MOTORCYCLE GPS TRACKING SYSTEM

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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MOTORCYCLE GPS TRACKING SYSTEM

MUHAMMAD FIKRI BIN MUHAMMAD FADHIL

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA 2019

DECLARATION

I admit that the project report entitled

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I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor Computer Science (Computer Networking) with Honours.

SUPERVISOR'S NAME:…… DATE:……

(MR. ERMAN BIN HAMID)

DEDICATION

To my dearest beloved parents, Muhammad Fadhil Bin Harun and Norlina Binti Abdul Shukor the ones who support me to get through everything during my studies.

To the most kind Academic Advisor, Dr. Nazrulazhar Bin Bahaman.

To the most caring of my Supervisor, Mr. Erman Bin Hamid.

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First of all, I would like to express my deepest appreciation to my Supervisor Mr. Erman Bin Hamid for being very helpful in order for me to finish this Final Year Project. He has the attitude and the substance of a genius; he continually helped me during my project. Without his guidance and persistent help, this project would not be this successful.

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In addition, a thank you to all my friends, especially the ones that have been staying with me since the day 1 in UTeM until today. Without them, my life in UTeM would be dull.

ABSTRACT

Motorcycle GPS Tracking System is a type of prototype GPS tracking system especially implemented for the rider who are not able to buy to install the GPS technology tracking system. Motorcycle GPS Tracking System is a system that uses raspberry pi and GPS module as a GPS tracker device for rider to get the GPS location by using android smartphone. This is due to rider faces some problem such as the issues of rider's motorcycle safety and parking, the high rate of motorcycle theft in an area and the difficulty of rider to track and monitor the motorcycle location. To solve the current problem, Motorcycle GPS Tracking System is proposed to develop with the objectives implement a medium lower cost GPS tracking system. Therefore, the purpose of this project is to develop a GPS device tracker with android application for user to track and monitor motorcycle location. It also generate travel report for user to view where it had been travelled before and ease the rider by track and monitor the motorcycle safeness and parking location from android application. To ensure the project can be successfully developed, the Rapid Application Development (RAD) methodology is being chosen. It allows the end users to collaborate with the system developer from the starting of the project. As a conclusion the Motorcycle GPS Tracking System can solve the problem facing by the rider.

ABSTRAK

Motorcycle GPS Tracking System adalah sejenis sistem prototaip pengesanan GPS terutama dilaksanakan bagi penunggang yang tidak dapat membeli untuk memasang sistem pengesanan teknologi GPS. Motorcycle GPS Tracking System adalah sistem yang menggunakan raspberry pi dan modul GPS sebagai alat pengesanan GPS untuk penunggang mendapatkan lokasi GPS dengan menggunakan telefon pintar android. Ini kerana penunggang menghadapi masalah seperti isu keselamatan motosikal dan tempat letak motosikal, kadar kecurian motosikal tinggi dan kesukaran penunggang untuk mengesan dan memantau lokasi motosikal. Untuk menyelesaikan masalah semasa, Motorcycle GPS Tracking System dicadangkan untuk dibangunkan dengan tujuan melaksanakan sistem pengesanan GPS berkos rendah sederhana. Oleh itu, tujuan projek ini adalah untuk membangunkan alat pengesanan GPS dengan aplikasi android bagi pengguna untuk mengesan dan memantau lokasi motosikal. Ia juga menjana laporan perjalanan bagi pengguna untuk melihat di mana ia telah dilawati sebelum ini dan memudahkan penunggang dengan mengesan dan memantau keselamatan motosikal dan lokasi letak motosikal dari aplikasi android. Untuk memastikan projek dapat dibangunkan dengan jayanya, metodologi Pengembangan Aplikasi Rapid (RAD) dipilih. Ia membolehkan pengguna akhir bekerjasama dengan pemaju sistem dari permulaan projek. Sebagai kesimpulan Motorcycle GPS Tracking System boleh menyelesaikan masalah yang dihadapi oleh penunggang.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Introduction

Nowadays, almost everyone has cars. The road has been crowded, full of vehicles. Some people prefer to ride motorcycle to everywhere. That is why it easier to ride motorcycle than a car. It has many benefits such as low fuel cost, more time saving, easy to take care of and low maintenance and do not have to pay for toll. But, today using motorcycle has major problem without the need ask for statistics from police, every rider must be aware of the high rate of motorcycle theft in Melaka. Today's motorcycle safety technology has changed as much as the magnetic key shutter. As a rider, they still maintain traditional way of locking a motorcycle such as using padlock key or a chain. But the risk remains today's thieves thrive. Along with the progress of thieves, riders should also advance and among the most advanced ways to do is install a navigation GPS tracking device at the motorcycle.

GPS tracker are not new innovations in vehicle safety as there have long been a hallmark of luxury cars. Then, with the advent of many cheap aftermarket products, installing a GPS tracker for ordinary cars is no longer seen as expensive and complicated accessory. However not for motorcycle because installing a GPS tracker is something that people rarely do. This may be because GPS tracker devices are expensive.

Therefore, the purpose of this propose project is to develop a Motorcycle GPS Tracking System which using the raspberry pi with GPS module and android application. This propose project will help to track and monitor the rider's motorcycle safety and view history report of location travel.

1.2 Problem Statement

The main problem is with the issues of rider's motorcycle safety and parking. Next, the high rate of motorcycle theft in Melaka area. This will cause the rider to always think negatively and not calm with the motorcycle safety and parking when they left. Besides, the rider has difficulty to track and monitor their motorcycle location. It makes the rider feel uneasy and difficult to be with the high rate theft situation.

Table 1.1: Summary of Problem Statement

PS	**Problem Statement**
PS1	The issues of rider's motorcycle safety and parking.
PS2	The high rate of motorcycle theft in rider area.
PS3	The difficulty of rider to track and monitor their motorcycle location.

1.3 Project Research Question

Project research question is used to identify the ways of ensure motorcycle safety and parking issues, the ways to handle of motorcycle theft in area, the existing solution for this problem and global solution to tackle this problem, reason to use GPS module and android application. Table 1.2 shows the summary of the project research question.

Table 1.2: Summary of Project Research Question

PRQ	**Project Research Question**
PRQ1	How to ensure motorcycle safety and parking issues?
PRQ2	How to handle the high rate of motorcycle theft in area?
PRQ3	How to ease the rider feel to track and monitor motorcycle location?
PRQ4	What is the existing solution problem?
PRQ5	What is the solution in the global?
PRQ6	Why use GPS module and android application?

1.4 Project Objective

Project objective defines the improvement that wants to achieve at the end of the project. The improvement must be considered based on the problem statement and the project question of this project. The objectives for this project are shown in below.

Table 1.3: Summary of Project Objective

PO	**Project Objective**
PO1	To develop a propose system that can track and monitor the motorcycle safety and parking.
PO2	To develop a travel report to view which can track the motorcycle location to reduce theft rate
PO3	To ease rider by tracking and monitoring the safety and parking location from android application.

1.5 Project Research Hypothesis

A research hypothesis is the statement created by researchers to improve the outcome of a research. Based on the research, the current propose motorcycle GPS tracking application has insufficient features. Some of the hypothesis has been suggested to improve the propose system. The figure 1.1 shows the problem of the current propose motorcycle GPS tracking application and the hypothesis to make an improvement.

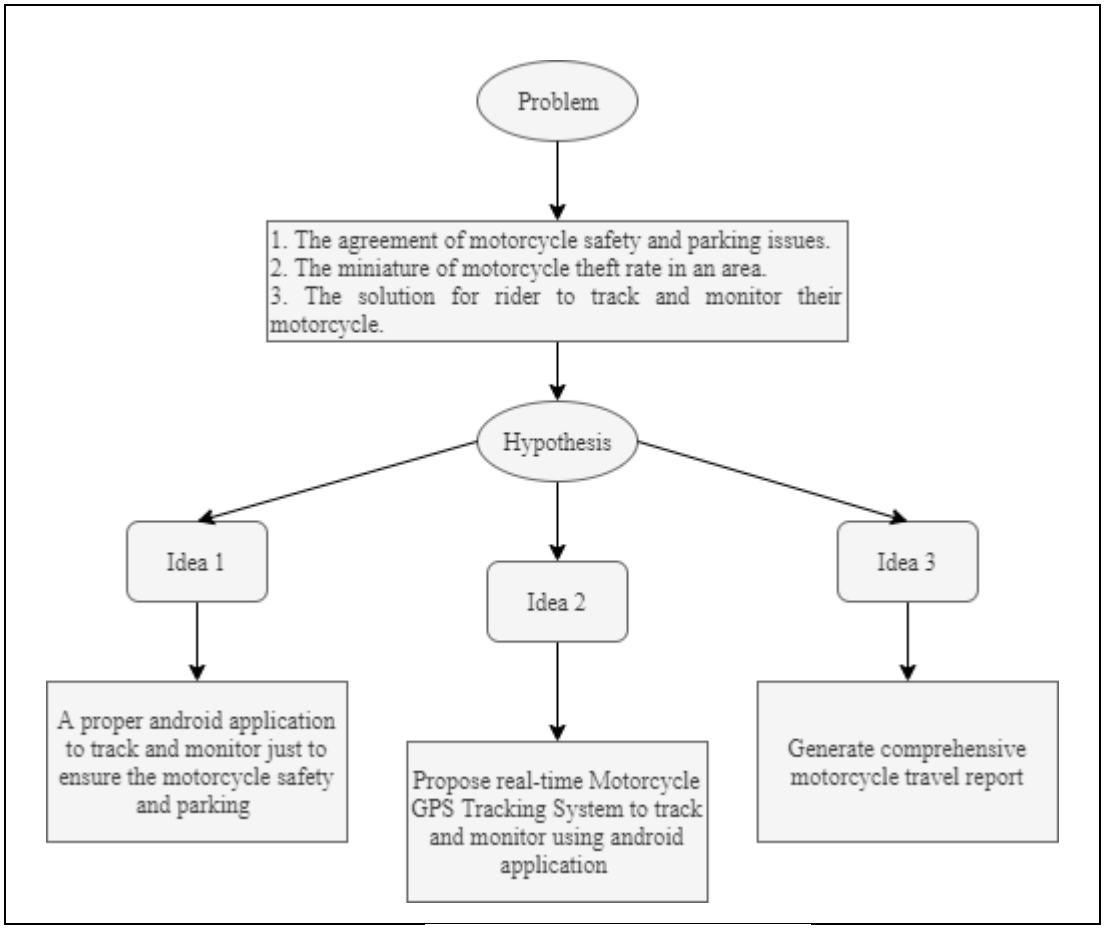

Figure 1.1: Project Research Hypothesis

1.6 Project Scope

A project scope is a certain work that is to be done in order to deliver final result (as a product, service) with specified features and functions. It also will give a view of the project. In this project, project scope will define the targeted user and some module of the Motorcycle GPS Tracking System.

1.6.1 Users

The target user of this project are the riders who want to track and monitor their motorcycle safety and parking issues to avoid from being stolen by motorcycle theft.

1.6.2 Modules/Functions

Module or function is part of a program in software. Programs consist of one or more independently developed modules that will not be combined until the program is connected. One or more function may be included in a single module.

i. **Responsive GUI**

This module consists of Motorcycle GPS Tracking System for android application, which GUI component for rider to interact with system.

ii. **Track and Monitor Module**

This module is to locate and monitor the rider motorcycle real-time current location based on map.

iii. **Travel Report Module**

This module generates data and view the motorcycle travel report.

1.7 Project Contribution

Project contribution defines the expected output from this project. This part can be referred to the objectives of this project. The project contribution can be referring to the table 1.3 in below.

Table 1.4: Project Contribution

PC	Project Contribution
PC1	A propose real-time GPS management system to track and monitor the rider motorcycle.
PC2	To generate comprehensive motorcycle travel report for rider.

1.8 Conclusion

In conclusion, this propose Motorcycle GPS Tracking System is to help user's motorcycle safety and parking issue using raspberry pi with GPS module and android application, produce travel report to view and track the motorcycle location to reduce theft rate and ease the user by tracking and monitoring the safety and parking location from anywhere with android application.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This propose project is to develop Motorcycle GPS Tracking System based on raspberry pi with GPS Module and android application. This project required some research and fact finding to support it and to study of the problem and solution for better understanding techniques will use. Therefore, literature review also plays an important role when a project is carried out.

In this chapter, facts and finding and literature review about relevant project and research about this system will be discussed. The purpose of literature review is to find relevant literature to support the project topic and conclude all the information that can be found in the literature.

The domain for this project is Global Positioning System technology (GPS). A GPS tracking system provides information on exact location. It uses the Global Navigation Satellite System (GNSS) network. This network incorporates a range of satellites that use microwave signals that transmitted to GPS devices to give location, vehicle speed, time and direction

2.2 Research Problem

A research problem is define about an area of concern. This consists of the concept and the theory for the area of concern.

2.2.1 Concept

Based on Sturza, Hills, & Black (1995), a GPS tracking system is “a low cost tracking system employing satellites of the global positioning system (GPS) is suitable for applications involving radiosondes, sonobuoys, and other objects. The tracking system includes a sensor mounted on each object which digitally samples the GPS satellite signals and records them in a data buffer. The digital samples are then transmitted, at a rate lower than that at which the GPS satellite signals were sampled, over a data telemetry link, interleaved with other telemetry data from the object. The GPS data is processed in a data processing workstation where the position and velocity of the sensor, at the time the data was sampled, is computed. The data buffer in the sensor is periodically refreshed, and the workstation periodically computes the new position and velocity of the sensor. Differential corrections are also provided at the workstation to aid in signal acquisition and to increase the precision of the position fix”.

2.2.2 Theory

According to Carl & Brook (1985),a vehicle tracking system for determining the vehicle's lateral position relative to the desired road track consist, in addition, scanning mechanism functionally attached to that vehicle for the optical scanning at a specified frequency of a transverse track to the expected travel direction of the vehicle at intervals spaced as the vehicle moves along the road, included in the scan path is an optically distinct feature that extends substantially parallel to the path that the vehicle intends to transverse. The scan mean s produces a signal that matches the scanned path reflection. The tracking system also includes methods to store the signals resulting from time-spaced scans including the signal portion that corresponds to the optically distinct function and methods sensitive to the stored signals to generate signals indicating the time difference of the signal portion resulting from successive scans to determine the lateral of the signal relative to the optically distinct characteristic of the vehicle displacement.

2.2.3 Previous Existing System

There are many types of Motorcycle GPS Tracking System being introduces in the market. The most common and famous are:

i. Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi (Shinde & Mane, 2015).
ii. Anti-Theft Vehicle Tracking and Immobilization System (Mukherjee, 2014).
iii. Vehicle Anti-theft Tracking System Based on Internet of Things (Liu, Zhang, & Li, 2013).
iv. UTeM Bus Tracking System using Google Map (Chen, 2016).

The theory of all type of the vehicle GPS tracking system will be the same with the propose project which is to track and monitor the vehicle owner to know where is the location of the vehicle but every type of vehicle GPS system consists of difference accessing method. In this Motorcycle GPS Tracking System, the research on GPS technology on GPS system will be carry out and compared with other types of Vehicle GPS Tracking System. Figure 2.1 shows the summary of Research Problem.

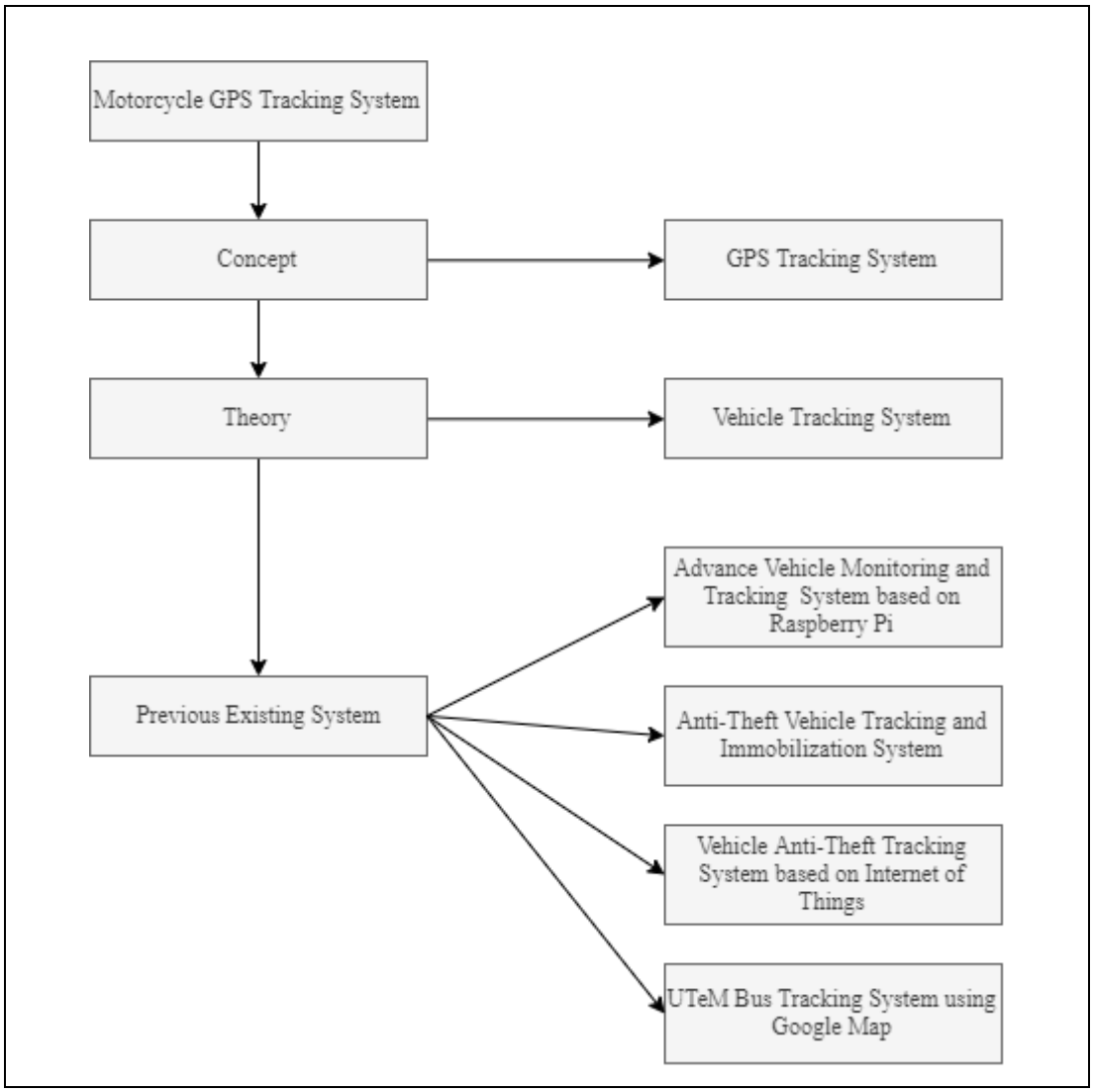

Figure 2.1: Summary of Research Problem

2.3 Research Question

The research question is the fundamental core of a research project, study or review of literature from the research question stated. In this part will be focused on the background of Global Positioning System (GPS), the background of Android Application and the integrated Development Environment (IDE).

2.3.1 Background of Global Positioning System (GPS)

According to Croca (2015), Tom Van Flandern defined the Global Positioning System (GPS) consists of a network of 24 satellites as shown in Figure 2.2. Each atomic bearing clock on board in orbits of approximately 12 hours. The orbital radius of the satellite is roughly 4 Earth radii (26,600 km). The orbits are almost circular, with less than 1% of the normal eccentricity. Orbital inclination against Earth's equator is normally 55 degrees.

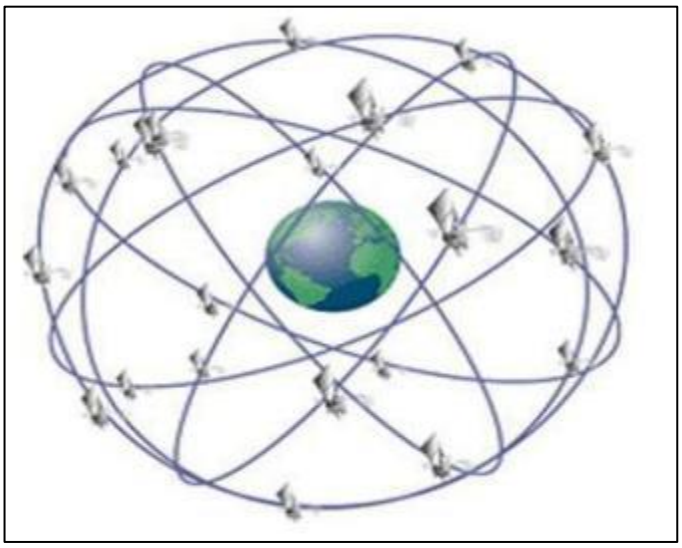

Figure 2.2: 24 GPS Satellite around the Earth

Nominally, the satellites occupy one of six equally spaced orbital flights. Four of them occupy every plane, revolving about 90-degree intervals around the Planet in that direction. The correct orbital intervals of the satellite are equivalent to 11 hours and 58 minutes, so that the ground tracks of the satellite are repeated day after day, as the Earth rotates every 23 hours and 56 minutes.

Atomic clocks on board are fine at approximately 1 nanosecond (ns) in epoch and at a frequency of approximately 1 ns / day. Since the speed of light is about one foot per nanosecond, the device can detect anything on Earth or in the vicinity of Earth with extraordinary accuracy. For example, if the satellite clocks are completely synchronized with ground atomic clocks and the time a satellite sends a signal, the time delay for that signal to reach a ground receiver immediately shows the distance by using four satellites to triangulate and quantify clock corrections, the position of a transmitter at an unknown location can be determined with equal precision. The Figure 2 shows satellite triangulate and calculate clock corrections.

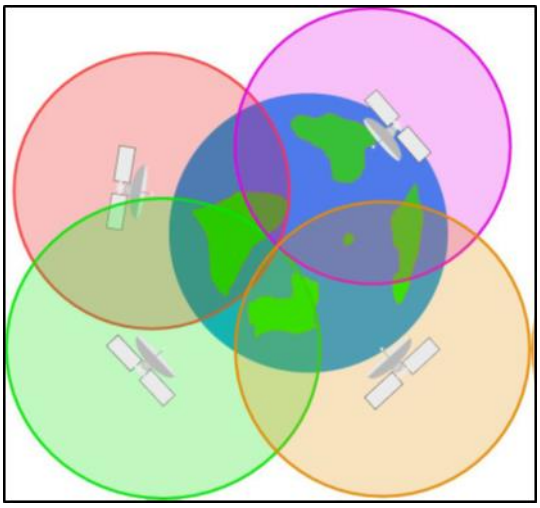

Figure 2.3: 4 Satellite Triangulate and Calculate Clock Corrections

2.3.2 Background of Android Application

According to J. Liu & Yu (2011), "Android is a comprehensive operating environment that based on Linux® V2.6 kernel, it is also a layered system, the architecture of Android system".

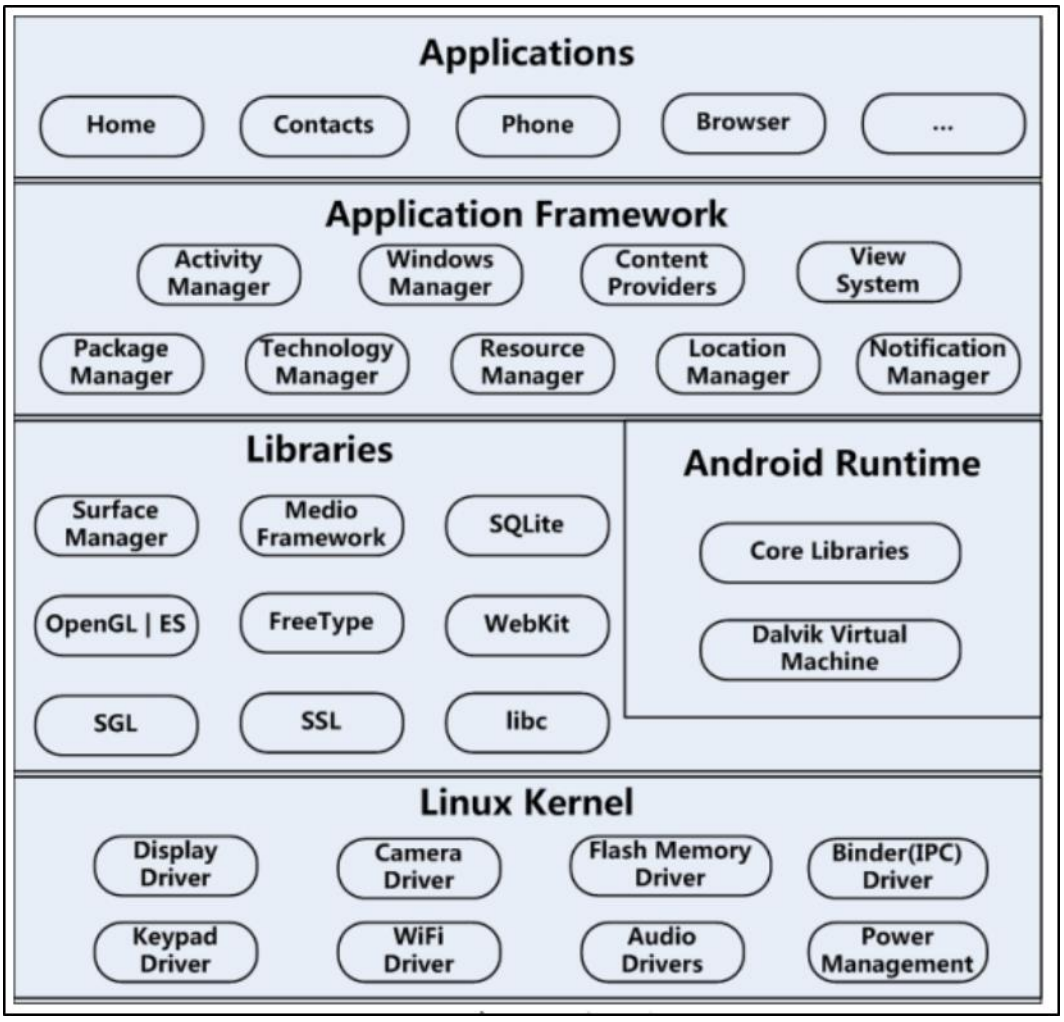

Figure 2.4: Architecture of Android System

Besides, J. Liu & Yu (2011) also mention there are four types of application components and each of them has their own purpose and lifecycle that define how it is started and end.

The first component is Activity, “activity represents a single screen with a user interface. The activities in an application work together to form a cohesive user experience, but each one is independent of the others. As such, a different application can start any one of these activities. An activity is implemented as a subclass of Activity. The particular form that an activity show users and the amount of activities in an application depend on how the developer design the application. In a multiple activities application, typically, one activity is specified as the "main" activity, which is presented to the user when launching the application for the first time. Each activity can then start another activity in order to perform different actions. Each time a new activity starts, the previous activity is stopped, but the system preserves the activity in a stack (the "back stack")”

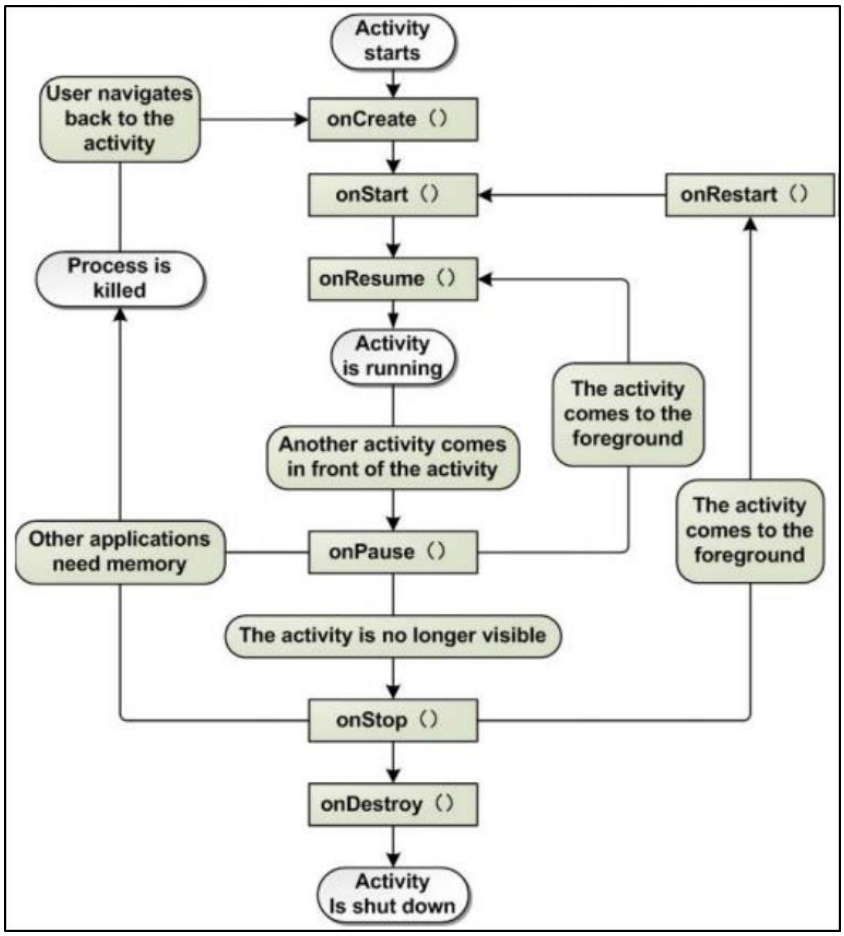

Figure 2.5: Lifecycle of an Activity

Second component is Service. “Service is an Android component that runs in the background to perform long-running operations or to perform work for remote processes and does not provide a user interface. An activity can connect or bind a service that is running. (if the service is not running, launch it). When connected to a service, the activity can communicate with the service through the interface that the service exposed. Like other application components, service components always running in the main thread of an application by default. So for the intensive or blocking operating a service performs (may slow down activity performance), it is usually start a new thread inside the service.”

Third component is content providers which “provide data share mechanism among applications. The data that be shared could in the file system, a SQLite database, or any other persistent storage location an application can access. A content provider is implemented as a subclass of Content provider, it defines the data format it supported and provides a set of method to enable other applications to query or modify the data. But an application does not call these methods immediately, instead, it call these methods by an object named Content Resolver.” “Content Resolver can communicate with every Content Provider. Content Resolver cooperated with Content Provider to manger IPC (inter process communication) while sharing data.”

The last component is “Broadcast Receivers is in charge of the reception of system wide broadcast and take response aiming at the information that a broadcast transmitted. Many broadcasts originate from the system—for example, a broadcast announcing that the screen has turned off, the battery is low. Applications can also initiate broadcasts. There could be any number of Broadcast Receivers in an application and each Broadcast Receiver implemented as a sub class of Broadcast Receiver. Although broadcast receivers don't display a user interface, they may create a status bar notification to alert the user when a broadcast event occurs. More commonly, though, a broadcast receiver is just a "gateway" to other components and is intended to do a very minimal amount of work.”

2.3.4 Integrated Development Environment (IDE)

IDE is needed to develop the android application. There are two very popular IDE which are Android Studio and Eclipse. Both of them have their own strength and weakness. Table 2.1 shows the comparison between AS and Eclipse.

Table 2.1: Android Studio vs Eclipse

Aspect	Android Studio	Eclipse
User Interface	Simple user interfaces because it is dedicated for android development.	Complex user interface because Eclipse compatible with multiple platforms and need to work on Android Development tools to create android application.
Gradle Structure	Gradle build system is more efficient and organized.	Apache Ant is robust XML based system.
Code Completion	The code implementation is more intelligent by using IntelliJ platform.	Might give wrong result.
Google Cloud Platform	Build in support.	Need to add plugin to Google plugin for Eclipse to support it.
App testing and debugging	Can set up test classes and include them in the run configuration projects. The program bugs can be detected and ironed out when it still in build storage.	Does not support.

In conclusion, based on the table 2.1 shown Android Studio is chosen as the IDE to develop an android application for this project. Android Studio is definitely a step ahead of Eclipse. Based on Wulansari, Mahawati & Hartini (2013) said "Android Studio is designed specifically for Android development and its main goal is to speed up the Android development process and make it easier and simpler". Thus, it has more advantages such as Android Studio uses the faster growing Gradle build system, the code implementation is really better and the user interface dedicated because Android Studio is built for an android.

2.4 Research Gap

Research gap is important for project to find the missing or insufficient of the information of the current system and to improve the system to make it more usable. In research gap will discuss the definition, importance of research gap, comparison of the existing system and critical review of current problem and justification.

2.4.1 Definition

A research gap defined as the project or system which missing or insufficient function or reach the ability limits as a conclusion for a question. Research need is defined as gap that limits the ability of decision-makers from making decisions. Research gap is the research for the missing element for the existing research literature and fill the research approach to improve the existing project.

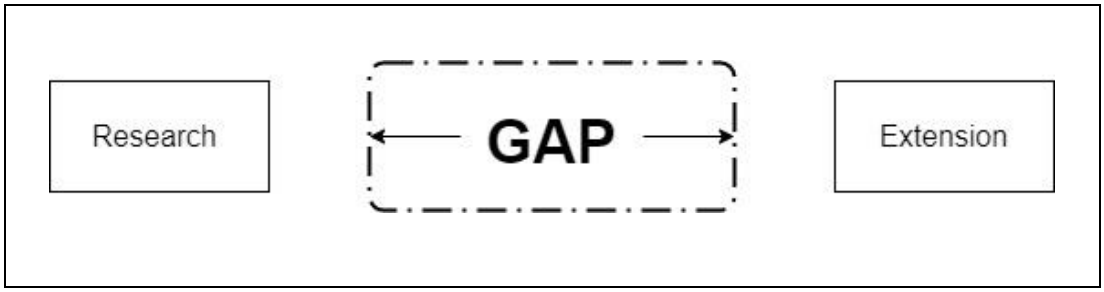

Figure 2.6: Plan of the System in Research Gap

Below shows the research gap for Motorcycle GPS Tracking System based on Internet of Things with android application. There are some extensions to focus to make the system function, usable and comprehensive.

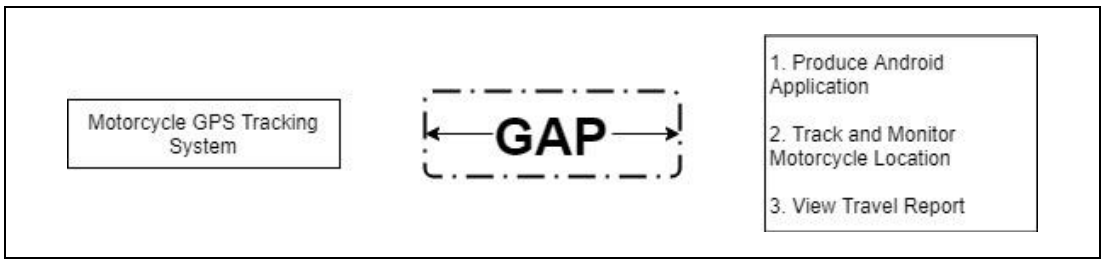

Figure 2.7: Research Gap for Motorcycle GPS Tracking System

2.4.2 Importance of Research Gap

The important of research gap is it explain the main issues, ideas, concept and frameworks identified in the literature review. Below show the importance of identifying gaps in research.

i. Refining the understanding about the research topic.
ii. Identifying the objectives of the future research.
iii. Improvement for the future research scope.

2.4.3 Comparison of Existing System

There are some type of most common vehicle GPS tracking system in the market. Some research has been carry out for these 3 type of vehicle GPS system. First of the research is Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi (Shinde & Mane, 2015), second is Anti-Theft Vehicle Tracking and Immobilization System (Mukherjee, 2014) and the third is Vehicle Anti-theft Tracking System Based on Internet of Things (Liu, Zhang, & Li, 2013) and the last one is UTeM Bus Tracking System Using Google Map (Chen, 2017).

Based on Shinde & Mane (2015), in their research on "Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi". This research mainly about of method that using raspberry pi for vehicle GPS tracking system. The system would get control with the help of Raspberry pi which placed inside the vehicle. The GPS, GPRS, GSM, SIM908 module would get communicate to raspberry pi board with USB interface. It provides a real-time monitoring in the webpage. The longitudes and latitudes of the current path received from GPS of GPS GPRS GSM SIM908 module get compared with the stored longitudes and latitudes in the particular file format inside the database of raspberry pi. If that longitudes and latitudes not match with the stored one then wrong path detection alert massage will get sent to vehicle's owner mobile.

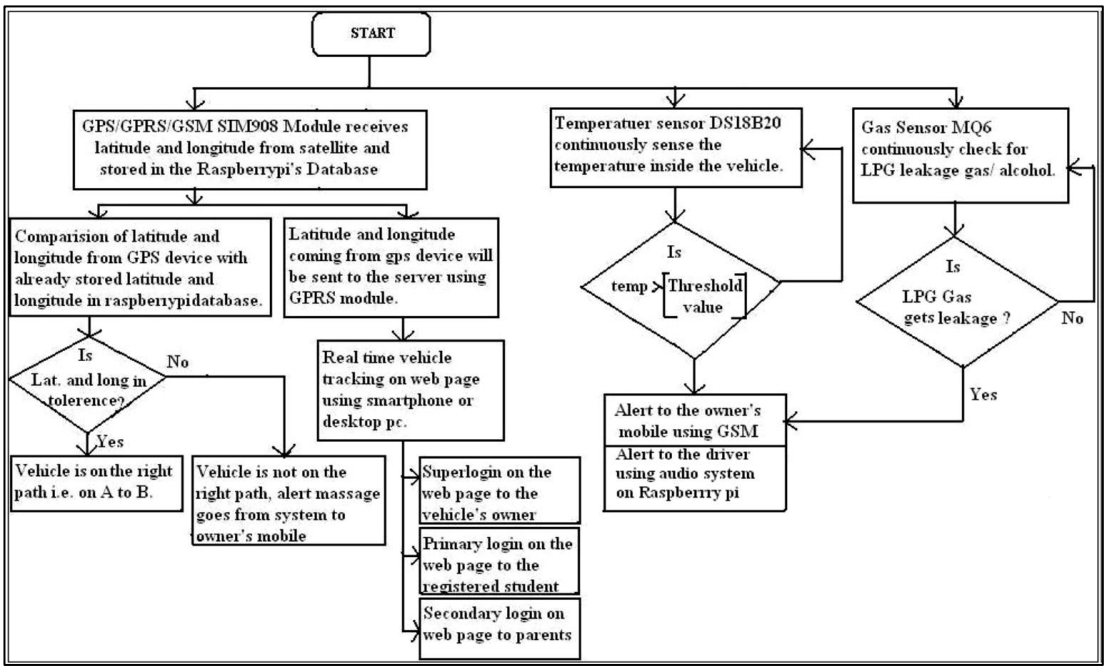

Figure 2.8: Flowchart of Advanced Vehicle Monitoring and Tracking System Based on Raspberry Pi

Based on Mukherjee (2014) in his research on “Anti-Theft Vehicle Tracking and Immobilization System”. The research is about on vehicle GPS tracking system using Immobilization System. The most important function is to provide a user friendly and efficient tracking system of the vehicle to the owner through a simple text message from his mobile phone. Whenever the owner deems it necessary, he may send a text message from his phone to a GSM modem in the car and within seconds the modem will reply with a text message that includes the current of the vehicle. The tracking system in the car includes a GSM modem and a GPS module interfaced with an Arduino microcontroller. If the Arduino receives the 'TRACK' message from the user through the GSM modem it uses the GPS module to track the current location and sends the coordinates to the user through the GSM modem via another text message. The second function lets the owner immobilize the vehicle remotely through text messages in case he suspects a vehicle theft.

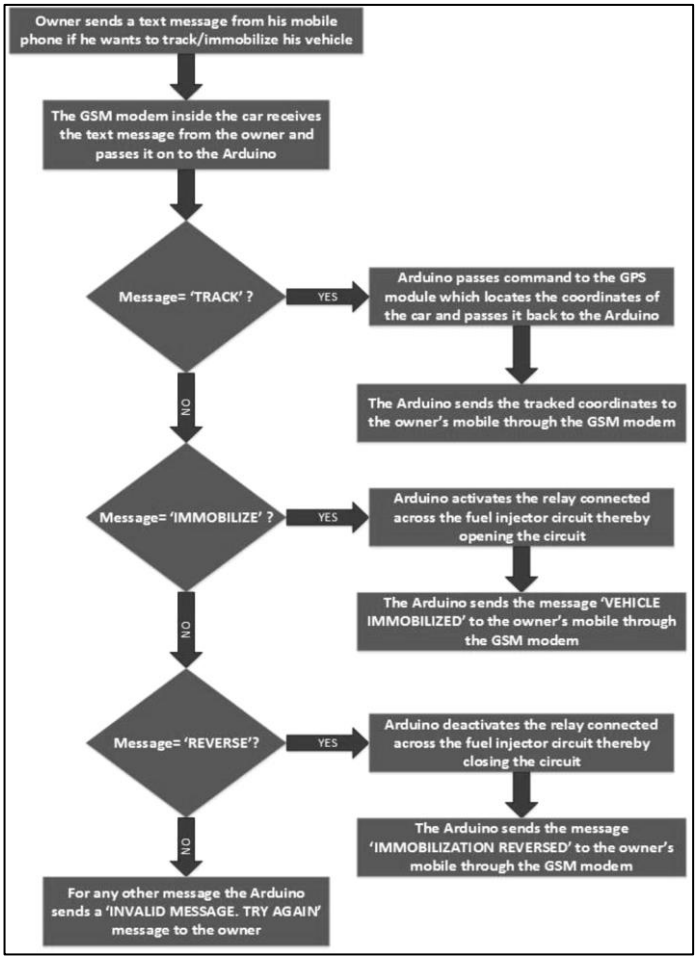

Figure 2.9: Flowchart of Anti-Theft Vehicle Tracking and Immobilization System

Based on Liu, Zhang, & Li (2013), in their research on "Vehicle Anti-theft Tracking System Based on Internet of Things". The research is about on vehicle GPS tracking system using Internet of Things. The device switch is controlled by RFID module. An active RFID tag is attached to the car key and the reader is fixed inside the car. The device not work when the owner stays in the car, and starts working when the owner leaves the car. Pyroelectric infrared sensors installed. GSM module will send information collected by the GPS module via SMS to the owner's mobile phone every 10 seconds. Owner can communicate with the GSM module on the car via Android software. Android software can send short message to GSM module, then GSM reports the information to master control module, which is able to forcibly lock and unlock the car.

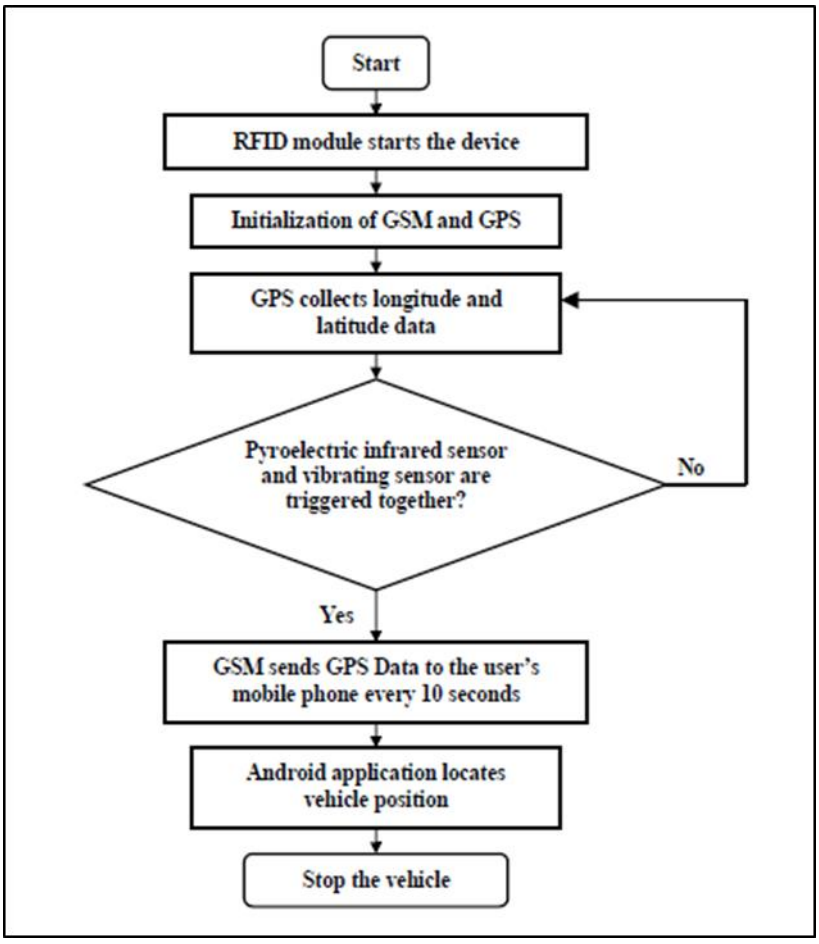

Figure 2.10: Flowchart of Vehicle Anti-Theft Tracking System Based on Internet of Things (IoT)

Based on Chen (2016), in his research on “UTeM Bus Tracking System Using Google Map” this research is about on UTeM bus tracking using the google map. This system provides a bus tracking system for UTeM student to help them to locate the location of the UTeM bus. The bus driver need to use android application to get the GPS position of the bus and sent data to the database server in the internet. The application will request the location of the bus when the student use the android application to track it. Both users needed the application on android phone. For bus driver it needed for request the GPS location. Meanwhile, the student need the application to request the bus location and after request it will display in Google Map. Besides the application will calculate the bus ETA to let the student know when the bus will arrive. Thus when the bus is almost reached it will alert

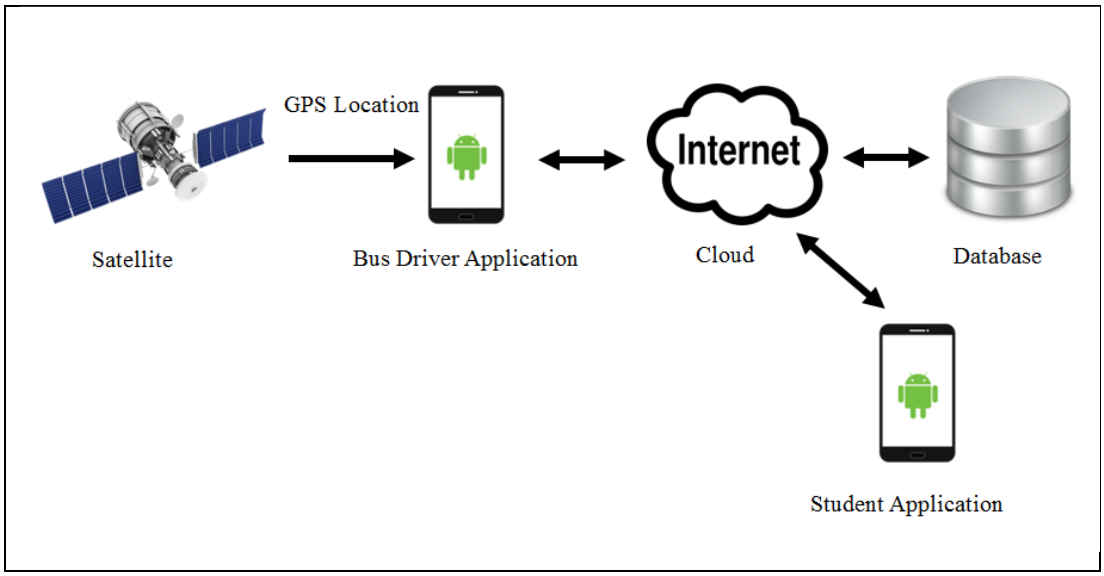

Figure 2.11: Data Flow of the UTeM Bus Tracking System

2.4.4 Critical Review of Current Problem and Justification

From the related work that being study, there are many types of development and methods being used. As a conclusion for the different of the gate system, a summary has been done as shown in table 2.2.

There are four type of different system which is Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi (Shinde & Mane, 2015), second is Anti-Theft Vehicle Tracking and Immobilization System (Mukherjee, 2014), third is Vehicle Anti-theft Tracking System Based on Internet (Liu, Zhang, & Li, 2013) and the last one is UTeM Bus Tracking System Using Google Map (Chen, 2016).

Each of them have their own feature. For example the Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi (Shinde & Mane, 2015), provides safety and secure solution to the traveller using sensors when the vehicle theft situation or vehicle's accident situation occurs, the proposed system provides the vehicle's current location, speed to the vehicle owner's mobile. Hence this benefits to track the vehicle as early as possible.

Anti-Theft Vehicle Tracking and Immobilization System (Mukherjee, 2014), has immobilization function is used effectively, it basically removes the threat of theft by adding an extra layer of security. In case of theft, the tracking function provides a great resource in tracking the stolen vehicle. If used in tandem with the immobilization function and a quick police force, the chances of vehicle recovery are extremely high.

Third, Vehicle Anti-theft Tracking System Based on Internet of Things (Liu, Zhang, & Li, 2013), contains communication platform with remote monitoring function. The owner can simply use mobile phone to locate and monitor the car in real time, which provides the technical foundation for the development of wireless network vehicle anti-theft system.

Lastly, UTeM Bus Tracking System Using Google Map (Chen, 2016), a system that can keep track of bus location. An online database is needed in the web hosting site to allow the bus driver send the GPS location to it. The student can use the system to track the bus location through accessing the data in the database.

Table 2.2: Comparison between Existing Systems

Aspect	**Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi**	**Anti-Theft Vehicle Tracking and Immobilization System**	**Vehicle Anti-Theft System Based on Internet of Things (IoT)**	**UTeM Bus Tracking System Using Google Map**
Microcontroller	Raspberry Pi	Arduino	RFID	-
Technology Category	▪ GPS ▪ GPRS ▪ GSM SIM908 Module ▪ LPG Gas leakage sensor ▪ Temperature sensor ▪ Temperature sensor DS18B20	▪ GSM Modem ▪ GSM Module ▪ Immobilization Circuitry	▪ GPS ▪ GSM ▪ WAP ▪ Data traffic and SMS costs	▪ Android Studio
Type of tracking	Website	SMS	SMS	Android Application
Real-time monitoring	Yes	No	No	Yes
Tracking Information	▪ Longitude ▪ Latitude ▪ Speed ▪ Time	▪ Longitude ▪ Latitude	▪ Longitude ▪ Latitude	▪ Longitude ▪ Latitude
Alert	Yes	No	Yes	Yes

2.5 Propose Solution

By study the fact finding of the existing systems, the solution of the propose project system is found. The Motorcycle GPS Tracking System is suggested to be implement for the problem persists from the user. Based on Advanced Vehicle Monitoring and Tracking System based on Raspberry Pi (Shinde & Mane, 2015), the propose project system is going to be use some of the design stated before. As for the hardware, this propose project system use the Raspberry Pi as the microcontroller and the GPS module as the technology that needs to implement with the Raspberry Pi that need to be putted in the seat of the rider motorcycle. The hardware cost use average than before which makes the propose project cost is cheaper because it is in under development. The hardware will provide GPS coordinates. Apart of that, the type of tracking in Motorcycle GPS Tracking use an android application which will be develop in android software (Android Studio). This android application will be develop for GPS coordinates from the hardware transverse to the desired smartphone where the GPS coordinates are mapped on a google map. Instead of using website in real-time monitoring, this propose project will help user to track and monitor the location of motorcycle using android application in smartphone at anywhere and anytime by GPS data that has been transverse in it . Thus, the hardware contains GPS that stores the motorcycle travel data where user can check the current motorcycle travel in android application software.

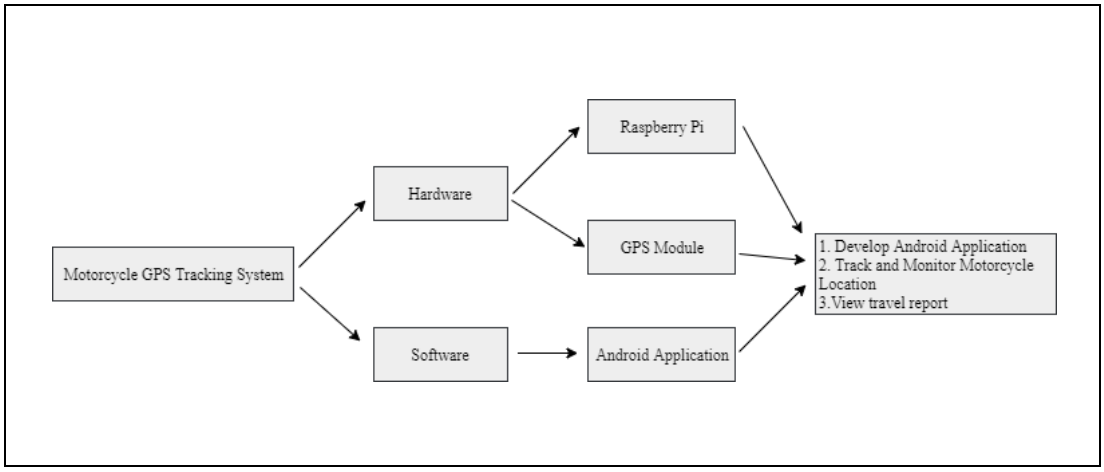

Figure 2.12: Propose Solution of Motorcycle GPS Tracking System

2.6 Conclusion

In conclusion, literature review is a necessary chapter and very important part to develop a project concept. It helps to understand the existing features of the system and to get a clear information to implement the system. The research and study will make the progression on doing this project smoother and more understanding.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter will be discuss about the methodology approach that is going to be used in completing this project successfully. Methodology relates to the theoretical, systematic assessment of the techniques applied to the field of research study. There are many types of methodology applied to different types of development which includes System Development Life Cycle, Agile, Rapid Application Development (RAD), Waterfall, and Object-Oriented Methodology. Software development methodology have different scope and the advantages. This project will use RAD methodologies. According to James Martin (1991), “Rapid Application Development (RAD) is a development lifecycle designed to give much faster development and higher-quality results than those achieved with the traditional lifecycle.” RAD is a software development methodology are suitable for this project and uses minimal planning in favour of rapid planning.

3.2 Methodology

In this project, Rapid Application Development (RAD) model will be implemented. This methodology is the most suitable as it designs to produce a high-quality output in a shortest time compare to traditional lifecycle software development. Besides that, the RAD methodology can provide some output of the product in very short time and getting feedback from end users regarding their requirements.

RAD is a four-phase software development that combines the elements of Standard System Development Life Cycle (traditional SDLC). The four-phase are requirement planning, user design, construction, testing and cutover. The figure below shows the process of RAD.

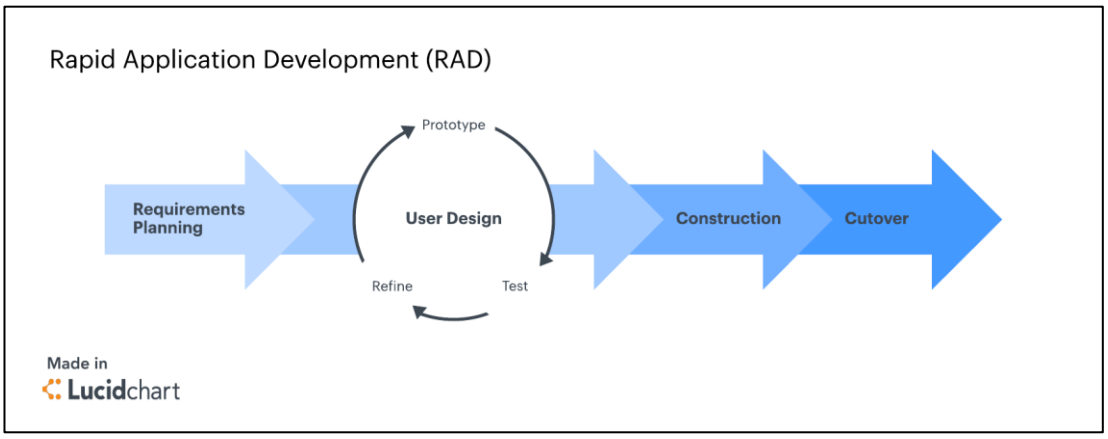

Figure 3.1: RAD Process

3.3 Research Process

Research process is about the step-by-step development of the project. There are four-phase according to RAD methodology which are requirement planning, user design, construction and cutover. Each phase has its own important characteristics to carry out the project. The flow of research process can be referred to the figure below.

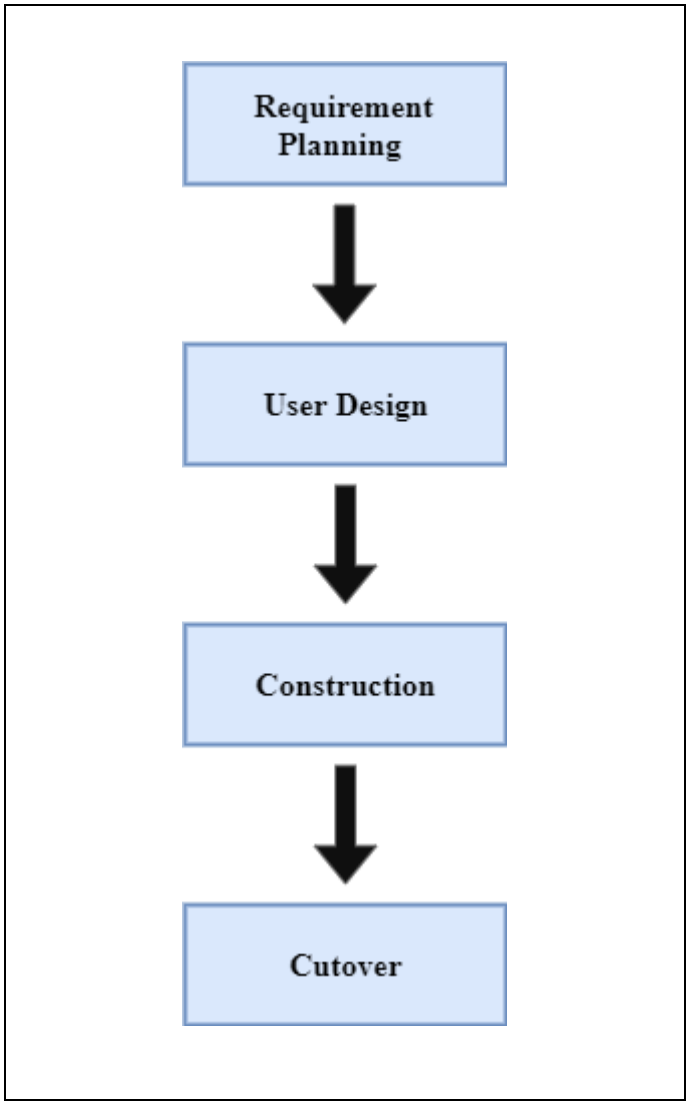

Figure 3.2: Flow of Research Process

3.3.1 Requirement Planning

Requirement planning phase is to make the Motorcycle GPS Tracking System scope meets the requirement. All possible requirement of the system to be developed are implemented in this phase. This phase is summarized compared to other previous project methodologies, this is a critical step for the decisive success.

Based on the research previous existing system on chapter 2, the result shows that the current vehicle tracking system in the market are not satisfying with the project objective requirement. For this reason, in this phase, it will analyse the appropriate requirement required by the user. First, the objective is to make the user an android application to track and monitor the motorcycle that connects with a GPS tracker device. Instead of android application, the GPS tracking method should be in live and real-time display. Besides, the travel report must be generate for the motorcycle. However, all of the previous existing system do not meet the objective requirement.

In that case, there are some solution to develop the GPS tracker device and android application for the user to track and monitor motorcycle location to ensure its safety and where last place it has been parked. The Motorcycle GPS Tracking System will be develop as for user comfort of high rate motorcycle theft.

3.3.2 User Design

User design phase is an analysis and design development once the requirement planning has been scoped out. This phase describe how the design of the project flow. This will shows the system architecture design and system flowchart design of Motorcycle GPS Tracking System.

a. System Architecture Design

The design is conceptualized of how the flow of the project. An interface will be created by using Android Studio to develop Motorcycle GPS Tracking System android application. The application control the Raspberry Pi with GPS module to get the GPS location. The Raspberry Pi with GPS module need an internet connection to receive and send the GPS location data to it through the database server. Then, GPS location data can be retrieve from android application when the rider uses the android application to request the motorcycle location.

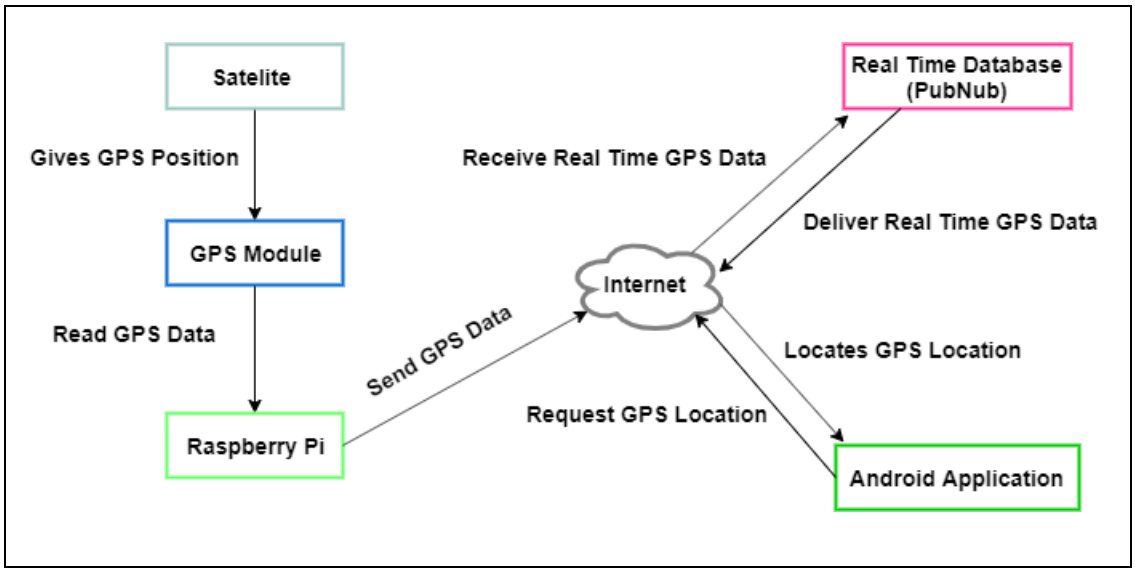

Figure 3.3: System Architecture Design

b. System Flowchart Design

System flowchart design represents a workflow or process of the Motorcycle GPS Tracking System. It shows the input, output, data process and decision in the flowchart design.

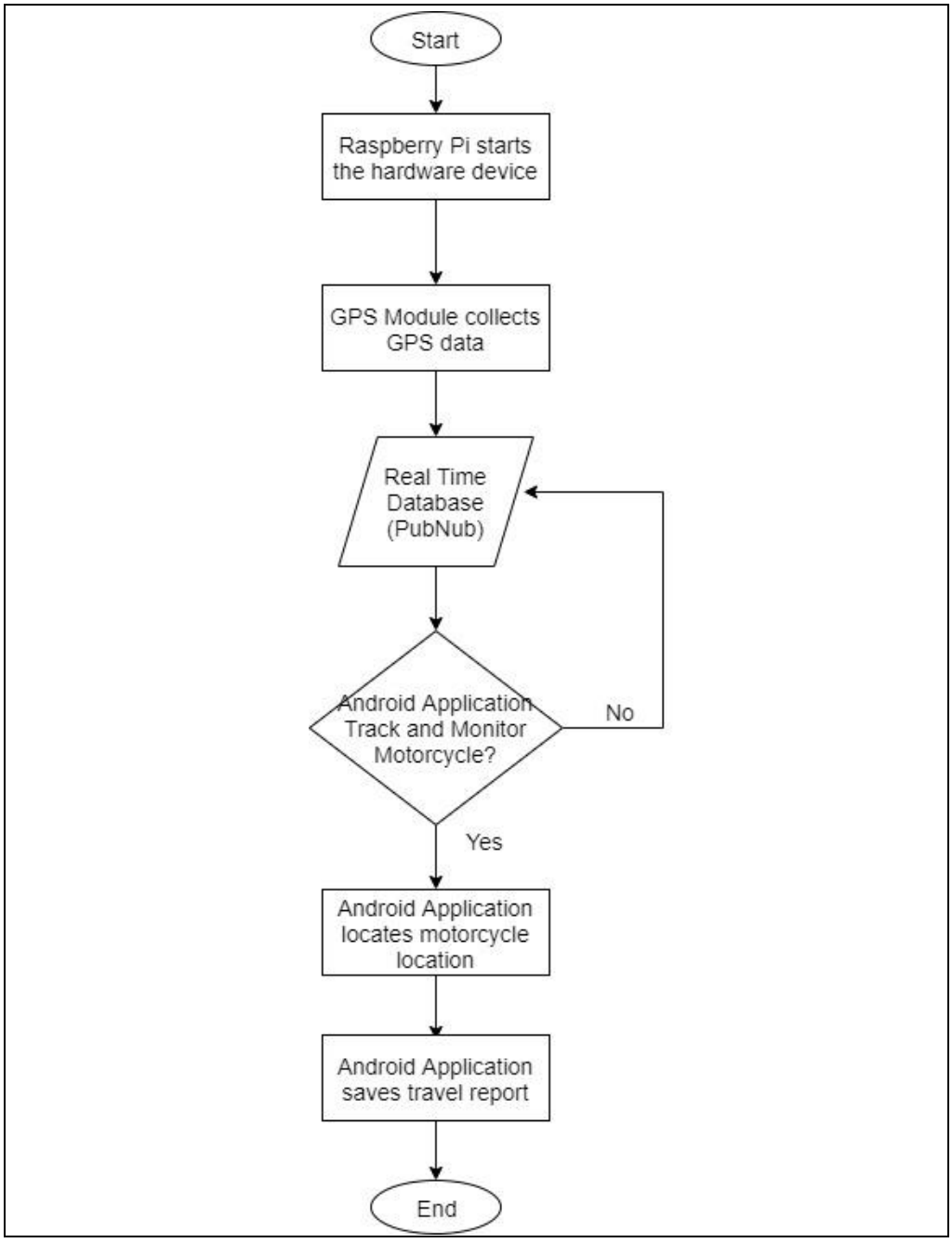

Figure 3.4: System Flowchart Design

3.3.3 Construction

Construction phase takes the prototype and software system from the design phase. There are 2 stages involved in the implementation such as hardware connection and software application. The details of implementation will be further discussed on it.

a. Hardware Connection

The raspberry pi will be plug in to the laptop by using ethernet port. The raspberry pi need the raspbian OS to be program to have a connection with the Neo 6M GPS module and write the code for Neo 6M GPS module to get the GPS data. After all has been set, this hardware will be a GPS tracker device which can give the real-time GPS data and send the GPS data to the PubNub real-time database.

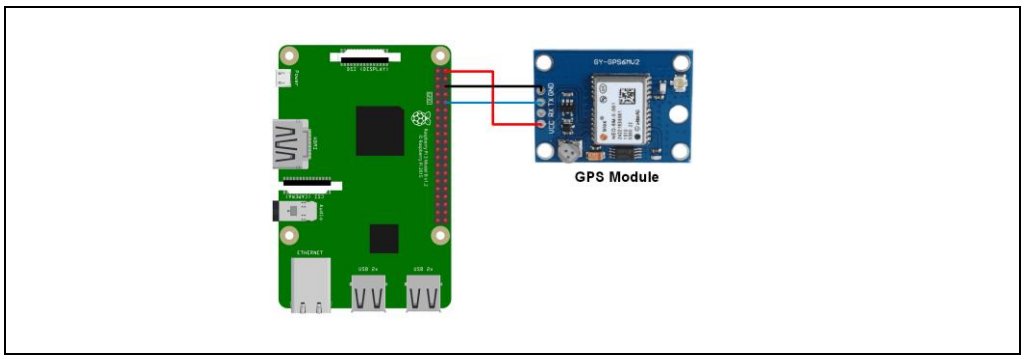

Figure 3.5: Hardware Connection

The figure above shows the connection of hardware in this project. The Neo 6M GPS module is attached to raspberry pi at pin 5v, pin GND, and pin RX (gpio 15). For the Neo 6M GPS module pin is pin VCC for pin 5v, pin GND for pin GND, and last one pin TX for pin RX (gpio 15) by using the male to male jumper wire. The VCC of Neo need 6M to be connected with 5v of raspberry pi, GND of Neo 6M with GND of raspberry pi and TX of Neo 6M with RX of raspberry pi so that the GPS module can send data to raspberry pi through the serial connection.

b. Software Application

Android Studio is the IDE for design and develop the android application that created using Java language for a user to track and monitor the motorcycle location as well as can view the history of travel report.

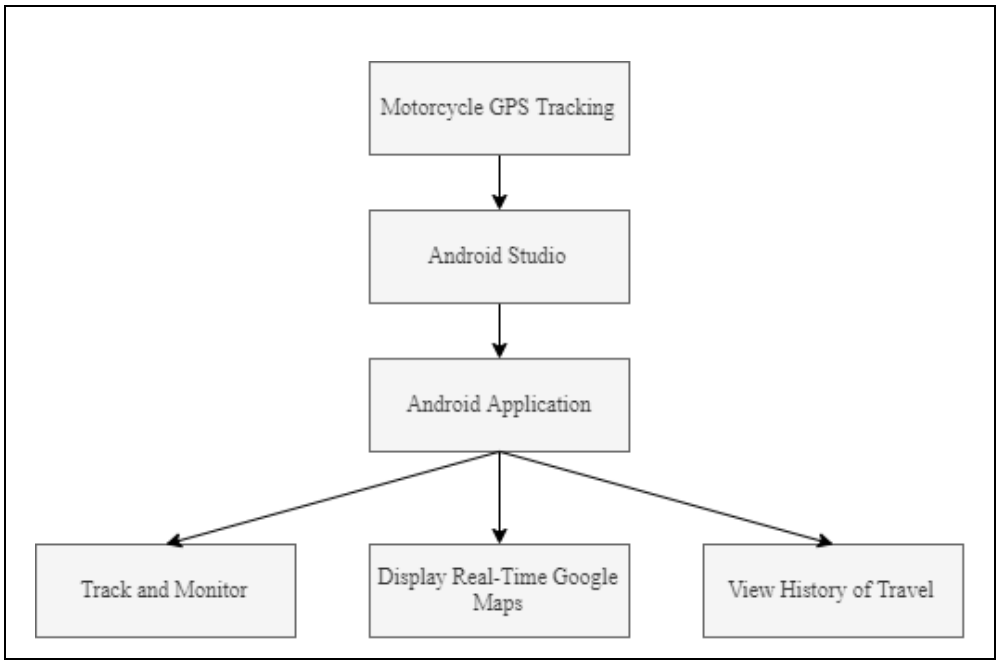

Figure 3.6: Motorcycle GPS Tracking Software Application

Figure 3.6 shows the Motorcycle GPS Tracking System software application. The real-time GPS data read from the hardware device will be send to the PubNub real-time database. The tracking method of geolocation tracking is using the Google Map API. This android application allows the user to track and monitor motorcycle location which it will retrieve the GPS location from the hardware device thru the PubNub real-time database. The map displays in real-time live. Thus, it also can make the rider to view the history of the travel report where the motorcycle had been travelled.

3.3.4 Cutover

Cutover phase is the operation phase where the finished product goes to launch. It is the testing phase which is a process of execute the system application and make sure if it is running as well as expected. Every testing process has to follow the correct procedure and the result will be fill up in a testing form. In order to carry out the testing process for Motorcycle GPS Tracking System, there are 2 stage will be focus on which is hardware testing and software application testing.

a. Hardware Testing

Hardware testing include the raspbian operating system (OS), raspberry pi and GPS module. The testing is to make sure if the hardware device can be run as a GPS tracker device. The raspbian OS is needed to program the code inside the raspberry pi and GPS module while the raspberry pi and GPS module must be attach to each other before it need to program as a GPS device tracker.

b. Software Application Testing

Software application testing include the android application software and PubNub real-time database. This testing is needed to test for the android application to have a connection with the GPS tracker device that will send the GPS location thru the PubNub real-time database. Every created function of the system will be tested and make sure it can run correctly. The database also will be tested to verify all information is successfully stored inside the database.

3.4 Theory Structure

Theory structure will explain from the big picture of the project to the specific scope that suggested to focus on. Every part will be explain in briefly to give a basic idea of the project. Figure 3 below shows the summary of theory structure for this project.

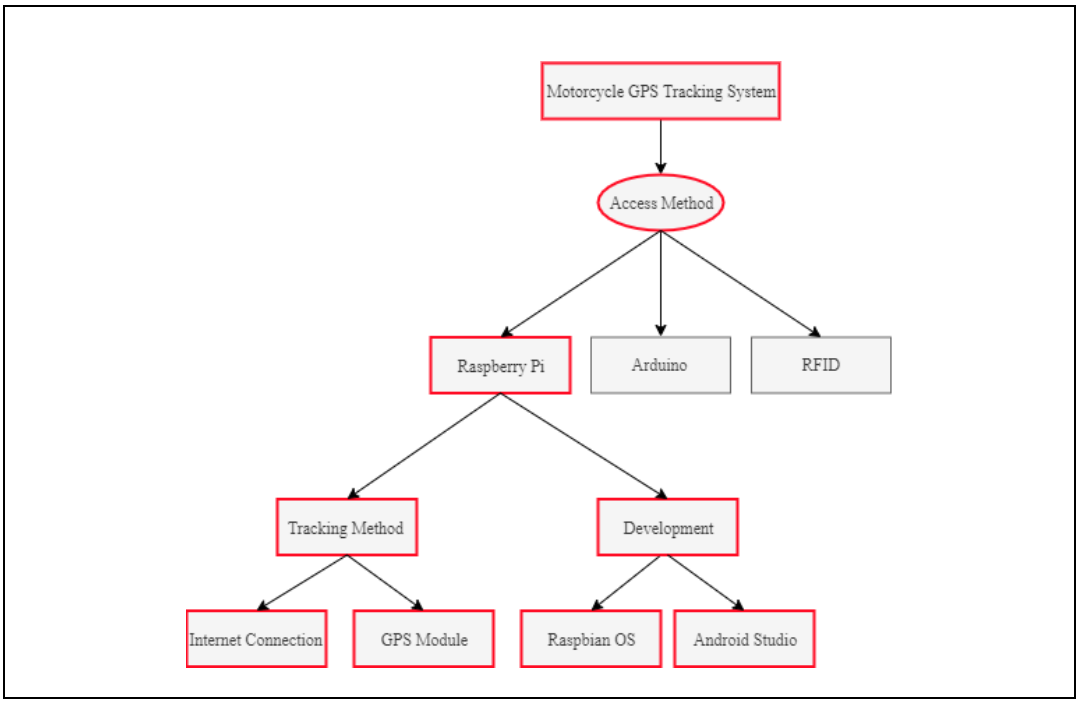

Figure 3.7: Summary of Theory Structure

3.4.1 Motorcycle GPS Tracking System

The Motorcycle GPS Tracking System is designed to determine and manage the motorcycle location by based on raspberry pi with GPS Module and android application. This project system is to track and locate the location of motorcycle's user safety and parking from any location. The system contains two part which is hardware and software. The hardware combine the Global Positioning System (GPS) for the uses of motorcycle move along the road to collect the data. It will install and carry inside the motorcycle to achieve the comprehensive data. Next, the software will be develop in android based application (Android Studio) to gain by rider. The data collects in the hardware will be transverse in android application for the rider to determine the position of motorcycle to track and monitor as well as view the current motorcycle where it has been travelled. This project system is to test and mainly focus on the propose rider which is afraid of high risk theft issues to park their motorcycle at anywhere without know the motorcycle safety.

3.4.2 Tracking Method

Tracking method is the way to retrieve the location of the motorcycle. There are two commonly used methods which are GPS Module and GMS Module. GPS module provides GPS coordinates to desired android smartphone where these coordinates are mapped on a google map with the help of an android based application. GMS Module is a specification of wireless network infrastructure which the object's position is determined using signal strength and triangulation from base stations. The hardware contains GPS that needs GMS as an internet to achieve and stores the GPS motorcycle travel data to the PubNub real-time database which rider can track and monitor the real-time location of motorcycle in android application software by request the location and the PubNub will deliver the GPS data.

3.3.4 Show Map

Show Map is the method to show the position of motorcycle location in the map using the Google Map API.

3.5 Research Technique

To develop the Motorcycle GPS Tracking System, the Raspberry Pi with GPS module has being chosen as the technique to create the GPS tracker system to transmit the location of the motorcycle to android application. Next, android studio also need in order to create the android application. Android Studio is the official integrated development environment (IDE) for the Android platform. In android studio, GPS data is used to retrieve the motorcycle location from the hardware. Moreover, Google Map API is used to implement the Google Map feature into android application.

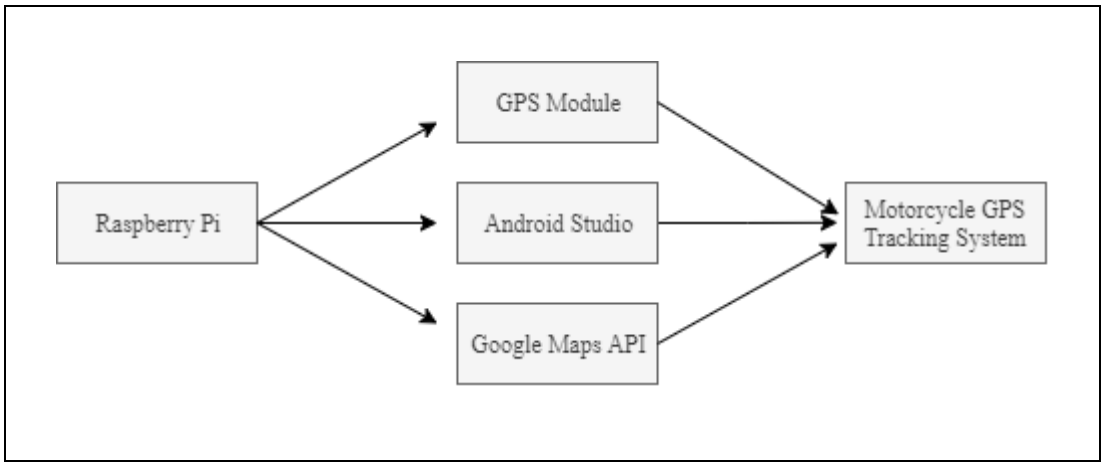

Figure 3.8: Research Technique

3.6 Research Framework

In order to carry out this project, a framework is design to have a big picture about the project. First, identify the problem. In this project, the main problem is with the issues of rider's motorcycle safety and parking. After the problem is identified, research is done to analysis the solution of overcome the problem. Next, study is conducted to gain the knowledge about the theory in this project such as what is GPS, android application and IDE to create android application, what is technique of previous existing system and the propose solution to develop this project. This knowledge is important as theory is needed to implement the method in the project. The strategies in this project are including the RAD methodology, Raspberry Pi with GPS Module, android studio and Google Map API. These strategies are chosen in order to develop the Motorcycle GPS Tracking System.

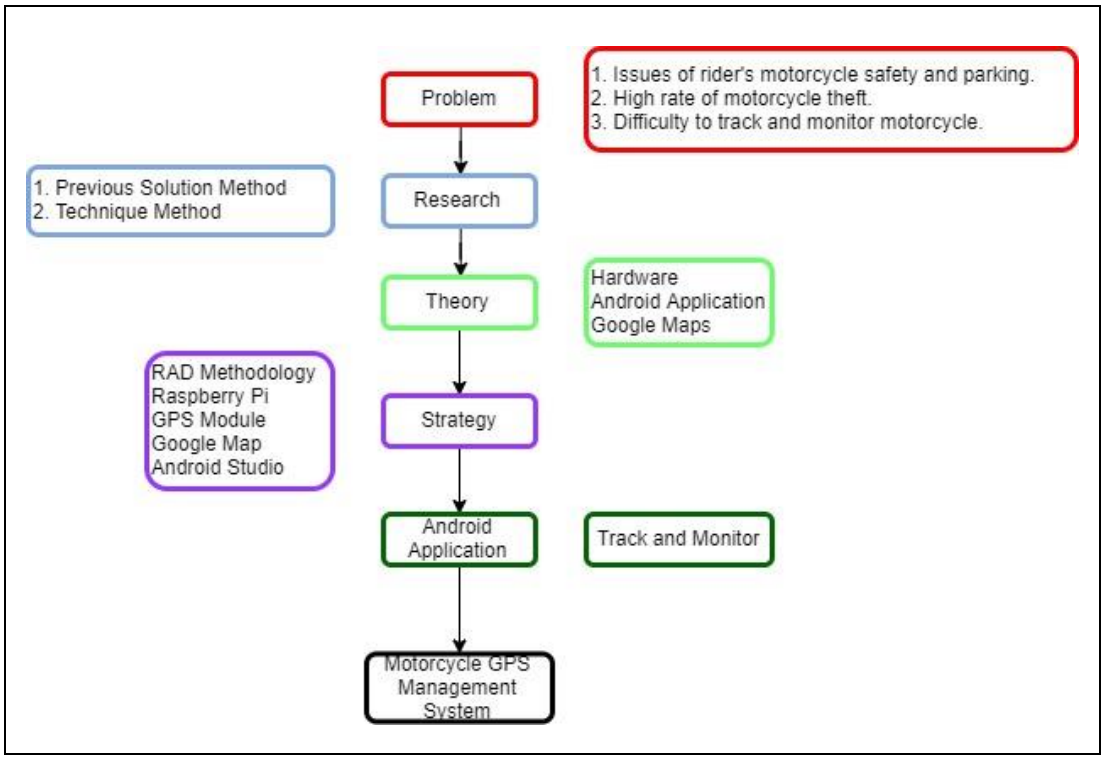

Figure 3.9: Project Framework

3.7 Research Requirement

Research requirement is needed to carry out this project. Some of hardware and software requirement have to fulfil to ensure the progression of the project can run smoothly. Below shows the details of the hardware and software requirement.

a. Hardware Requirement

The hardware requirements need in the project are:

i. Raspberry pi 3B

Raspberry pi acts as a microcontroller to start as a GPS device.

ii. Neo 6M GPS module

A GPS module is a technology device that need to configure in Raspbian Operating System in raspberry pi to read and get the GPS data.

iii. Laptop

A laptop with at least 4GB RAM recommended for configure the code in raspberry pi with GPS module and Android Studio to ensure the development process run smoothly.

iv. Android Smartphone

An android smartphone with minimum android SDK version of 10 needed to use for Google Map API.

b. Software Requirement

The software requirement need in this project.

i. Raspbian Operating System

An operating system for raspberry pi to program Motorcycle GPS Tracking System code.

ii. PubNub Real-Time Database

PubNub is a programmable network develops real-time applications; an evolution from three-tier which are architecture, purpose-built to handle all the complexities of data streams.

iii. Android Studio

Android Studio is the IDE for design and develop the android application.

iv. Android SDK

Android SDK to provide the API libraries and necessary developer tool for android studio.

3.8 Project Milestone

Project milestone is a reference point that will be used to monitor the project's progress and marks the major activity in a project. In order to make sure the flow of this project runs smoothly, the project milestone will be crated and well planned to ensure all the activities in the project are able to complete within the project timeline. Gantt chart will track the time of every progression of the chapter to ensure that all tasks can be completed on the given time. Table 3.1 below shows the summary of the Gantt chart table.

Table 3.1: Summary of Gantt chart Table

Week	Phase	Action	Deliverable
1-4 (PSM 1)	Planning	Identify title, problem statement and scope.	
		Study and research the literature review. Write and submit project proposal to supervisor.	
		Proposal accepted.	
		Identify title, problem statement, objective and scope of project.	Chapter 1: Introduction
		Chapter 1 is done and submitted to supervisor for evaluation.	Progress report Chapter 1
5-9 (PSM 1)	Analysis	Studies on related work and previous research and critical review of the project.	Chapter 2: Literature Review
		Study methodology on previous research.	Chapter 3: Methodology
		Information collection and analysis.	Chapter 4: Analysis and Design

10-13 (PSM 1)	Design	Design the network and choose the tools for implement.	Chapter 4: Analysis and Design
		Design the environment for implementation.	Progress report on Chapter 4
		Project Demonstration	
14-15 (PSM 1)		PSM I: Final Presentation	
		Chapter 5: Implementation	
		Chapter 6: Testing	
		Chapter 7: Conclusion	Chapter 7: Conclusion
		PSM II: Final Demonstration (Product & Report)	PSM II: Final Demonstration (Product & Report)

3.9 Conclusion

In conclusion, this chapter have explained the methodology that will be use in this project. The Rapid Application Development (RAD) methodology consists of different phase that will help to develop the system faster and efficient. The milestones set the time to finish the project so that the progression of the project will always in track. This is very important to make sure the project can finish in time.

CHAPTER 4: ANALYSIS AND DESIGN

4.1 Introduction

Analysis and design is the next phase in the Rapid Application Development and it follows on from the Analysis phase. It is define how the project is going to be carried out. The design phase is about planning the project in details so that the system meet the requirements. The requirements include the hardware and software needed on this project. The block diagram architecture and proper analysis in detail for this project is stated to ensure the project can be completed and well designed.

In this chapter, it will define the results of the system analysis of the preliminary design and the result of the detailed design. Interface design including input design, output design and database design will be explained in this chapter to facilitate the process of the overall system is understandable. Each design will be described in details to make it clear and easy to understand. This chapter describes the system more clearly.

4.2 Problem Analysis

For this Motorcycle GPS Management System project, the main problem is with the issues of user motorcycle safety and parking. Therefore, this project will be implemented for an application development that will create based on Raspberry Pi with GPS module and Android Studio to ease the user to track the motorcycle location. Besides, this project also implements real time live map location in the android application to user monitor the motorcycle.

4.3 Requirement Analysis

Requirement Analysis is the process of determining user requirement or expectation for a system. In requirement analysis will be discuss about the data requirement and functional requirement.

4.3.1 Data Requirement

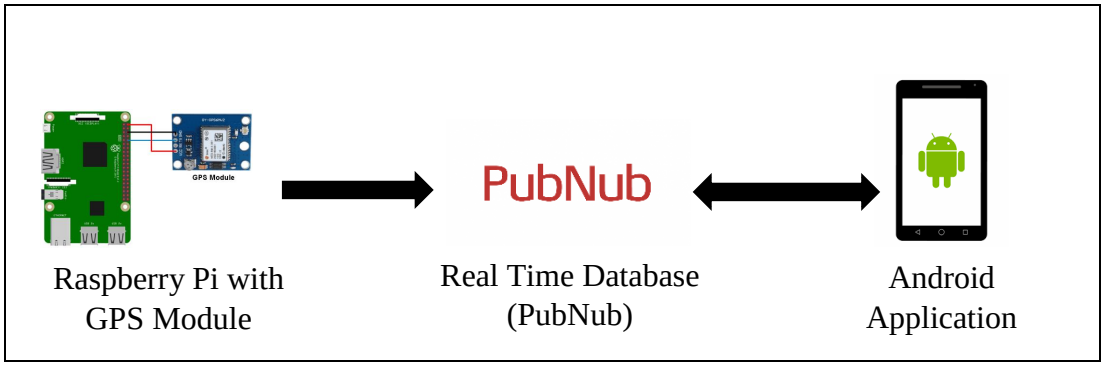

Figure 4.1: Data Flow

Figure 4.1 shows the data flow of the Motorcycle GPS Tracking System. The GPS module will connected with Raspberry Pi to start the hardware device to get the GPS information data. The command will program in the Raspbian OS that send thru via serial communication. Therefore, the GPS data information will deliver real time data by using API called PubNub. Then, the GPS data information will send from the hardware device to the android application when the user use to track and monitor by using the android application.

4.3.2 Functional Requirement

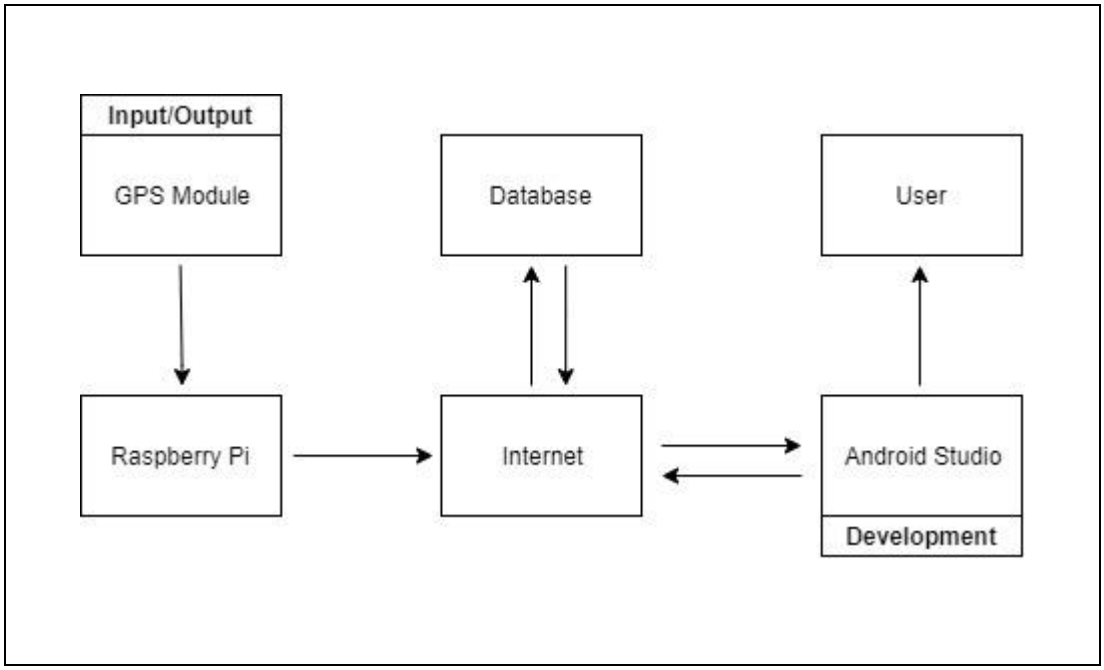

Figure 4.2: Block Diagram

This project will be divided into several blocks namely input/output block, GPS module block and development block. The figure shows the details of block diagram for this project.

i. **GPS Module**

The GPS Module will read and send the GPS data to Raspbian OS to control the GPS data. All code will be program by the Raspberry Pi using Raspbian OS.

ii. **Input/Output**

Raspberry Pi will connect with GPS module to start the device, then the GPS module will read the GPS data.

iii. **Development**

The main function will be located at the development block. The function consists of produce an android application by using Android Studio which can make rider to track and monitor the motorcycle location of safety and last parked. The GPS module directly connect using Raspberry Pi to start and run the hardware. Then, the GPS data gets from the hardware will send the GPS data to Pubnub API real time database for it to deliver real time data to the android application when the user use to track and monitor the motorcycle location. Therefore, android application will be able to request and receive GPS data from the hardware.

4.4 Hardware Requirement

a. Raspberry Pi 3B

The Raspberry Pi 3B is single board computer with wireless LAN and Bluetooth connectivity. It need to prepare to be able to communicate with GPS module. Thus, this Raspberry Pi 3B acts as an important hardware to start and run as the GPS device.

Figure 4.3: Raspberry Pi 3B

b. Neo 6M GPS Module

A Neo 6M GPS module technology is a complete GPS module with an active antenna integrated, and a built-in EEPROM to save configuration parameter data. It built in 25 x 25 x 4mm ceramic active antenna provides strong satellite search capability. This GPS module consist of 4 pins which are TX, RX, VCC, GND that need to attach with the used Raspberry Pi for it to read the GPS data.

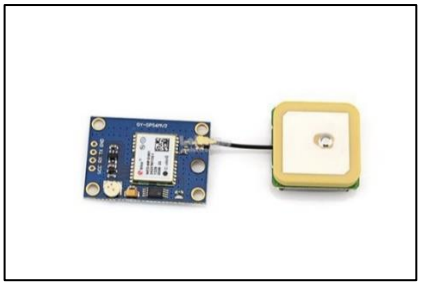

Figure 4.4: Neo 6M GPS Module

c. Laptop

A laptop play an important role for it use to program the hardware, develop a software and write project report. A minimum RAM of 4GB use to run the project. In this project it use to develop the Motorcycle GPS Tracking System by using Android Studio.

Figure 4.5: Asus X425C Series

d. Android Smartphone

An android smartphone is needed for develop the android application and to test the android application software.

Figure 4.6: Oppo Neo 7

4.5 Software Requirement

a. Raspbian Operating System (OS)

Raspbian is a free operating system for normal use on Raspberry Pi which is based on Debian. It uses the Debian Linux Command Line Interface to program the Raspberry Pi with the GPS module.

Figure 4.7: Raspbian Operating System (OS)

b. PubNub Real Time Database

PubNub real time database uses as for storing and delivering the GPS data. It provides with the two important keys – the 'Publish Key' and the 'Subscribe Key'.

Figure 4.8: PubNub Real Time Database

c. Android Studio

Android Studio is an official IDE for Android platform. Android Studio allow the user to develop their own application. Besides, Google API key can be easily used in Android Studio.

Figure 4.9: Android Studio

d. Android SDK

Android SDK allows mobile software developers the opportunity to tinker with the platform and create new and interesting work. The kit contains everything to start building apps. The Android SDK also comes with an emulated virtual device that is fully functional to for testing and debugging.

Figure 4.10: Android SDK

4.6 High Level Design

High level design describe how the project explains the architecture that would be used for developing a software product. This will shows the System Architecture and the Interface Design for the project architecture.

4.6.1 System Architecture

Figure 4 shows the system architecture of Motorcycle GPS Management System. The GPS module and the raspberry pi used as a GPS hardware device for a rider to get the GPS location. The GPS device will be program to connect with an android application to view the tracking motorcycle location. Android phone is used as GPS receiver to get the GPS location from the GPS hardware device. This information play a huge role as the rider need to get this data to know the motorcycle location. Therefore, the data is store in the PubNub API real time database and can easily retrieve it using the android application.

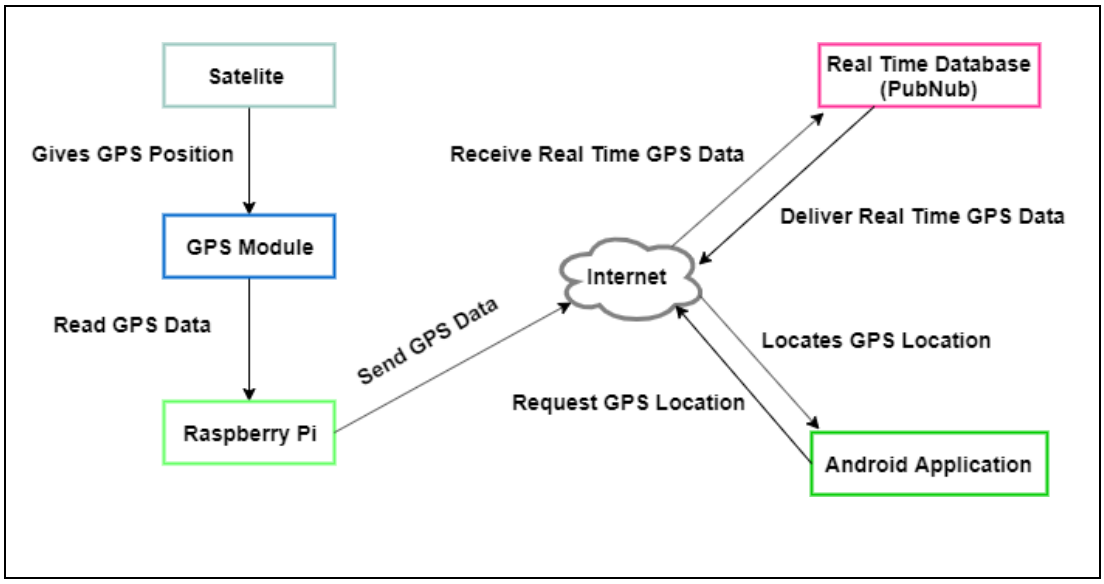

Figure 4.11: System Architecture

4.6.2 Interface and Flow Design

A propose user interface and flow design is designed for Motorcycle GPS Tracking System. This interfaces allow the user to have some basic idea on how the flow system is works. Figure below show the interface and flow design of the project.

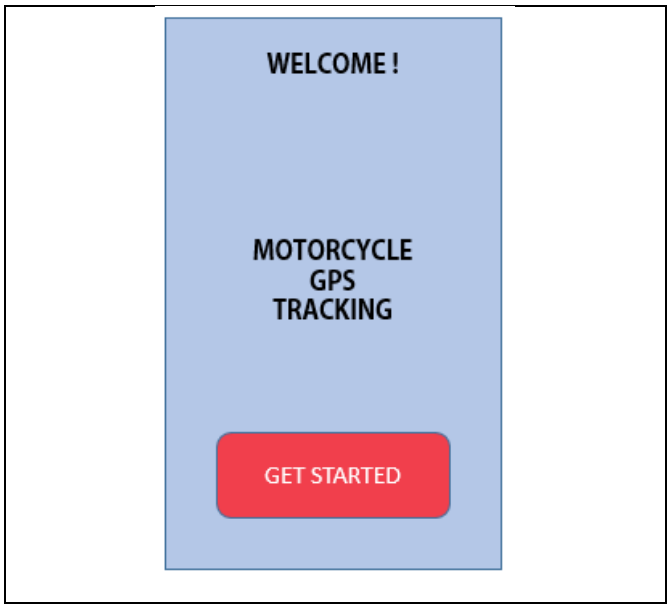

Figure 4.12: Main interface

Figure 4.12 shows the main interface of the Motorcycle GPS Tracking System. In this interface, user needs to press the Get Started button to move to the menu page.

Table 4.1: Main Interface Function

Function:	
Get Started Button: 	Move to menu interface.

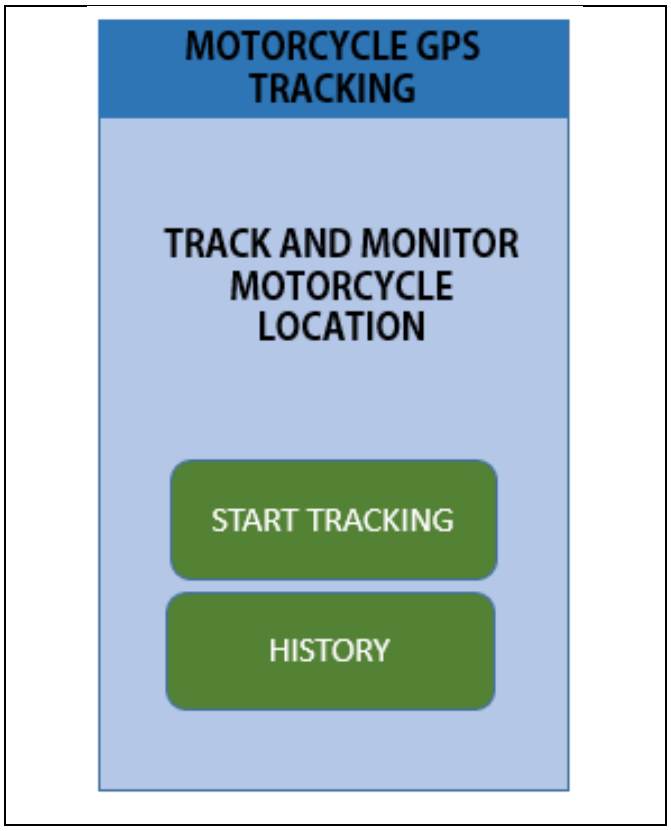

Figure 4.13: Menu Interface

Figure 4.13 shows the menu interface for the system. There are two options, which are start tracking and history. When a user selected either of the option it will move to the selected interface. As for start tracking it will move to track and monitor interface. Meanwhile, the history will move to motorcycle travel report interface.

Table 4.2: Menu Interface Function

Function:	
Start Tracking Option: 	Move to track and monitor interface.
History Option: 	Move to history interface.

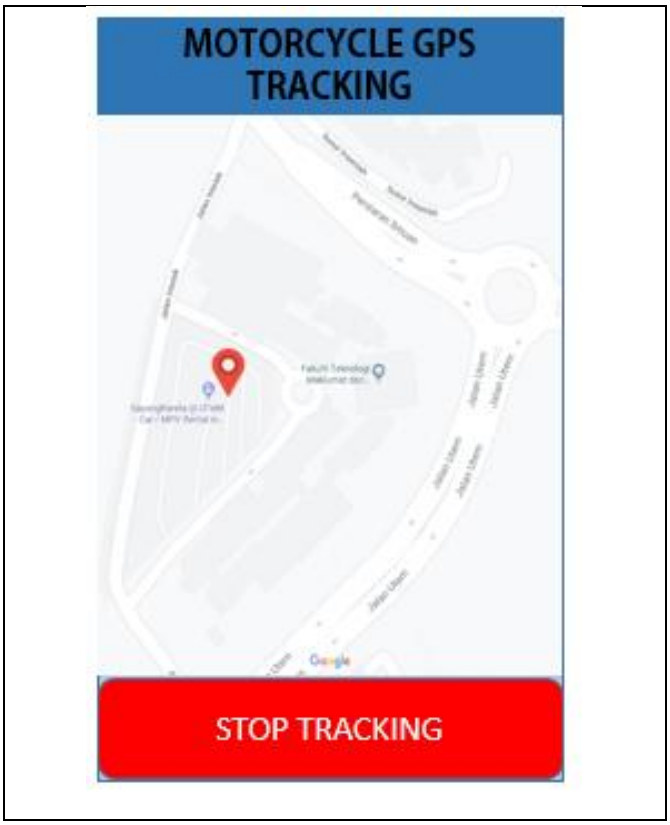

Figure 4.14: Track and Monitor Interface

Figure 4.14 shows the track and monitor interface. After the user has selected the start tracking option the track and monitor interface will be shown. In this interface it will displays the live real-time map and where the GPS hardware device located using the Google map. This interface provide user to track and monitor the motorcycle location.

Table 4.3: Track and Monitor Interface

Function:	
Stop Tracking Button: STOP TRACKING	It will stop the process of track and monitor motorcycle location and move to the menu.

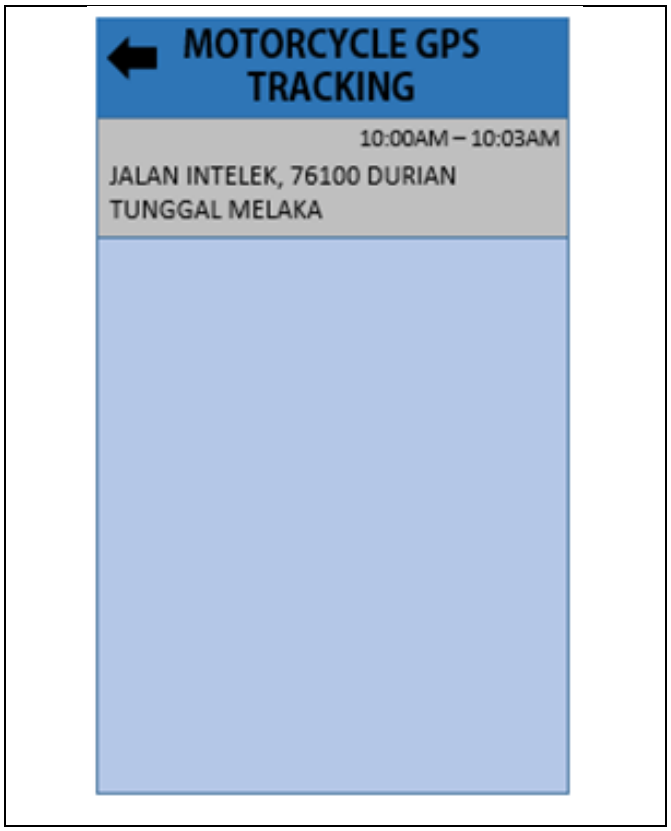

Figure 4.15: History Interface

Figure 4.16 shows the history interface. This interface will shows the history of motorcycle location travel report where it has been travelled. It allows the user to view information such as last place, date and time of last track the motorcycle.

Table 4.4: History Interface Function

Function:	
Back Button: 	Move back to menu interface.

4.7 Conclusion

Analysis and design is one of the important part to implement project. All software and hardware requirements need to be identified and studied before carry out a project. This chapter is the pre-preparation stage for the implementation and it also include the flow of the overall system so that to have a better understanding before implement it. The next chapter Implementation will discuss how the project to be implement and the output expected for this project.

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