'Route-Me' - A Mobile App and Web Based System to manage Vehicles and Drivers

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2019

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A dissertation submitted for the Degree of Master of Information Technology

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2019

Abstract

In a large company, scheduling and tracking of their vehicles are not an easy process. In Sri Lanka, there are less organized systems for scheduling vehicles in a company. If the business has to manage and track the company vehicles, it takes much effort it takes to plan and manage the calendar. It gets more complicated when scheduling and managing trips with manual process.

Global E marketing solution is a leading classified advertising and marketing company. The company prepares and places advertisements on websites, weekly business newspapers, legal papers, magazines, and various monthly directories. They have teams to visit site locations and collect advertisements.

In the current business context, human lifestyles have become more and more complex and complicated. People expect to have much easier, simple and productive systems that they can use to achieve their daily needs successfully and effectively

This Master's Thesis defines an implementation of a system which replaces the Global E - marketing solution's manual operating process. "Route-Me" is a mobile app and a web based system for managing vehicles and drivers easily and cost effectively. As the main users of the system are employees, transport manager and drivers more attention is put towards the UI designing. The mobile application is created with feature-rich and eye-catching to enhance the user experience and ease of use.

This mobile application is developed using Android and the Web based System is developed using HTML, CSS, PHP and Maria DB (MySQL). This proposed solution has a mobile application and a web based system, which helps to find optimized routes. This solution consists of time windows for drivers to create routes which enable employees to cover more destinations while remaining on the schedule. This has mobile components for on-the-go updates and tracking the route. The objective of this is allowing managers and employees to work together and get maximum efficiency in each operation. With a subjective evaluation shows this mobile application and the web based system provide and idle solution.

Keywords - Scheduling and tracking, Mobile app and a Web based system, vehicle Tracking, Drivers, Managers.

Declaration

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.
To the best of my knowledge it does not contain any material Published or written by another person, except as acknowledged in the text.

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_____ _____

Signature Date

This is to certify that this thesis is based on the work of Mr./Ms. _____ under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:
Supervisor Name: Dr K.L.Jayaratne

_____

Signature Date

Acknowledgement

It is my pleasure to thank many individuals who contributed to the success of this project. I thank Dr K.L.Jayaratne, supervisor of the project, for his supervision, advice, and guidance from the very early stage of this project. I would also acknowledge my parents and all the friends who provided their support in making this research a success. Finally big thank to each and every person for the support and the assistance given to make this a success.

Table of Contents

List of Figures

List of Tables

Chapter 01

Introduction

1.1 The Client - Global E Marketing Solutions

Global E marketing solution is a leading classified advertising and marketing company. The company prepares and places advertisements on websites, weekly business newspapers, legal papers, magazines, and various monthly directories. They have teams to visit site locations and collect advertisements. Their head office is situated at Kadawatha and other branches are in Matara and Ganemulla. They are operating few famous classified advertising web domains such as http://watapita.lk[14], https://adsking.lk[15], www.lkautomart.com[16] and http://www.tution.lk[17].

1.2 Problem Domain

In a large company, scheduling and tracking of their vehicles are not an easy process. In Sri Lanka, there are less organized systems for scheduling vehicles in a company. With the "Route-Me" mobile app and web based system, managing vehicles and drivers become easy and cost effective. When an employee of the company wants to arrange a transport, he/she can request a trip with the online web based system. Then the transport manager, can accept the trip and assign those trips to drivers according to their availability. When a driver accepts and confirms the trip, it will pop up on driver's mobile app. Then the driver can select a vehicle and he is capable of changing the trip status by using the mobile app throughout the assigned trip. All drivers' working hours, idle hours, over time hours, vehicle profiles and trips can be tracked with the system. With above specified features, the Route-Me app will make life easier for the transport manager in the company.

At the moment, Global E marketing solution is manually operating this process by using Excel. Therefore, it is necessary for them to have a computerized information system to make their work more easy, efficient and cost effective. Global EMS has their own vehicles and drivers pool to collect classified advertisements by visiting various site locations. Their aim is to arrange those trips to visit locations and keep records of all the information's such as the name of the driver assigned, the vehicle assigned, booking time, the name of the officer

requested the trip, drivers working hours, driver's idle hours, driver's OT hours, distance travelled and rout path with this mobile app/web system.

1.3 Aims and Objectives

This app / web helps to operate efficient optimized routes and with minimized idle time. These solutions consider critical information, such as time windows and available drivers, to create routes that enable employees to hit more destinations while remaining on schedule. These tools have mobile components allowing for on-the-go updates and to keep a track about the route. The objective is for managers and employees to work together for maximum efficiency in operations.

Following are the high-level project objectives of the proposed system

- Creating a user friendly mobile application for divers.
- Time Saving by real time tracking and scheduling.
- Manage transport needs of the company efficiently by scheduling and allocating drivers to vehicle.
- Calculating working hours, idle hours, OT hours.
- Keep track of drivers/vehicles.
- Easy access to information by mobile and web.
- Check availability of drivers.

1.4 Motivation

In the current business context, human lifestyles have become more and more complex and complicated. People expect to have much easier, simple and productive systems that they can use to achieve their daily needs successfully and effectively. Therefore, for that purpose IT based solutions are now having a good approach.

The manual business process is very time consuming, inaccurate, not safe due to the unavailability of a backup system and very tiresome to handle, as the load of information to be handled is too much. As the manager of the company who is mostly working out of the office premises, he needs to have the ability to work remotely at any time. For these reasons, the management of Global EMS is looking for a computerized automated system, which can be used to accomplish their needs with current technology.

1.5 Scope

Mobile application and web application are to be designed using HTML and CSS. Maria DB will be used to design the database to store all the information. In implementation of the mobile application AngularJS, JavaScript will be used, as it will be developed using Android framework. This will target devices with android version 5.0 or above. The functions of the web based system will be implemented using PHP according to the client server architecture. Trip distance calculated by the mobile device using GPS and accelerometer. The chart.js will be used for reports and chart developments. The web application will be available for 24 x 7.

(Web application)

- Request trip by employees.
- Allocate driver and vehicle by transport manager and approve the trip.
- Keep track of vehicle and drivers.
- Calculate drivers working hours, over time hours and idle hours.
- View all drivers' time allocation with time line.
- Generate report on web application. (Drivers working hours, over time hours and idle hours, Vehicle usage summary and Vehicle usage according to type of the trip).
- View own trip history when user log in to web application.

(Mobile application)

- Start trip and end trip.
- Calculates time and distance while traveling.

1.6 Structure of the Report

Chapter 1: Introduction

- The introduction chapter provides an overview of the project and define the problem, motivation and objectives in the project. The scope is also well defined through this chapter.

Chapter 2: Background

- This chapter gives a summary of the background information to the implementation. In addition, a critical review of similar systems, technologies available and summary of implementation tools are explained.

Chapter 3: Methodology

- This chapter includes fact gathering techniques, functional and non-functional requirements, feasibility study, design diagram methods and tools used in design, user interface design, database design etc.

Chapter 4: Evaluation

- This chapter includes evaluation scenarios, test plan, test cases, tools such as questionnaires, test automation tools and testing frameworks.

Chapter 5: Conclusion

- This is the final chapter of the dissertation. This chapter summarizes the work and include about lessons learnt, achievement of objectives and how the work could be extended.

Chapter 02

Background

2.1 Introduction

Fast advancement of microelectronics and mobile communications the scope of fleet diagnostics and satellite provide geo-spatial position. These advancements gave an innovative foundation of the production of these systems. These Systems gather, store and give finish far reaching data about the flow condition of the vehicles, the history, the normal occasions, and also the driver activities for the vehicle maintenance and administrator organizations. The establishment of a Fleet Management System reduce the expenses of the organization. The additional costs of the system are balanced the investment funds. This can be gained by the following follow-ups.

- Reduction of activity costs from proper vehicle utilization and the route planning.
- The Fleet Management System increases the maximal usage of the vehicle parts by the regular monitoring of the vehicle.

There are two ways of this kind of systems according to the location, off-line Fleet Management Systems and on-line Fleet Management Systems. In off-line Fleet Management Systems a recording unit in the vehicle will record the necessary data. Then those are processed and evaluated afterwards. In on-line Fleet Management Systems all the vehicles are connected via online to a server and real time data collection, processing and evaluation happened. In the on-going years the on-line frameworks have come into general use as the aftereffect of the development of the wireless communication. With that some are able to facilitate the fleet management systems. Normally the techniques are based on GSM networks mainly on packet-switched services like GPRS. Later UMTS will extend the outcomes and information transfer speed.

Deciding the vehicle's area is normally performed by GNSS frameworks. The standards of the satellite-based route frameworks (called GPS) were produced in the United Sates for military route purposes. The GPS is a widespread and reachable solution which is capable of discovering 3D positions, chronometry and measurement of velocity. The framework utilizes satellite signs for the assurance of the position; therefore it guarantees consecutive estimation

ability in 0-24 hours in general World. The Fleet Management Systems normally use GPS receivers or combined GPS/GLONASS receivers.

2.2 Implementation Background

This proposed solution has a mobile application and a web based system, which helps to find optimized routes. This solution consists of time windows for drivers to create routes which enable employees to cover more destinations while remaining on the schedule. This has mobile components for on-the-go updates and tracking the route. The objective of this is allowing managers and employees to work together and get maximum efficiency in each operation.

The mobile application is for drivers which have ability to track the activities done by the driver from the work start time to work off time. The Transport manager able to allocate necessary vehicles for specific tours. As the availability of the vehicles and the drivers are tracked methodically it is time saving when allocation tasks for each. After the task assigned according to the transport type the app is able to track all locations, speed and routes etc. of the vehicles. Since the driver is under tracking process it is easy to calculate working hours, inert hours, OT hours too. All the allocations and managerial activities are done by the transport manager using the web system.

There are distinctive technologies that can be used to implement a web based solution like PHP, Java, Perl, Python, Drupal, Ruby, ASP.NET which can be connected with the database such as MySQL, MS SQL, Oracle and so on. For the proposed framework PHP was choose as the programming languages and MySQL as the database.

To create the mobile application Android studio is used with the JAVA programming language. The application will be connected to the server via REST APIs.

2.3 Similar Systems

- Dialog fleet management system

Dialog combines GPS technology and Google Maps into a reliable, scalable and comprehensive fleet management solution, accessible through a user friendly web based interface. A GPS and GPRS combined tracking solution has the ability to track movable assets, people and vehicle fleets from anywhere at any time [11].

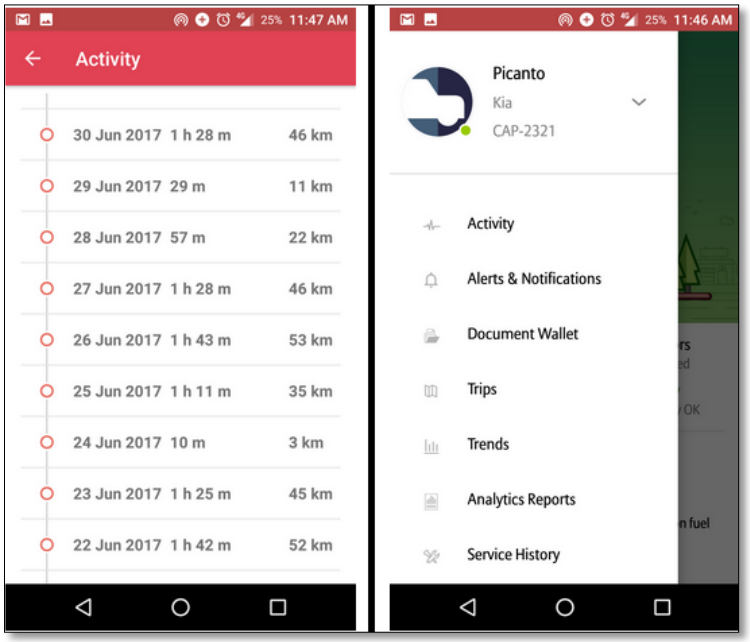


Figure 2.3.1: Dialog Fleet Management System

Features

- Real time GPS-based tracking over Google maps through satellite connectivity
- Time, distance and velocity monitoring (Figure 2.3.1)
- Ignition and openings monitoring and control
- Virtual fencing
- Fuel monitoring
- Two way communication
- User-defined automatic alerts
- Operational and statistical reports

Benefits

- Increased employee productivity
- Increased driver safety
- Improved utilization of the fleet
- Enhanced customer service
- Lower fuel and maintenance costs
- Reduced paperwork
- Prevention of unauthorized vehicle use
- Help in stolen vehicle recovery

- Vehicle Tracking and Fleet Management

This Fleet management software includes a range of functions, such as vehicle financing, vehicle maintenance, driver management, speed management, fuel management and health and safety management. [12] This allows companies which rely on transportation in business to remove or minimize the risks associated with vehicle investment, improving efficiency, productivity and reducing their overall transportation and staff costs. This provides with,

- Vehicle movement monitoring
- Temperature monitoring
- Fuel Level monitoring
- Door Monitoring
- Route Planning
- Shipment delivery identification and Reports

Figure 2.3.2 : Vehicle Tracking and Fleet Management

- Suhuru GPS Fleet tracking solutions

Figure 2.3.3 : Suhuru Fleet Management System

Suhuru is a multifunctional fleet management system, also used for mobile and stationary assets tracking. For more than 14 years in the international market, Suhuru GPS Fleet tracking solutions have entered the national markets of 130+ countries.

Over 950 fleet tracking service providers have chosen Suhuru recognizing our favourable business terms (we never put our customers into long-term contracts), flexible, yet powerful fleet management features and 24/7 high-quality technical support. [13]

2.4 Alternative Technologies

There are several different alternative technologies for implementing the proposed web based system and the mobile application. Here are only few of them which are on the lead and used by majority.

- Python

  Python is an interpreted programming language which is used in general purpose programming. Python is also object oriented.

- Ruby

Ruby is also an object oriented, general purpose computational programming language which has the features of dynamic type system and automatic memory management.

- Perl

  Perl is a family of languages with Perl 5 and Perl 6.Perl is a high level, general purpose and dynamic programming language.

- JavaScript

  JavaScript is one of the three core technologies used for the World Wide Web content. It is a high level, interpreted; prototype based programming language mostly used along with the HTML and CSS.

In current system the distance calculated by the device itself without using APIs as they need internet to calculate distance.

For mobile application use android over other technologies because most people have android device.

Communication system

Table 2.4.1: Table of OSI Model

OSI model	Used protocol or service
Physical layer	GSM, 100BASE-TX
Data link layer	GPRS, Ethernet
Network layer	Internet Protocol (IP)
Transport layer	Transmission Control Protocol (TCP)
Session layer	TCP socket
Presentation layer	UTF8
Application layer	XML based protocol

2.5 Pros and Cons of Alternative Technologies

When comparing the alternative front end technologies that can be used to the development of the web based systems, we can identify some pros and cons related to each of those technologies.

For the comparison the below mentioned facts were taken in to consideration.

- Efficiency of the language
- Available platforms and frameworks
- Community support
- How quick and ease the language was learnt
- Security

Table2.5.1: Table of Comparison of technologies

Language/Technology	Pros	Cons
Python	• Clean, expressive • Free availability • Powerful • Performs well across different platforms. • Easy to learn	• Too slow in performance (than java or ASP.NET) • Not secure • Absence of commercial support • Absence of GUI
Ruby	• Easy to learn • Framework has a simple structure • Has a big development community • Powerful • Rapid development(reduced development time)	• More expensive • The performance is not fast as PHP • Not so common • Require more boot speed • Consumes more system resources
Perl	• Multipurpose • Versatile • Quick running	• Poor usability • Not portable • Slow

JavaScript	• Easy to learn • Versatile • Speed being client side	• Less secure • Interpreted differently on different browsers

This chapter summarizes about the implementation background, similar systems to the proposed system, alternative technologies and pros and cons of alternative technologies that gives a clear comprehension about the background of this proposed system.

Chapter 03

Methodology

3.1 Introduction

System analysis and design are two outstanding important phases in SDLC. The analysis chapter gives a better comprehension about the existing system and client domain along with the fact gathering techniques, functional and non-functional requirements etc. Analysis should be completed in an effective an efficient manner in order to achieve a better design. Design phase emphasis on the technical or implementation concerns of the system. In the process of design, defining of inputs, outputs, files, modules, interfaces and other computer based components are done.

3.2 Feasibility Study for the Proposed System

This system helps to operate efficient optimized routes and with minimized idle time. These solutions consider critical information, such as time windows and available drivers, to create routes that enable employees to hit more destinations while remaining on schedule. These tools have mobile components allowing for on-the-go updates and to keep a track about the route. The objective is for managers and employees to work together for maximum efficiency in operations.

A feasibility analysis was done for this proposed system, under the following categories, in order to satisfy main business requirements.

3.2.1 Operational Feasibility

An operational feasibility was done to analysing all system functionalities, in order to find whether they meet and fulfil all business requirements. From this system client mainly expected,

- Request vehicle for a trip.
- Assigning vehicle and driver for the trip.
- Track diver in, out time and over time.
- Optimize rout and minimized idle time.

3.2.2 Market Feasibility

Most of the available fleet management systems provide services to client base on their cloud server. Client need own system and going to develop system step by step. To develop the system open source software and technologies are used. Mobile application only develops for Android devices because most of the mobile users use Android.

3.2.3 Economic Feasibility

There is no customized system currently available for trip allocation according to client requirement. This operation happened over the phone and lots of mess-ups. To develop system used open source development tools and technologies. For the mobile app goes for Android because of the cost. (First client need hybrid mobile version for both Android and Apple).

3.3 Fact Gathering Techniques

"Fact finding is a format process that uses techniques to collect/ gather information about system requirements, problems and preferences. This is also known as information gathering." From the available fact gathering techniques, the following were used to collect information of the system.

- Interviews
- Questionnaires
- Observation of the working environment
- Sampling of existing documents.
- Mainly the facts were gathered by interviewing the transport manager and drivers who is going to be the main user of the system. The staff members too were interviewed because they are also going to use this system to request trips.
- A questionnaire was prepared and obtained answers from the whole staff, including the manager.
- An observation was done to verify the facts and for additional comprehension of the system.
- Sample materials such as member registration forms, receipts, invoices, job cards, estimates, photographs and feature descriptive documents, leaflets were gathered in order to complete the fact gathering part of analysis.

3.4 Requirement Analysis

- Drivers are expected to work for 8 hours (inclusive of breaks) from the time the driver first holds the steering wheel in a 24-hour cycle and 40 hours a week. Maximum daily driving hours will be 12 hours from the time the driver first holds the steering wheel in a 24-hour cycle.
- Drivers must be provided with an adequate break to have a minimum of 8 hours sleep in a 24-hour cycle.
- Requests for World Bank vehicles for field mission travel should ideally be made to the reception 5 working days before the expected time of departure to facilitate the drivers entering their TR into the system and alternate arrangements for CMU travel to be made.
- The earliest time a Bank vehicle is permitted to leave the Colombo Office on field travel is 4.00 AM and latest arrival time in Colombo on return from field travel should be 10.00 PM. travelling after 6pm for mission travel should be avoided.
- Overtime will be restricted to a maximum of 40 hours a month. Any official driving requests undertaken by drivers during weekends will be considered overtime.

3.5 Design Methodology

Agile methodology will be used to carry out this project. This methodology is rooted in adaptive planning, early delivery and continuous improvement, all with an eye toward being able to respond to change quickly and easily.

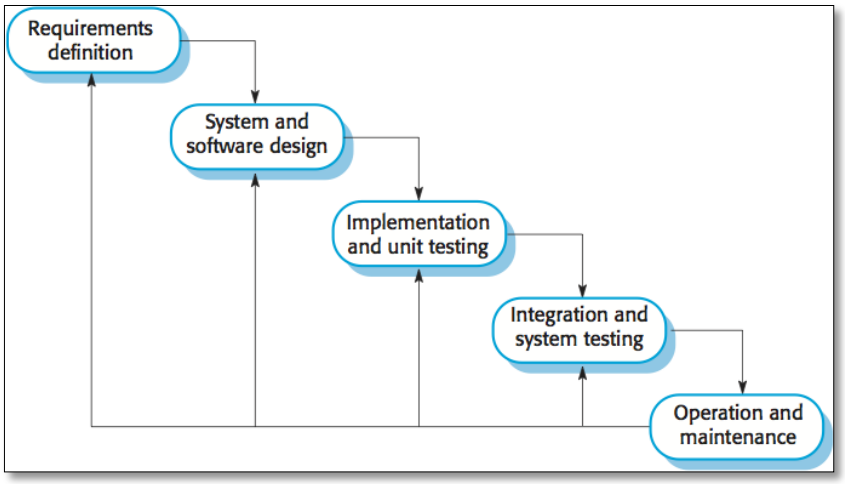


Figure 3.5.1 : Design Methodology

Requirements definition

- After observing the similar systems, not having organized mobile application and a web based system to schedule and track vehicles in a company was found as the issue and requirements are gathered accordingly.

System and design

- In designing phase conception and creation of the interfaces and design the actual mobile application and the web based system according to the layouts and structures will be performed.

Implementation and unit testing

- The proposed mobile application and web based system is to be developed using several different application software. During this phase all interface must be designed as required by each functional module maintaining uniformity and consistency throughout all designs. In addition all the processing functions, coding and the implementation of database should be completed.

Integration and system testing

- Ensures that the component is functioning as it was intended to during the design phase. Software testing is really required to point out the defects and errors that were made during the development phases.

Operation and maintenance

- A prototype is delivered to the supervisor and the modifications are done according to the feedback until the finalization of the system**.**

3.6 Alternative Design Methodologies

Table3.6.1 : Table of comparison design methodologies

Methodology	Pros	Cons
Waterfall Model	• Easy to understand and implement • Widely known • Document driven	• Does not match with the reality • Difficulty in risk management • Costly for small teams

	• Identifies deliverables and milestones	• Absence of an iterative nature
Spiral Model	• High risk analysis • Software is produced early at the life cycle • Better for large and mission critical projects	• Costly • Doesn't work on smaller projects • Project success depends on the way of risk analysis.
Agile Development Model	• Test based approach • Iterative • Incremental development is supported • Maintains simplicity	• Costly • Better in team projects • Lack of emphasis on documentation
Rapid Application Development Model	• High productivity • Iterative • Can be used at evolutionary requirements	• Suitable for projects requiring shorter development times • Costly
Rational Unified Process Model	• Accurate documentation • Integration throughout the life cycle of software development • Reusability of components	• Too complex • Need expertise

3.7 Comparison of Alternative Design Strategies

There are several alternative design strategies.

- Structured Design
- Function Oriented Design

Table3.6.2 : Comparison of Alternative Design Strategies

	Structured Design	Function Oriented Design
Features	• Conceptualization of problem into several well-organized elements of solution. • Concerned with the solution design • Give better understanding of how the problem being solved • Based on 'divide and conquer' strategy • Modules of the design are well organized	• System is viewed as a set of many smaller sub-systems known as functions. • Top down approach • Each function is described at large.
Pros	• Improved Design • Greater productivity • A good design has high cohesion and low coupling	• Higher level of abstraction • Structural decomposition • More expressive
Cons	• Lack of encapsulation • Repetition • Lack of information hiding	• Lack of encapsulation

3.8 Design Strategy

3.8.1 High-level Use case Diagram

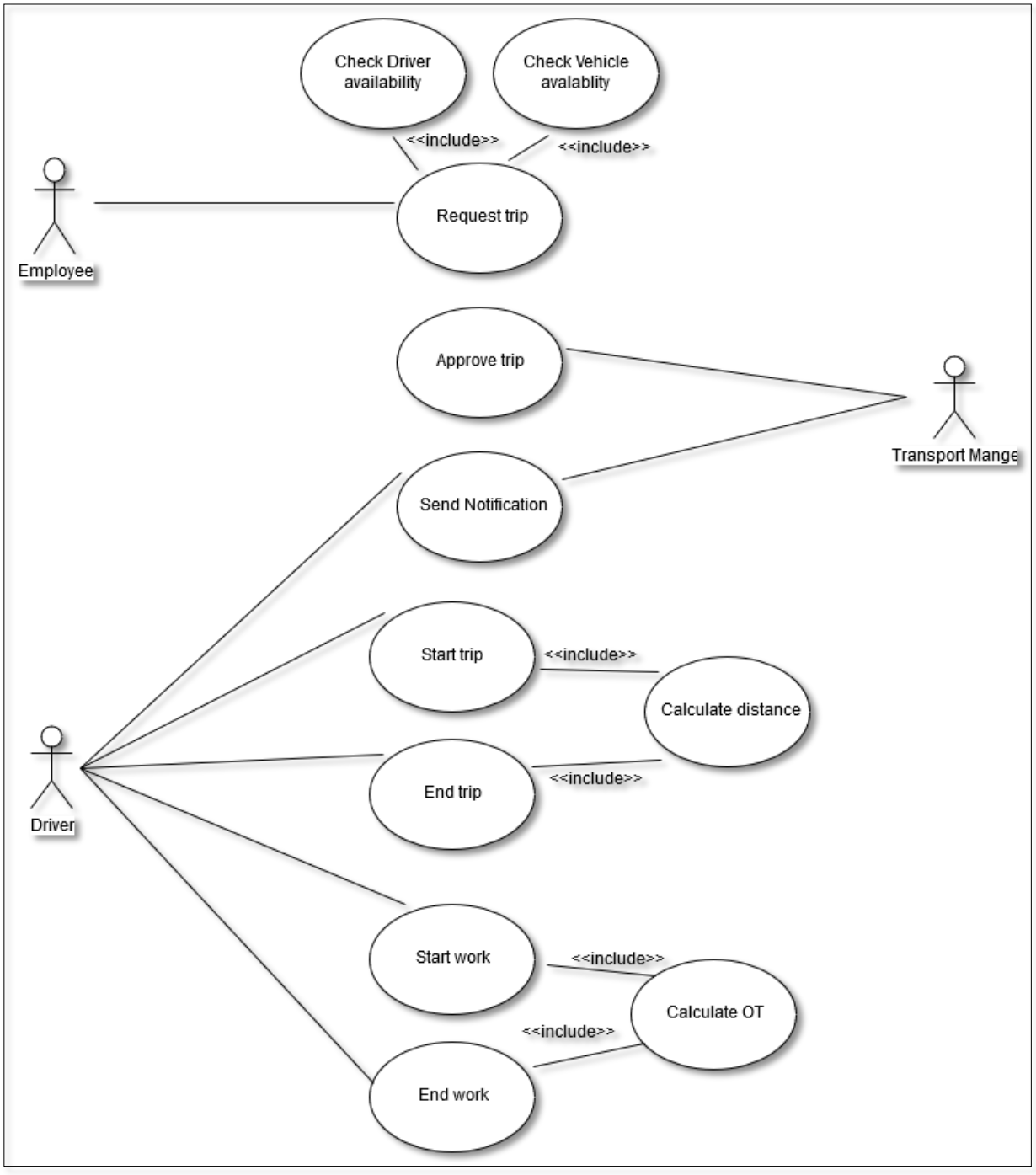


Figure 3.8.1 : Use Case Diagram

A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. This is made up of a set of possible sequences of interactions between systems

and users in a particular environment and related to a particular goal. A use case diagram contains four components.

- The boundary, which defines the system of interest in relation to the world around it.
- The actors, usually individuals involved with the system defined according to their roles.
- The use cases are the specific roles played by the actors within and around the system.
- The relationships between and among the actors and the use cases.

The main actors of the Route-Me System are identified as Employee, Transport Manager and Driver.

3.8.2 Class Diagram

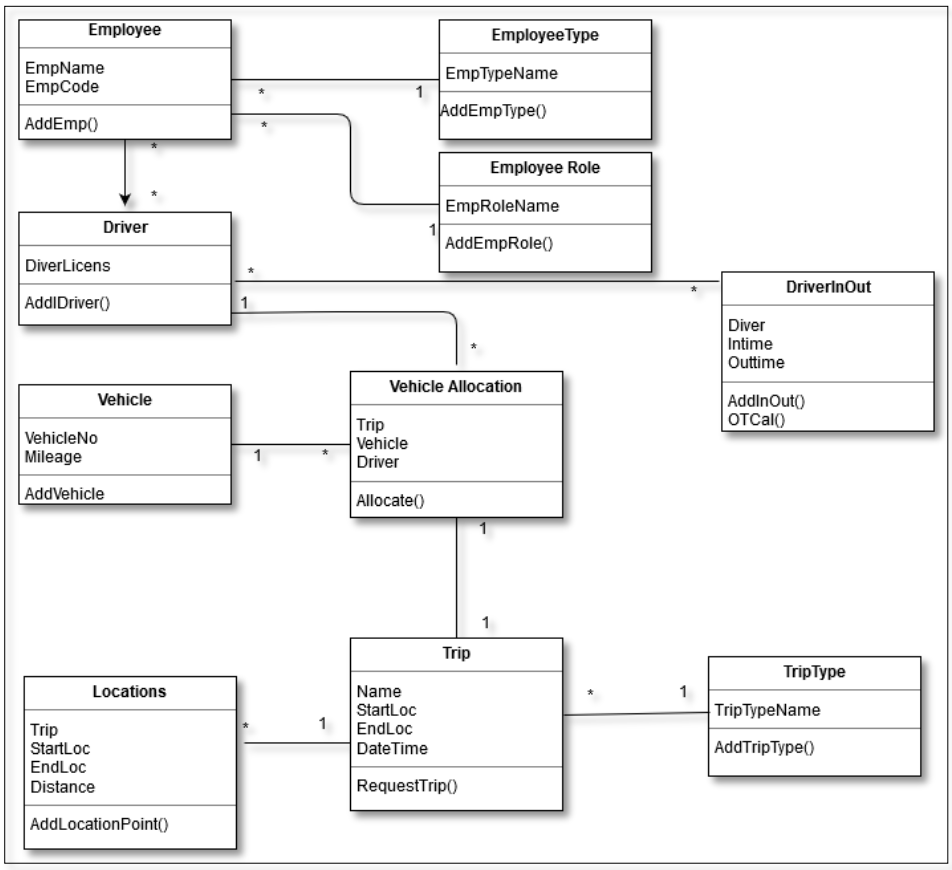


Figure 3.8.2 : Class Diagram

Class Diagram gives the static view of an application. A class diagram describes the types of objects in the system and the different types of relationships that exist among them. This modelling method can run with almost all Object-Oriented Methods. A class can refer to another class. A class can have its objects or may inherit from other classes.

UML Class Diagram gives an overview of a software system by displaying classes, attributes, operations, and their relationships. This Diagram includes the class name, attributes, and operation in separate designated compartments.

3.8.3 Entity Relation Diagram

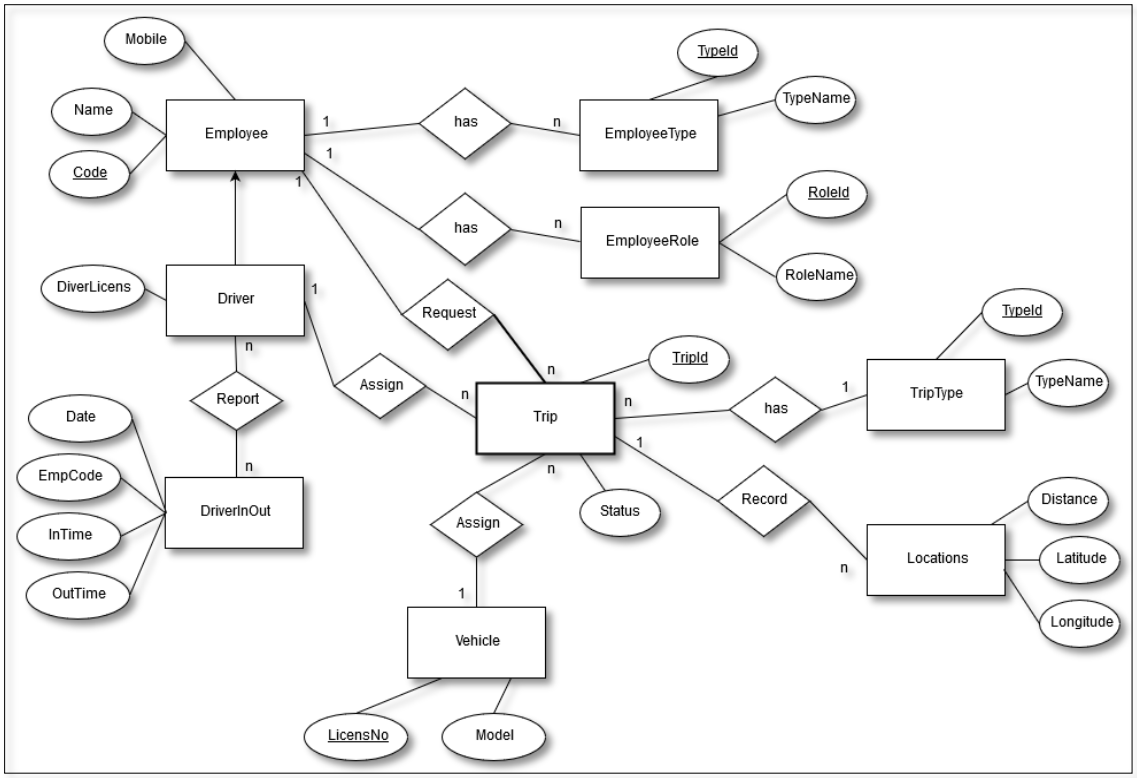


Figure 3.8.3: ER Diagram

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database. An entity in this context is an object, a component of data. An entity set is a collection of similar entities. These entities can have attributes that define its properties.

By defining the entities, their attributes, and showing the relationships between them, an ER diagram illustrates the logical structure of databases.

ER diagrams are used to sketch out the design of a database.

3.9 User Interface

3.9.1 Web Interfaces

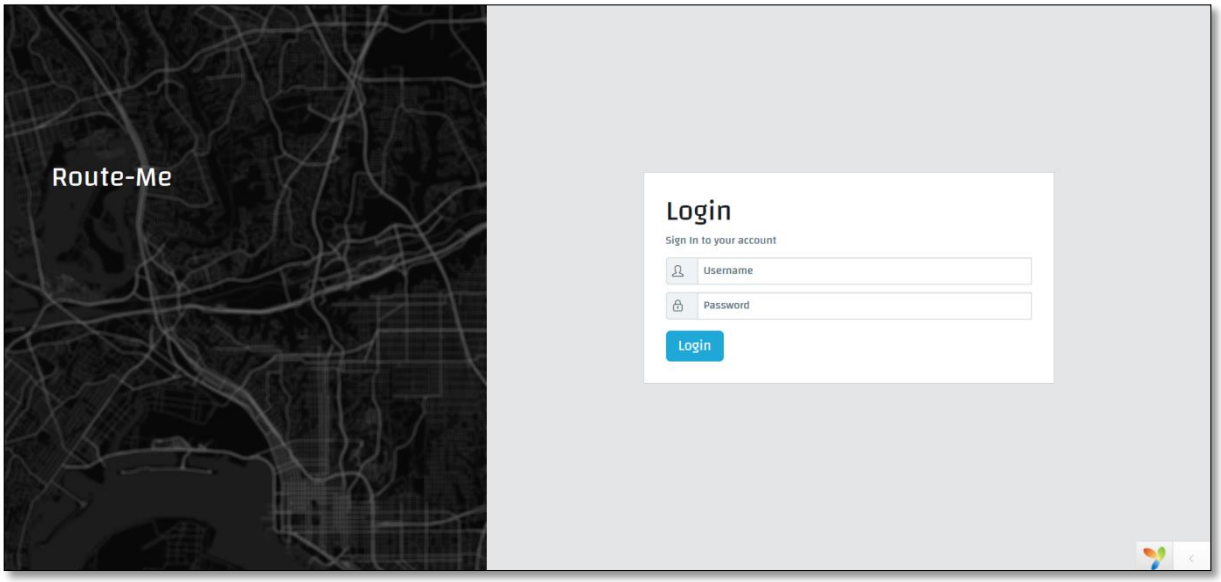


Figure 3.9.1 : Login

This is the system login, where all users can login to web site thought this login.

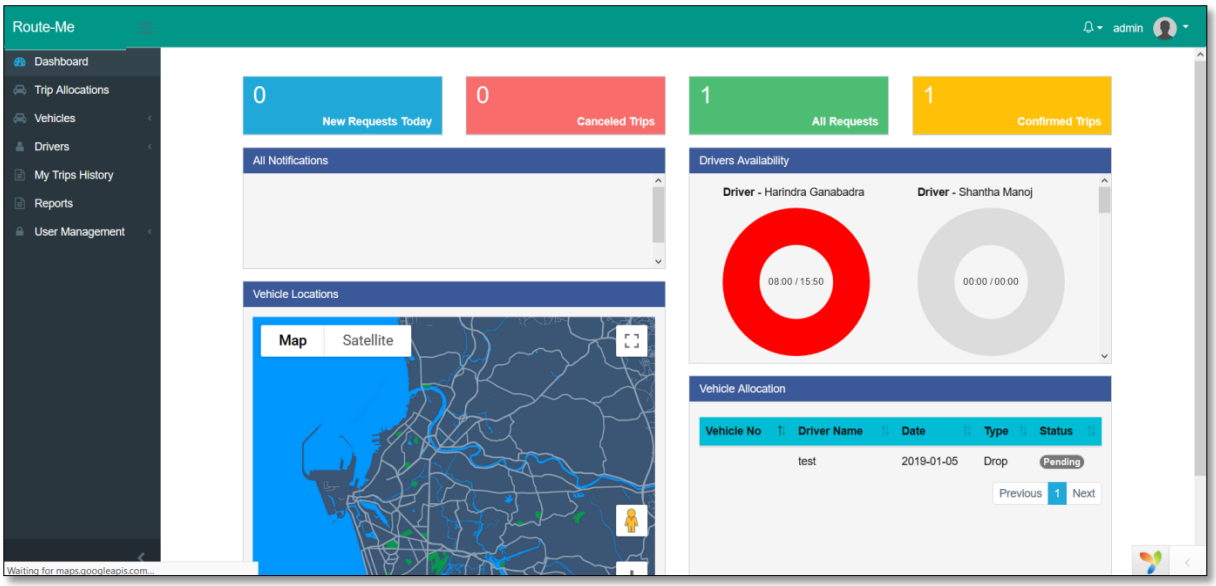


Figure 3.9.2 : Dashboard

This is dashboard, when user login goes to this page show some statists at once. Main menu is on left side.

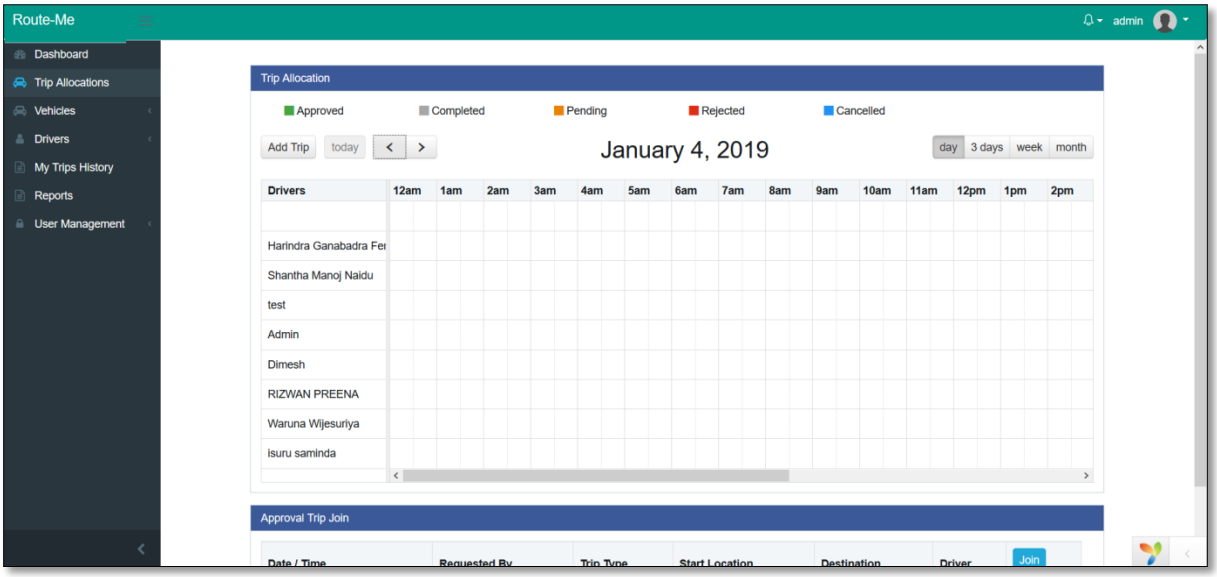


Figure 3.9.3 : Trip Allocation

Show all driver's time allocation (current request trips) with time line and if user need to allocate trip by clicking on "Add Trip".

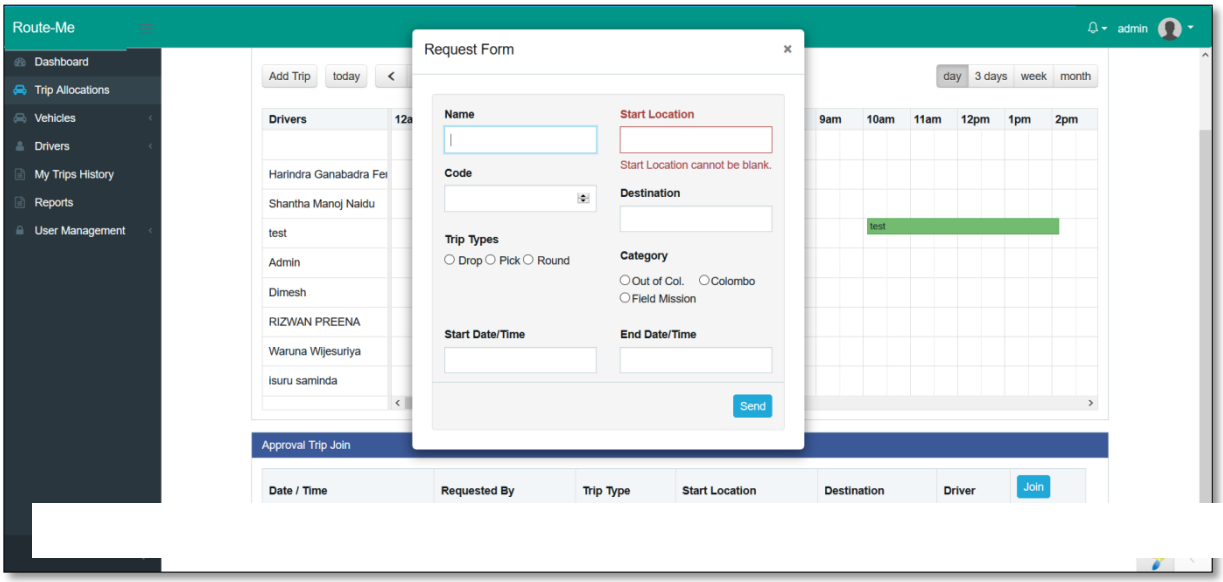


Figure 3.9.4 : Trip Request

User need to fill details to request trip.

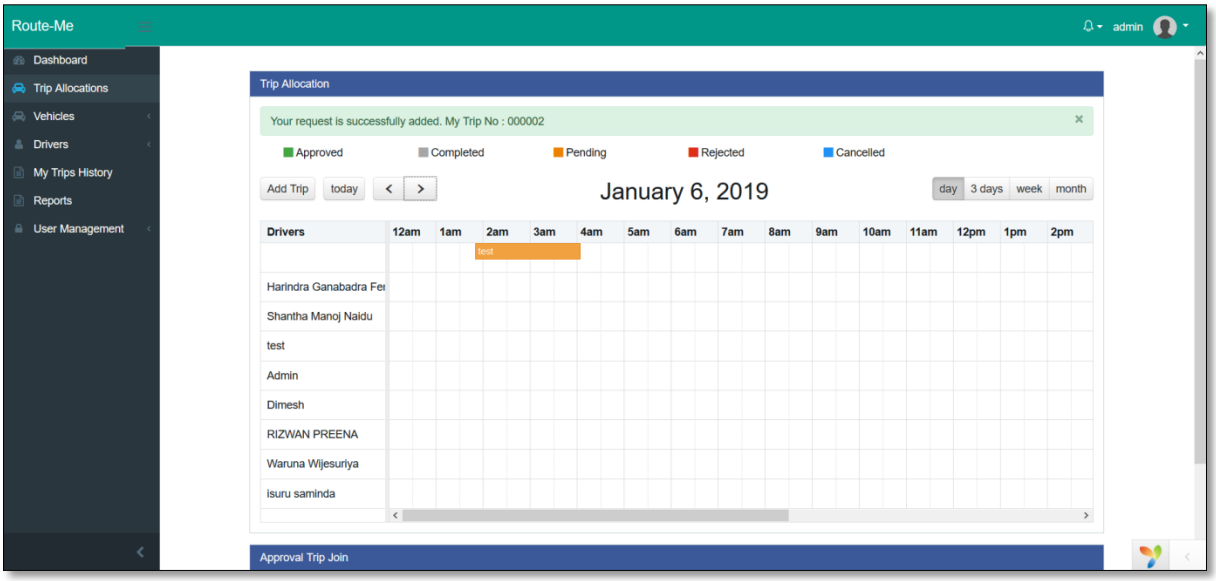


Figure 3.9.5 : Assign Driver and Approve Trip

Show all unapproved trips (orange colour) on first row for approval without driver name. Requested trip time shown in time line.

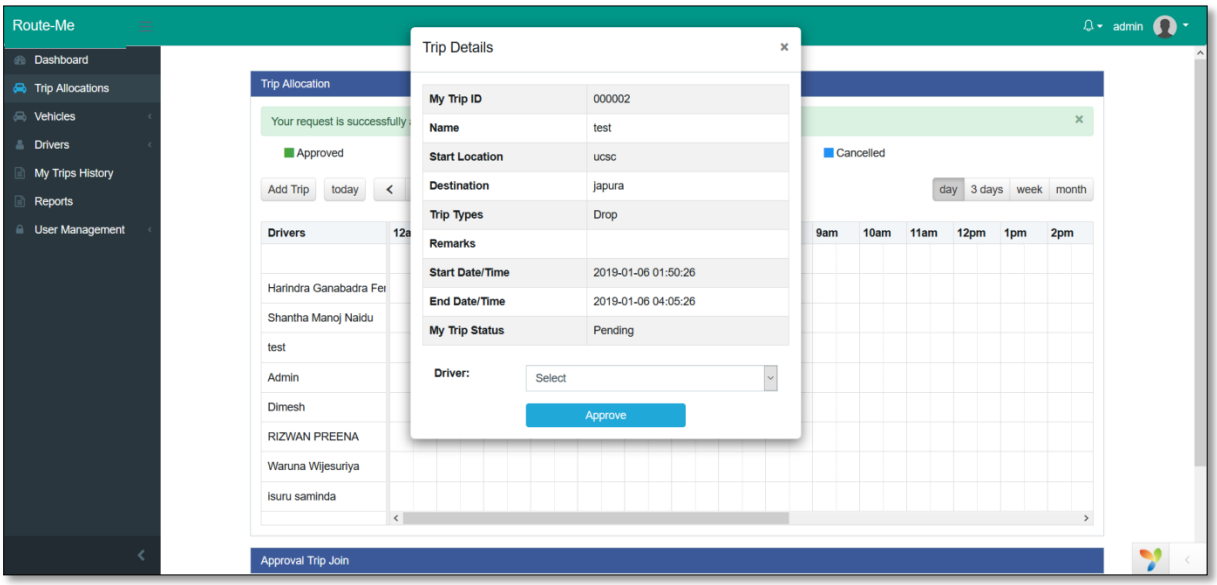


Figure 3.9.6 : Trip need to be Approved

To approve trip need to assign driver and need to approve by transport manager.

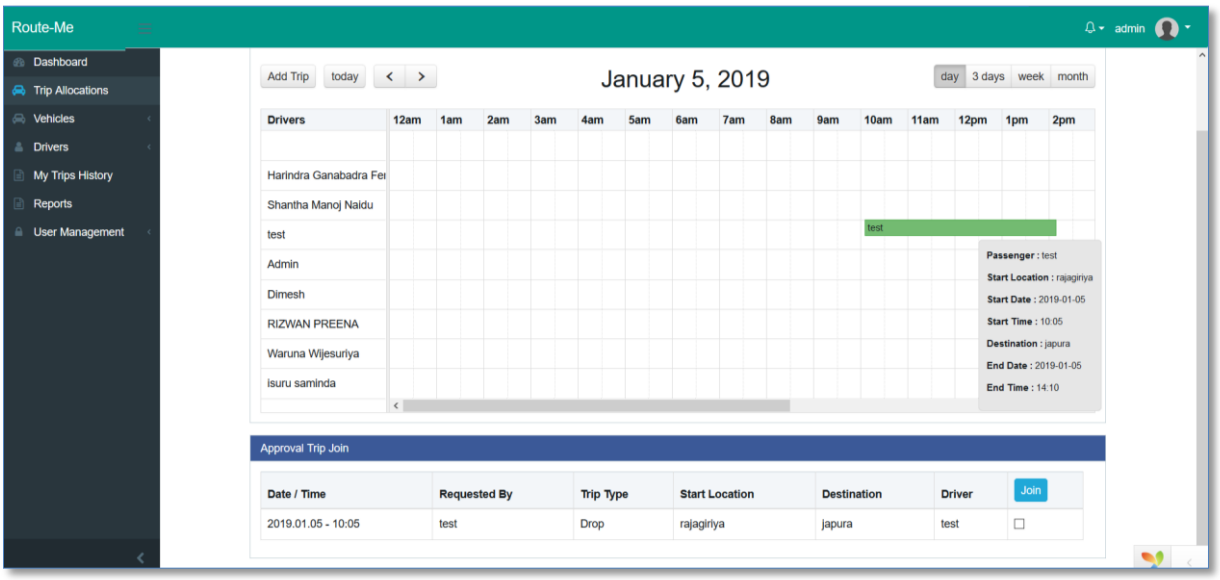


Figure 3.9.7 : Approved trip

All proved trips show in green colour according to driver name and allocated time.

3.9.2 Mobile Interfaces

Prerequisite requirement

- The mobile device **should** connect to the internet through WIFI or mobile Data.

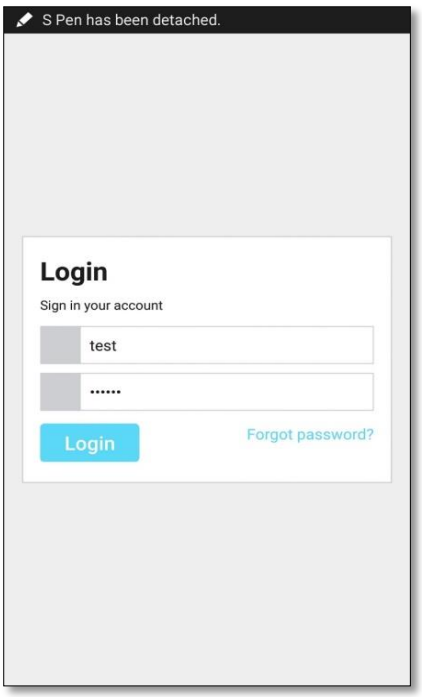


Figure 3.9.8: Screen A

- This is the first screen of the application. The user has to enter the login information which is given to them by the World Bank.
- As an example (Username – test ; Password - ******)
- Once user login to the application, user can use the application till he/she logouts.

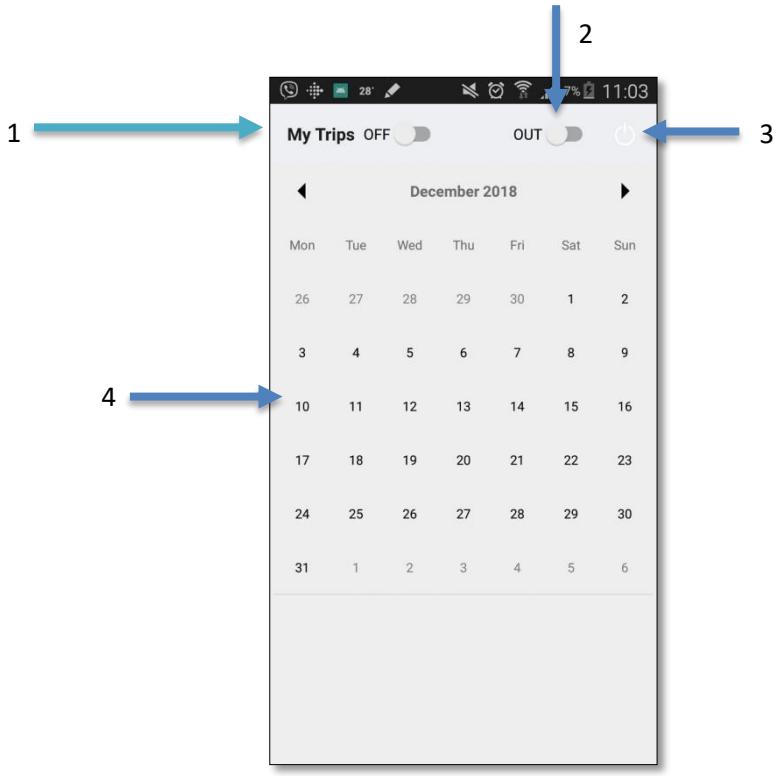


Figure 3.9.9 : Screen B

This is the main screen. After a successful login the application will direct the user to this screen. There are four main components in this screen.

1. My Trips ON/OFF button – This button uses to indicate the system whether user has attended to the work or not. Each day when user start working he/she should switch on this button and when he/she is off user has to switch off this button.
2. Vehicle IN/OUT button – This button uses to indicate system which vehicle the user is driving. When user switch on this button it will direct the application to another page.
3. Logout Button – Using this button user can logout from the application. Then user will direct to the first screen of the application.
4. Calendar

Figure 3.9.10 : Screen C

- When My trips are on the system should look like this.
- After user reported to work he can view all the trips he/she has been assigned. User has the privilege to view the trips on upcoming days.

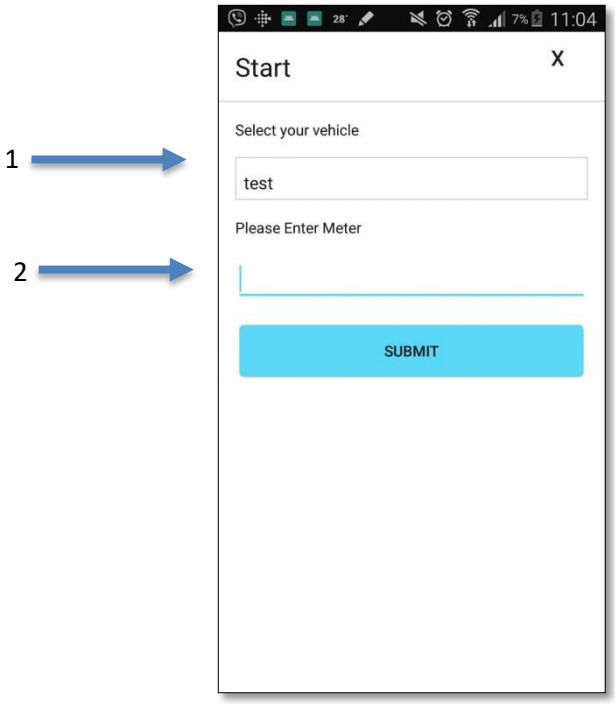


Figure 3.9.11: Screen D

When user switch on vehicle IN/OUT button it will direct to this page.

1. User has to select the vehicle. When user click Select your vehicle box it opens a drop down menu. In that menu there will be all the vehicles which facilitate this system. The user can select the vehicle he uses.
2. After selecting the vehicle the user has to enter the current odometer reading to proceed with the system.

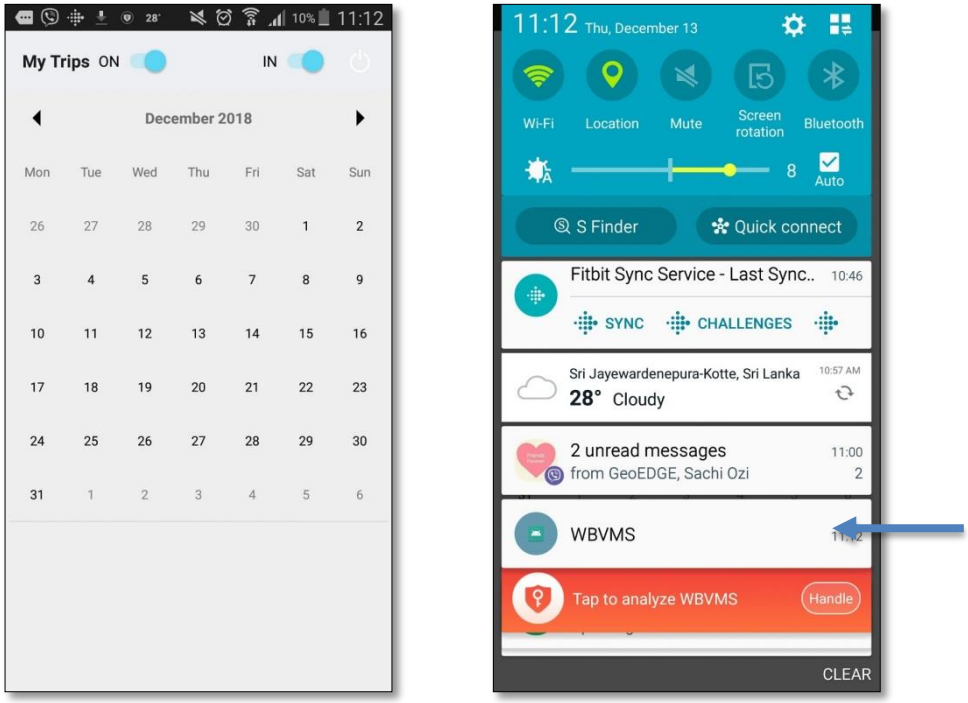


Figure 3.9.12 : Screen E1 and E2

- After successfully entering the values of the vehicle it automatically directs to main screen (Screen E(1)) and the top two buttons should be look as above.
- When the admin adds a task to a user that task will come as an notification to the mobile device.
- The user has to click the notification, then it will appear in the application.

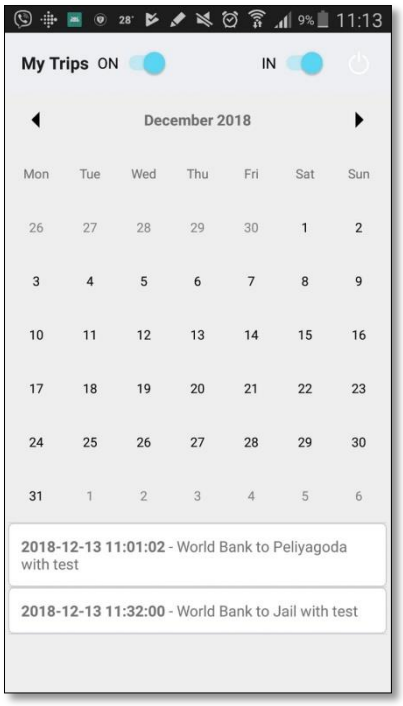


Figure 3.9.13 : Screen F

- When user is assigned with tasks, it will be shown as above.
- It normally shows the time, the name of the passenger, trip detail.
- When user wants to start a task he/she has to click the relevant task and that will direct to another page.

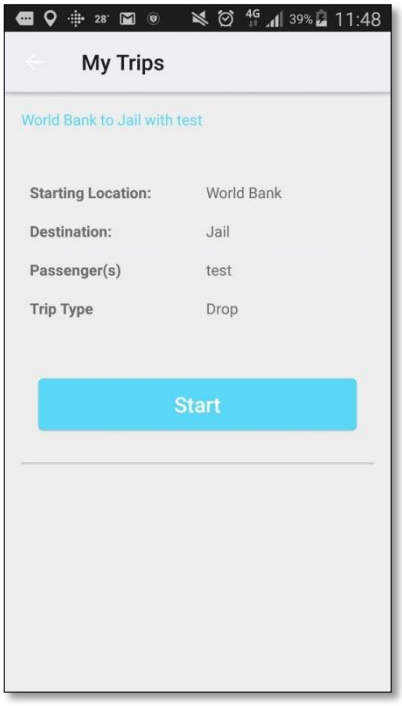


Figure 3.9.14 : Screen G

- In this page, user can view all the information about the application about the task. User can start task by clicking start button. Then the system recognizes that the user has started the trip.

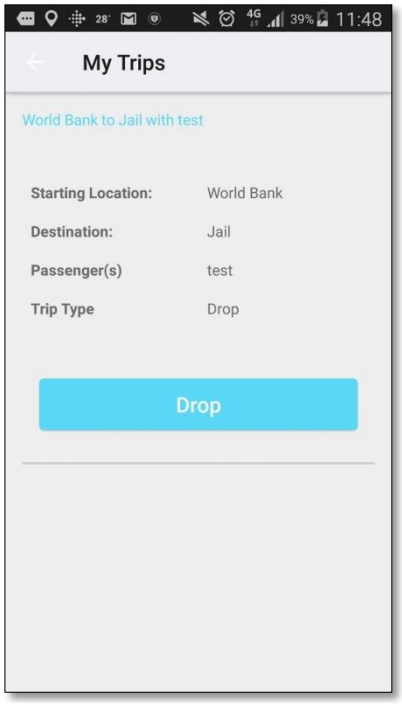


Figure 3.9.15 : Screen H

- When user finishes the given task he/she can click Drop button. That will direct the application to another page.

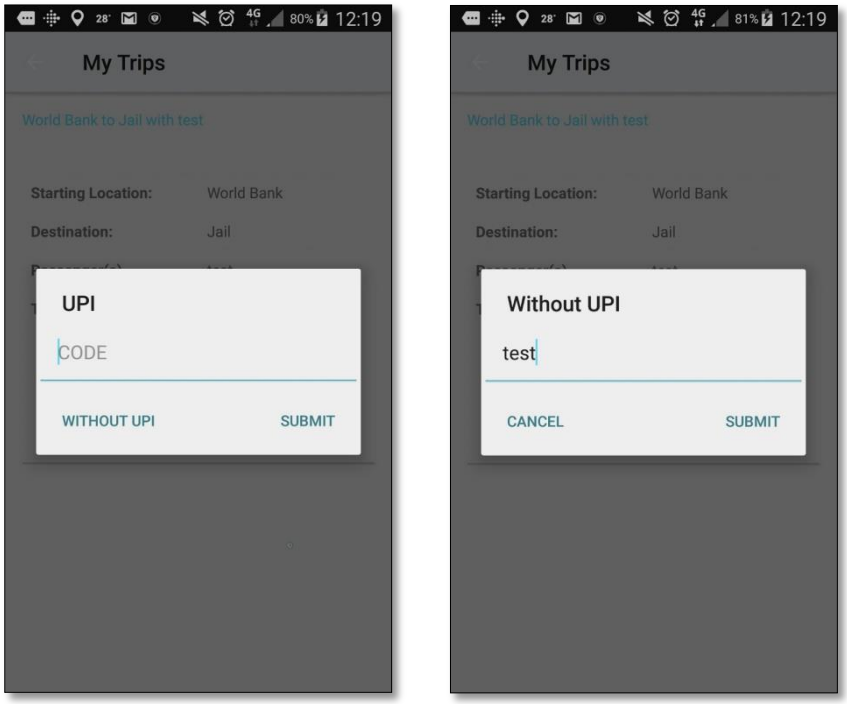


Figure 3.9.16 : Screen I (1) and I (2)

- After completing the task, user will be directed to the screen A. User has to enter the UPI code which is given to them by the World Bank. In case the user couldn't remember the UPI code he/she can choose WITHOUT UPI option.
- Then it will direct to the screen B. then user has to enter the name of the passenger to finish the task.
- After submitting the relevant information it will direct to another page.

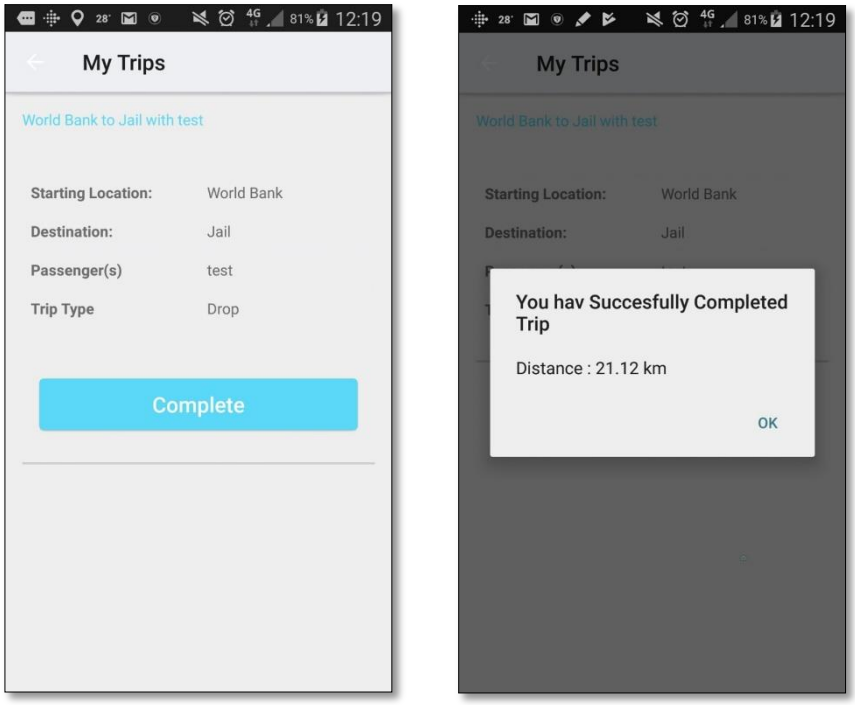


Figure 3.9.17 : Screen J(1) and J(2)

- After entering UPI or the passengers name it will direct to above page(Screen j(1)).
- Then user has to click complete button to end the trip. After that user will able to view the distance he/she travelled(Screen j(2)).
- If user presses ok button it will direct to main screen.

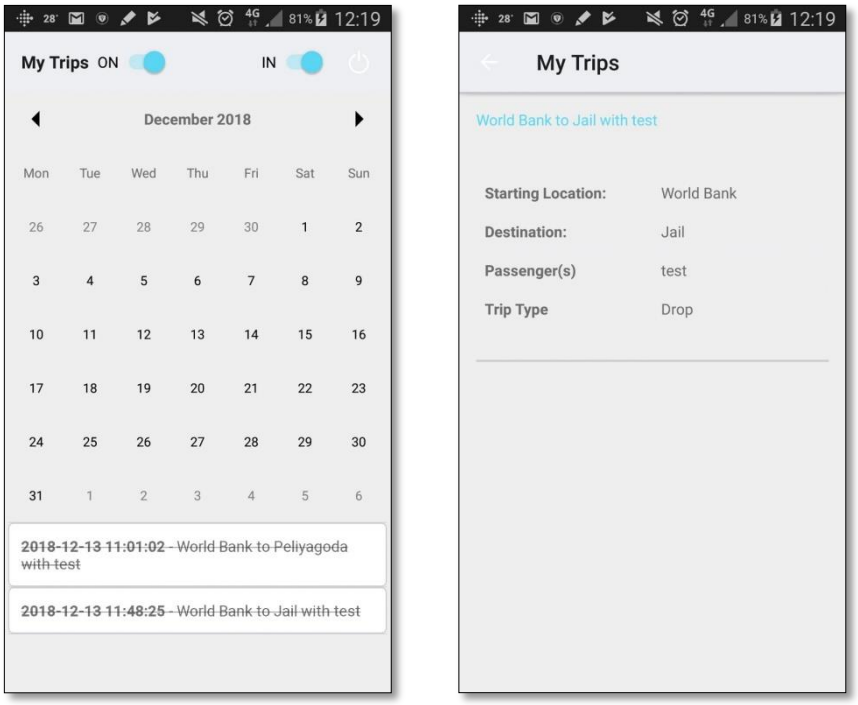


Figure 3.9.18 : Screen I(1) and I(2)

- After completing the trip the allocation will be notified as it is done. So user can identify which tasks have completed.
- If user click one of the completed tasks Information will be look as above(Screen I(2)).

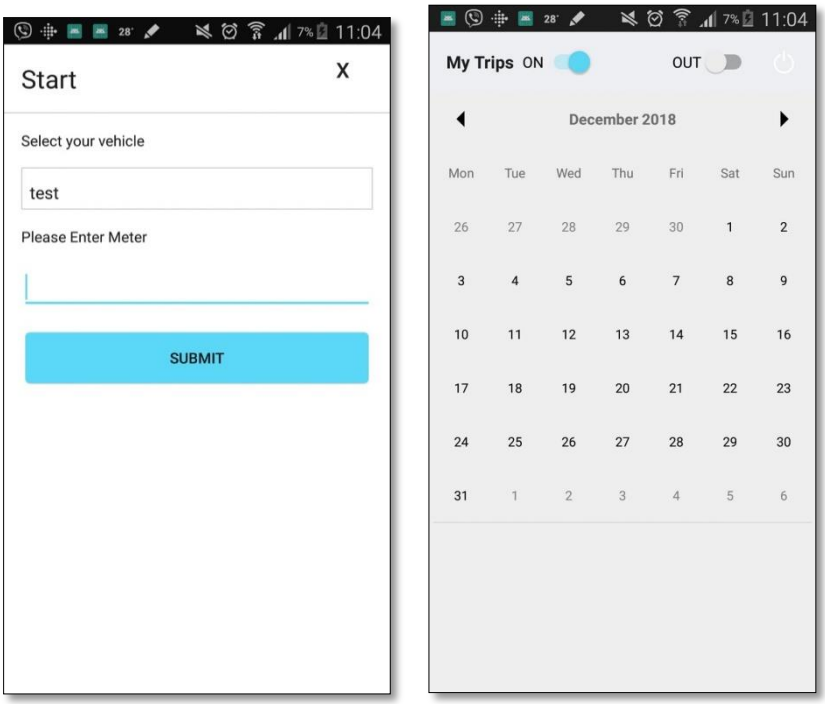


Figure 3.9.19 : Screen J(1) and J(2)

- Before user return the vehicle he/she should enter the odometer reading and logout from the vehicle.
- If user entered a false value he would not be able to logout from the vehicle.
- After logout from vehicle the main screen look as above J(2).Only then user can end the day by clicking My Trips switch to off.

Limitations to the user

- User cannot start a trip while he/she is in another trip. User has to finish on-going trip to start another trip.
- If user tries to enter a lesser value of odometer he cannot proceed to the system.

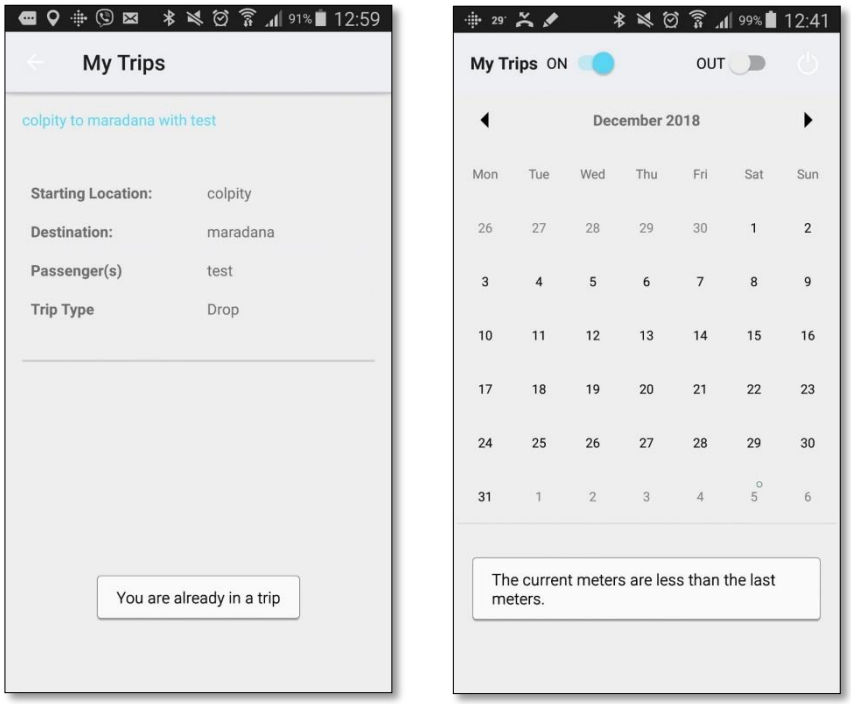


Figure 3.9.20 : Screen K(1) and K(2)

Chapter 04

Evaluation

4.1 Introduction

In software development “Evaluation” is a process measure whether all goals and requirements are achieved by the developed software. Evolution happed when after developed whole software. Mainly measures efficiency and effectiveness of developed software product.

Testing the software is the process of validating and verifying a software program. Validating means testing whether the requirements of the system are satisfying and verification means testing whether the system meets its functions. This is an important phase in the software development life cycle. So, the main objective of software testing is to deliver a quality product to the client. Therefore, a good system evaluation and testing has to be introduced to the system.

4.2 Test Plan

In the testing of the System, testing was conducted for the each functionality of the web site, starting from the login to each tasks of saving, searching, updating the records and alert generating, report generating that occur in the system. The testing was also carried on the rest of the API developed for mobile app.

When coding the system a unit test was carried out to check their performance as intended. Integration testing was done to test each modules of the system. Through integrated testing it was ensured that all the integrated modules performed correctly. After completing the unit testing and integrating testing according to the test strategies, the whole system was tested. After the system testing, the software was tested by the clients through a user acceptance testing to ensure whether the system fulfil their intended functions. Selenium IDE was used as an automation tool and the testing framework in the testing process of the web site. Questionnaire was made to collect the user feedback on the final outcome of the tested system.

Through this testing procedures, it was able to find instances where inaccurate outputs that are generated and wrong functioning of some modules. They were subjected to testing again and finally they were remedied. User feedback was also collected through the questionnaire and the system was tuned according the gathered feedback.

4.3 Test Cases and Test Results

4.3.1 Web Application

Table 4.3.1 : Login

No	Test Case	Expected Output	Actual Output	Status
01	Wrong user name entered	Shows error message	Shows error message	Pass
02	Wrong password entered	Shows error message	Shows error message	Pass
04	Identify username and password	Login success and shows username on home page	Login success and shows username on home page	Pass

Table 4.3.2 : Trip Allocation

No	Test Case	Expected Output	Actual Output	Status
01	Fill all required fields correctly and click send button	Add trip to calendar	Add trip to calendar	Pass
02	All required fields null and click send button	Shows error message	Shows error message	Pass

Table 4.3.3 : Trip Request

No	Test Case	Expected Output	Actual Output	Status
01	Click on trip in calendar	Shows a popup with trip details and list available drivers to the dropdown	Shows a popup with trip details and list available drivers to the dropdown	Pass

Table 4.3.4 : Assign Driver

No	Test Case	Expected Output	Actual Output	Status
01	Select driver from the dropdown and click approve button	Send notification message driver	Send notification message driver	Pass
02	Not select driver from the dropdown and click approve button	Shows error message	Shows error message	Pass

Table 4.3.5 : Trip Approval

No	Test Case	Expected Output	Actual Output	Status
01	Click approve button	Add trip to calendar	Add trip to calendar	Pass

4.3.2 Mobile Application

Table 4.3.6 : Login

No	Test Case	Expected Output	Actual Output	Status
01	Wrong user name entered	Shows error message	Shows error message	Pass
02	Wrong password entered	Shows error message	Shows error message	Pass
03	Press Cancel Button	Cancel details filled	Cancel details filled	Pass
04	Identify username and password	Login success and shows username on home page	Login success and shows username on home page	Pass

Table4.3.7 : Driver Work On

No	Test Case	Expected Output	Actual Output	Status
01	Switch on	Toggle button changed to blue colour.	Toggle button changed to blue colour.	Pass

Table 4.3.8 : Driver Work Off

No	Test Case	Expected Output	Actual Output	Status
01	Switch off	Toggle button changed to ash colour.	Toggle button changed to ash colour.	Pass

Table 4.3.9 : Vehicle In

No	Test Case	Expected Output	Actual Output	Status
01	Switch on	Toggle button changed to blue colour and direct to vehicle selecting page.	Toggle button changed to blue colour and direct to vehicle selecting page.	Pass

Table 4.3.10 : Vehicle Out

No	Test Case	Expected Output	Actual Output	Status
01	Switch off	Toggle button changed to ash colour.	Toggle button changed to ash colour.	Pass

Table 4.3.11 : Start Work

No	Test Case	Expected Output	Actual Output	Status
01	Click Select your vehicle box	List all the vehicles	List all the vehicles	Pass
02	Required fields null	Shows error message	Shows error message	Pass

03	Admin adds trip from web application	Shows notification message in mobile	Shows notification message in mobile	Pass

Table 4.3.12 : Trip Notification

No	Test Case	Expected Output	Actual Output	Status
01	Admin adds trip from web application	Shows notification message in mobile	Shows notification message in mobile	Pass
02	Click Notification	Direct to the calendar with assigned trips	Direct to the calendar with assigned trips	Pass

Table 4.3.13 : Start Trip

No	Test Case	Expected Output	Actual Output	Status
01	Click on assigned trip	Shows the time, the name of the passenger, trip details.	Shows the time, the name of the passenger, trip details.	Pass
02	Click on start button	Start button changed the status into drop	Start button changed the status into drop	Pass

Table 4.3.14 : End Trip

No	Test Case	Expected Output	Actual Output	Status
01	Click on drop button	Shows popup to enter the UPI code	Shows popup to enter the UPI code	Pass
02	Enter Valid UPI code	Direct to page with complete button	Direct to page with complete button	Pass
03	Click Without UPI and enter passenger name	Direct to page with complete button	Direct to page with complete button	Pass

04	UPI or Without UPI fields null	Shows error message	Shows error message	Pass
05	Incorrect UPI code	Clear field	Clear field	Pass
06	Click Complete button	Shows successful message with trip distance	Shows successful message with trip distance	Pass
07	Click ok button in successful message	Direct to first page with calendar	Direct to first page with calendar	Pass

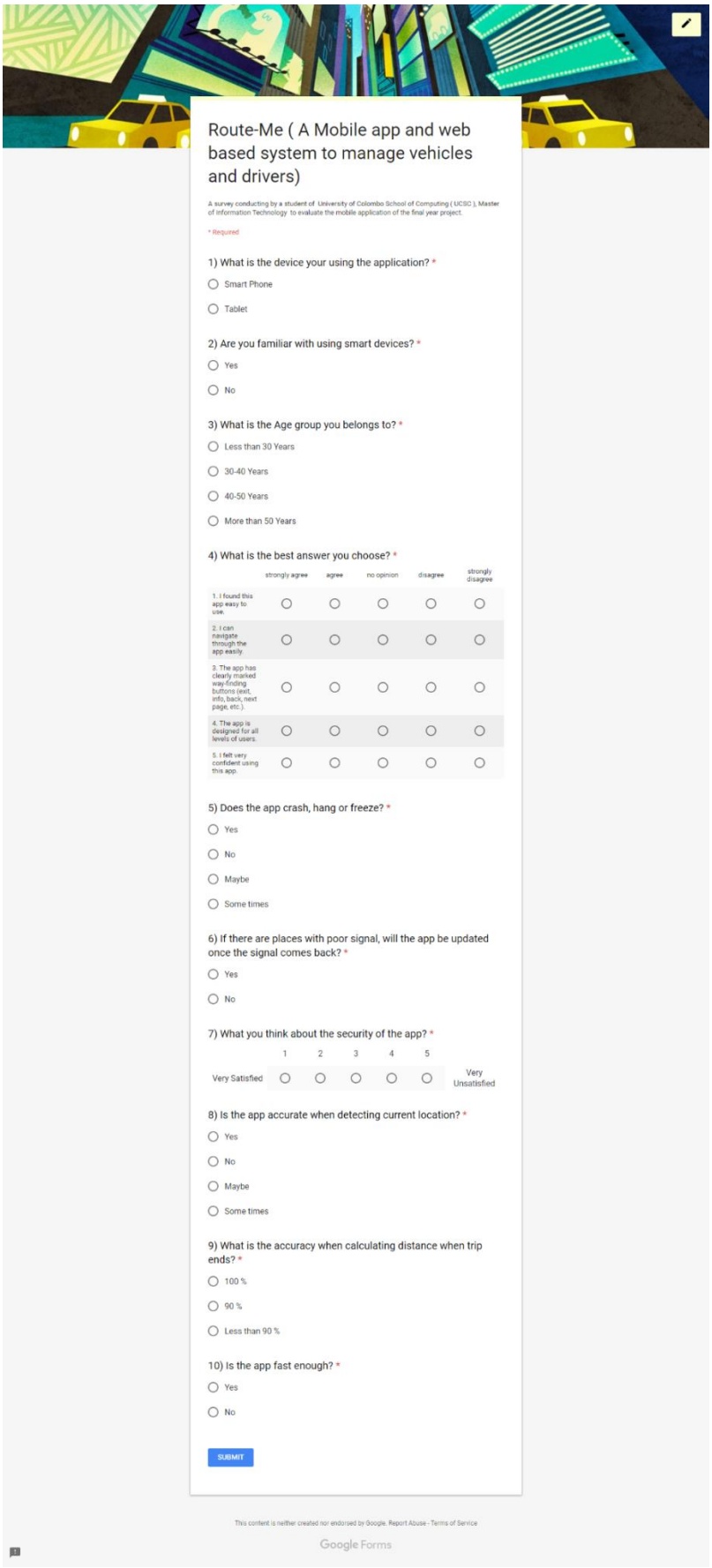
4.4 Tested Devices

Application can be installed in Android devices and web base system can be viewed by chrome browser.

Table 4.4.1 : End Trip

Tested Devices	Operating System
Samsung J7	Android 7.0 - Nought
Samsung J7	Android 8.0 – Oreo
Samsung Note 3	Android 5.0 – Lollipop
Samsung Note 3	Android 6.0 - Marshmallows

4.5 Questioner for developed system



Route-Me (A Mobile app and web based system to manage vehicles and drivers)

A survey conducting by a student of University of Colombo School of Computing (UCSC), Master of Information Technology to evaluate the mobile application of the final year project.

* Required

1) What is the device your using the application? *

- Smart Phone
- Tablet

2) Are you familiar with using smart devices? *

- Yes
- No

3) What is the Age group you belongs to? *

- Less than 30 Years
- 30-40 Years
- 40-50 Years
- More than 50 Years

4) What is the best answer you choose? *

	strongly agree	agree	no opinion	disagree	strongly disagree
1. I found this app easy to use.					
2. I can navigate through the app easily.					
3. The app has clearly marked way-finding buttons (exit, info, back, next page, etc.).					
4. The app is designed for all levels of users.					
5. I felt very confident using this app.					

5) Does the app crash, hang or freeze? *

- Yes
- No
- Maybe
- Some times

6) If there are places with poor signal, will the app be updated once the signal comes back? *

- Yes
- No

7) What you think about the security of the app? *

	1	2	3	4	5	
Very Satisfied						Very Unsatisfied

8) Is the app accurate when detecting current location? *

- Yes
- No
- Maybe
- Some times

9) What is the accuracy when calculating distance when trip ends? *

- 100 %
- 90 %
- Less than 90 %

10) Is the app fast enough? *

- Yes
- No

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Figure 4.5.1 : Questionnaire

Chapter 05

Conclusion

5.1 Overview

Global E Marketing is a leading classified advertising company in Sri Lanka. Their main branch situated in Kadawatha. They started their business activities in a traditional way. But as the competition arouse, they were in need of an automated computer system in order to make their work more easy, efficient and cost effective. Global EMS have their own vehicles and drivers pool to collect classified advertisements by visiting various site locations.

From this system support to arrange those trips to visit locations and keep records of all the information such as the name of the diver assigned, the vehicle assigned, booking time, the name of the officer requested the trip, drivers working hours, drivers' idle hours, drivers OT hours and distance travelled from this mobile app/web system. For management and staff can view real-time situation from this system.

The new developed system saves the time of the user. Because of the simplicity even a person having less knowledge of IT can use this system. The interfaces are designed attractively and simple in order to keep the user-friendliness. This system has become a valuable solution for the business activities of Global E Marketing Solutions, because of the includance of all above mentioned distinguished features in the system.

5.2 Lessons Learnt

By doing this project, learnt how to apply the theoretical knowledge what was gained over the past three years practically.

At the initial stage, even at the submission of the project proposal, a clear idea on the development of the system was not available. But gradually followed the guidelines for the project and learnt how to overcome the weaknesses. Proper time management were achieved by following the schedule of the project. The implementation phase was the hardest phase of the project and it made to try out the languages like PHP and Android in deep. Other than that learn about GPS systems and distance calculation from the mobile devices. Writing the dissertation was another interesting part of the project. There the writing skills were improved further more.

5.3 Critical Assessment of the Proposed System

This system is unique from already existing other similar applications, as it is developed to cover client's specific requirements. Normally the similar applications are only of one type, such as vehicle maintaining or financial handling etc. But this system is a combination of several such modules and fulfils client's all requirements and the need of several systems at once in a single system.

- Mobile cannot use offline. (Unable to use without an internet connection)
- Inability to merge two trips in the same route in same time.

Mobile Application User Evolution Results Summary

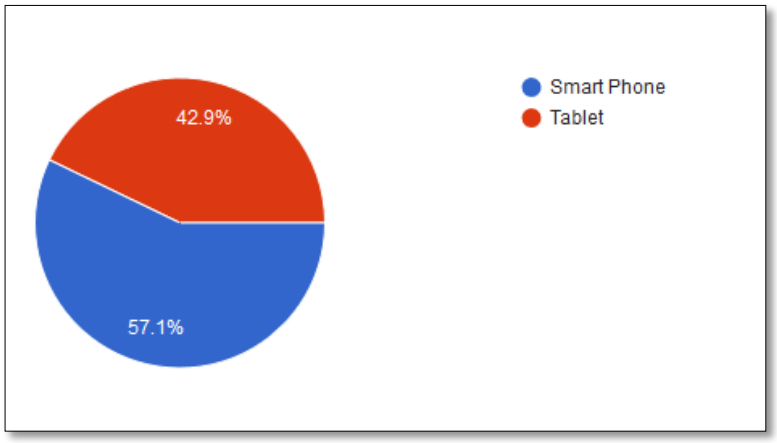

Figure 5.3.1 Summary of used device

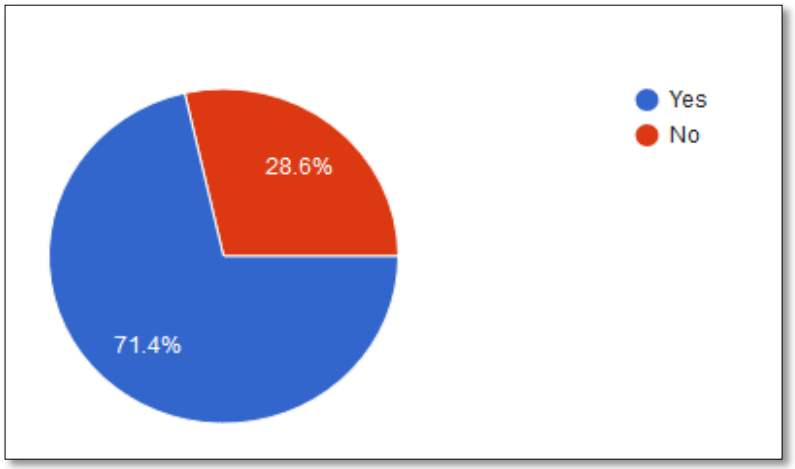

Figure 5.3.2Familiarity of using smart devices

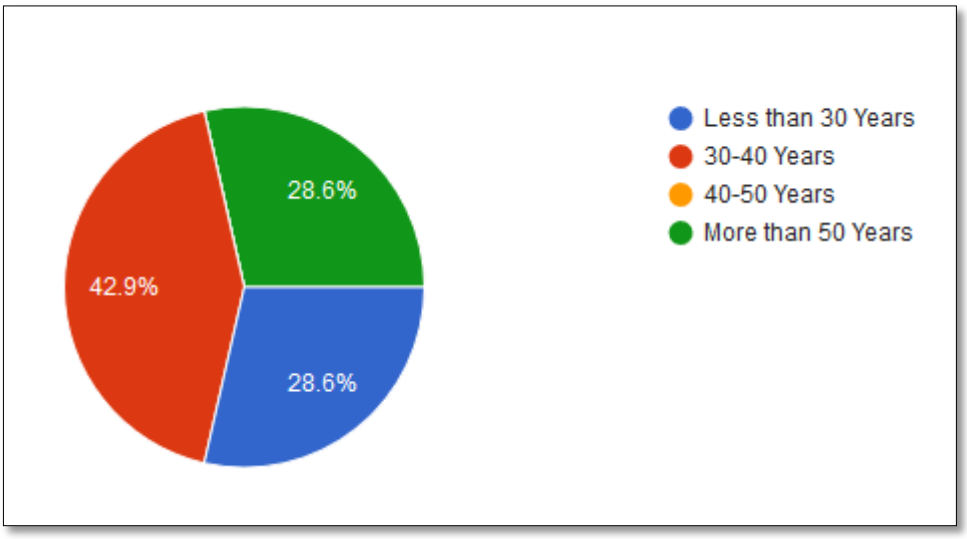

Figure 5.3.3 User belong age group

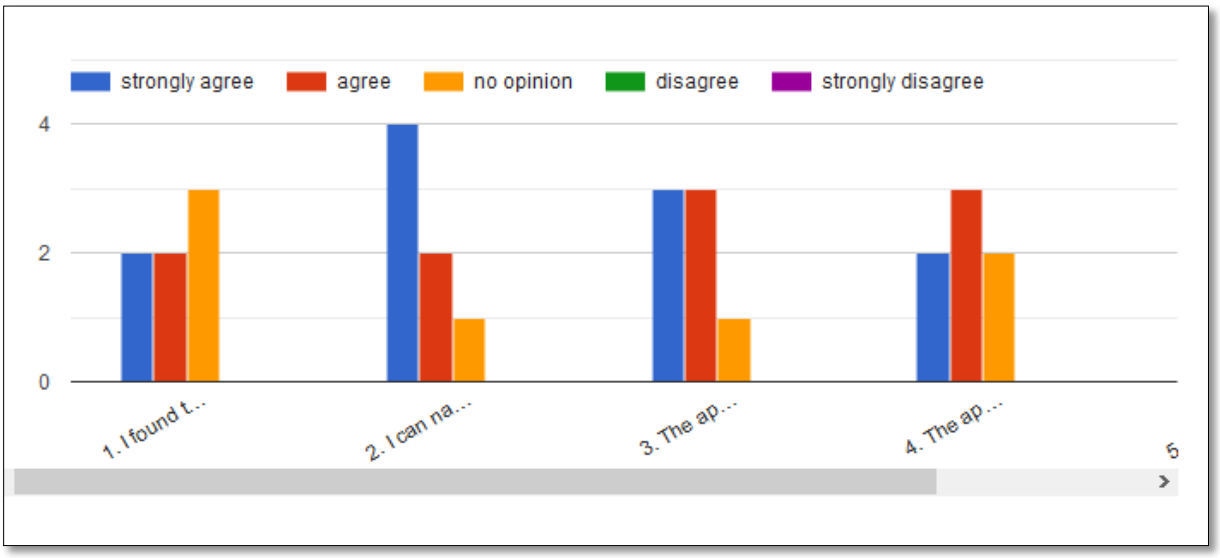

Figure 5.3.4 User interfaces experience

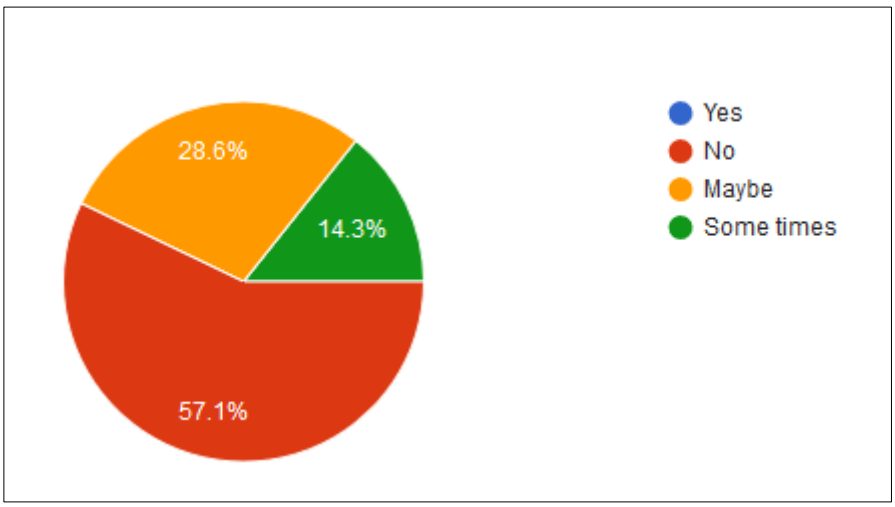

Figure 5.3.5Application crash, hang or freeze

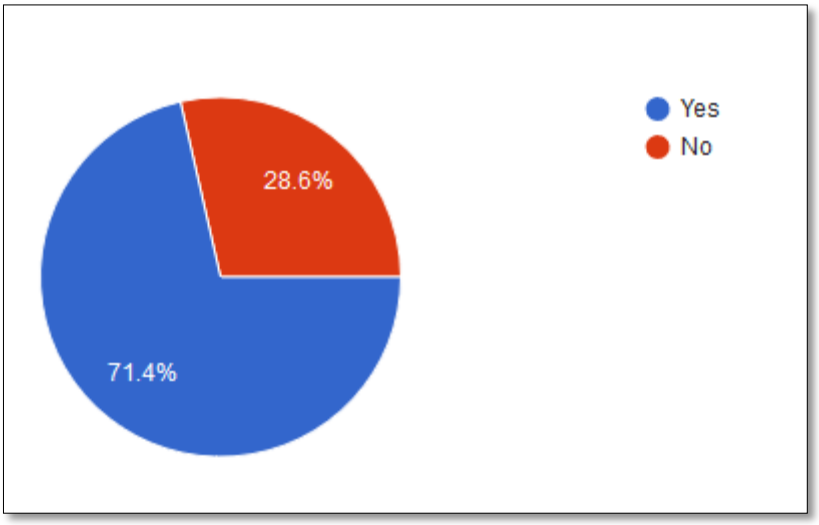

Figure 5.3.6Working with poor signal strength

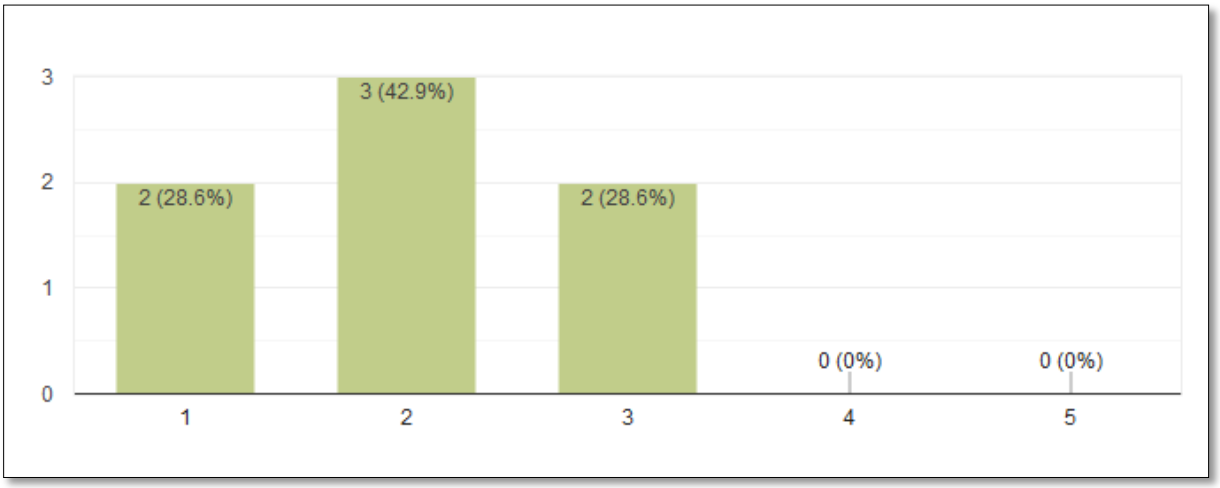

Figure 5.3.7 User satisfaction with the app security

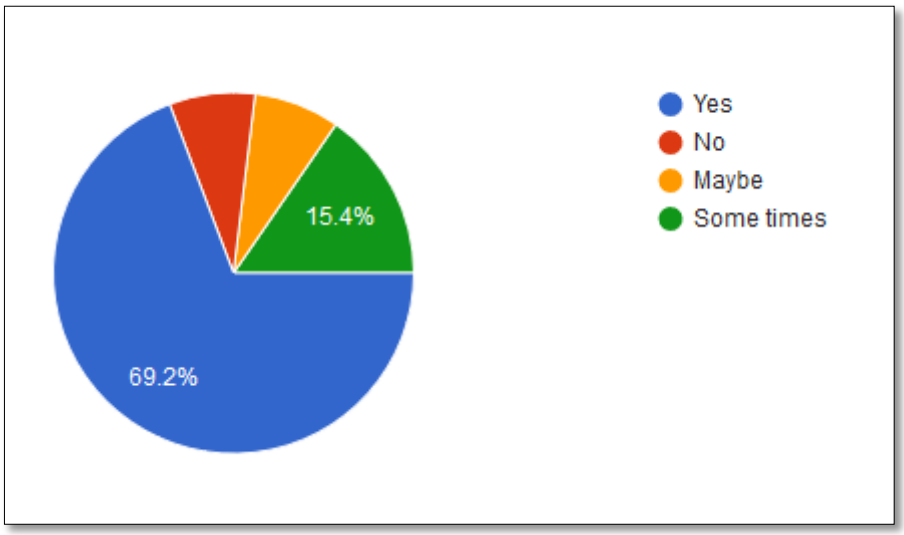

Figure 5.3.8 Accuracy of detecting location

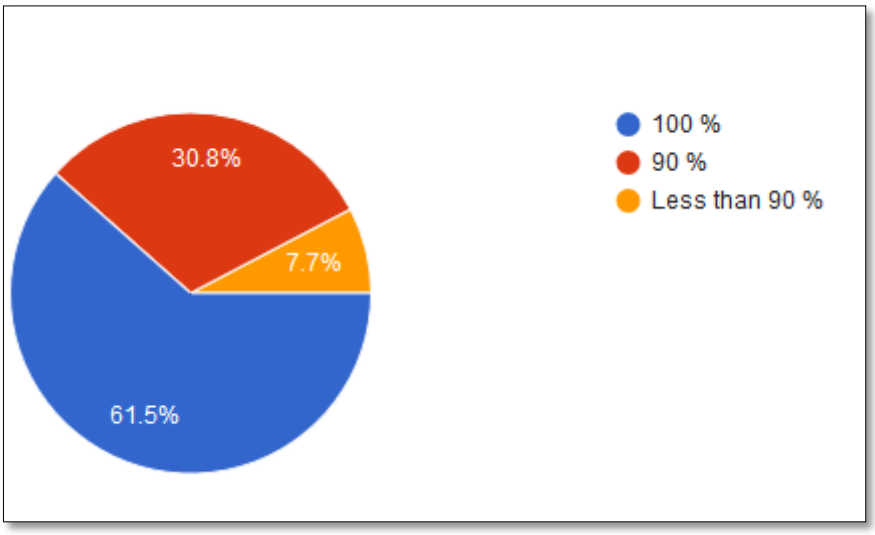

Figure 5.3.9 Accuracy of distance calculation at end of the trip

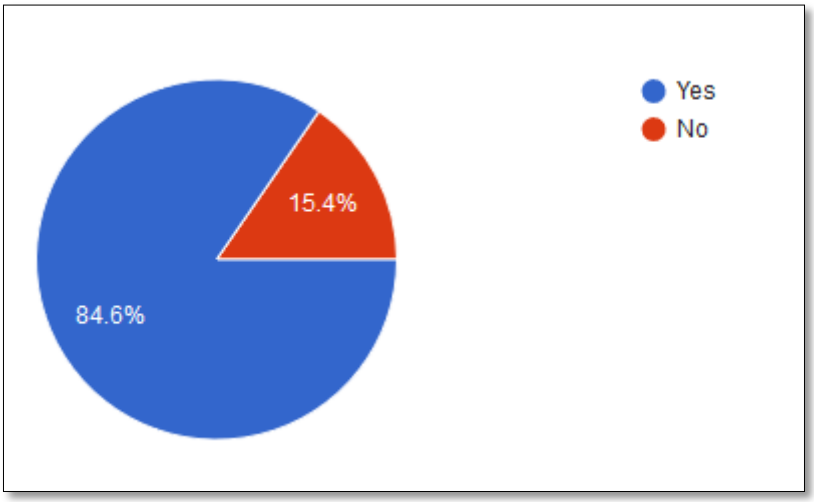

Figure 5.3.10 User satisfaction with application speed

5.4 Future Enhancements

The system could be improved and enhances with the following features.

- Calculate average time distance before trip start.
- Alert before trip start.
- Create an IOS app for this mobile application.
- Send alert via SMS.
- Trip allocation calendar merge with Google calendar.

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Appendix – A

Mobile Application Programming Interface

1. **Login authentication**

Request:

…/apilogin?username=<xxxxx>&password=<123456>

Response:

{"status":"success", "message":"successful login", "data":{"id":<user_id>, "username":"<username>", "token":"xxxxxxxx"}}

Error:

{"status":"error","message":"password is failed.","data":""}

2. **Get trip details assigned to the driver**

Request:

.../apitrips_assigned?token=<xxxx>&id=<user_id>

Response:

"status" : true,

"Driver" : Details of driver (user),

"Driver_allocated" : Trip list assigned to the driver,

"Trip_details" : Trip details,

"Trips_join" : Trip group,

"Vehicles" : Available vehicle list

Error:

"status" : false,.....

3. **Driver's work start/end date-time**

3.1 To check driver's current work is status.

Request:

.../apidriver_status?id=<user_id>&token=<xxxx>

Response:

{"status":true,"meassage":"work_on","data":
{"id":<last_task_id>,"drivers_id":<drivers_id>,"start_task_datetime":"2018-07-23 1 6:43:59","end_task_datetime":null,"task_status":1}}

{"status":false,"meassage":"work_off","data":"Driver is off for the last task."}

3.2 When driver's work on or off, update date/time to the record.

Request:

.../apidriver_task_update?

token=<xxxx>&id=<driver_id>&last_task_id=<last_task_id>&task_status="<xxxxx>"

When driver's work on, send the request as task_status=work_on. Else task_status=work_off.

4. **Driver select a vehicle and return vehicle.**

4.1 To check current vehicle selected by driver.

Request: .../apivehicle_status?token=<xxxx>&id=<user_id>

Response:

{"status":true,"meassage":"Vehicle_on",
"data":{"id":4,"vehicle_no":"CAQ-2134","vehicle_types_id":1,"vehicle_make":"JEEP","vehicle_model":"Navara","fule_id":2,"meter":4,"vehicle_status":1,"user_id":2,"created_date":"2018-06-26 13:14:02","updated_date":"2018-06-26 13:14:02","fule_consumption":"12.00","cost":"12.00","next_service_date":null,"next_meter":null,"service_interval":1,"km_interval":21},
"last_vehicle":{"id":41,"vehicles_id":4,"drivers_id":15,"start_meter":122500,"start_datetime":"2018-07-23 13:17:51","end_meter":null,"end_datetime":null}}

- Hint

  "Meassage" : "Vehicle_on" => vehicle which has been already selected, is still used.

  "data" : Details of vehicle has been already selected by driver.

  "last_vehicle" : report of the vehicle selected.

or

{"status":false,"meassage":"Vehicle_off","data":"Driver is off for the last task."}

4.2 To select a vehicle

Request:

.../apiupdate_driver_allocation?token=<xxxx>&id=””&trip_status=”other_vehilce_start”&meter=<120000>&geo_location=””&distance=””&employee_id=””&vehicle_id=”<vehicle_id>”&driver_id=<driver_id>&join_no=””& date_time=”2018.07.04 00:00:00”

Response:

“Status” : true,

“Message” : “success_other_vehilce_start”,

“Id” : <id_selected_last_vehicle>

Error:

“Status” : false,

“error”: “error”,

“Message” :

“The last vehicle selected by you is not completed. Please handover the vehicle to the company.”

or

“The current meters are less than the last meters.”,

“Id” : <id_selected_last_vehicle>

4.3 To return vehicle

Request:

.../apiupdate_driver_allocation?token=<xxxx>&id=<id_selected_last_vehicle>&trip_status=”other_vehilce_end”&meter=<120100>&geo_location=””&distance=””&employee_id=””&vehicle_id=”<vehicle_id>”&driver_id=<driver_id>&join_no=””& date_time=”2018.07.04 00:00:00”

Response:

“Status” : true,

“Message” : “success_other_vehilce_end”,

“Id” : <id_selected_last_vehicle>

Error:

“Status” : false,

“error”: “error”,

“Message” : “failed_other_vehilce_end”,

“Data” :

"ID is invalid for selecting other vehicle or The current meters are less than previous meters"

Or

"ID is invalid for selecting other vehicle."

"Id" : <id_selected_last_vehicle>

5. To update the trip selected by the driver

Request:

.../apiupdate_driver_allocation?token=<xxxx>&id="<driver_allocated_id>"&trip_status="<xxxx>"&meter=<120000>&geo_location="<current geolocation>"&distance=3.091&employee_id=<employee UPI or name>&vehicle_id="<vehicle_id>"&driver_id=<driver_id>&join_no=<trip_group_id>& date_time="2018.07.04 07:34:00"

- Hint

  Trip type:

  1. PICK : trip_status="start" -> trip_status="end"
  2. DROP : trip_status="start" -> trip_status="end"
  3. ROUND : trip_status="start" -> trip_status="stop" -> trip_status="start_again" -> trip_status="end"

Response:

"Status" : true,

"Data" : "Driver updated successfully. <Trip ID>,

"next_trip_status" : <next_trip_status>

Error:

"Status" : false,

"error": "error"

6. Send geolocation and distances to server

Request:

.../apigeo_locations_test?token=<xxxx>&id="<driver_allocated_id>" &startLocation=<geolocation>&endLocation=<geolocation>&mobile_data=<xxx>&located_datetime=<"2018.07.04 07:34:00">&sequence=<number>

- Hint

If Online, mobile_data=1.

If Offline, mobile_data=2.

Response:

"Status" : true,

"meassge" : success,

"distance" : <Total distance>

Error:

"Status" : false,

"meassge": "error"

7. Get total distance

Request:

.../apigeo_total_distance?token=<xxxx>&id="<driver_allocated_id>"

Response:

"Status" : true,

"total_distance" : <Total distance>