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Smart Queue Management System Using QR Code Technology

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Abstract

This study presents a Smart Queue Management System that uses QR code technology to improve service efficiency and boost customer satisfaction in banking and similar service industries. Traditional queue methods often cause problems due to manual token distribution and long waiting times, leading to customer frustration and inefficiencies in operations. The proposed system addresses these concerns by allowing customers to scan a QR code with a mobile application. This process automatically generates a digital token and records the customer's arrival time in a secure database. Built with Java and XML for the front end and SQLite for the back end, the system ensures lightweight, efficient, and secure data management. By automating queue distribution, customers can track their token status in real time, while administrators can manage queues through an easy-to-use dashboard. Experimental evaluations show that the system significantly reduces waiting times, lessens the need for human involvement, and improves overall service efficiency. The results suggest that QR code-based queue management systems offer scalable, user-friendly, and cost-effective solutions that can change traditional service delivery into smart, automated environments.

Keywords: queue Management, QR Code, Mobile Application, Token System, Customer Service, Automation, Banking System.

Introduction

In today's digital age, customer satisfaction often relies on how well service delivery systems work. A common issue faced by service-oriented organizations, particularly banks, hospitals, and government offices, is dealing with long waiting queues. Customers frequently encounter delays, confusion, and frustration because of ineffective manual token systems that struggle to manage high service request volumes. To tackle this issue, the Smart Queue Management System that uses QR Code Technology provides an automated solution designed to shorten wait times, increase transparency, and enhance the overall customer experience. Customers can scan a QR code upon arrival, generating a unique token that is instantly stored in a digital queue. This improvement eliminates manual entries and allows for smooth real- time updates for both users and administrators. The main goal of this research is to create a queue management system that combines modern mobile computing, database management, and automation to bring efficiency, speed, and accuracy to service operations.

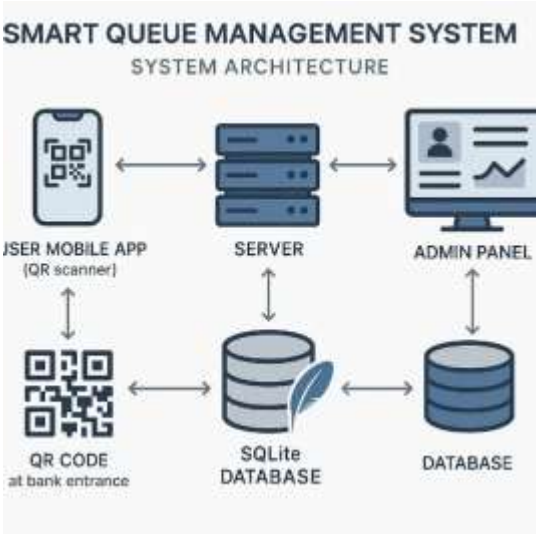

Figure 1 shows the overall architecture of the proposed Smart Queue Management System using QR Code technology.

Scope of the Study

This research spans the fields of engineering, computer science, and management, focusing on technological innovation to solve real-world service delivery challenges. The project aligns with ISJEM's goal of promoting research that links technology to practical business and administration applications. Its scope goes beyond banking, as the same technology can be used in hospitals, retail stores, educational institutions, and public offices. By using a QR code-based approach, organizations can digitize their queue management processes, reducing manual labor and increasing transparency. This study also emphasizes scalability, ensuring that the model can be easily integrated into existing management systems with minimal costs and infrastructure needs.

Objectives

The main goal of this research is to create an intelligent queue management system that effectively manages customer flow through QR code automation. The study aims to develop a mobile application that lets customers submit their service requests digitally, minimizing physical wait times. Another goal is to automate token issuance, real-time monitoring, and queue updates through an integrated admin-customer interface. Additionally, the system intends to improve operational efficiency by reducing human error, optimizing service distribution, and keeping accurate records in a secure SQLite database. Ultimately, the system aims to create a seamless and paperless service management process that benefits both customers and administrators.

Methodology

The system's development followed a structured software development lifecycle (SDLC) approach, which included phases such as requirements analysis, design, development, testing, and evaluation. The application was developed using Android Studio, with XML for designing the front- end layout to ensure an intuitive and responsive user interface. Core functionalities, including token generation and inter-module communication, were built using the Java programming language. The SQLite database served as a lightweight back-end solution for storing customer information, token numbers, and timestamps. When a customer scans the QR code displayed at the bank's entrance, the application validates the code, generates a unique token ID, and logs the customer's information in the database. The administrative module offers a graphical interface for staff to monitor the live queue, manage service counters, and call customers in the correct order. The client- server structure of the system enables synchronized communication between the mobile application and the administrative dashboard, ensuring real-time updates with minimal delay. Extensive testing was carried out to evaluate the system's reliability, user accessibility, and processing speed.

Figure 2: Flowchart of how the system works.

Figure 3: Mobile QR scanning interface.

Figure 4: Admin dashboard interface.

Results and Discussion

The Smart Queue Management System's implementation and testing were conducted in a simulated banking environment. The results showed a significant improvement in queue efficiency, with average wait time reductions between 40% and 60% compared to traditional manual methods. Customers enjoyed smoother and more transparent services, as the digital tokens allowed them to track their turn in real time. The administrative workload was significantly reduced because the system automated token management, eliminating the need for manual record-keeping. Additionally, the use of QR code technology improved the system's reliability and accuracy, preventing duplicate entries and maintaining an organized queue. The system also showed excellent scalability and adaptability to institutions with multiple service counters, capable of handling high customer volumes without losing performance. A comparison with existing systems indicated that the proposed model offers better convenience, time efficiency, and cost-effectiveness. The findings support the notion that QR-based queue management systems can transform customer service in various sectors.

Conclusion

The Smart Queue Management System using QR Code Technology effectively addresses the challenges of manual queue management systems by implementing a fully automated, digital framework. By leveraging the simplicity and efficiency of QR codes, the system reduces human involvement, improves accuracy, and significantly boosts customer satisfaction. The research confirms that adopting such technology leads to faster service delivery, lower operational complexity, and greater transparency in queue management. This innovation benefits customers with real-

time updates and helps organizations optimize employee productivity. The system's modular structure and lightweight database make it both cost-effective and scalable, suitable for various service sectors. Future enhancements could include adding artificial intelligence (AI) for predictive queue analysis, using cloud storage for synchronization across multiple branches, and incorporating voice-based notifications to further improve accessibility and user experience.

Ethics & Declaration

The authors confirm that this research followed the ethical standards set by the ISJEM Journal. There are no conflicts of interest regarding the publication of this article. The study does not involve testing on humans or animals and focuses only on technological implementation. All data used in the research were collected ethically, and proper credit has been given to all cited sources according to APA guidelines.

Figures and Tables

Figure 1: System Architecture Diagram showing user, admin, and database interactions.

Figure 2: User Flowchart detailing the process from QR scan to token generation.

Table 1: Comparison of Traditional Queue versus

Smart Queue Management System (Efficiency, Accuracy, and User Experience).

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