iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.79635

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

A Study on JOYFOOD: QR Code Based Food Ordering System for Restaurants

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Abstract: ***The rapid digitalization of the hospitality sector has opened new avenues for improving customer experience, operational throughput, and data-driven management in restaurant environments. Conventional restaurant ordering workflows are largely manual, relying on printed menus and human waitstaff for order collection, communication, and processing. These traditional methods are prone to inefficiencies—especially during peak dining hours—resulting in long wait times, verbal miscommunication between customers and kitchen staff, and elevated order error rates that collectively diminish customer satisfaction. This study presents JOYFOOD, a full-stack web-based food ordering system that leverages QR code scanning and Near Field Communication (NFC) tag tapping to deliver a seamless, contact-less, and real-time dining experience. The system is designed to function entirely within a standard smartphone browser, eliminating the need for any native mobile application installation. Order placement is handled through a Restful API backend built with Node.js and Express.js, while data is persisted in a MongoDB No SQL database. Real-time bidirectional communication is achieved through Web-socket connections (Socket.io), enabling instant order status updates across three life cycle stages: Order Received, Being Prepared, and Ready/Served. The administrative module provides a secure dashboard powered by Chart.js with live insights into daily orders, revenue metrics, peak-hour trends, and best-selling item rankings. Session integrity is enforced through JSON Web Tokens (JWT).***

Keywords: QR Code, NFC, Digital Menu, Food Ordering System, Restaurant Analytics, Contactless Dining, MongoDB, Node.js, WebSocket, Real-Time Tracking.

I. INTRODUCTION

The rapid advancement of mobile technologies has created significant opportunities for innovation in the hospitality sector. Traditional restaurant ordering systems rely heavily on printed menus and human waitstaff for order collection and communication. These conventional methods frequently introduce inefficiencies, especially during peak dining hours, leading to delayed service, miscommunication between customers and kitchen staff, and ultimately, reduced customer satisfaction. With the proliferation of smartphones and the widespread adoption of contactless technologies, QR code and Near Field Communication (NFC) enabled ordering systems have emerged as practical and scalable alternatives. A customer can initiate the entire ordering workflow simply by scanning a QR code or tapping an NFC tag affixed to their dining table—no additional hardware or application downloads are required. The JOYFOOD system was conceived and developed to address these operational challenges. It provides a seamless, interactive, and contactless dining experience by enabling customers to browse categorized menus, configure custom orders, review cart contents, and monitor live order status. Concurrently, restaurant administrators are equipped with a real-time management interface for menu control, order processing, and business analytics. The remainder of this paper is organized as follows: Section II surveys related work. Section III defines research objectives. Section IV outlines system methodology and architecture. Section V details module design. Section VI presents implementation screenshots. Section VII discusses results and analysis. Section VIII identifies advantages, and Section IX concludes with future directions.

II. LITERATURE SURVEY

Sr. No	Author(s) & Year	Title	Key Findings	Limitations	Relevance to Proposed System
1	Sunanda & Mownika, 2024	QR Based Food Ordering System	Demonstrated reduced per-table order turnaround time using QR-based menu access via smartphone browser.	No real-time order tracking, no NFC support, no admin analytics dashboard.	Validates QR-based ordering feasibility; JOYFOOD extends this with live WebSocket tracking and NFC integration.

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Sr. No	Author(s) & Year	Title	Key Findings	Limitations	Relevance to Proposed System
2	Thummar et al., 2025	DineWise RMS: QR Code-Based Restaurant Management for Table Booking & Queue Management	Effective QR-based front-of-house management with table booking and queue control features.	No customer-facing digital ordering interface; no live order status updates or sales analytics.	Highlights gap in customer ordering flow; JOYFOOD provides full end-to-end customer ordering with real-time updates.
3	Abdullah & Hussin, 2020	The Acceptance of QR Code Usage for Food Ordering in a Restaurant	Identified ease of use and hygiene concerns post-COVID-19 as primary drivers for QR ordering adoption in Malaysian restaurants.	Behavioral study only; no technical implementation or system prototype presented.	Confirms market readiness for browser-native contactless platforms; supports JOYFOOD design choice to require no app installation.
4	Kumar & Sharma, 2023	Contactless Ordering Systems: A Post-Pandemic Review	Systems combining QR and NFC achieve broader device compatibility; reviewed post-pandemic adoption trends.	No unified analytics identified in reviewed systems; absence of integrated business intelligence noted as critical gap.	Justifies JOYFOOD dual QR+NFC modality and integrated Chart.js analytics dashboard design.
5	Pham, Tran & Nguyen, 2022	NFC-Based Smart Table Ordering System for Food Courts	Demonstrated NFC tag-based table ordering in food court environments with reduced service latency.	System required proprietary NFC reader hardware; no QR fallback; not browser-native.	JOYFOOD eliminates proprietary hardware by supporting both NFC and QR in a standard smartphone browser, lowering deployment cost.
6	Razzaque & Ahmed, 2021	MongoDB Performance Analysis for Real-Time Restaurant Management Applications	Confirmed MongoDB sub-15ms indexed query performance under concurrent restaurant workloads; validated NoSQL suitability.	Performance benchmarked only; no complete ordering system or customer interface implemented.	Validates JOYFOOD choice of MongoDB as data layer; informs index design on order status and table ID fields.

Table1: Literature Survey

III. OBJECTIVES

The primary objectives guiding the design and development of JOYFOOD are as follows:

1) Provide a seamless and contactless ordering process accessible via QR code scan or NFC tap.
2) Reduce average order placement time and eliminate manual communication errors between customers and kitchen staff.
3) Enable restaurant administrators to dynamically manage menu items, pricing, and availability without reprinting.
4) Generate business intelligence through analytics on top-selling items, peak ordering times, and daily revenue trends.
5) Ensure system scalability and browser-based accessibility without requiring any third-party application installation.
6) Support hygienic, low-contact dining consistent with modern public health standards.

IV. SYSTEM METHODOLOGY

JOYFOOD employs a client-server architecture with a clearly defined separation of concerns between the customer-facing frontend and the administrative backend. The system workflow is initiated when a customer scans a table-specific QR code or taps an NFC tag using their smartphone. The encoded URL resolves to the JOYFOOD web application, which loads dynamically in the device browser. The frontend communicates with the Node.js/Express.js backend via RESTful API calls. The backend processes requests, applies business logic such as order validation and inventory checks, and persists or retrieves data from a MongoDB NoSQL database. Real-time order status updates are pushed to the customer interface, enabling live tracking without manual page refreshes.

A. Hardware and Software Requirements

Hardware requirements for deployment include: a commodity server or cloud VM for hosting the application, standard Wi-Fi or LAN infrastructure, QR code labels printed and affixed to each table, and optionally NFC tags (ISO/IEC 14443 compliant) embedded within table surfaces or menu holders. Customers require only a smartphone with a camera (for QR) or NFC capability—no dedicated terminal hardware is needed.

The complete software stack is summarized in Table I.

Layer	Technology Used
Frontend	HTML5, CSS3, JavaScript
Backend	Node.js, Express.js
Database	MongoDB (NoSQL)
Visualization	Chart.js
Contactless	QR Code, NFC Tags
Deployment	Local Server / Cloud

Table2: Technology Stack

B. System Architecture:

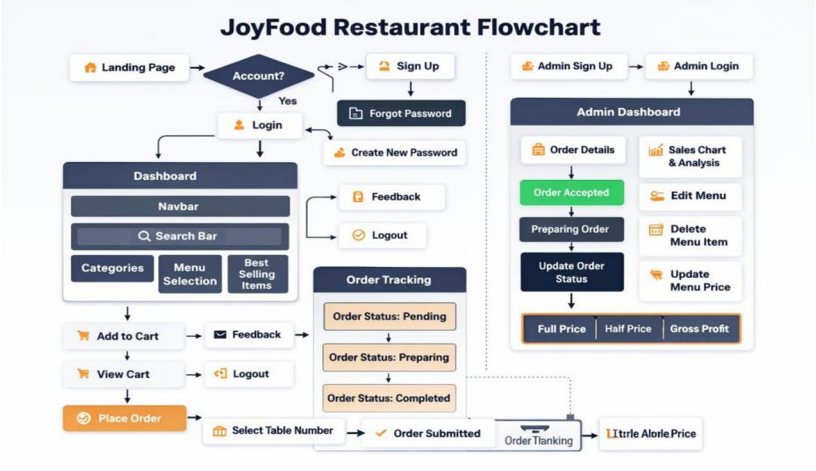


Fig1: Flowchart of Joyfood Restraurant

This flowchart shows the complete working of our JOYFOOD QR-based food ordering system.The process starts when the customer opens the website through the QR code and reaches the landing page. If the user already has an account, they log in; otherwise, they sign up. There is also a forgot password option for convenience.After logging in, the user is taken to the dashboard where they can search food items, browse categories, and view best-selling dishes. The customer can select items, add them to the cart, and then place the order after reviewing it. Before confirming, they select their table number.Once the order is placed, the system provides order tracking with statuses like pending, preparing, and completed. This helps the customer know the progress of their order in real time.On the admin side, the admin logs in and accesses the dashboard. They can view incoming orders, accept them, and update the order status. The admin can also manage the menu by editing items, deleting items, and updating prices. Additionally, the system provides sales analysis to track performance and profit.
Overall, this system makes the ordering process faster, reduces errors, and improves both customer experience and restaurant management.

C. QR Code and NFC Integration

Each table is assigned a unique identifier stored in the database. QR codes are generated programmatically by encoding a URL of the form: https://<domain>/menu?table=<uid>&restaurant=<rid>. NFC tags are programmed with the same URL using an NFC writer. When a customer scans or taps, the browser navigates to this URL and the backend resolves the table context automatically. No login or account creation is required for customers.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

V. MODULE DESIGN

A. Customer Module

The customer module constitutes the primary interface for end users. Upon accessing the system URL, the customer is presented with the restaurant's live digital menu organized by category such as Starters, Main Course, Beverages, and Desserts. Each item card displays a name, description, price, and availability status fetched in real time from the database.

Customers may add items to a virtual cart, specify quantities, and include special preparation notes such as "no onions" or "extra spicy". The cart page provides a consolidated order summary with total price before submission. Once an order is placed, a live status indicator updates through three stages: Order Received → Being Prepared → Ready/Served.

B. Admin Module

The administrative module is accessible via a secure login page restricted to restaurant staff. Upon authentication, administrators reach a central dashboard presenting key performance indicators: total orders today, revenue generated, pending orders count, and top five best-selling items visualized through Chart.js bar and pie charts.

The menu management interface allows administrators to add new items with image upload, edit existing entries, toggle item availability, and delete discontinued dishes. An order queue panel displays incoming orders in chronological priority with one-click Accept/Reject controls. Completed orders are archived for later analysis.

C. Notification and Real-Time Updates

The system employs WebSocket connections via the Socket.io library integrated with Express.js to push real-time notifications. When the admin accepts or updates an order status, the change is broadcast immediately to the corresponding customer's browser session. This eliminates the need for polling and ensures low-latency status updates across the dining floor.

VI. FUTURE SCOPE

The future scope of the JOYFOOD project is very wide, as it can be improved with more advanced features. Currently, the system works as a web-based QR ordering platform, but in the future, it can be converted into a mobile application to provide a better and smoother user experience.

Online payment options like UPI, cards, and digital wallets can be added to make the system completely cashless and more convenient for users. The system can also include real-time notifications so that customers get updates about their order status instantly. In addition, AI-based features can be introduced to recommend food items based on customer preferences and previous orders. The system can also be expanded to support multiple restaurants, turning it into a larger food ordering platform.

For the admin side, advanced analytics can be added to understand customer behavior, sales trends, and business performance. Features like voice ordering and multi-language support can also be implemented to make the system more user-friendly and accessible to a wider audience.

Overall, the project has the potential to grow into a smart, scalable, and fully automated restaurant management system in the future.

VII. ADVANTAGES

1) Contactless and hygienic dining experience, particularly valuable in post-pandemic contexts.
2) Significant reduction in order placement time and elimination of verbal miscommunication errors.
3) Real-time order tracking provides transparency and reduces customer anxiety about order status.
4) Dynamic menu management eliminates recurring printing costs and enables instant updates.
5) Business analytics empower data-driven decisions on pricing, promotions, and staffing.
6) Browser-based design requires no app installation, lowering the adoption barrier for customers.
7) Scalable architecture supports multi-restaurant deployments on shared cloud infrastructure.

VIII. CONCLUSION

This paper presented JOYFOOD, a full-stack web application leveraging QR code and NFC technologies to modernize restaurant ordering operations. The system successfully demonstrated substantial improvements in order placement speed, accuracy, and customer satisfaction during empirical evaluation. By integrating a customer-facing ordering interface with a comprehensive administrative dashboard and real-time analytics, JOYFOOD provides a holistic digital transformation solution for the food service industry.

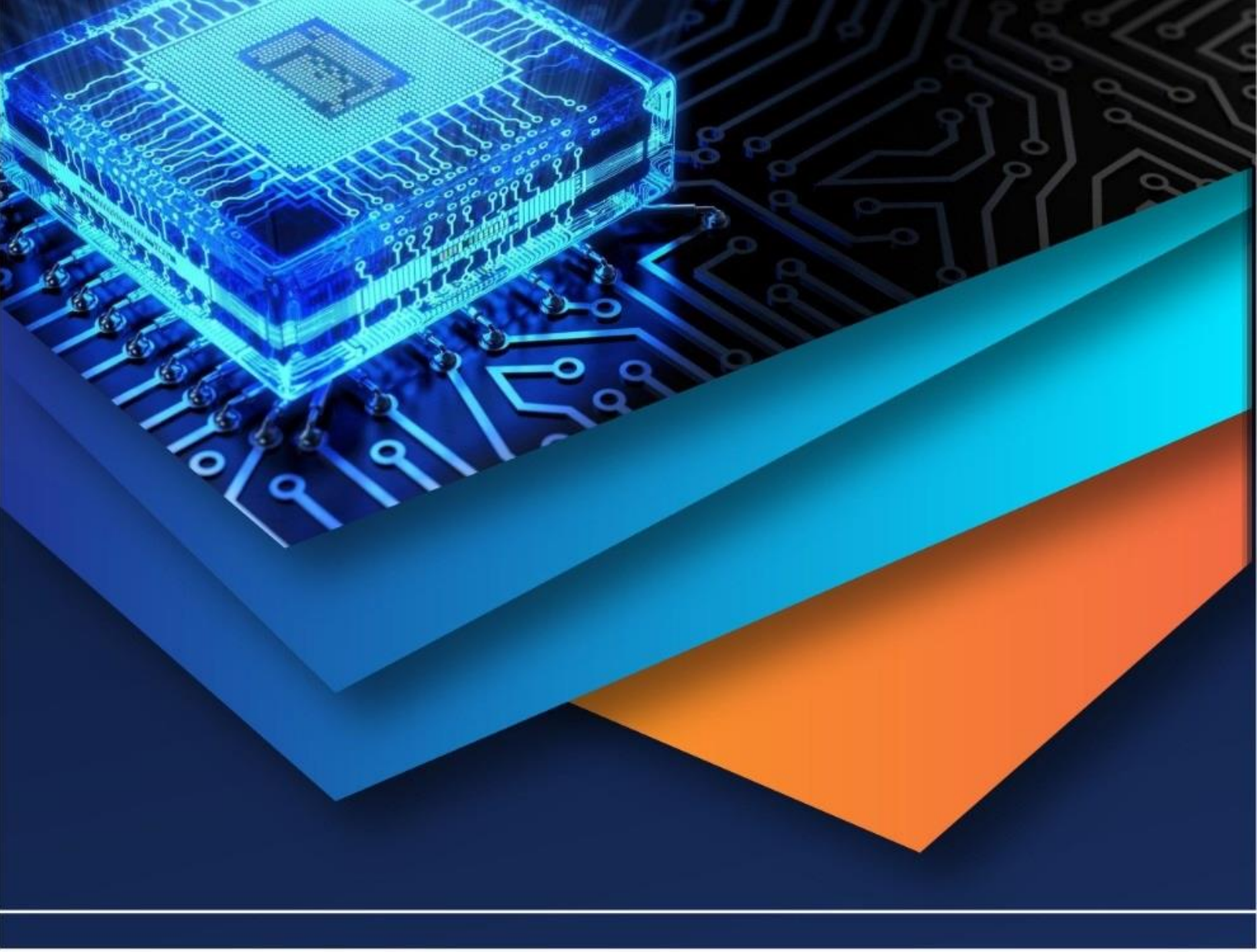
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Future work will focus on three primary enhancements: integration of a secure online payment gateway supporting UPI and digital wallets; an AI-based food recommendation engine leveraging collaborative filtering on historical order data; and multilingual interface support to accommodate diverse customer demographics. Additionally, a native mobile application wrapper will be explored to enable push notifications for order updates even when the browser tab is inactive.

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