

THE PIZZA MANIA APPLICATION

Higher National Diploma in Software Engineering

Mobile Application Development
Report Documentation



School of Computing
National Institute of Business Management
Colombo - 07

**NATIONAL INSTITUTE OF BUSINESS MANAGEMENT
HIGHER NATIONAL DIPLOMA IN SOFTWARE ENGINEERING**

Report Documentation

The Pizza Mania Application

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DECLARATION

We, the undersigned, hereby declare that the project titled "**The Pizza Mania Application**", submitted for the partial fulfillment of the course requirements at **NIBM Institute**, has been carried out by us under the guidance of **Mr. Ishara Sanka**. The content of this project report is based on our own work, except where explicitly stated otherwise in the text. We also declare that this project has not been submitted, in whole or in part, for any degree or diploma at any other institution or university.

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ABSTRACT

The rapid growth of the food industry has created a demand for innovative technological solutions to improve customer convenience and business efficiency. The Pizza Mania Restaurants, a fast-growing brand in Sri Lanka with branches in Colombo and Galle, has dedicated to implement a mobile-based platform to extend its services to a wider customer base. This project focuses on the design and development of an Android application that enables customers to explore restaurant branches, browse menus with item image, create personal accounts, places food orders, and track their deliveries in real time. Orders are automatically directed to the nearest branch with available stock, ensuring faster service and improved resource management.

The system Integrates Firebase and SQLite databases to provide secure data Management and synchronization, while Android Studio with Java serves as the primary development framework. Key features include GPS-based branch location identification, remote web services for data exchange, camera and image integration for menu visualization, and offline functionality supported by SQLite and content providers. The outcome of this project is user friendly, reliable and efficient mobile application that enhances customer satisfaction and strengthens the digital presence of the Pizza Mania.

TABLE OF CONTENTS

DECLARATION	3
ABSTRACT	4
TABLE OF CONTENTS.....	5
Chapter 1: INTRODUCTION	6
1.1 Introduction of the Project.....	6
1.2 Problem Statement.....	6
1.3 Project Objectives	7
1.4 Scope of the Project	7
1.5 Tools and Technologies.....	8
1.6 Chapter Summary	9
Chapter 2: SYSTEM ANALYSIS AND ARCHITECTURAL DESIGN	10
2.1 Requirement Analysis.....	10
2.2 Proposed System Architecture.....	10
2.3 Technology Stack Selection	11
2.4 Database Design	11
2.5 Chapter Summary	12
Chapter 3: SYSTEM IMPLEMENTATION AND CORE FUNCTIONALITIES	13
3.1 Development Environment and Setup	13
3.2 Implementation of Key Modules	13
3.3 Integration of Advanced Features	14
3.4 Testing and Validation Strategy	15
3.5 Chapter Summary	15
Chapter 4: RESULTS, DISCUSSION, AND FUTURE WORK	16
4.1 Evaluation of Results	16
4.2 Critical Discussion and Limitations	16
4.3 Proposed Future Enhancements.....	17
4.4 Conclusion	18
4.5 Chapter Summary	18
REFERENCES	19
ACKNOWLEDGEMENT	20
APPENDIX	21

Chapter 1: INTRODUCTION

1.1 Introduction of the Project

The food and beverage industry has undergone significant digital transformation in recent years, with mobile applications becoming a primary tool for enhancing customer engagement and streamlining business operations. Restaurants increasingly rely on mobile technology to provide efficient services, attract new customers, and improve overall satisfaction. The Pizza Mania, a newly established restaurant chain in Sri Lanka with branches in Colombo and Galle, is expanding operations and recognizes the needs for a strong technological foundation to support its growth.

To address this need, the restaurant has decided to implement an Android-based mobile application that will act as a digital platform between the business and its customers. The application is designed to provide several key functions, including branch information, an interactive menu with item images, user account creation, food ordering, and real-time order tracking. Additionally, the system ensures that customer orders are automatically placed at the nearest branch with available stock, improving both efficiency and customer satisfaction.

The development of this project is carried out using **Android Studio** with Java as the programming language. For data storage and synchronization, **Firebase** is utilized for real-time updates, while **SQLite** serves as the structured backend database for maintaining long-term records. Other important aspects of the system include the use of GPS for location services, camera and image integration for menu visualization, and SQLite with content providers to enable offline functionality.

By integrating these technologies, the proposed system aims to strengthen The Pizza Mania's digital presence, simplify the food ordering process, and ensure timely delivery of services. Ultimately, this project contributes to both customer convenience and the restaurant's operational efficiency, providing a scalable solution that can support future business expansion.

1.2 Problem Statement

Despite its growing popularity, The Pizza Mania operated with a limited technological infrastructure. This led to several critical challenges:

- **Inefficient Customer Engagement:** Reliance on traditional walk-in and phone orders restricted market reach and provided no dynamic platform for showcasing the menu.
- **Manual and Prone to Error Operations:** Order taking, routing to the nearest branch, and dispatching riders were manual processes, leading to delays and errors.

- **Lack of Transparency:** Customers had no means of tracking their orders in real-time, leading to uncertainty and a less satisfactory experience.
- **Disconnected Management:** Administrators lacked a centralized digital tool to manage menus, monitor orders, and analyze customer data effectively.
- **Ineffective Delivery Coordination:** Riders had no digital interface to receive assignments or navigate to customer locations efficiently.

1.3 Project Objectives

The primary aim was to design, develop, and deploy a multi-faceted Android application to address these problems. The specific objectives were:

- **For Customers:** To provide an intuitive platform for user registration, immersive menu browsing with high-quality images, a seamless cart and checkout experience with multiple location input options, and real-time, transparent order tracking.
- **For Administrators:** To deliver a powerful management interface within the app to effortlessly add, edit, or remove menu items and branch information, and to monitor all order activities in real-time.
- **For Delivery Riders:** To create a dedicated application view that provides a clear list of assigned orders, integrated navigation to customer locations using coordinates captured during checkout, and status update capabilities.
- **For the System:** To implement intelligent order routing to the nearest branch and ensure robust, real-time data synchronization across all user roles using a hybrid database architecture.

1.4 Scope of the Project

The scope of the project was carefully defined to ensure focused development:

❖ In-Scope:

- Development of a single native Android application with three distinct user interfaces (Customer, Admin, Rider) based on login credentials.
- Implementation of a hybrid backend using **Google Firebase** (for real-time data like menus and orders) and **SQLite** (for structured data like user accounts and branches).

- Core features including authentication, menu management, order placement with map-based location selection, order tracking, and rider navigation.
- GPS integration for both branch locator and precise customer delivery location mapping.

❖ **Out-of-Scope:**

- Development of an iOS or web application.
- Integration of an online payment gateway (Cash-on-Delivery only).
- Real-time inventory management system for stock tracking.
- Development of a dedicated web admin panel (admin functions within the Android app).

1.5 Tools and Technologies

The project was built on a modern, robust, and scalable technology stack:

- **Application Development: Android Studio** was the primary Integrated Development Environment (IDE), utilizing **Java** as the core programming language for its stability and extensive community support. UI layouts were designed using **XML**.
- **Backend & Databases: Google Firebase** was selected for its exceptional real-time capabilities (Firebase Realtime Database), and cloud storage (Firebase Storage for images). **SQLite** was chosen as the relational database for its reliability in managing complex queries for user data and branch information.
- **APIs & Services:** The **Google Maps Android API** was integral for all location-based services, including displaying branches, capturing delivery coordinates, and enabling turn-by-turn navigation.
- **Version Control: Git** was used for source code management, with the repository hosted on **GitHub** for collaboration and version tracking.
- **Design:** UI/UX prototypes were created to guide development (see Appendix for UI designs).

1.6 Chapter Summary

Chapter 1 presents an overview of the Pizza Mania Mobile Application Project, designed to modernize operations and improve customer experience for the Pizza Mania restaurant chain in Sri Lanka. The chapter first highlights the challenges faced by the business, including inefficient customer engagement, manual and error-prone order handling, lack of real-time tracking, weak administrative control, and poor delivery coordination.

To solve these issues, the project introduces a **native Android application** with three distinct roles: **Customer, Administrator, and Rider**. Customers can register, browse menus with images, place orders, and track deliveries in real time. Administrators can manage menus, monitor branches, and oversee order activities, while riders receive digital assignments with GPS navigation and delivery status updates.

The project objectives emphasize improving customer satisfaction, enabling centralized management, and enhancing delivery efficiency. The defined scope covers mobile app development with real-time data synchronization, GPS integration, and order tracking, while excluding features such as iOS/web versions and online payments.

Technologies such as **Android Studio (Java, XML)**, **Firebase** for real-time updates, **SQLite** for structured data, and **Google Maps API** for GPS services form the core of the system. GitHub was used for version control, and UI/UX prototypes guided the interface design.

In summary, Chapter 1 establishes the need for a digital solution, outlines the system's objectives and scope, and presents the technological foundation that ensures scalability, efficiency, and improved service delivery for Pizza Mania.

Chapter 2: SYSTEM ANALYSIS AND ARCHITECTURAL DESIGN

2.1 Requirement Analysis

A systematic requirement gathering process was conducted, categorizing needs for each user role:

❖ Functional Requirements:

- **Customer:** User registration/login, menu browsing with categories and search, detailed product views, cart management, checkout process with location selection ("Use Current Location" or "Choose on Map"), order placement, and real-time order status tracking.
- **Administrator:** Secure login to an admin portal, CRUD (Create, Read, Update, Delete) operations for menu items (including image association), CRUD operations for branch details, and view all customer orders and profiles.
- **Delivery Rider:** Login to a rider portal, view a list of orders assigned to them, see detailed order information, and access an integrated map with the customer's pinned delivery location for navigation.

❖ Non-Functional Requirements:

- **Usability** (intuitive, role-specific UI), **Performance** (fast image loading, smooth navigation), **Reliability** (stable under varying network conditions), **Security** (secure authentication and data privacy), and **Scalability** (ability to handle growing numbers of users, menu items, and orders).

2.2 Proposed System Architecture

A modular three-tier architecture was adopted:

- **Presentation Layer (UI Layer):** The Android app with different UIs for Customer, Admin, and Rider roles. Built with Activities, Fragments, and XML layouts.
- **Business Logic Layer:** Java classes handling role-specific logic: order processing for customers, menu management for admins, order assignment and navigation for riders. Contains the algorithm for determining the nearest branch.

- **Data Access Layer:** Manages all data operations using:
 - **Firebase API:** For real-time data (Menu, Active Orders).
 - **SQLite Connector:** For structured data (User Profiles, Branch info) via REST API calls.
 - **Google Maps API:** For all location-based services.

2.3 Technology Stack Selection

The technology stack was carefully chosen to meet specific technical requirements:

- **Android Studio & Java:** The industry standard for native Android development, offering powerful tools, extensive libraries, and a mature ecosystem.
- **Firebase:** Selected over alternatives like building a custom backend due to its speed of integration, built-in real-time synchronization, which is crucial for live order tracking, and its managed services that reduce development overhead.
- **SQLite:** Chosen for storing relational data because of its ACID compliance, reliability, and efficiency in handling complex relationships between entities like Users, Orders, and Branches.
- **Google Maps Android API:** The natural and most robust choice for embedding interactive maps and leveraging location services within an Android application.

2.4 Database Design

A hybrid database model was implemented to leverage the strengths of different systems:

❖ **Firebase Realtime Database:**

1. **Collection: [pizzas]**

{pizzaId (**PK**), title, price, description, picture, category, time, star}

2. **Collection: [orders]**

{orderId (**PK**), customerName, address, email, gender, phone, items, itemsTotal, tax, total, latitude, longitude, timestamp}

3. Collection: [riders]

{riderId (**PK**), riderName, price, customerName, email, customerAddress, customerPhone, status, deliveryLocation}

4. Collection: [branches]

{branchId (**PK**), branchName, address, latitude, longitude, phone}

❖ SQLite Database:

- **Table: [users]**

{userId (**PK**), name, email, gender, address, password, phone,}

- **Table: [riders]**

{riderId (**PK**), name, email, password, address, gender, vehicleNumber}

2.5 Chapter Summary

Chapter 2 outlines the system analysis and design of the Pizza Mania mobile application. Functional requirements were defined for customers (registration, ordering, tracking), administrators (menu and branch management), and riders (delivery assignment and navigation). Non-functional needs such as usability, performance, security, and scalability were also considered.

The system adopts three-tier architecture with role-based Android UIs, Java business logic for order processing and management, and a data layer combining Firebase for real-time updates, SQLite for structured data, and Google Maps API for location services.

A hybrid database model was implemented: Firebase manages dynamic collections like pizzas, orders, riders, and branches, while SQLite stores user and rider records. The chosen technology stack—Android Studio with Java, Firebase, SQLite, and Google Maps—ensures reliability, scalability, and smooth performance.

In summary, Chapter 2 defines the requirements, architecture, and database design that establish the technical backbone of the Pizza Mania system.

Chapter 3: SYSTEM IMPLEMENTATION AND CORE FUNCTIONALITIES

3.1 Development Environment and Setup

The entire application was developed within the **Android Studio** IDE. The project was configured using **Gradle** with all necessary dependencies declared, including the Firebase, Google Play Services for Maps, the Glide library for image loading. Version control was maintained using **Git**, with a central repository hosted on **GitHub** to facilitate team collaboration and track the project's history through iterative commits.

3.2 Implementation of Key Modules

❖ Unified Authentication and Role-Based Routing:

In this system, authentication is handled entirely through the **SQLite database**, without using Firebase Authentication. All users, including administrators, customers, and delivery riders log in through the same **LoginActivity** using their stored credentials from SQLite.

Once login is successful, the application checks the user's role (stored in the database) and routes them to the appropriate interface: **CustomerHomeActivity** for customers, **AdminDashboardActivity** for administrators, and **RiderPortalActivity** for delivery personnel. This ensures a single, unified login process with role-based redirection managed directly from the application's SQLite backend.

❖ Customer Module Implementation:

- **Menu Browsing:** The menu is displayed using a RecyclerView component. A custom PizzaAdapter binds the data from the Firebase pizzas collection to the item views. The Glide library is used to asynchronously load and cache images from the URLs stored in Firebase, ensuring a smooth scrolling experience.
- **Checkout and Location Capture:** The OderActivity is a critical component. It presents the user with two buttons: "**Use Current Location**" (which uses the Fused Location Provider API to get a precise GPS fix) and "**Choose on Map**" (which launches a MapActivity with an interactive map where the user can long-press to drop a pin at their exact delivery location). The selected latitude and longitude are stored as a LatLng object and saved with the order.

- **Order Tracking:** Upon order placement, a document is created in the Firebase Orders collection. OrderActivity attaches a real-time listener to this specific document. Any update to the status field by an admin or rider triggers an instantaneous UI update on the customer's device.

❖ **Administrator Module Implementation:**

The admin dashboard provides options to "**Manage Menu**" and "**Manage Branches**". The "Add Pizza" interface includes form fields for all item details and a field for the image URL. Upon submission, this data is written directly to the Firebase pizzas collection. Similarly, adding a branch posts the data to the SQLite database via an API endpoint.

❖ **Delivery Rider Module Implementation:**

When a customer places an order, their delivery location (latitude and longitude) is stored in the Firebase Orders collection along with other order details. The rider's application automatically retrieves orders assigned to them by matching the `riderId` field. Each order contains the customer's stored delivery coordinates.

The rider can view their assigned orders, and when they select one, the system opens a new activity with a Google Map fragment. The customer's location is automatically plotted as a marker on the map using the stored coordinates. From this map, the rider can initiate turn-by-turn navigation directly to the customer's delivery address, ensuring accurate and efficient delivery.

3.3 Integration of Advanced Features

- **GPS and Map Integration (Enhanced):** The Google Maps API was integrated in two key places:
 1. **BranchesActivity:** For customers to view branch locations.
 2. **OrderActivity (Checkout):** For the customer to "**Choose on Map**" and precisely select their delivery location. These precise coordinates are what the delivery rider uses for navigation.
- **Image Integration:** Administrators add new menu items by entering a name, price, description, and a link to an image hosted online (URL). The app uses the Glide library to load these images efficiently in the customer's menu.

- **Real-Time Synchronization:** The Firebase Realtime Database is the core of this feature. Any status update on an order by an admin or rider is instantly reflected in the customer's tracking interface and the rider's assignment list.

3.4 Testing and Validation Strategy

A multi-faceted testing approach was employed:

- **Role-Based Testing:** Each user flow (Customer, Admin, Rider) was tested independently and for interactions (e.g., an admin adding an item appears for a customer).
- **Location Testing:** The "Use Current Location" and "Choose on Map" functionalities were rigorously tested on physical devices to ensure accuracy.
- **Real-Time Testing:** Order status updates were tested across multiple devices simultaneously to validate Firebase synchronization.
- **UI/UX Testing:** The interfaces were tested for intuitiveness and ease of use for all three user roles.

3.5 Chapter Summary

Chapter 3 describes the implementation and core functionalities of the Pizza Mania mobile application. The project was developed using Android Studio with Java, utilizing libraries such as Glide for efficient image loading and Google Play Services for Maps integration. Version control was maintained with GitHub to track development progress and facilitate team collaboration. The application includes a unified login system, where all users authenticate via SQLite and are routed to their respective interfaces-customers, administrators, or delivery riders-based on their roles.

The customer module allows menu browsing with images, order placement, precise location selection through GPS or interactive maps, and real-time order tracking using Firebase. Administrators can manage menu items and branch information, with updates reflected in Firebase and SQLite, while delivery riders automatically receive assigned orders, view customer locations on Google Maps, and navigate directly for timely deliveries.

Advanced features such as real-time synchronization, image integration, and GPS-based navigation enhance usability and operational efficiency. Rigorous testing ensured accurate location handling, real-time updates across devices, role-based functionality, and a smooth user interface. Overall, Chapter 3 demonstrates how the system was implemented to provide seamless interaction for all users, combining real-time data, location services, and intuitive workflows to deliver a robust and efficient mobile application.

Chapter 4: RESULTS, DISCUSSION, AND FUTURE WORK

4.1 Evaluation of Results

The project was successfully completed, resulting in a fully functional, multi-role Android application. All initial objectives were met:

- **For Customers:** A seamless journey from registration to order tracking is implemented, including the precise map-based location selection.
- **For Administrators:** A functional dashboard for managing content and viewing orders is complete.
- **For Riders:** A dedicated app for receiving orders and navigating to customer locations is operational.
- **System Core:** The order routing logic and real-time Firebase synchronization work as intended.

4.2 Critical Discussion and Limitations

A critical review of the completed system reveals both strengths and areas for improvement:

❖ Strengths:

- **Successful Multi-Role Integration:** The application seamlessly caters to three distinct user types from a single codebase, a significant architectural achievement.
- **Effective Real-Time Communication:** The use of Firebase provides a flawless real-time order tracking experience, which is a core value proposition for customers.
- **Precision Delivery System:** The implementation of the map-based location picker ensures delivery riders navigate to an exact point, not just a vague address, drastically improving delivery accuracy.

❖ Limitations:

- **Manual Image Management:** The requirement for admins to manually host images and provide URLs is a workflow bottleneck and is less user-friendly than a built-in image upload feature.

- **Internet Dependency:** The application's core functionality is largely dependent on a persistent internet connection, limiting usability in areas with poor connectivity.
- **Semi-Automated Logistics:** The system identifies the nearest branch but does not fully automate rider assignment; this process may still require manual intervention from an admin to assign a rider to an order.

4.3 Proposed Future Enhancements

To address the limitations and add significant further value, the following enhancements are proposed for subsequent versions:

1. **Integrated Image Upload:** Develop a feature within the admin portal to directly capture an image using the device's camera or select one from the gallery and upload it to Firebase Storage automatically, with the returned URL being stored without manual intervention.
2. **Online Payment Gateway:** Integrate a secure payment processor like Stripe or PayPal to support credit/debit card payments and digital wallets, moving beyond the cash-on-delivery model and reducing friction at checkout.
3. **Advanced Offline Support:** Utilize Firebase's offline persistence and more sophisticated caching strategies to allow customers to browse menu items and previously loaded images without a connection, only requiring internet for placing and tracking orders.
4. **Automated Rider Dispatch System:** Develop an algorithm that automatically assigns the nearest available rider to a new order that is ready for delivery, based on the rider's current location and workload, fully automating the logistics chain.
5. **Push Notifications:** Implement **Firebase Cloud Messaging (FCM)** to send push notifications to riders for new assignments and to customers for order status updates (e.g., "Your order is out for delivery!").

4.4 Conclusion

The Pizza Mania mobile application successfully achieves its core objectives of digitizing the restaurant's operations and enhancing customer service. This comprehensive solution effectively addresses the initial challenges of manual processes and limited customer engagement by providing a seamless platform for ordering, management, and delivery coordination.

The application's robust architecture, combining Firebase for real-time data synchronization and SQLite for structured data management, ensures reliable performance across all user roles. Customers benefit from an intuitive ordering experience with precise location selection and live order tracking, while administrators gain efficient tools for menu and branch management. Delivery riders receive clear assignments with integrated navigation to exact customer locations, significantly improving delivery accuracy.

The project demonstrates successful implementation of advanced mobile technologies including GPS integration, real-time database updates, and role-based access control. While the current version focuses on core functionality, the solid technical foundation allows for straightforward implementation of future enhancements such as payment integration and automated dispatch systems.

This application transforms The Pizza Mania's business model, providing a competitive advantage through improved operational efficiency, enhanced customer satisfaction, and scalable digital infrastructure. The project stands as a successful example of how mobile technology can revolutionize traditional restaurant operations and create value for all stakeholders.

4.5 Chapter Summary

Chapter 4 presents the results, discussion, and future work of the Pizza Mania mobile application. The project successfully delivered a multi-role Android app where customers can register, browse menus, select delivery locations via a map, place orders, and track them in real time. Administrators can manage menus and branches, and delivery riders can view assigned orders with navigation to customer locations. The system's core, including order routing and Firebase synchronization, functions as intended.

The system's strengths include seamless multi-role integration, real-time updates, and precise delivery using map-based location selection. Limitations include manual image management by admins, reliance on internet connectivity, and semi-automated rider assignment that may need manual intervention.

Future enhancements could address these limitations by adding integrated image upload, online payment support, offline functionality, automated rider dispatch, and push notifications. Overall, the chapter concludes that the application successfully digitizes Pizza Mania's operations, improves customer experience, and provides a scalable foundation for future improvements.

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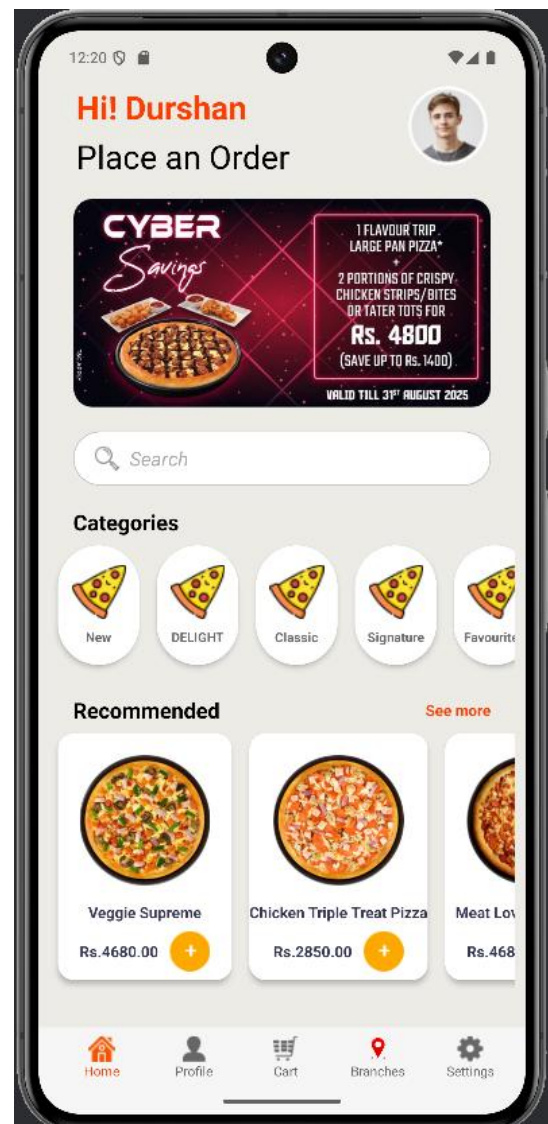
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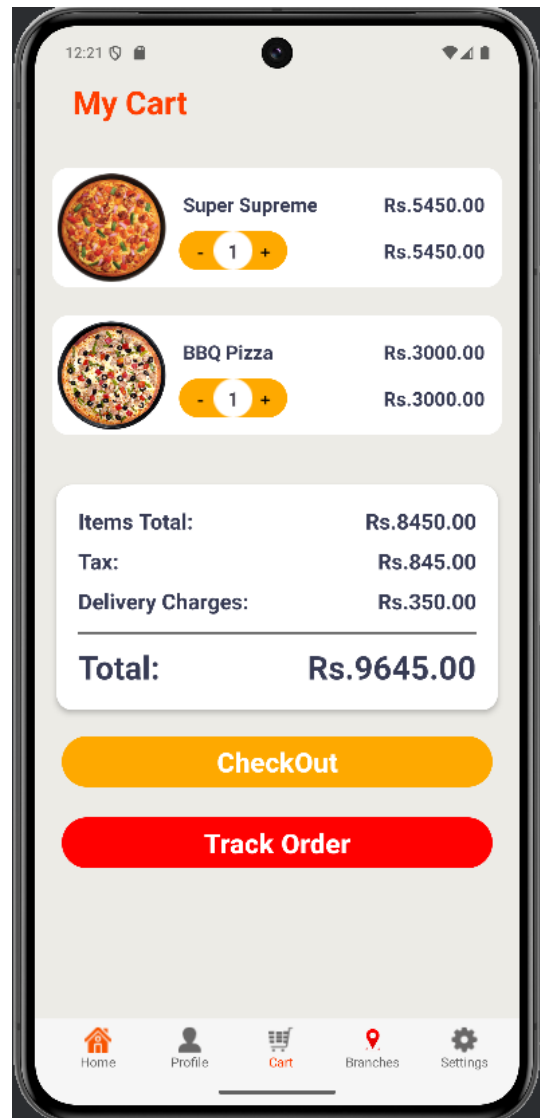
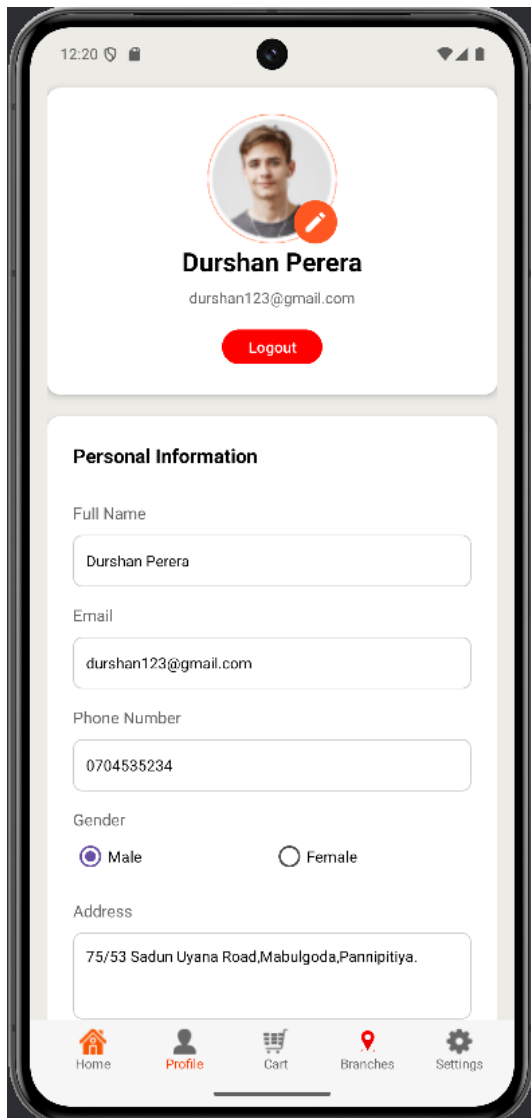
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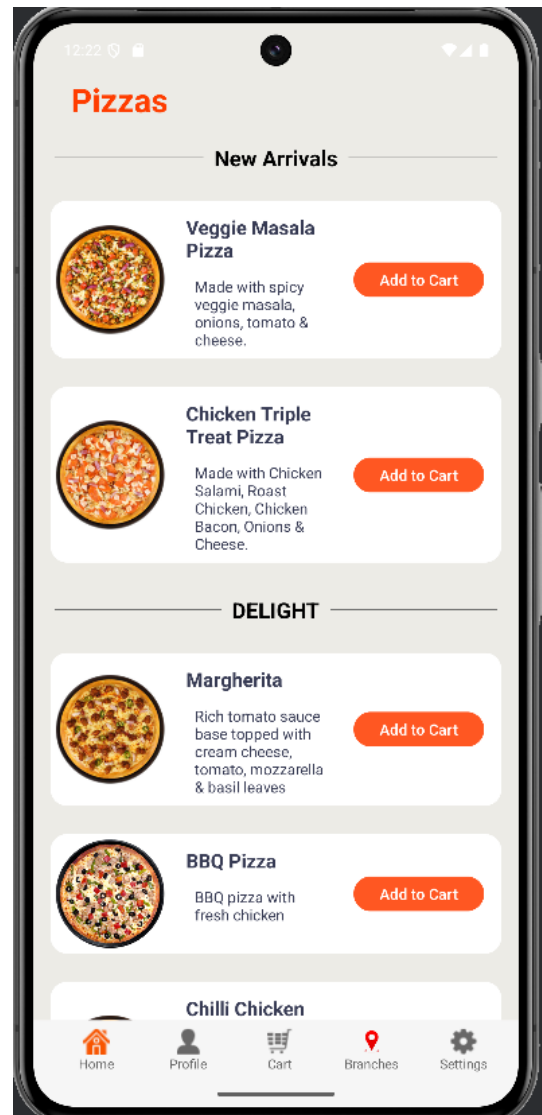
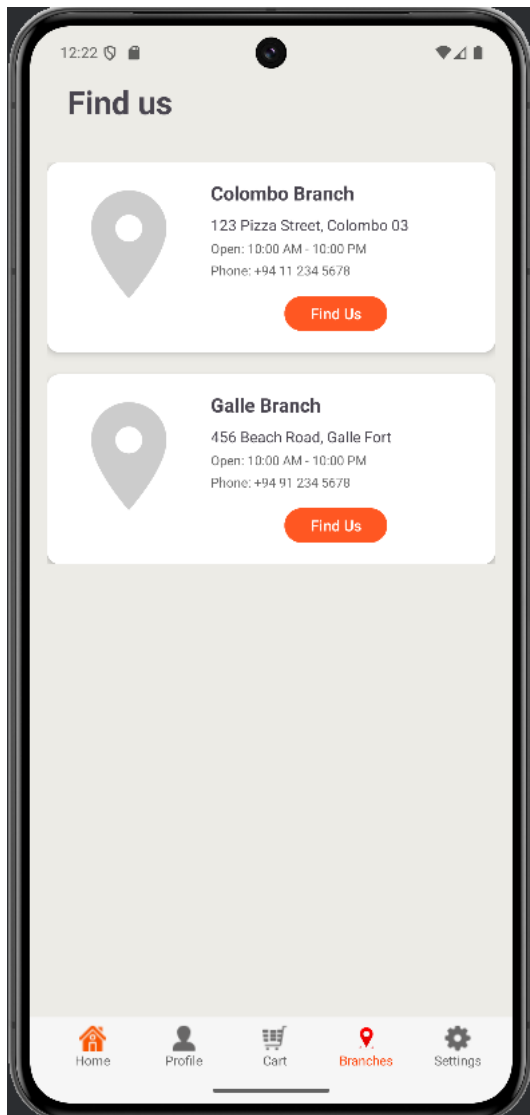
We also extend our appreciation to our team members for their creativity, dedication, and collaborative spirit, which enabled us to develop the **Pizza Mania app** effectively within the allocated timeframe.

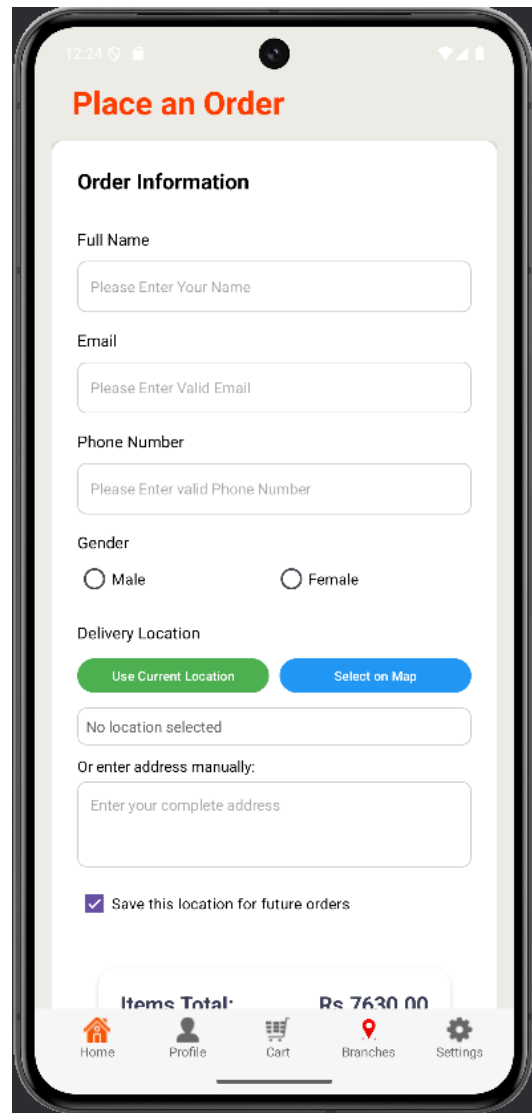
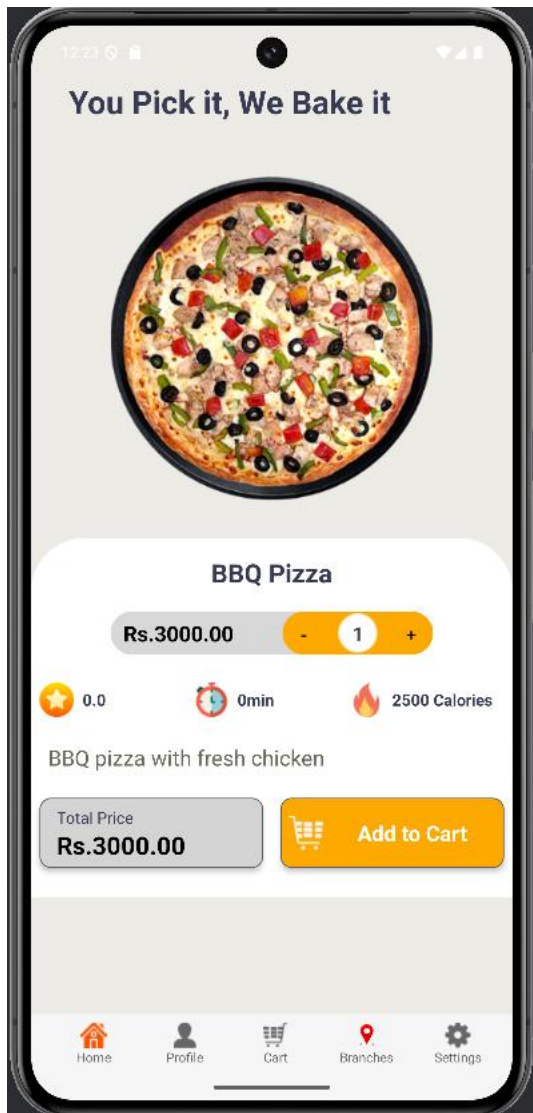
APPENDIX

▪ Main Interfaces









- **GitHub Link**

<https://github.com/nibm-devs/ThePizzaManiaProject.git>