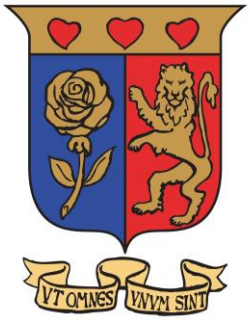

Strathmore University

Faculty of Information Technology

UNIVERSITY CARPOOL SYSTEM

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An Information System proposal submitted to the Faculty of Information Technology in partial fulfillment of the award of a Degree in Bachelor of Science in Informatics and Computer Science

Date of submission: 15th September 2017

Declaration

We declare that this project has not been submitted to any other university for the award of a Degree in Bachelor of Science in Informatics and Computer Science.

Students' signatures:

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Dr. Joseph Orero, PhD.

Sign: _____ Date: _____

Abstract

Many people living in Nairobi often suffer travelling to work or school in the morning or leaving in the evening. The main means of reaching work or school is through the institution's buses, a personal vehicle, public transport and walking. Due to the wanting public transport, many people would rather drive to their destination.

It was noted that some of the members who are going in the same direction drive alone. Hence, we have a situation where hundreds of vehicles are on the road, leading to the sever traffic jams we experience daily. Moreover, it increases the amount of pollution which has a negative impact on the environment. Strathmore University is not immune to this problem. The number of the students and staff drive to institution is larger than the available parking spaces. This leads to the parking lot filling up early in the morning. Anyone who misses a spot will have to look for another space in the vicinity or return the vehicle home.

This problem can be solved through the use of carpooling. Carpooling is the sharing of a car journeys so that more than one person uses the vehicle. By just a few people in one vehicle instead of in separate ones, traffic problem will immediately start to reduce.

In this study, we propose to develop an Android application that will allow members of Strathmore to have an easier and stress free means of coming to the institution. Users will be able to register as either a driver and provide transport or as a rider seek transport respectively. The system will match users coming from the same area and enable the, to easily share a ride. This will not only alleviate the congestion of vehicles within the organization but will also reduce the increasing congestion levels on the roads.

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Chapter 1: Introduction

1.1 Background

Many people living in Nairobi often suffer travelling to work or school in the morning or leaving in the evening. The main means of reaching work or school is through the institution's buses, a personal vehicle, public transport and walking. Due to the wanting public transport, many people would rather drive to their destination.

It was noted that some of the members who are going in the same direction drive alone. Hence, we have a situation where hundreds of vehicles are on the road, leading to the sever traffic jams we experience daily. Moreover, it increases the amount of pollution which has a negative impact on the environment. This problem has been attempted to be fixed through the expansion of roads. This is insufficient because the roads which face the largest congestion, such as Mombasa Road, do not have any room for expansion. Another attempt was the building of the bypass. While this has had an impact, it is still not sufficient. It is designed for people on one side of the city to easily get to another side. As such those within the city are still affected.

The university offers transportation for its members to and from the CBD at specific times of the day; early in the morning to the university and twice in the evening while taking them back to the CBD. For one to use the bus, they only require there Strathmore identification card. There are also numerous hostels in its surroundings which makes it possible for a portion of its members to reach the institution through walking. For the rest of the population who do not use either of these means of transport, they either have personal vehicles, or use public means. For those with private vehicles, there is a parking area within the school grounds. Some staff members, especially those in administrative positions, have a designated parking area within the first phase of the school whereas the students and other members have a larger parking area within the second phase of the school.

Strathmore is continuously growing as an institution with more staff and students joining the institution. This has both good and bad implications to the institution. For the latter, the facilities are quite affected, especially the parking space. It was also noted that some of the members of the institution singly arrive in a vehicle which leaves numerous other seats that could be used to carry others. This would not only be advantageous to the institution but also to the environment as we try to fight global warming.

1.2 Problem statement

The issue with the current system is that people living within a certain area often use different means of transport towards the same place. This has contributed to road congestion as well as facility strain in the institution; there are only a limited number of parking spaces compared to the number of members with personal vehicles who would like to use them. During the semester, the parking is often filled up by 9 am.

1.3 Aim

To develop an Android application that will allow Strathmore members to easily find nearby members and use a shared means of transport to the institution.

1.4 Specific objectives

i. To analyze existing carpool systems.
ii. To investigate challenges faced by existing carpool systems
iii. To design, develop and test an Android based carpool system.
iv. To test the functionality of the developed system.

1.5 Research questions

i. What are the existing carpool systems?
ii. What are the challenges faced by the users?
iii. What are the available carpool systems?
iv. Does the developed system function?

1.6 Justification

The proposed system is a worthwhile undertaking because it will reduce congestion and pollution on Kenyan roads and in the institution as well as give members of Strathmore an efficient and headache free means of transport towards and from the institution.

1.7 Scope/limitation

The system will only be available for members of Strathmore.

The application will only be available on Android.

The application will require an active internet connection.

The application will require location services.

The application will not facilitate payment between the driver and the riders.

Chapter 2: Literature Review

2.1 Introduction

The transport systems available in Kenya are walking, public transport, private vehicles, an institution owned bus or a car for hire with a driver. Institution owned buses are restricted to members of the institution, private vehicles to their owners and the prices of car for hire are often high so the only options left are public transport and walking, the latter of which is not practical in some situations.

This chapter reviews the existing carpool systems, identifying their challenges and their gaps.

2.2 Existing carpool systems

2.2.1 Carrambee

According to an article written by The Standard in 2014 Carrambee is a web based carpooling facilitator developed by Edwin Ongola. Its website is supposed to be carrabmee.com but the domain is available for purchase. There is a Facebook and a Twitter profile of the same name, however, the last activity on the pages were in 2014 and 2015 respectively and offer no insight into the organization. Another website in the article is carpooling.co.ke (© 2016 carPooling Kenya. All Rights Reserved.)

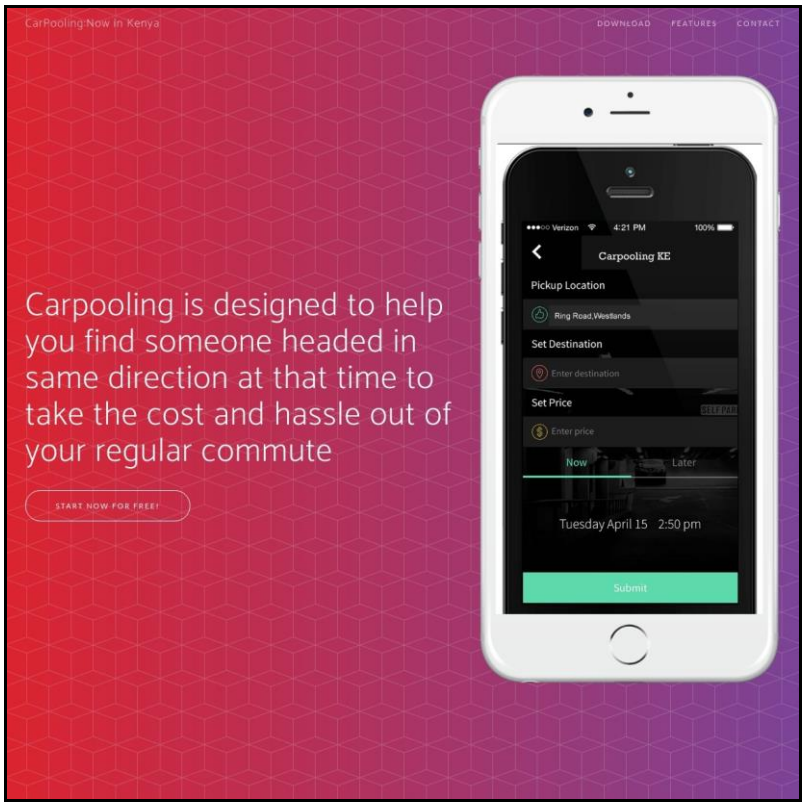


Figure 2.1: Carpooling.co.ke homepage. Source: carpooling.co.ke

This website is active, however, the links to download their apps or contact them lead nowhere. The only other mention of the Carrambee is from three nearly identical articles posted early this year that only list it as an available carpooling facilitator. It is therefore safe to assume that Carrambee is no longer active, if it ever was.

2.2.2 CarpoolWorld

CarpoolWorld is an international ride sharing app that regards itself as Kenya's most popular rideshare. It has 481881 registered users across the world.

Their website is https://www.carpoolworld.com (© 2000-2017 Datasphere Corporation). It offers a page to add details about your ride after which it will send a confirmation code to your email.

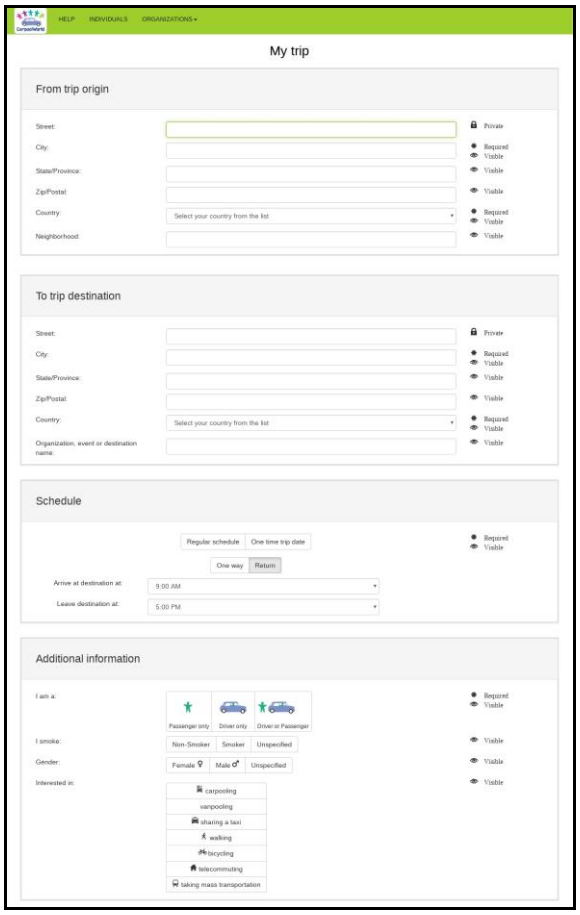


Figure 2.2: CarpoolWorld signup form. Source: https://www.carpoolworld.com/trips_form.html

After logging in, it allows you to edit your trip, delete it or add a new trip. The system attempts to match your trips with other similar ones based on filters such as passengers or drivers, smokers or non-smokers, gender and regular schedule or one time trip. Once it matches you or you find a trip that you want, it offers you a contact form communicate with the person.

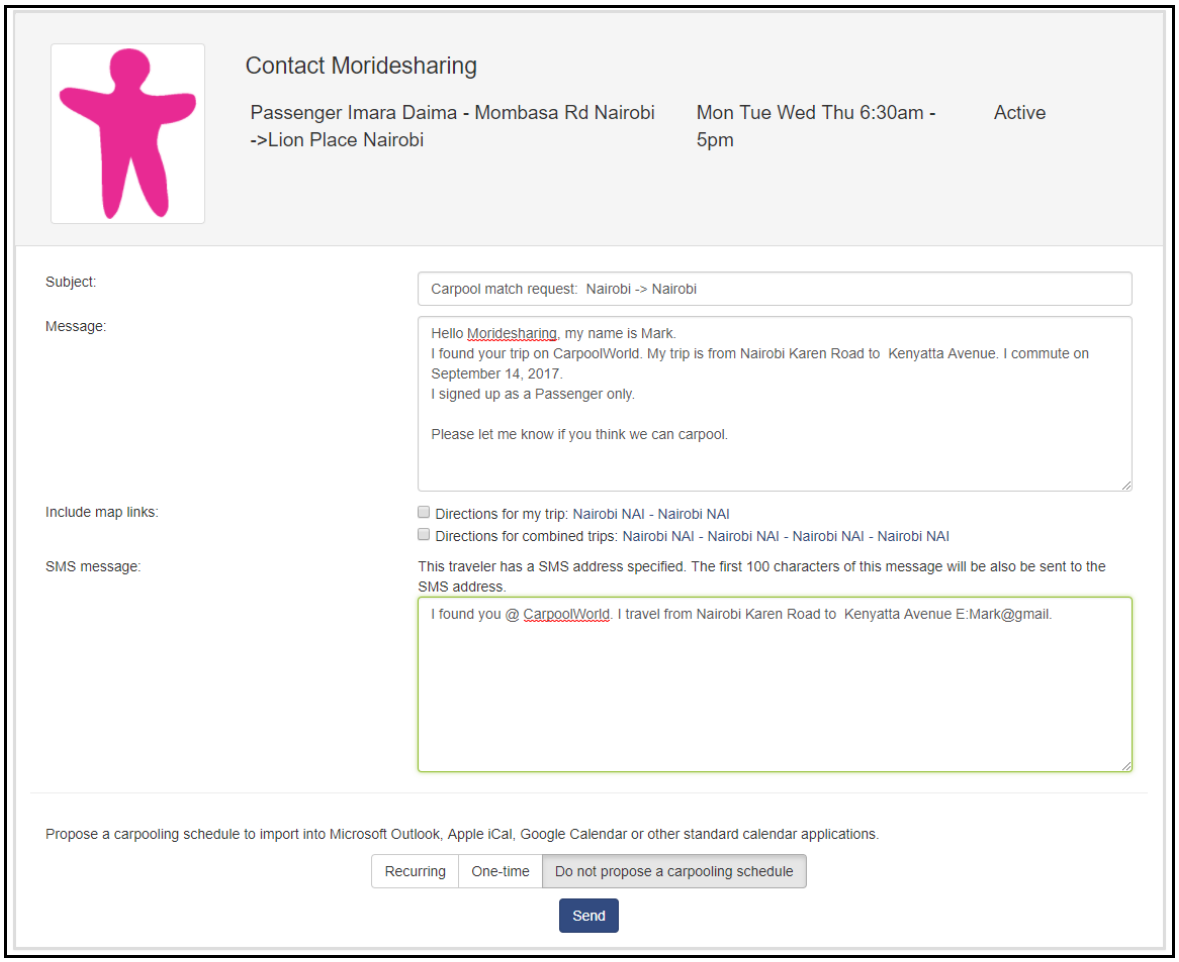


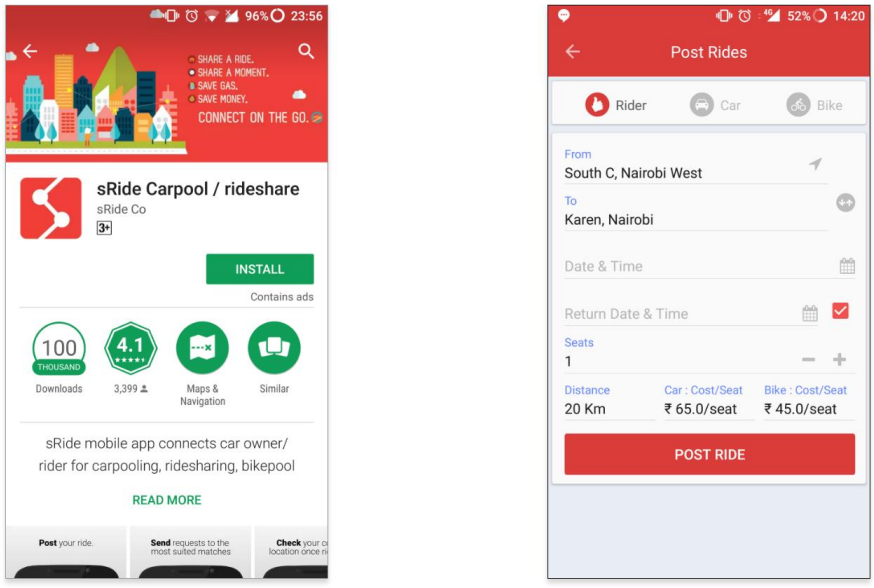
Figure 2.3: CarpoolWorld contact form. Source: https://www.carpoolworld.com/matches_email.html?ttin=604606&to_trip=561723

They also have an Android application but it only opens a browser window in the app.

2.2.3 sRide

sRide is an India based carpool app but is able to function in any country. You register in the app using a phone number and after verification, you are asked to input more details about yourself (first name, last name and email). After registration, you can post for a new ride as rider or a driver. As a driver you can either use a car or a bicycle.

The app also allows you to view rides posted by your friends, rides that you've been matched to, recommendations based on past rides, rides that are along your way and rides that are nearby. Due to its lack of usage in Kenya, its features could not be tested. Their website is http://sride.co



Play Store listing

Post new ride

Figure 2.4: sRide Android application

2.2.4 uberPOOL

Uber has a carpooling functionality that enables users to be matched with other riders along their route. It is however not yet available in Kenya. The webpage for the feature is https://www.uber.com/en-KE/ride/uberpool/ (© 2017 Uber Technologies Inc.)

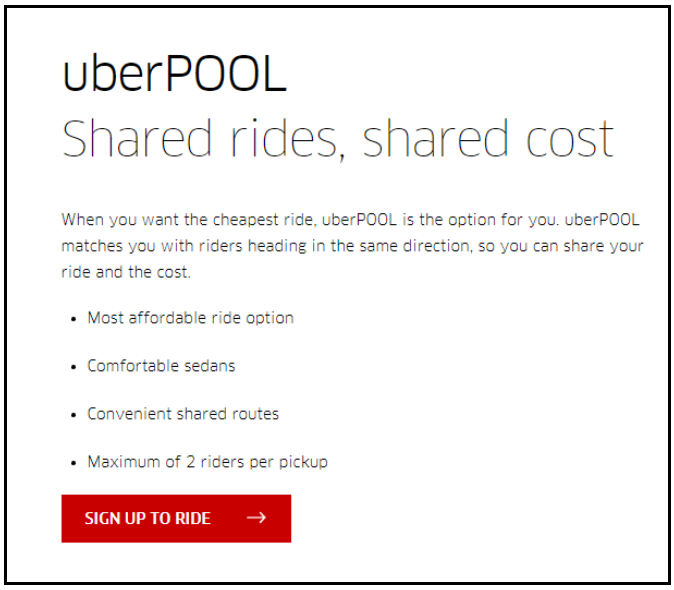


Figure 2.5: About uberPOOL. Source: https://www.uber.com/en-KE/ride/uberpool/

2.2.5 Waze Carpool

Another popular existing system is Waze Carpool. It is however not available in Kenya.

Their website is https://www.waze.com/carpool/ (© 2006-2017 Waze Mobile. All Rights Reserved.)

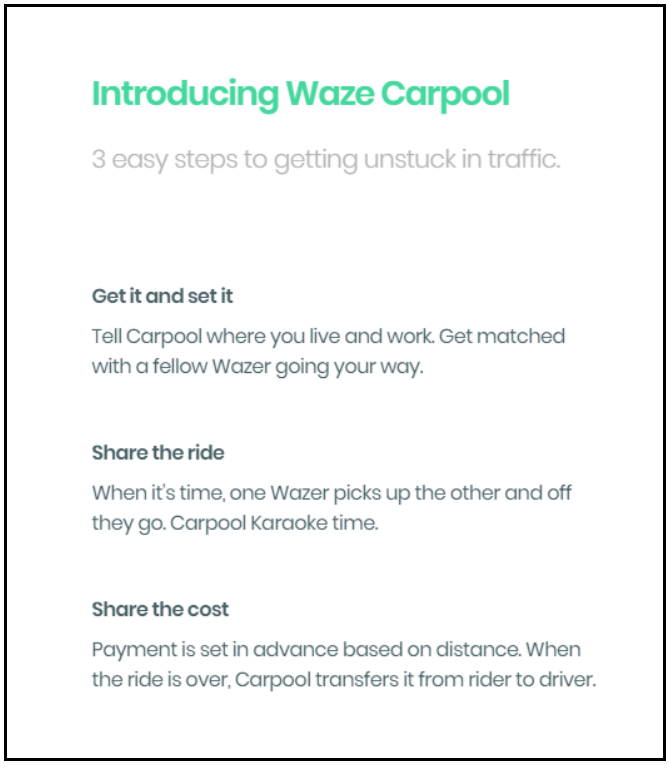


Figure 2.6: About Waze Carpool. Source: https://www.waze.com/carpool/

2.3 Challenges faced by users

By far the biggest issue with the existing system is their lack of popularity in Kenya. Their functionality works in theory however there are not enough people in Kenya that are on their platforms. This is made worse by the fact that their users don't have a common purpose for them to use the system, for example, a common destination. This causes their small user base to be spread thin.

Another challenge is security. Due to their hands-off approach they do not have any form of verification of the riders or more importantly, the driver. In the case of a crime, the data they have on their users cannot be trusted as legitimate. Our system will not face this challenge this due to it being limited to only members of Strathmore, the data on the users can be trusted.

2.4 Gaps in existing systems

Due to their inadequate popularity in Kenya, the features couldn't be tested enough for any gaps to be identified.

Chapter 3: Methodology

3.1 Introduction

We will be using an object-oriented analysis design (OOAD) as the system development methodology. It can be defined as a structured method for analyzing, designing a system by applying the object-orientated concepts. Under this methodology we will use an iterative model.

“Iterative and incremental software development (IID) offers a reliable and verified method for software development in the situation of insufficiently precise or evolving user requirements” (Ljubović, 2009). The iterative model starts with implementation of a small set of the requirements and iteratively enhancing it by implementing more requirements of the system over the development period.

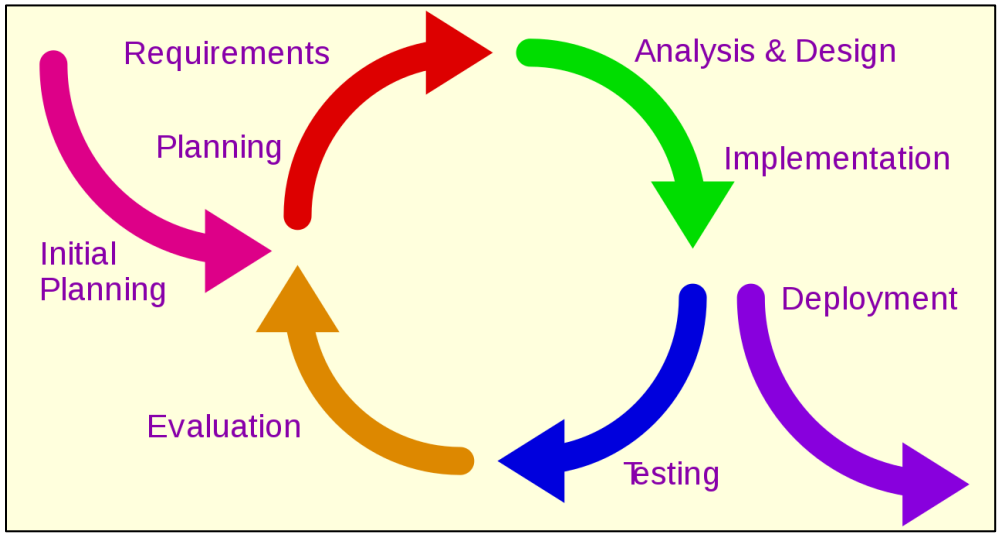


Figure 3.1: Iterative system development model. Source: https://commons.wikimedia.org/wiki/File:Iterative_development_model.svg

The model has five distinct stages:

3.1.1 Planning

This stage identifies the problem(s) that the system is intended to fix. The requirements and the scope of the system are specified at a high level. This stage also involves carrying you a feasibility study to determine whether or not the system is viable. Feasibility study looks at:

i. Economic feasibility - whether the system can be afforded and whether it is worth the money.
ii. Operational feasibility - Whether the system will solve the problem and is of benefit.

iii. Technical feasibility - Whether the developers are capable of developing the system and whether the end users are capable of using it once it is completed.

3.1.2 Analysis and design

In this stage, the system is broken down into its constituent modules and their requirements are given in more detail. Screen layouts and progress diagrams are made at this stage.

3.1.3 Testing

The system is tested at the various levels of software testing such as:

i. Unit testing - Individual modules are tested separately.
ii. Integration testing - Modules are combined and tested as a group.
iii. System testing - The whole system is tested as a whole.
iv. User acceptance testing - It is verified that the system provides a solution to the end user.

This stage is crucial because it prevents a faulty system being deployed to the user.

3.1.4 Implementation

In this stage, the system is deployed to the user. Any training or transition from previous systems is performed at this stage.

3.1.5 Evaluation

Finally, the effectiveness of the system is measured and potential enhancements are specified.

An advantage of this model is that since the system goes through the stages multiple times before its final release, defects are quickly found and rectified before they accumulate. Moreover, it allows for higher user interaction since they are progressively given the system as it is developed.

3.2 Analysis

Analysis is defined as “the procedure by which we break down an intellectual or substantial whole into parts or components.”(Ritchey, 2009)

3.2.1 Functional Requirements

These are what the system should accomplish in order for it to accomplish its intended purpose.

3.2.1.1 Authenticate users

Users should be able to securely create an account and sign in using their Strathmore email address.

3.2.1.2 Request for a ride

Riders will be able to request for a pickup on demand.

3.2.1.3 Schedule a ride

The rider will be able to schedule rides beforehand.

3.2.1.4 Offer to fulfil requests

Drivers will be able to offer to fulfil requests made by riders.

3.2.1.5 View ride history

Both riders and drivers will be able to view a history log of their past rides.

3.2.2 Non-Functional Requirements

These are extra qualities of the system that improve the user experience.

3.2.2.1 Complete Information

The application should give its users clear and adequate information in regards to those they will be riding with.

3.2.2.2 Intuitive design

The application should offer the users a simple and clear means to achieve their objective on the application, from setup to ride request to confirmation of payment and rating after the ride.

3.2.2.3 Privacy

The application should only request for their location when they intend to take a ride and not any other time.

3.2.3 Narrative

Users are first required to sign up using a valid Strathmore email address. Once they have been verified, they will be able to choose whether they will function as a driver or as a rider.

If they choose to be a rider, they can enter their destination address (their current location will be automatically detected) and request a ride. From there, the drivers will be able to see their request and offer to fulfil it. Alternatively, the rider can schedule a ride and drivers can offer to fulfil the request. If they choose to function as a driver, they will be able to view current requests and scheduled requests and offer to fulfil them.

Once the driver picks the rider, they are to both check in. Once the ride if finished, they are to both check out. Both the rider and the driver will be able to view their past rides.

Users will also be able to personalize their profile.

3.3 Designs

The following designs show how the various components of the system interact with each other.

3.3.1 Use case Diagram

A use case diagram shows the key actors in a system as well as their behavior. Our class diagrams show the rider and the driver and their operations such as signing up, logging and requesting for a ride.

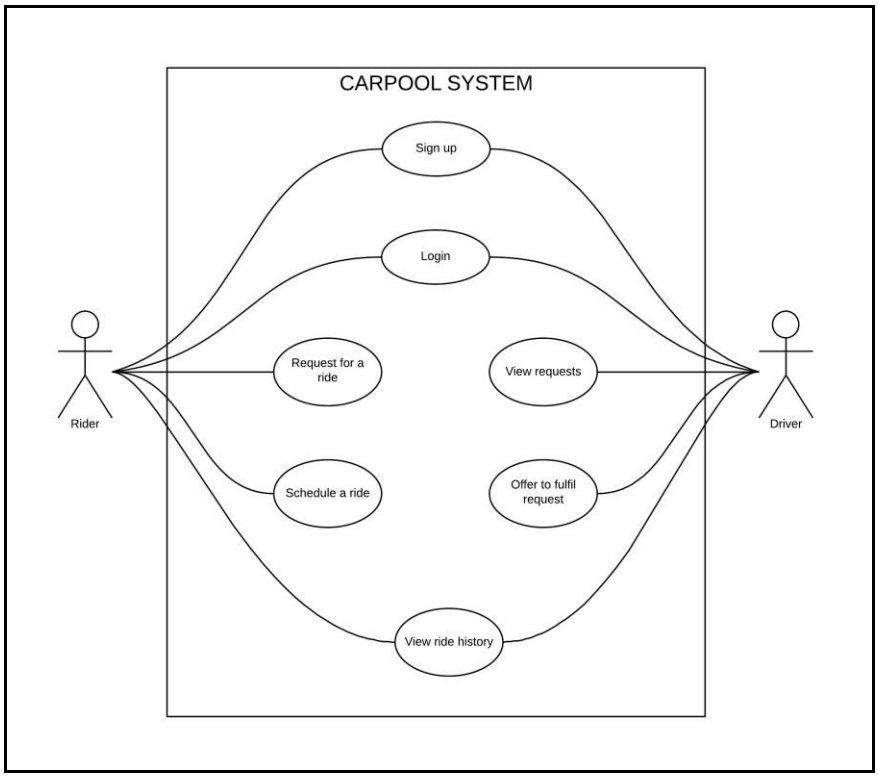


Figure 3.2: Use case diagram

3.3.2 Data Flow Diagram (DFD)

A data flow shows business processes and the data that flows between them. An example of such is when the ridder attempts to log in, their details are sent to the login process after then to the users' data store. After this a login response is sent back to the rider via the login process.

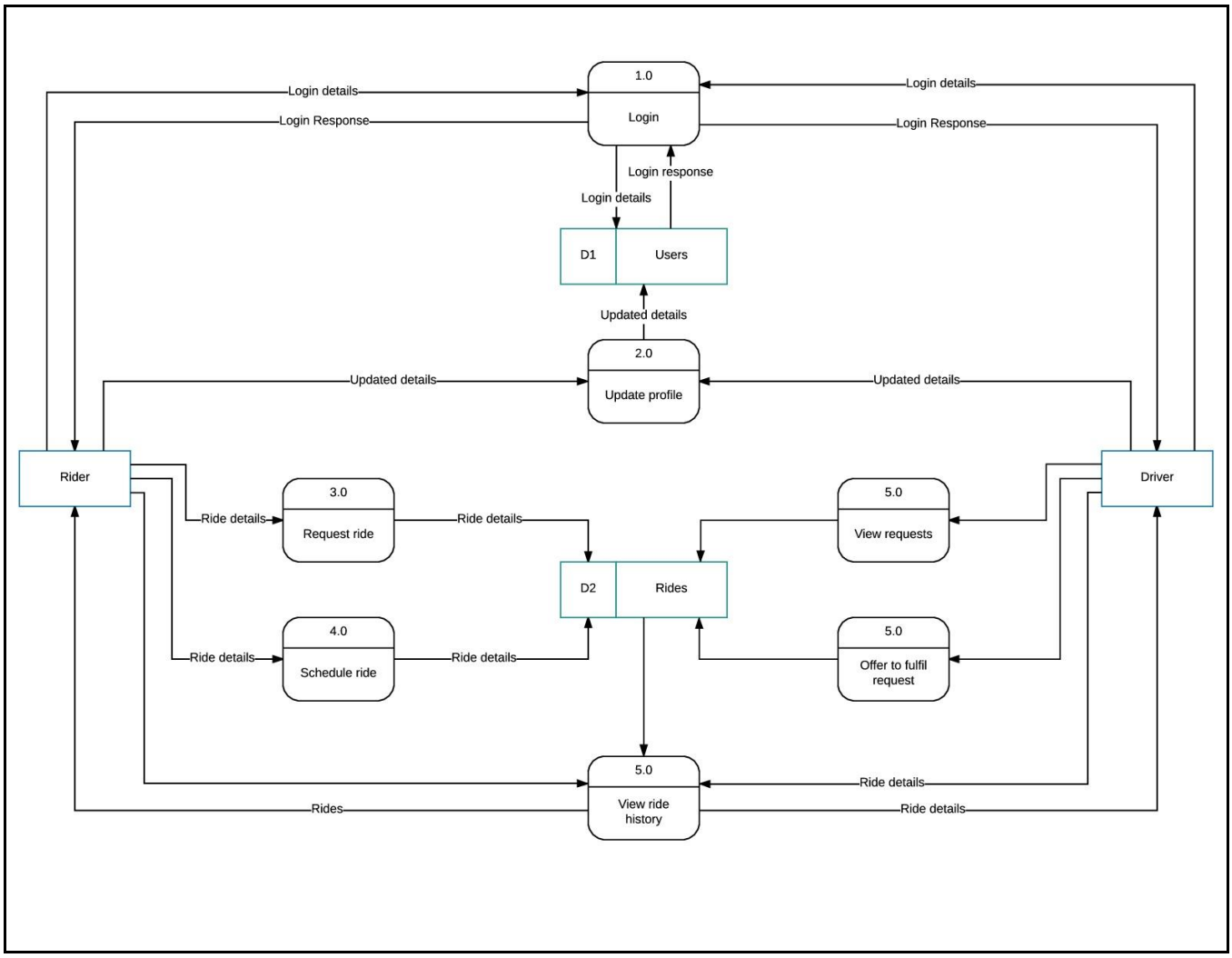


Figure 3.3 Data flow diagram

3.3.3 Entity Relationship Diagram (ERD)

Entity Relationship Diagrams depict only structural features and provide a static view of the system. In our case, a rider has an id, full name, email and phone number. They request for a ride while a driver fulfils a ride.

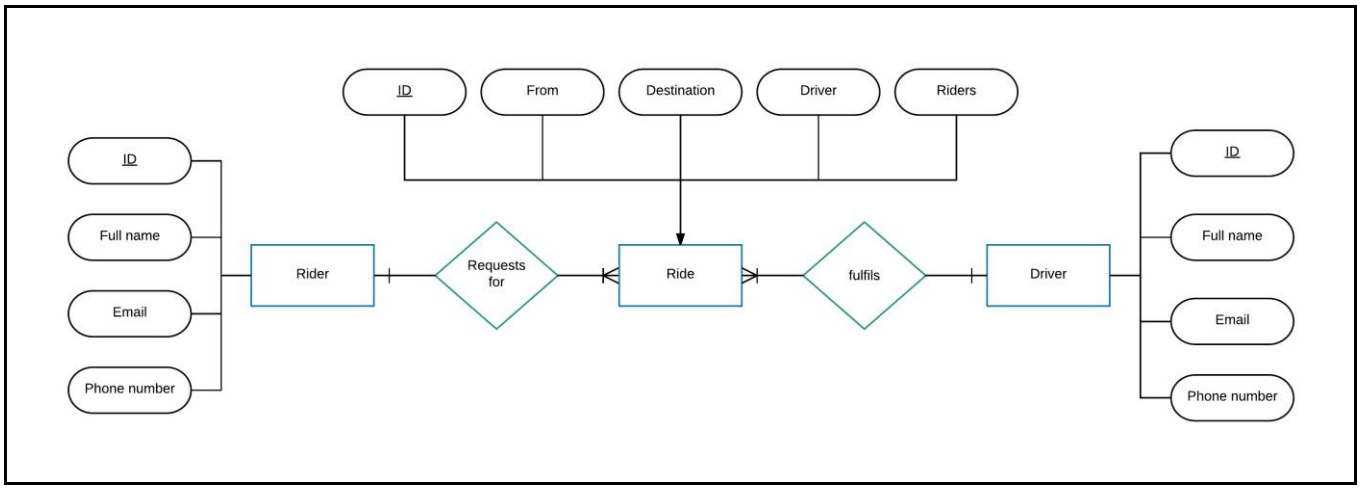


Figure 3.4 Entity relationship diagram

3.4 System Development Tools and Techniques

3.4.1 Firebase

A backend as a service platform by Google that provides services such as authentication, real time database and messaging.

i. Realtime Database - It will be used to store data because it is designed to facilitate real time transfer of data.
ii. Authentication - It will be used because it provides a simple and secure way to authenticate users.
iii. Cloud Functions - It will be used to handle the backend logic of the system that relies on changes in the database.
iv. Cloud Messaging - It will be used to send notifications to the user's device.

3.4.2 Crashlytics

Crashlytics is a crash reporting solution by Fabric. It provides immediate reporting and in-depth information on the cause and source of crashes in an application.

3.4.3 Android Studio

The official IDE for Android development. It is a fork of IntelliJ IDEA managed by Google. It provides various advantages for Android development:

i. Advanced code completion and intellisense.
ii. Android specific code refactoring and lint checks.
iii. A rich layout editor that supports drag and drop.
iv. Virtual device manager.
v. ProGuard integration and app-signing capabilities.

3.4.4 Kotlin

It is a "statically typed programming language for modern multi-platform applications" (kotlinlang.org) that is 100% interoperable with Java. It was first introduced in 2011 by JetBrains, the developers of IntelliJ IDEA and other IDEs. During Google I/O 2017, the Android team announced first-class support for Kotlin. It provides various advantages over Java, most notably, the reduction or complete removal of null pointer exceptions, "The Billion Dollar Mistake" (Hoare, 2009)

3.4.5 Node-red

It is a programming tool that for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime. It will be used to handle back-end logic such as regional identification of users through geofencing and geolocation.

3.5 Deliverables

After the completion of these project, the following will be available:

i. An android application that enables easy sharing of rides.
ii. A node-red based backend system that will handle user geo-classification.

iii. A system documentation describing the relationship between different components of the application.

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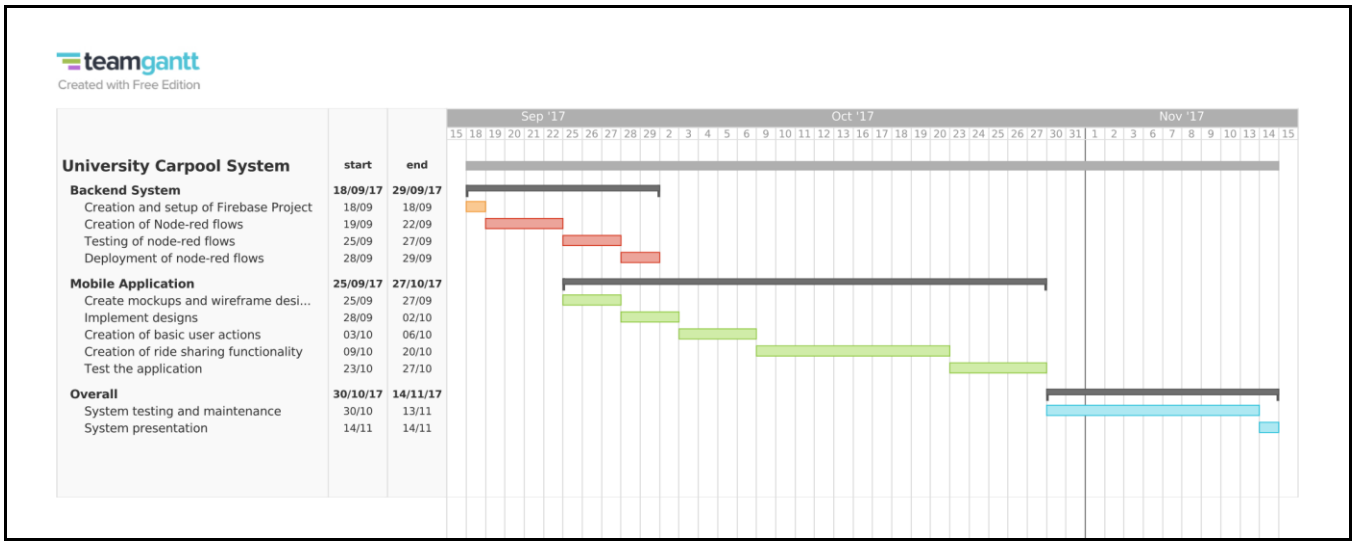
Appendix

Appendix A: Time Schedule



Appendix A: Time Schedule