Project Report (CSBB-352)

on

Small Bites: Campus Food, Simplified.

Submitted in fulfilment of the project

of

the course

Theory of App Development

by

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Chapter 1

Introduction

Food is more than just nourishment—it's a daily routine that significantly affects productivity, mood, and time management for both students and faculty. At NIT Delhi, where three active canteens serve hundreds every day, a smooth dining experience is essential. Unfortunately, long queues, slow service, and order confusion create unnecessary frustration. The **Small Bites** app aims to modernize this experience through a tech-driven approach.

1.1 Overview of Smart Canteen Systems

Smart canteen systems integrate mobile technology, digital payments, and real-time order tracking to offer a more organized and user-friendly dining experience. These systems aim to eliminate manual inefficiencies and common errors in traditional canteens, such as:

- Manual queue management
- Misplaced or wrong orders
- Delayed food preparation
- Lack of digital transaction records

By leveraging platforms like **React Native with Expo** for cross-platform mobile development and **Firebase** for backend services, smart canteen systems create a seamless bridge between the user and the vendor. They enable:

- Menu browsing from anywhere

- Instant order placement and status updates
- Online payments or UPI integration
- Order history and vendor analytics

Such systems enhance convenience, accuracy, and transparency, improving user satisfaction and canteen efficiency.

1.2 Motivation Behind "Small Bites"

During routine observations and informal student feedback at NIT Delhi, several recurring issues in the campus canteen system were identified:

- Long queues, especially during peak hours
- Delays in receiving food
- Lack of proper order tracking
- Instances of incorrect or missing orders
- Cash and online transactions leading to payment hassles

Students typically spend around 1000 per month on food, with most opting for quick items like burgers, parathas, shakes, and fries. Despite the frequency of visits, there was no efficient system in place to handle the volume and expectations.

This led to the development of **Small Bites**, a smart canteen application aimed at:

- Eliminating queue wait times
- Improving order accuracy
- Enabling online payments
- Boosting canteen workflow through data tracking and vendor dashboards

Small Bites was created to enhance the everyday dining experience for both students and faculty, reducing friction and maximizing convenience.

Chapter 2

Project Overview

2.1 Objectives

The primary goal of **Small Bites** is to modernize the campus food ordering experience by providing a smart, digital, and user-centric application. It addresses the long queues, slow order processing, and lack of menu transparency by enabling students and faculty to pre-order meals and view real-time updates directly on their smartphones.

Key objectives include:

- Minimizing queue times with online pre-ordering.
- Enhancing the transparency of food availability and pricing.
- Empowering vendors with tools to manage their menus and orders.
- Delivering a modern UI/UX tailored for campus needs.

2.2 General Features

- **Real-time Updates:** Firebase handles order status syncing across users and vendors.
- **Responsive Design:** Fully optimized for mobile with intuitive layout and navigation.
- **Custom Navigation:** Tailored tabbed navigation experience for both users and canteen owners.

2.3 Target Users

The application is specifically tailored for:

- **Students:** To quickly order meals without standing in long queues.
- **Faculty and Staff:** To schedule meals efficiently within limited break times.
- **Canteen Vendors:** To better manage rush hours, inventory, and gain sales insights.

This system ultimately bridges the communication gap between users and vendors while making food services faster and smarter.

Chapter 3

Key Features

3.1 User App Features

1. **Authentication & Profile Management**
    - Users can securely log in using Google Sign-In for a seamless experience.
    - Users can manage their profile details including name, email, and preferences.
2. **Menu Browsing**
    - Users can explore food items with rich details such as:
        - Item descriptions
        - Pricing
        - Calorie information
        - Average user ratings
3. **Favorites Management**
    - Allows users to:
        - Mark favorite food items and canteens for easy access.
        - Quickly reorder from their saved favorites.
4. **Cart Management**
    - Users can:
        - Add items to their cart.

- Remove items or update item quantities.
- Review total cost before checkout.

5. **Order Management**

- Users can:
  - Place new food orders.
  - Track real-time order status (e.g., Ordered, Preparing, Ready).
  - Access complete order history for reference.

6. **Search & Filters**

- Users can easily locate desired canteens and dishes by:
  - Keyword-based search.
  - Applying filters such as food type, price range, and dietary preferences.

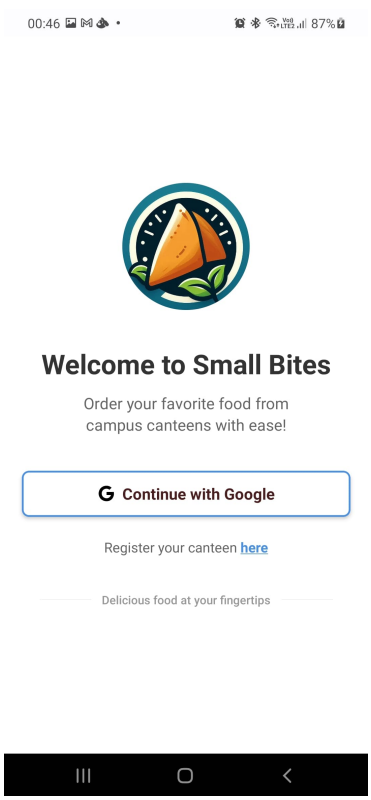

Figure 3.1: User sign in

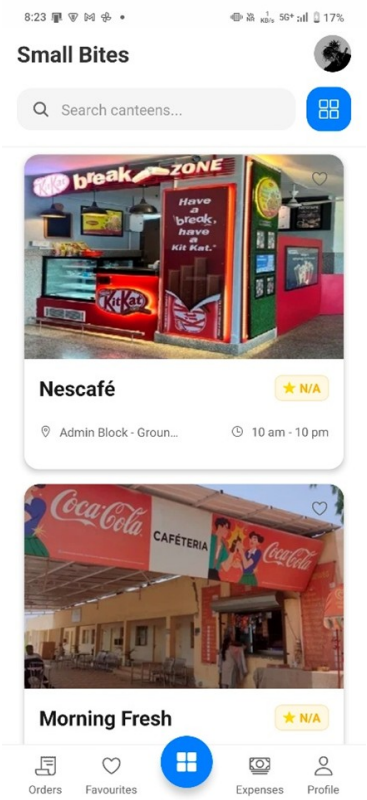

Figure 3.2: User Home

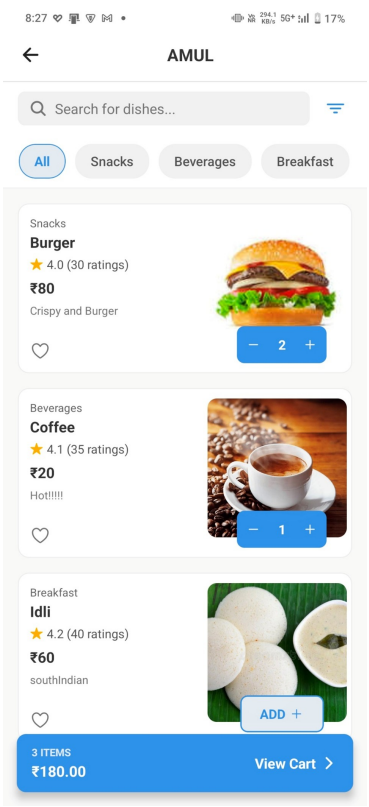

Figure 3.3: Canteen Menu

7. **Checkout & Payment**

- Offers flexible checkout process where users can:

  - Select preferred payment methods (e.g., online, cash).
  - Choose available time slots for pickup or delivery.

8. **Expense Tracker**

   - Automatically logs each transaction made through the app.
   - Features include:
     - A dedicated monthly expense report.
     - Daily, weekly, and monthly breakdowns of spending.
     - Filters by canteen or item to analyze where the user spends most.
     - Visual summary (e.g., bar or pie chart) of food expenses over time.

9. **Review System**

   - After order completion, users can:
     - Submit reviews and star ratings for each ordered item.
     - Provide text-based feedback on food quality, taste, and service.
     - View other users' reviews to make informed choices.

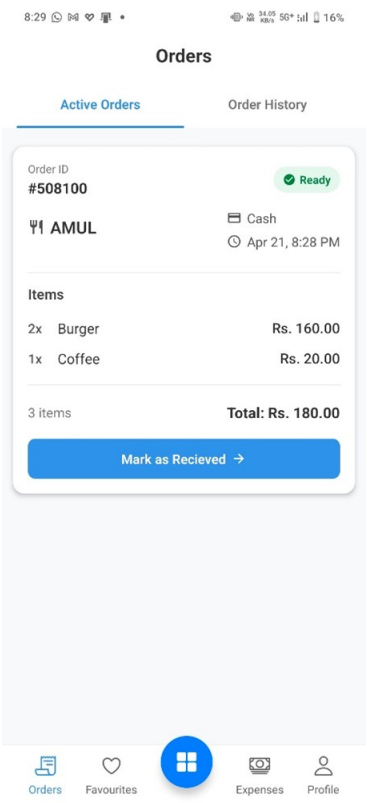

Figure 3.4: User orders

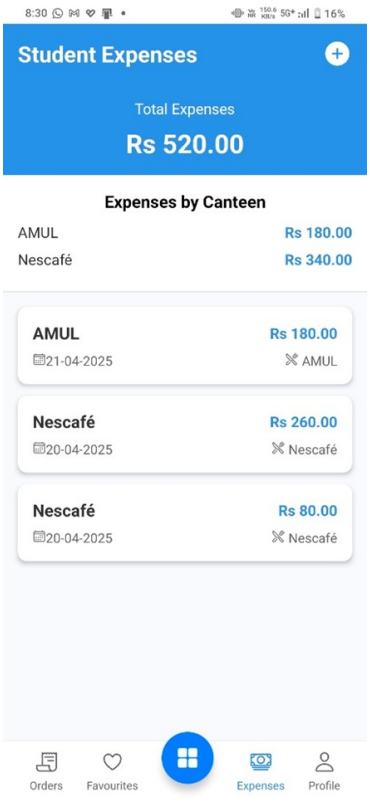

Figure 3.5: Expense Tracker

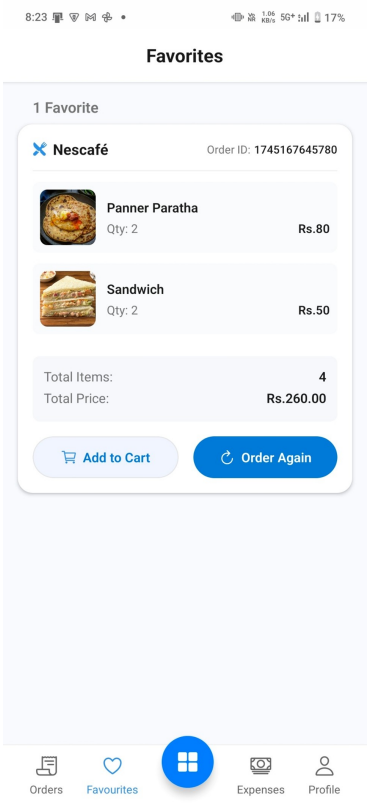

Figure 3.6: Quick Order

3.2 Canteen App Features

1. **Canteen Registration & Profile Management**
    - Canteen owners can register their food outlet through a simple onboarding process.
    - Manage login credentials and define operational hours for the canteen.
2. **Menu Management**
    - Canteens have full control over their menu:
        - Add new dishes with photos and details.
        - Edit or remove items.
        - Mark availability status (In Stock / Out of Stock).
        - Update pricing and nutritional details.

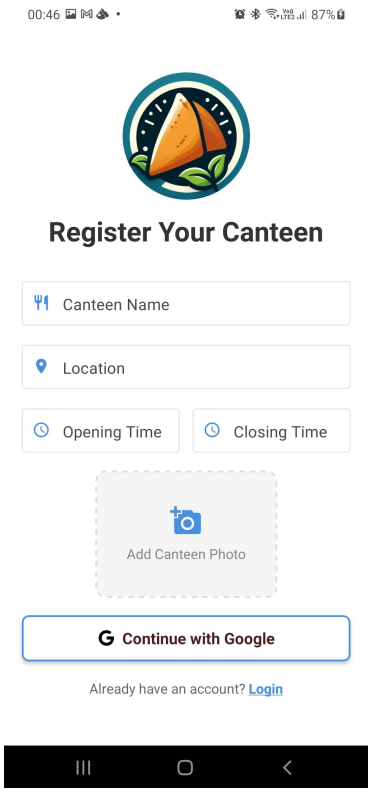

Figure 3.7: Register your canteen

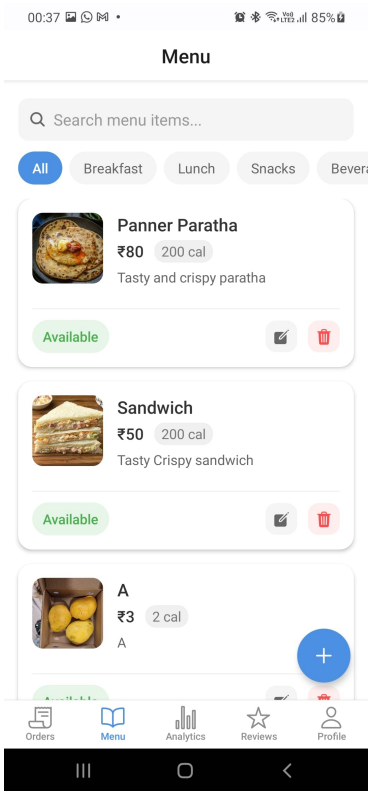

Figure 3.8: Update menu

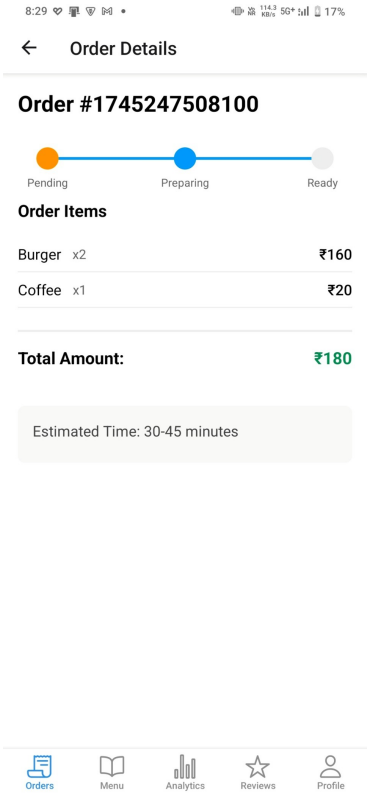

Figure 3.9: Update order details

3. **Order Tracking**

   - Canteens can:
     - View all incoming orders in real-time.
     - Update live order status (e.g., Accepted, Preparing, Ready, Pending).
     - View past orders.

4. **Analytics Dashboard**

   - Provides comprehensive insights including:
     - Total orders processed.
     - Daily, weekly, and monthly revenue statistics.
     - Top-selling items and customer favorites.

5. **View User Reviews**

   - Canteens can read feedback left by users to improve service and food quality.

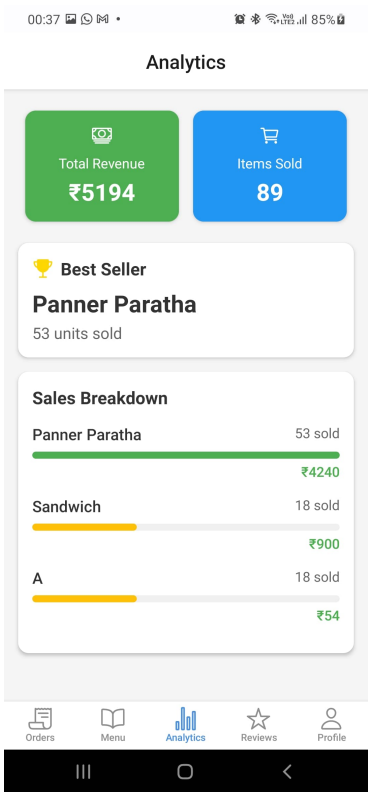

Figure 3.10: Analytics

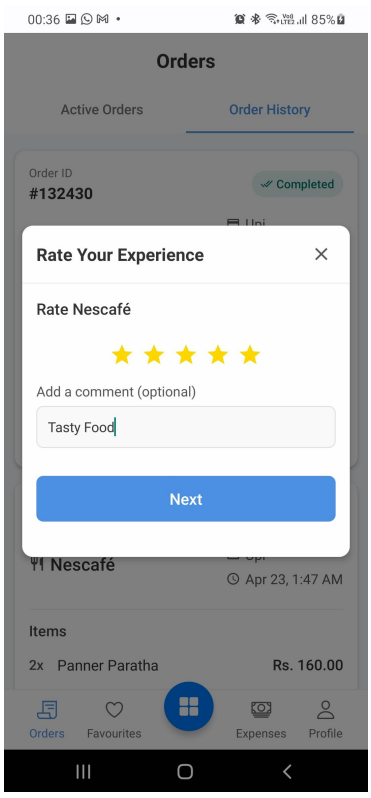

Figure 3.11: User Ratings

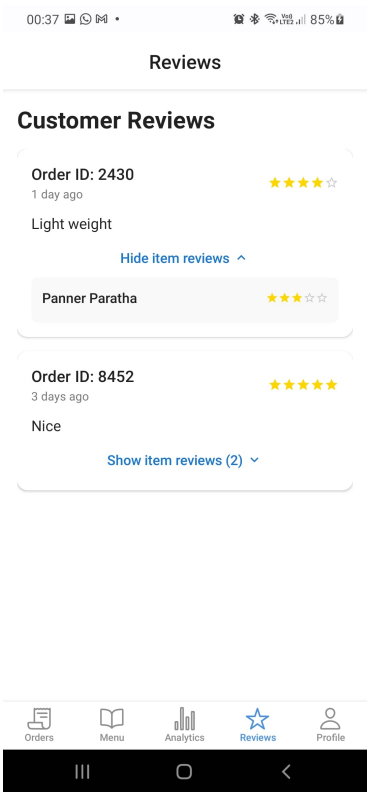

Figure 3.12: Reviews

Chapter 4

System Architecture

4.1 User Flow Diagram (Student Perspective)

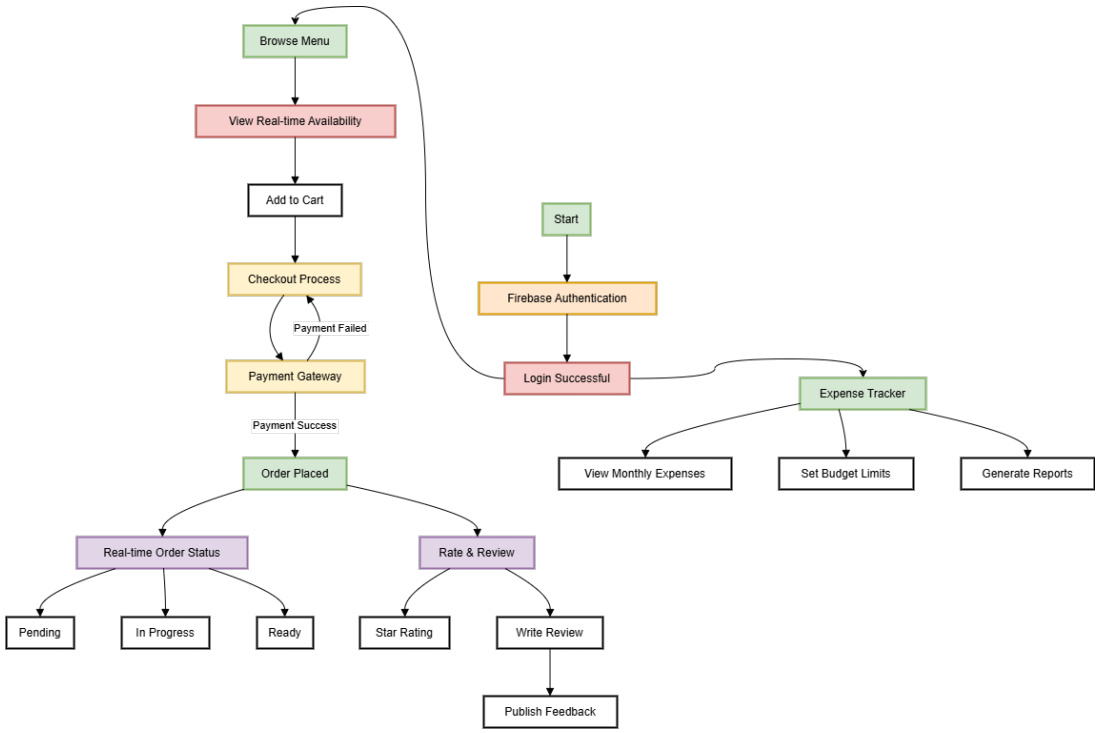

Figure 4.1: User Flow - Student Perspective

Key Processes

1. **Authentication**
    - **Purpose:** Ensure secure and personalized access to the app.
    - **Implementation:**

  - Students log in using Firebase Authentication.
  - Authentication enables access to personalized features like order history, expenses, and preferences.

2. **Menu Browsing and Real-Time Availability**

   - **Purpose:** Allow students to explore food options and make informed choices.
   - **Features:**
     - Browse full menu with item names, descriptions, prices, and images.
     - See real-time availability of items.
     - Search and filter options to quickly find desired items.

3. **Ordering and Payment**

   - **Purpose:** Provide a seamless and secure ordering experience.
   - **Flow:**
     - Select items and add them to the cart.
     - Proceed to checkout and confirm order details.
     - Complete transaction via integrated payment gateway.
     - Receive confirmation upon successful payment.

4. **Order Status Tracking**

   - **Purpose:** Keep students informed of order progress.
   - **Features:**
     - Real-time updates: Pending → In Progress → Ready.
     - Notification when order is ready.
     - Option to cancel or modify order if allowed.

5. **Ratings and Feedback**

   - **Purpose:** Allow students to share their experience.
   - **Options:**
     - Star ratings and written reviews.

- View other users' ratings and reviews.

6. **Expense Tracker**

   - **Purpose:** Help students monitor their canteen spending.
   - **Capabilities:**
     - Monthly transaction history.
     - Budget limits with alerts.
     - Generate/download reports.
     - Analyze spending patterns.

4.2 Canteen App Workflow

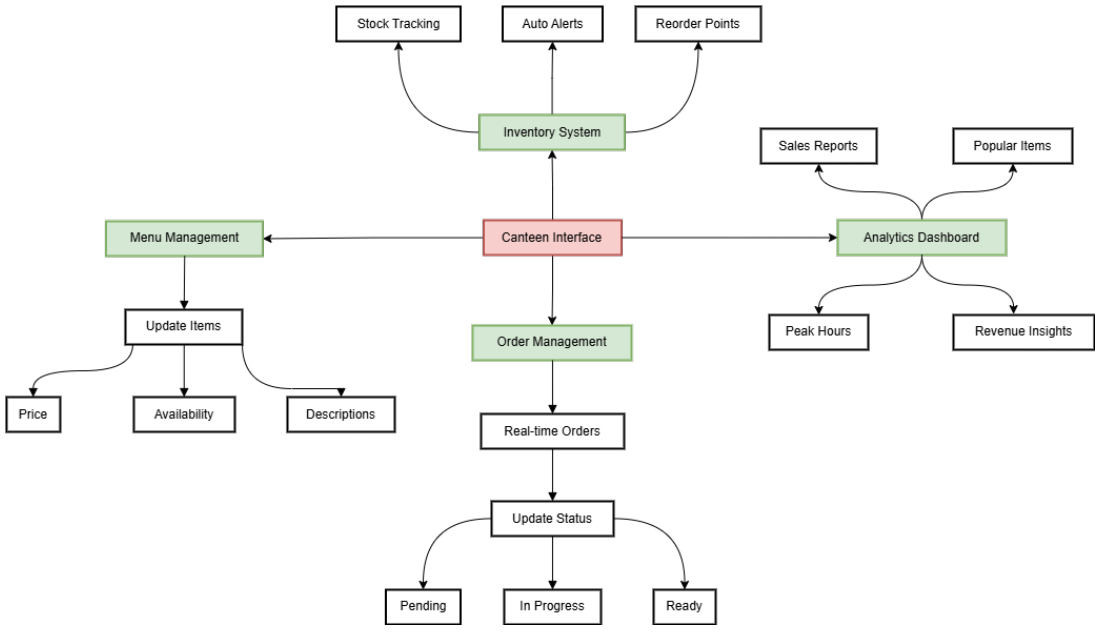

Figure 4.2: Canteen App Workflow

Key Processes

1. **Authentication**

   - Ensures only authorized staff can manage operations.
   - Implemented via Firebase Authentication with role-based access control.

2. **Order Management**

- Real-time order notifications.
- View order details (items, quantity, time).
- Update order status: Pending → In Progress → Ready.
- Students receive real-time status updates.

3. **Menu Management**
   - Add, edit, remove menu items.
   - Update item availability and pricing.
   - Instant sync with student app.
4. **Analytics and Reporting**
   - View total orders, peak times, top items.
   - Analyze sales reports.
   - Improve service based on user feedback.
5. **Ratings and Feedback Monitoring**
   - View user feedback.
   - Identify issues or popular items.
   - (Optional) Respond to feedback.

4.3 Sequence Diagram

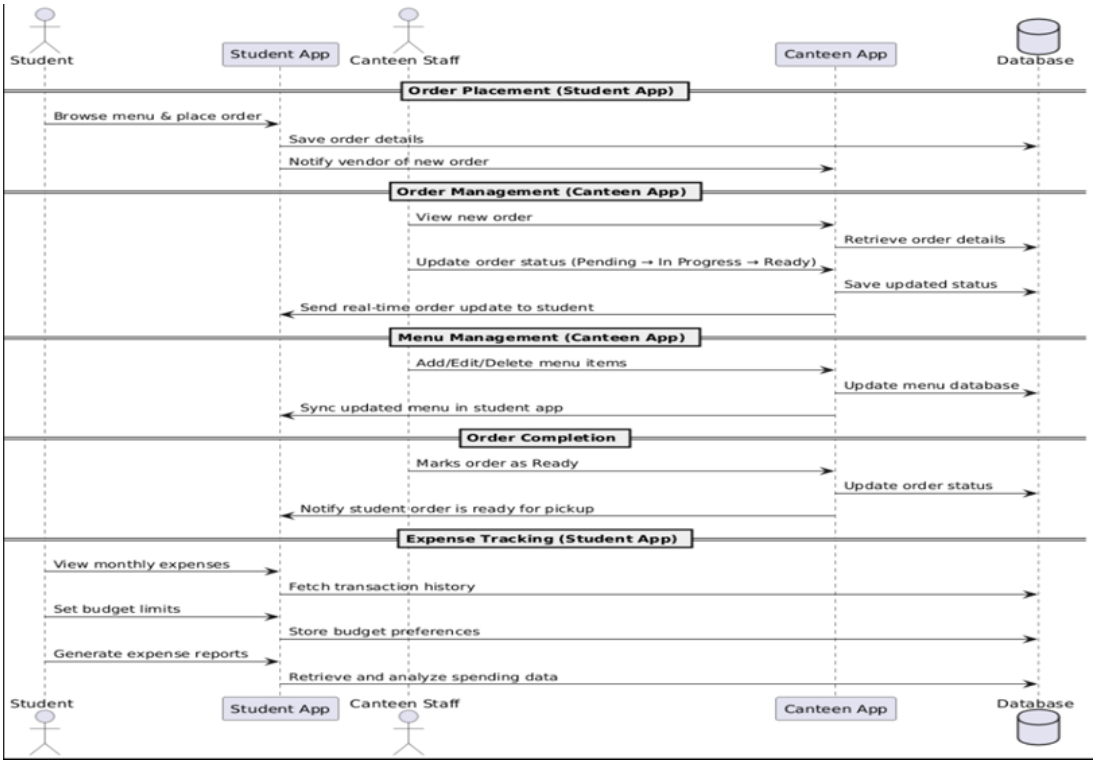

Figure 4.3: App Interaction Sequence

This section outlines the key interactions between users (students and canteen staff) and the system components, as represented in the sequence diagram in Figure 4.3.

Key Interactions

- **Authentication**
  - Both students and canteen staff authenticate via Firebase before accessing the app.
- **Order Placement (Student App)**
  - Student → Student App: Browse menu & place order
  - Student App → Database: Save order details
  - Student App → Canteen App: Notify vendor of new order
- **Order Management (Canteen App)**

  - Canteen App: View new order
  - Canteen App → Database: Retrieve order details
  - Canteen App: Update order status (Pending → In Progress → Ready)
  - Canteen App → Database: Save updated status
  - Canteen App → Student App: Send real-time order status updates

- **Menu Management (Canteen App)**
  - Canteen App: Add/Edit/Delete menu items
  - Canteen App → Database: Update menu database
  - Canteen App → Student App: Sync updated menu

- **Order Completion**
  - Canteen App: Mark order as Ready
  - Canteen App → Database: Update order status
  - Canteen App → Student App: Notify student that order is ready for pickup

- **Expense Tracking (Student App)**
  - Student → Student App: View monthly expenses
  - Student App → Database: Fetch transaction history
  - Student → Student App: Set budget limits
  - Student App → Database: Store budget preferences
  - Student → Student App: Generate expense reports
  - Student App → Database: Retrieve and analyze spending data

- **Ratings & Feedback**
  - Student → Student App: Provide rating and feedback
  - Student App → Database: Store feedback and rating
  - (Optional) Canteen App → Database: Retrieve feedback
  - (Optional) Canteen Staff → Canteen App: View student feedback for analysis

4.4 Tech Stack Used

The development of *Small Bites* leverages a modern and efficient technology stack designed for rapid cross-platform development, real-time interaction, and seamless user experiences. The key components include:

- **React Native:**
  Serves as the core framework for building the mobile application. It enables a single codebase for both Android and iOS platforms, allowing faster development cycles and streamlined maintenance.

- **Expo:**
  Provides a robust toolchain for building, testing, and deploying React Native apps. Expo simplifies development by offering a wide array of pre-built APIs and services.

- **Firebase:**
  Acts as the Backend-as-a-Service (BaaS), offering:
  - User authentication via Firebase Auth
  - Real-time database and cloud storage
  - Cloud messaging for push notifications

  Firebase ensures secure, scalable, and real-time data exchange.

- **JavaScript:**
  The primary programming language used across the application, from user interface components to business logic. JavaScript's flexibility and ecosystem make it ideal for mobile app development.

- **Node.js:**
  Utilized for writing backend APIs and handling server-side logic. Its event-driven, non-blocking architecture is well-suited for real-time applications and integrates seamlessly with Firebase services.

Together, these technologies form a cohesive stack that enables *Small Bites* to offer a dynamic, responsive, and intelligent campus food-ordering experience tailored to the NIT Delhi community.

Chapter 5

Challenges Faced

The development of *Small Bites* came with several challenges that required innovative solutions. These challenges spanned across real-time data handling, UI design, payment integration, and ensuring scalability for future growth. Some of the key challenges include:

- **Managing Real-Time Updates Across Different User Roles:**
  One of the main challenges was ensuring that updates to orders, menu items, and transaction statuses were consistently synchronized across all users, including students and canteen vendors. Firebase's real-time database was leveraged, but ensuring smooth real-time data flow without latency issues across different user roles posed significant challenges.

- **Handling Asynchronous Data Operations in Firebase:**
  Firebase is highly efficient for real-time data synchronization; however, managing asynchronous operations such as data fetching, saving, and updating in a highly dynamic environment required careful handling of promises, error handling, and ensuring data consistency without blocking the user experience.

- **Designing a Responsive UI for Diverse Screen Sizes:**
  The app needed to be responsive and user-friendly across a range of devices (both Android and iOS), each with different screen sizes. Ensuring that the layout and UI elements were properly scaled for various screen resolutions was a challenge. This was addressed by using flexible layout designs and testing across multiple devices.

- **Razorpay Payment Integration:**
  Integrating a secure and reliable payment gateway (Razorpay) for online payments

posed challenges with regards to secure data handling, transaction processing, and managing successful/failed transactions. Ensuring a seamless user experience for payments, including notifications and error handling, was crucial.

- **Role-Based Access:**
  Implementing role-based access control (RBAC) to differentiate between students, faculty, and canteen staff was necessary for maintaining proper permissions and access levels within the app. Ensuring that each role could only access appropriate data and features was a significant security challenge.

- **Designing a Scalable App:**
  Building an app capable of handling hundreds of users simultaneously while maintaining performance was a challenge. Scalability had to be ensured at both the frontend (with React Native) and the backend (using Firebase). This involved managing database queries efficiently and handling high volumes of user interactions.

- **Ensuring Data Privacy and Security:**
  Handling sensitive user data such as personal details and transaction information necessitated strong encryption, secure data storage, and adherence to data privacy regulations. Ensuring that all data transactions were secure from both a user and vendor perspective was a priority.

- **Optimizing for Offline Usage:**
  While real-time updates were key, there were instances when users may have limited or no internet connectivity. Ensuring that the app provided a functional offline experience, such as saving orders locally and synchronizing once connectivity was restored, added complexity to the development.

- **Testing Across Multiple Platforms:**
  Ensuring consistency and functionality across Android and iOS platforms with a single codebase was a challenge. Rigorous testing was necessary to identify and resolve platform-specific issues that could affect the user experience.

These challenges, while significant, were critical in refining the application's architecture and functionality. Each obstacle provided valuable insights into the technical and operational complexities of developing a comprehensive solution like *Small Bites*.

Chapter 6

Contributions

The successful development and deployment of the **Small Bites** application was made possible through the collaborative efforts of all team members. Each member contributed their unique strengths and skills to different facets of the project. The following outlines individual contributions:

Manav

- Took the lead on designing and implementing the **Canteen Staff Flow**.
- Developed the UI for core features such as order tracking, menu updates, and real-time order status updates for the canteen side of the app.
- Integrated functionality for managing food availability and dynamic menu control.
- Worked on interface responsiveness for ease of use by non-technical staff.
- Coordinated feedback collection and analytics features tailored for the canteen dashboard.

Pradneya

- Spearheaded the **Firebase backend architecture** for authentication, database design, and real-time data synchronization.
- Engineered seamless communication between the student and canteen flows.

- Created the database design for user authentication, menu browsing, order tracking, payment gateway integration, and expense tracking.
- Developed custom Firebase queries for analytics and budget tracking features.
- Debugged asynchronous operations and optimized real-time performance across multiple user roles.

Pranav

- Led the design and development of the **Student/User Flow**.
- Created the user interface for menu browsing, order placement, payment gateway integration, and expense tracking.
- Designed intuitive UX for smooth navigation across the app, ensuring responsiveness and performance across screen sizes.
- Integrated feedback and rating system from the user perspective.
- Conducted user testing sessions to refine the experience based on actual usage.

Each member worked collaboratively on documentation, testing, bug-fixing, and aligning the overall UI/UX design to maintain consistency. Weekly sync-ups, task boards, and peer reviews ensured that the project remained on track and was delivered as envisioned.

Chapter 7

Future Scope

While *Small Bites* has successfully addressed many issues related to campus canteens, there are several areas where the app can be expanded and improved to provide even more value to users and vendors. Below are some potential future features and improvements:

- **Friends Integration:**
  A future version of the app could allow users to connect with their friends on the platform. This would enable students to see what their friends are ordering, share food preferences, and even coordinate orders together for convenience. Friend connections could lead to more social interactions and create a more community-driven experience in the canteen ecosystem.

- **Splitting Orders Among Friends:**
  A highly requested feature is the ability to split the total cost of an order among multiple people. This feature would be especially useful for students who regularly order food together with their friends. The app could provide an option to split the order cost evenly or allow for custom distribution, which would help with payment processing and avoid the need for manual calculations. This could be further integrated with a group payment system, allowing multiple users to contribute to the bill using different payment methods.

- **Meal Suggestions Based on Preferences:**
  By analyzing user behavior and food preferences, *Small Bites* could recommend meals to users based on their past orders, dietary preferences, or seasonal trends.

This would enhance the app's usability by providing personalized meal suggestions, improving the overall experience, and helping users discover new dishes.

- **Loyalty and Rewards Program:**
  Implementing a loyalty program could incentivize users to frequent the canteens more often. Points could be awarded for every purchase, which could later be redeemed for discounts, free items, or exclusive deals. This would foster customer retention and make the food ordering process more rewarding for users.

- **Integration with Campus Events:**
  The app could be integrated with campus event calendars, allowing the system to offer meal specials or discounts during special events (such as festivals, sports days, or seminars). This integration could also allow event organizers to place bulk orders for guests, further streamlining the food-ordering process during large events.

- **Smart Inventory Management for Canteens:**
  To help canteens better manage their inventory, the app could include features like real-time stock tracking, automatic low-stock notifications, and demand forecasting based on order patterns. This would help vendors maintain adequate stock levels and reduce food wastage by ensuring they only prepare meals according to real-time demand.

- **Integration with Campus Delivery Services:**
  Another potential future feature is integrating delivery services within the campus or collaborating with local delivery partners. This would give users the option to have their meals delivered to their classroom or dorm, adding an extra layer of convenience for students and faculty who may not have time to pick up their orders.

These future scope features, along with improvements to existing functionalities, would continue to enhance the *Small Bites* experience, making it an indispensable tool for NIT Delhi students and faculty while also laying the foundation for broader use cases across different institutions and campuses.

Chapter 8

Conclusion

The development of *Small Bites* has aimed at solving key challenges faced by the campus community regarding food ordering and canteen management. Through the seamless integration of mobile technology, real-time updates, and backend services, the application has been able to deliver a smooth and user-friendly experience for both students and canteen vendors. By reducing queue times, improving order accuracy, enabling online payments, and offering transparency in the ordering process, *Small Bites* has significantly enhanced the overall dining experience at NIT Delhi.

The system's design, powered by modern technologies like React Native, Expo, Firebase, and Node.js, ensures cross-platform support, scalability, and real-time updates, making it a highly efficient solution for campus canteens. It is optimized for mobile devices and delivers intuitive navigation for both users and vendors, with features like order history, expense tracking, and feedback systems.

However, there are still several opportunities for further development and improvement. The future scope outlined in this report indicates multiple directions for expanding the app's functionality, such as integrating social features, improving meal suggestions, offering loyalty rewards, and even expanding to other campuses. By continually addressing user feedback and iterating on the design, *Small Bites* can evolve into a more robust and versatile system.

In conclusion, *Small Bites* provides a strong foundation for enhancing campus food services. With continuous enhancements and future feature integrations, the app is poised to further transform the way food is ordered and served on campus, contributing to improved productivity, time management, and overall user satisfaction.