



Faculty of Computer Science and Information Technology

UNIMAS Real-time Bus Tracking System

Franco Anak Kemin

Bachelor of Computer Science with Honours (Network Computing)

2019

UNIMAS Real-time Bus Tracking System

Franco Anak Kemin

This project is submitted in partial fulfilment of the
requirements for the degree of
Bachelor of Computer Science with Honours

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2019

UNIVERSITI MALAYSIA SARAWAK

THESIS STATUS ENDORSEMENT FORM

TITLE UNIMAS Real-time Bus Tracking System

ACADEMIC SESSION: 2016/2017

(CAPITAL LETTERS)

hereby agree that this Thesis* shall be kept at the Centre for Academic Information Services, Universiti Malaysia Sarawak, subject to the following terms and conditions:

1. The Thesis is solely owned by Universiti Malaysia Sarawak
2. The Centre for Academic Information Services is given full rights to produce copies for educational purposes only
3. The Centre for Academic Information Services is given full rights to do digitization in order to develop local content database
4. The Centre for Academic Information Services is given full rights to produce copies of this Thesis as part of its exchange item program between Higher Learning Institutions [or for the purpose of interlibrary loan between HLI]
5. ** Please tick (✓)

- CONFIDENTIAL (Contains classified information bounded by the OFFICIAL SECRETS ACT 1972)
- RESTRICTED (Contains restricted information as dictated by the body or organization where the research was conducted)
- UNRESTRICTED

(AUTHOR'S SIGNATURE)

Permanent Address

SL 879, TMN SAMARINDAH,
JLN DTK MOHD MUJA, 94300
KOTA SAMARAHAN

Date: 12/8/2020

Validated by

(SUPERVISOR'S SIGNATURE)

Noor Alamshah bin Bolhasan
Associate Professor
Faculty of Computer Science and Information Technology
Universiti Malaysia Sarawak

Date: 10/08/2020

- Note * Thesis refers to PhD, Master, and Bachelor Degree
** For Confidential or Restricted materials, please attach relevant documents from relevant organizations / authorities



VERIFICATION OF FYP REPORT CORRECTION AND SUBMISSION

Faculty of Computer Science and Information Technology

Remark

This form must be endorsed by MAIN SUPERVISOR and EXAMINER(s) submitted along with two (2) copies of corrected report (Hard Binding) to the Office of FYP Coordinator. Final Year Project Report submitted WITHOUT this form will not be processed for the purpose of grading.

A. Endorsed by Main Supervisor & Examiner

I have reviewed and confirmed

Student's Name	Franco Anak Kemin
Project Title	UNIMAS Real-time Bus Tracking System
Student ID	58615
Program	Network Computing

Has done thesis correction according to the recommendation from Examiners and ready for final submission.

Main Supervisor

.....
Neor Alamshah bin Bohassan

Associate Professor

Date 10/08/2020

Signature & Official Stamp
Faculty of Computer Science and Information Technology
Universiti Malaysia Sarawak

Examiner

.....
Signature & Official Stamp
Dr. LAU SEL PING
Senior Lecturer
Faculty of Computer Science and Information Technology
Universiti Malaysia Sarawak

Date 14 August 2020

Acknowledgment

In the name of God, the most beneficent and merciful, it is my radiant sentiment to place on the record of my best regards to my dearest supervisor, Associate Professor Dr. Noor Alamshah B. Bolhassan who took his time to hear, supervise and guide me in completing my Final Year Project despite his busy schedule.

Aside from that, I would like to express my most sincere gratitude to my parent, Kemin Anak Sumbeh and Lily Mena Anak Ngelayang and my other family members, who had supported me, encouraged me and always prayed for me to do my best in my studies. I'm also never forget to my friends always with me, appreciation and uttermost sense of gratitude to them, Ephraim Lyeron, Mcwalter Clement, Calvin Jackpot, Lorenzoe Lampas and Hillary Sidie and also who had helped me and stayed with me in my ups and down in life.

Finally, I would like to give special thanks to all the lecturers in the faculty that taught me and have given me second chance to improve myself. It is a delight for me to acknowledge and work with all of you. Thank You.

Table of Contents

Abstract	1-2
Chapter 1: Introduction	
1.1 Introduction	3
1.2 Problem Statements	3-4
1.3 Scope	4
1.4 Aim and Objective	4
1.5 Brief Methodology	5-6
1.6 Significance of Project	6
1.7 Project Schedule	6
1.8 Expected Outcome	6-7
1.9 Project Report Outline.....	7-8
Chapter 2: Literature Review	
2.1 Introduction	9
2.2 Current Scenario Analysis.....	9
2.3 Review of Similar Existing System	9-18
2.4 Summary of Features of Applications.....	18
2.5 Discussion on Existing Application Summary	18-19
2.6 Summary	19-20
Chapter 3: Requirement Analysis and Design	
3.1 Introduction	21
3.2 Methodology	21
3.3 Requirement Planning Phase.....	22-42
3.4 Sketch User Interface	42-43
3.5 Summary	43
Chapter 4: Implementation and Testing	
4.1 Introduction.....	44
4.2 Software Components.....	44-54
4.3 Hardware Components.....	54-55
4.4 User Roles.....	55
4.5 Application Implementation.....	55-60

4.6 Constraints.....	60
4.7 Testing.....	60-64
4.8 Implementation and Testing Summary.....	65
4.9 Strength and Weakness Evaluation.....	65-66
4.10 Discussion and Result.....	66
4.11 Evaluation.....	66-67
4.12 Evaluation Summary.....	67
Chapter 5: Conclusion and Future Work	
5.1 Introduction.....	68
5.2 Objective Achievement.....	68
5.3 Limitation.....	68-69
5.4 Future Work.....	69
References.....	70
Appendices.....	71-73

Abstract

UNIMAS Real-time Bus Tracking System is a simple but useful system that allows students to locate UNIMAS buses through a dedicated mobile application in smartphone. This system reduces the time wasted by students at the bus stop which increase and improve the usage of their own precious personal time. At current time, students have no idea on the location of UNIMAS buses and need to wait at bus stops cluelessly without knowing when bus will arrive. By proposing this system, the students can know the current location and can estimate when the bus will arrive at bus stops. The methodology that used to develop the proposed system is Rapid Application Development (RAD).

Abstrak

Sistem Penjejakan Waktu Sebenar Bas UNIMAS ialah satu sistem yang mudah tetapi berguna kepada pelajar. Sistem ini membolehkan pelajar untuk mengetahui kedudukan bas UNIMAS melalui aplikasi Sistem Penjejakan Waktu Sebenar Bas UNIMAS dalam telefon pintar. Sistem ini mengurangkan masa pelajar yang menunggu di perhentian bas daripada terbuang. Dengan ini, pelajar dapat memanfaatkan masa peribadi yang emas dengan lebih baik. Pada masa kini, pelajar tidak dapat mengetahui kedudukan sesebuah bas UNIMAS dan ini menyebabkan pelajar harus menunggu di perhentian bas tanpa mengetahui bila bas akan sampai. Dengan menggunakan sistem yang dicadangkan ini, pelajar dapat mengetahui kedudukan sebenar bas UNIMAS dan dapat mengira tempoh bila sesebuah bas akan sampai di perhentian bas. Metodologi yang digunakan untuk membangunkan sistem yang dicadangkan ialah Rapid Application Development (RAD).

Chapter 1: Introduction

1.1 Introduction

Bus transport is a type of public transport that has been around for several decades and has improved ever since. The main contribution of bus transport services is it lower down the number of private cars operation on the road hence reduce the traffic jam. Many people around Malaysia choose bus as their main public transport as trains such as Light Rail Train (LRT) are not available widely in the country and cost of using bus transport services for their daily commute is very low.

Users of buses usually want to know the precise arrival time of bus at the bus stop or bus station. Some of the bus users may in hurry or not patience enough and do not want to wait for buses for a longer period and this can cause them to refuse taking the bus to commute. To handle this problem, bus operating companies create a timetable or schedule which contain the bus operating hours and time intervals. But the problem is this schedule may outdate and not updated from time to time. The new students may not know the real arrival time of the bus at bus station and this result of this experience cause them reluctant to use public bus transport again.

To tackle the problem of non-accurate bus arrival time, a mobile application must be developed to allow students track the movement and location of UNIMAS buses. This can be achieved by utilizing Global Positioning System (GPS) module to allow bus users tracks UNIMAS buses in real-time from the system's mobile application in students' mobile devices. By providing such mobile application to students, students will not have to waste their precious time by waiting for buses for extended period.

1.2 Problem Statements

Bus waiting time at Universiti Malaysia Sarawak (UNIMAS) has been a problem for UNIMAS student for quite some time now. The waiting time of bus for students is inconsistent and sometimes require long time for bus to arrive at bus stop. In the morning, this problem become worsen to students and bus drivers because of terrible traffic jams in the morning where students need to attend their classes of the day and meanwhile in the evening where students go back to their respective hostels.

One of the reasons why this system is needed because the students do not know when the actual arrival time of the bus at the bus stops which can be very different from

original schedule. The wasted waiting time can be used to do more important tasks like doing assignment and having breakfast, lunch, or dinner.

Second reason is because UNIMAS students do not know the estimation time of bus to arrive at bus stops.

1.3 Scope

The project scopes are:

1. The mobile application is designs for the use of UNIMAS students.
2. The mobile application covers all the bus stops where all UNIMAS buses stop include outside of UNIMAS.
3. The mobile application shows the location of bus through virtual map from students' mobile devices.
4. The mobile application only can be use in mobile devices in presence of Internet connection.

1.4 Aims and Objectives

The aim of this system is to reduce the amount of waiting time for students and staffs of UNIMAS to wait for UNIMAS buses while reducing the amount of their wasted personal time.

The main objective of this project is to develop a mobile application to enable students to locate UNIMAS buses real-time location and view bus movement in virtual map in a mobile application. The other objective is:

1. To build a mobile application dedicated to the system to view real-time bus location in a virtual map.
2. To implement GPS module such as NEO-6M GPS module connected with microcontroller or microcomputer on bus to send data from the tracker module to mobile application.

1.5 Brief Methodology

For development of this UNIMAS Real-time Bus Tracking System, Rapid Application Development (RAD) is chosen as a guideline. The detailed explanation of these phases will be explained in chapter 3 of the report which discussed more specific of the methodology used in this project. Figure 1 below shows RAD includes its phases named: Analysis and Quick Design, Prototype Cycles, Testing and Deployment.

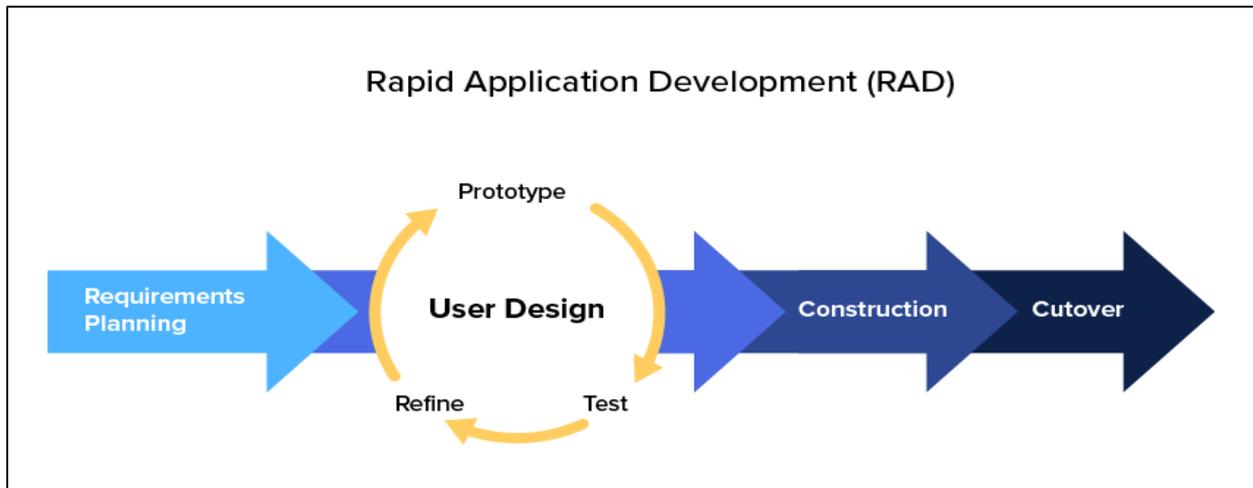


Figure 1.1 Rapid Application Development (RAD)

1. Analysis and Quick Design

In this phase, developers do not have to sit and take list of specifications details from end user. Instead, this phase asks for broad requirement. We can use methods like surveys or interviews to know more about user's requirements regarding the bus tracking system. From the surveys or interviews, data are collected and analysed. Then, the functionality and non-functionality function can be identified. The suitable hardware and software to be used to build the system also will be considered during this phase.

2. Prototype Cycles

This is where the actual development of UNIMAS Real-time Bus Tracking System takes place. Developers create a prototype with different functions and features without following strict requirements. Then, the prototype then displayed to clients who then decide what they like and do not like. Usually, the prototype is quickly made to work so that certain features can be shown without proper polish. This approach is normal because the final product or system is created during finalization stage where clients and developer both agree with the final product.

3. Testing

When the prototype has been approved, tests need to be done to identify errors that are not appeared during prototype development process. The testing is done on software which is mobile application interface and hardware which is placed on bus.

The prototype can be tested using combination of two techniques which is white box testing and black box testing. The errors or defects in the system must be solved before it became final product.

4. Deployment

The proposed system is deployed in this phase and release to client side after the functionality of system are tested.

1.6 Significance of Project

The significant of this project is to provide UNIMAS students to locate the UNIMAS buses at real-time using their mobile devices. Hence, UNIMAS students can locate the location of buses from their mobile devices via mobile application and students can calculate the time estimation for UNIMAS buses to arrive at bus stops. Therefore, this can contribute to reduction of waiting time wasted at bus stops.

1.7 Project Schedule

This Figure 2 shows the project schedule and Gantt Chart of the proposed system

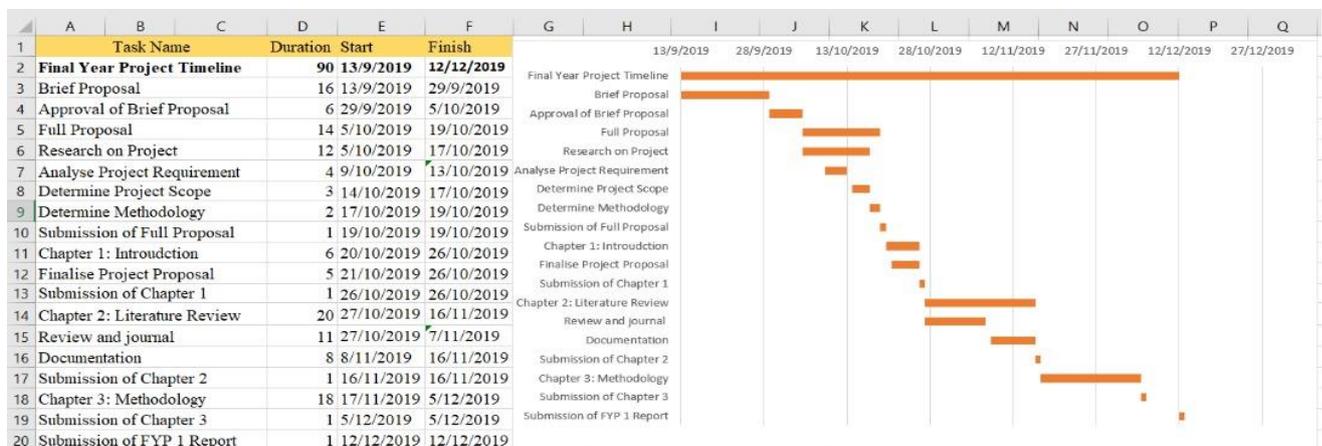


Figure 1.2 Project schedule

1.8 Expected Outcome

The outcome of my project is to enable users especially students to know where the bus is located by only using their mobile devices and from anywhere as long, they have internet connection on their mobile devices. After that, students of UNIMAS can know the time estimation for the buses to arrive at the bus stop. Moreover, this project will ensure safety of women passengers of the buses improved as women passengers does not

have to wait at bus stops for extended period especially during night time.

1.9 Report Outline

Throughout this project, there will be five chapters that are going to be completed.

1.10.1 Chapter 1: Introduction

In this chapter, there are several components are used to explain the introduction of this system such as problem statement, project scope, aim and objective, brief methodology, project significance, project schedule, expected outcome, report outline and conclusion. The main problem of there is no real-time bus tracking system for UNIMAS buses and unknown waiting time for buses at bus stop. These problems become the main reasons why this system needs to be developed. Besides, the aim and objectives are used to make the target of the proposed system clearer and how it will help to solve the problems. The methodology being used to guide the development of the system is Rapid Application Development (RAD). In the other hand, project schedule is used to explain the milestones of this project in certain period. The expected outcome described the achievement of this system after the development of the system complete.

1.10.2 Chapter 2: Literature Review

This chapter describe the review of similar system that implemented in other areas or country which can be mentioned on any related journals or articles. This is chapter is important to give early expectation of the proposed system. Advantages and disadvantages of this system also will be discussed in this chapter.

1.10.3 Chapter 3: Requirement Analysis and Design

The methodology to be used in this system will be mentioned and discussed here and the methodology to be used in this proposed system is Rapid Application Development (RAD). Requirements of users of this system will be asked to provide better understanding on what kind of features does users want to have in this system that can benefits them. The hardware design and prototyping phase also will be done by using this

methodology to make this system deployment faster.

1.10.4 Chapter 4: Implementation and Testing

The implementation and testing of the proposed system will be done here to ensure system is being implemented and testing is required to make sure the system works with less error in real life. The importance of implementation and testing also will be discussed in this chapter.

1.10.5 Chapter 5: Conclusion and Future Work

A summary will be written to conclude the proposed system that being made. Some future enhancement of the system also will be later discussed in this chapter.

Chapter 2: Literature Review

2.1 Introduction

This chapter is the review of the existing applications that is compatible with the objective of this project. The applications that being reviewed are chosen based on the features and usability. Strengths and weaknesses of these applications also will be discussed.

2.2 Current Scenario Analysis

The number of UNIMAS students increases year by year and this make more students or staffs of UNIMAS that will be using UNIMAS buses. Due to this matter, the number of UNIMAS students who wait at the bus stops also increase. The increase number of passengers at bus stops always lead to increase in time for buses to departure from the bus stops hence increase the waiting time of passengers at the next bus stops. If there is sudden increase in number of students, this will then affect the time for bus to depart from respective bus stops. Therefore, a system and its dedicated mobile application should be built to enable UNIMAS students to know where the real-time location of these buses. The benefit gained from this mobile application is UNIMAS students does not have to wait for extended period at bus stops. This result in more personal time for them to rest or doing important works.

2.3 Review of Similar Existing System

There are three existing application that have been found which is close to project outcome of this project. The first one iFleet Intelligent GPS Tracking and Fleet Management System, the second one Katsana GPS Tracking System Malaysia and lastly is Stopanik GPS Tracking System. All these applications can be downloaded from Apple App Store and Android Play Store and its all free to download. These applications are chosen to be review because all these applications are for Malaysia market and already being implanted in this country. iFleet Intelligent GPS Tracking and Fleet Management System is focused more towards fleet management system which can be used for commercial vehicles such as buses and lorries of a company rather than tracking of private vehicles. Katsana Vehicle Tracking System on the other hand focused on both aspects. Katsana Vehicle Tracking System offers private car owners to track their car in

real-time and offer tracking the fleets of commercial vehicles like buses and lorries of a company. Furthermore, Stopanik GPS tracking system covers more aspects such as portable GPS tracker for person, motorcycle GPS tracker and pet GPS tracker. Nonetheless, Stopanik GPS tracking system also offers private vehicles and fleet vehicles real-time tracking which contain as many features as other GPS tracking system.

2.3.1 iFleet Intelligent GPS Tracking and Fleet Management System

iFleet Intelligent GPS Tracking and Fleet Management System is a local company which offer GPS tracking services for their customers. This system is built to allow commercial vehicles fleet of a company being tracked in real-time while getting the each of the vehicle information to increase the functionality of this system. For new or interested customers, they can get a quote on the prices of the system on its website. To use this system, users must purchase their package first. Then, installation of hardware on the fleets will be done. After that, users can access all the information and track their fleets using application specifically for this system from their mobile devices. There are two features that set it apart from other competitors which are this system using Digi services as their main network and this system also offers accident reconstruction. Accident reconstruction speed up the insurance claim processes with accident reconstruction reports.

2.3.1.1 Features

The figure below is the details of tracked vehicle that being shown in the system mobile application.

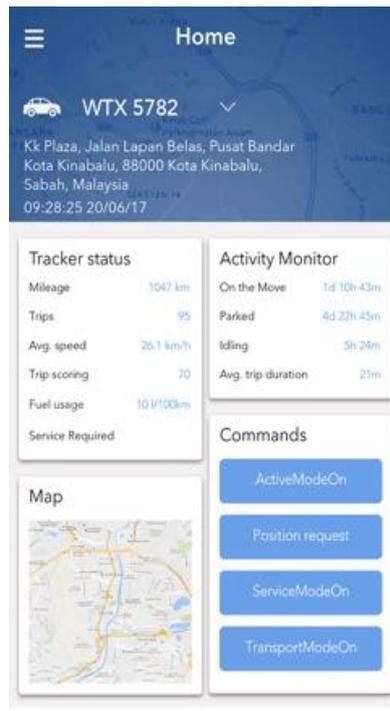


Figure 2.1 Dashboard of each vehicle for quick overview

The figure below is the types of notifications alert that will be displayed in the system user phone.



Figure 2.2 Notifications alert

The figure below is the overview of tracked vehicle location on the map in the system mobile application.



Figure 2.3 Overview of fleet location

2.3.1.2 Strength

It has accident reconstruction features which improve the speed of insurance claim reports if accidents happen to any of the fleet. This will reduce the time for fleet management team to do the insurance claims for their damaged vehicle.

2.3.1.3 Weakness

iFleet Intelligent GPS Tracking and Fleet Management System is more focused towards commercial vehicles rather than private vehicles.

2.3.2 Katsana GPS Tracking System Malaysia

Katsana GPS Tracking System is a one of local company that operated in Malaysia that provides GPS tracking services. Their focus is towards private car owners who want to track their car in real-time in case their car got stolen and for those who want to track their commercial vehicle fleet for business purpose. People who interested to use their services can first get quotation from their own website. Main features that set this company from others is this system allow integration of live in-vehicle video streaming into the GPS tracking system. The live in-vehicle video streaming allows fleet manager to view up to 3 simultaneous of different vehicle point of view which

are front, rear and inside vehicle itself. Besides, this system offers remote engine shutdown for private car and fleet vehicles. This is a very excellent features for private car and fleet vehicles owners because this allow them do remote shutdown the vehicles engine if the vehicle got stolen or if their workers try to stole or getaway with the company vehicles. This of course increase the peace of mind for private car and fleet vehicles owners.

2.3.2.1 Features

The figure below shows the dashboard of each tracked vehicles details in the system mobile application.

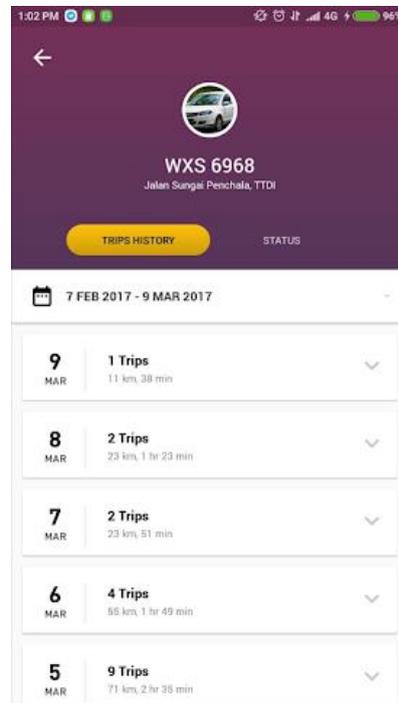


Figure 2.4 Daily summary of each vehicle

The figure below shows the tracked vehicle real-time position on the maps in the system mobile application and being constantly updated.

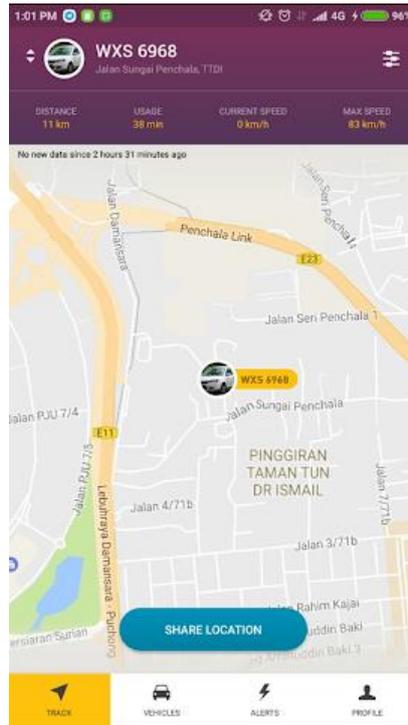


Figure 2.5 Real-time location update

The figure below shows the unique feature of this system mobile application which allow users of this system to immobilize their vehicle if the users suspect their vehicle get stolen.

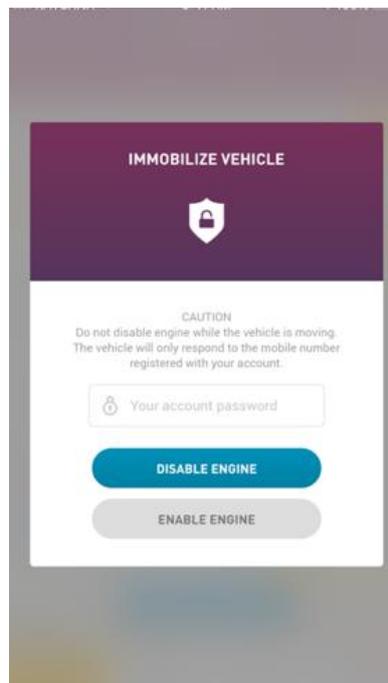


Figure 2.6 Interface to immobilize vehicle

2.3.2.2 Strength

The strength of this system is it allows customer to add functionality such as remote engine shutdown for their vehicles. Furthermore, this system also allow customer to do live in-vehicle video streaming from different viewpoint. This can be evidences in case accidents happen inside or to the vehicle.

2.3.2.3 Weakness

The weakness of this system is the in-vehicle video streaming only available for fleet vehicles and not for private cars.

2.3.3 Stopanik GPS Tracker Malaysia

Stopanik GPS Tracker Malaysia is a Malaysian company become one of main providers of GPS tracking services. This company GPS tracking services covers many fields such as portable/asset GPS tracker, car and commercial vehicle fleets GPS tracker, motorcycle GPS tracker and pet GPS tracker. But in this context, only car and commercial vehicle fleets GPS tracker being discussed. This company also allow demo of the system for new user who want to experience it. This system offers almost the same features as other competitors. The only difference is GPS tracking service from this company is not limited to commercial fleets vehicle and cars only.

2.3.3.1 Features

The figure below shows all the tracked vehicle location on the maps in this mobile application. There is also icon to show the tracked vehicle types.



Figure 2.7 Overview of vehicles live tracking

The figure below shows all event and notifications that being alerted to the mobile application users.



Figure 2.8 Important events alerts and notifications

The figure shown below is route history of tracked vehicle drivers in the mobile application.

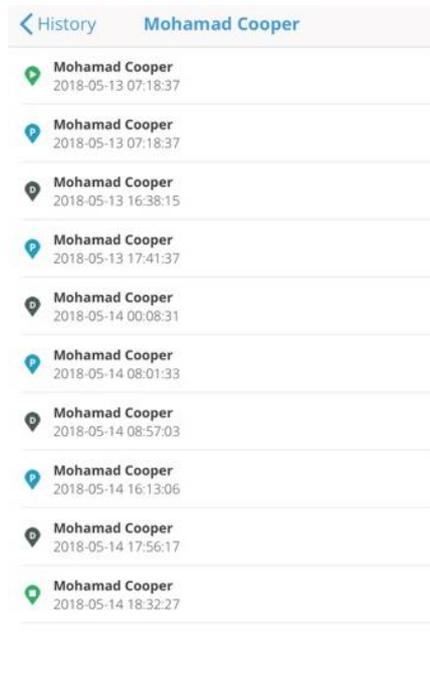


Figure 2.9 History of route taken

Figure below shows the basic information of users tracked vehicles which being displayed in the mobile application.

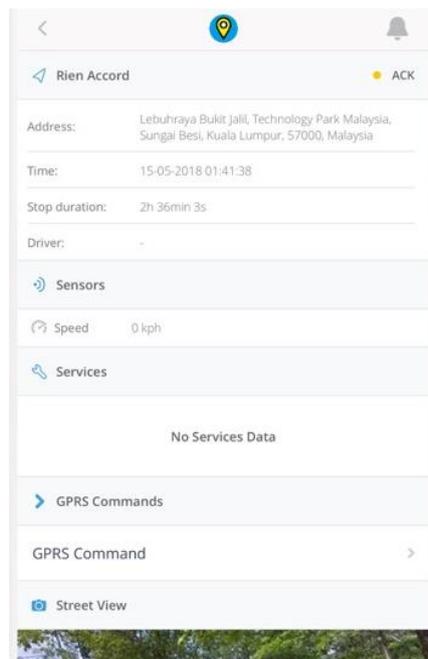


Figure 2.10 Brief information of user's vehicle