SOFTWARE DESIGN SPECIFICATION

IntelliCART

FYP - I

Version: 1.5

Project Code	F23-216C
Supervisor	Dr. Muhammad Farrukh Shahid
Co-Supervisor	-
Project Team	1. Abdul Ahad Shaikh (20K-0319) 2. Mohammad Basil Ali Khan (20K-0477) 3. Syed Ali Jodat Naqvi (20K-0155)
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1.0	Abdul Ahad Shaikh	November 9, 2023	Document created
1.1	Abdul Ahad Shaikh	November 10, 2023	Introduction completed
1.2	Basil Ali Khan	November 11, 2023	Design consideration completed
1.2	Syed Ali Jodat	November 11, 2023	System architecture, Design strategy completed
1.3	Basil Ali Khan	November 12, 2023	Detail Design (ER Diagram, Data Dictionary) Completed
1.4	Basil Ali Khan	November 30, 2023	Sequence Diagram Completed
1.5	Syed Ali Jodat	December 3, 2023	Document Completed

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Definition of Terms, Acronyms and Abbreviations

Term	Description
GPS	Global Positioning System
API	Application Programming Interface
ML	Machine Learning
DL	Deep Learning

Table of Contents

1. Introduction

1.1 Purpose of Document

This document is a definition of software requirements to facilitate the Pakistani Fruit and Vegetable vendors and Customer by providing a quality assessment and government price validation platform named “IntelliCART”. This document will present the functional, nonfunctional, and design constraint requirements for the system to be developed. Use case models and descriptions are included along with class diagrams to help model and specify the functional requirements and specifications of the system.

1.2 Intended Audience

The potential audiences for this document are:

- Development team for coding, implementing and integrating various system components.
- Design team involved in designing the system architecture.
- Quality assurance and testing team for conducting various testing phases to ensure systems performance and quality.
- Consumers utilizing mobile application to assess quality, validate pricing and locate nearby fruit carts.
- Vendors using system for fair pricing and quality assurance.

1.3 Document Convention

Font: Times New Roman

Font Size:

Heading: 18px

Subheading: 16px

Sub-Subheading:14px

Description: 12px

1.4 Project Overview

In today's changing global market, the freshness and quality of produce such as fruits and vegetables have become increasingly crucial to purchasers. Our solution referred to as "Smart cart, also known as IntelliCART," that aims to enhance customer convenience while purchasing fruits and vegetable from a cart. This system utilizes technologies including mobile applications, cloud computing, Global Positioning System (GPS), etc. to create a platform that offers real-time monitoring of fruit and vegetable freshness and price verification based totally on government regulations and location-based services for finding nearby-by fruit carts. The proposed solution now does not only benefit clients, but also presents benefits for vendors. By using this system, vendor can construct a relationship with their customers by ensuring a

pleasant warranty and doubtlessly expanding their consumer base. Furthermore, adhering to government pricing tips can help companies avoid headaches while retaining their reputation. In summary, the IntelliCART addresses issues associated with pleasant manipulation and truthful pricing for carts. With its camera-based freshness assessment quality, price verification capabilities, and person pleasing mobile application, along with Global Positioning System (GPS) -based location offerings, it gives a solution that empowers purchasers to make choices while helping nearby farmers. This project brings together technology, agriculture and consumer awareness to create a more transparent and effective fresh produce market.

1.5 Scope

The scope of the project is to develop a technological solution that solves the problems of quality assessment, price transparency, and availability of fresh fruit and vegetable from carts nearby. The main focus of the project is as follows:

a. Create and implement a system architecture that integrates camera to measure quality, cloud technology, deep learning and ML algorithms, government price verification, and GPS location services.
b. Develop and implement computer vision algorithms to accurately measure the freshness of fruit and vegetables.
c. Create a user-friendly mobile application.
d. Efficiently process image data with the utilization of cloud technology and use deep learning (DL) and machine learning (ML) algorithms to evaluate freshness in real-time.
e. Create algorithms to verify the displayed prices of fruit and vegetables against the government mandated price data.
f. Include GPS functionality in the mobile application to enable users to access location based services

2. Design Consideration

2.1 Assumptions and Dependencies

2.1.1 Assumptions

- Data collected for training deep learning models accurately represents various quality of fruits and vegetable for data accuracy.
- System pricing validation aligns with government regulations.
- Assumes availability of necessary technical infrastructure including reliable internet connection, compatible devices and cloud service accessibility.

2.1.2 Dependencies

- On Successful integration with external APIs such as GPS services, government databases for pricing validation.
- On stability and compatibility of selected framework libraries and development tools for implementing system.
- On user engagement and feedback for iterative improvements and adjustments to enhance the application usability.

2.2 Risk and Volatile Areas

- If changes in government induces pricing regulation or quality standards might make necessary to make adjustments to the system pricing validation algorithm.
- As world evolves customer preferences or feedback also evolves that make necessitate the addition of new features or updates to existing system.
- Competitive market variations in vendor adoption make it necessary to modify system to attract and gain users.

To allow timely response changes the system will be designed with Modular approach, Flexible APIs, Agile Methodologies and continuous feedback and evaluation.

3. System Architecture

3.1 System Level Architecture

3.1.1 Component Diagram

Our system consists of three modules Mobile Application, Backend and External Interfaces. As system level architecture shows the top level that why no internal description is shown.

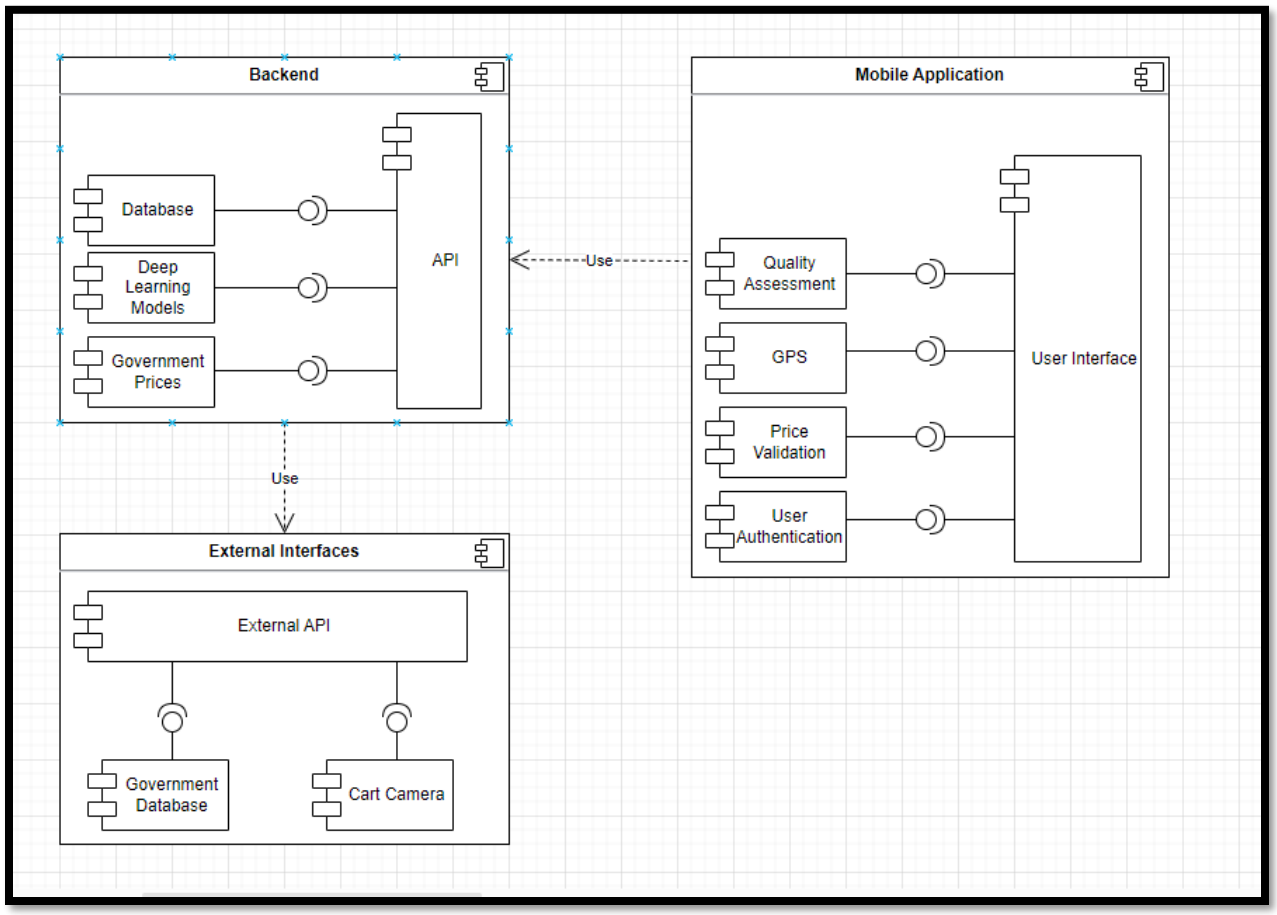

Figure 1 Component Diagram

3.1.2 Deployment Diagram

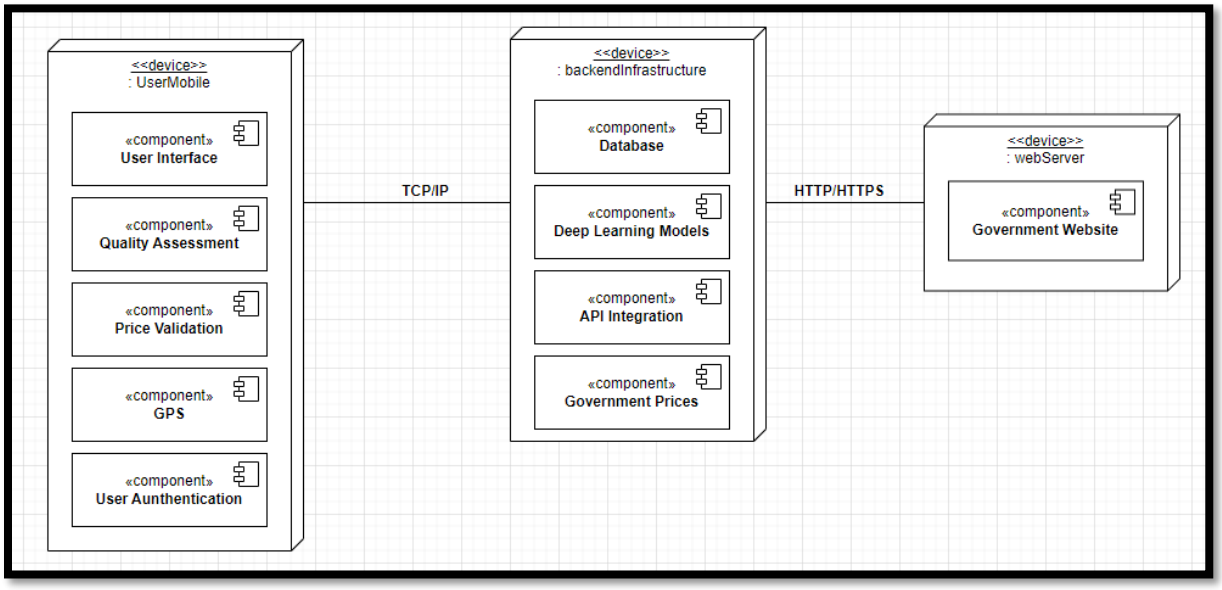

Figure 2 Deployment Diagram

3.2 Software Architecture

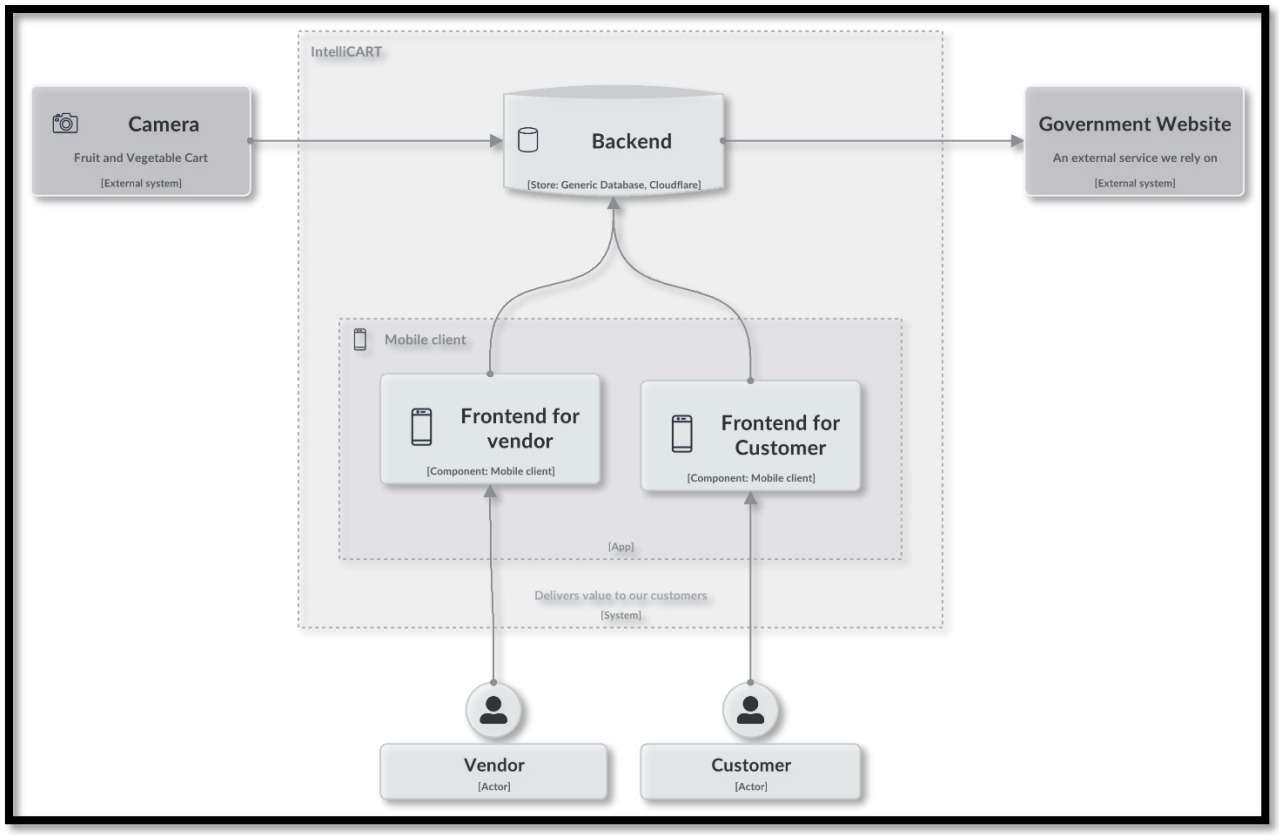

Figure 3 Software Architecture Diagram

4. Design Strategy

- Strategy: The system is designed with modular architecture that will help in future for extension and adding new functionalities.
    - Tradeoff: Upfront complexity and may need more careful coordination and interfaces between the modules.
- Strategy: Focused on making components highly reusable across different components in new systems.
    - Tradeoff: Result in increased efforts to make component generic and can also result in development time.
- Flutter has been used on frontend and complete application is built on it.
- Firebase as backend database as its reliable and extensive database.

5. Detailed Design System

5.1 Database Design

5.1.1 ER Diagram

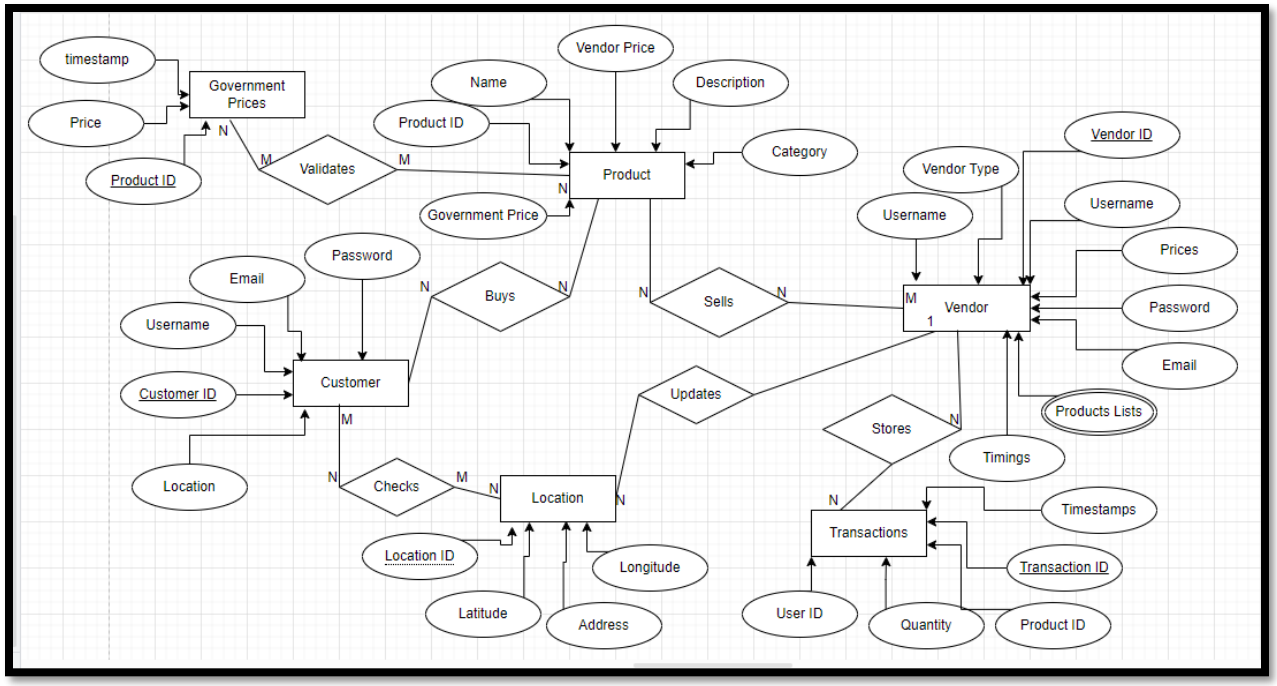

Figure 4 Entity Relationship Diagram

5.1.2 Class Diagram

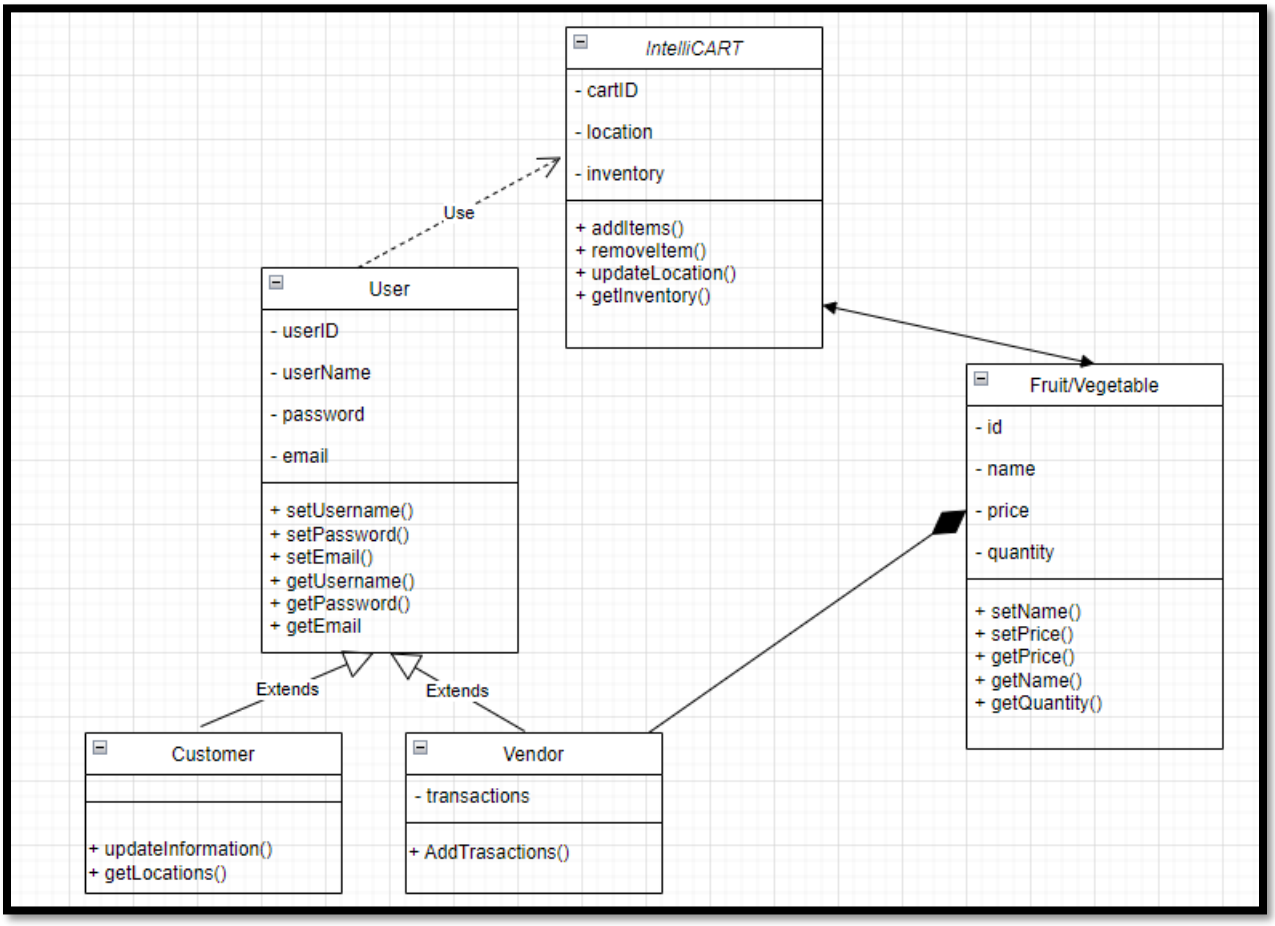

Figure 5 Class Diagram

5.1.3 Data Dictionary

5.1.2.1 Customer

Table 1 Customer

Customer						
Name	Customer					
Alias	User					
Where-used/how-used	Used When customer login/signup or buys a product.					
Content description	Composed of people buying fruits and vegetables.					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**

customer_id	Unique auto number generated number	Integer	12	No	None	PK
username	Name of customer	String	100	No	None	-
email	Unique email of customer	String	100	No	None	-
password	Hashed password	String	200	No	None	-
location	Location of customer	Object	500	No	None	-

5.1.2.2 Vendor

Table 2 Vendor

Vendor						
Name	Vendor					
Alias	User					
Where-used/how-used	Used When vendors login/signup or sells a product.					
Content description	Composed of people selling fruits and vegetables.					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**
vendor_id	Unique auto number generated number	Integer	12	No	None	PK
username	Name of customer	String	100	No	None	-
email	Unique email of customer	String	100	No	None	-
password	Hashed password	String	200	No	None	-
prices	Prices of fruits/vege	float	6	No	None	-

	tables					
vendor_type	Sells fruits or vegetables or both	String	100	No	None	-
location_id	Location of vendor	String	12	No	None	FK
products_lists	Name of products	Object	500	No	None	-
timings	Open and close time	Object	100	No	None	-

5.1.2.3 Product

Table 3 Product

Product						
Name	Product					
Alias	Fruits and Vegetables					
Where-used/how-used	Used When customer buys and vendors sell fruits and vegetables					
Content description	Composed of fruits and vegetables.					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**
product_id	Unique number	Integer	12	No	None	PK
name	Name of customer	String	100	No	None	-
vendor_price	Price set by vendor	Integer	10	No	None	-
description	Description of products	String	500	Yes	None	-
category	Belongs to either Fruits and Vegetable	String	100	No	None	-
government_price	Price set by government	Integer	10	No	No	-

5.1.2.4 Government Prices

Table 4 Government Price

Government Price						
Name	Government Price					
Alias	Govt. Price					
Where-used/how-used	Used When customer buys fruits/vegetable to validate prices.					
Content description	Composed of prices of fruits and vegetable set by government.					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**
product_id	Unique number	Integer	12	No	None	PK
price	Name of customer	String	10	No	None	-
timestamp	Last updated price	Object	100	No	None	-

5.1.2.5 Location

Table 5 Location

Location						
Name	Location					
Alias	current location					
Where-used/how-used	Used When customer search for nearby carts or vendors update their location					
Content description	Composed of location of fruit and vegetable vendors.					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**
location_id	Unique auto number generated number	Integer	12	No	None	PK

latitude	Coordinates of location	Float	100	No	None	-
longitude	Coordinates of location	Float	100	No	None	-
address	address	String	200	No	None	-

5.1.2.6 Transaction

Table 6 Transaction

Transaction						
Name	Transaction					
Alias	Records					
Where-used/how-used	Used to store transaction between customer and vendor.					
Content description	Composed of record of sell and purchase between vendors and customers					
Column Name	**Description**	**Type**	**Length**	**Null able**	**Default Value**	**Key Type**
transaction_id	Unique auto number generated number	Integer	12	No	None	PK
user_id	Customer ID	Integer	12	No	None	FK
product_id	Product ID	Integer	12	No	None	FK
quantity	Number of product sale	Integer	10	No	None	-
timestamps	Date and time of transaction.	Object	100	No	None	-

5.2 Application Design

5.2.1 Sequence Diagram

5.2.1.1 Customer Registration

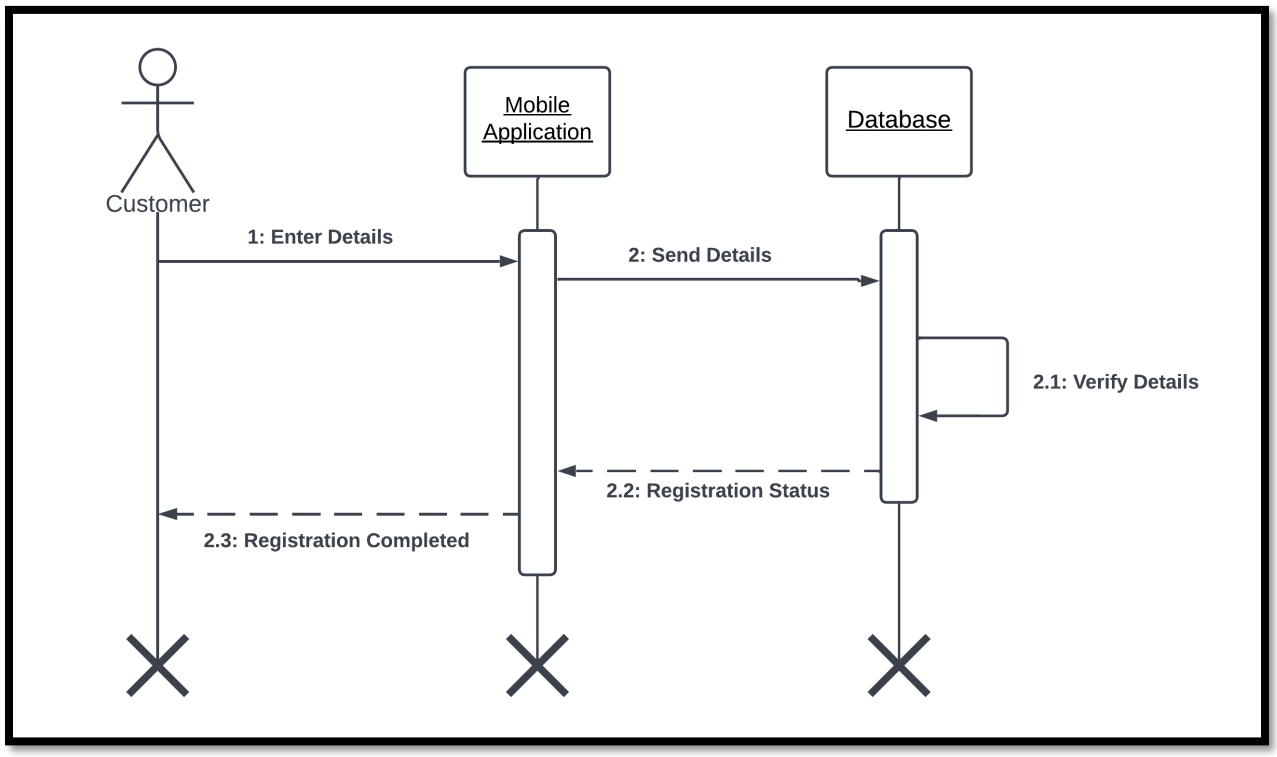

Figure 6 Sequence Diagram for Customer Registration

5.2.1.2 Vendor Registration

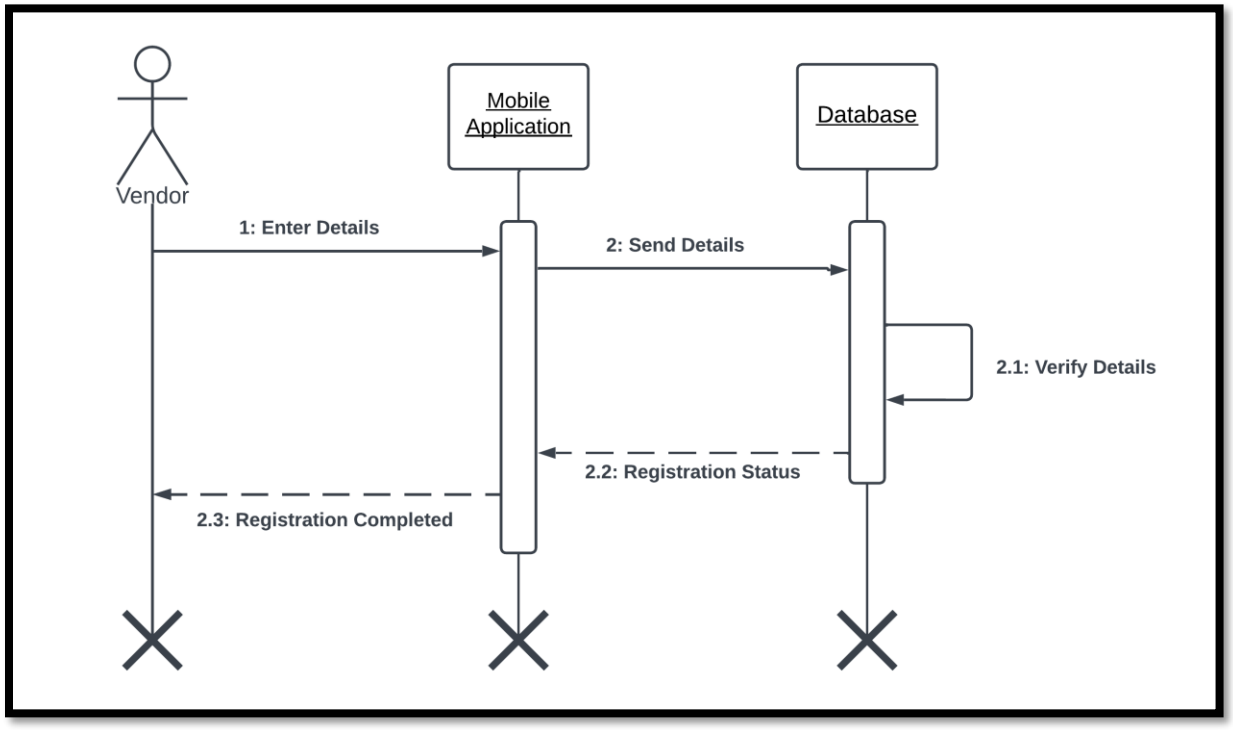

Figure 7 Sequence Diagram for Vendor Registration

5.2.1.3 Customer Login

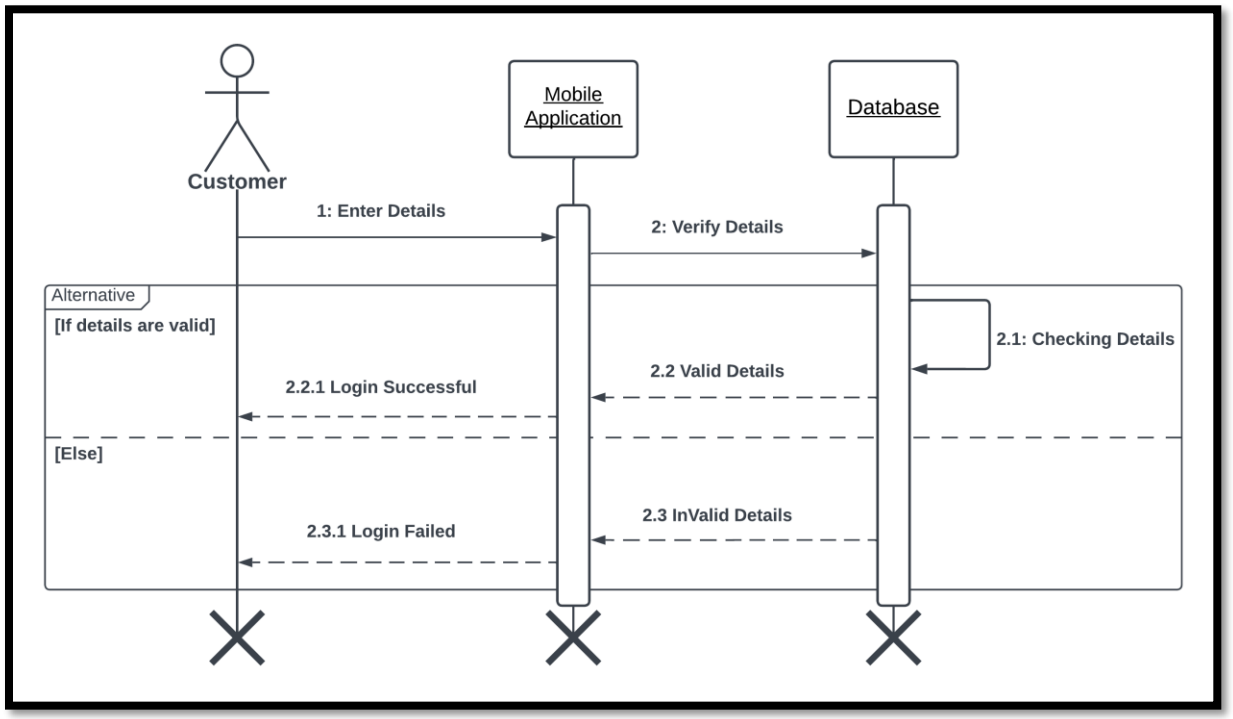

Figure 8 Sequence Diagram for Customer Login

5.2.1.4 Vendor Login

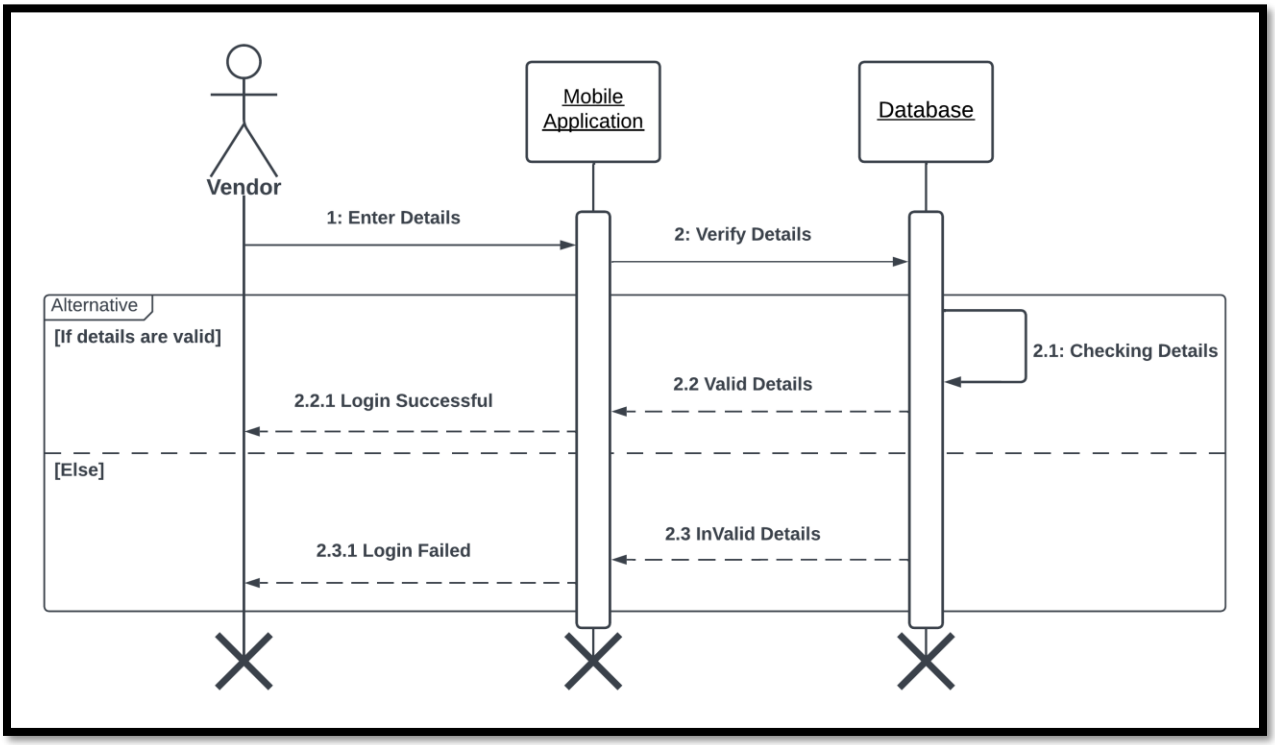

Figure 9 Sequence Diagram for Vendor Login

5.2.1.5 Quality Assessment

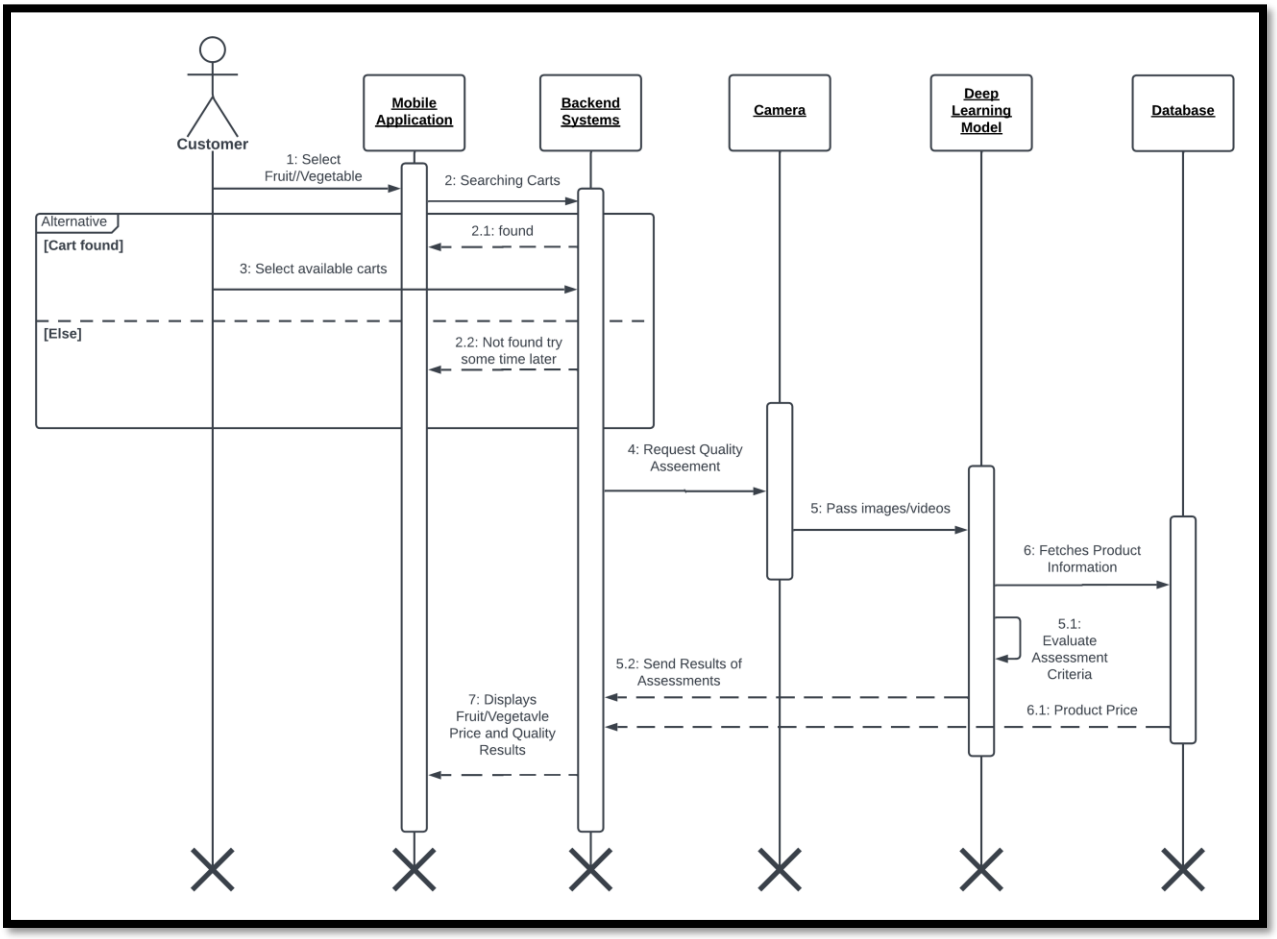

Figure 10 Sequence Diagram for Quality Assessments

5.2.1.6 Price Validation

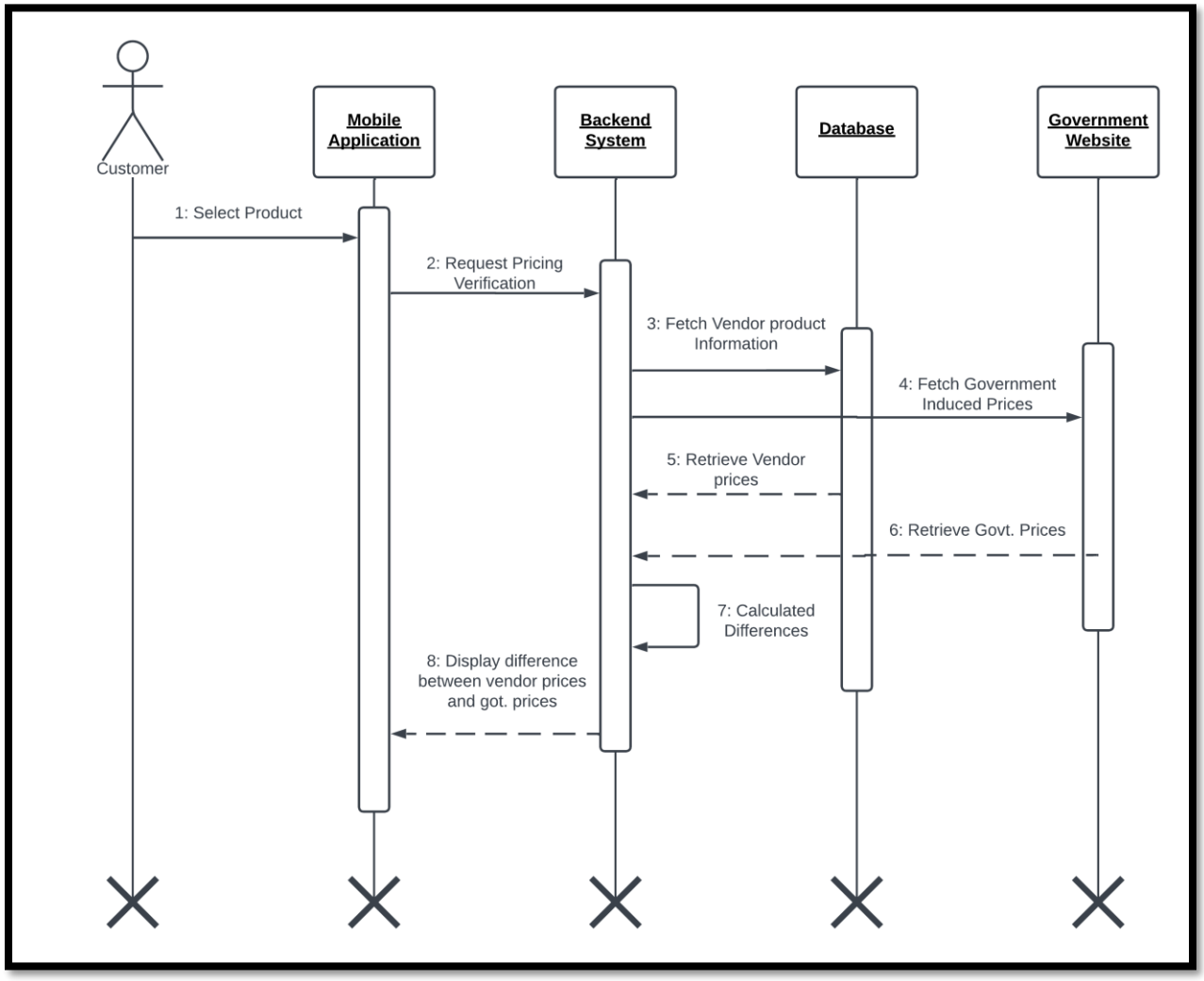

Figure 11 Sequence Diagram for Price Validation

5.2.1.7 Customer Locating Nearby Carts

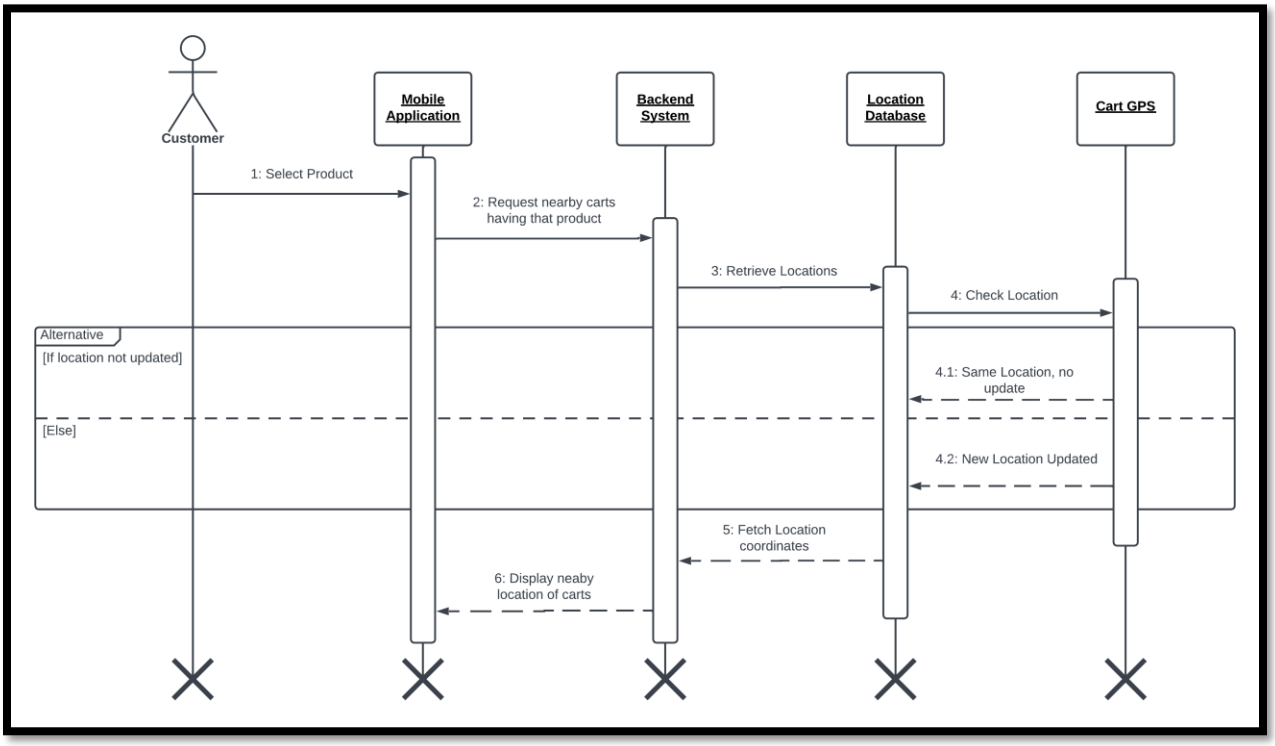

Figure 12 Sequence Diagram for Locating Nearby Carts

5.2.1.8 Customer Providing Feedback

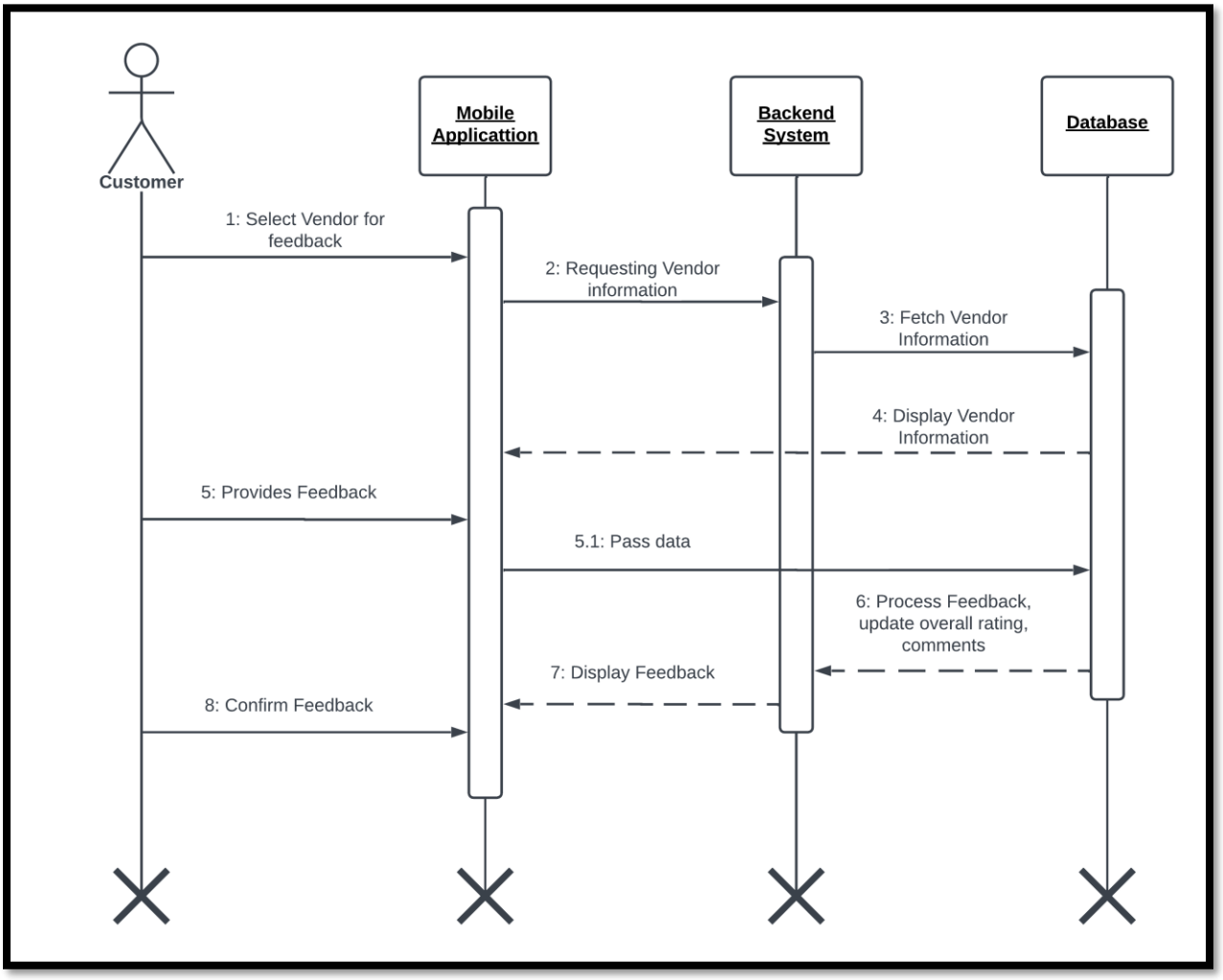

Figure 13 Sequence Diagram for Customer Providing Feedback

5.2.1.9 Customer updates Information

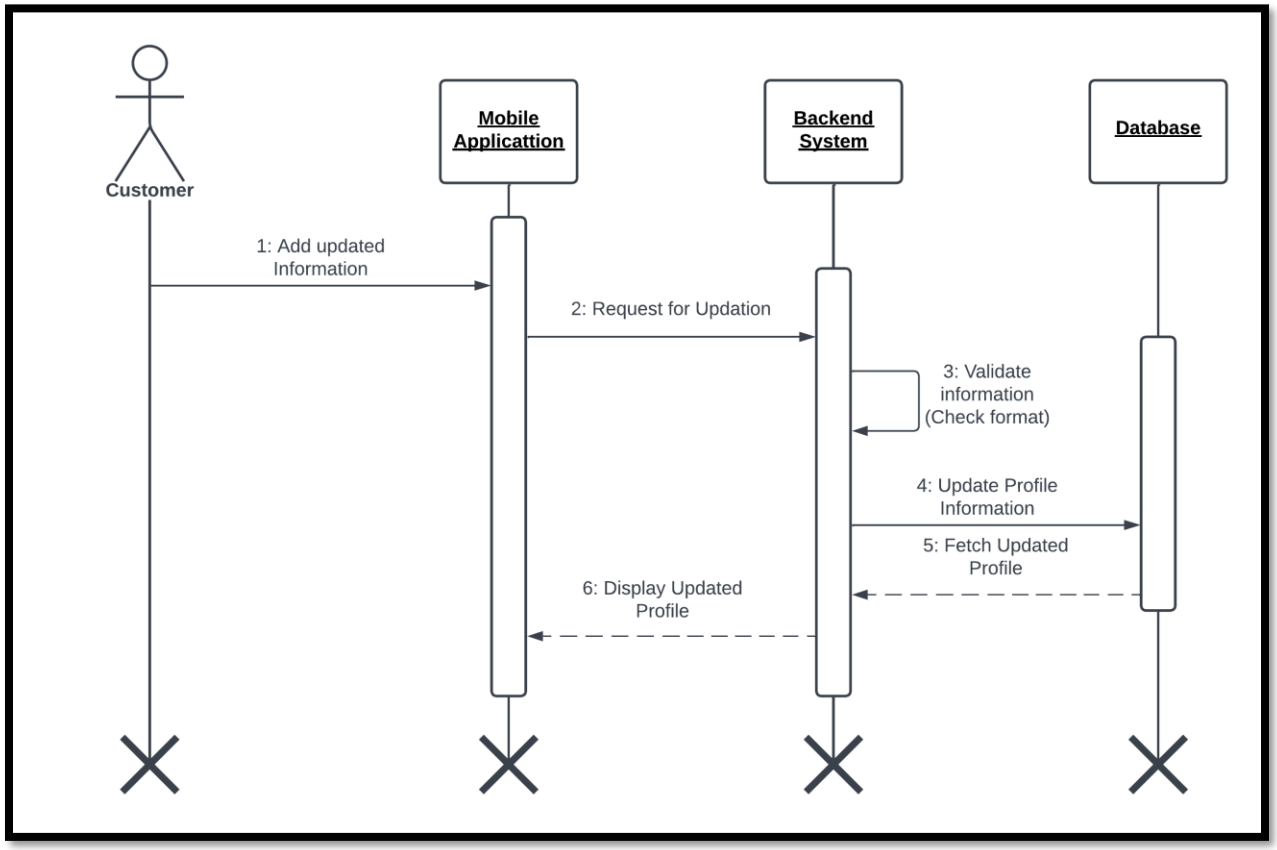

Figure 14 Sequence Diagram for Customer Profile Updating

5.2.1.10 Vendor add Product

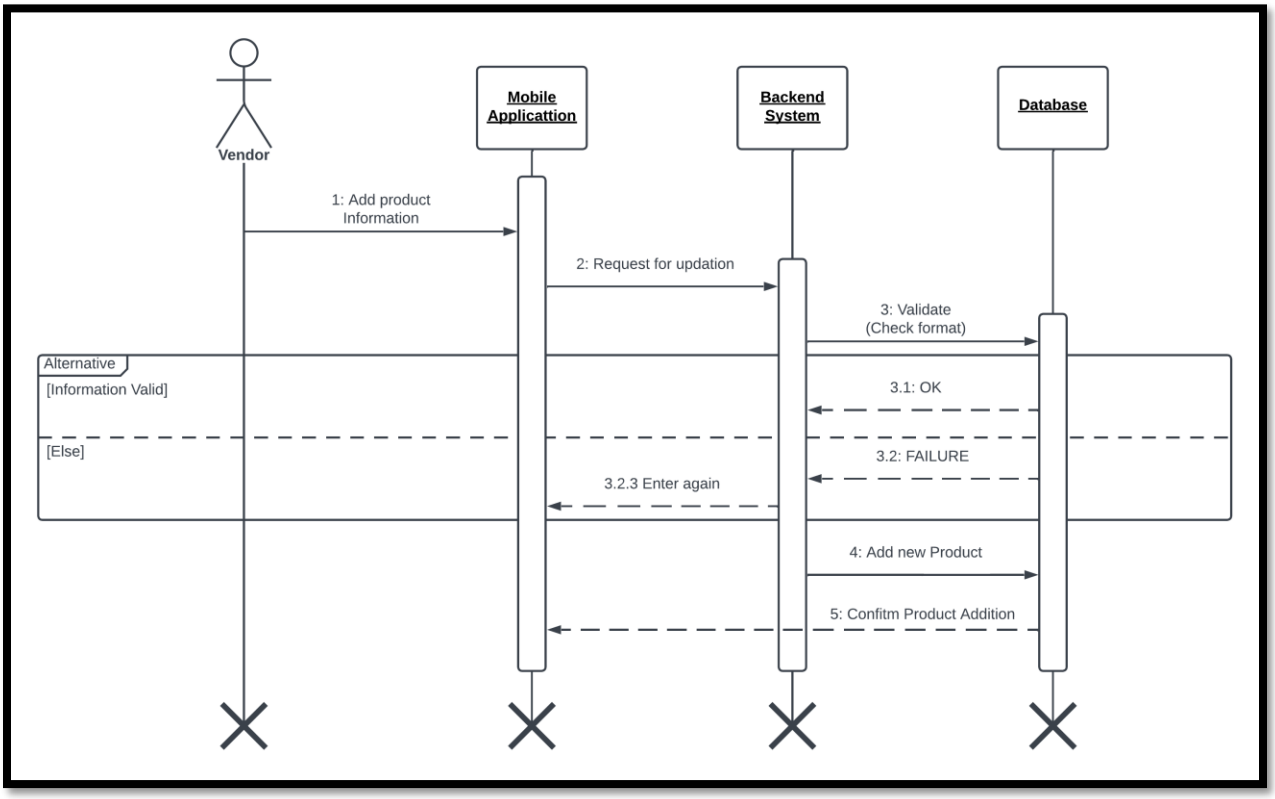

Figure 15 Sequence Diagram for Adding New Product

5.2.1.11 Vendor Delete Product

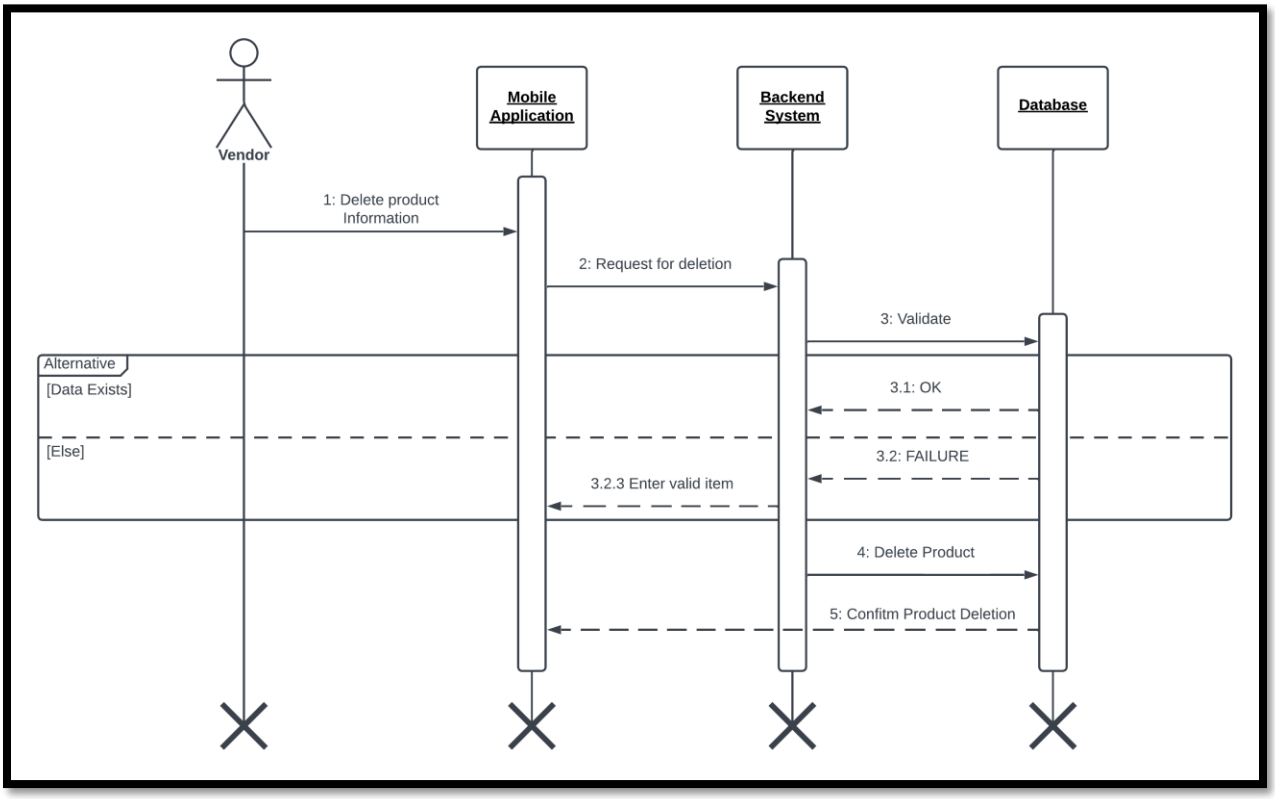

Figure 16 Sequence Diagram for Deletion of Product

5.2.1.12 Transactions

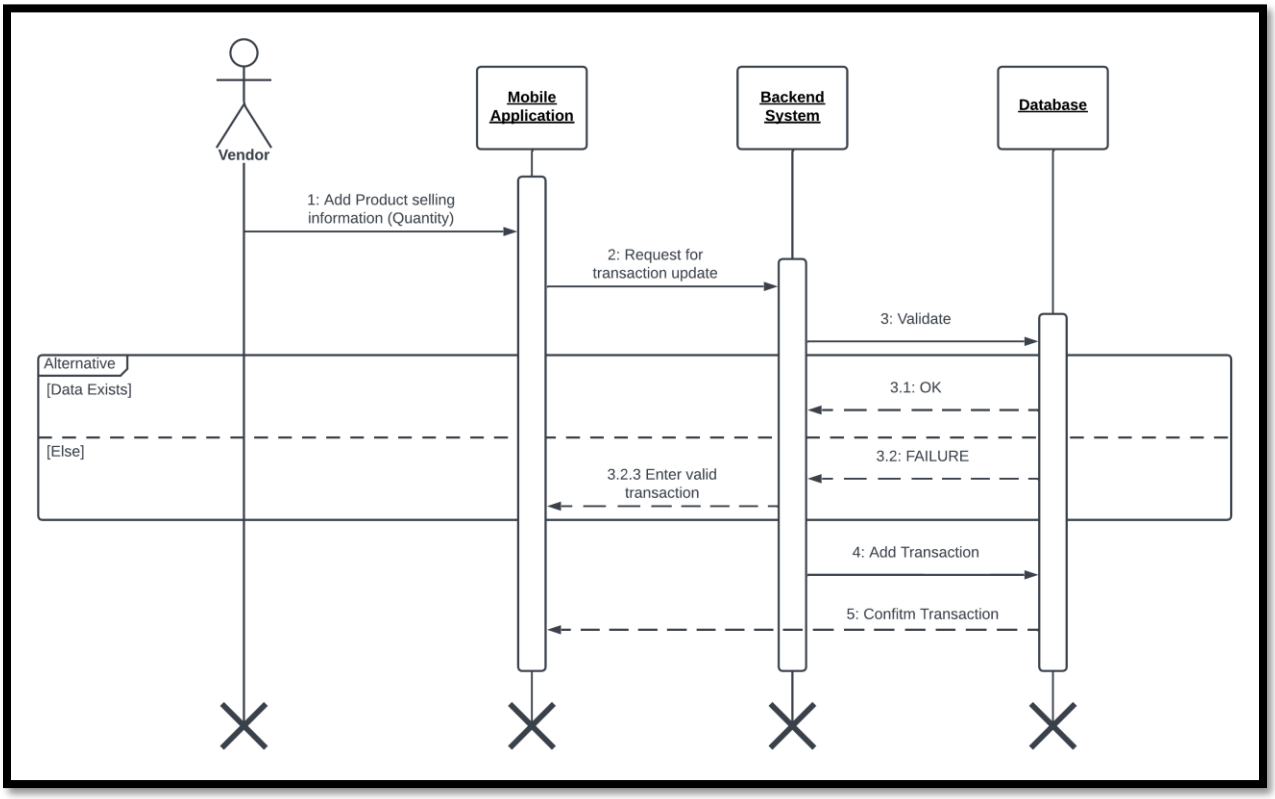

Figure 17 Sequence Diagram for Adding Transaction

5.2.2 State Diagram

5.2.2.1 Camera Status

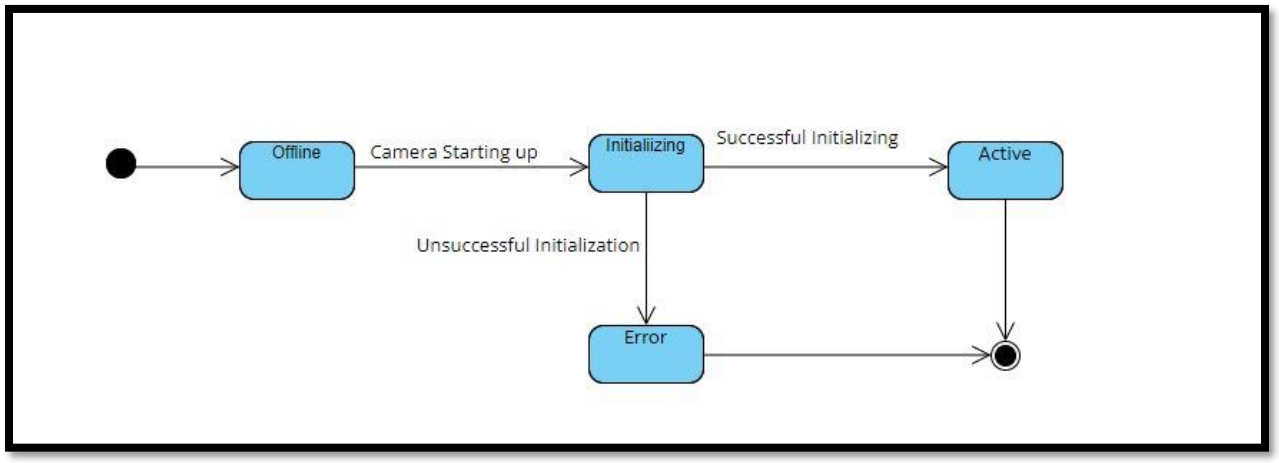

Figure 18 State Diagram for Checking Camera Status

5.2.2.2 Cart Location Availability

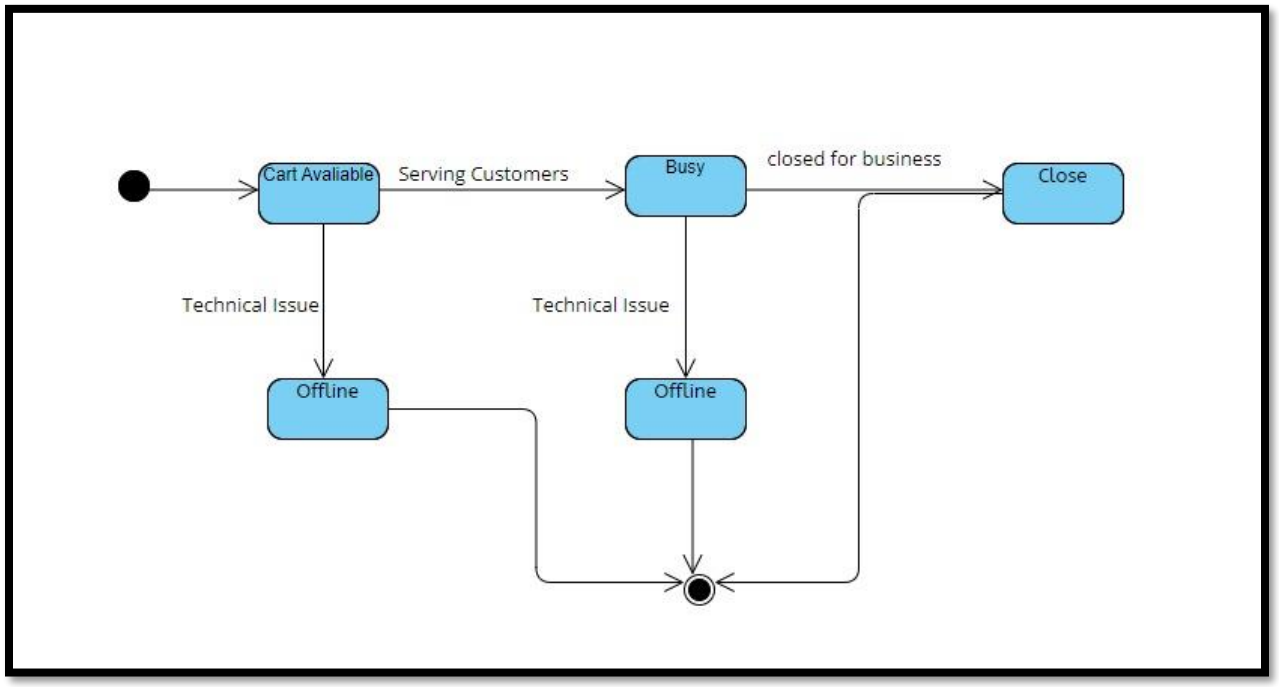

Figure 19 State Diagram for Cart Location Availability

5.2.2.3 Feedback Process

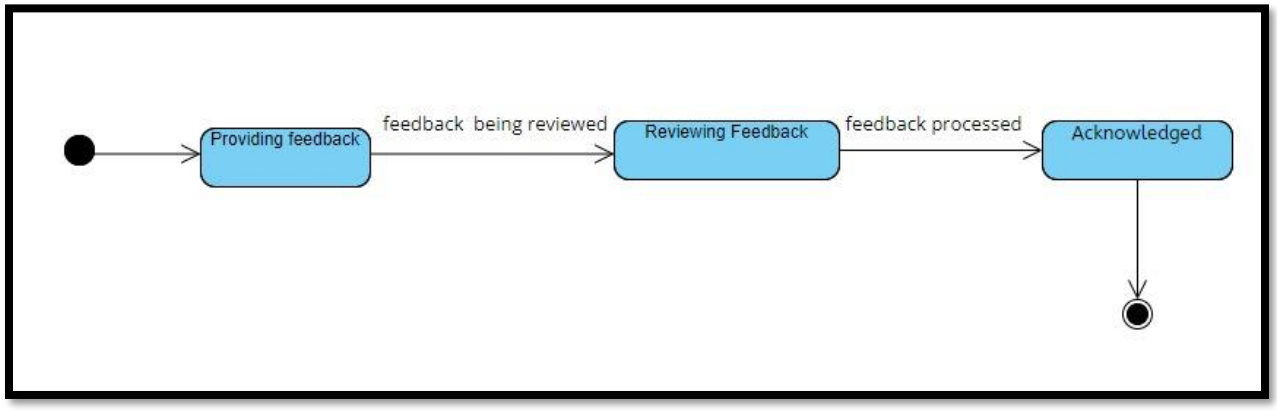

Figure 20 State Diagram for Feedback Process

5.2.2.4 GPS Location Status

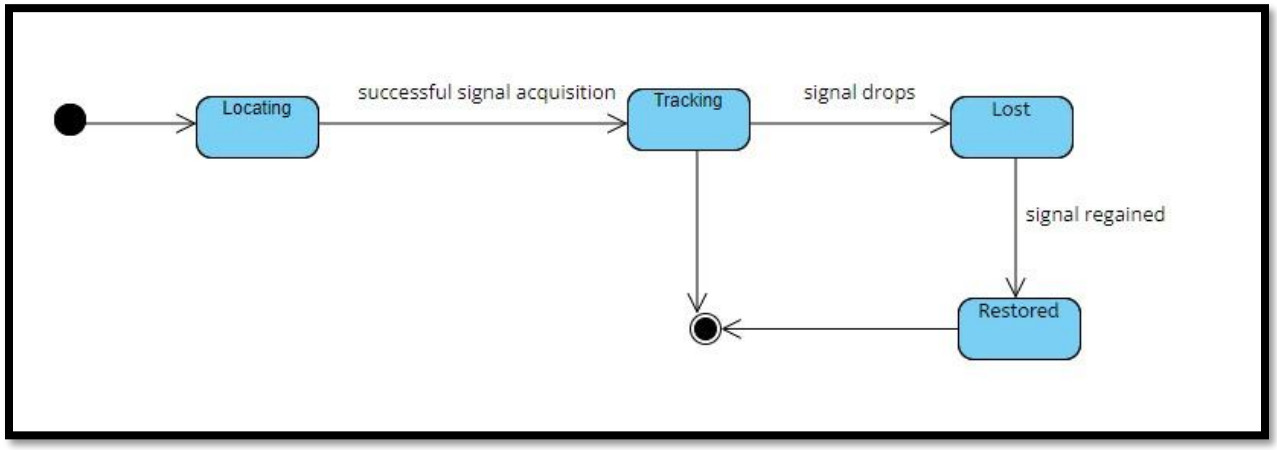

Figure 21 State Diagram for GPS Location Status

5.2.2.5 User Authentication

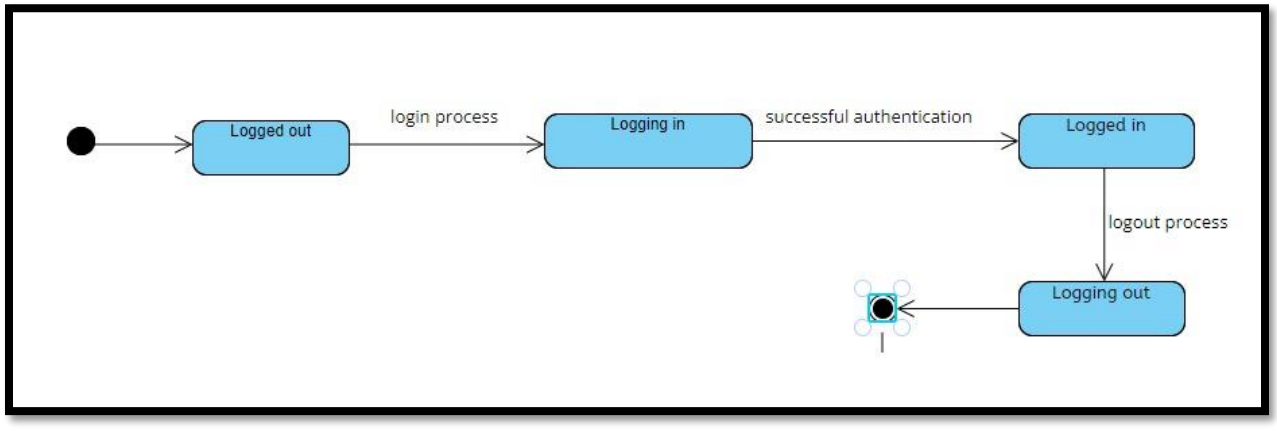

Figure 22 State Diagram for User Authentication Process

6. References

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