SOFTWARE REQUIREMENT SPECIFICATION

SRS REPORT

IntelliCART

(AI – Enabled Smart Cart)

Project Code	F23-216C
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Document History

Version	Name of Person	Date	Description of change
1.0	Abdul Ahad Shaikh	November 25, 2023	Document Created
1.1	Abdul Ahad Shaikh	November 30, 2023	Functional requirements Completed
1.2	Syed Jodat Naqvi	December 5, 2023	Security Requirements Completed
1.3	Basil Ali Khan	December 7, 2023	User Documentation Completed
1.4	Ahad Shaikh	December 10, 2023	Document Finalized

Distribution List

Name	Role
Dr. Muhammad Farrukh Shahid	*Supervisor*

Document Sign-Off

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Table of Contents

1. Introduction

For “IntelliCART” or “AI enabled Smart Card” SRS report is created in order to give a thorough and precise description of the software system that has been developed. This document is an essential communication tool for all the buyers and sellers, basically all the stakeholders of this project, including clients and the development team.

1.1 Intended Audience

The primary audience for the "IntelliCART" or "Intelligent Rehri Wala" project would include:

1. **Clients/Stakeholders:** Individuals who have invested in the company. Fast University, the Supervisor and the students that are creating this project are stakeholders of this project.
2. **End Users:** The ultimate consumers of the IntelliCART, which in this case would be both customers purchasing fruits and vegetables and the fruit sellers using the technology.
3. **Support and Maintenance Team**: Individuals responsible for providing ongoing support and maintenance for the deployed IntelliCART system.

1.2 Abbreviation

1. **SRS:** Software Requirements Specification
2. **GPS:** Global Positioning System
3. **IoT:** Internet of Things
4. **AI:** Artificial Intelligence
5. **CV:** Computer Vision
6. **UI:** User Interface
7. **FCV:** Fruit Cart Vendors

1.3 Document Convention

Font: Times New Roman

Font size: 20, 16 (Headings and Subheadings) and 12 for content.

2. Overall System Description

2.1 Project Background

The "AI enabled Smart Cart" or "IntelliCART" is a product that we are creating to meet the changing demands of fruit cart holders and customers in the fast-paced market. Freshness and quality of goods, especially fruits and vegetables, are now top priorities for buyers in today's hectic world. Our project offers a solution that uses technology to establish a seamless platform for purchasing and selling fresh fruit in order to satisfy these expectations and improve customer confidence and convenience.

2.2 Project Scope

“IntelliCART” aims to revolutionize the fruit cart experience by developing a mobile application equipped with real-time monitoring features, using CV for freshness and Quality measurement, and integrating GPS for location services. The system will allow fair transactions by implementing price verification according to the government regulated prices. Cloud technology will support data storage, ensuring security. The project scope is that we are creating a seamless platform that enhances customer confidence, convenience and the overall quality of the fresh produce market.

2.3 Not in Scope

Items outside the project scope include extensive physical modifications to fruit carts, payment processing, and detailed inventory management for vendors.

2.4 Project Objectives

“IntelliCART” aims to improve accessibility through GPS-based location services, ensuring transparency in pricing by implementing a government regulated based pricing system. Additionally, it seeks to strengthen relationships between fruit and vegetable cart holders and customers by guaranteeing product quality and adherence to pricing guidelines. By implementing government regulations, the project contributes to the smoother operation of mobile smart carts and, ultimately, supports local farmers and promotes fair trade.

2.5 Stakeholders

Individuals who have invested in the company. Fast University, the Supervisor and the students that are creating this project are stakeholders of this project. Also, the ultimate consumers of the IntelliCART, which in this case would be both customers purchasing fruits and vegetables and the fruit sellers using the technology.

2.6 Operating Environment

The "Smart Cart" software operates in a mobile environment, supporting Android (version 7.0 and above) and iOS (version 11.0 and above) platforms. Utilizing mobile data connectivity, the application uses a cloud-based database for efficient data management. The software works by computer vision algorithms for real-time freshness assessment, GPS services for location-based functionalities. It is designed to seamlessly run on a variety of mobile devices while remaining independent of external payment processing applications. This versatile software environment ensures the effective functioning of IntelliCART Application through-out diverse urban and suburban places.

2.7 System Constraints

System Constraints: The software must adhere to compatibility requirements for both Android (version 7.0 and above) and iOS (version 11.0 and above) platforms to ensure widespread accessibility.

Hardware Constraints: The system is constrained by the capabilities of the mobile devices used by consumers and fruit cart carriers, necessitating optimization for smartphones and tablets.

Cultural Constraints: The application must be sensitive to cultural factors, including language preferences. Multilingual support may be limited, impacting users who speak languages not covered by the system.

Legal Constraints: The "Smart Cart" system must comply with local and national government regulations regarding data privacy, pricing transparency, and any other legal considerations to ensure lawful operation.

Environmental Constraints: The software may be deployed in diverse environments, and as such, it needs to function effectively in varying network conditions, potentially including areas with limited connectivity or high interference.

Privacy and Security Constraints: The system must adhere to strict privacy and security measures to protect user data, ensuring compliance with relevant regulations and industry standards.

2.8 Assumptions and Dependencies

(Not Required)

3. External Interface Requirements

Our "IntelliCART" project necessitates seamless external interface requirements, prominently having a user-friendly mobile application interface, ensuring real-time access to freshness and pricing details, alongside GPS location services for nearby cart detection. Additionally, it requires integration with cloud technology that is ensuring efficient data management and storage, enabling easy accessibility and scalability while ensuring a good user experience for customers interacting with the system.

3.1 Hardware Interfaces

The interface between the software and hardware components in the "IntelliCART" project involves a mobile application designed for all iOS and Android devices. The app interacts with the device's hardware, including the camera used in freshness assessment, GPS for location tracking to identify nearby carts. This allows the software to gather real-time information, enabling functionalities such as fruit and vegetable assessment, and location-based services.

3.2 Software Interfaces

The "IntelliCART" project interfaces with a Firebase Database to manage and store data concerning fruit and vegetable quality evaluations, pricing, customer details, and cart locations. The mobile application, designed using platform Flutter and Dart for both IOS and Android, interacts with the operating systems for development and deployment. Additionally, it utilizes integrated features like the camera, GPS, and potentially other sensors for real-time data collection, including images for freshness assessment, and location data for cart tracking. This data is exchanged between the mobile app and the database for storage, retrieval, and update purposes, enabling functionalities like real-time freshness assessment, location-based services.

3.3 Communications Interfaces

The "IntelliCART" system relies on internet connectivity using HTTP/HTTPS protocols for secure data exchange between the mobile app and the cloud server through RESTful APIs. It employs push notifications or email functionalities within the mobile application to communicate updates or alerts to users. Security measures entail encryption methods for data transmission, ensuring confidentiality, and data integrity across the network. Synchronization mechanisms maintain real-time updates, while data transfer rates aim for optimal efficiency in transmitting freshness assessments, location data, and notifications between the app and the server.

4. Functional Requirements

4.1 Functional Hierarchy

4.1.1 Data Collection and Analysis

4.1.1.1 Image Capture and Analysis

- Capture images of fruits and vegetables.
- Analyze images for freshness assessment using computer vision algorithms.
- Collect online available dataset.

4.1.1.2 Sensor Integration

- Utilize GPU for location tracking.
- Attach camera to fruit cart to assess their quality of fruits.

4.1.2 Mobile Application Functions

4.1.2.1 User Interface

- Provide an intuitive interface for customers.
- Display real-time freshness assessments and pricing details.
- Comparison between government prices and offered prices.
- Provide customers to choose which cart they choose with the price they agree on.
- Feedback option for customers.

4.1.1.1 Location Services

- Utilize GPS to locate nearby fruit carts.
- Offer navigation guidance to identified carts.

4.1.1.2 Ordering and Reservation

- Enable customers to place orders or reserve items.
- Provide confirmation and pickup details.

4.1.3 Database Management

4.1.3.1 Data Storage and Retrieval

- Store fruit and vegetable freshness evaluations.
- Manage pricing information.
- Manage cart locations.

4.1.3.2 Customer Profiles and Preferences

- Store and update customer details and preferences.
- Enable personalized experiences and recommendations.

4.1.4 Communication and Notification

4.1.4.1 Push Notifications

- Alert users about freshness updates or promotions.

4.1.4.2 Customer Profiles and Preferences

- Store and update customer details and preferences.

4.1.5 Security and Authentication

4.1.5.1 Data Encryption

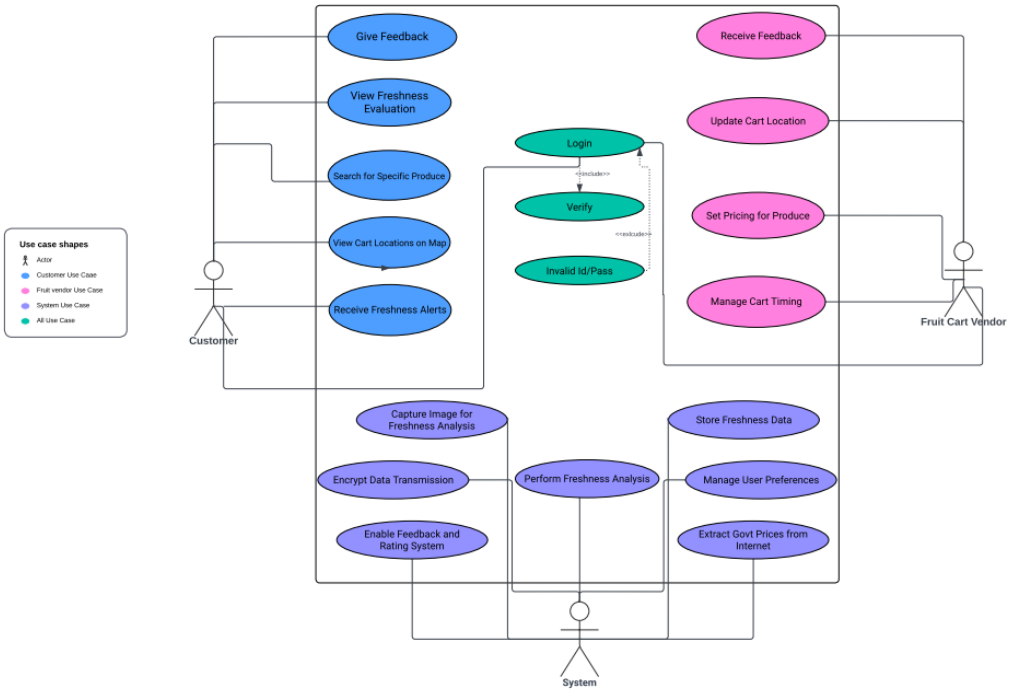
- Secure data transmission and storage.

4.1.5.2 User Authentication

- Verify user identity for access to sensitive information.

4.2 Use Cases

4.2.1 IntelliCART Use Case Diagram



This use case involves users accessing and viewing the freshness evaluation of fruits and vegetables available on nearby carts through the "IntelliCART" mobile application. There are two primary Actors, Customers and Sellers, and a secondary actor, System.

The customer can view the quality of produce that the nearby carts offer. They can also search for specific produce, such as if they want to buy bananas, they can type it in the search bar. Customers can also view cart locations, and receive freshness alerts about the produce they want. Moreover, they can also give feedbacks of the quality that they received.

The Seller can receive feedback on their qualities offered, and can update their cart location. Additionally, they can set pricing for their produce as well. They can also tell their cart timings and whether they are currently available or not.

The system is the secondary actor which will work between the seller and the customer. The overall system will capture image, perform evaluation analysis, encrypt data transmission while sending data to cloud, and store freshness data on cloud. Moreover, the system will extract daily updated government prices of the produce offered. The system will also offer the customers to give feedback and sellers to receive feedbacks in their respective dashboards.

<Use case Id: IntelliCART>		
Use case Id:	UC-VFE-001	
Actors: **Primary:** Customers and Fruit Cart Vendors (FCV). **Secondary:** System.		
Feature: Real time freshness assessment.		
Pre-condition:	1. The user has installed the "IntelliCART" mobile application. 2. The user's location services are enabled to identify nearby carts.	
Scenarios		
Step#	***Action***	***Software Reaction***
1	Customer View Freshness Evaluation	Extracts the quality that the cart offers.
2	Customer Gives Feedback	Shows feedback to Seller and displays to other customers.
3	Customer Search for specific Produce in search bar	Gives details of that produce.
4	Customer View Cart Location	Gives exact address of the fruit cart.
5	Receive Freshness Alerts	System extracts best freshness available nearby.
6	FCV Receive Feedbacks	Extracts customers feedback that they receive.
7	FCV updates cart location	Updates cart location for accurate location to customers.

8	FCV Manage Cart Timing	Updates cart timing availability for customers.
9	FCV Set Pricing for produce	Updates prices of the produce offered by FCVs.
10	System Capture image	Evaluates freshness assessment.
11	System Perform Freshness Analysis	Use Deep Learning Models to perform freshness assessment.
12	System Encrypt Data Transmission	Images sent from FCV to customer protected via safe data transfer connection.
13	System Extract Govt. Prices from internet	Extract data from latest uploaded document by govt. and make prices available for all customers so that they can match prices offered by FCVs and govt price.
14	System Enable Feedback and Rating System	Make customer rating available to respect FCV.
15	System Store Freshness Data	Store the images and their evaluation in database.
16	System Manage User Preferences	Shows customer their preferred produce is in stock or not.

Post Conditions

Step#	***Description***
1	User has viewed the freshness evaluation of selected produce items from nearby carts
2	The customer's feedback is successfully submitted and stored in the system's database
3	The system successfully retrieves and displays results matching the customer's query for specific produce
4	The system shows a map displaying the locations of nearby carts based on selected location.
5	The system presents the freshness in a timely manner, displaying details such as the type of produce available, and cart locations.
6	The system successfully receives and records the feedback provided by customers into system database.
7	The system database reflects the updated location information for the vendor's cart accurately.

8	The updated cart timing is now visible to customers through the system's interface.
9	The updated prices for the produce are now visible to customers through the system's interface.
10	Captured images are securely stored in the system's database for further processing.
11	The system generates and stores freshness evaluation data for each produce item based on the analysis.
12	Data transmitted between the application and server is protected against unauthorized access.
13	The updated government prices for the produce are now visible to customers through the system's interface.
14	Users can access and provide feedback on produce quality and vendor service through system interface.
15	Store the images and their evaluation in database.
16	User preferences, are accurately reflected in the system, providing a tailored experience for each user.

5. Non-functional Requirements

5.1 Performance Requirements

5.1.1 Speed

The system should provide real-time or near-real-time responses when users interact with the application, ensuring swift loading times for cart locations, produce details, and order processing.

5.1.2 Precision

Accuracy in freshness evaluations and pricing information displayed to users, ensuring precise and reliable data for informed decision-making.

5.1.3 Concurrency

The system should handle multiple user interactions concurrently, allowing seamless access and updates for various users browsing cart locations, placing orders, and receiving alerts simultaneously.

5.1.4 Capacity

The system must accommodate a large volume of users and cart data without compromising performance, ensuring scalability as user numbers and cart locations increase.

5.1.5 Safety

Security measures must safeguard user data, personal information, ensuring encryption, authentication, and data protection protocols.

5.1.6 Reliability

The system should operate consistently and predictably without unexpected downtime, ensuring high availability for users at all times.

5.2 Safety Requirements

5.2.1 Safety Requirements

5.2.1.1. Data Security Measures

Implement robust encryption protocols to safeguard user data, preventing unauthorized access or data breaches. Regularly update security measures to mitigate potential risks.

5.2.1.2 User Privacy Protection

Adhere to privacy regulations (e.g., GDPR, CCPA) by anonymizing sensitive information, obtaining user consent for data usage, and providing clear privacy policies.

5.2.2 Safeguards and Preventive Actions

5.2.2.1 User Authentication Measures

Implement User verification processes to prevent unauthorized access to sensitive data.

5.2.2.2 System Testing

Thoroughly test system updates or changes in a controlled environment before deployment to prevent unintended disruptions or vulnerabilities.

5.2.3 Certifications and Compliance

5.2.3.1 ISO Standards

Adhere to ISO 27001 (Information Security Management) for robust data security measures.

5.3 Security Requirements

5.3.1 Data Encryption

All user data, including personal information, and preferences, must be encrypted to prevent unauthorized access.

5.3.2 Data Integrity Checks

Employ data integrity checks to ensure that information remains unaltered and intact during storage, safeguarding against data tampering.

5.3.3 Authorization Levels

Assign different authorization levels to users (e.g., customers, vendors) to control access rights within the system.

5.3.4 ISO 27001 Compliance

Adherence to ISO 27001 standards for information security management.

5.4 User Documentation

5.4.1 User Manual

Comprehensive guide outlining system functionalities, navigation, and instructions for users to effectively utilize the application.

5.4.2 Troubleshooting Guide

Reference document assisting users in resolving common issues or errors triggered while using the system.

5.4.3 Contact Information and Support

Details regarding customer support, including contact information, and procedures for user assistance.

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