UNIVERSITY OF NAIROBI

COLLEGE OF BIOLOGICAL & PHYSICAL SCIENCES
SCHOOL OF COMPUTING & INFORMATICS

E-COMMERCE APPLICATION FOR SMALL SCALE FARMERS - kuLima

BY

JEFF KIMINGI KARANJA

P15/1924/2018

Supervisor

Professor Elisha Opiyo

2021

DECLARATION

I hereby declare that this project is my own work, and has to the best of my knowledge, not been submitted to any other university.

Signature..... **Date.....**

Student :Jeff Kimingi Karanja
Reg.no : P15/1924/2018

This project has been submitted as a partial fulfilment of requirements for the Bachelor of Science in Computer Science of the University of Nairobi with my approval and the University Supervisor.

Signature..... **Date.....**

Supervisor: Prof. Elisha T. Opiyo Omulo

ABSTRACT

Farming has been part of our society for more than ten millenia now, the practise has remained the same, it is the methods that have changed. We have increasingly become better at utilising our lands to get the maximum yield. Farming remains a lucrative pursuit just as it was 100 years ago. But with increasing competition in our local markets and ineffective distribution services farmers are being dissuaded to enter an otherwise profitable business. kuLima addresses this issue by providing farmers with a broader market, it allows them to cater for consumers who do not directly visit their local market ‘soko’. kuLima is a web based application implemented with the MERN stack(MongoDb, express, react and NodeJs) that aims to mitigate this barrier of entry to farmers and also alleviate the risks of contracting the Covid-19 virus by visiting crowded areas like the ‘soko’. kuLima will allow consumers to shop for fresh locally produced fruits and vegetables and farmers to post their produce and also check on how they are competing in the online market. kuLima fully realised will enable farmers to garner more profit by exposing them to larger markets, promote consumer safety by allowing them to order food in the safety of their homes and promote good farmer consumer relationship as it is important to know who produces what you eat.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND STUDY

Small Scale Farming has become a revolution world wide as people have seen the profit that comes from producing agricultural products. Previously only people with large pieces of land would grow and rear livestock for commercial purposes. Now, we are seeing more and more farmers get into the market even with farms as little as a half an acre. Small scale farming has revolutionised the farming industry. The advent of small scale farming could not come at a better time, our current society values online shopping or e-commerce as opposed to going to the market physically. This has further been perpetuated by the current Covid-19 pandemic that has forced us to practice social distancing. Thus selling farm produce has become a popular business venture. The only problem now is that it is decentralised there is no central hub where all farmers can meet the consumers on the same platform.

1.2 PROBLEM STATEMENT

From a recent survey done by the route to food organisation we know that 70% of farmers in Kenya are small scale farmers. Of this percentage, 3.5 million are crop farmers. The produce from these farmers accounts for 33% of the GDP. However, the existing infrastructure that levies farmers' produce to consumers is inefficient and clouded with corruption, especially now in the Covid-19 pandemic when farmers need assistance the most. This has greatly discouraged most small scale farmers from venturing further into agriculture. In 2018 for instance, NCPB owed farmers Kshs 3.5 billion, 8 months after farmers took their produce to the board. How then can we create a system that ensures continuity and even distribution of agricultural produce throughout the year? How do we help small scale farmers maximise on their agricultural produce and encourage more farming in Kenya? As we can see the existing systems of distribution and payment for agricultural produce is sub-optimal. There is a need for independence from these big established organisations, there is a need to incentivize farmers and potential farmers into the profitable world of small scale farming especially now when we are all struggling to make ends meet.

1.3 OBJECTIVES

Project Aim: To develop a stand-alone e-commerce platform where farmers and consumers can interact freely and trade online.

Project Objectives

1. To enable farmers to post their produce on the platform for consumers to purchase.
2. To enable consumers to purchase locally available produce at the convenience of their residence and/or remotely.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Food security is a condition in which, according to the Food and Agriculture Organization, 'all people, at all times, have physical, social and economic access to sufficient, safe, nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO 2002). Promisingly, the draft Food Security Bill 2014, currently before the national assembly, closely mirrors internationally accepted norms of defining food security.

Small-scale farming is the backbone of agriculture and food security because it prioritises food production. It not only feeds families but also generates jobs and catalyses the growth of rural businesses, particularly in the sector of micro and small enterprises. It is also important in urban settings with peri-urban agriculture increasing the amount and quality of food available to people living in major towns.

As demand for food is growing in Kenya, rural and urban consumers are increasingly relying on small-scale farmers to secure their supply of agricultural commodities. These farmers are a central player in the production of cereals (millet, rice, maize etc.), roots and tubers (cassava, yams etc.), production of seasonal fruits as well as breeding of poultry, cattle and fish. Increased small-scale agricultural production means more food enters the marketplace, leading to lower food prices. Moreover, it means small-scale farmers who are often also food poor farmers, are able to earn a living that allows them to reinvest in their farms and feed themselves and their families. Increased small-scale agricultural production supports the livelihoods of people on both ends of the food value chain.

Small-scale farming is also a positive driving force to curb climate change and to enhance carbon sequestration. As stated earlier small scale farmers form the majority of the agricultural producers in Kenya and thus have the greatest impact on climate change because they occupy a majority of the land. It may not be apparent at first glance but since they account for over 70% of agricultural production and meet about 75% of the national food demand they are the biggest producers and also biggest contestants to help stop climate change.

2.1.2 E-Commerce Background Study

Electronic Commerce commonly known as e-commerce, eCommerce or e-comm consists of buying and selling of products or services over electronic systems such as the internet or other computer networks. This is a new standard compared to the old brick and mortar businesses: companies that have a physical presence, a physical store and offer face-to-face consumer experiences. This term is usually used to contrast with a transitory business or an internet only presence, such as an online shop.

E-commerce can further be classified to pure play and click and mortar. Pure play is an organization that originated and does business purely through the internet; they have no physical store (brick and mortar) where customers can shop. Examples of large pure and play companies include Amazon.com. On the other hand, click and mortar employs a business model that includes both online and offline operations, which typically include a website and a physical store. A click and mortar company can offer customers the benefits of fast, online transactions or traditional, face to face services. An example of such a company is Carrefour

Classification of E-Business Transactions.

The different business models involved in e-commerce include:

- Business-to-business (B2B) describes commerce transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer.
- Business-to-consumer(B2C, sometimes also called Business-to-Consumer) describes activities of businesses serving end consumers with products and/or services
- Business-to-business-to-consumer(B2B2C), an e-commerce model in which a business provides some product or service to a client business that maintains its own customers.
- Consumer-to-business(C2B) E-commerce model in which individuals use the internet to sell products or services to organizations or individuals who seek sellers to bid on products or services they need.
- Consumer-to-Consumer(C2C). E-commerce model in which consumers sell directly to other consumers.
- Mobile-commerce (M-commerce). E-commerce transactions and activities conducted in a wireless environment.

Revenue Model

A revenue model outlines how the organization or the EC project will generate revenue. The major revenue models are:

1. Sales. Companies generate revenue from selling merchandise or services over their websites.
2. Transaction Fees. A company receives commission based on the volume of transactions made.
3. Subscription Fees. Customers pay a fixed amount, usually monthly, to get some type of service.
4. Advertising Fees. Companies charge others for allowing them to place a banner on their sites. This is how Google has made its fortune
5. Affiliate Fees. Companies receive commissions for referring customers to other websites.

6. Other revenue sources. Some companies allow people to play games for a fee or watch a sports competition real time for a fee.

2.1.3 Small-Scale Farming Background Study

Small scale farmers in Kenya farm everything from cereals(maize, millet, rice) roots and tubers(cassava, yams); production of seasonal fruits and indigenous vegetables; breeding poultry, fish and cattle.

Routinely overlooked small scale farmers are the key to food security in Kenya.We often assume that the only way to resolve Kenya's hunger problem is through large-scale commercial agriculture or through genetically modified food while the key to resolving the country's ongoing food crisis is through small-scale farmers.

Kenya's agriculture is predominantly small-scale farming and is carried out on farms averaging 0.2–3ha, mostly on a subsistence basis. Small-scale operations account for over 70% of agricultural production and meet about 75% of the national food demand. Therefore, the most important reason for supporting small-scale farming is its critical role in achieving food security, particularly for those who are vulnerable to chronic hunger or food poverty.

Small scale farming forms the backbone of agriculture and food security because it prioritizes food production. It not only provides food for families but also creates jobs in both rural and urban settings. Small scale farming has also increased the quality and quantity of food available in major towns because of the adoption of peri-urban agriculture. The major problem facing small scale farming is the amount of food that is lost throughout the post harvest chain but mostly in the transportation stage and during market storage.

2.2 Related Systems

Online platforms that bridge the gap between consumers and producers do currently exist but they solely focus on the business perspective and are mostly only centered around one business. Some examples of these applications are:

enricfarmfresh.co.ke

This is an e-commerce platform but it is an online business solution for the enricfarm and by no means a platform for other farmers

mkulimayoung.com

Mkulimayoung serves the purpose of a platform for farmers but the scope also encompasses large scale farmers. Their market distribution is also global thus they are overstretched

kalimonigreens.com

This is also a business centered approach

Supermarkets like Carrefour and Quickmart that offer home deliveries for even their agricultural products. This still introduces a middleman in the transaction and consumers are unable to form relationships with the actual farmers. Also supermarkets work with a select number of farmers who supply them with goods by means of contracts such as tenders.

Most of the owners of the web applications are individually owned businesses. This accounts for a negligible percentage of the number of small-scale farmers in the country or in the county.

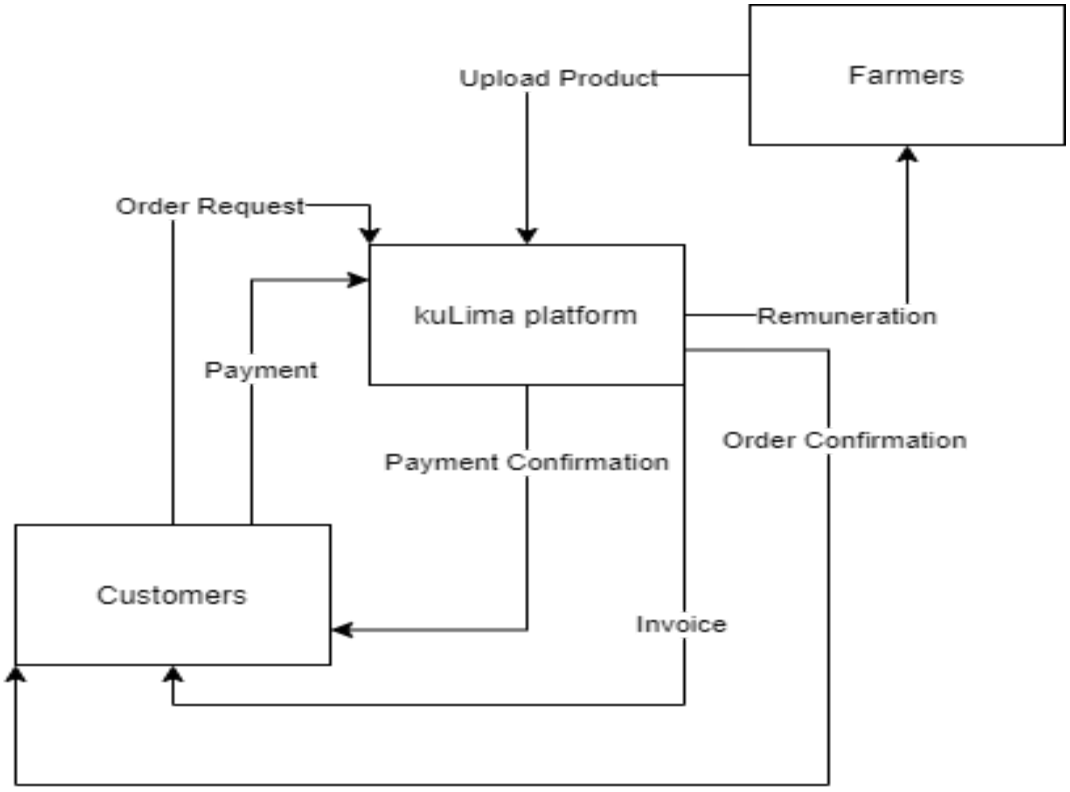
2.3 CONCLUSION

There is currently no solution to provide online transactions between farmers and consumers in Nakuru county and the solutions that do exist are only pertinent to individual business operations as we have seen above. The growing population demands for more food production but the majority of the people do not want to venture into the field because they fear making losses. This is far from the truth because the market for produce is there, the problem is accessing it. With the onset of 'do everything online' culture currently, selling produce online can be a profitable pursuit as well as a worthy one.

2.4 PROPOSED SYSTEM

Currently in Kenya there is no existing system that provides this functionality, if you want fresh produce you have to physically go to the market or visit one of the intermediary vendors. The only way for consumers to form relationships with the farmers who produce their food is to visit the market personally. The inverse is the same, for farmers to know their consumers they have to levy their produce to the local markets 'soko' where the market extent is shallow and showered with competition.

kuLima streamlines the trade process between farmers and consumers and makes the transaction a seamless interaction. The system allows customers to leave reviews and form personal relationships with the producers of their food. It allows a completely transparent transaction between farmers and their consumers.


Farmers
Upload Product
Order Request
kuLima platform
Remuneration
Payment
Payment Confirmation
Order Confirmation
Customers
Invoice

CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

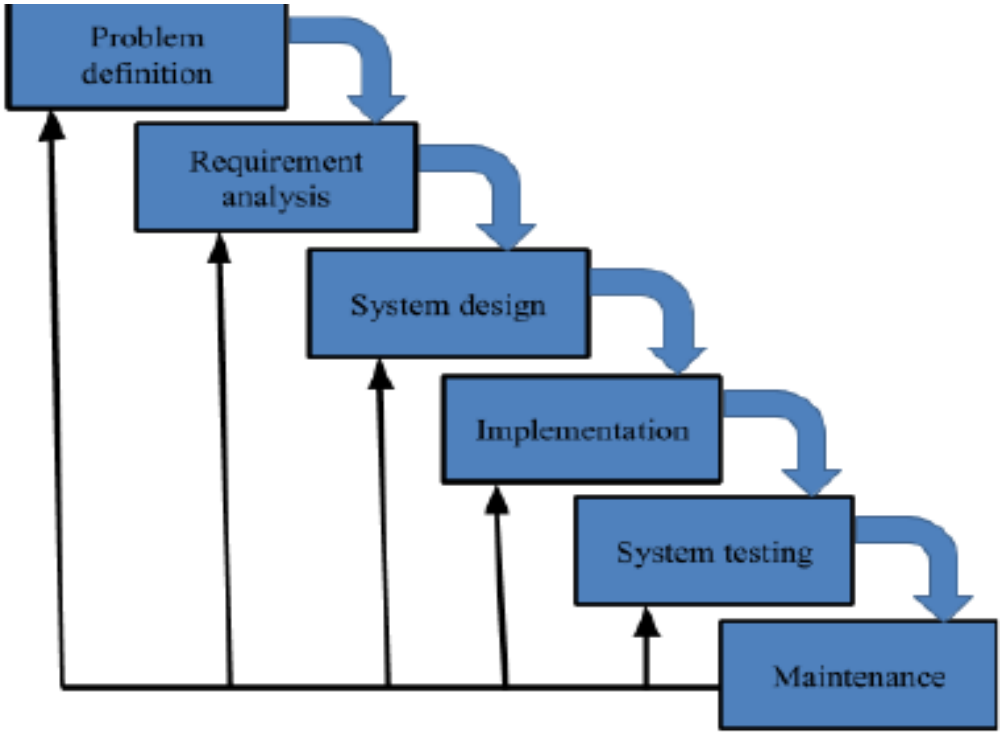
This chapter primarily deals with the technical and non-technical aspects of development in order to get an accurate understanding of the system before implementation.

3.1 Methodology

Development Methodology

To develop the application I will use the modified waterfall method as it features incremental stage by stage development. This methodology is appropriate as I will be working on the project alone and the deadline for submission is close. Using Agile methodology that focuses on iteration may produce better but may also take up more time. The methodology shall follow the traditional approach of requirements elicitation followed by analysis and design before implementation and building the application. Each stage must be completed before I transition to the next. Although being a modified waterfall it allows for some form of iteration as different stages of the cycle can be revisited.

The figure below depicts the software development process:



3.2 Systems Analysis

3.1.1 Research Methods

3.1.1.1 Interviews

Interviews proved to be the best requirements elicitation technique here as I could get the full opinions of the farmers and consumers personally. Since the scope of my project was limited to Nakuru county, I only interviewed the residents in Nakuru.

3.1.1.2 Questionnaires

I prepared closed questionnaires for both farmers and consumers since they are the major stakeholders of the application.

- The farmers one focused mainly on the challenges they face using the current model of taking their produce to market and their opinions on my proposed model.
- The consumers one focused on their opinion about an application that locates all the farmers and all their produce centrally rather than only settling for farmers who have already established an online presence or supermarkets that offer home deliveries for almost anything.

Conclusion

The findings from the data collection proved the necessity of this application. After the feasibility study, the implementation of the project was deemed practical.

3.1.2 Requirements

3.1.2.1 Functional Requirements

These include:

1. The farmer should be able to log in to the system and access their account
2. The farmer should be able to upload his products and the quantity
3. The farmer should be able to see his product list and order history ##revise
4. The farmer should be able to set the product price and compare his price to other vendors
5. The consumer should be able to select a product choose the quantity and add the product to his or her cart

3.1.2.2 Non-Functional Requirements

1. Registration

   The system should be able to authenticate and authorize a registered user
2. Order

   The system should be able to process every order made and record the orders
3. Availability

   The system should be able to tell the customer whether a particular product is available or not
4. Reliability and Responsiveness.

   The system should provide a seamless experience for transitioning into different views such as the home page where the products are to the cart screen where all the user's products are listed

3.1.2.3 Constraints

This application requires:

1. A user with an internet connection
2. A user with a paypal account.

3.2 FEASIBILITY STUDY

Feasibility study is the process of measuring the practicality of a project. It is used to decide whether a given solution can be implemented and whether it is beneficial to the relevant stakeholders.

3.2.1 Operational Feasibility

This is the measure of how well the solution works as well as people's sentiment towards the proposed system.

With the advent of 'buy everything online culture', there is an increasing need to take the farmer's market online. kuLima does just this, in order to quench the market demands for fresh produce to be delivered to their doorstep and what better resource to leverage than the existing farmers who are also in need of more consumers in order to make profit.

3.2.2 Technical Feasibility

It is the measure of the practicality of the proposed project given the availability of technical resources and expertise.

The proposed system will be a web application which will facilitate communication between the farmers and consumers. All of this will be done with open source software like Visual Studio Code as the editor and basic web skills to combine the frontend(CSS, HTML and JavaScript) and backend(NodeJs) which are all available.

3.2.3 Schedule Feasibility

This is the measure for how reasonable the timeline for the proposed system is.

The allocated time is more than enough to finish the development of the system. Thirteen weeks is enough as there exists technical expertise to navigate the various facets of development.

3.2.4 Economic Feasibility

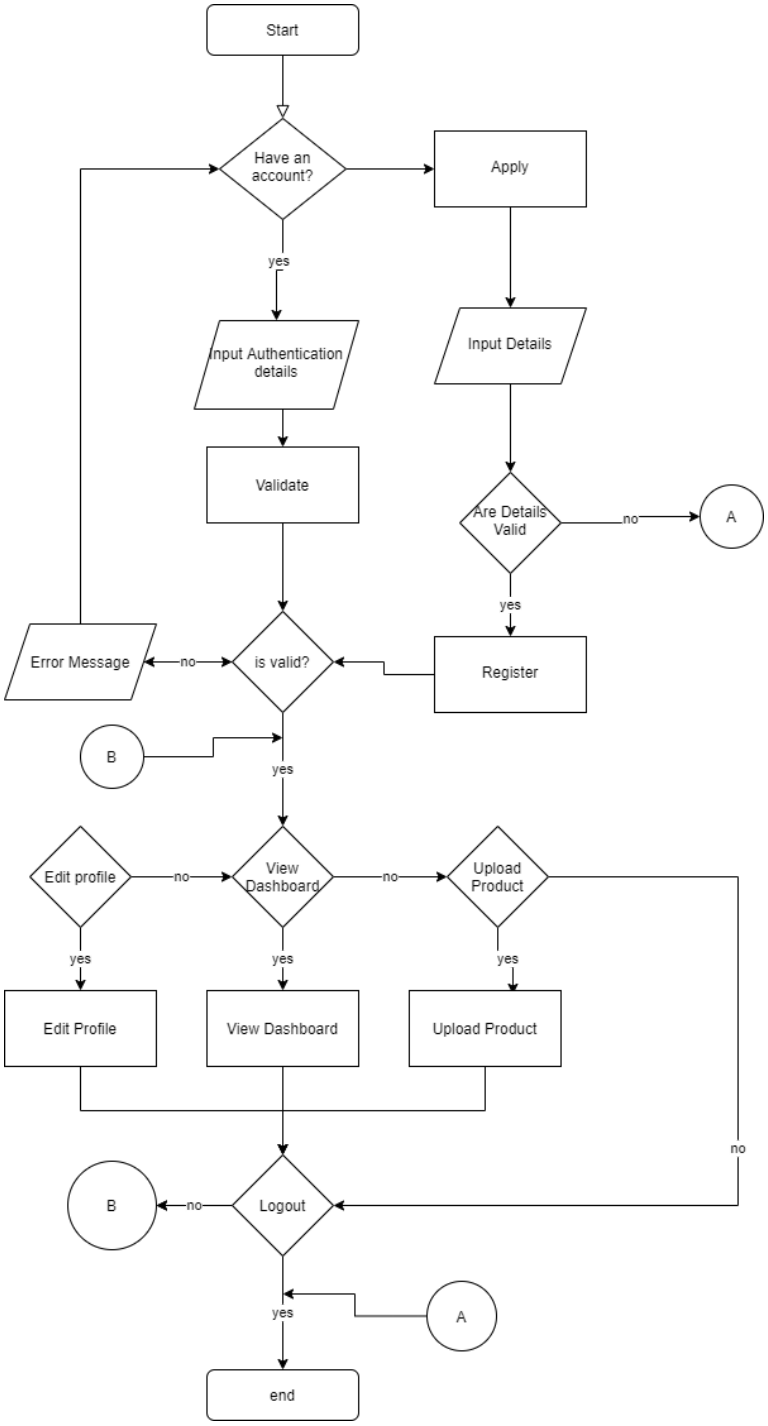
This is a measure of the cost effectiveness of the proposed system in terms of building and the returns after the system is complete and functional.

Building the system will be almost entirely free as most of the software to be used is open source, the only real costs are the man hours put into development and since the project is a school assignment, they are warranted. The revenue model of the system after completion will be commission based, for every consumer purchase a percent will go back to the maintenance of the platform.

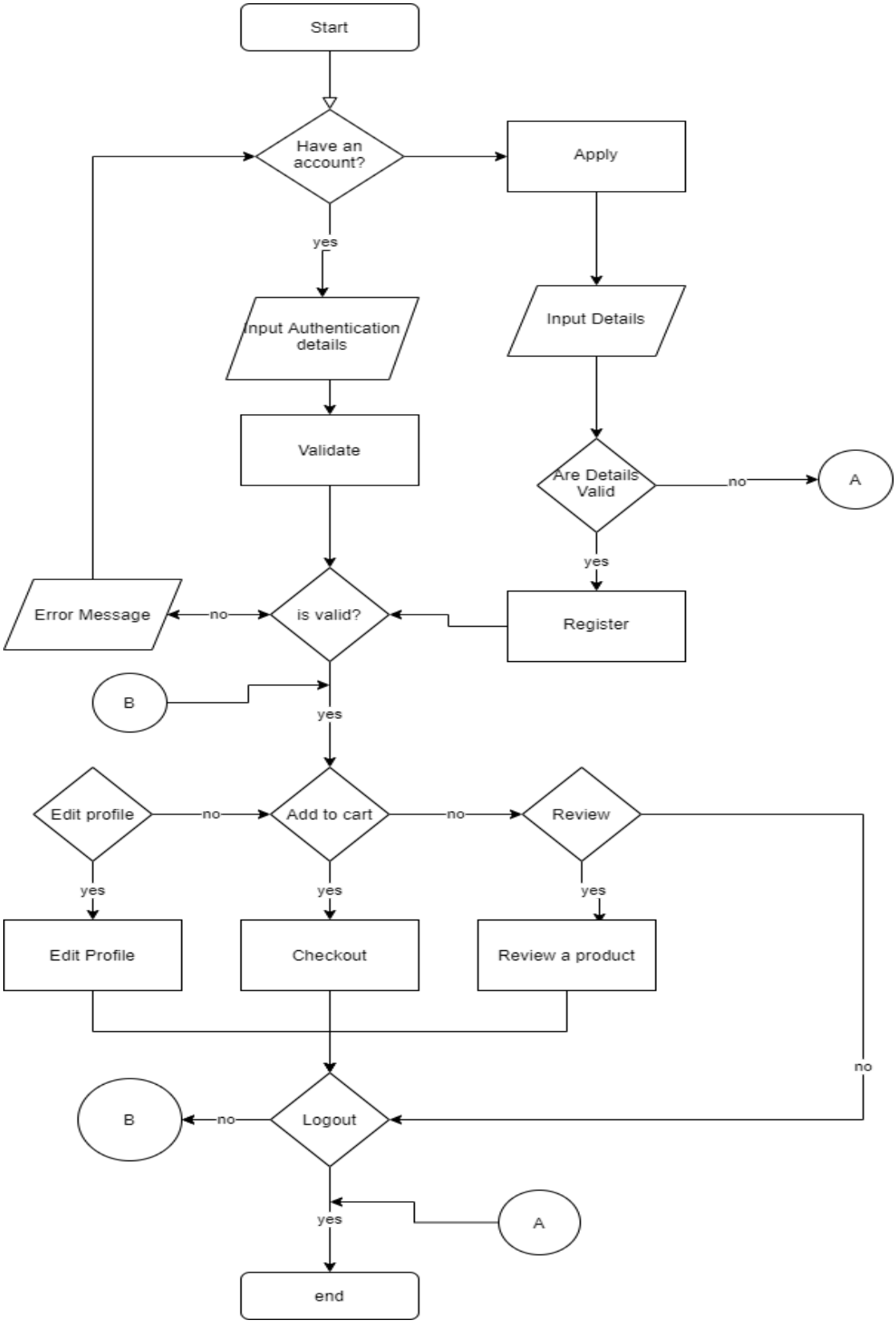
4.3 System Design

4.3.1 Flowcharts

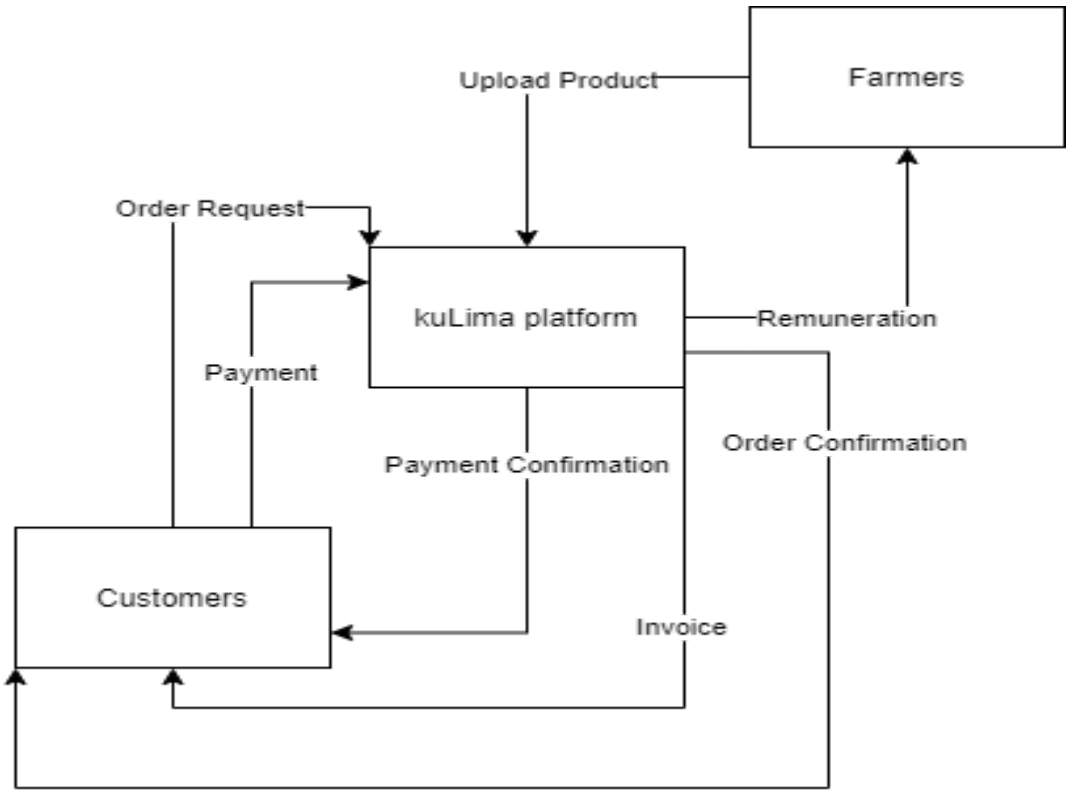
Vendor product upload sequence.



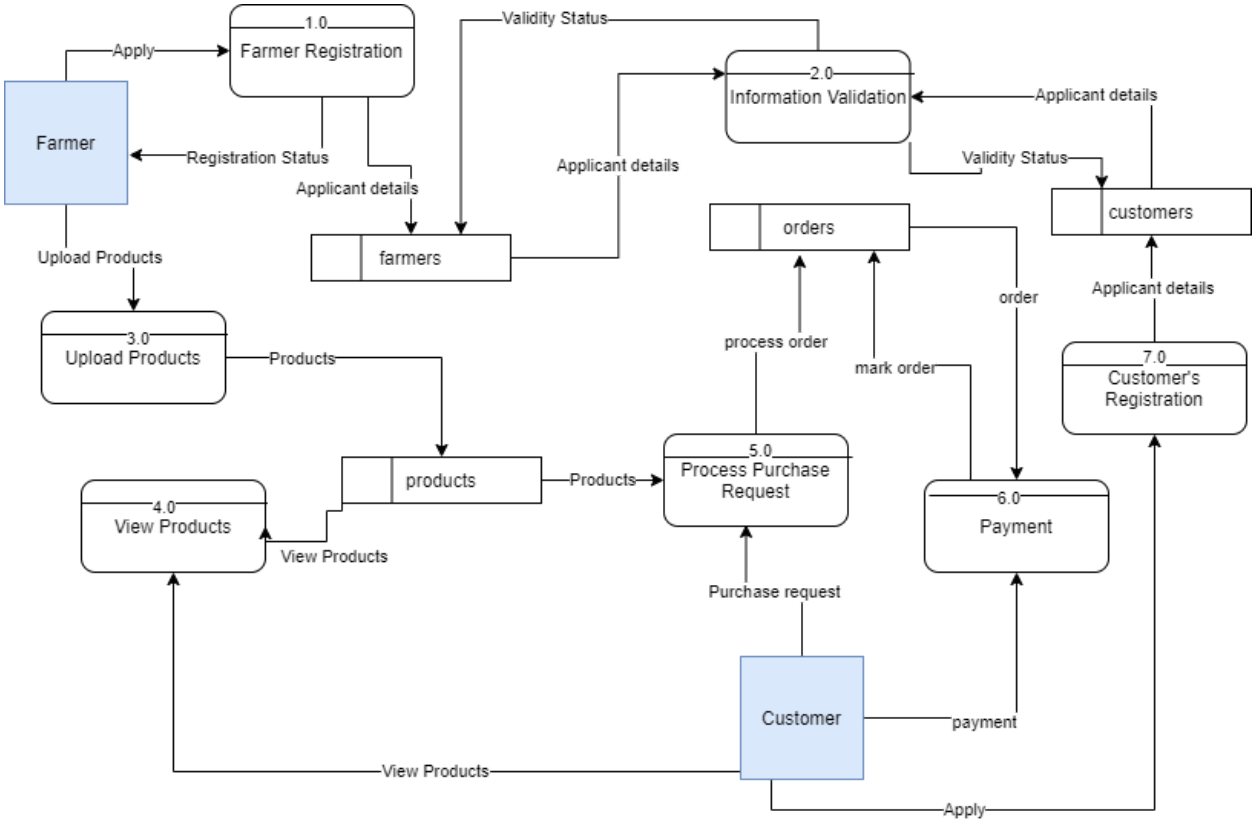
Consumer Purchase flowchart



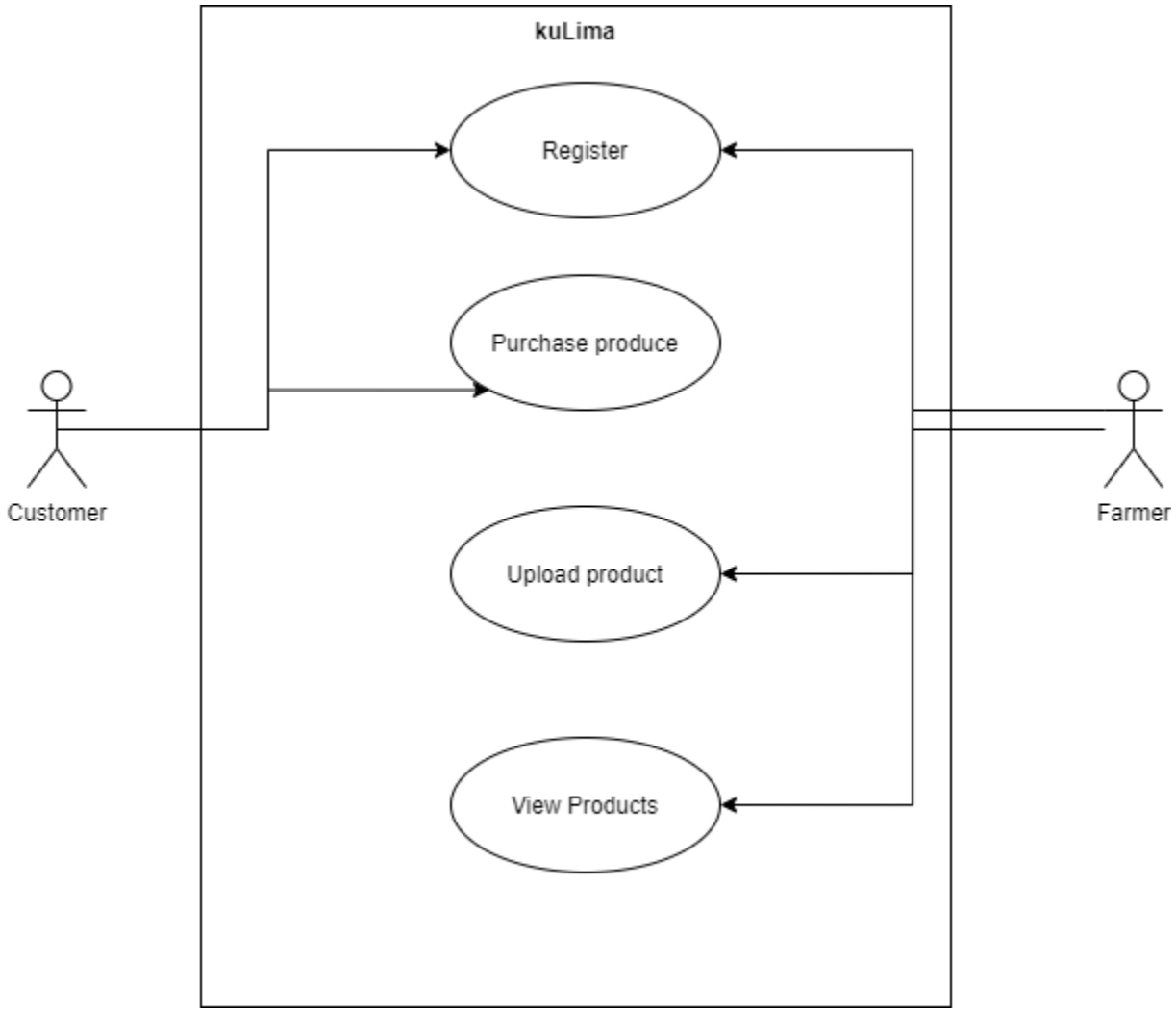
4.3.2 Data Flow Diagram



Level 1 DFD


1.0
Farmer Registration
Apply
Farmer
Registration Status
Applicant details
Validity Status
2.0
Information Validation
Applicant details
Validity Status
customers
Applicant details
Applicant details
farmers
orders
order
Upload Products
3.0
Upload Products
Products
process order
mark order
7.0
Customer's Registration
products
Products
5.0
Process Purchase Request
4.0
View Products
View Products
6.0
Payment
Purchase request
Customer
payment
View Products
Apply

4.3.3 Use Cases



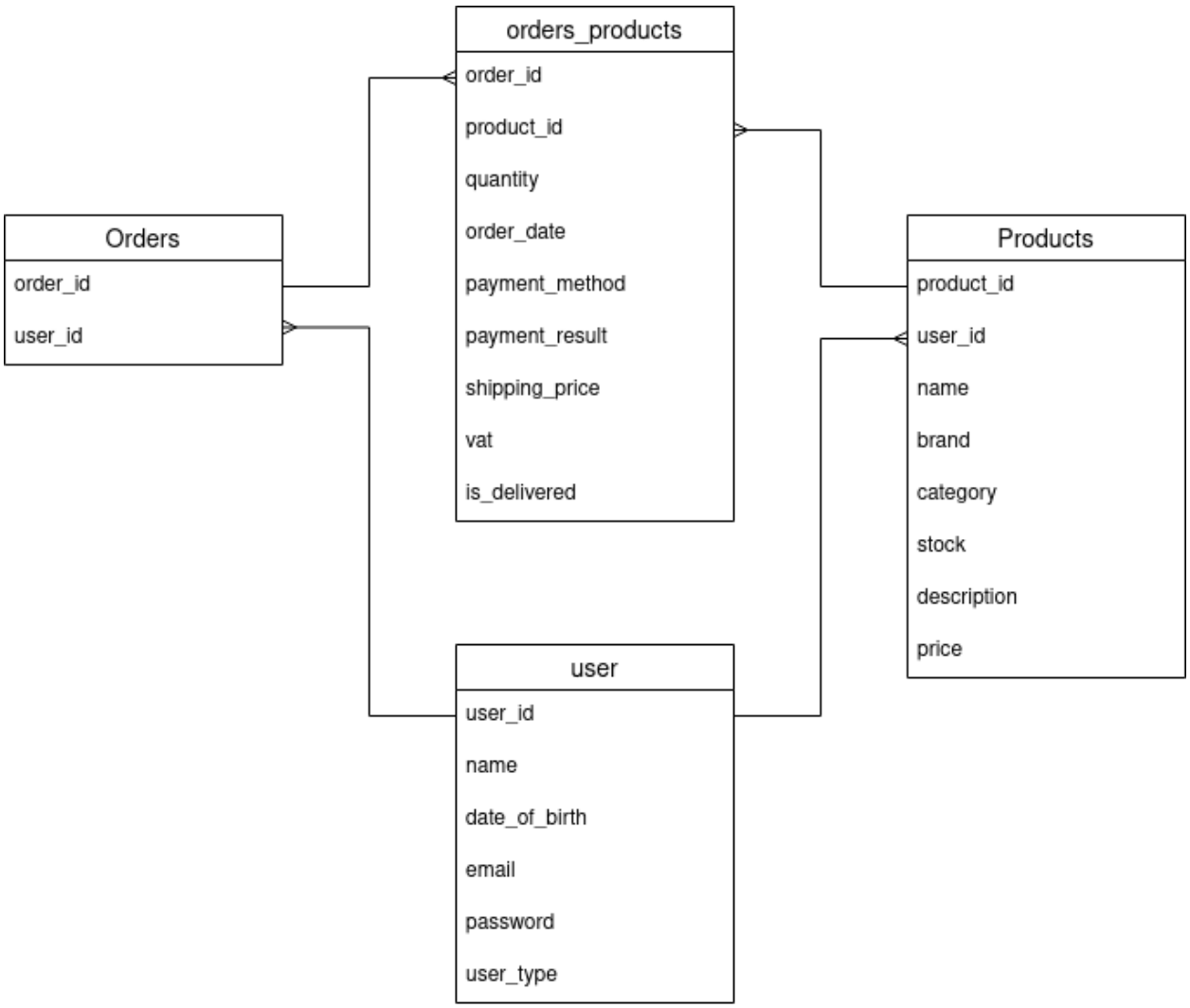
Use Cases:

- View Items
- Make Purchase
- Checkout
- Client Register
- Upload Products

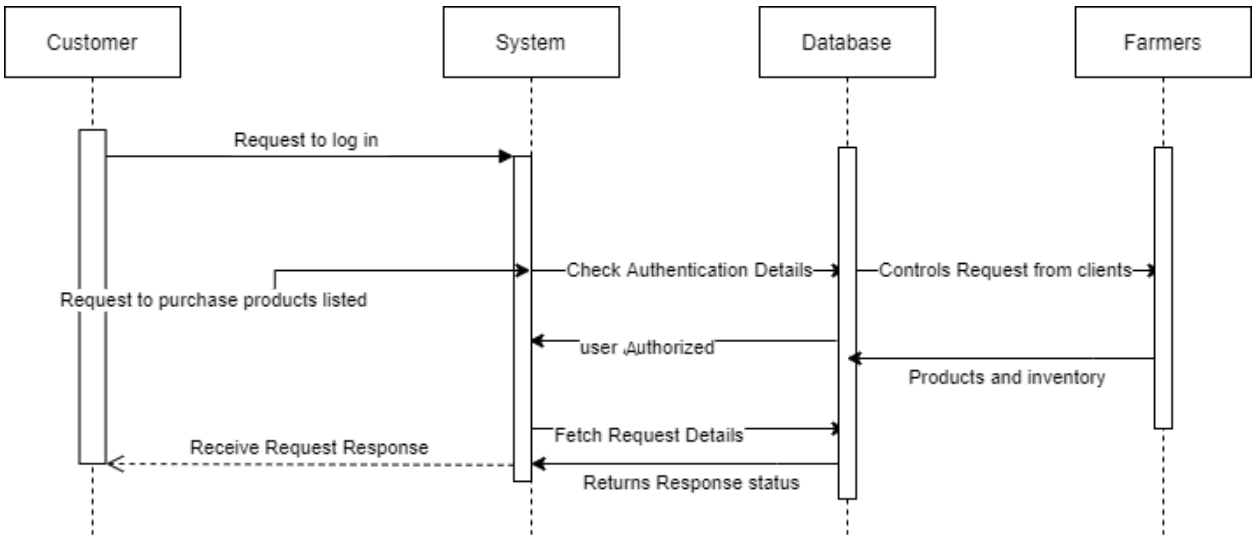
Actors:

- Registered Customer
- Registered Farmer

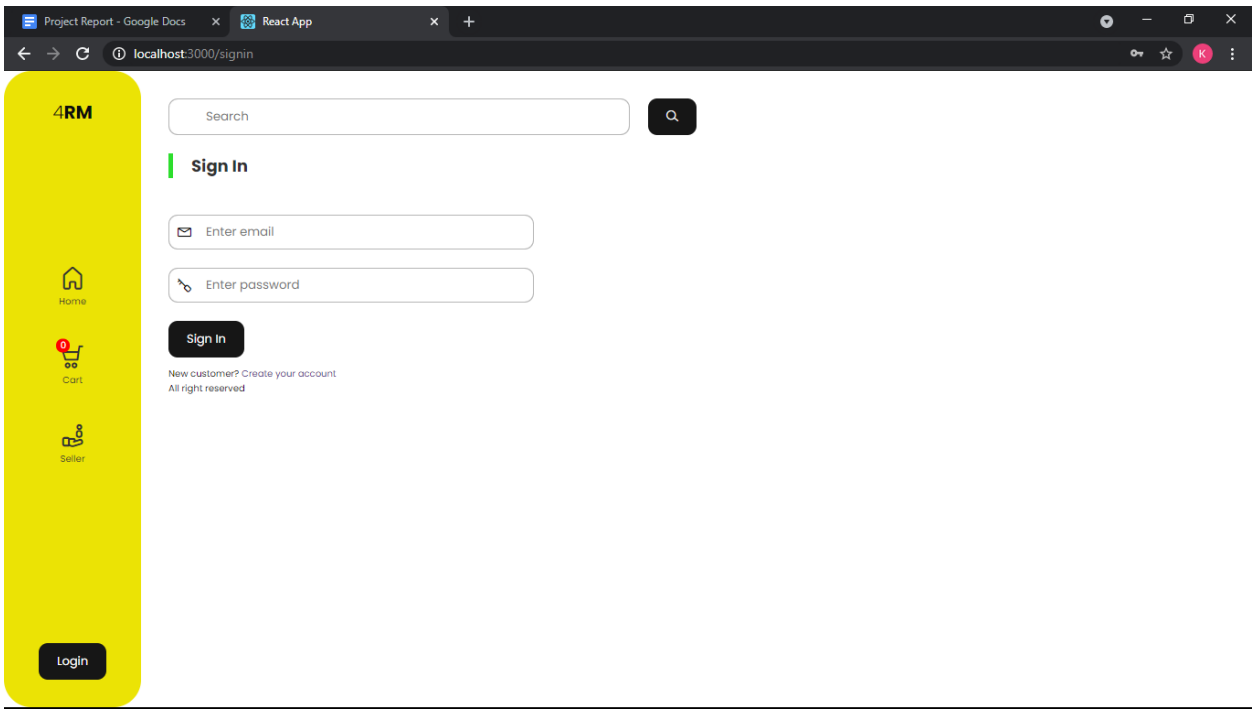
4.3.4 Entity Relationship Diagram



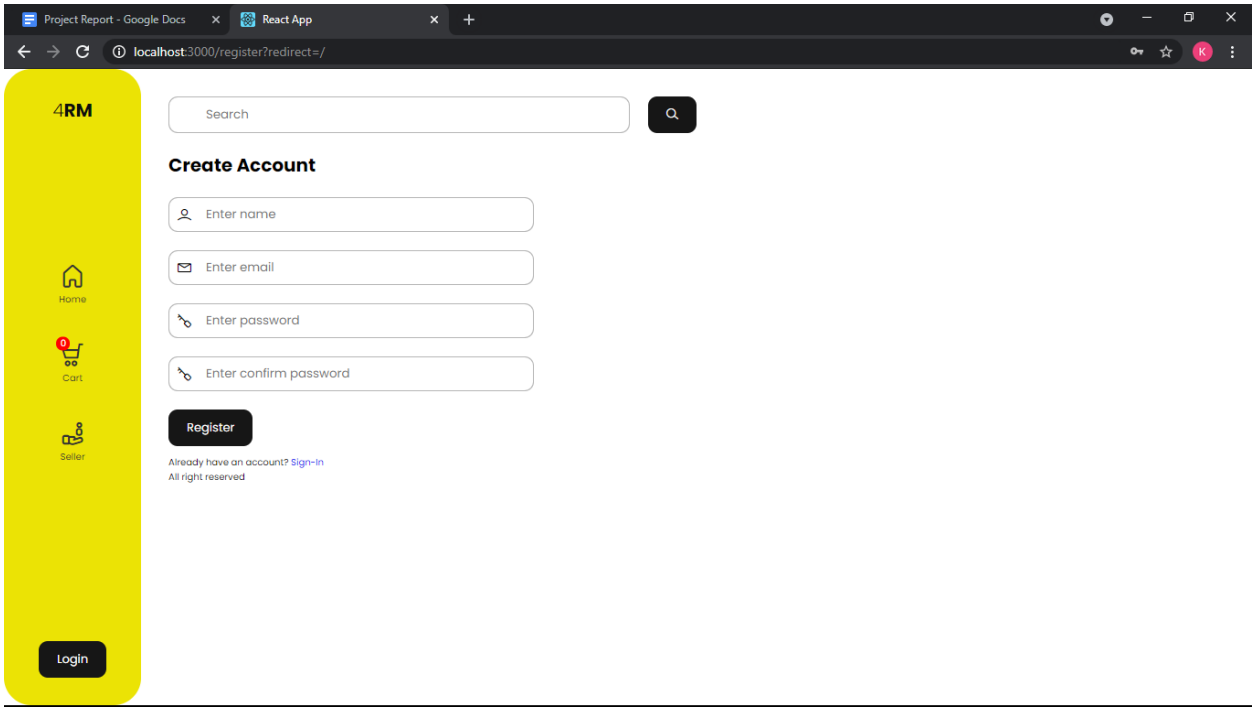
4.3.5 Sequence Diagram



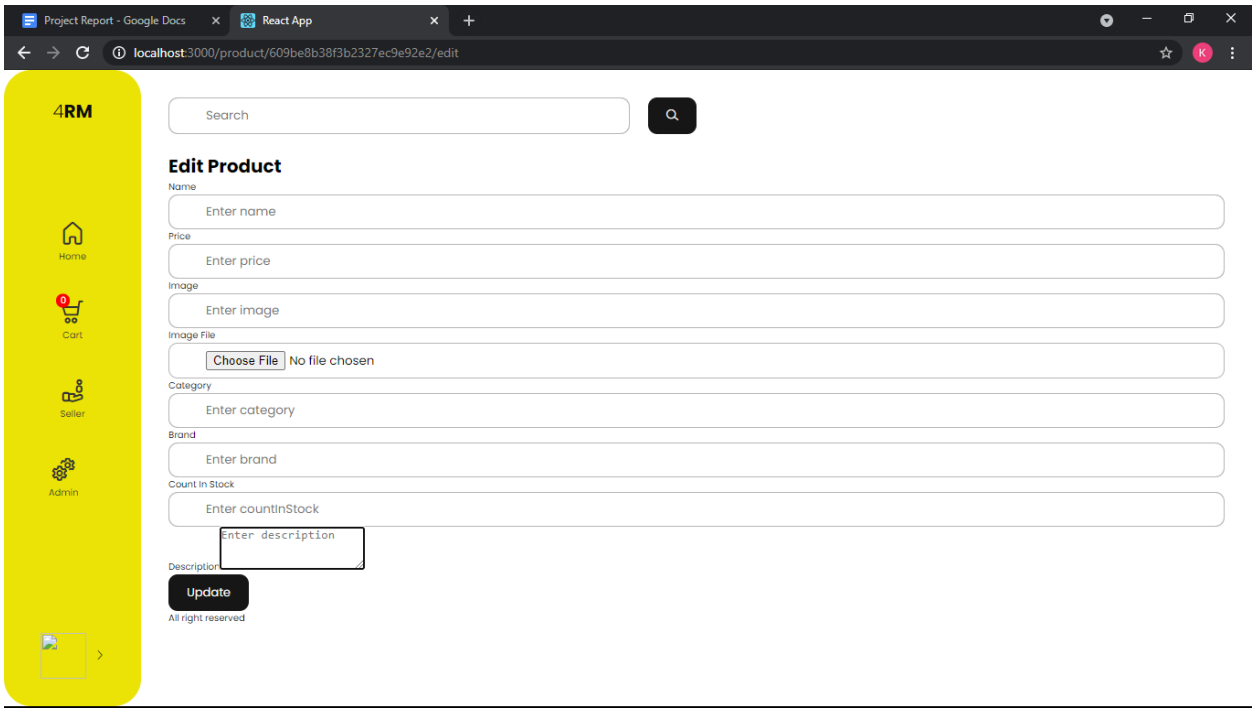
Screenshot of log in & sign up page



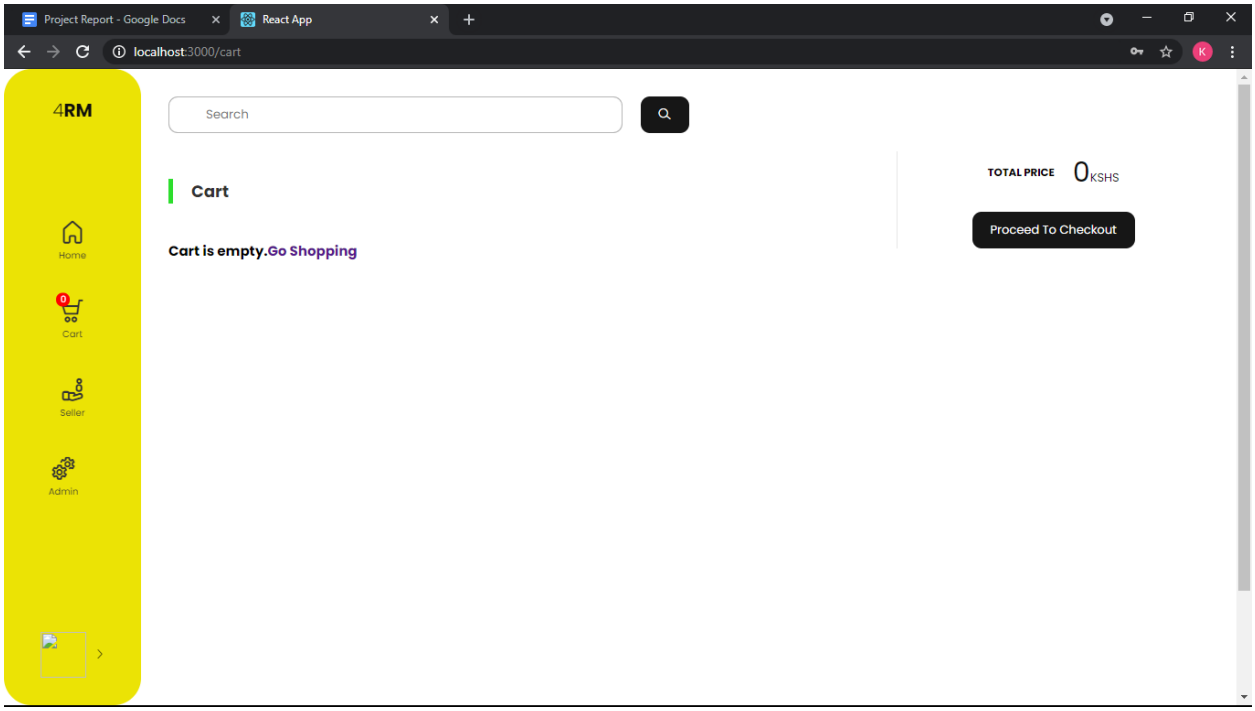
Screenshot of Registration Page



Screenshot of Vendor Upload Screen



Screenshot of Cart Screen



CHAPTER 4: SYSTEMS IMPLEMENTATION

This section describes how the design will be actualised into the final deliverable that is the e-commerce system. This involves the programming language used, the editor used and the necessary environment for the platform to run. For kuLima the tools for implementation were:

Hardware Resources:

The platform is not demanding and it can run on a computer with at least 2GB RAM, Intel Corei3 processor and 50 GB hard disk space

Software Resources:

a. Javascript - General purpose for JS use is to make the proposed project to make both client side and server side interactive with its element that engages the users. i.e. Fading, Loading, Drop down e.t.c
b. NodeJs - For implementing the server side infrastructure.
c. MongoDb - For leveraging the database services.
d. CSS - Its main purpose in the proposed system is to put information in the proper display format i.e to define font, size, colour, spacing e.t.c.
e. Visual studio Code - This is the text editor that is used to develop all the software components.

4.1 System Tests

Test ID	Test Description	Expected Output	Observed Output	Comment
001	Logging into the system	The system should redirect the user to the homepage where products are listed and if wrong notify the user accordingly	The system redirects the user to the homepage	N/A
002	Adding items to the cart	The system should respond by storing all the customer's items in the cart ready to checkout	The system provides the necessary functionality to hold the customer's products	N/A
003	Uploading a product	The system should allow farmers to upload their products and their products should appear in the site	The system records the farmers products and displays them on the homepage of the application	N/A
004	Order Processing	The system should be able to collect the user's shipping and payment information in order to charge them for the products they want to purchase	The system records the order and purchase details and is able to call paypal for order processing	N/A

Chapter 5: Conclusions and Recommendations

5.1 Conclusions

The platform satisfies the objective of allowing farmers to upload their products online and thus market them to a larger subset of users. The vendors can also see the products they have listed on the site. The platform is able to register and validate users who can engage in trade while within the site. The consumers are able to view the products, add them to cart and also checkout. Thus transactions between farmers and consumers(local and those far away have been achieved).

5.2 Recommendations

- A more common and easier payment system should be implemented i.e the Mpesa platform as the one used is a paypal extension.
- Farmers educational blog attached to the site. To educate farmers on the best practices of small scale farming in order to increase production

References

Njenga, M. (2016). Small-scale farmers are key to food security. https://routetofood.org/small-scale-farmers-are-the-key-to-food-security-in-kenya/#:~:text=Kenya's%20agriculture%20is%20predominantly%20small,of%20the%20national%20food%20demand.

The Hunger Project(2016). The Role of the Small-Scale Farmer in Minimizing Climate Change Impact. https://advocacy.thp.org/2016/10/the-role-of-the-small-scale-farmer-in-minimizing-climate-change-impact/

Appendix I: User Manual

For the consumer:

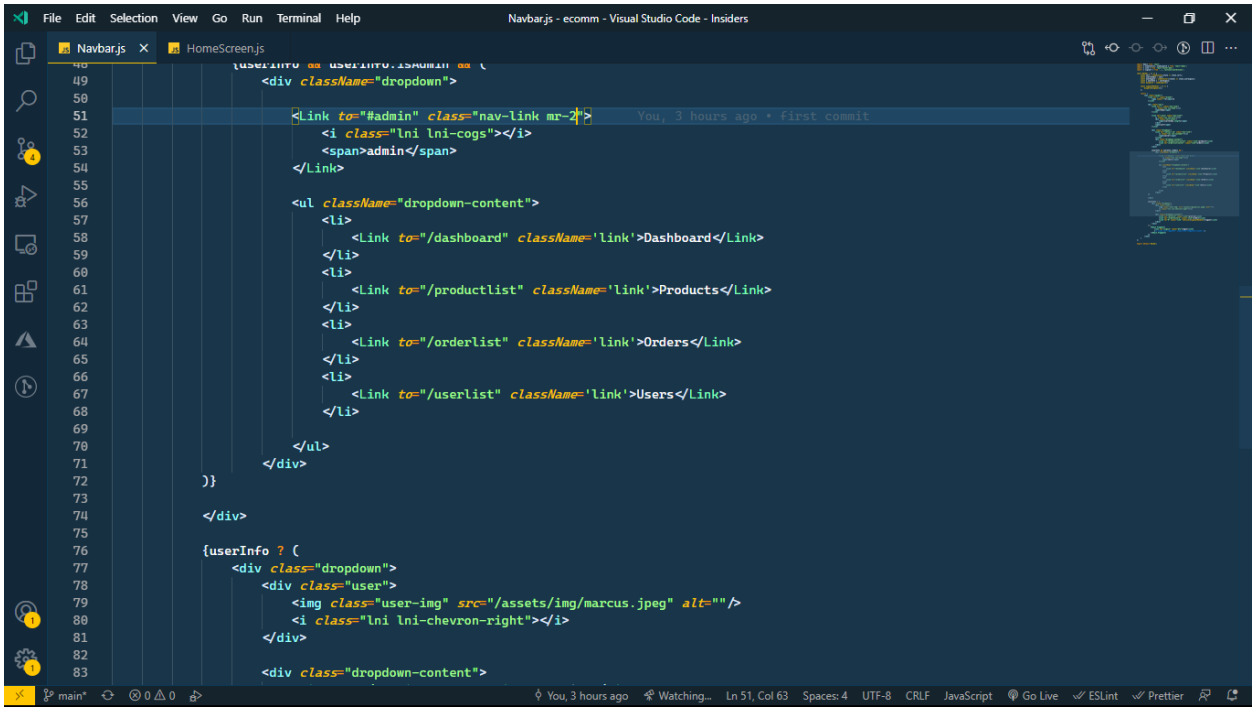
1. Log into the site if already a register user otherwise create an account
2. Proceed to select an item that you would like to purchase
3. Once done shopping, provide the necessary information and pay for the desired goods

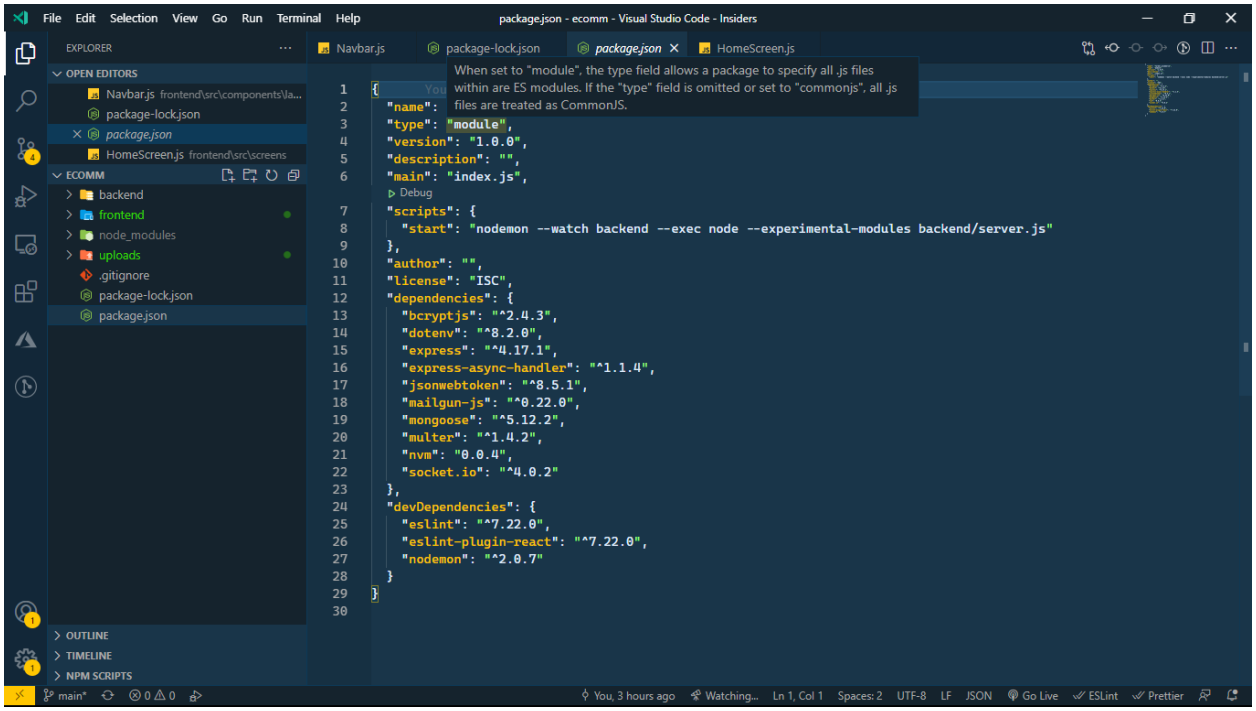
For the farmer

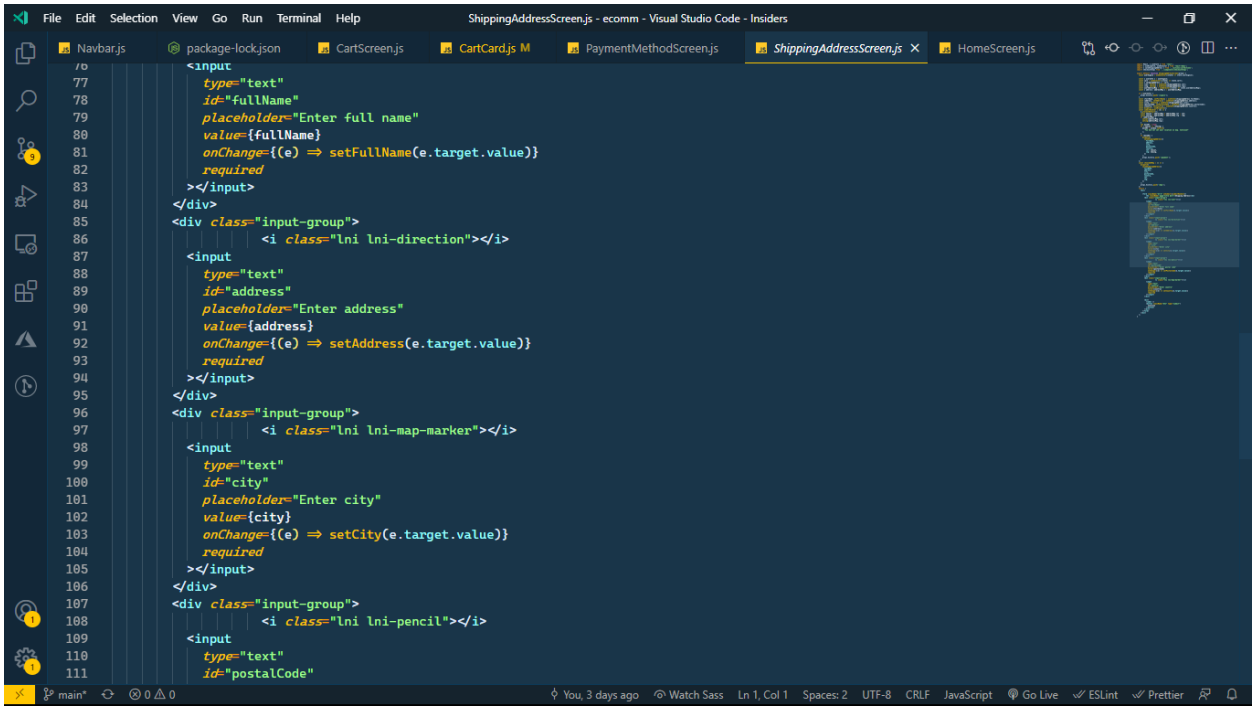
1. Submit application to be a registered vendor in the site

2. Once the application is approved, upload the products you want to sell.
3. Wait for your goods to be purchased to receive payment

Appendix II: Sample Source Code






File Edit Selection View Go Run Terminal Help
ShippingAddressScreen.js - ecomm - Visual Studio Code - Insiders
Navbar.js
package-lock.json
CartScreen.js
CartCard.js M
PaymentMethodScreen.js
ShippingAddressScreen.js
HomeScreen.js
<input
type="text"
id="fullName"
placeholder="Enter full name"
value={fullName}
onChange={(e) => setFullName(e.target.value)}
required
></input>

<input
type="text"
id="address"
placeholder="Enter address"
value={address}
onChange={(e) => setAddress(e.target.value)}
required
></input>

<input
type="text"
id="city"
placeholder="Enter city"
value={city}
onChange={(e) => setCity(e.target.value)}
required
></input>

<input
type="text"
id="postalCode"
main*
0 0
You, 3 days ago
Watch Sass
Ln 1, Col 1
Spaces: 2
UTF-8
CRLF
JavaScript
Go Live
ESLint
Prettier