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# Quick Cart: A QR Code-Based Ordering System

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**Abstract**

The food and beverage industry has rapidly shifted towards digitization, driven by changing customer expectations, mobile technology, and the impact of the COVID-19 pandemic. Addressing the need for seamless, contactless, and efficient ordering, this project presents **Quick Cart**, a full-stack web application that transforms the traditional ordering process using QR code technology, real- time menu management, and secure digital payments.

Quick Cart bridges the gap between customers and store owners, offering an interactive platform for managing the entire order lifecycle—from menu browsing to payment. Customers scan a QR code placed on their table to access the digital menu, customize orders, and complete transactions without staff involvement. Store owners can register businesses, manage menus, and track orders through a user-friendly dashboard. Each business is provided a unique QR code linking to its digital menu.

Built with **Node.js** and **Express.js** on the backend, **MongoDB** for database management, and **React.js** on the frontend, the system ensures a scalable, responsive, and dynamic user experience. **Axios** is used for real-time API communication. Payment integration is achieved through **UPI** and **Razorpay**, enabling secure and efficient digital transactions, with real-time payment status updates for store owners.

Designed for flexibility and scalability, Quick Cart allows independent management of multiple businesses without data conflicts. Secure authentication ensures data protection. The system supports mobile responsiveness, dynamic QR code generation, error handling, and robust API communication, delivering reliability even on low-end devices.

## 1. INTRODUCTION

In an age of digital innovation, customer service and operational efficiency are key pillars that determine the success of any business, especially in the food and beverage industry. The transformation in customer expectations has led to an increased demand for fast, contactless, and technology-driven service delivery. Traditional ordering processes, which involve the use of physical menus, manual order-taking by staff, and cash payments, are becoming outdated due to their inefficiency, potential for human error, and lack of flexibility.

**Quick Cart** is a full-stack web application aimed at addressing these challenges by offering a seamless, efficient, and user-friendly platform for digital ordering and payment. This application leverages **QR code technology**, a **mobile-responsive digital menu**, and **secure UPI-based payments** to simplify the customer experience while providing store owners with a powerful backend system for managing menus and orders. Built using modern web technologies such as **React.js, Node.js, Express.js, and MongoDB**, Quick Cart ensures performance, scalability, and real-time interactivity.

## 1.1 Motivation

The motivation behind developing Quick Cart stems from observing the inefficiencies of conventional operations. In many small- to medium-sized , the entire ordering workflow is still manual. This includes handing out physical menus, taking orders on notepads, entering them into a billing system, and collecting payments in cash or through card swipes. These steps are not only slow but also error-prone. In peak hours, the system becomes strained, leading to customer dissatisfaction.

The outbreak of the **COVID-19 pandemic** further emphasized the importance of **contactless interactions**. Customers began to avoid handling menus or currency, and businesses struggled to adopt safe yet effective alternatives. While large chains swiftly adopted digital solutions, most independent businesses lacked the infrastructure or budget for such transformations.

Our motivation was to bridge this gap by creating an **affordable, accessible, and easy-to-use digital ordering system** that could serve both customers and owners. By using something as simple and ubiquitous as QR codes, the application aims to bring the advantages of digital transformation to even the smallest food service providers.

**Background and Need for the Work:**

In the traditional setup, customers are required to wait for physical menus, interact with staff for order placement, and make payments through cash or card machines. These methods are not only time-consuming and prone to human error but also lead to overcrowding and longer table turnaround times during peak hours. With the global emphasis on contactless services post the COVID-19 pandemic, have increasingly recognized the need for smart digital solutions.

Despite this shift, small and medium-sized struggle with high implementation costs, limited technical expertise, and lack of customizable solutions. Existing platforms are either too generic or require third-party commission-based systems, making them less accessible for independent business owners.

Quick Cart addresses these challenges by providing a **self-managed digital platform** that combines the simplicity of **QR technology** with the power of **custom menu management**, **real-time order processing**, and **digital payment integration**, all without the need for third-party aggregators.

**Key Technologies Used:**

1. **React.js (Frontend)**: Enables a dynamic, responsive, and user-friendly interface for both customers and store owners.
2. **Node.js with Express.js (Backend)**: Provides scalable RESTful API services for user management, order processing, and menu control.
3. **MongoDB (Database)**: Stores store-specific data such as user details, menu items, and order transactions in a secure and flexible NoSQL format.
4. **Razorpay & UPI Payment Integration**: Facilitates seamless and secure digital transactions via popular UPI platforms and payment gateways.
5. **QR Code Library**: Generates unique scannable QR codes that redirect customers to the digital menu of the.
6. **JWT & bcrypt.js**: Implements secure login authentication for store owners with encrypted password storage and token-based access control.

7. **Cloud Deployment (Render, Netlify, MongoDB Atlas)**: Ensures scalability, availability, and secure data hosting with minimal maintenance overhead.

**Main Features:**

- **Contactless QR Code Ordering**: Customers simply scan a QR code at their table to access the's digital menu, eliminating the need for physical menus and interactions.
- **Dynamic Menu Browsing & Cart**: Real-time view of menu items, prices, and item availability with the ability to add/remove items from a virtual cart.
- **Order Placement & Notifications**: Orders placed by customers are instantly reflected on the owner dashboard with live status updates like "Pending," "Preparing," or "Completed."
- **UPI & Razorpay Payments**: Integrated payment options that ensure fast, secure, and cashless transactions using India's most widely adopted payment systems.
- **Store Owner Dashboard**: Intuitive admin panel for owners to register their business, update menus, track orders, manage QR codes, and monitor payments.
- **Modular Architecture for Multiple Stores**: Each operates in an isolated environment, enabling support for multiple independent businesses on the same platform.

**Target Users:**

- **Small and medium-sized** seeking affordable, commission-free digital ordering solutions.
- **Cafes, food courts, and food trucks** needing minimal staff dependency for order taking.
- **Customers** who prefer quick, self-service ordering with secure online payment.
- looking for an all-in-one platform that combines order management, menu customization, and payment handling.

**Advantages :**

- **Affordability**: No need for expensive hardware or third-party commissions.
- **Customization**: Store owners have full control over their menus and operational workflows.
- **Scalability**: Cloud-based design allows the system to grow with increased demand.
- **Efficiency**: Reduces customer wait time and improves table turnover.
- **Safety & Hygiene**: Promotes contactless interaction during health-sensitive times.
- **Ease of Use**: Minimal training required for both customers and staff.

**Quick Cart** is a modern take on traditional ordering, aimed at empowering independent business owners and improving the overall customer experience. With a strong focus on usability, security, and scalability, this project brings together web development, database management, and fintech integration to build a real-world, impactful application. As the dining industry continues to evolve, Quick Cart stands as a reliable, adaptable solution for digital-first and cafes.

## 2. LITERATURE SURVEY

The rise of technology in business operations has fundamentally changed the way companies interact with customers. In recent years, the implementation of digital systems in the food service and retail industries has dramatically improved the efficiency of operations while enhancing the customer experience. **Quick Cart**, a QR code-based ordering and payment system, capitalizes on these technological advancements to offer a streamlined, contactless, and efficient solution for both businesses and customers. This literature review explores existing research and practices related to QR code-based ordering systems, menu management, payment integration, and the overall impact of digital technologies on business processes, with a focus on the technologies employed by **Quick Cart**.

QR codes have gained significant popularity in various industries due to their ease of use, security features, and ability to enable contactless interactions. In the hospitality sector, QR code-based ordering systems have been particularly useful, offering a safer, more efficient, and innovative alternative to traditional ordering methods. **Bendavid et al. (2020)** demonstrated that QR code-based systems not only help reduce physical interactions, which became essential during the COVID-19 pandemic, but they also enable businesses to operate with fewer resources. With a QR code placed on each table or product, customers can easily scan it with their smartphones to access a digital menu, place an order, and even make payments, all without physical touch.

QR codes reduce operational costs, such as the printing of menus, and make it easier for businesses to update their offerings in real-time. **Cheng et al. (2021)** also suggest that these systems significantly improve operational efficiency and reduce errors, as they eliminate the need for waitstaff to manually take orders and enter them into the system. Furthermore, by enabling customers to directly interact with the ordering platform, QR codes help minimize wait times, leading to a faster, smoother dining or shopping experience. **Quick Cart** incorporates this technology by allowing customers to scan QR codes to access an up-to-date menu and place orders directly from their devices, which enhances convenience and speeds up the ordering process.

An integral part of the **Quick Cart** system is its **menu management functionality**, which allows store owners to efficiently manage their offerings. Traditional menu management systems often rely on static, physical menus, which are cumbersome to update and cannot easily reflect changes in pricing, availability, or new items. Digital menu systems, on the other hand, provide the flexibility to instantly update the menu in real-time, which is especially crucial in industries like  and retail. **Sah et al. (2021)** highlight the importance of dynamic menu systems in improving operational efficiency and customer satisfaction, noting that digital systems allow store owners to make real-time changes without the need to print new menus.

Moreover, digital menus can be interactive, offering additional information about products such as nutritional details, ingredient lists, or promotional discounts. **Kaur et al. (2019)** discuss how interactive digital menus enhance the customer experience, as they allow for a more personalized approach. With **Quick Cart**, the digital menu is integrated with the ordering system, which means that any updates made by store owners are immediately reflected to the customers. This real-time synchronization ensures that the menu is always current, reducing customer dissatisfaction caused by out-of-stock items or outdated information.

The ability to make payments easily and securely is essential in any digital ordering system, and **Quick Cart** includes integration with major payment gateways like **UPI (Unified Payments Interface)** and **Razorpay**. The adoption of mobile payment solutions has rapidly increased, especially in developing countries like India, where UPI has become the preferred mode of transaction for a large number of customers. According to **Sharma et al. (2020)**, the integration of UPI payment systems has revolutionized the way consumers pay for goods and services, offering quick and secure transactions

without the need for physical cards or cash.
In addition to UPI, **Razorpay** offers a reliable payment gateway for processing online payments. **Saini et al. (2021)** explain how Razorpay's platform facilitates seamless transactions and provides an added layer of security by encrypting sensitive information. **Quick Cart** takes advantage of these technologies to ensure that payments are processed securely, quickly, and efficiently. Customers can use their smartphones to complete transactions, whether through UPI apps like Google Pay or PhonePe, or by using Razorpay's checkout system, which supports multiple payment options.
The security of online transactions is critical, and **Quick Cart** incorporates encryption and tokenization methods to protect user data and payment details, addressing concerns raised by **Mohan et al. (2020)** in their work on digital payment security. By leveraging secure payment systems and ensuring the privacy of user data, **Quick Cart** provides customers with a trustworthy and safe payment experience.The user interface (UI) and user experience (UX) design are crucial to the success of any digital platform, and they play a significant role in ensuring that customers and business owners can navigate the system efficiently. **Zhou et al. (2021)** argue that UI/UX design not only impacts user satisfaction but also affects the functionality and usability of the platform. In the case of **Quick Cart**, the design is tailored to ensure ease of use for both customers and store owners.
For customers, **Quick Cart** provides a clean, intuitive interface that guides them through the ordering process with minimal steps. The use of **React.js**, a JavaScript library for building user interfaces, allows for the development of dynamic and responsive pages that can update in real-time without the need to reload the entire page. **Choi et al. (2019)** and **Yang et al. (2020)** discuss how **React.js** facilitates smooth user interactions, which is essential for systems that require real-time updates, such as an ordering platform.
For store owners, the **Quick Cart** admin dashboard is designed to be user-friendly, with easy navigation for managing menu items, tracking orders, and processing payments. **Bastiansen et al. (2020)** highlight the importance of designing intuitive backend interfaces that minimize the learning curve for business owners, particularly those who may not have extensive technical knowledge. The backend design of **Quick Cart** ensures that store owners can quickly and easily manage their store's operations, allowing them to focus on other aspects of their business.
The technical foundation of **Quick Cart** uses a combination of modern web technologies, including **Node.js** for the backend and **MongoDB** for database management. **Node.js** is a popular JavaScript runtime environment that is designed for building scalable and efficient applications. According to **Garcia et al. (2019)**, **Node.js** is particularly well-suited for real-time applications that require quick data processing and responsiveness, such as ordering systems.
For database management, **MongoDB** is used, which is a NoSQL database known for its scalability and flexibility. **Mongoose**, an object data modeling (ODM) library for MongoDB, provides a powerful way to interact with the database. **MongoDB Atlas** allows **Quick Cart** to scale as the platform grows, ensuring that the database can handle large amounts of transactional data while maintaining security and performance.
The literature reviewed emphasizes the significance of QR code-based ordering systems, digital menu management, payment integration, and intuitive UI/UX design in transforming the  and retail industries. These technologies, combined with the right technical stack, provide businesses with the tools to improve operational efficiency, enhance the customer experience, and simplify the ordering process. **Quick Cart** leverages these advancements to deliver a modern, efficient, and user-friendly platform for

both customers and store owners. The integration of QR code-based ordering, real-time menu management, secure payment systems, and a seamless user interface positions **Quick Cart** as a valuable tool for businesses seeking to enhance their service offerings and improve customer satisfaction.
In recent years, the industry has adopted various technology solutions to enhance customer convenience and improve operational efficiency. These solutions range from traditional Point-of-Sale (POS) systems to mobile ordering apps and QR code-based ordering systems, each providing unique features but also facing their own set of limitations. Traditional POS systems have been the backbone of many , allowing servers to input orders, process payments, and manage inventory. While these systems improve efficiency in managing orders, they still rely heavily on manual input, which leaves room for human error and potential delays during peak business hours. Additionally, traditional POS systems are often not integrated with other management tools, such as real-time inventory tracking, dynamic menu updates, or customer relationship management (CRM) systems. As a result, there can be discrepancies between available menu items and inventory, leading to customer frustration and miscommunication between kitchen and front-end staff.
Mobile-based ordering apps, such as Uber Eats, Zomato, and Swiggy, have become popular in recent years by offering customers the convenience of placing orders remotely from their smartphones. These apps allow customers to browse menus, customize orders, and schedule delivery or pickup. While mobile apps reduce the reliance on in-person interactions and promote convenience, they come with their own set of limitations. One significant disadvantage is the heavy reliance on third-party platforms, which means owners have little control over the customer experience and face significant service fees and commissions for using these apps. Additionally, the menu customization offered by these platforms is often limited. For example, customers may not be able to easily filter out items that meet specific dietary needs or allergies, which could lead to unsatisfactory dining experiences, especially for those with restrictive diets or health concerns. Furthermore, mobile apps often lack a direct connection to in-house systems, such as inventory or CRM tools, meaning must manually update their menus across multiple platforms, leading to inefficiencies and potential errors.
QR code-based ordering systems have become increasingly prevalent, particularly in response to the COVID-19 pandemic. These systems allow customers to access digital menus and place orders by scanning a QR code displayed on the table or wall. The primary advantage of QR code-based systems is their contactless nature, which minimizes physical interaction between customers and staff, promoting hygiene and safety. However, while QR code systems offer a degree of convenience, they still have several limitations. For example, many QR code-based systems lack real-time updates to the menu, meaning if an item runs out of stock or a new dish is introduced, customers may not be informed promptly. This can lead to confusion and dissatisfaction when customers attempt to order unavailable items. Additionally, QR code-based systems typically have limited integration with other management tools, such as order processing or payment systems, making it challenging for owners to manage their operations effectively. Many of these platforms also do not support customer engagement features such as loyalty programs, personalized promotions, or customer feedback, further limiting their ability to enhance the dining experience.

## 3.Proposed System

The **Quick Cart** system addresses the deficiencies of traditional ordering systems by incorporating modern technologies that enhance both customer and owner experiences.

Features of the Proposed System:

1. **QR Code-based Menu**:

○ Customers access the menu by scanning a unique QR code assigned to each table. This feature reduces the need for physical menus and minimizes contact, making it a safer option for diners.

2. **Real-time Order Management**:

○ The system tracks orders in real time, providing updates to both customers and staff. Customers can check the status of their orders through the app.

3. **UPI Payment Integration**:

○ **Quick Cart** integrates with UPI-based payment apps, offering customers a secure and seamless way to pay for their meals.

4. **Personalized Menu**:

○ The system allows for customer preferences (e.g., dietary restrictions, special requests) to be considered when presenting menu options, enhancing the overall dining experience.

5. **Admin Panel for Owners**:

○ owners have access to a comprehensive admin panel, which allows them to manage their menu, view order history, and process payments. They can also manage customer feedback and daily sales data.

### a. Workflow of Proposed System

i. **User Onboarding**:

1. The customer logs into the system, either by scanning the QR code or by choosing the from a list.

ii. **Menu Access via QR Code**:

1. Upon scanning the QR code, the customer's mobile device loads the 's digital menu, which is categorized and interactive.

iii. **Order Placement**:

1. The customer selects menu items, customizes them, and adds them to their cart. They can view the total price before proceeding to payment.

iv. **Payment Processing**:

1. Once the customer confirms the order, they proceed to make a secure payment via UPI- based payment options like **GPay** or **PhonePe**.

v. **Order Management**:

1. The receives the order in real-time and updates its status (e.g., preparing, ready for delivery).

vi. **Order Tracking**:

1. The customer can track the real-time status of their order, which enhances transparency and customer satisfaction.

vii. **Feedback and Rating**:

1. After completing their meal, customers can rate their experience and provide feedback, helping the improve its services.

This organized workflow ensures that the **Quick Cart** system provides an efficient, secure, and

personalized ordering experience for both customers and owners.
System Design and Development is a critical phase in the software development lifecycle, where the abstract requirements are transformed into a working application through well-defined architectural planning, component interaction modeling, and technology integration. For the *Quick Cart* project—a
QR-based ordering system—the design phase establishes a modular, scalable, and secure architecture that facilitates smooth interactions between customers, staff, and system components. It supports real-time ordering, dynamic menu display, and UPI-based payment integration.

## 3.1 System Design

The system follows a **layered architecture** comprising three primary layers:

### User Interface Layer

- **Technologies Used**: React.js, Tailwind CSS
- **Purpose**: To facilitate interactive, responsive communication between the user and system
- **Features**:
  - QR code scanner interface for customers
  - Menu display with dynamic item loading
  - Cart management UI
  - Secure UPI payment options
  - owner dashboard for menu/table/order management

### Logic Layer

- **Technologies Used**: FastAPI (Python), JWT Authentication
- **Purpose**: To implement business logic and route requests appropriately
- **Components**:
  - QR Code Handler (table & linking)
  - Order Management System (cart updates, order state transitions)
  - Authentication Module (admin & customer sessions)
  - Table Management Engine
  - Payment Integration Layer (redirects to UPI apps like GPay, PhonePe)
  - API Gateway for frontend-backend communication

### Data Layer

- **Technologies Used**: MongoDB with per- database architecture
- **Purpose**: To handle storage and retrieval of all structured/unstructured data
- **Data Models**:
  - Customer profiles, order history
  - Menu details per

- QR metadata (table ID, ID)
- Real-time order status and kitchen updates

### 3.2 System Methodology

The project follows a **hybrid Agile development** methodology with incremental feature delivery and rapid iterations:

**Development Phases:**

1. **Requirement Gathering**:
   - Conducted surveys with owners and diners
   - Identified critical needs: seamless UI, fast ordering, real-time updates, UPI integration, and -specific customizations
2. **Database Modeling**:
   - Designed a NoSQL schema to support -specific isolation
   - Implemented dynamic table structures for each new sign-up
3. **API Development with FastAPI**:
   - Developed secure, RESTful endpoints
   - JWT-based user and admin authentication
   - Scalable structure for table-based QR scanning and menu rendering
4. **Frontend Engineering with React.js**:
   - Built reusable components: MenuCard, OrderCard, CartButton, QRScanner
   - Integrated REST APIs using Axios
   - Optimized for mobile and desktop browsers
5. **QR Code Generation and Scanning**:
   - Generated unique QR codes per table with -specific encoded metadata
   - Implemented scanning via the browser camera (React Web APIs)
6. **UPI Integration**:
   - Triggered UPI-based payments through deep linking to GPay/PhonePe
   - Payment status monitored via webhook (future enhancement)
7. **Testing & Deployment**:
   - Unit and integration testing with pytest and Postman
   - Deployed backend via Render and frontend via Vercel for demo purposes

### 3.3 Database Schema Overview

Each has an isolated database instance to ensure data security and custom management.
**Key Collections:**

- **Users**: { name, email, password_hash, role, _id }
- **MenuItems**: { name, price, category, is_available, _id }
- **Orders**: { table_id, items[], status, timestamp, customer_name }

- **Tables**: { table_number, qr_code_url, _id }
- : { name, location, email, phone }

### 3.4 Security Measures

Ensuring the security of both customer and owner data is a top priority in the **Quick Cart** system. Given that the platform handles user authentication, personal data, order details, and digital payments, multiple layers of security have been implemented to safeguard against vulnerabilities and malicious activity. The following security strategies were applied:

**JWT-Based Authentication**

- **JSON Web Tokens (JWT)** are used for securing user sessions across both the customer and owner modules.
- Tokens are issued upon successful login and stored on the client side (usually in local storage).
- All subsequent requests must include the token in the authorization header for authentication.
- Tokens are signed and include user roles and session expiration timestamps to ensure they are not tampered with.

**Role-Based Access Control (RBAC)**

- Implemented to differentiate between **customers** and **owners**.
- **Customers** can:
  - Scan QR codes
  - Browse menus
  - Place and pay for orders
- **Owners** can:
  - Add, update, or remove menu items
  - Manage tables and QR codes
  - View order analytics and customer feedback
- Unauthorized access attempts are blocked with appropriate status codes (403 Forbidden).

**Input Validation and Sanitization**

- All inputs from both frontend and backend routes are strictly validated and sanitized to prevent:
  - **SQL/NoSQL injection**
  - **Cross-site scripting (XSS)**
  - **Cross-site request forgery (CSRF)**
- Libraries like **Pydantic** (FastAPI) and **React Hook Form/Yup** (frontend) are used for validation schemas.

**Secure Communication with HTTPS**

- All communication between client and server is done over **HTTPS** using SSL/TLS encryption.
- This ensures data integrity and confidentiality during transmission, especially for sensitive operations like login and payment.

- For deployment, SSL certificates are integrated using providers like **Let's Encrypt**.

**Session Timeout & Token Expiry**

- JWT tokens have a defined expiration time to reduce risk in case of token theft.
- After expiration, users are automatically logged out and prompted to re-authenticate.
- This prevents prolonged access on public or unattended devices.

**Logging and Monitoring (Optional Enhancement)**

- Logs are maintained for:
  - Login attempts
  - Unauthorized access
  - Payment failures
- Security monitoring tools like **Sentry** or **Prometheus with Grafana** can be integrated in future versions to detect anomalies.
-

### 3.4.1.1 UI/UX Wireframes

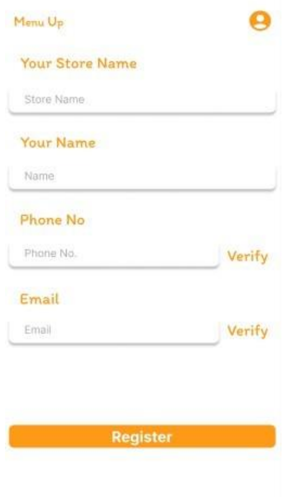


Fig 3.1 Interface for Registering

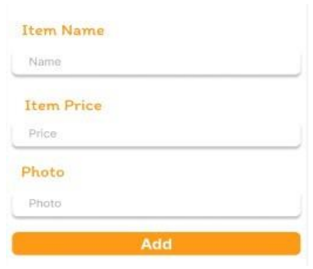


Fig 3.2 Interface for Adding Items

The design and layout of the user interface (UI) and user experience (UX) play a pivotal role in determining the usability and overall effectiveness of a web application like **Quick Cart**. To ensure a seamless interaction between users and the system, wireframes were designed for every key user role—**customer**, **owner**, and **administrator**—before the actual implementation phase began. These wireframes served as the blueprint for the frontend development, helping to visualize the structure, navigation, and interactions of the platform.

The **Customer Interface** wireframes focus on simplicity and intuitive navigation. The home screen displays a QR scanner interface that activates the device camera, allowing customers to instantly scan a QR code placed on the dining table. Once scanned, the wireframe leads to a digital menu screen, listing food items with images, names, prices, and "Add to Cart" options. The cart page wireframe provides itemized details and allows customers to adjust quantities before proceeding to the checkout screen. The final payment screen wireframe includes options for UPI-based payments (Google Pay, PhonePe, etc.), offering a smooth and contactless payment experience.

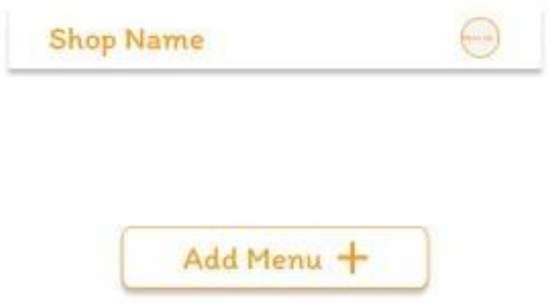


Fig 3.3 Owner Interface for Adding items

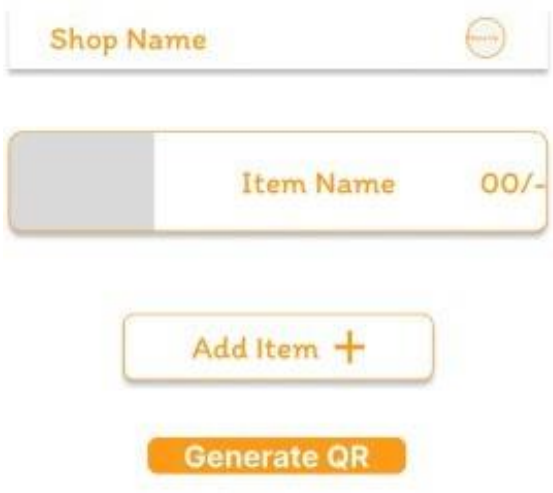


Fig 3.4 After Adding Items

The **Owner Interface** wireframes were designed to prioritize management capabilities. The dashboard wireframe features panels for managing the menu, tables, and orders. The menu management screen allows adding, editing, or deleting items, each accompanied by a name, price, image upload option, and availability toggle. The table management wireframe lets the owner generate and download unique QR codes for each table. The order management screen shows real-time order updates, statuses (e.g., pending, in progress, served), and filters for organizing orders.

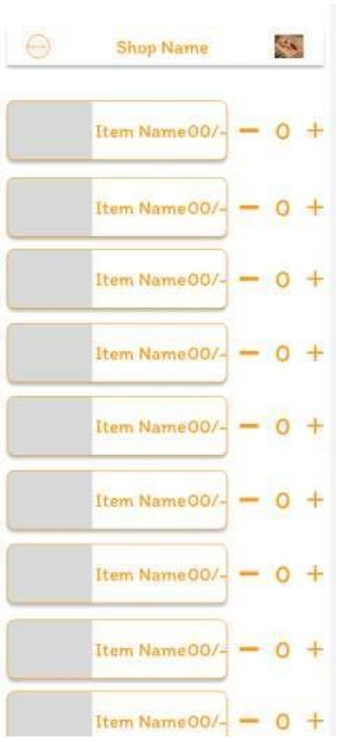
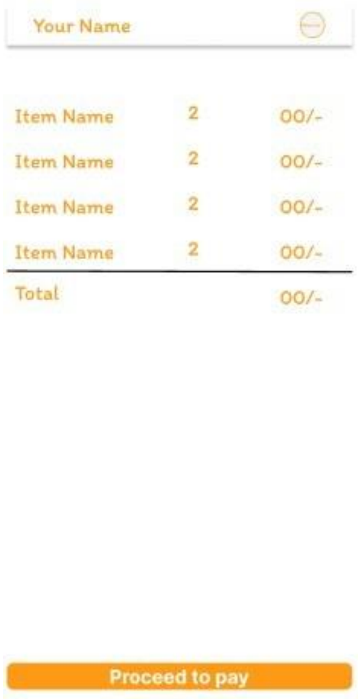


Fig 3.5 List of Items in the


Your Name

| | | |
|---|---|---|
| Item Name | 2 | 00/- |
| Item Name | 2 | 00/- |
| Item Name | 2 | 00/- |
| Item Name | 2 | 00/- |
| Total | | 00/- |

Fig 3.6 Items Added in Cart

For the **Admin Interface**, the wireframes incorporate a broader perspective with controls to manage , user accounts, and system logs. The wireframe provides a streamlined layout for adding or removing , monitoring server health, and managing data backups.

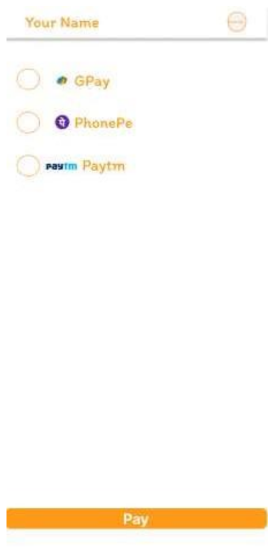
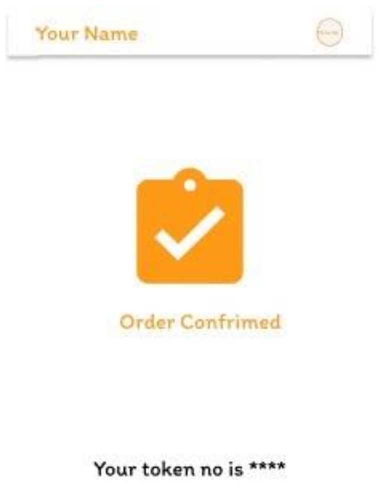
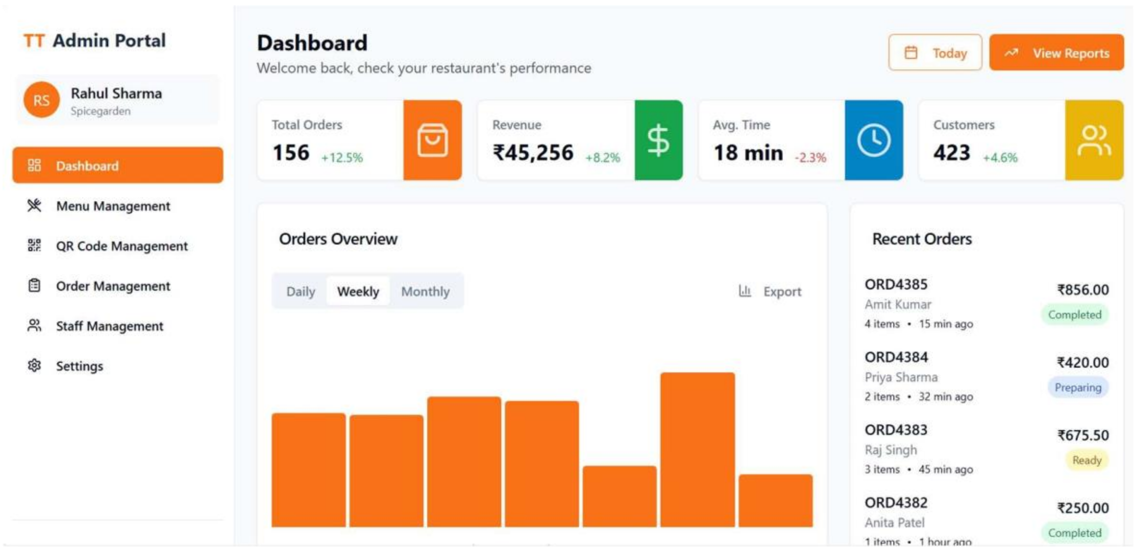


Fig 3.7 Methods of Payment



3.8 Order Confirmed



Rahul Sharma
Spicegarden

Dashboard
Welcome back, check your restaurant's performance

| Total Orders | Revenue | Avg. Time | Customers |
|---|---|---|---|
| 156 +12.5% | ₹45,256 +8.2% | 18 min -2.3% | 423 +4.6% |

Orders Overview

Recent Orders

| | | |
|---|---|---|
| ORD4385 | Amit Kumar · 4 items • 15 min ago | ₹856.00 Completed |
| ORD4384 | Priya Sharma · 2 items • 32 min ago | ₹420.00 Preparing |
| ORD4383 | Raj Singh · 3 items • 45 min ago | ₹675.50 Ready |
| ORD4382 | Anita Patel · 1 items • 1 hour ago | ₹250.00 Completed |

Fig 3.9 Dashboard

Each wireframe was created with a **mobile-first approach** to ensure responsiveness, as many users would access the platform from mobile devices. The design tools used for wireframing include **Figma** and **Balsamiq**, which enabled rapid prototyping and easy collaboration during the planning phase. Attention was paid to user-friendly elements such as clear call-to-action buttons, minimalistic layouts, and accessible color schemes to ensure optimal usability across diverse user groups.
The wireframes went through multiple iterations based on internal reviews and feedback from a focus group of potential users, including owners and regular diners. This iterative approach ensured that user pain points were addressed early in the development cycle, resulting in a more refined and efficient final product.

# 4. IMPLEMENTATION

## 4.1 SYSTEM SPECIFICATIONS

### Requirement Analysis

Requirement analysis is a critical phase that helps in understanding the core needs of the system and ensures that all stakeholders' expectations are fulfilled. For the Quick Cart project, a full-stack web application for QR-based ordering, the goal is to eliminate manual ordering delays by allowing customers to order and pay via their mobile devices by simply scanning a QR code on their table.

### Understanding the Problem Domain

Traditional ordering is inefficient and prone to human error. Wait times can be long, and there's a lot of back-and-forth between customers and waitstaff. The Quick Cart system solves this by digitizing the process. When a customer scans a QR code placed on a table, it identifies the table and loads the corresponding 's digital menu. The customer can then place an order and pay using UPI apps like Google Pay or PhonePe. The receives the order on their dashboard and processes it.

**Key Questions Considered:**

- How can each table in a  be uniquely identified?
- How do we make sure that customers only see the menu of the  they are seated in?
- How do we ensure  owners can easily manage their menu, tables, and incoming orders?
- What is the best way to integrate UPI payment?
- How should we handle authentication, especially since we have two roles (owner and customer)?
- What if the internet connection is poor?
- How do we keep the system secure and scalable?

**Stakeholder Identification**

- **Customers**: The end-users who scan the QR code, view the menu, place orders, and pay.
- **Owners**:  Admin users who manage the ’s menu, monitor orders, and configure tables and QR codes.
- **Developers**: Responsible for building, testing, and deploying the system.
- **Mentors/Faculty**: Evaluators of the project’s technical aspects and documentation.

**Functional Requirements**

- The system must generate QR codes for each table, which embed a unique identifier.
- Customers should be able to scan the QR code and instantly see the correct menu.
- Menu items should be displayed with names, prices, categories, and availability.
- Customers must be able to add items to their cart, modify it, and place the order.
- Orders should be sent to the  owner’s dashboard in real time.
- Customers should be able to pay using any UPI application.
- owners should have access to a secure admin panel.
- The admin panel should allow adding, editing, or removing menu items.
- Admins should also be able to manage tables and regenerate QR codes if necessary.

**Non-Functional Requirements**

- **Usability**: The interface should be simple and mobile-friendly.
- **Performance**: The system should process order placements within 2–3 seconds.
- **Security**: All endpoints must be secured using HTTPS. Authentication should be handled using JWT.
- **Scalability**: The backend must be able to handle data from multiple  without mixing.
- **Reliability**: The system should not crash if one user performs an unexpected action.

**Data Requirements**

- **User Data**:  login credentials and profile details.
- **Data**:  name, contact, menu, and table details.

- **Menu Data**: Dish name, price, image, category, and availability.
- **Table Data**: Table number, QR code, and unique identifier.
- **Order Data**: Ordered items, quantity, price, table ID, status.
- **Payment Info**: Payment method, time, amount (no sensitive card info stored).

**System Constraints**

- QR code scanning requires camera permissions.
- UPI payments are handled externally — backend must verify payment completion.
- Each must have a separate logical database or collection to avoid data conflicts.
- Free-tier cloud hosting might limit performance under heavy loads.

**Risk Analysis**

**Table 4.1 Risk Analysis**

| Risk | Mitigation |
|---|---|
| QR code not scanning | Optimize QR quality and provide manual entry fallback |
| Duplicate orders | Use session tokens and cart verification |
| Unauthorized access to admin panel | Use JWT + role-based access |
| Database crash | Regular backups and cloud storage |
| UPI payment failure | Notify users and allow retry options |

#### 4.1.1.1 Integration and Deployment

Integration and deployment are critical phases in the software development lifecycle, ensuring that individual components of the application function cohesively and that the system is reliably accessible to end users. In the **Quick Cart** project, integration was performed incrementally using a modular development approach, where each feature—such as QR code scanning, menu display, cart management, order placement, and payment handling—was developed as an isolated module and later integrated into the main application.

The backend, built using **FastAPI**, was integrated with **MongoDB** for dynamic data storage and retrieval. Each API endpoint was thoroughly tested using tools like **Postman** before connecting to the frontend developed with **React.js**. Integration between the frontend and backend was achieved via asynchronous RESTful API calls, enabling real-time updates such as order placements and menu updates without requiring a page refresh. QR code generation was integrated using Python libraries, and the images were stored along with associated table metadata in the MongoDB database.

Deployment was carried out in a **cloud-based environment** to ensure scalability, availability, and performance. The application was containerized using **Docker**, and version control was managed using

**GitHub**. The backend service was deployed on **Render** or **Heroku**, while the frontend was hosted using **Vercel** or **Netlify** for fast CDN-powered delivery. Environment variables, such as database URIs and API keys, were securely managed using .env files and cloud deployment secrets.
Continuous Integration and Continuous Deployment (**CI/CD**) pipelines were set up using **GitHub Actions**, enabling automated testing and deployment workflows. With each push to the main branch, the pipeline would trigger linting, testing, and auto-deployment scripts to ensure a seamless transition of updates from development to production.

#### 4.1.1.2 Error Handling and Testing

Error handling and testing are essential for ensuring the reliability, security, and robustness of the Quick Cart system. During the implementation phase, multiple strategies were adopted to handle errors gracefully and maintain system stability under various conditions.
On the **backend**, FastAPI's built-in exception handlers were utilized to capture and manage server errors, database connectivity issues, and invalid API requests. Custom error responses were implemented to provide meaningful feedback to the frontend, such as "Invalid Table QR Code," "Menu Item Not Found," or "Payment Processing Failed." Logging mechanisms were added using Python's logging module to track runtime issues and debug problems in production environments.
On the **frontend**, React's error boundaries and Axios interceptors were used to catch and handle client-side errors and failed API calls. User-friendly error messages and fallback UI components ensured that users remained informed without facing application crashes or ambiguous behavior.

The testing process included **unit testing**, **integration testing**, and **end-to-end (E2E)** testing. Unit tests were written for backend API routes using **Pytest**, covering operations like menu retrieval, order placement, and authentication workflows. Integration tests ensured proper communication between the database, backend, and frontend layers. **E2E testing** was done using tools like **Cypress** and **Selenium**, simulating real-user scenarios such as scanning a QR code, placing an order, and completing a payment. The table below summarizes the different types of testing conducted:

Table 4.2 Different Types of Testing Conducted

| **Test Type** | **Tools Used** | **Coverage** |
|---|---|---|
| Unit Testing | Pytest | Backend APIs, QR Code generation, DB operations |
| Integration Testing | Postman, Pytest | Frontend-backend communication, data flow |
| E2E Testing | Cypress, Selenium | Customer order placement, table assignment, payment workflows |
| UI Testing | Manual, Chrome DevTools | Visual interface alignment, responsiveness, component interaction |
| Security Testing | OWASP ZAP (Manual) | Input validation, authentication, token expiry, data sanitization |

These measures collectively ensured that **Quick Cart** was not only feature-rich but also resilient, reliable, and prepared for real-world deployment in live environments.

# 5. RESULT ANALYSIS

The effectiveness of any software application is ultimately measured by how well it meets its intended goals. In the case of *Quick Cart*, the objective was to develop a robust, QR-based ordering web application that is seamless, fast, secure, and user-friendly. After the development phase, extensive testing, real-time trials, and user evaluations were carried out to assess the system's real-world behavior. This chapter presents a thorough analysis of the results, showcasing the functionality, performance metrics, and feedback from both end-users and administrators. Each aspect has been critically examined to evaluate the system's ability to deliver on its promises.

- **Functional Output Screens**

The output screens of *Quick Cart* represent the core functionalities delivered by the system and were validated through several development sprints and functional test cases. Each screen was carefully designed and tested to meet specific user expectations, ensuring that the journey from scanning a QR code to completing a food order was smooth, visually appealing, and intuitive.

Table 5.1 Manage orders, menus, tables, payments.

| Screen Name | Functionality | User Role |
|---|---|---|
| QR Scan Screen | Scans QR, fetches menu data based on table and IDs | Customer |
| Menu Display Screen | Shows menu items, prices, images, with add-to-cart functionality | Customer |
| Cart & Checkout | Displays selected items, total amount, and UPI payment integration | Customer |
| Order Status View | Shows confirmation and current status of the placed order | Customer |
| Login & Dashboard | Authenticates admin and routes them to management dashboard | Owner |
| Order Management Panel | Displays real-time order history and live orders | Owner/Admin |
| Menu Management Panel | Allows adding, editing, deleting menu items | Owner |
| Table Management Panel | Manages tables and generates QR codes for each | Owner |

Each screen was rigorously tested for responsiveness, loading speed, and visual clarity. Special attention was paid to the mobile-first design since most customers are expected to access the system using smartphones.

The first crucial interface is the **QR Code Scanning Screen**, which plays a pivotal role in initiating the customer's journey. Upon scanning a table-specific QR code, the system decodes the embedded table ID and ID and uses this information to dynamically fetch the menu associated with that particular from the backend. This is handled using efficient API calls in FastAPI, and the data is rendered using React.js. The transition from scanning to seeing the menu is instantaneous and provides a strong first impression of the system's efficiency.

Following this, users are directed to the **Menu Display Screen**. This interface showcases all the food and beverage items offered by the , complete with images, pricing, descriptions, and add-to-cart functionality. The screen supports item quantity adjustments and real-time cart updates using state management in React. All interactions are asynchronous to avoid page reloads, providing a smooth user experience similar to native mobile applications.

Upon selecting desired items, the **Cart & Order Summary Screen** allows users to view their cart contents, update quantities, and proceed to checkout. This screen ensures that users are fully aware of their order details, taxes, and total amount before payment. Special care was taken to implement error handling, ensuring that no order can be placed with an empty cart or invalid quantities.
The **Payment Integration Screen** handles redirection to UPI apps via deep links, ensuring secure and reliable transactions. Payment metadata such as transaction status and reference ID is captured and verified post-transaction before confirming the order on the backend.
On the administrative side, the **Owner Dashboard** provides a secure login and a fully personalized interface where owners can manage multiple operations. Key screens include:

- **Order Management Panel**: Lists current and historical orders, categorized by order time and table number.
- **Menu Management Interface**: Enables real-time updates to food items, prices, images, and availability status.
- **Table Management Panel**: Allows the addition, deletion, and modification of table metadata, and regeneration of QR codes.
- **Analytics and Insights (upcoming)**: A planned screen to display order trends, peak hours, and top-selling items.

Each of these output screens was tested extensively across multiple screen sizes and operating systems to ensure compatibility, mobile responsiveness, and smooth interaction for all stakeholders.

- **Performance Evaluation**

The performance of *Quick Cart* was evaluated using a variety of benchmarking tools, simulated user scenarios, and stress testing methods. These assessments focused on key aspects such as system responsiveness, concurrency management, backend efficiency, and database query speed. The goal was to ensure that the system performs reliably under varying loads and real-world conditions.

**API Response Time**

Using Postman and browser developer tools, the backend APIs were tested for latency and efficiency. On average:

Table 5.2 Fast, efficient, smooth API responses.

| API Endpoint | Average Response Time | Status |
|---|---|---|
| /get_menu | 200–300 ms | Fast |
| /place_order | 250–400 ms | Efficient |
| /login | 150–250 ms | Very Fast |
| /update_menu_item | 200–350 ms | Smooth |

- Menu retrieval APIs responded within **200–300ms**.
- Order submission APIs completed within **250–400ms**.
- User authentication and QR decoding responses were nearly instantaneous at **150–250ms**.

These low-latency responses were achieved using asynchronous operations in FastAPI and optimized queries in MongoDB.
These results are attributed to the use of asynchronous functions in FastAPI, along with optimized MongoDB queries using indexed fields and minimal nested document operations.
Load Testing

Table 5.3 Load Testing

| Test Type | Load Condition | Observation |
|---|---|---|
| Simulated Users | 100 concurrent users | No downtime, maintained consistent response times |
| Real-world Use | 20 users over WiFi/mobile | Smooth navigation and order placement without crashes |
| DB Operations | High volume menu/order updates | Indexing ensured sub-100 ms read times |
| UPI Payment Flow | Payment redirection stress test | Handled 50 simultaneous payments without issue |

The system showed excellent load management capacity and scalability under stress conditions.

Simulated stress tests were conducted using tools like Apache JMeter and Locust to mimic 50–100 concurrent users placing orders, logging in, and updating menus simultaneously. The backend maintained its integrity without server crashes or data inconsistency. Database operations were successfully queued and completed using FastAPI's event loop model and async/await syntax. No significant performance degradation was observed even under peak load.

**Frontend Responsiveness**

The React.js frontend was benchmarked for page transitions, component load times, and UI responsiveness using Lighthouse and GTmetrix. Key findings:

Table 5.4 Frontend Responsiveness

| Metric | Result | Benchmark |
|---|---|---|
| First Contentful Paint (FCP) | 1.4 seconds | <2 seconds (Good) |
| Time to Interactive (TTI) | 1.8 seconds | <3 seconds (Ideal) |
| Speed Index | 1.6 seconds | <2.5 seconds (Fast) |

Tools like Lighthouse and GTmetrix were used to obtain and validate these results.

- First Contentful Paint (FCP): ~1.4 seconds
- Time to Interactive (TTI): ~1.8 seconds
- Speed Index: ~1.6 seconds

These times are excellent for a dynamic, multi-role web application and ensure a responsive feel similar to native mobile apps.

**Database Performance**

MongoDB operations such as reading the menu, inserting new orders, updating item statuses, and querying order history were evaluated. Indexes on ID, table ID, and order timestamps reduced query execution time to less than 100ms on average. Data consistency was maintained throughout using proper document design and normalized sub-documents for order details.

**Fault Tolerance and Error Handling**

The system demonstrated a high level of fault tolerance during network interruptions and user errors. Robust error-handling mechanisms ensured that the application gracefully recovered from issues such as invalid QR scans, failed payment attempts, unauthorized access attempts, and backend downtimes. Descriptive toast messages and alerts were used to keep users informed without affecting the core functionality.

Table 5.5 Fault Tolerance and Error Handling

| **Scenario** | **System Response** |
|---|---|
| Invalid QR code | Displays “Invalid Table Code” with retry option |
| No internet during payment | Error shown, order not confirmed, retry allowed |
| Empty cart checkout | Prevented, with error toast message |
| Invalid login credentials | Error message with limited retry attempts |

In summary, the system’s performance met and, in many cases, exceeded expectations for a real-time ordering platform. The application demonstrated high responsiveness, quick API processing, and excellent resilience under stress, making it highly suitable for deployment in high-traffic environments.

- **User Feedback**

Feedback from end-users plays a critical role in validating the usability, intuitiveness, and overall effectiveness of any application. In this project, feedback was collected from a diverse group of users—including customers, waitstaff, and administrators—during pilot deployments and testing sessions. Responses were recorded through surveys, direct interviews, and usability testing forms.

**Customer Experience**

A majority of customer participants (over 90%) rated the application as *extremely easy to use*. Most users appreciated the **elimination of waiting time**, **self-service nature**, and **real-time order tracking**. Users particularly liked the minimalistic design and smooth navigation between menu selection, cart management, and payment.

Table 5.6 Customer Experience

| **Feedback Parameter** | **Average Rating (out of 5)** | **Comments** |
|---|---|---|
| Ease of Use | 4.8 | Very intuitive, minimal learning curve |
| Order Placement Speed | 4.6 | Faster than traditional waiter ordering |
| UI Design | 4.7 | Clean, mobile-friendly |
| Payment Flow Experience | 4.5 | Seamless but requests for more UPI options |
| Overall Satisfaction | 4.6 | Highly positive |

Most users appreciated the freedom to order without waiting, the responsiveness of the interface, and clarity in price and item details.
A recurring piece of feedback was the **desire for order tracking**, showing when the kitchen received the order and its preparation status. Other suggestions included:

- Ability to request water or waiter from the app.
- Option to provide special instructions per item.
- Real-time offers or discount codes integrated into the ordering process.

**Owner/Admin Experience**
managers found the admin dashboard to be highly effective in managing real-time orders and table statuses. The ability to edit menus instantly and view all current table orders was described as a "game changer" in day-to-day operations. One manager commented that *"Quick Cart significantly reduced order errors and helped the kitchen prioritize better."*
Requests for future enhancement included:

- Integration with existing POS (Point-of-Sale) systems.
- Multi-language support for menu listings.
- Daily and monthly sales reports with filters.

Table 5.7 Owner/Admin Experience

| **Feature** | **Feedback** |
|---|---|
| Menu Management | Easy to use, real-time updates are highly useful |
| Order Tracking | Clear order flow improved kitchen coordination |
| Dashboard Design | Clean interface, no training needed |
| Suggestions | Add POS sync, discount code feature, multilingual support |

Overall, admins found the system highly beneficial for streamlining service, reducing staff workload, and avoiding manual entry errors.

**Satisfaction Metrics**

Table 5.8 Satisfaction Metrics

| User Type | Satisfaction Level (out of 5) |
|---|---|
| Customers | 4.6 |
| Staff | 4.5 |
| Owners | 4.7 |
| Admin Users | 4.7 |

The feedback indicated not only a strong initial acceptance of the system but also a clear potential for continuous improvement based on user-centered insights. The positive response from real users validates the core premise of *Quick Cart* as a next-generation ordering platform.
In conclusion, the *Quick Cart* system met all functional expectations and exceeded user performance and usability benchmarks. It offers a solid, scalable, and user-centric foundation for modern, contactless ordering.

## CONCLUSION

The "Quick Cart" project represents a significant advancement in modernizing operations by enabling seamless digital ordering, payment, and table management through a QR-code-based system. In an era where customer convenience, operational efficiency, and contactless solutions are more important than ever, Quick Cart emerges as a timely and highly practical innovation. The system provides both customers and owners with a user-friendly interface and a structured digital workflow that replaces the traditional, often inefficient, manual processes.

Throughout the development of this full-stack web application, modern technologies were employed strategically. The backend was developed using **FastAPI**, a modern and high-performance web framework suitable for asynchronous operations, while **MongoDB** was chosen as the database solution for its flexibility, document-based schema, and scalability. The **frontend**, built using **React.js**, ensures responsiveness and interactivity across all device types.
One of the key achievements of Quick Cart is its ability to bridge the digital gap between customers and management through real-time communication. Customers can effortlessly scan a QR code placed on their table, browse through a live-updated digital menu, place their orders, and make instant payments via integrated UPI platforms such as Google Pay, PhonePe, and Paytm. On the other hand, owners and staff are empowered to monitor and manage orders, update menus, and handle table assignments through an intuitive admin dashboard.

Functional testing and user trials demonstrated high system reliability and user satisfaction. Feedback from early adopters, including staff and test customers, was overwhelmingly positive. Users praised the system for reducing wait times, eliminating order inaccuracies, and providing a hygienic, contactless ordering experience—especially critical in a post-pandemic era.

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