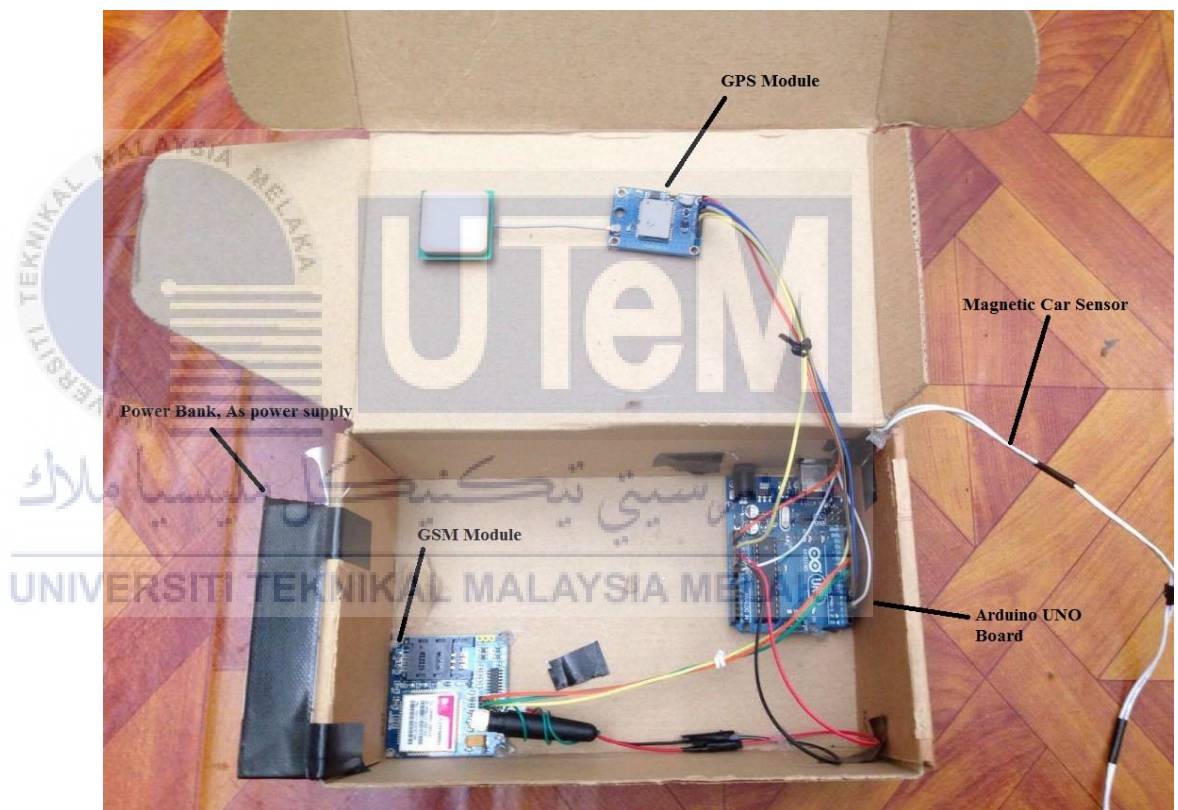


Figure 5.1: Environment Physical Circuit

2. To setup the Arduino board, connect to Laptop or computer and setup the coding using Arduino IDE software. To using the Arduino portabally, using Power Bank as the power supply

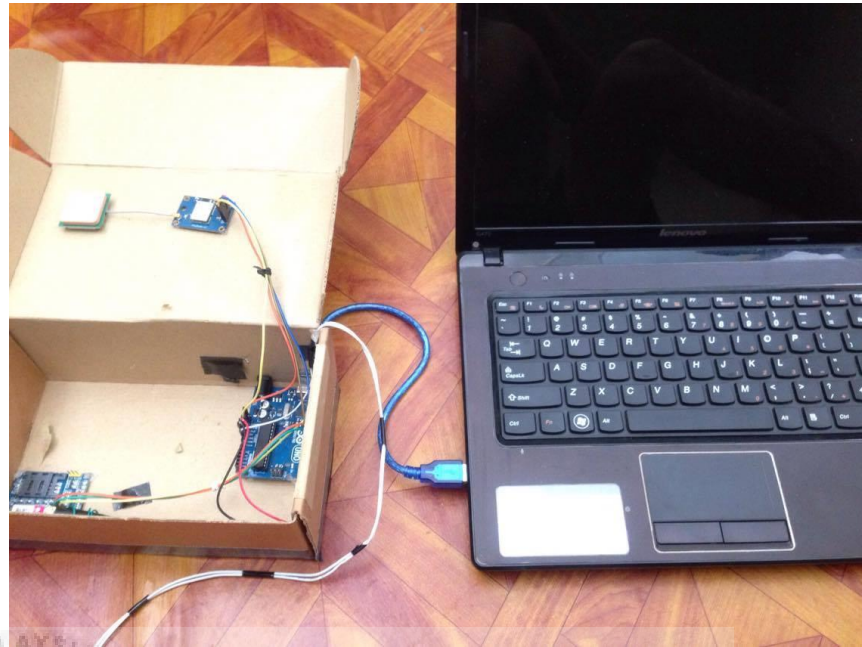


Figure 5.2: Editing Arduino Code

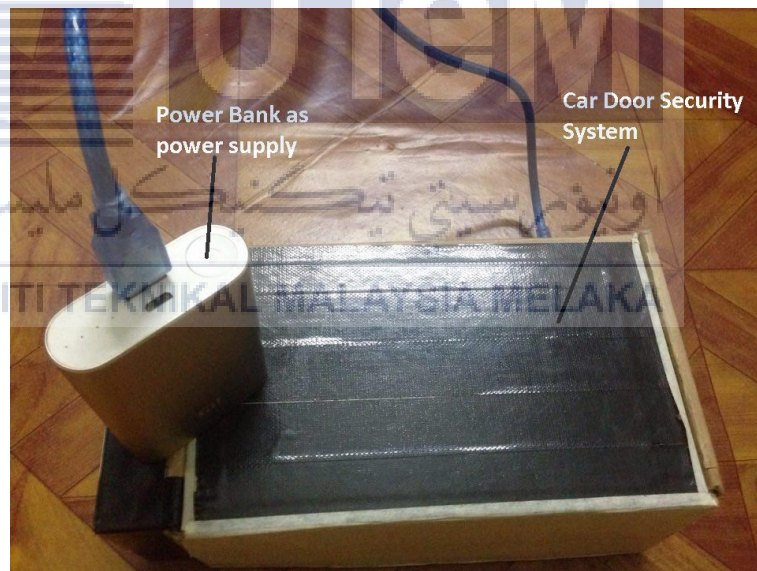


Figure 5.3: Power Supply

3. Implement the Car Security system onto the user car. For safety purpose, it is suggested to put the device under the car seat. There are two poles for magnetic car sensor, thus both poles need to imply side by side to each other

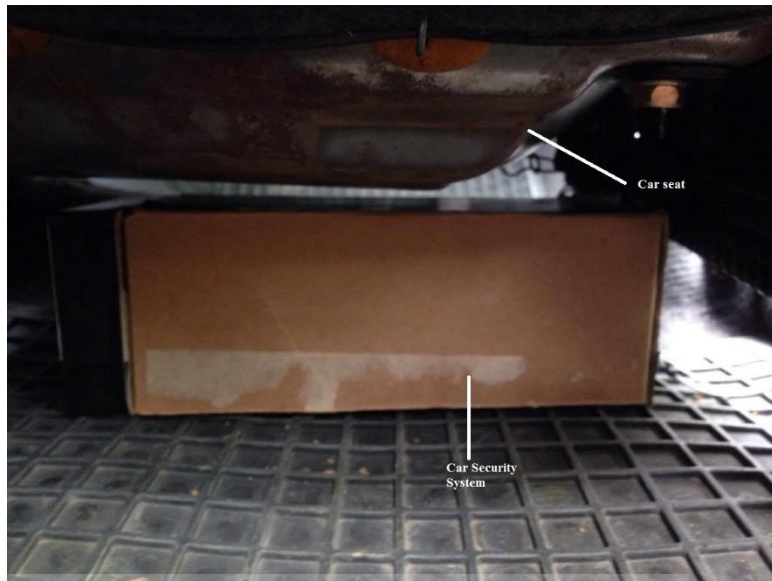


Figure 5.4: Under the car seat.



Figure 5.5: Car door area (seat)



Figure 5.6: Car Door area (door)



Figure 5.7: Area to apply Magnetic Door Sensor



Figure 5.8: Complete position for Magnetic Door Sensor

5.2.3 Software Setup


i. Source Code for Arduino

Arduino programs are written in C or C++. The Arduino software 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
<pre> #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); } </pre>	<p>This code section is needed to know the library used for the Arduino code. Its also to know which pin were used</p>
<pre> void loop() { while(GPRS.available()) { Serial.write(GPRS.read()); } lastState = state; state = digitalRead(2); if (state != lastState) { sendSMS(); } delay(500); } </pre>	<p>This code will do the loop process as long as the Arduino is switch on.</p>

<pre> 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); } </pre>	<p>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</p>
	
<p>Tracking process</p>	
<pre> #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); </pre>	<p>This is the code for the Arduino Library</p>

<pre> void delOldSms(); void doGpsIo(); void doSmsMsg(); void gpsTest(); void powerUpSms(); int8_t sendAtCmd(char* atCmd, char* matchStr, unsigned int timeout); </pre>	<p>The method of the code</p>
<pre> 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); } } </pre>	<p>This code section is to delete the older message that have inside the serial</p>
<pre> 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"); } } </pre>	<p>This source code are for the arduino to ready to send message to the user</p>

```

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..."));

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 is the code where GSM Module will send the coordinate that have been receive from GPS Module. The coordinate will be sent to user telephone number in form of message.

<pre> 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() + 4LU * 1000LU; 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(); powerUpSms(); delOldSms(); ssGps.listen(); // listen to GPRS rx pin // wait for GPRS to power on // delete any waiting SMS msgs // listen to GPS rx pin </pre>	<p>This code are the setup for Arduino tracking process</p>
<pre> 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 t c = Serial.read(); while (Serial.available()) // flush buffer Serial.read(); if (c == 'T' c == 't') { ssGprs.listen(); // listen to GPRS while we send cc 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 if (debugMode) gpsTest(); ssGprs.listen(); // start listening to GPRS doSmsMsg(); // check for incoming SMS and resp ssGps.listen(); // go back to listening to GPS timeout = millis() + textScanTimeout * 1000UL; // determine next time to check f } } } </pre>	<p>The code where allows the process to be loop.</p>

5.3 Software Configuration Management

5.3.1 Version Control Procedure

To control and allow the sources code or sketch to keep working, the product need to be tested regularly. If there is error, that is the moment to updating the source code.

- i. The first version for this product in Car Security System A and Car Security System B where both versions only including one function. Car Security System A for notification and Car Security System B for gps tracking
- ii. The second version for this product is Car Security System X where it is the compilation of two function inside one device.

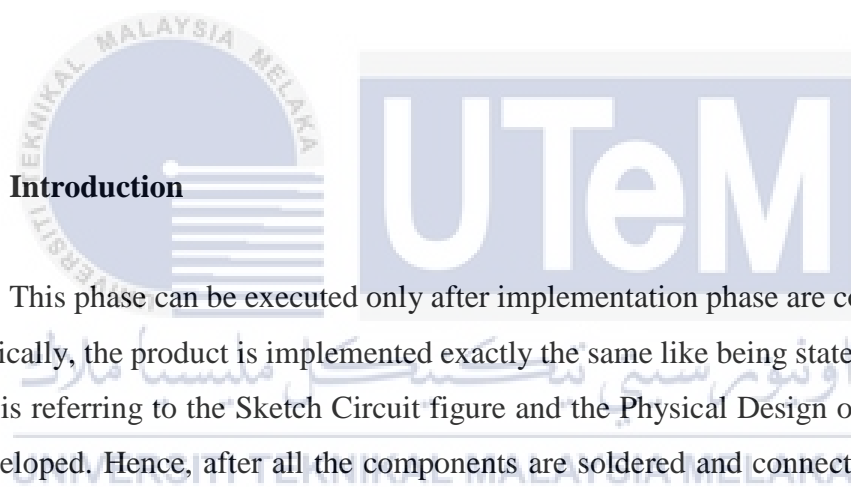
5.5 Conclusion

In conclusion, the implementation phase is to show how to make this project work, the environment setup of this project that list and explain all the process involved to make this project done. All the information that has been gathered in this phase will be test in next process which is testing and analysis. Next activities will involve in testing the product that has been implemented as to ensure that the product is running as supposes.

CHAPTER VI

TESTING

6.1 Introduction



This phase can be executed only after implementation phase 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 will be undergoing in order to ensure that the product has achieved its objectives. Conducting the testing, it will help to identify all the possible drawbacks or any malfunctions within it.

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

Test organization is the group of people which testing the system through testing process. For 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 taken or be done by the developer to get the best outcome from the system. Test strategy can be divided into two groups that are

structural and functional. The implementation phase will play the biggest part in planning the strategy. The overall approach that is used in the project such as method, techniques and tools that been used can be identified.

Table 6.2: Test Strategy

Black-box testing
Testing all the function notification and gps tracking of the car security system
The testing is being done in different place and time
Testers 1 which is system developer will doing the testing for this product

6.2.4 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:

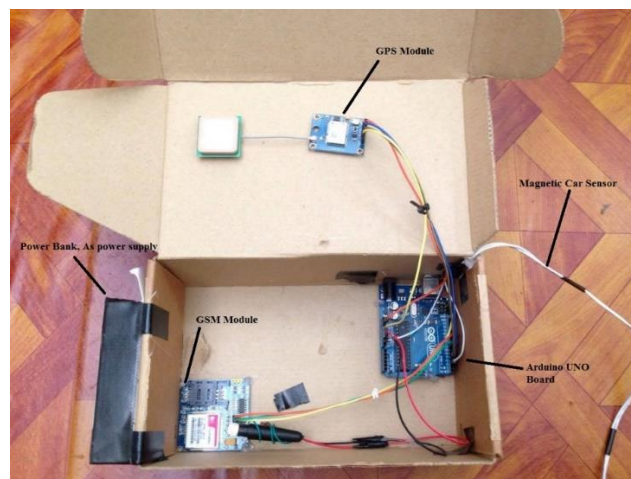
- i. Arduino UNO
- ii. GSM Module
- iii. GPS Module
- iv. Magnetic Door Sensor

Table 6.3: Hardware Testing

Component	Type Testing	Result
Arduino UNO	Hardware Testing	The arduino LED light up that show it is functional
GSM Module	Connection Testing	As the GSM module connected to arduino and the sim card is inserted, the GSM module LED will be blinking with a delay interval.
GPS Module	Hardware Testing	GPS module LED blinking (depends on the location)
Magnetic Door Sensor	Connection Testing	Using code and its software to test, if the changes pole give a reply on serial monitor in the arduino IDE, the sensor is working

6.2.5 Project Application and Circuit Board

All the components that going to 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. People that need to use this system just need to supply the power 5v to Arduino to use this system.
2. Next, the devices will be applying inside the car which is at door area
3. The testing process on notification function start when the car door being opened.
4. The user must first apply their phone number into the arduino.
5. If the testing success, user will get the notification in their phone either via message or call notify.
6. To test the GPS function, user need to send a message to the sim card inside the arduino.
7. The arduino will reply to the user the location in form of latitude and longitude coordinate.
8. The test will be success if the arduino give the location and it can be opened by map application.

6.3 Test Design

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

6.3.1 Test Description

The test description discusses about the test case identification, test cases and expected result for each scenario which are designed and documented. The test description discusses integration test and functionally test.

Table 6.4: Arduino IDE Test Case

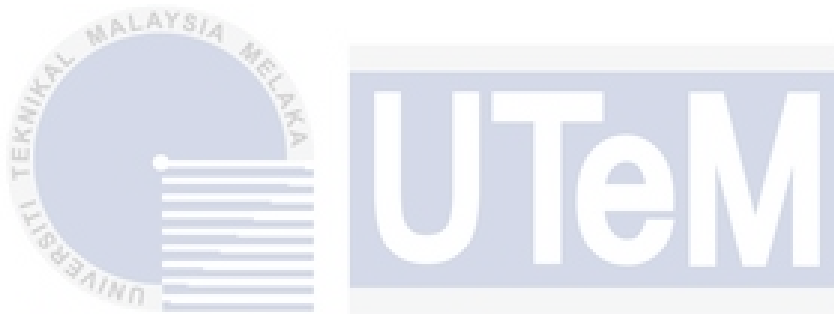
Test	Arduino IDE
Test Purpose	To check an error of arduino coding
Test Environment	Windows 7
Test Step	<p>Run arduino terminal and open the client file. Verify the program and upload to arduino board.</p> <p>Positive testing The coding run without error</p> <p>Negative testing The coding show an error.</p>
Expected Result	Coding will run without any error

6.5 Conclusion

In summary, testing is very important phase that needs 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. Finally, the next chapter will provide project conclusion that will include strength, weakness and recommendations of the project and its benefits to case study.

CHAPTER VII

PROJECT CONCLUSION



7.1. Introduction

This chapter will explain about the project conclusion. This phase 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 project.

7.2. Project Summarization

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

- i. To create a security system that consist a multiple function.

The objective has been done and the function of notification and tracking has been combine into a single device.

- ii. To develop a car security system that can work with smartphone and including lowering the cost.

The objective has been done and the Car Security System by using the Arduino and smartphone have been done properly. The objective also has shown that the cost of doing this project is lower that existing product. The use of Arduino, GPS module and GSM module as a Car Security System is cheaper than other product in the market.

. The use of Arduino, GPS module and GSM module as a Car Security System is cheaper than other product in the market. The range price to developed this project around 100-200. The price comparison table below is based on study of cost in Chapter 2 (Table 2.2 : Study on product cost)

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. The GUI of the project are not yet being develop
- iii. Low performance of GPS and GSM module resulting the device to malfunctioning.

7.2.1.2 Project Strength:

- i. The power supply used for the Arduino is low and it can be powered up by using a power bank.

- ii. The prototype is small and can be put anywhere inside the car
- iii. The detected location will be send to user in form of hyperlink and can be open straight by maps application.
- iv. The notification of door sensor is fast.

7.3. Project Contribution

This project was developed to be helpful to any car user, this is because the car user is most likely to use the more secure security system for their car. Next, the project will produce a security system that can work with any smartphone. Next, this project will increase the security of a car for the car itself. This project also will help the user that have a low budget for their car safety. Other than that, this project is usefull for every type of vehicle that have door at it.

7.4 Project Limitation

This project has been use the Arduino UNO microcontroller instead of Raspberry Pi to reduce the cost. Other than that, the cost of the project is lessen by using low quality of GSM Module and GPS Module. Since it is the low performance of GPS Module, most of the places such as inside a multifloor building, will make the GPS cannot detect its location which will resulting the gps locating process become failure. Next, the power supply for this project are depends on the power bank's power itself, if the mAh use is bigger, the longer this device can be use.

Besides that, the use of Arduino UNO resulting the lower voltage for other modules. Sometimes the power voltage cannot reach the modules and resulting the

modules to not functioning. For the use of GSM Modules, it also depends on the sim card's service provider. For rural places, some service provider is low, so the message from GSM modules can not be sent to user. Other than that, the prepaid in the sim cards also important, if there is no balance (prepaid) the message also can not be sent.

7.5 Future Works

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

- i. Adding camera for security function
- ii. Add more user friendly GUI
- iii. Use a high quality equipment.
- iv. Use postpaid type of sim card to prevent it from expired.

7.6 Conclusion

As the conclusion, this project successfully meets the objectives that have been identified earlier when start this project. Hopefully, the Car Door Security System can help to increase the chances of the user to find their car if the car being stolen. At this moment, the project is just for my personal use, thus, in the future in can be upgrade into a new version and then in can be commercialise.

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