A mobile application for Farmers, Traders and Transport Aggregators in Kenya.

Student No: 093170

Group: B

An Information Systems Project Proposal Submitted to the Faculty of Information Technology in partial fulfillment of the requirements for the award of a Degree in Business Information Technology

Date of Submission: January 2021

Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the research proposal contains no material previously published or written by another person except where due reference is made in the research proposal itself.

Student Signature:

Sign: _____ Date: _____

Supervisor's Name:

Abstract

Agriculture plays an important role in Kenya's Economy. It plays a huge impact in the country's economy contributing to approximately 25% of the Gross Domestic Product (GDP). Small scale Farmers use Manual systems to market their products as there isn't an automated system that currently helps them to do so. Transport Aggregators also do not get the exposure they need to get people who would like to receive products. In today's markets, farmers are lied to by the middle men, exploiting them and demanding high prices and this leads to poverty for most farmers.

Advancements in technology are leading the world to greater heights and this has been lagging behind in concern to farming when it comes to Kenya. The aim of this study will be coming up with an automated system that will benefit the farmers as it will help them sell their products across the country at maximum profit. The application also aims to help farmers get access to market information. The system helps Transporters who also do not get the exposure they require in the market and this brings a balance between the farmers and transporters. Traders will also benefit from the system as they will be able to order, request and get their produce delivered straight to their doorstep.

An Object-Oriented approach will be used towards development of the system to improve quality of the system. Tools to be used in the project developments include, java programming language, firebase DBMS and Android Studio IDE. The testing to be used once the system is completed will be acceptance testing. This is to make sure all the requirements are met as per business requirements or end user requirements.

Table of Contents

Declaration ii

Abstract iii

List of Figures vii

List of Abbreviations viii

Chapter 1: Introduction 1

1.1 Background 1

1.2 Problem Statement 1

1.3 Aim 2

1.4 Specific Objectives 2

1.5 Justification 2

1.6 Scope and Limitation 2

1.6.1 Scope 2

1.6.2 Limitation 2

Chapter 2: Literature Review 3

2.1 Introduction 3

2.2 Current marketing strategies used by Farmers. 3

2.2.1 Brokers/Middlemen. 3

2.2.2 Connections with close neighbors and family. 4

2.3 Current Transportation Mechanisms. 4

2.3.1 Farmers transporting by themselves. 4

2.3.2 Current Transporters. 4

2.4 Transport Aggregators. 5

2.5 Gaps in Existing works. 5

2.6 Conclusion 6

2.7 Conceptual Framework. 6

Chapter 3: System Development Methodology 9

3.1 Introduction 9

3.2 Waterfall Development Methodology 9

3.2.1 Requirement Analysis Planning. 9

3.2.2 System Design and Specification. 10

3.2.3 Coding and Verification. 10

3.2.4 Testing and Integration. 10

3.2.5 Maintenance. 10

3.3 System Development Tools and Techniques. 10
3.3.1 React Native Tool 10
3.3.2 Firebase 10
3.3.3 Java 10
Chapter 4: System Analysis and Design 11
4.1 Introduction 11
4.2 Requirements Gathering 11
4.3 Propose Modules and System Architecture 11
4.3.1 Farmer Module 11
4.3.2 Transport Aggregator Module 11
4.3.3 Trader Module 12
4.3.4 Administrator Module 12
4.4 Analysis. 12
4.4.1 Functional Requirements. 12
4.4.2 Non-Functional Requirements. 13
4.5 Design 13
4.5.1 Use case diagram 14
4.5.2 Sequence diagram 15
4.5.3 Class diagram 16
4.5.4 Entity Relationship Diagram 17
Chapter 5: System Implementation and Testing 18
5.1 Introduction 18
5.2 Implementation 18
5.2.1 Administrator Functions 19
5.2.2 Trader Functions 21
5.2.3 Farmer Functions 27
4.2.4 Transporter Functions 30
5.3 Testing 31
5.3.1 Integration Testing 31
5.3.2 Smoke testing 32
5.3.3 Performance testing 32
Chapter 6: Discussion, Conclusions, Recommendations and Future Works 33
6.1 Introduction 33
6.2 Discussion 33
6.3 Conclusion 34

6.4 Recommendations 34
6.5 Future Works 34
References 35
Appendix A 36

List of Figures

Figure 2. 1: Relationship between suppliers, middle men and consumers. 3
Figure 2. 2: Farmer Conceptual Diagram 6
Figure 2. 3: Trader Conceptual Diagram 7
Figure 2. 4: Transport Aggregator Conceptual Diagram 7

Figure 3. 1: Waterfall model 9

Figure 4. 1 Use case diagram 14
Figure 4. 2 Sequence diagram 15
Figure 4. 3 Class Diagram 16
Figure 4. 4 Entity Relationship Diagram 17

Figure 5. 1 Admin Dashboard 19
Figure 5. 2 Approve new Products 20
Figure 5. 3 Login and Register 21
Figure 5. 4 View New Products 22
Figure 5. 5 Search For Products 23
Figure 5. 6 Order New Products 24
Figure 5. 7 Trader Menu 25
Figure 5. 8 Update Information 25
Figure 5. 9 Payment Methods 26
Figure 5. 10 Mpesa Payment 26
Figure 5. 11 Product Categories 27
Figure 5. 12 Add new Products 28
Figure 5. 13 View Customer Orders 29
Figure 5. 14 Call Transporting Vehicle 30
Figure 5. 15 Customer Found 31

List of Abbreviations

DBMS – Database Management System

ICT – Information and Communication Technology.

IDE – Integrated Development Environment

GDP – Gross Domestic Product.

OOAD – Object-Oriented Analysis and Design

OOD – Object Oriented Design

SDLC – System Development Life Cycle.

UI – User Interface

OTP- One Time Password

Chapter 1: Introduction

1.1 Background

In Kenya, Agriculture is one of the key drivers of its economy contributing to approximately 25% of the GDP (Alila & Atieno, 2006). Majority of Kenya's population live in the rural areas and most of them depend on agriculture as their only source of income. According to (Langat, Litondo, & Ntale, 2016), there is a strong relationship between Agriculture and Technology and this could be exploited by farmers who can make vital decisions for economic growth.

There is a fairly low involvement by small scale farmers to be able to get access to the market as they have little to no information about it. In many Countries, ICT has become one of the major tools that is used to drive the country's economy. Farmers getting access to information online could be vital for them and also for the growth of the economy.

(Kurtenbach & Thompson) say that accurate and complete information is vital to all market sectors including agriculture as it promotes efficiency and effectiveness of production and customer service. Majority of smallholder farmers sell their produce in local low-paying markets rather than travel to distant better-paying markets (Fafchamps & Hill, 2005). Thus, the mobile phone offers smallholder farmers the potential to resolve market failure and increase market participation through access to information on available markets and popular market prices.

1.2 Problem Statement

The agriculture industry is faced with a problem where the farmers and the transporters find it challenging to market their business to a wider market and they are only limited to an informal channel (S.Negi, 2018). This becomes a disadvantage to the farmer as He can only be able to sell a small part of the produce and the rest might rot. The transporters also lack a way to know which farmer requires their produce to be transported to the market and this lack of exposure may lead them not to earn anything.

1.3 Aim

The aim of the system is to be able to provide a channel for both the farmers and the transporters to get the exposure they need to the market. The traders will also benefit as the system will be automated. Traders can choose the load they need from a list of farmers who wish to transport their produce. The farmer will be able to choose the transporter they want depending on the price that each transporter will post on the system. The farmer can therefore agree terms and mode of payment with the traders and transporters.

1.4 Specific Objectives

i. To investigate current marketing strategies used by farmers.
ii. To examine current transportation mechanisms.
iii. To examine gaps in the existing works.
iv. To develop a mobile application that will facilitate fast and easy sales of farm produce by the farmer.
v. To test the system.

1.5 Justification

The project is important as it will help tackle the problem of farmers not being able to sell their produce and also the problem of poor transportation mechanisms where farmers are also not able to get transporters who are willing to carry their produce. A mobile based system would therefore benefit all parties involved and speed up the rate at which farmers transport and also provide an opportunity for the transporters to get exposure.

1.6 Scope and Limitation

1.6.1 Scope

The aim of this system is to create a mobile application that will be used by farmers to key in their produce and how much they wish to transport. Whatever the farmer posts on the system will then be visible to traders and transporters. If the trader is interested in what the farmer is selling, he will therefore order and a notification will be sent to the trader that he ordered from. The farmer will then be able to see a list of transporters from the system and the farmer can choose one that he finds fit at agreed upon payment terms.

1.6.2 Limitation

This project is that it will be mobile based and will require the internet.

Chapter 2: Literature Review

2.1 Introduction

This chapter will be reviewing the current mechanisms that are already in place in reference to farm produce transportation by transporters and access to the market by the farmers. We will later look at the gaps that each of the existing systems have and why they are not very effective. The research will also look at Transport aggregators and their importance in the system.

2.2 Current marketing strategies used by Farmers.

2.2.1 Brokers/Middlemen.

A broker is an individual or a firm who is responsible for arranging transactions between a buyer and a seller for a commission. The Diagram below shows the current relationship between customers and suppliers (Role of middlemen in the marketing of agricultural commodities, 2019).

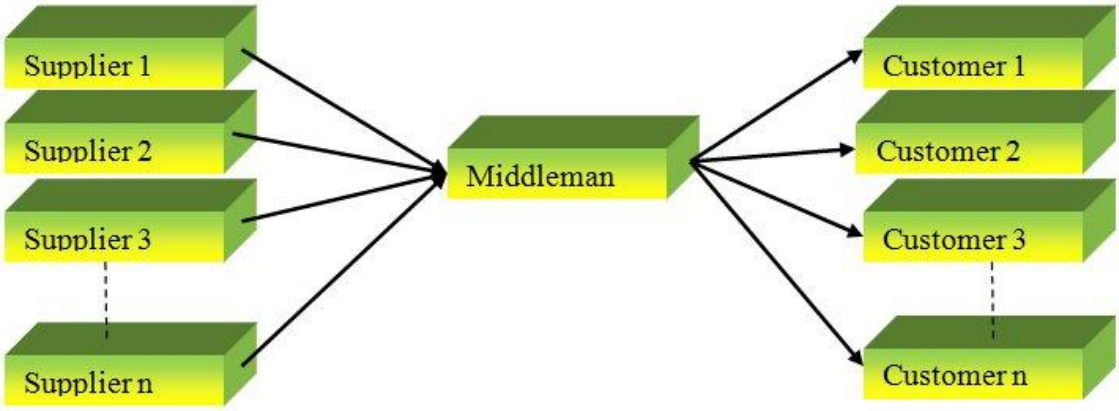

Figure 2. 1: Relationship between suppliers, middle men and consumers.

Most farmers in Kenya, especially those in the rural areas rely on brokers/ middle men to help them market their product. The brokers help the farmers market their products (mostly those located in nearby areas). Although middle men act as important people in the Agri business and create a relationship between farmers and the traders, they often exploit the market and use it for their own gain.

The challenges of having brokers in the system include; Brokers might hike the prices of certain commodities the farmer wishes to sell and this ends up burdening the consumer of the product, Middlemen sometimes practice illegal trade of products that are not allowed to be bought or sold.

This again becomes a disadvantage for the traders, some brokers end up selling expired goods to the traders because they capitalize ignorance by the consumers and finally there is 'poor after service sale' by the brokers and this most of the time irritates the consumers as they require some courtesy from them.

2.2.2 Connections with close neighbors and family.

Some farmers rely on their close friends and family members to help them market their products. The farmer asks them to inform him if they are able to get anybody who would be interested in a product i.e. tomatoes.

The challenges of having close neighbors and family include; Unreliable when it comes to them helping to market the farmers products and they might take this as an opportunity and buy products on loan and later on failing to pay the farmer.

2.3 Current Transportation Mechanisms.

2.3.1 Farmers transporting by themselves.

Due to lack of a transportation system, the farmers might be forced to transport the produce they wish to sell to a specific location. According to (R, Pabshettiwar, & Ghumatkar, 2012), farmers have to go to the nearest market to hand over his product to a particular broker and the broker asks him to visit back after some time to collect the cash earned out after the sale of the product.

When a farmer transports produce by himself, this becomes very tiresome for the farmer especially if they are transporting to someone who lives far away or if the farmer is transporting multiple products. The other disadvantage is that consumers have to wait for a long period of time before they actually get their orders.

2.3.2 Current Transporters.

There are some farmers who already have their own transporters who help them transport their products. Transporters at times exploit the farmer and charge them highly and the farmer has no option but to pay because the only thing they want is to sell and make money and this becomes challenging for the farmer. The other challenge is that transporters are not always available when needed as they might have other errands they are attending to.

2.4 Transport Aggregators.

(Transportation Aggregators Market, 2020) explains that a transport aggregator is an entity that offers transportation services as a core business either as a standalone or through partnerships. Transportation aggregators are therefore shortening the gap between the farmer and the consumer. The proposed system plans to make the transport aggregation section online.

The advantage of making Transport aggregation online is that it would help the Farmer and they will be able to make maximum sales for their produce without having expenses. This would also help reduce the cost that they would have incurred in commuting and delivery of goods by using current transporters who overcharge the farmer. The other benefit is they will be readily available for the traders and this will facilitate faster delivery of goods.

2.5 Gaps in Existing works.

The main challenge faced with the current system is the lack of market information for the farmers through proper channels i.e. through a mobile channel in Kenya. This causes the farmer to make few or no sales at all. The middle men also benefit a lot from acting as a channel between the farmers and the consumers. According to (Kokemulle, 2018), The removal of the middle men from the current system will help in a number of ways.

Removal of middle men from the system will help to save costs as the farmer will be in direct contact with the buyer. Rather than paying highly to those middle men, the farmer takes orders and sells directly to the customer. There will be improved efficiency as the steps in the distribution channel will be reduced. Efficiency will also be greatly improved as the traders will only be in direct contact with the farmer and vice versa. This will increase customer satisfaction and revenue to the farmer. Finally, there will be better value which creates a win-win for the farmer and the customer from a money perspective. The costs that are normally added to the cost of price of goods to cover for profit for the middle men will be gotten rid of. Therefore, a farmer can offer a customer a lower price while getting a higher gross profit for himself.

The current system in place does not give the farmer access to market information i.e. when a trader posts a request and the farmer can be able contact the trader without use of middle men. The current system also doesn’t support transport aggregation and this makes it hard for the trader to start thinking of how they will get the product.

2.6 Conclusion

Farmers can be able to sell their products with ease. This will solve the issue of the third man (Middle men) who add an extra expense to the farmer and they are not able to make as much profit as they would like to. Consumers will also be able to get the exact price from the farmer through the application and their time to search for items will be reduced immensely. Access to market information will also be improved as the farmer will be able to get the exposure, they need to sell their products.

2.7 Conceptual Framework.

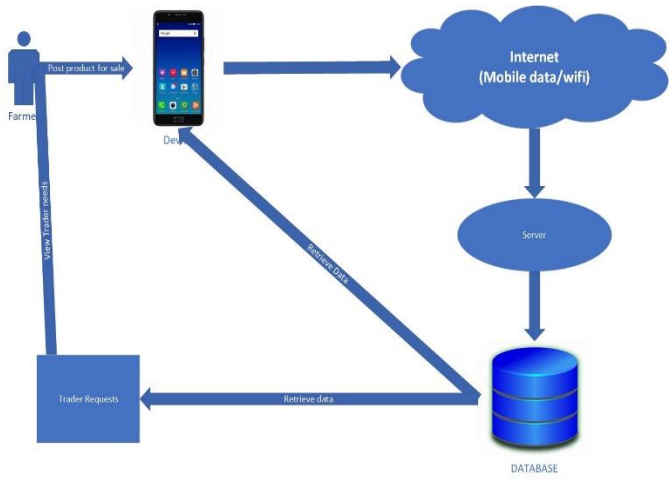

Figure 2. 2: Farmer Conceptual Diagram

The diagram above explains how the proposed system will function. The application will basically allow a user to either register as a Farmer, Transporter or a Trader. They can all log in to the system but each interface will be different. The farmers will be able to login into the system and post the produce that they wish to sell. A farmer can also be able to view traders who need some produce from the system and they can contact the Trader directly.

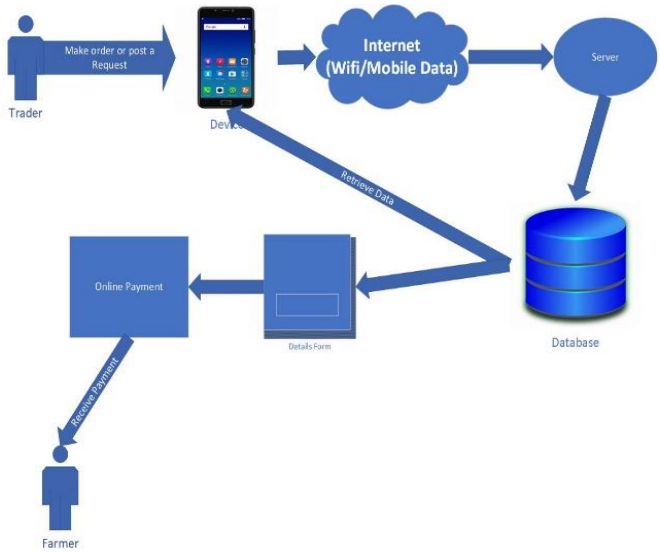

Figure 2. 3: Trader Conceptual Diagram

Figure 2.3 shows how the Trader interface will look like. The information posted by the farmer is therefore visible to the traders who can be able to select any produce they wish to have from any of the farmers. Once the Trader makes an order, they are requested to select their current location and fill in the details on a form. A notification is therefore sent to the Farmer showing him that an order has been made. The trader then makes an online payment from the application directly to the famer.

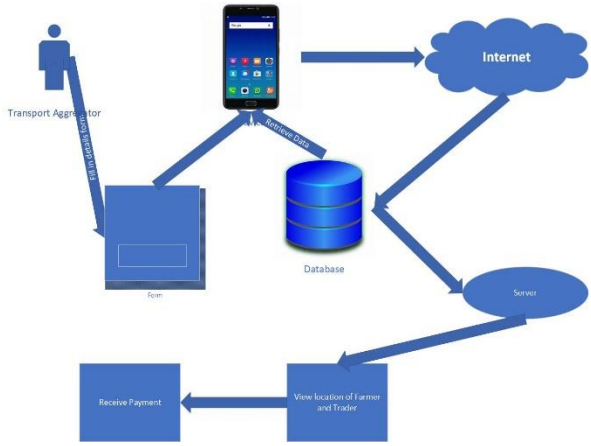

Figure 2. 4: Transport Aggregator Conceptual Diagram

The transport aggregators will have a price quote set on the system depending on the load and distance. This will help the trader to choose the transporter that they wish to deliver. The transporter will therefore get the current location of the nearest farmer and the consumer location. The transporter then gets the produce from the Farmer and transports it to the Traders specified

location. Once the product reaches the Trader, they should make cash on delivery payment to the transporter before they actually receive the produce.

Chapter 3: System Development Methodology

3.1 Introduction

A methodology is a process consisting of development processes, containing a set of activities that result in a set of deliverables (Oldevik & Berre, 1997). System Development Methodology refers to the framework that is used to plan, manage and control the process of developing an information system (Bassil, 2012). In this chapter we will be using Waterfall Development Methodology. The purpose of the methodology is to be able to ensure that the proposed system will improve on the current manual system. The chapter will also cover the following areas: Agile Development Methodology, justification of the methodology, functional and non-functional requirements and tools and techniques.

3.2 Waterfall Development Methodology

The Waterfall System Development Life Cycle (SDLC) is a sequential development process in which progress is regarded as flowing downwards through a list of phases that must be executed in order to successfully build a computer software (Bassil, 2012). The waterfall model comprises of 5 phases as illustrated in figure 3.1.

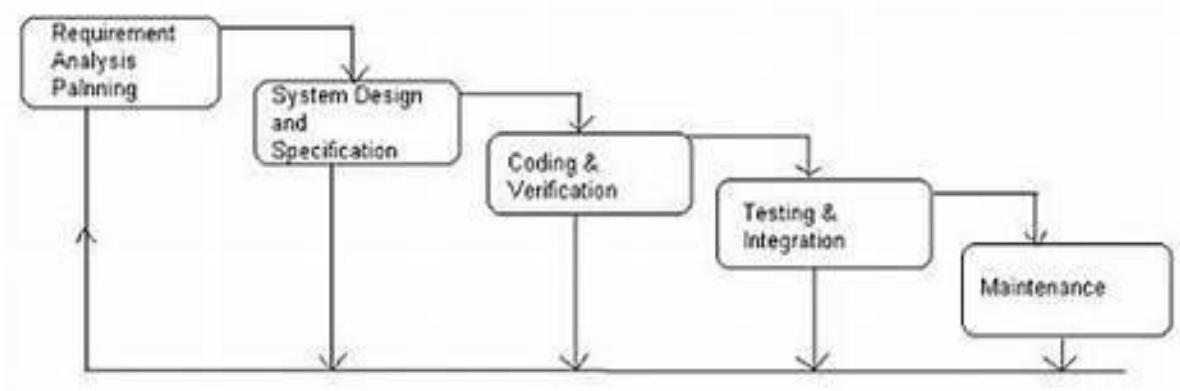

Figure 3. 1: Waterfall model

3.2.1 Requirement Analysis Planning.

All the requirements of the system to be developed are captured and written down in a requirements specification document.

3.2.2 System Design and Specification.

The specifications written down from the first phase are studied and a system design is prepared. System design will help in specifying hardware requirements and define the overall system architecture.

3.2.3 Coding and Verification.

The system is developed in small programs called units. Each unit is developed and tested for its functionality.

3.2.4 Testing and Integration.

All the units developed are then integrated into a system after testing each unit.

3.2.5 Maintenance.

Some issues come up in the client environment and the issues could be fixed through patches.

3.3 System Development Tools and Techniques.

These are the tools and procedures that we will use to make sure the system works perfectly.

3.3.1 React Native Tool

A react native tool is a software that allows developer to create applications in a single platform or device. The IDE we will be using is Android Studio. This is because it is free and easy to use.

3.3.2 Firebase

Firebase is a mobile and web application real time Database that will be used to store data of our application. It provides a firebase User Interface (UI) library that helps to quickly to common UI elements to the firebase Database for storage.

3.3.3 Java

This will be the programming language we will be using to code the functionality of the system. This is because java has the most support from google and one of the most apps on play store are built on.

Chapter 4: System Analysis and Design

4.1 Introduction

In this chapter, we will dwell deeper and cover more on the system and what the system dwells to achieve. We are going to provide a list of the identified system requirements (functional and non-functional requirements). It will also cover how the different actors of the system will be able to interact with the system. We will also cove the interactions of the different entities with the system and how they affect the system. It will finally cover the System architecture which will illustrate the basic interactions between the components and the different modules.

4.2 Requirements Gathering

This refers to the process of generating a list of requirements (functional and non-functional) from different stakeholders (customers, users) to know what tasks will be accomplished by the system and how the different users will perform certain tasks bearing in mind that different users will perform different functions. There are different ways that a researcher can use to gather system requirements. This can either be classified as qualitative or quantitative. For qualitative data, this refers to insights and understanding about a particular problem. one of the methods of qualitative data used was the use of observation.

Observation was used to target some rural farmers who were observed to see how they are able to conduct their business of selling farm produce. At the end of the observation, we were able to discover the means to which most farmers are able to sell their produce; this mostly involved using middlemen and the produce was transported by someone who the middle man had to look for.

Interviews were also conducted with a few farmers to get more insight on whether their sales were profitable and a huge percentage argued that most times they do not sell a single item for almost a week because of lack of a market.

This helped us getting to know the different modules that we were going to use on the system and therequirements for the system. Participants for the interview were randomly selected.

4.3 Propose Modules and System Architecture

The proposed system is expected to have the following modules:

4.3.1 Farmer Module

This module will enable farmers to post the produce they wish to sell and choose a transporter they wish to deliver their product.

4.3.2 Transport Aggregator Module

This module will enable transport aggregators to receive requests from farmers who wish for their produce to be transported.

4.3.3 Trader Module

This module will help Traders to order products from farmers.

4.3.4 Administrator Module

This module will enable the administrator to approve or disapprove new products from the farmers.

4.4 Analysis.

Requirements Analysis is the process of reviewing a business's processes to determine the non-functional and the functional requirements that the system must meet. The approach I will be taking in Analysis and design of the system will be an Object-Oriented Analysis and Design (OOAD) approach. The reason for the approach is because it is flexible, reliable and offers high code reusability.

4.4.1 Functional Requirements.

A functional requirement refers to a description of the service that the software must offer. Functional requirements are also known as Functional Specifications. The functional requirements to be used in the system are:

1. Authentication – The system will be able to validate details entered into the system and allow the user to access the system if the credentials match the ones entered into the database.
2. Authorization – Different users of the system will only have permission to view a specific resource i.e., when a trader logs in he can only buy products and not sell.
3. Transaction Handling – The system will be integrated with a banking API and for our system we will be using Mpesa API.
4. Data Management – The system should allow farmers, traders and transport aggregators to record their data in the database. This is saved and they can be able to edit their data if they need to.
5. Audit Tracking – The system will be able to trail the device and location of the person who makes an order to improve on security.
6. Google Maps – The system will use a web mapping service to help in tracking for picking up and delivery of goods.

4.4.2 Non-Functional Requirements.

A non-functional requirement refers to the attributes and characteristics the system will have. These include:

1. Security – These are critical requirements in the system. The system will have a security feature in case a user forgets their password.
2. Reliability – The system is meant to quickly respond to user commands in the shortest time possible without any delays.
3. Usability – The system will not be complicated and will be easy for the user to learn and navigate through it.
4. Compatibility – The system will be focusing on android devices only and it will not be compatible with other operating systems.

4.5 Design

Design is a phase in software engineering that involves defining the architecture, components, interfaces and other characteristics of the system. The following are diagrams I will be using to design.

4.5.1 Use case diagram

A use case is a diagram used to show how actors interact with the system. This will be able to show the relationship between the different users and how the interact with the different components of the system.

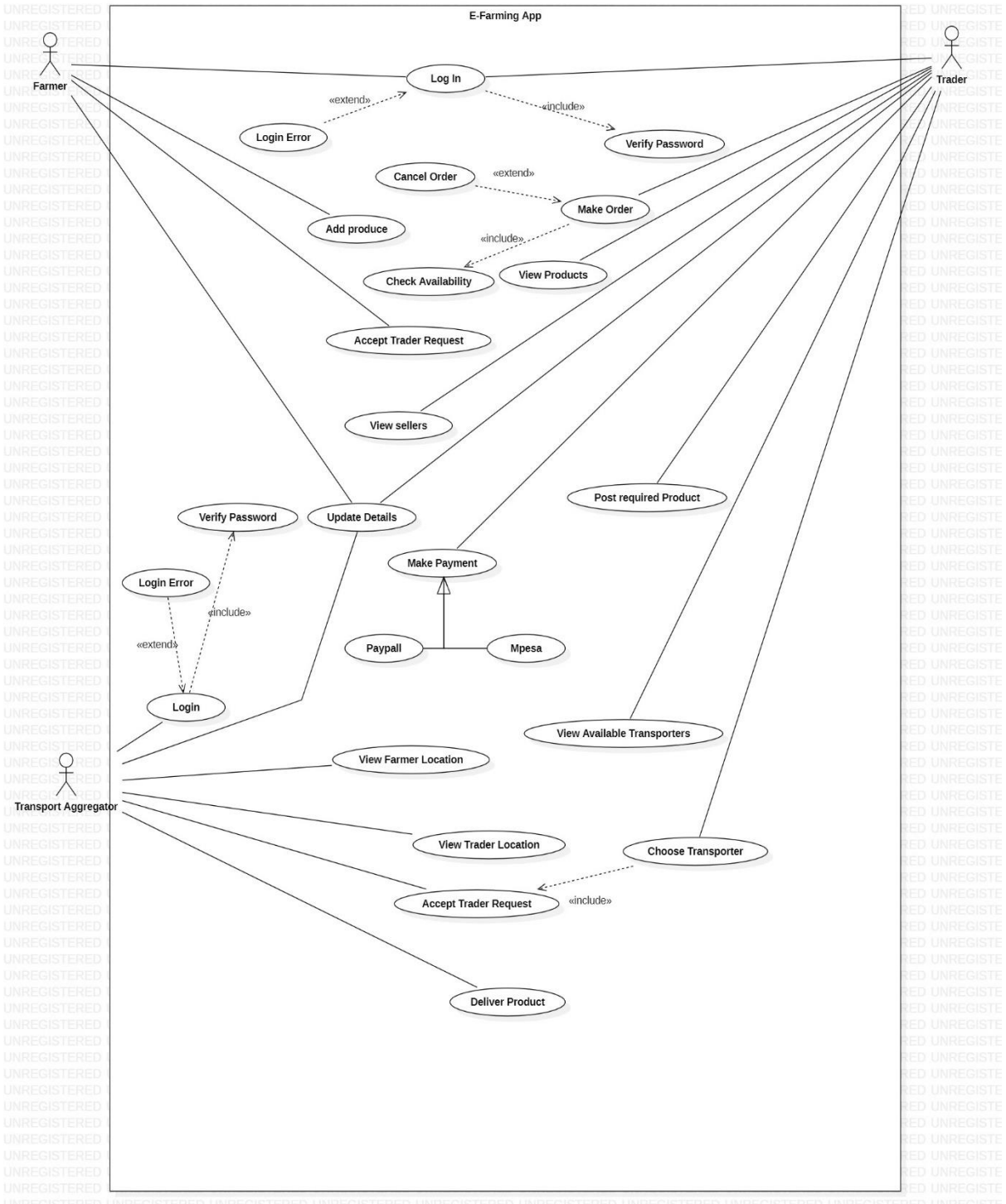

Figure 4. 1 Use case diagram

4.5.2 Sequence diagram

A sequence diagram is part of the UML and is used to model interactions between actors and objects within a system based on a time sequence. This would be helpful in our system because a Trader needs to first order before they get a confirmation and finally receive their product.

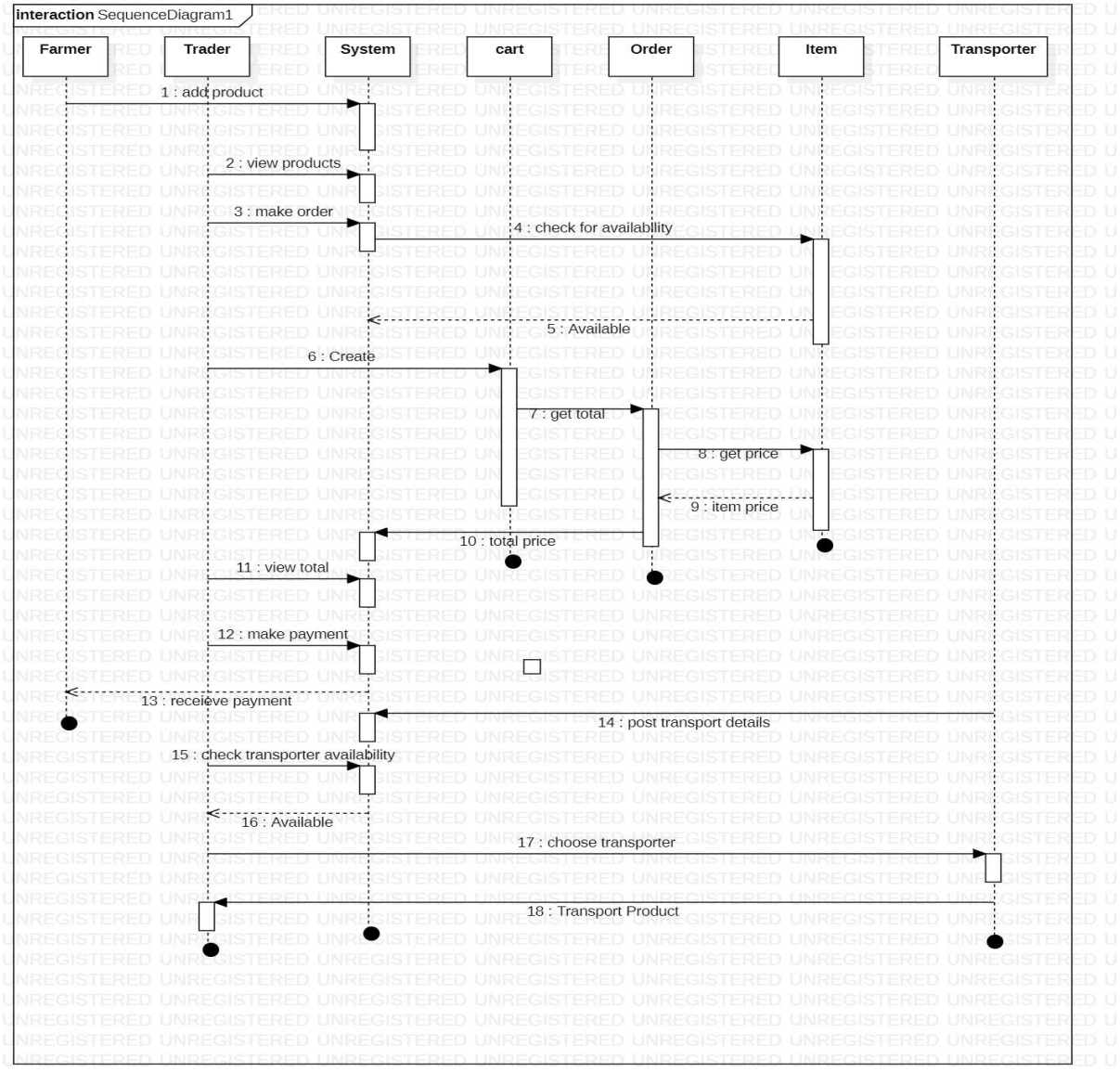

Figure 4. 2 Sequence diagram

4.5.3 Class diagram

A class diagram is used to show the classes in a system and the Relationship between those classes. This will be used as the building block as it will help me model the structure of the application.

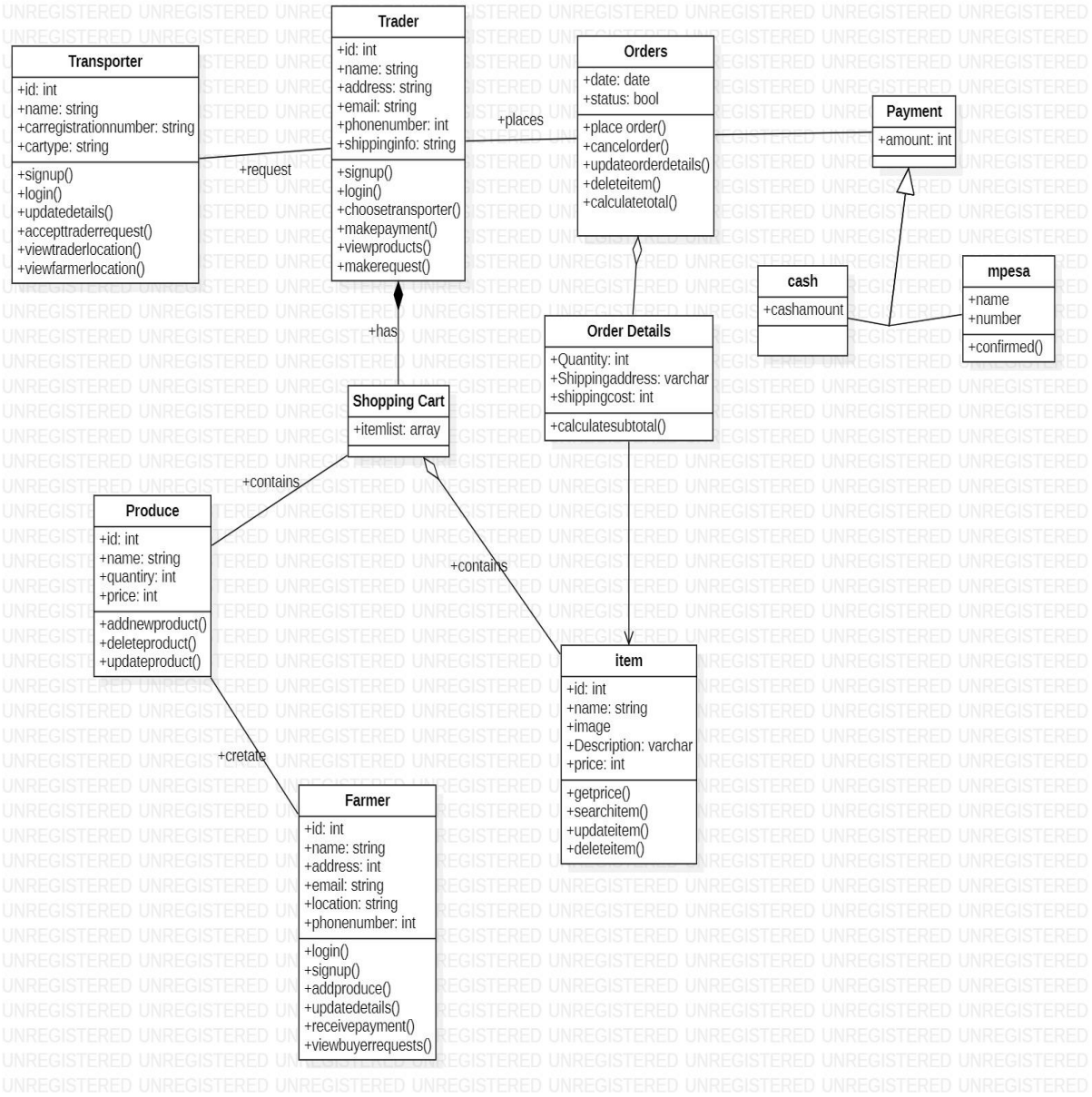

Figure 4. 3 Class Diagram

4.5.4 Entity Relationship Diagram

The figure below illustrates the design of the database, the system entities, their relationships and how data is organized on the database.

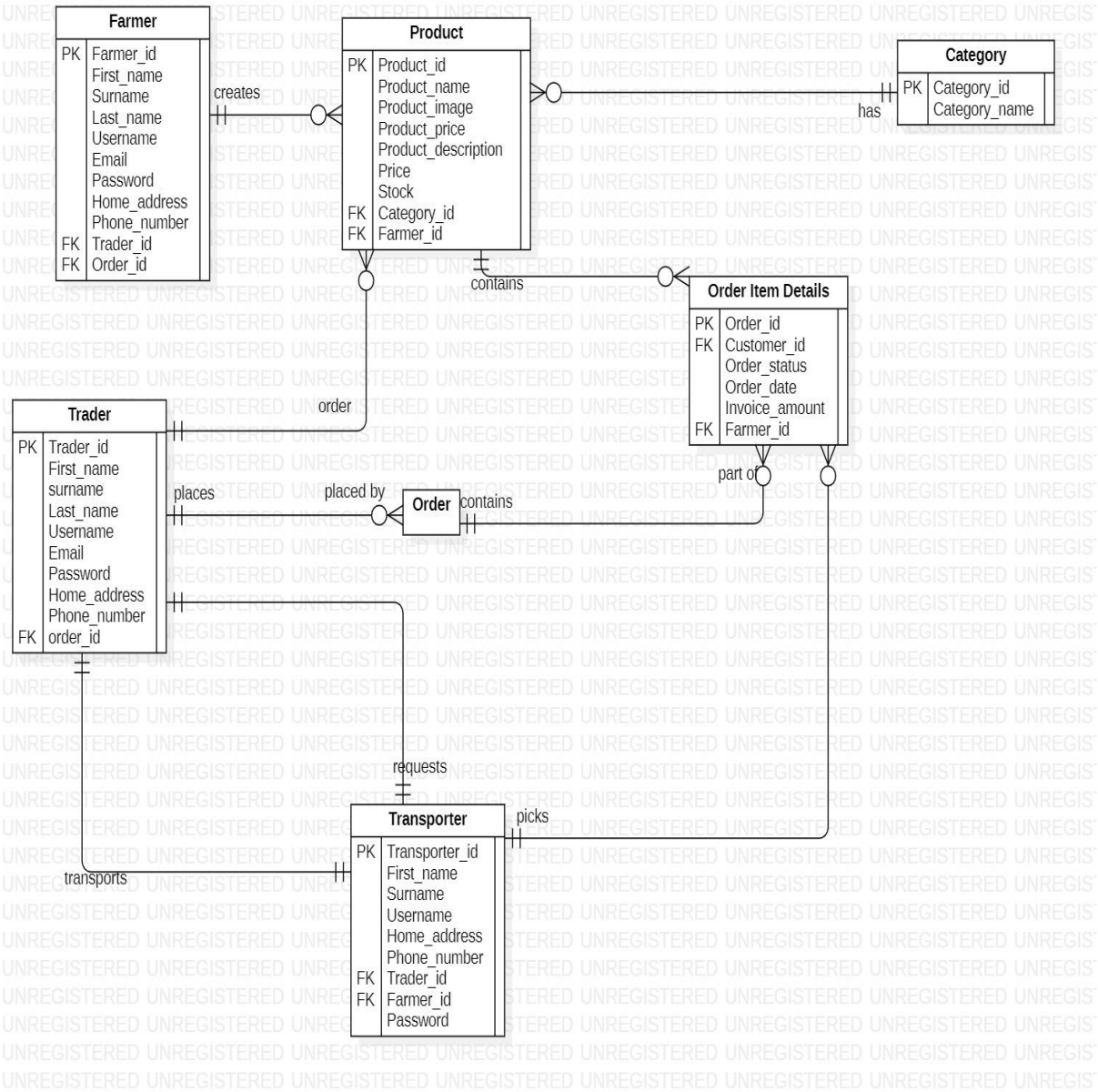

Figure 4. 4 Entity Relationship Diagram

Chapter 5: System Implementation and Testing

5.1 Introduction

This chapter seeks to cover more on what the system is about and the purpose of the different sections of the system. This involves describing how the system was developed and front-end of the system. This chapter also focuses on how the system was tested and how the different sections fulfilled specified requirements with the aim of meeting the objectives.

5.2 Implementation

The implementation phase of the project has so far been the most challenging of the phases of the project. Because of significant time constraint, functions that seemed inconsiderable to implement became very time consuming to implement. Below is a list of functions that are already implemented in the system based on the different modules.

5.2.1 Administrator Functions

a) Check and approve new products

The Administrators main role is to check and approve the products that the farmers post on the system before they can be accessed by the traders. The purpose for this is to avoid unnecessary or irrelevant items from being displayed on the system.

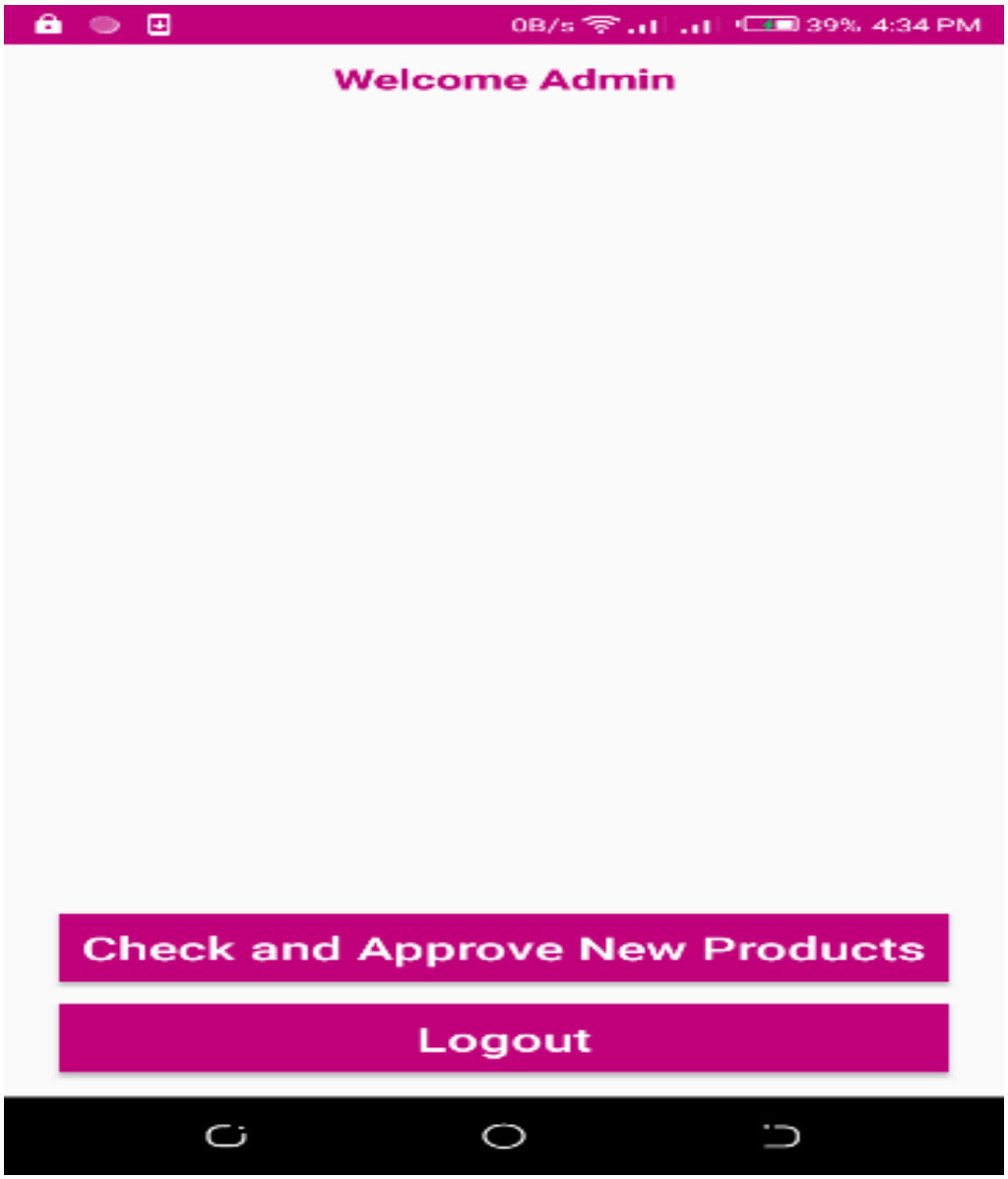

Figure 5. 1 Admin Dashboard

Figure 5. 2 Approve new Products

5.2.2 Trader Functions

a) Login and Register

Any person who is interested in purchasing items can register and also log in into the system. When registering, the user has to enter his or her phone number and the system will authenticate the user by sending an OTP that the user has to input to access the system.

Figure 5. 3 Login and Register

b) View and search products

The customers or traders can be able to view the new items that are posted on the system and the products that have already been approved by the Administrator. A user can also be able to search for a product directly without having to scroll through lots of data.

Figure 5. 4 View New Products

Figure 5. 5 Search For Products

c) Order new products

When a customer is satisfied with what they would like to purchase, they can go ahead and make an order. The order will be captured by the database and the farmer will receive the orders from their end of the system.

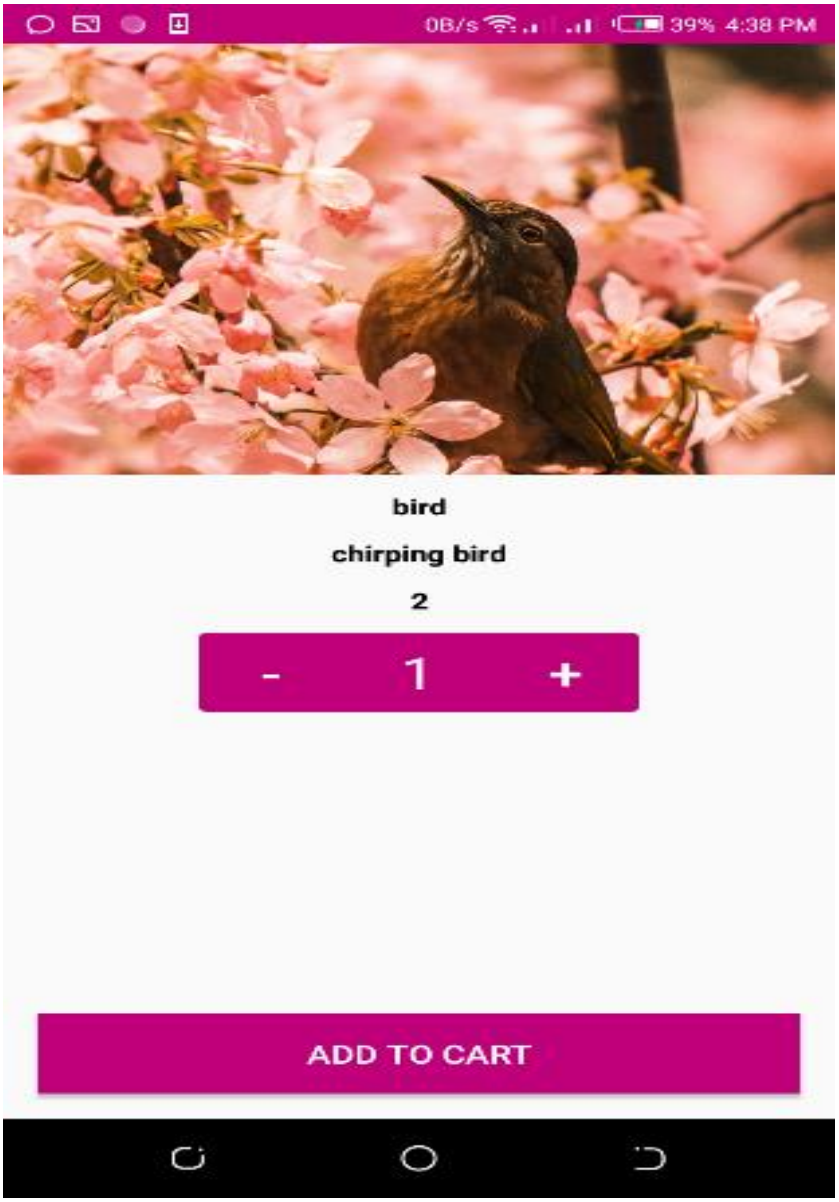

Figure 5. 6 Order New Products

d) Update user Information

A user can update their information and add a profile picture if they would wish.

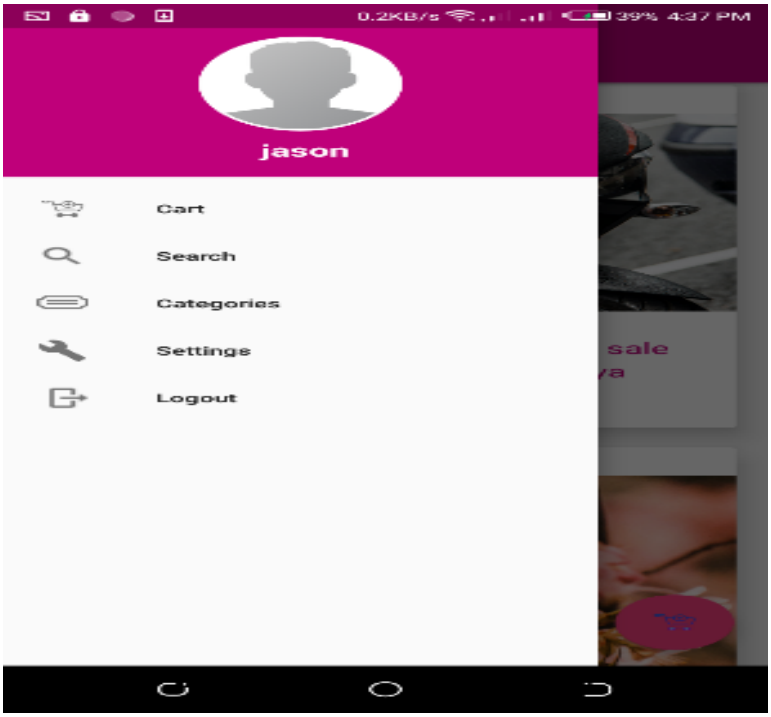

Figure 5. 7 Trader Menu

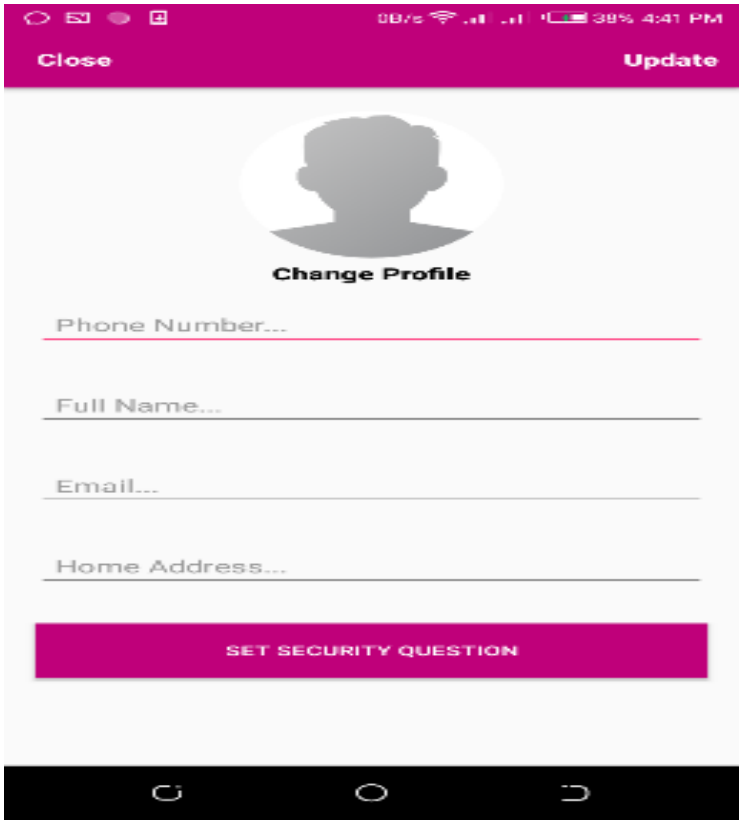

Figure 5. 8 Update Information

e) Payment

The system allows for two modes of payment; the user can either pay with Mpesa or pay with PayPal. This is done after the customer makes an order and finally wants to confirm their final order.

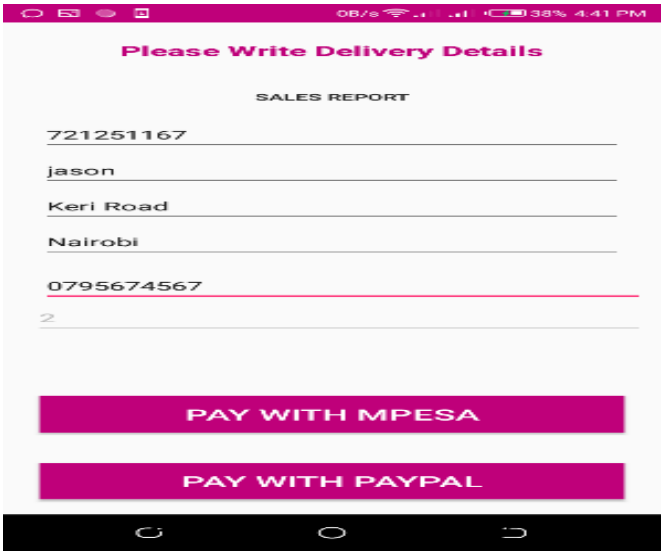

Figure 5. 9 Payment Methods

Figure 5. 10 Mpesa Payment

5.2.3 Farmer Functions

a) Add new products

The Farmers main purpose on the system is to post items that they intend to sell. They select a Category of items they wish to sell and the farmer will then post the product name together with a description and Price.

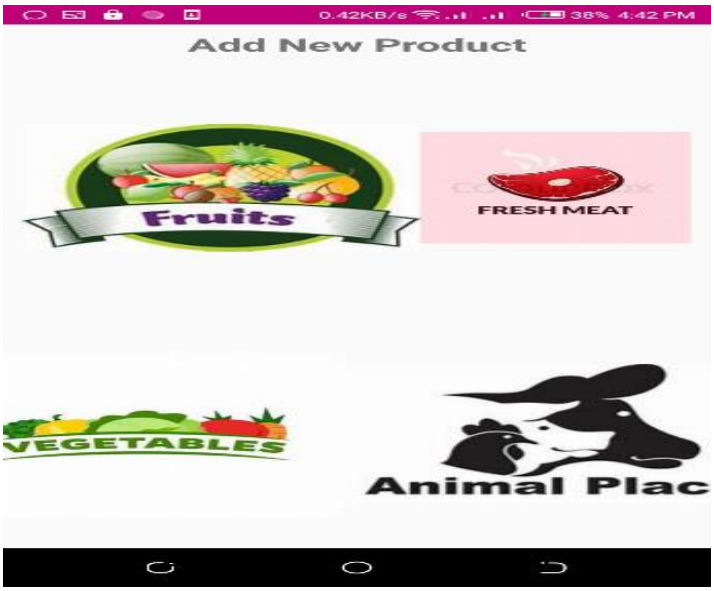

Figure 5. 11 Product Categories

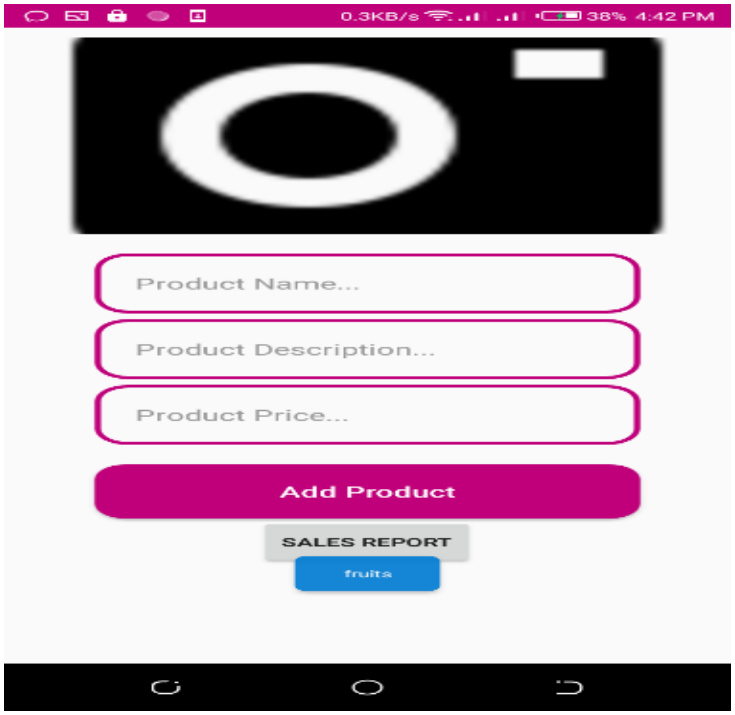

Figure 5. 12 Add new Products

b) View customer Orders and Request Transporter

Once a trader has made an order, the farmer can therefore view the requests from the different traders and organize on how the traders will receive their products. If the products have not been shipped, the system allows the Farmer to select an Online Transporter from the system.

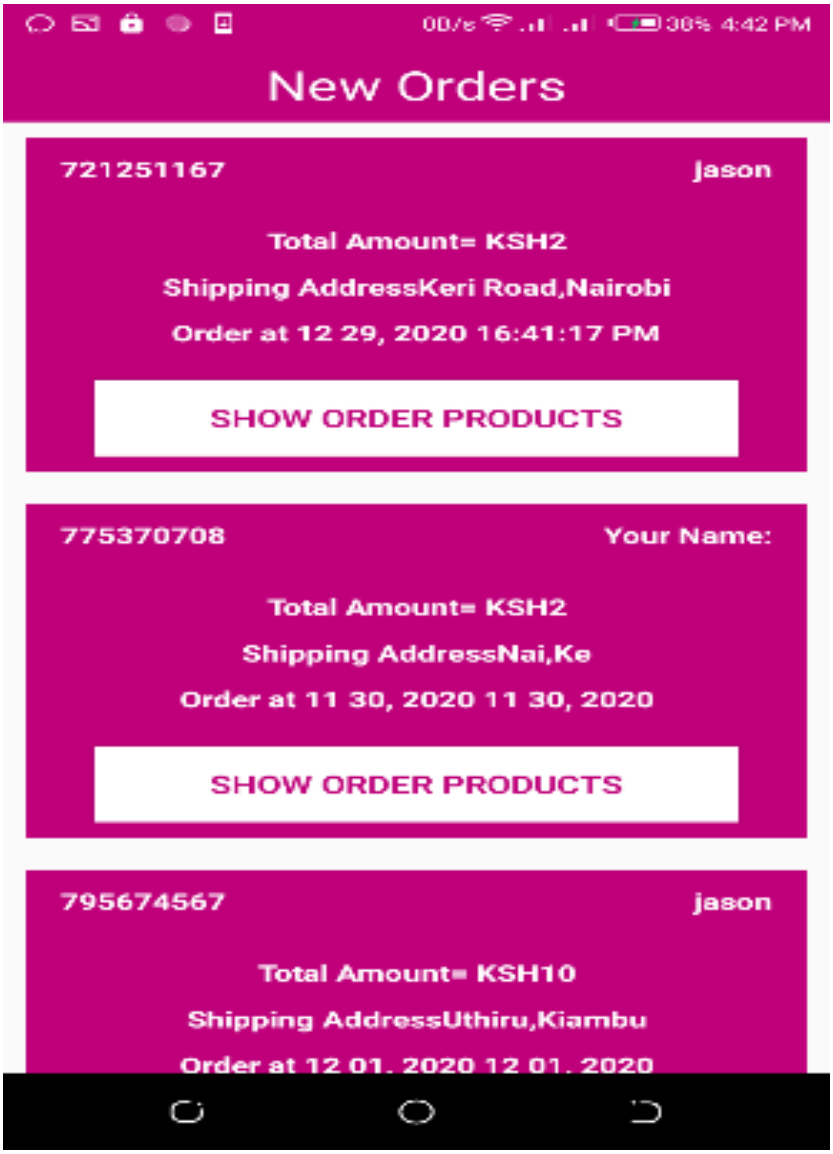

Figure 5. 13 View Customer Orders

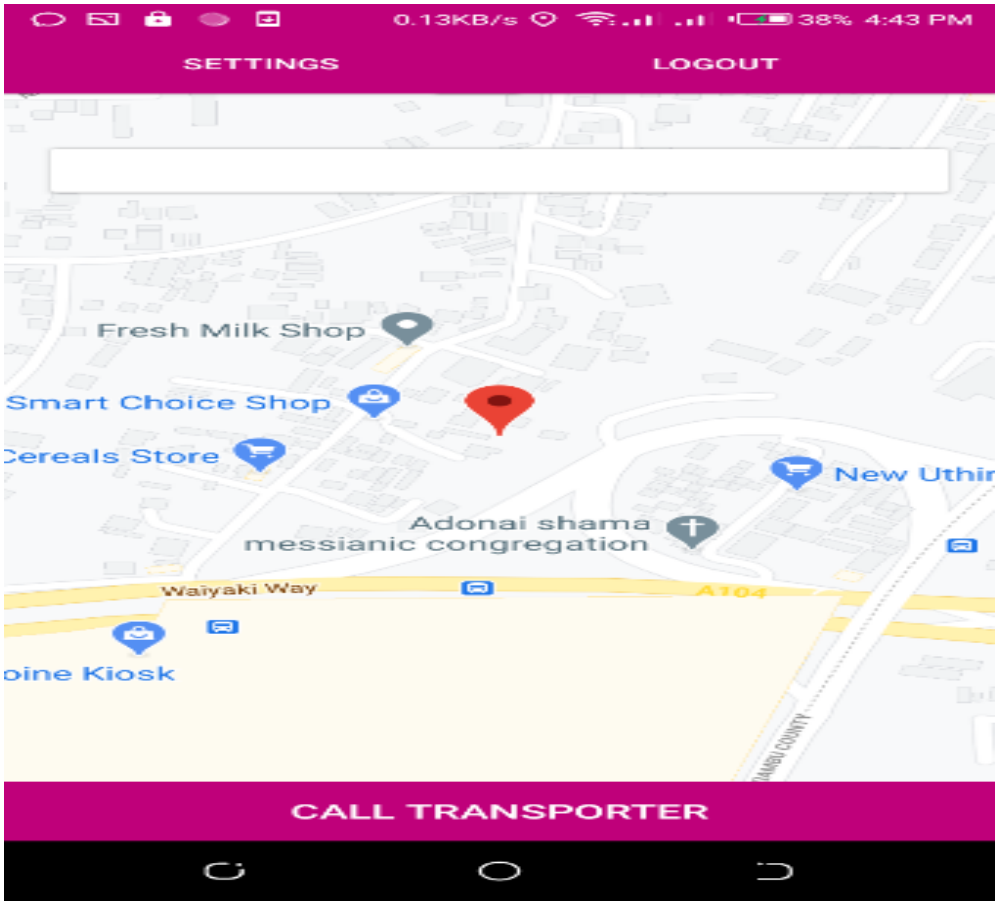

Figure 5. 14 Call Transporting Vehicle

4.2.4 Transporter Functions

a) Login and Register

When a new Transporter opens the application, they are able to log in if they already have an account or register if they are new to the system and they need to provide required information before they register and log in.

b) Accept Farmer Requests

The Transporter receive the transporter request together with the name and location of the Farmer and the Destination.

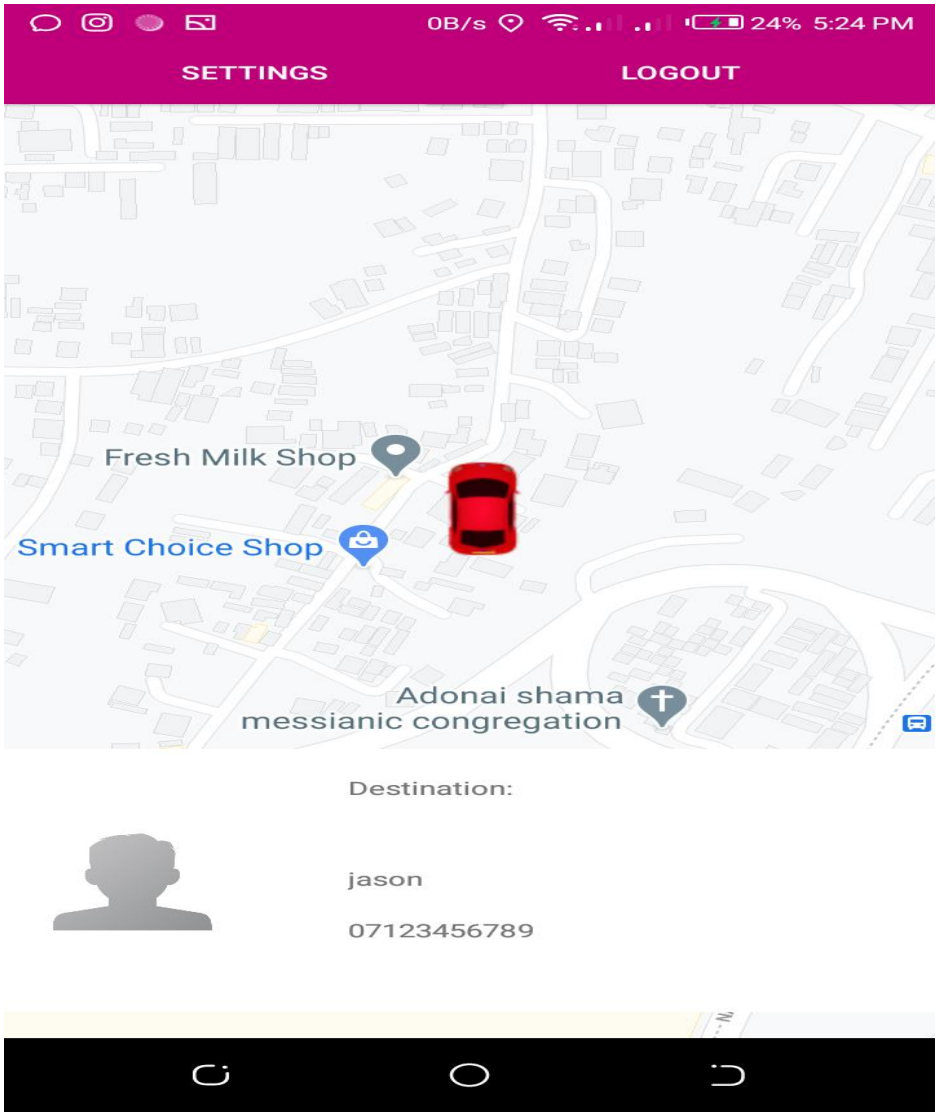

Figure 5. 15 Customer Found

5.3 Testing

This section mainly focuses on the system testing and whether the system succeeded or not. As mentioned earlier, the testing that is used in section 3.6, White box testing has been employed because the proposed system will be developed from scratch. Therefore, I will have full knowledge and workings of the application. Integration testing, smoke testing and performance testing was used.

5.3.1 Integration Testing

This type of testing verifies that the different modules used in the system are working well together. The system had different modules that needed to interact together for the system to operate efficiently. When a Farmer requests for Transportation, the Farmer module interacts with

the transporter module to find the transporter who is actively online and once a transporter if found by the system, the system automatically allocates the transporter to the farmer.

5.3.2 Smoke testing

This type of testing is used to give assurance that the major features of the system are working as expected. The major functionalities of the system were tested to detect any major issues and they were working as expected i.e., when the user logs in, they are able to move onto the next screen with a valid username and password.

5.3.3 Performance testing

This type of testing is used for testing the speed, performance and response time of the software application. It was discovered that the systems response time is working well but it takes a bit of time retrieving the images from the database.

Chapter 6: Discussion, Conclusions, Recommendations and Future Works

6.1 Introduction

This chapter presents the conclusions of the objectives that were mentioned in chapter 1. The objectives are reviewed and the achievements are addressed. Discussion will be on the different modules of the system and what each of the modules is able do so far. There will be coverage on what the system was not able to achieve and also make recommendations on future works that can be achieved by similar systems that aim to solve the same problem. This will help current and future developers know the areas they could cover in future. The conclusion will cover what the system has been able to accomplish and will also cover the termination of system development as a whole.

6.2 Discussion

The system can be used by four different actors and in our case, we will have four modules. That is the Administrator module, Trader module, Farmer module and finally the Transporter module each with different roles and functionalities. On the Administrator module, an Administrator is able to log in into the system and has the role of approving products that the farmers are selling. Approved products are the visible to the Traders while the disapproved ones are deleted from the database

The Farmer module enables farmers to login and Register on the system. The system Authenticates the user when they register by sending the trader a One Time Password (OTP) that the user has to input in order to be logged in into the system. These prevents users from registering using fake phone numbers. Once the Farmer is logged in, he/she can be able to post products that they wish to sell under a specific category. The farmer can also view if their products have been approved or not, they can edit or delete their products and finally they can view Trader orders and request for transportation of those orders.

The Trader module enables customers to make orders of products that they would wish from the farmers. They confirm their final order and they make payments either through Mpesa or PayPal. The trader can also update their information and delete items from their cart.

The Transporters module enables the Transporters to accept Farmer requests and get the products for transportation.

6.3 Conclusion

The aim of the system was to provide a channel for both the farmers and the transporters to get the exposure they need to the market. Traders will also benefit as the system will aid them to get access to any products they might need to purchase, without leaving their houses. To achieve the aim of the project, an Object-Oriented Approach was used to improve on the quality of the system

6.4 Recommendations

For the system to work and function as expected, there should be interaction between the different modules. The modules should be able to communicate with each other. The user also needs to have internet connectivity and have their location turned on. This is important as the system will be able to track the Farmers current location and also the transporters current location. This helps to know how far the transporter is from the farmer.

6.5 Future Works

Despite the fact that the system tries to tackle the problem arising between the farmer and middlemen, not all areas have been addressed due to the scope of the project, therefore, future works would include Product tracking where once the product leaves the Farmer, the trader can actually track the movement of his/her products on the system. The other future works that could be done is the Farmers receiving a notification on their phone once an order has been made instead of them opening the app to check for new orders.

There could be also the use of session timers to make the application more secure. The timer would time out the user after a long inactivity period and prompts the user to log in again and get back to their task.

References

Alila, P. O., & Atieno, R. (2006). *Agricultural Policy in Kenya: Issues and Processes* . Nairobi.

Bassil, Y. (2012). A Simulation Model for the Waterfall. *International Journal of Engineering & Technology (iJET*, 2049-3444.

Fafchamps, M., & Hill, R. V. (2005). Selling at the Farmgate or Traveling to Market. *American Journal of Agricultural Economics*, 717-734.

Kokemulle, N. (2018, April 05). *The Advantages of Eliminating the Middleman*. From azcentral: https://yourbusiness.azcentral.com/advantages-eliminating-middleman-13463.html

Kurtenbach, T., & Thompson, S. (n.d.). *Information Technology Adoption: Implications for Agriculture.*

Langat, R. J., Litondo, K. O., & Ntale, J. F. (2016). Information Communication Technologies and Marketing Decisions among Small scale Farmers. *International Journal of Economics, Commerce and Management* , 1167-1169.

Oldevik, J., & Berre, A. J. (1997). *UML-Based methodology for distributed systems.* Oslo: SINTEF Telecom and Informatics.

R, S. M., Pabshettiwar, A., & Ghumatkar, K. K. (2012). *E-FARMING.* Pune: Raisoni College of Engineering and Management.

Role of middlemen in the marketing of agricultural commodities. (2019, December 03). From Agribusiness Media: http://agribusiness.co.zw/index.php/articles/131-role-of-middlemen-in-the-marketing-of-agricultural-commodities

S.Negi, D. (2018). Food Policy. *Farmers' choice of market channels and producer prices in India: Role of transportation and communication networks*, 106-121.

Transportation Aggregators Market. (2020, July). From Future Market Insights: https://www.futuremarketinsights.com/reports/transportation-aggregators-market

Appendix A

ID	Task	Start	Finish	Duration	Progress	Priority	Resources
1	Identify Problem set	2020-04-15	2020-04-21	4.6 d	100%	None	
2	Concept Note	2020-04-22	2020-04-28	4.6 d	100%	None	
6	Chapter 1	2020-04-29	2020-05-05	4.6 d	100%	None	
7	Chapter 2	2020-05-13	2020-05-19	4.6 d	80%	None	
8	Chapter 3	2020-05-20	2020-05-26	4.8 d	70%	None	
9	System Proposal	2020-04-29	2020-07-03	47 d	0%	None	
10	System Analysis and Design	2020-06-10	2020-11-09	108.6 d	0%	None	
11	Database schema	2020-06-24	2020-06-30	4.6 d	0%	None	
12	Entity Relationship Diagrams(ERD)	2020-06-17	2020-06-23	4.6 d	0%	None	
13	Structural Diagrams(Class Diagrams/Sequence Diagrams/DFD's)	2020-06-10	2020-06-16	4.6 d	0%	None	
14	Progress Presentation	2020-06-10	2020-07-01	15 d	0%	None	
15	Coding, Class presentations and documentation writing	2020-08-05	2020-11-03	64.6 d	0%	None	
16	Final Presentations	2020-11-04	2020-11-09	3.6 d	0%	None