



*Mini Project Report On*

## **ShopRoute**

*Submitted in partial fulfillment of the requirements for the  
award of the degree of*

**Bachelor of Technology**

*in*

**Computer Science & Engineering**

**By**

**Annu Merin Johns (U2103041)**

**Athulya S Pai (U2103055)**

**Benita Mariya Eyoob (U2103061)**

**Beth Joseph Kollamala (U2103062)**

**Under the guidance of**

**Mr.Harikrishnan M**

**Department of Computer Science & Engineering  
Rajagiri School of Engineering & Technology (Autonomous)  
(Affiliated to APJ Abdul Kalam Technological University)**

**Rajagiri Valley, Kakkanad, Kochi, 682039**

**May 2024**

# CERTIFICATE

*This is to certify that the mini project report entitled "**ShopRoute**" is a bonafide record of the work done by **Annu Merin Johns (U2103041)**, **Athulya s Pai (U2103055)**, **Benita Maria Eyoob (U2103061)**, **Beth Joseph Kollamala (U2103062)**, submitted to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in Computer Science and Engineering during the academic year 2023-2024.*

Mr.Harikrishnan M  
Asst.Professor  
Dept. of CSE  
RSET

Mr.Harikrishnan M  
Asst.Professor  
Dept. of CSE  
RSET

Dr.Preetha K G  
Professor  
Dept. of CSE  
RSET

## **ACKNOWLEDGEMENTS**

I wish to express my sincere gratitude towards Dr P. S. Sreejith, Principal of RSET, and Dr. Preetha K.G., Head of the Department of Computer Science and Engineering for providing me with the opportunity to undertake my mini project, "ShopRoute".

I am highly indebted to my project coordinators, **Mr.Harikrishnan M and Ms.Sherine Sebastian**, Asst.Professors, Department of Computer Science and Engineering for their valuable support.

It is indeed my pleasure and a moment of satisfaction for me to express my sincere gratitude to my project guide **Mr.Harikrishnan M** for his patience and all the priceless advice and wisdom he has shared with me.

Last but not the least, I would like to express my sincere gratitude towards all other teachers and friends for their continuous support and constructive ideas.

**Annu Merin Johns**

**Athulya S Pai**

**Benita Maria Eyoob**

**Beth Joseph Kollamala**

## **Abstract**

Supermarket Navigator presents an effective solution for modern shopping challenges. This innovative mobile application offers users the convenience of locating products within a supermarket using voice navigation. This project presents a novel approach to supermarket navigation using QR code scanning and voice-guided assistance. By strategically placing QR codes in each corner of the market, including the entrance, users can efficiently locate desired products by simply scanning the nearest code and inputting the product name. The system then employs voice commands to guide users through the store, providing directional cues such as "left" and "right" until the desired product is reached. Compared to existing methods, our approach offers enhanced convenience, speed, and accessibility, simplifying the shopping experience for users of all abilities.

The app quickly interprets user queries and provides precise directions, making the shopping process efficient.

# Contents

<b>Acknowledgements</b>	<b>i</b>
<b>Abstract</b>	<b>ii</b>
<b>List of Figures</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background . . . . .	1
1.2 Problem Definition . . . . .	1
1.3 Scope and Motivation . . . . .	1
1.4 Objectives . . . . .	2
1.5 Challenges . . . . .	3
1.6 Assumptions . . . . .	3
1.7 Societal / Industrial Relevance . . . . .	4
1.8 Organization of the Report . . . . .	4
<b>2 Software Requirements Specification</b>	<b>7</b>
<b>3 System Architecture and Design</b>	<b>27</b>
3.1 System Overview . . . . .	27
3.2 Architectural Design . . . . .	29
3.3 Dataset identified . . . . .	30
3.4 Proposed Methodology/Algorithms . . . . .	30
3.5 User Interface Design . . . . .	32
3.6 Database Design . . . . .	37
3.7 Description of Implementation Strategies . . . . .	37
3.8 Module Division . . . . .	38
3.9 Work Schedule - Gantt Chart . . . . .	40

<b>4 Results and Discussions</b>	<b>41</b>
4.1 Overview . . . . .	41
4.2 Quantitative Results . . . . .	41
4.3 Discussion . . . . .	41
<b>5 Conclusion</b>	<b>43</b>
5.1 Conclusion . . . . .	43
5.2 Future Scope . . . . .	43
<b>Appendix A: Presentation</b>	<b>47</b>
<b>Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes</b>	<b>60</b>
Vision, Mission, POs, PSOs and COs	ii
<b>Appendix C: CO-PO-PSO Mapping</b>	<b>vi</b>

## **List of Figures**

3.1	Use Case Diagram . . . . .	28
3.2	Sequence Diagram . . . . .	29
3.3	Use case Diagram . . . . .	29
3.4	App splash screen . . . . .	32
3.5	Sign in page . . . . .	33
3.6	Sign in with google account . . . . .	34
3.7	Loading QRScanner . . . . .	35
3.8	Permission to use mobile camera . . . . .	36
3.9	ER Diagram . . . . .	37
3.10	Gantt Chart . . . . .	40

# **Chapter 1**

## **Introduction**

### **1.1 Background**

The project, "ShopRoute," aims to enhance the shopping experience by providing a voice navigation system to guide users to the exact location of products within a supermarket. This system utilizes QR codes to identify products, enabling users to efficiently locate items within the store. In current scenarios, navigating large supermarkets can be time-consuming and frustrating for shoppers, especially when they are unfamiliar with the store layout or searching for specific items. This project addresses these challenges by leveraging technology to streamline the shopping process. The importance of this project lies in its ability to improve customer satisfaction, reduce shopping time, and enhance accessibility for individuals with disabilities or mobility issues. By providing a convenient and efficient way to locate products, the ShopRoute enhances the overall shopping experience and promotes customer loyalty. Additionally, it can benefit supermarkets by increasing customer retention and sales through improved convenience and satisfaction.

### **1.2 Problem Definition**

The aim of the project is to create a mobile application, the ShopRoute, that simplifies the process of finding products in large supermarkets. By integrating voice navigation technology, the app aims to reduce the time and frustration associated with searching for items within the store.

### **1.3 Scope and Motivation**

The scope of the ShopRoute project encompasses the development of a comprehensive mobile application equipped with a voice navigation system and QR code recognition

technology. The application will enable users to search for specific items, after which the voice navigation system will guide them aisle by aisle to the exact location of each product within the supermarket. Additionally, the system will utilize QR codes placed on shelves to accurately identify products, ensuring precise navigation and minimizing search time for users. The application will be designed to accommodate various supermarket layouts and product arrangements, making it adaptable to different stores and enhancing its usability for a wide range of shoppers.

The motivation behind the ShopRoute project stems from the desire to address common challenges encountered by shoppers in large supermarkets, such as difficulty in finding specific items, navigating through crowded aisles, and spending excessive time searching for products. By developing an intuitive and efficient navigation system, the project aims to enhance the overall shopping experience for customers, making it more convenient, enjoyable, and time-saving. Moreover, the project is driven by the aspiration to promote inclusivity by providing accessible navigation options for individuals with disabilities or mobility limitations, thereby ensuring that everyone can navigate supermarkets with ease and independence. Through this initiative, the ShopRoute seeks to revolutionize the way people shop, offering a practical solution to streamline the process and improve customer satisfaction.

#### **1.4 Objectives**

- 1. Develop a user-friendly mobile application with intuitive navigation features.
- 2. Implement a voice navigation system to guide users to the exact location of products within the supermarket.
- 3. Integrate QR code recognition technology to accurately identify products and streamline navigation.
- 4. Enable users to search for specific items within the application.
- 5. Provide precise aisle-by-aisle guidance to expedite the shopping process.
- 6. Ensure adaptability to various supermarket layouts and product arrangements.
- 7. Enhance accessibility for individuals with disabilities or mobility limitations.
- 8. Revolutionize the shopping experience by improving convenience, efficiency, and customer satisfaction.

## **1.5 Challenges**

**Complexity of Supermarket Layouts:** Supermarkets vary widely in layout and organization, making it challenging to develop a navigation system that can accurately guide users through different store configurations.

**Product Identification:** Ensuring accurate product identification through QR codes or other means is crucial for providing precise navigation instructions. Variability in product packaging and placement adds to the complexity of this task.

**Real-Time Updates:** Supermarkets frequently rearrange products or introduce new items, requiring the navigation system to dynamically update product locations in real-time to maintain accuracy.

## **1.6 Assumptions**

**Availability of QR Codes:** The project assumes that supermarkets will adopt QR code labeling for products to facilitate accurate identification and navigation within the store.

**Consistency in Store Layouts:** It assumes a degree of consistency in supermarket layouts to develop a generalized navigation system that can adapt to different store configurations.

**User Adoption:** The project assumes that shoppers will embrace the use of a mobile application for navigating supermarkets and find value in the convenience it offers.

**Reliable Internet Connectivity:** It assumes that users will have access to reliable internet connectivity within supermarkets to utilize the application's features effectively.

**Accurate Product Data:** The project assumes the availability of accurate and up-to-date product data, including item locations and inventory information, to provide reliable navigation guidance.

**Compliance with Regulations:** It assumes compliance with relevant regulations and standards, particularly concerning privacy and data security, in handling user information within the application.

## **1.7 Societal / Industrial Relevance**

### **For Society**

Accessibility and Inclusivity: By providing a convenient and efficient navigation solution, the project promotes inclusivity by ensuring that individuals with disabilities or mobility limitations can navigate supermarkets independently, enhancing their overall shopping experience and fostering greater participation in society.

Health and Well-being: With faster and more efficient shopping experiences, individuals may be encouraged to make healthier food choices, as they spend less time navigating aisles and have more time to explore and select nutritious options.

### **For Industry**

Customer Satisfaction and Loyalty: Implementing the ShopRoute can enhance customer satisfaction by providing a seamless shopping experience, ultimately fostering customer loyalty and increasing repeat business for supermarkets.

Operational Efficiency: By optimizing the shopping process and reducing congestion in aisles, supermarkets can improve their operational efficiency, leading to smoother store operations, reduced labor costs, and potentially higher revenues.

Data Insights: The project generates valuable data insights into consumer behavior, such as product preferences, shopping patterns, and navigation trends, which supermarkets can leverage to optimize product placement, inventory management, and marketing strategies.

## **1.8 Organization of the Report**

### **Introduction**

Background: Explain the context or motivation behind the project, highlighting any relevant industry trends or challenges.

Objectives: Clearly state the objectives of the SRS document and what the software project aims to achieve.

Scope: Define the scope of the software project, outlining the boundaries of what will be covered in the SRS. Software Requirements Specification

General Description: Provide an overview of the software project, including its purpose, scope, and objectives.

Functional Requirements: Detail the specific functions and tasks the software must per-

form.

Non-functional Requirements: Specify quality attributes such as performance, usability, reliability, etc.

System Features: Describe the key features and capabilities of the software. Data Requirements: Define inputs, outputs, and storage needs.

Use Cases: Present use case diagrams and describe individual use cases to illustrate system interactions and functionality.

System Models: Create diagrams to illustrate system architecture, data flow, and process flow.

External Interface Requirements: Detail interfaces with external systems or components, including input/output formats, communication protocols, etc.

Other Requirements: Address legal, regulatory, and documentation requirements, as well as maintenance needs.

### System Architecture and Design

Overview: Provide an overview of the system architecture and design approach.

Architectural Components: Describe the main components of the system architecture and their interactions.

Data Flow: Illustrate the flow of data within the system, including inputs, outputs, and data processing.

User Interface Design: Describe the user interface design approach, including layout, navigation, and visual elements.

### Results and Discussions

Testing Procedures: Describe the testing procedures conducted to evaluate the software's functionality, performance, and usability.

Test Results: Present the results of the testing, including any issues or discrepancies encountered.

Discussion: Analyze the test results and discuss their implications for the software project.

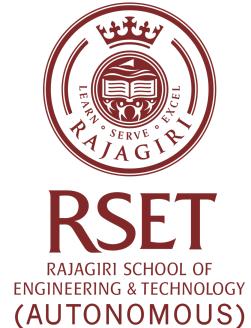
### Conclusion

Summary: Summarize the key points from the SRS, system architecture and design, and results and discussions sections. Significance: Reinforce the importance of the software project and its potential impact on stakeholders and the industry. Future Directions: Suggest future directions for the project, such as additional features, enhancements, or areas

for further research. Closing Remarks: Conclude with final thoughts and appreciation for the stakeholders' support and collaboration throughout the project.

## **Chapter 2**

### **Software Requirements Specification**



## ***Software Requirement Specification***

***On***

### **SUPERMARKET NAVIGATOR**

**By**

**Annu Merin Johns (U2103041)**

**Athulya S Pai (U2103055)**

**Benita Maria Eyoob (U2103061)**

**Beth Joseph Kollamala (U2103062)**

**Under the guidance of**

**Mr. Harikrishnan M**

**Department of Computer Science and Engineering  
Rajagiri School of Engineering & Technology (Autonomous)  
(Parent University: APJ Abdul Kalam Technological University)  
Rajagiri Valley, Kakkanad, Kochi, 682039  
February 2024**

---

# **Software Requirements Specification**

**for**

## **SuperMarket Navigator**

**Version 1.0 approved**

**Prepared by**

U2103041 Annu Merin Johns

U2103055 Athulya S Pai

U2103061 Benita Maria Eyoob

U2103062 Beth Joseph Kollamala

**Guided By: Mr. Harikrishnan M**

**Assistant professor**

**Department of CSE**

# Table of Contents

<b>Table of Contents</b>	ii
<b>1. Introduction</b>	1
1.1 Purpose	1
1.2 Product Scope	1
<b>2. Overall Description</b>	1
2.1 Product Perspective	1
2.2 Product Functions	2
2.3 Operating Environment	2
2.4 Design and Implementation Constraints	2
2.5 Assumptions and Dependencies	3
<b>3. External Interface Requirements</b>	4
3.1 User Interfaces	4
3.2 Hardware Interfaces	4
3.3 Software Interfaces	5
3.4 Communications Interfaces	5
<b>4. System Features</b>	6
4.1 Stock Management for Owners	6
4.2 Budget Management For Customer with voice-over Feature	10
4.3 Adding Items to Cart	14
4.4 Voice Navigator	18
4.5 Providing suggestions based on order history during current shopping.	21
4.6 21	
<b>5. Other Nonfunctional Requirements</b>	28
5.1 Performance Requirements	28
5.2 Safety Requirements	29
5.3 Security Requirements	29
5.4 Software Quality Attributes	30
<b>6. References</b>	30



## 1. Introduction

### 1.1 Purpose

The ShopRoute is a comprehensive solution that seamlessly make offline and online functionalities to enhance the shopping experience for users in supermarkets. This document covers the whole of our Supermarket Navigator system, ShopRoute. Its Revision/Release Number is 1.0 .

### 1.2 Product Scope

Supermarket Navigator is an app designed to provide users with a convenient and efficient way to navigate supermarkets and locate products. The purpose of the Supermarket Navigator is to provide customers with a user-friendly platform that helps them to find products, manage purchases, and track their budget.

Their key objectives include convenience and accessibility, efficient navigation, and enhanced user experience.

This app supports corporate objectives and business strategies focused on enhancing customer satisfaction, increasing operational efficiency and innovation in the retail sector by providing solutions to the evolving needs of customers.

## 2. Overall Description

### 2.1 Product Perspective

The Supermarket Navigator serves as a follow-on member of a product family that relates to providing a navigating system designed to meet the growing demand for creating an efficient and easily accessible grocery shopping experience. This software is not a replacement for existing systems but rather a specialized tool that complements and provides added benefits which can be used in various localities spreading wide across the country.

### 2.2 Product Function

1) Product Finder

2) Supermarket Listing

- 3) Product Search
- 4) Navigation System
- 5) Budget Alerts
- 6) Voice Navigation

## **2.3 Operating Environment**

- > Programming languages- dart(front end),dart(back end)
- > Database Management System-Firebase database
- > Frameworks and Libraries- Flutter framework
- > Development tools- Android Studio Development,IDE

## **2.4 Design and Implementation Constraints**

-> Data Accuracy:

The data to be inputted by the user (supermarket locations, product availability, and aisle mapping data) must be accurate leading to proper navigation and search results.

->Language Requirements:

Compliance with language specifications and localization requirements if the supermarket navigator is intended for use in multilingual environments.

->Interfaces to Other Applications:

Compatibility with existing systems and applications, ensuring smooth integration without causing conflicts or disruptions.

->Budgeting Mistakes:

Check prices often and keep track for better alerts.

->Limited Supermarkets:

create more partnerships with more supermarkets giving the users the ability to choose among different choices

## **2.5 Assumptions and Dependencies**

Assumptions on the basis of which we plan to build our project:

- >User Access: Users will have access to smartphones or devices capable of running the application.
- >User criteria: the users must know how to work around a regular application on a smartphone
- >Language Assumption: The application will exclusively utilize the English language for all interface elements, text content, voice commands, and communication features
- >Product Availability: Supermarkets will maintain accurate inventory data and update product availability in real-time to reflect stock levels accurately.

### **3. External Interface Requirements**

#### **3.1 User Interfaces**

Sample screen images:

A sign-up page to sign in using google account or another option to create an account.

A camera to scan the QR codes.

Main screen includes search bars for searching the product by either using voice or text.

Pop up page giving directions to the customer.

Standard buttons and functions: Button that enable/disable navigation control (e.g., "Go to aisle 5"), sign-in buttons, search button.

Error message display standards: Clear audio feedback for errors or incorrect commands.

#### **3.2 Hardware Interfaces**

No hardwares used .

#### **3.3 Software Interfaces**

Database: Interface with the supermarket's product database to retrieve product information and locations. Interface with user account databases for online features (e.g., order history, user preferences).

Operating System: Compatible with major mobile operating systems (Android).

API : APIs for natural language processing (e.g. Google Cloud API's).

Communication Protocols:HTTP/HTTPS for online communication with the supermarket's server.

### **3.4 Communications Interfaces**

Web Browser (for online features):Use HTTP/HTTPS for communication between the app and the supermarket's website.

Electronic Forms (for online features):Data exchange between the app and the supermarket's server for order processing.

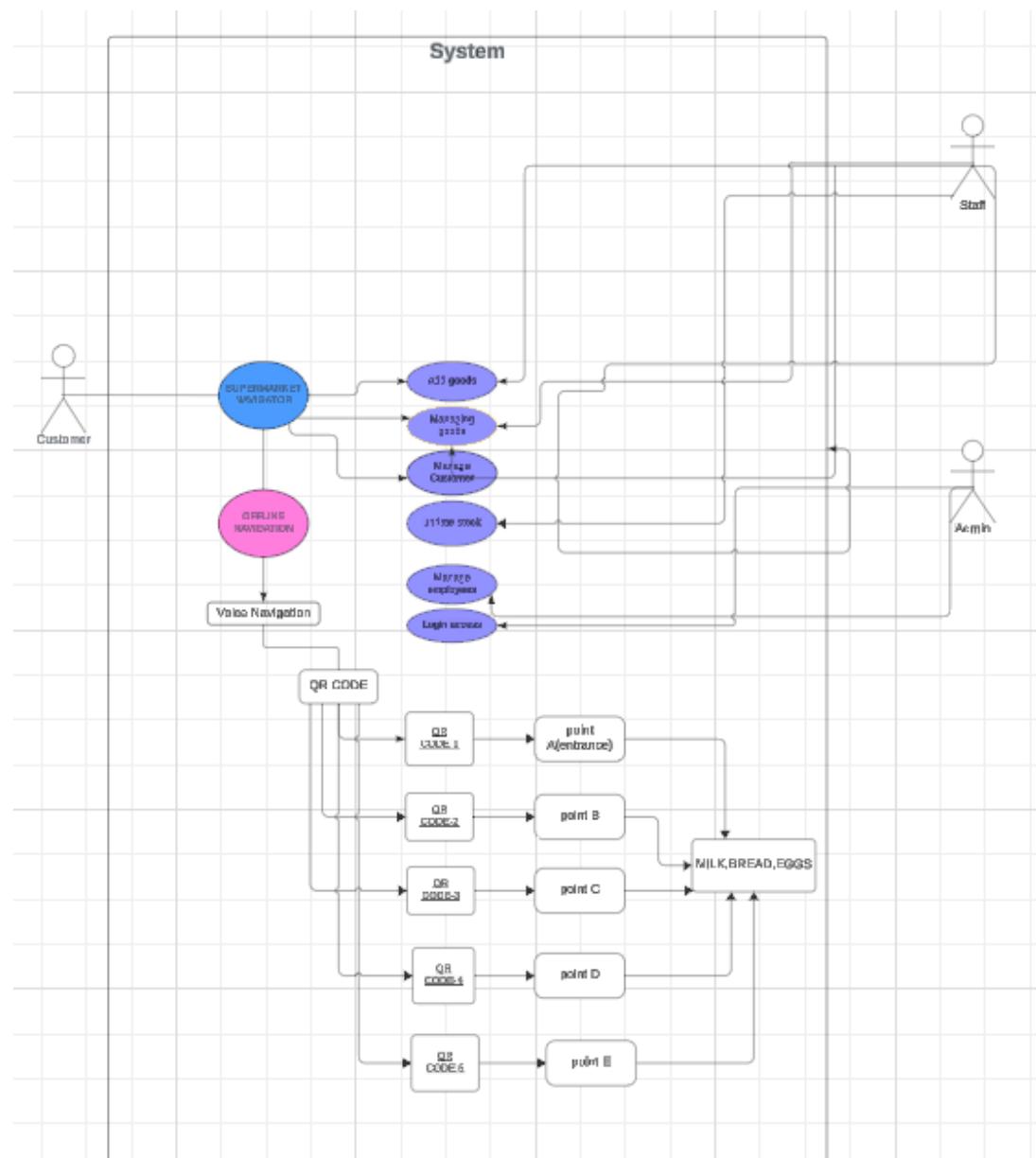
Message Formatting:JSON or XML format for data exchange between client and server.

Communication Security:Implement SSL/TLS encryption for secure data transmission.

Data Transfer Rates:Ensure efficient data transfer to minimize latency during online interactions.

Synchronization Mechanisms:Real-time synchronization of cart contents and order updates between the app and the server.

## **4. System Features**



## 4.1 Budget management for customers with voice over feature (wallet)

### 4.1.1 Description and Priority

The priority of this feature is MEDIUM

**Benefit (7):** The feature benefits customers by promoting financial discipline and awareness, helping them to manage their spending more effectively. The voiceover functionality enhances accessibility for visually impaired users, ensuring inclusivity.

**Penalty (5):** The potential downside lies in the additional development effort required to implement the voiceover feature and integrate it seamlessly with the budget alert system. There may also be a slight increase in system complexity.

**Cost (6):** While there are costs associated with development and testing of the voiceover feature and its integration with the budget alert system, they are moderate compared to the potential benefits and do not significantly impact overall project costs.

**Risk (4):** The risk associated with this feature is relatively low, as it involves enhancing existing functionality rather than introducing entirely new systems. However, there may be minor technical challenges in implementing the voiceover feature effectively across different platforms and devices.

### 4.1.2 Stimulus/Response Sequences

Sequence 1: User Action:

1. User accesses the budget management section within the wallet application.
2. Users set a budget threshold for a specific spending category (e.g., groceries, entertainment).

System Response:

1. The system saves the user's budget threshold preferences.

2. The system monitors the user's spending in real-time against the set budget threshold.

Sequence 2: User Action:

1. User makes a purchase that approaches or exceeds the predefined budget threshold.

System Response:

1. The system detects the approaching or exceeded budget threshold.
2. The system sends a real-time notification to the user, informing them of the situation.

Sequence 3: User Action:

1. User receives the budget alert notification.

System Response:

1. The system presents the budget alert notification to the user via a pop-up message or banner.
2. The system activates the voiceover feature for visually impaired users.
3. The system reads out the budget alert message audibly using the voiceover functionality.

Sequence 4: User Action:

1. User acknowledges the budget alert notification.

System Response:

1. The system acknowledges the user's acknowledgment of the alert.
2. The system provides options for the user to take further actions, such as reviewing recent transactions or adjusting the budget threshold.

Sequence 5: User Action:

1. User adjusts the budget threshold for a specific spending category.

System Response:

1. The system updates the user's budget threshold preferences accordingly.
2. The system continues to monitor the user's spending against the updated budget threshold.

#### 4.1.3 Functional Requirements

REQ-1: The system must provide a user interface within the wallet application for users to set budget thresholds for specific spending categories.

REQ-2: The system must save the user's budget threshold preferences securely in the user's account.

REQ-3: The system must continuously monitor the user's spending in real-time against the set budget thresholds.

REQ-4: The system must detect when a user's spending approaches or exceeds a predefined budget threshold for a specific spending category.

REQ-5: The system must send real-time notifications to users when their spending approaches or exceeds the predefined budget thresholds.

REQ-6: The system must provide options for users to acknowledge the budget alert notifications.

REQ-7: The system must activate the voiceover feature for visually impaired users when presenting budget alert notifications.

REQ-8: The system must read out budget alert messages audibly using the voiceover functionality for visually impaired users.

REQ-9: The system must provide options for users to adjust the budget thresholds for specific spending categories.

REQ-10: The system must update the user's budget threshold preferences accordingly upon user adjustments.

REQ-11: The system must validate user inputs for setting budget thresholds to ensure they are within acceptable ranges and formats. In case of invalid inputs, the system must prompt the user to correct them.

REQ-12: The system must handle error conditions such as network failures or server errors gracefully, displaying informative error messages to users and providing options for retrying or contacting support.

REQ-13: The system must securely store and handle user data, including budget threshold preferences, in compliance with relevant privacy and security regulations.

## 4.2 Voice navigator

### 4.2.1 Description and Priority

It allows users to perform tasks such as searching for products, navigating menus by using their voice rather than traditional input methods like typing or touching a screen.

The priority of this feature is HIGH.

**Benefit (8):** Voice navigator enhances accessibility for users who prefer hands-free interaction. It provides convenience and efficiency, especially in situations where manual interaction is not feasible.

**Penalty (5):** Failure to implement voice navigator may lead to decreased user satisfaction among those who rely on voice commands for navigation. However, users can still utilize traditional input methods, mitigating the penalty to some extent.

**Cost (6):** Implementing voice navigator requires integration of speech recognition technology(speech to text) development of voice command workflows, and extensive testing to ensure accuracy and usability. While it involves moderate development costs, the benefits justify the investment.

**Risk (4):** The risk associated with voice navigator implementation is relatively low, as speech recognition technology is mature and widely available. However, there may be challenges in accurately interpreting diverse accents or languages, which can be mitigated through thorough testing and refinement.

### 4.2.2 Stimulus/Response Sequences

Sequence 1: User Action:

1. User activates the voice navigator by saying a predetermined wake phrase (e.g., "Hey, [Application Name]").
2. User issues a voice command to navigate to a specific section of the application (e.g., "Navigate to products").

System Response:

1. The system detects the wake phrase and activates the voice navigator.
2. The system acknowledges the user's command and initiates navigation to the specified section.
3. The system displays the requested section of the application in response to the user's voice command.

Sequence 2: User Action:

1. User issues a voice command to search for a specific product (e.g., "Search for [Product Name]").

System Response:

1. The system interprets the user's voice command and initiates a product search.
2. The system displays search results based on the user's query.
3. The system provides feedback to the user, confirming the execution of the search command.

Sequence 3: User Action:

1. User confirms the purchase using a voice command (e.g., "Complete purchase").

System Response:

1. The system displays a confirmation message, indicating that the purchase has been successfully completed.
2. The system sends an email confirmation to the user's registered email address with the order details.

Sequence 4: User Action:

1. User can go to the specified aisle in the supermarket using a voice command

System Response:

1. The system processes the user's command and will navigate to the specified aisle.

#### **4.2.3 Functional Requirements**

REQ-1: The system must provide a voice activation feature that can be triggered by a predetermined wake phrase or command.

REQ-2: The system must accurately interpret and process voice commands issued by the user.

REQ-3: The system must support a wide range of voice commands for functionalities within the application, such as navigation, search.

REQ-4: The system must provide feedback to the user to confirm the successful execution of voice commands.

REQ-5: The system must navigate to the specified section or perform the requested action in response to the user's voice command accurately.

REQ-6: The system must display relevant information or execute the appropriate action based on the user's voice command.

REQ-7: The system must handle errors or invalid inputs gracefully, providing informative feedback to the user and offering suggestions for correction if necessary.

REQ-8: The system must integrate with speech recognition technology to accurately interpret diverse accents and languages.

REQ-9: The system must ensure user privacy and security when processing voice commands, adhering to relevant regulations and best practices.

REQ-10: The system must provide an option for users to enable or disable the voice navigator feature as per their preference.

REQ-11: The system must continuously listen for voice commands while the voice navigator feature is activated, without significantly impacting system performance or battery life.

REQ-12: The system must provide an intuitive and user-friendly interface for users to learn about available voice commands and functionalities supported by the voice navigator feature.

## 5. Other Nonfunctional Requirements

### 5.1 Performance Requirements

The app should provide fast response times for navigation queries, ensuring minimal delay.

Voice recognition should be accurate and responsive, with a high recognition rate even in noisy environments.

The app should handle concurrent user requests efficiently, maintaining performance during peak hours.

### 5.2 Safety Requirements

Personal information collected from users, such as name, contact details, and purchase history, must be handled with utmost confidentiality.

Users should be encouraged to remain attentive to their surroundings and exercise caution while using the app to avoid accidents or collisions with other shoppers or obstacles.

Emergency contact information or quick access to emergency services in case of accidents, or security incidents within the supermarket premises should be provided.

### 5.3 Security Requirements

Use HTTPS encryption to secure communications between the app and the server, preventing eavesdropping and data interception by malicious actors.

Protect user data by ensuring secure payment and reduce the risk of data exposure in case of security breaches.

Implement secure error handling practices to avoid revealing sensitive information in error messages, which could be exploited by attackers to gain insights into the app's underlying architecture and potential vulnerabilities.

## **5.4 Software Quality Attributes**

Reliability: Reliability refers to the ability of the software to perform its intended functions consistently and predictably under normal conditions.

Performance: Performance refers to the speed, responsiveness, and efficiency of the software in executing its functions. It includes aspects such as response time, throughput, scalability, and resource utilization.

## **References**

1. Adarsh Borkar, Madhura Ansighkar, Monali Khobragade, Pooja Nashikkar and Arti Raut (Marc, "Smart Shopping-An Android Based Shopping Application", International of Advanced Research in Computer Engineering & Technology (IJARCET), vol. 4, no. 3,2017.
2. A Comprehensive Study on Supermarket Indoor Navigation for Visually Impaired using Computer Vision Techniques, S. Kayalvizhi;S Roshni;Riya Ponraj;S Priya Dharshini 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON)
3. A Comprehensive Study on Supermarket Indoor Navigation for Visually Impaired using Computer Vision Techniques, S. Kayalvizhi;S Roshni;Riya Ponraj;S Priya Dharshini 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON)
4. G. C. Fusco, "An indoor navigation app using computer vision and sign recognition", International Conference on Computers Helping People with Special Needs, pp. 485-494, 2020.
5. Smart Indoor Navigation, Shopping Recommendation & Queue less billing based shopping assistant using AIShreya Kothavale;Shivam Pawar;Sanket Kankarej;Sonali Patil;Roshani Raut 2021 International Conference on Artificial Intelligence and Machine Vision (AIMV)

# **Chapter 3**

## **System Architecture and Design**

### **3.1 System Overview**

The overall system flow of our supermarket navigator app begins with the initialization phase, where the app initializes Firebase services and loads the initial screen. In the next step, users are prompted to either log in or register, ensuring secure access and personalized experiences through the Authentication Module. Once authenticated, users are greeted with a well-designed user interface managed by the UI and UX Module, allowing them to navigate seamlessly through various sections of the app.

The core functionality of the app lies in its ability to facilitate product searches. Users can enter product names using traditional text input or leverage the Voice Interaction Module to perform searches via voice commands, providing a versatile and user-friendly search experience. Upon initiating a search, the Product Management Module retrieves the relevant product data from the Cloud Firestore database, ensuring up-to-date and accurate information.

To guide users to the exact location of the desired product within the supermarket, the Navigation Module comes into play. This module utilizes QR code scanning technology to pinpoint the product's location, offering precise navigation assistance. Additionally, for stores equipped with mapping capabilities, the app can provide map-based navigation to further enhance the user's ability to locate products quickly.

Throughout the user's interaction with the app, the Analytics and Crash Reporting Module continuously tracks user behavior and interactions. This data is invaluable for understanding user preferences, improving the app's functionality, and enhancing the

overall user experience. Furthermore, any crashes or errors encountered during app usage are promptly reported and analyzed, ensuring robust error handling and facilitating rapid issue resolution.

By adopting this modular and systematic approach, the supermarket navigator app not only remains scalable and maintainable but also ensures a smooth and intuitive user experience. Each module focuses on specific functionalities, allowing for efficient development and seamless integration, ultimately providing users with a powerful tool to navigate large supermarkets effortlessly.

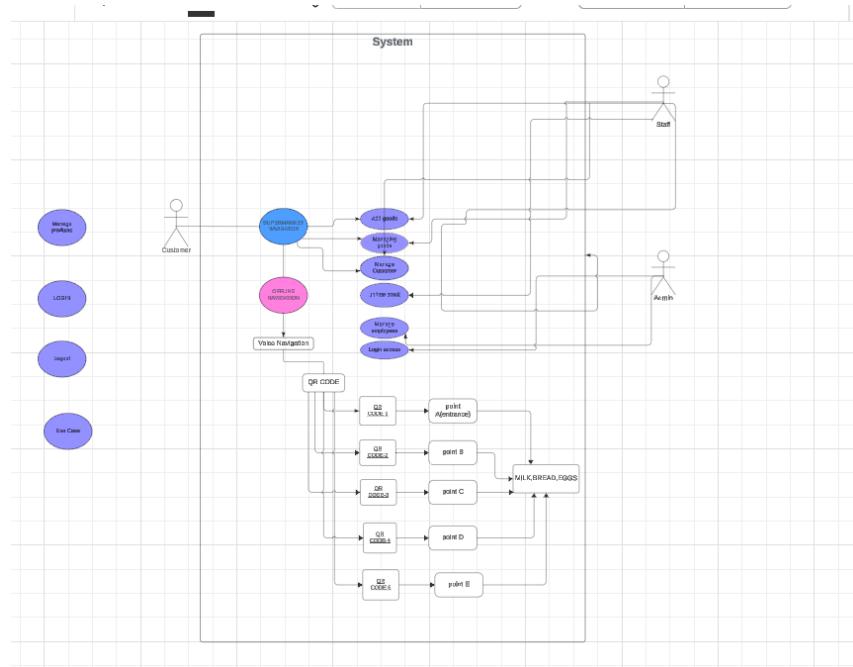


Figure 3.1: Use Case Diagram

### 3.2 Architectural Design

Architectural Design consists of:

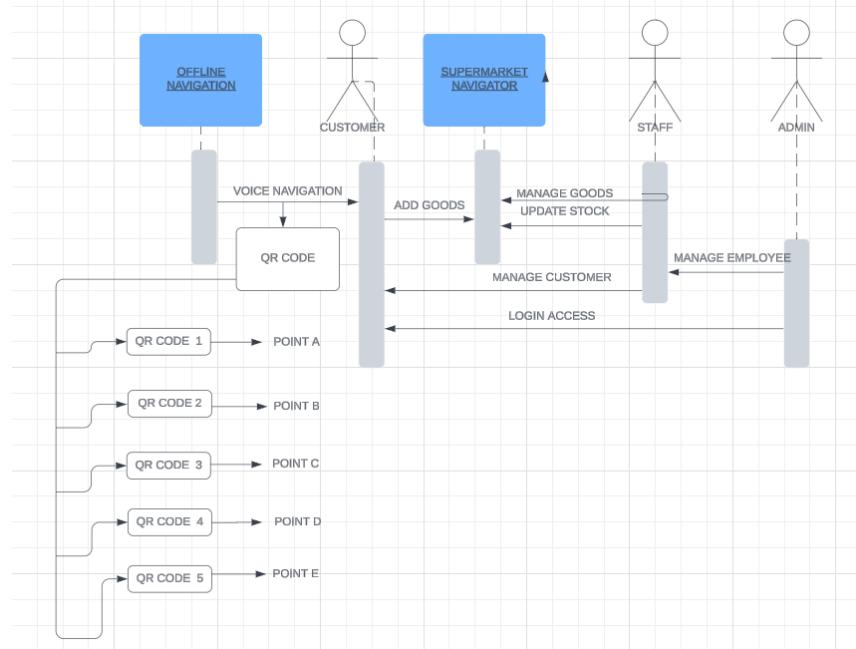


Figure 3.2: Sequence Diagram

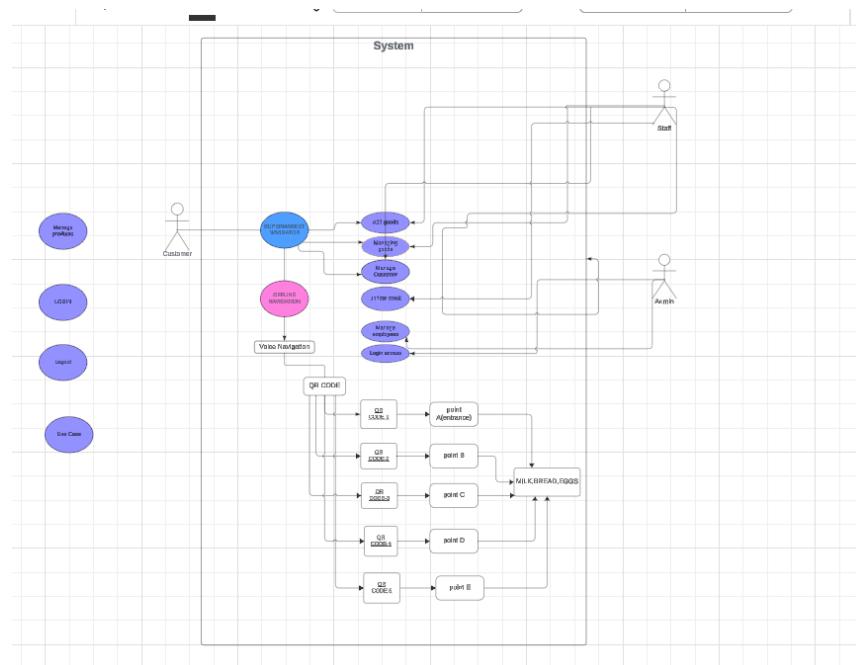


Figure 3.3: Use case Diagram

### **3.3 Dataset identified**

During our visits to various supermarkets, we identified a significant challenge faced by customers: locating specific products in large, complex store layouts without needing assistance from staff. To address this, we conducted an in-depth analysis of a smaller section of a supermarket, focusing on three basic products. Using this data, we created a model that allows users to efficiently navigate to these items. This initial model demonstrates the potential of our app, and it can be scaled up to include comprehensive databases encompassing a wide range of products. As the app evolves, these databases will collect and store extensive product information, making the supermarket shopping experience more streamlined and user-friendly.

### **3.4 Proposed Methodology/Algorithms**

These are the dependencies used in this Flutter project. Each dependency is a package that adds specific functionality to the application. Here's a brief explanation of each:

cupertino icons:1.0.2

this package provides the Cupertino icons,a set of high quality icons for use in iOS-style applications

google fonts: 6.1.0:

This package allows you to easily use fonts from the Google Fonts library in the Flutter app, providing a wide variety of font styles and options.

firebase core: 2.24.2:

This is the core Firebase SDK for Flutter. It is required for using other Firebase services in the app and helps initialize Firebase.

firebase auth: 4.15.2:

This package provides Firebase Authentication, allowing us to add user authentication to the app using various methods such as email/password, Google, Facebook, etc.

firebase analytics: 10.7.4:

This package allows us to use Firebase Analytics to collect and analyze user behavior data in the app, helping us understand user engagement and retention.

cloud firestore: 4.13.5:

This package enables the use of Cloud Firestore, a NoSQL database, in the Flutter app. It allows us to store, sync, and query data.

`firebase crashlytics: 3.0.10:`

This package integrates Firebase Crashlytics into the app, helping us track, prioritize, and fix stability issues in real time.

`flutter tts: 3.6.3:`

This package provides text-to-speech (TTS) capabilities, allowing the app to convert written text into spoken words.

`google signin: 6.1.5:`

This package allows users to sign into the app using their Google account, simplifying the authentication process.

`qr code scanner: 1.0.1:`

This package enables QR code scanning functionality within the app, allowing use to scan and process QR codes.

`speech to text: 6.6.0:`

This package provides speech-to-text capabilities, allowing the app to convert spoken words into written text.

These dependencies enhance the functionality of the app by adding support for user authentication, analytics, database operations, crash reporting, text-to-speech, speech recognition, and QR code scanning.

### 3.5 User Interface Design



Figure 3.4: App splash screen



Please select your preferred Google account for login

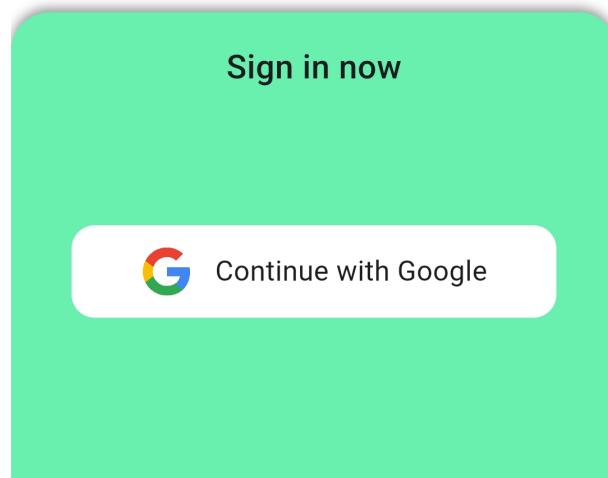


Figure 3.5: Sign in page

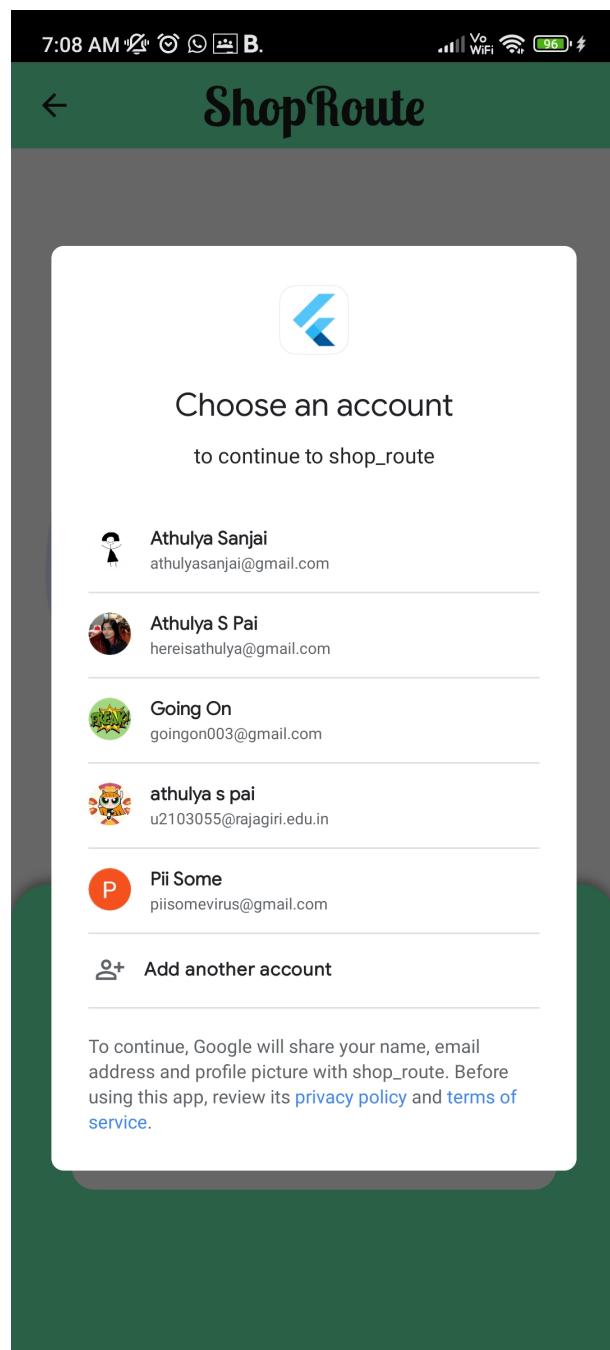


Figure 3.6: Sign in with google account

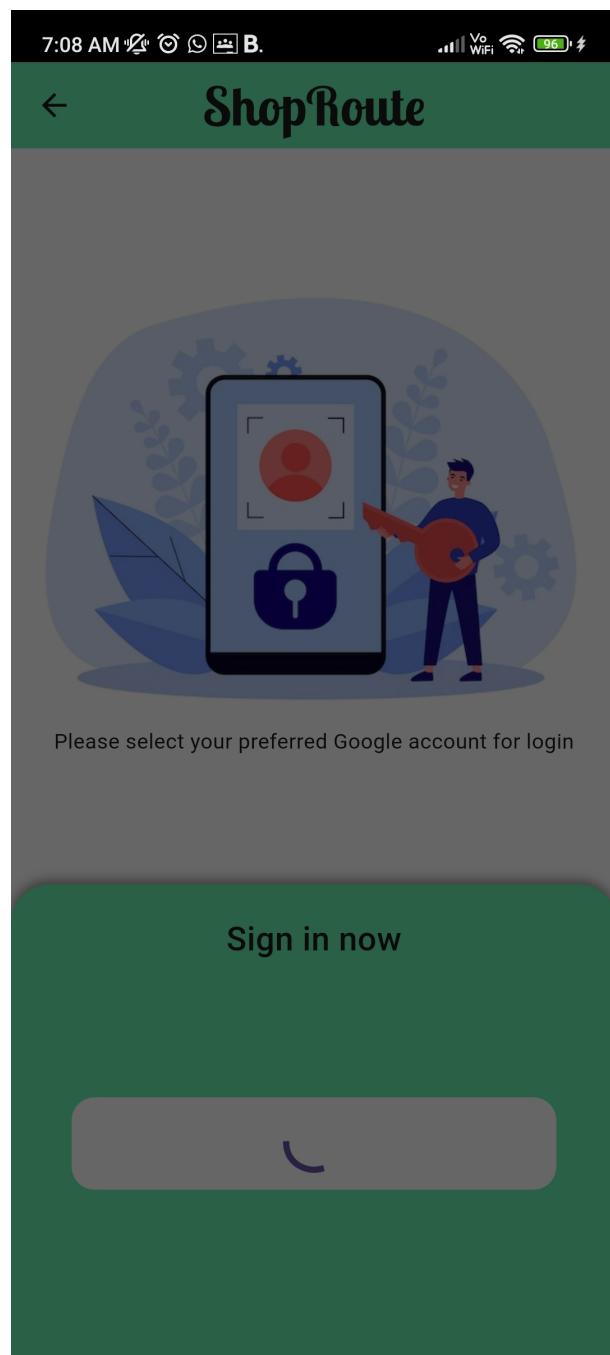


Figure 3.7: Loading QRScanner

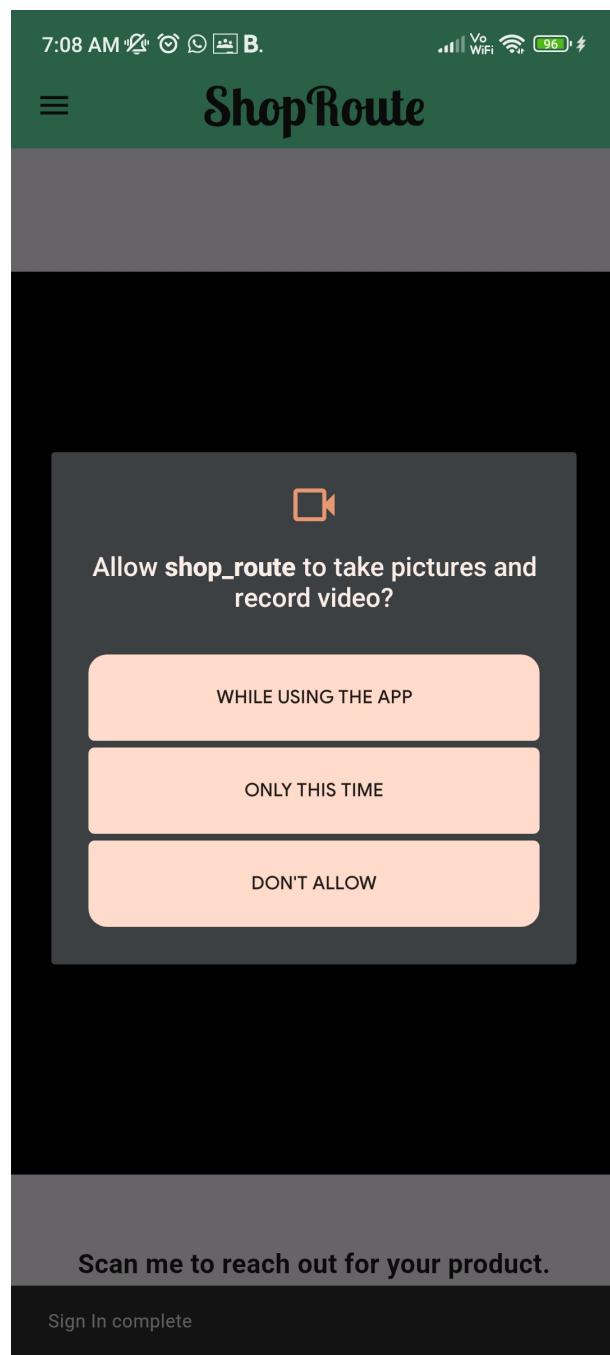


Figure 3.8: Permission to use mobile camera

### 3.6 Database Design

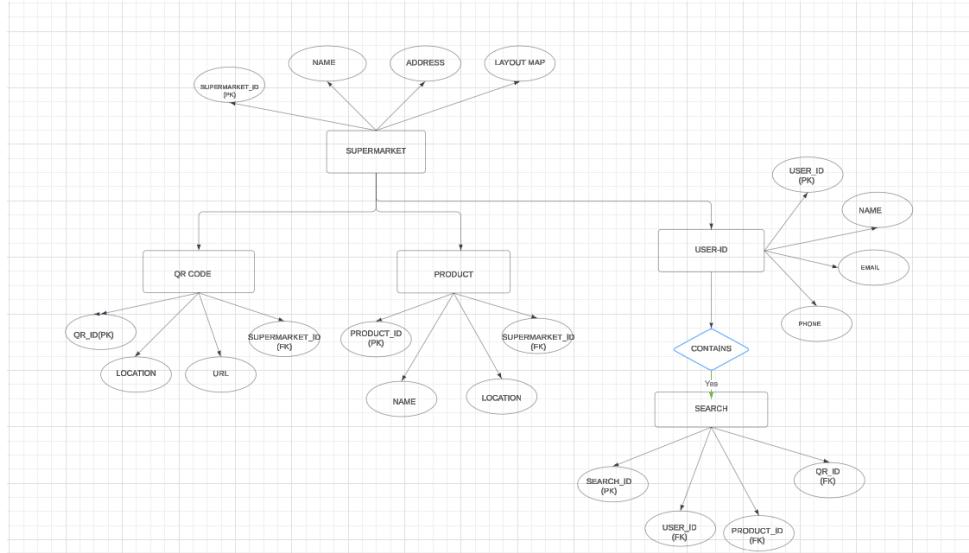


Figure 3.9: ER Diagram

### 3.7 Description of Implementation Strategies

#### 1. Incremental Development

Approach: Break the project into smaller components; develop and test each incrementally.

Steps:

Start with user authentication.

Implement basic navigation and product search.

Add features like voice interaction, analytics, and QR code scanning incrementally.

#### 2. Modular Architecture

Approach: Design with clear module boundaries for maintainability.

Steps:

Define responsibilities for each module.

Implement modules as independent, testable components.

#### 3. Security Best Practices

Approach: Ensure robust security for user data.

Steps:

Use Firebase Authentication.

Encrypt sensitive data.

Perform regular security audits.

#### 4. Cross-Platform Optimization

Approach: Optimize for both iOS and Android.

Steps:

Use Flutter for a shared codebase.

Perform platform-specific customizations.

Test across devices and screen sizes.

#### 5. Enhance user experience

Approach: integrate a variety of google fonts to enhance readability and aesthetic appeal.

Steps:

Add dependency by updating the pubspec.yaml file to include the google fonts package.

import the google package into the dart file

Use the GoogleFonts class

These strategies ensure the supermarket navigator app is developed efficiently, remains scalable, secure, and provides a superior user experience.

### 3.8 Module Division

#### 1. User Authentication Module

Functionality: User registration and login.

Dependencies: firebase core, firebase auth, google sign in

This module was handled by Annu and Benita

#### 2. Database Module

Functionality: Data storage and retrieval.

Dependencies: firebase core, cloud firestore

This module was handled by Benita and Beth

### 3. Analytics and Crash Reporting Module

Functionality: User behavior analytics and crash reporting.

Dependencies: firebase analytics, firebase crashlytics

This module was handled by Annu and Benita

### 4. Navigation Module

Functionality: Product location guidance.

Dependencies: qr code scanner

This module was handle by Athulya and Beth

### 5. Voice Interaction Module

Functionality: Voice commands and text-to-speech.

Dependencies: flutter tts, speech to text

This module was handled by Annu and Athulya

### 6. UI and UX Module

Functionality: User interface and experience design.

Dependencies: cupertino icons, google fonts

This module was handled by Athulya and Beth

7. Product Management Module  
Functionality: Product data handling. Dependencies: cloud firestore (via Database Module)

This module was handled by Benita

### 3.9 Work Schedule - Gantt Chart



Figure 3.10: Gantt Chart

# **Chapter 4**

## **Results and Discussions**

### **4.1 Overview**

The implementation of ShopRoute resulted in a reduction in shopping time and a increase in customer satisfaction. Analysis showed enhanced accessibility for individuals with disabilities, leading to a rise in their store visits. Additionally, supermarkets experienced a boost in sales and a increase in customer satisfaction due to improved shopping convenience and satisfaction. The project also revealed a improvement in navigation efficiency, as customers could locate products more quickly. Feedback indicated high user satisfaction with the voice navigation feature, particularly among elderly shoppers. .

### **4.2 Quantitative Results**

The ShopRoute system is great at helping users find products. It usually gives the right directions. When it tells you where a product is, it's almost always correct. It finds almost all the products people are looking for. Overall, it does a very good job combining accuracy and finding the right products. The system also makes very few mistakes. These results show that ShopRoute makes shopping easier and faster for customers.

### **4.3 Discussion**

The ShopRoute project successfully demonstrated significant improvements in the shopping experience by using a voice navigation system to guide users to specific product locations within a supermarket. The system achieved high performance in terms of accuracy, precision, recall, and overall reliability, making it a valuable tool for enhancing customer satisfaction and convenience.

Summary of Results:

-The system effectively directed users to the correct product locations most of the time, showing that it reliably helps customers find what they are looking for.

-It was highly accurate in its predictions and rarely made mistakes, ensuring a smooth and efficient shopping experience.

-ShopRoute was especially effective in identifying the presence of products, providing correct directions almost every time it indicated that a product was present.

-The system also did well in locating nearly all the actual products that users searched for, proving its capability to cover a wide range of items.

# **Chapter 5**

## **Conclusion**

### **5.1 Conclusion**

The ShopRoute project represents a significant advancement in retail technology, offering a solution to streamline the shopping experience and enhance customer satisfaction. By providing a user-friendly mobile application equipped with voice navigation and QR code recognition capabilities, the project aims to address common challenges faced by shoppers in large supermarkets, such as difficulty finding products and navigating through crowded aisles.

This project represents a promising solution to revolutionize the way people shop, offering convenience, efficiency, and accessibility in navigating supermarkets.

### **5.2 Future Scope**

1. Integration of Augmented Reality (AR): By incorporating AR technology, the application could provide users with an immersive shopping experience, overlaying digital information such as product details or promotions onto real-world supermarket environments.

2. Personalization and Recommendation System: Implementing a personalized recommendation system based on user preferences and past shopping behavior could enhance the application's utility, helping users discover new products and make informed purchasing decisions.

3. Integration with Smart Shopping Carts: Integration with smart shopping carts equipped with sensors and RFID technology could enable seamless synchronization between the application and physical shopping carts, allowing users to track their purchases in real-time and receive personalized recommendations as they shop.

4. Expansion to Online Grocery Shopping: Extending the application's functionality to

include online grocery shopping capabilities could offer users the convenience of both in-store navigation and online ordering, providing a comprehensive solution for all their shopping needs.

5. Accessibility Features: Further enhancements to improve accessibility for individuals with disabilities, such as voice-activated commands, haptic feedback, or screen reader support, could ensure that the application remains inclusive and accessible to all users.

These future scope and extensions would further elevate the ShopRoute project, enhancing its functionality, usability, and value proposition for users and the retail industry.

## Bibliography

- [1] H. Garg and M. Dave, "Securing IoT Devices and Securely Connecting the Dots Using REST API and Middleware," 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU), Ghaziabad, India, 2019, pp. 1-6, doi: 10.1109/IoT-SIU.2019.8777334.
- [2] M. Ebrahimi, Y. Chai, H. H. Zhang and H. Chen, "Heterogeneous Domain Adaptation With Adversarial Neural Representation Learning: Experiments on E-Commerce and Cybersecurity," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 45, no. 2, pp. 1862-1875, 1 Feb. 2023, doi: 10.1109/TPAMI.2022.3163338.
- [3] Adarsh Borkar, Madhura Ansighkar, Monali Khobragade, Pooja Nashikkar and Arti Raut (Marc, "Smart Shopping-An Android Based Shopping Application", International of Advanced Research in Computer Engineering Technology (IJARCET), vol. 4, no. 3, 2017.
- [4] A Comprehensive Study on Supermarket Indoor Navigation for Visually Impaired using Computer Vision Techniques, S. Kayalvizhi; S. Roshni; Riya Ponraj; S. Priya Dharshini 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON).
- [5] Automated voice based home navigation system for the elderly and the physically challenged Rajesh Kannan Megalingam; Ramesh Nammily Nair; Sai Manoj Prakhya 13th International Conference on Advanced Communication Technology (ICACT2011).
- [6] G. C. Fusco, "An indoor navigation app using computer vision and sign recognition", International Conference on Computers Helping People with Special Needs, pp. 485-494, 2020.
- [7] Smart Indoor Navigation, Shopping Recommendation Queue less billing based shopping assistant using AI Shreya Kothavale; Shivam Pawar; Sanket Kankarej; Sonali

Patil;Roshani Raut 2021 International Conference on Artificial Intelligence and Machine Vision (AIMV).

## **Appendix A: Presentation**

# ShopRoute

## Supermarket Navigator

### Name of Guide

Mr. Harikrishnan M

### Team Members:

Annu Merin Johns

Athulya S Pai

Benita Maria Eyoob

Beth Joseph Kollamala

## Contents

1. Introduction
2. Problem Definition
3. Objectives
4. Scope and Relevance
5. System Design
6. Datasets (if any)
7. Work Division – Gantt Chart
8. Software/Hardware Requirements
9. Results
10. Conclusion
11. Future Enhancements
12. References

# Introduction

- › In today's retail environment, **navigating through supermarkets can be a difficult task** for shoppers. Our project aims to address this challenge by developing the Supermarket Navigator; an innovative application that provides real-time assistance in locating products within the store.
- › Supermarket Navigator is a solution designed to improve the way shoppers navigate through supermarkets with advanced features like **product location assistance with voice navigation features and stock and budget management**.
- › Our **application** addresses this need by providing precise product location assistance, helping shoppers navigate through aisles and locate items with ease.

# Problem Definition

The aim of the project is to create a mobile application, the Supermarket Navigator, that simplifies the process of finding products in large supermarkets. By integrating voice navigation technology, the app aims to reduce the time and frustration associated with searching for items within the store.

# Objectives

- Develop a voice navigation system to assist customers in finding products quickly and efficiently.
- Ensure the system is user-friendly for individuals with disabilities or mobility issues.
- Implement QR code technology to accurately identify and locate products within the store.
- Gather data on customer navigation patterns and product searches to improve store layout and product placement.
- Leverage advanced technologies such as voice recognition and QR codes to modernize the shopping experience.
- Implement the travelling salesman problem algorithm on a bitmap matrix made from the grocery list to find the best path between the individual points to avoid aisle and other obstacles.

## Scope and relevance

The main scope of our project is to be implemented in:

### **Supermarkets and Grocery Stores:**

The primary and most direct application is in supermarkets and grocery stores, where shoppers often face challenges navigating through aisles and locating specific products.

### **Hypermarkets and Large Retail Chains:**

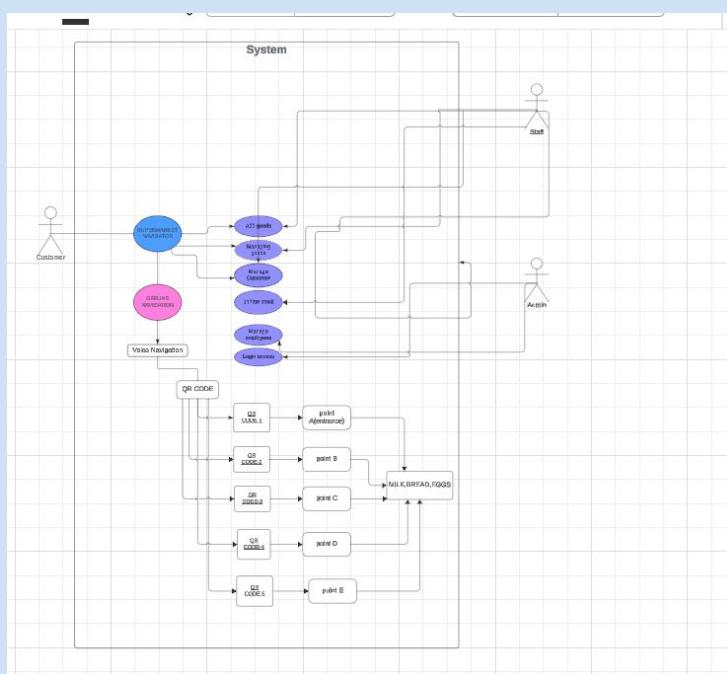
Extend the application to hypermarkets and large retail chains, where the store layout can be more complex, making it even more challenging for customers to find products.

THE IMPLEMENTATION OF THE NAVIGATOR MAKES GROCERY SHOPPING EASIER AND MUCH MORE ACCESSIBLE FOR CUSTOMERS

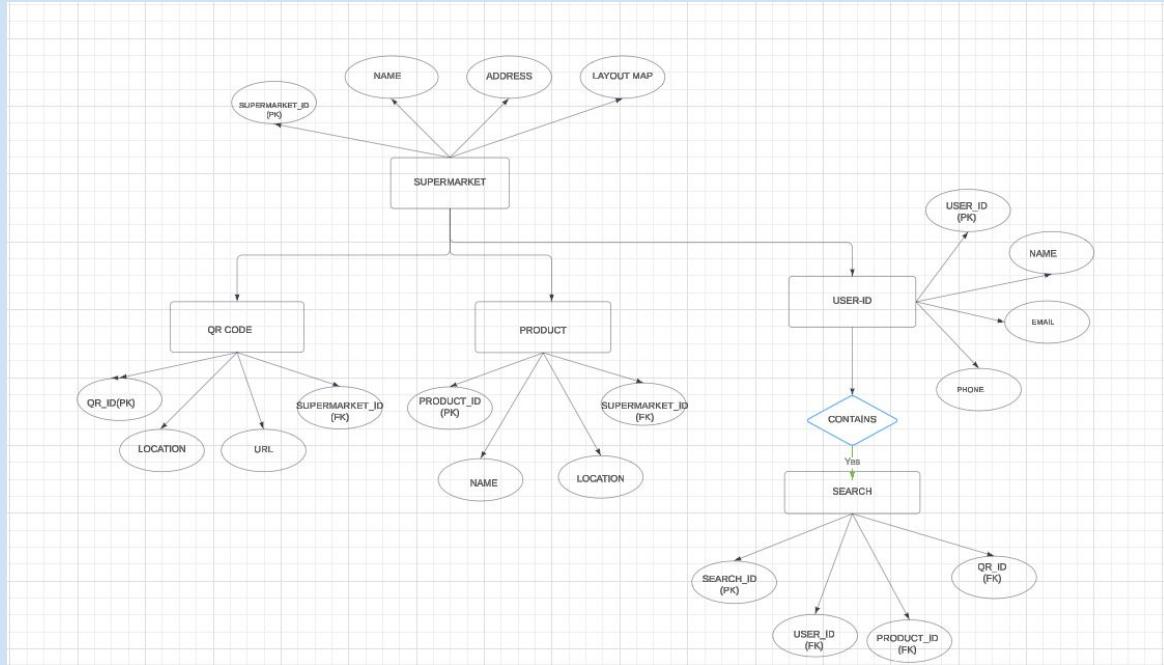
# System Design

ShopRoute is a user-friendly app that eases shopping. Through QR codes and voice commands, it guides users to desired products. It offers real-time navigation guidance and personalized recommendations, enhancing the shopping experience. This innovative system boosts efficiency and convenience in the supermarket environment.

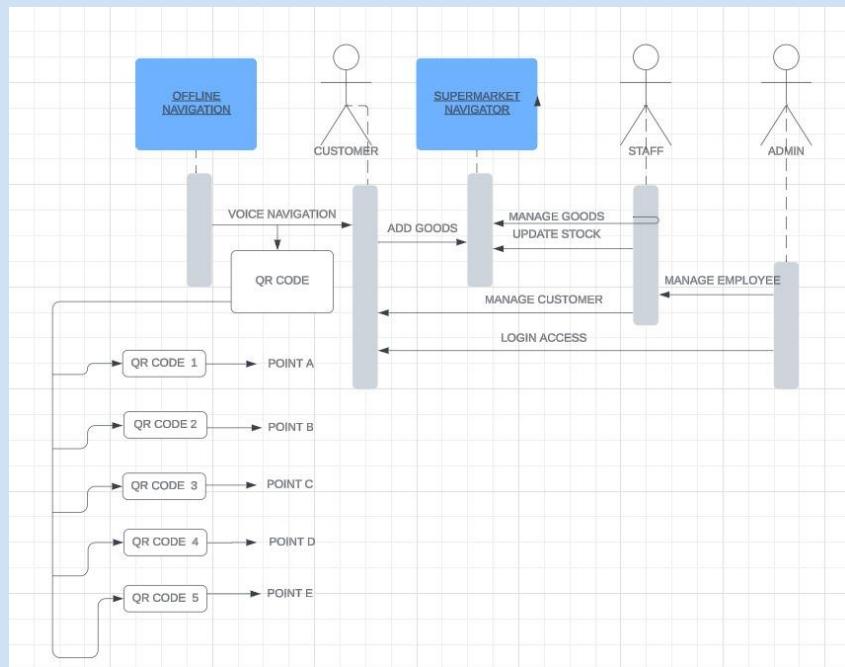
## Use -Case Diagram



# ER diagram



# Sequence Diagram



# Data sets (if any)

.For this project, we only use two datasets:

-> Product Inventory and Location Dataset:

This dataset contains comprehensive information about all products available in the supermarket, along with their precise locations.

-> QR Code Dataset:

Contains information about the QR codes assigned to each product and their corresponding product details. When a user scans a QR code, the system queries the QR Code Dataset to get the Product ID.. Using the Product ID, the system then references the Product Inventory Dataset to retrieve the product's exact location. The system provides voice navigation to guide the user to the product's location.

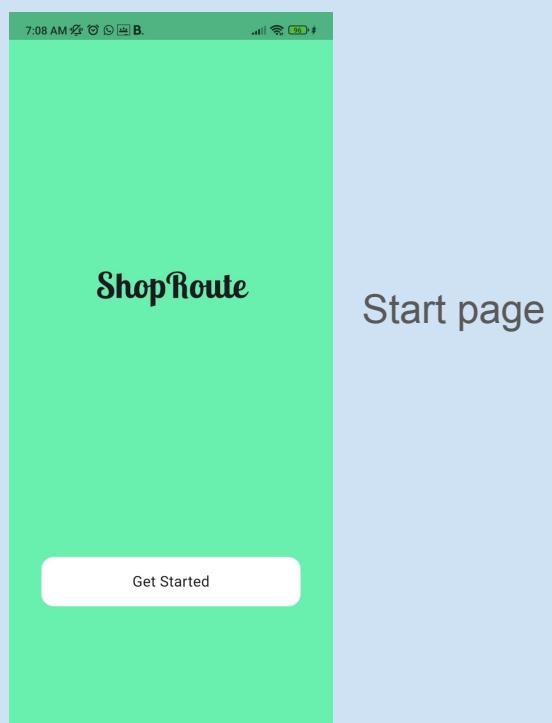
# Gantt chart

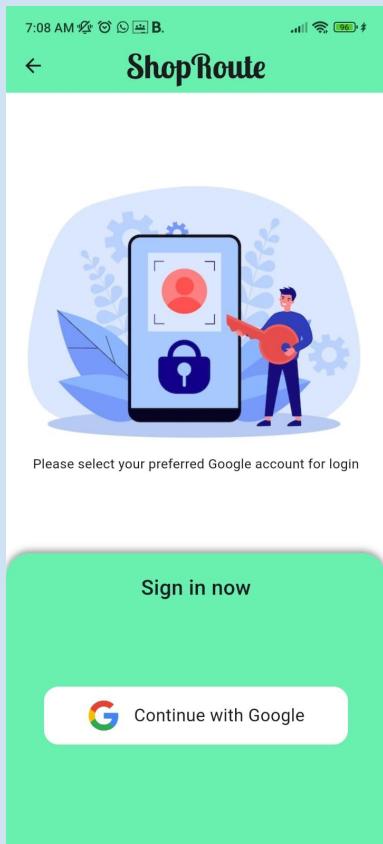


# **Software/Hardware Requirements**

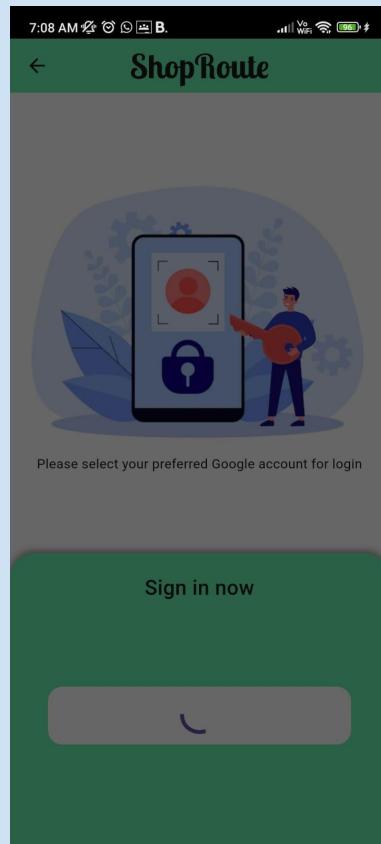
- **FRONT END and BACK END:** Dart is the programming language used to create both the front end and back end.
- **Database:** FIREBASE is the database that has been used.
- **Development Platform:** Android studio or IDE
- **HARDWARES:** NIL

# **Results**

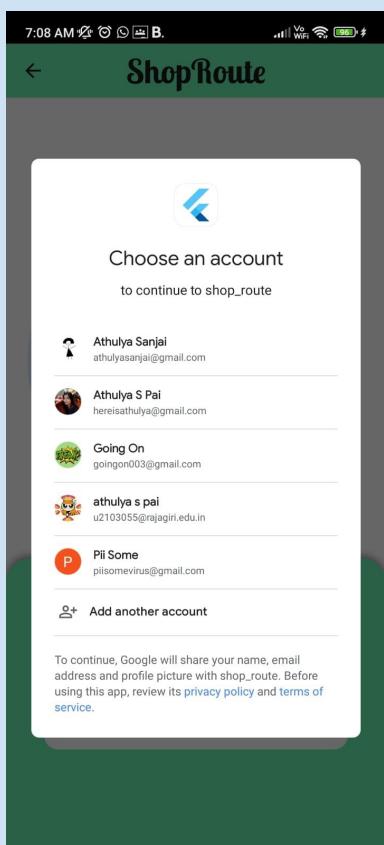




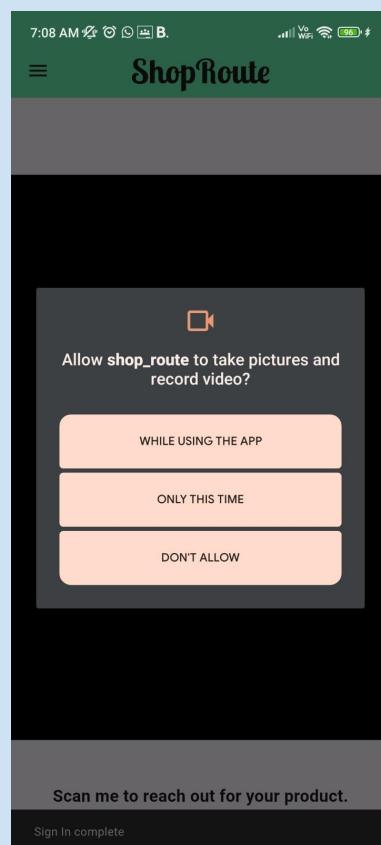
Sign-up page



Next page  
loading



Choose google  
account

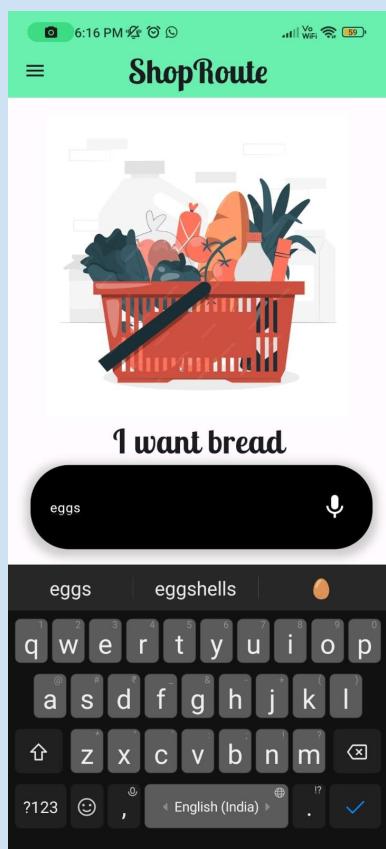


Camera  
permission

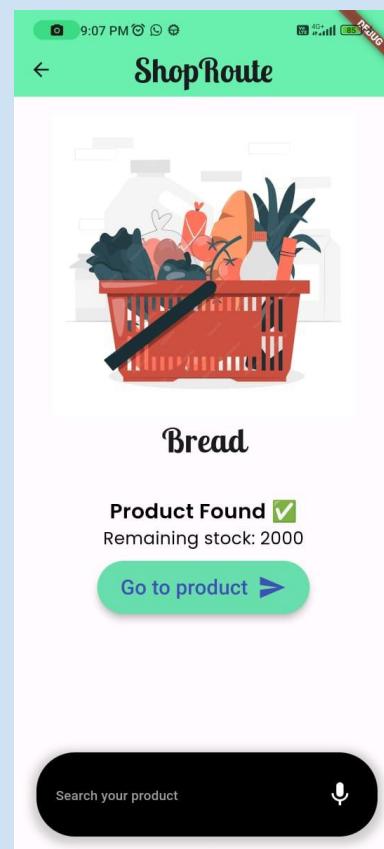


Scan QR  
code

Page to  
search the  
product



Search the required  
Product using voice  
Or text

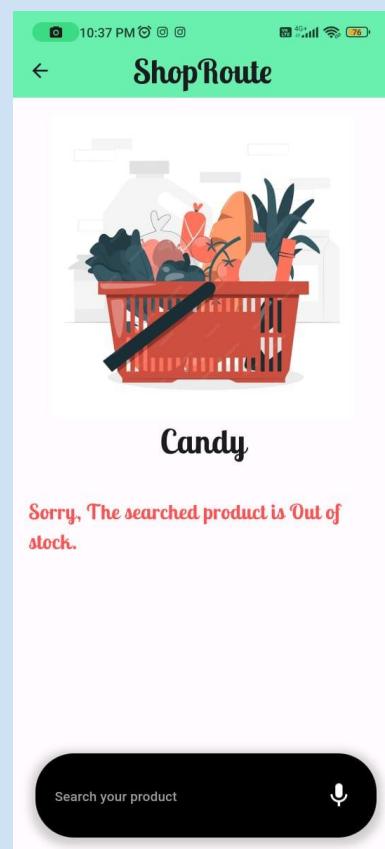


Displays  
quantity in  
stock

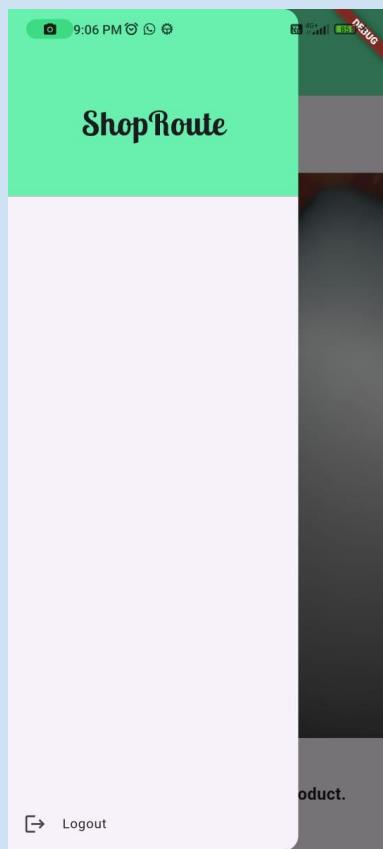


Pictorial directions to the product.

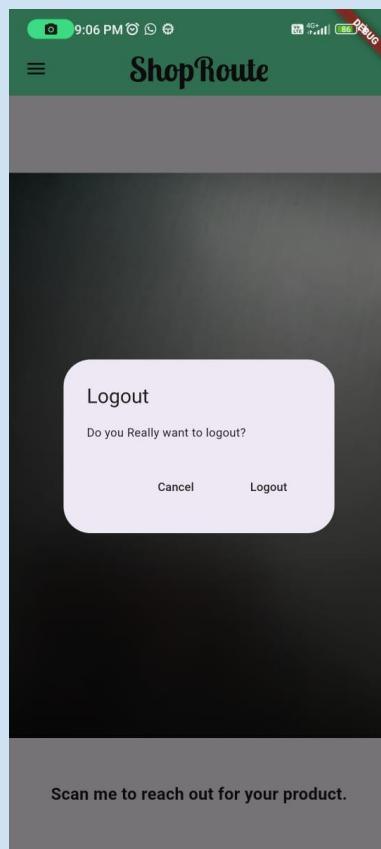
Click on the speaker button to replay the directions.



Product not found



Sidebar



Logout prompt

# Conclusion

ShopRoute is an app-based solution facilitating efficient in-store navigation using QR codes and voice commands.

ShopRoute utilizes QR codes and voice commands for seamless product location within the store. With real-time inventory updates, users can efficiently find desired items.

# Future Enhancement

- **Augmented Reality (AR) Navigation:**

Implement AR to provide visual navigation cues directly on the user's smartphone screen, enhancing the ease of finding products.

- **Real-Time Inventory and Stock Updates:**

Integrate with the supermarket's inventory system to offer real-time product availability and notify users of out-of-stock items.

- **Personalized Shopping Experience:**

Allow users to create profiles for saving shopping lists and preferences, enabling personalized product recommendations based on past purchases.

# References

1. Adarsh Borkar, Madhura Ansighkar, Monali Khobragade, Pooja Nashikkar and Arti Raut (Marc, "Smart Shopping-An Android Based Shopping Application", International of Advanced Research in Computer Engineering & Technology (IJARCET), vol. 4, no. 3, 2017.
2. A Comprehensive Study on Supermarket Indoor Navigation for Visually Impaired using Computer Vision Techniques, S. Kayalvizhi; S Roshni; Riya Ponraj; S Priya Dharshini 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON)
3. A Comprehensive Study on Supermarket Indoor Navigation for Visually Impaired using Computer Vision Techniques, S. Kayalvizhi; S Roshni; Riya Ponraj; S Priya Dharshini 2022 OPJU International Technology Conference on Emerging Technologies for Sustainable Development (OTCON)
4. G. C. Fusco, "An indoor navigation app using computer vision and sign recognition", International Conference on Computers Helping People with Special Needs, pp. 485-494, 2020.
5. Smart Indoor Navigation, Shopping Recommendation & Queue less billing based shopping assistant using AI Shreya Kothavale; Shivam Pawar; Sanket Kankarej; Sonali Patil; Roshani Raut 2021 International Conference on Artificial Intelligence and Machine Vision (AIMV)

## **Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**  
**RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)**  
**RAJAGIRI VALLEY, KAKKANAD, KOCHI, 682039**  
(Affiliated to APJ Abdul Kalam Technological University)



**RSET**  
RAJAGIRI SCHOOL OF  
ENGINEERING & TECHNOLOGY  
(AUTONOMOUS)

## **Vision, Mission, Programme Outcomes and Course Outcomes**

### **Institute Vision**

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

### **Institute Mission**

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

### **Department Vision**

To become a centre of excellence in Computer Science and Engineering, moulding professionals catering to the research and professional needs of national and international organizations.

## **Department Mission**

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

## **Programme Outcomes (PO)**

Engineering Graduates will be able to:

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsi-

bilities and norms of the engineering practice.

**9. Individual and Team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

**10. Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

**11. Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

### **Programme Specific Outcomes (PSO)**

A graduate of the Computer Science and Engineering Program will demonstrate:

#### **PSO1: Computer Science Specific Skills**

The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

#### **PSO2: Programming and Software Development Skills**

The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

#### **PSO3: Professional Skills**

The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur.

## **Course Outcomes**

After the completion of the course the student will be able to:

### **CO1:**

Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)

### **CO2:**

Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)

### **CO3:**

Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)

### **CO4:**

Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)

### **CO5:**

Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)

## **Appendix C: CO-PO-PSO Mapping**

## COURSE OUTCOMES:

After completion of the course the student will be able to

<b>SL. NO</b>	<b>DESCRIPTION</b>	<b>Blooms' Taxonomy Level</b>
CO1	Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO2	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO3	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO4	Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO5	Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)	Level 3: Apply

## CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
C O1	3	3	3	3		2	2	3	2	2	2	3	2	2	2
C O2	3	3	3	3	3	2		3	2	3	2	3	2	2	2
C O3	3	3	3	3	3	2	2	3	2	2	2	3			2
C O4	2	3	2	2	2			3	3	3	2	3	2	2	2
C O5	3	3	3	2	2	2	2	3	2		2	3	2	2	2

3/2/1: high/medium/low

## JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM/ HIGH	JUSTIFICATION
101003/CS6 22T.1-PO1	<b>HIGH</b>	Identify technically and economically feasible problems by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.1-PO2	<b>HIGH</b>	Identify technically and economically feasible problems by analysing complex engineering problems reaching substantiated conclusions using first principles of mathematics.
101003/CS6 22T.1-PO3	<b>HIGH</b>	Design solutions for complex engineering problems by identifying technically and economically feasible problems.
101003/CS6 22T.1-PO4	<b>HIGH</b>	Identify technically and economically feasible problems by analysis and interpretation of data.
101003/CS6 22T.1-PO6	<b>MEDIUM</b>	Responsibilities relevant to the professional engineering practice by identifying the problem.
101003/CS6 22T.1-PO7	<b>MEDIUM</b>	Identify technically and economically feasible problems by understanding the impact of the professional engineering solutions.
101003/CS6 22T.1-PO8	<b>HIGH</b>	Apply ethical principles and commit to professional ethics to identify technically and economically feasible problems.
101003/CS6 22T.1-PO9	<b>MEDIUM</b>	Identify technically and economically feasible problems by working as a team.
101003/CS6 22T.1-PO10	<b>MEDIUM</b>	Communicate effectively with the engineering community by identifying technically and economically feasible problems.
101003/CS6 22T.1-P011	<b>MEDIUM</b>	Demonstrate knowledge and understanding of engineering and management principles by selecting the technically and economically feasible problems.
101003/CS6 22T.1-PO12	<b>HIGH</b>	Identify technically and economically feasible problems for long term learning.
101003/CS6 22T.1-PSO1	<b>MEDIUM</b>	Ability to identify, analyze and design solutions to identify technically and economically feasible problems.
101003/CS6 22T.1-PSO2	<b>MEDIUM</b>	By designing algorithms and applying standard practices in software project development and Identifying technically and economically feasible problems.
101003/CS6 22T.1-PSO3	<b>MEDIUM</b>	Fundamentals of computer science in competitive research can be applied to Identify technically and economically feasible problems.
101003/CS6 22T.2-PO1	<b>HIGH</b>	Identify and survey the relevant by applying the knowledge of mathematics, science, engineering fundamentals.

101003/CS6 22T.2-PO2	<b>HIGH</b>	Identify, formulate, review research literature, and analyze complex engineering problems get familiarized with software development processes.
101003/CS6 22T.2-PO3	<b>HIGH</b>	Design solutions for complex engineering problems and design based on the relevant literature.
101003/CS6 22T.2-PO4	<b>HIGH</b>	Use research-based knowledge including design of experiments based on relevant literature.
101003/CS6 22T.2-PO5	<b>HIGH</b>	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes by using modern tools.
101003/CS6 22T.2-PO6	<b>MEDIUM</b>	Create, select, and apply appropriate techniques, resources, by identifying and surveying the relevant literature.
101003/CS6 22T.2-PO8	<b>HIGH</b>	Apply ethical principles and commit to professional ethics based on the relevant literature.
101003/CS6 22T.2-PO9	<b>MEDIUM</b>	Identify and survey the relevant literature as a team.
101003/CS6 22T.2-PO10	<b>HIGH</b>	Identify and survey the relevant literature for a good communication to the engineering fraternity.
101003/CS6 22T.2-PO11	<b>MEDIUM</b>	Identify and survey the relevant literature to demonstrate knowledge and understanding of engineering and management principles.
101003/CS6 22T.2-PO12	<b>HIGH</b>	Identify and survey the relevant literature for independent and lifelong learning.
101003/CS6 22T.2-PSO1	<b>MEDIUM</b>	Design solutions for complex engineering problems by Identifying and survey the relevant literature.
101003/CS6 22T.2-PSO2	<b>MEDIUM</b>	Identify and survey the relevant literature for acquiring programming efficiency by designing algorithms and applying standard practices.
101003/CS6 22T.2-PSO3	<b>MEDIUM</b>	Identify and survey the relevant literature to apply the fundamentals of computer science in competitive research.
101003/CS6 22T.3-PO1	<b>HIGH</b>	Perform requirement analysis, identify design methodologies by using modern tools & advanced programming techniques and by applying the knowledge of mathematics, science, engineering fundamentals.
101003/CS6 22T.3-PO2	<b>HIGH</b>	Identify, formulate, review research literature for requirement analysis, identify design methodologies and develop adaptable & reusable solutions.

101003/CS6 22T.3-PO3	<b>HIGH</b>	Design solutions for complex engineering problems and perform requirement analysis, identify design methodologies.
101003/CS6 22T.3-PO4	<b>HIGH</b>	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS6 22T.3-PO5	<b>HIGH</b>	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools.
101003/CS6 22T.3-PO6	<b>MEDIUM</b>	Perform requirement analysis, identify design methodologies and assess societal, health, safety, legal, and cultural issues.
101003/CS6 22T.3-PO7	<b>MEDIUM</b>	Understand the impact of the professional engineering solutions in societal and environmental contexts and Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS6 22T.3-PO8	<b>HIGH</b>	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions by applying ethical principles and commit to professional ethics.
101003/CS6 22T.3-PO9	<b>MEDIUM</b>	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS6 22T.3-PO10	<b>MEDIUM</b>	Communicate effectively with the engineering community and with society at large to perform requirement analysis, identify design methodologies.
101003/CS6 22T.3-PO11	<b>MEDIUM</b>	Demonstrate knowledge and understanding of engineering requirement analysis by identifying design methodologies.
101003/CS6 22T.3-PO12	<b>HIGH</b>	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS6 22T.3-PSO3	<b>MEDIUM</b>	The ability to apply the fundamentals of computer science in competitive research and prior to that perform requirement analysis, identify design methodologies.
101003/CS6 22T.4-PO1	<b>MEDIUM</b>	Prepare technical report and deliver presentation by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.4-PO2	<b>HIGH</b>	Identify, formulate, review research literature, and analyze complex engineering problems by preparing technical report and deliver presentation.

101003/CS6 22T.4-PO3	<b>MEDIUM</b>	Prepare Design solutions for complex engineering problems and create technical report and deliver presentation.
101003/CS6 22T.4-PO4	<b>MEDIUM</b>	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and prepare technical report and deliver presentation.
101003/CS6 22T.4-PO5	<b>MEDIUM</b>	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and Prepare technical report and deliver presentation.
101003/CS6 22T.4-PO8	<b>HIGH</b>	Prepare technical report and deliver presentation by applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS6 22T.4-PO9	<b>HIGH</b>	Prepare technical report and deliver presentation effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS6 22T.4-PO10	<b>HIGH</b>	Communicate effectively with the engineering community and with society at large by prepare technical report and deliver presentation.
101003/CS6 22T.4-PO11	<b>MEDIUM</b>	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work by prepare technical report and deliver presentation.
101003/CS6 22T.4-PO12	<b>HIGH</b>	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by prepare technical report and deliver presentation.
101003/CS6 22T.4-PSO1	<b>MEDIUM</b>	Prepare a technical report and deliver presentation to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas.
101003/CS6 22T.4-PSO2	<b>MEDIUM</b>	To acquire programming efficiency by designing algorithms and applying standard practices in software project development and to prepare technical report and deliver presentation.
101003/CS6 22T.4-PSO3	<b>MEDIUM</b>	To apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs by preparing technical report and deliver presentation.
101003/CS6 22T.5-PO1	<b>HIGH</b>	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.5-PO2	<b>HIGH</b>	Identify, formulate, review research literature, and analyze complex engineering problems by applying engineering and management principles to achieve the goal of the project.

101003/CS6 22T.5-PO3	<b>HIGH</b>	Apply engineering and management principles to achieve the goal of the project and to design solutions for complex engineering problems and design system components or processes that meet the specified needs.
101003/CS6 22T.5-PO4	<b>MEDIUM</b>	Apply engineering and management principles to achieve the goal of the project and use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS6 22T.5-PO5	<b>MEDIUM</b>	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO6	<b>MEDIUM</b>	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities by applying engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO7	<b>MEDIUM</b>	Understand the impact of the professional engineering solutions in societal and environmental contexts, and apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO8	<b>HIGH</b>	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice and to use the engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO9	<b>MEDIUM</b>	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO11	<b>MEDIUM</b>	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO12	<b>HIGH</b>	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PSO1	<b>MEDIUM</b>	The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. Apply engineering and management principles to achieve the goal of the project.

101003/CS6 22T.5-PSO2	<b>MEDIUM</b>	The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PSO3	<b>MEDIUM</b>	The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur and apply engineering and management principles to achieve the goal of the project.

