

Virtual Queue Management System with Application to Admission Processes

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Abstract—In many educational institutions and public service organizations, admission and service processes are still managed using physical queues and manual token systems. These traditional methods often lead to overcrowding, long waiting times, lack of transparency, and inefficient utilization of staff resources. This paper presents a Virtual Queue Management System (VQMS) designed to digitize and automate the queue handling process. The proposed system allows users to register remotely, generate queue tokens, track their real-time queue position, and receive notifications regarding their service turn. Administrators are provided with a centralized dashboard to monitor queue flow, manage priorities, and analyze performance statistics. The system is implemented using Python with Flask framework for backend processing, HTML, CSS, and JavaScript for frontend interfaces, and MySQL for data storage. Experimental evaluation shows that the system significantly reduces waiting time, minimizes manual intervention, improves transparency, and enhances overall operational efficiency. The proposed solution is scalable and can be adapted for use in educational admissions, hospitals, banks, and other service-based institutions.

Keywords — Virtual Queue Management, Admission Automation, Token System, Flask, Web Application, Real-Time Queue Tracking.

I. INTRODUCTION

Queue management plays a crucial role in institutions where a large number of users require service within a limited time. Educational admission processes, in particular, experience heavy congestion during counseling, document verification, and enrollment periods. Traditional queue systems require students to be physically present for long durations, leading to frustration, fatigue, and inefficiency.

With the advancement of digital technologies, there is a growing need to replace physical queues with virtual alternatives. A Virtual Queue Management System enables users to join a queue remotely, monitor their queue status in real time, and arrive at the service location only when required. This

approach reduces overcrowding and improves user experience.

This paper proposes a web-based Virtual Queue Management System that automates the admission queue process. The system ensures fairness, transparency, and efficiency while reducing administrative workload. It also provides analytics and reports that help institutions optimize resource allocation.

II. LITERATURE REVIEW

Several studies have been conducted on queue management systems in healthcare, banking, and government services. Digital Queue Management Systems (DQMS) have been shown to significantly reduce waiting times and improve customer satisfaction. Research on hospital outpatient departments indicates that virtual queues and appointment systems improve service throughput and reduce congestion.

However, most existing systems are domain-specific and not tailored for educational admission processes. Many lack real-time analytics, scalability, and integration with modern web technologies. Some systems also fail to address data security and role-based access control.

The literature highlights the importance of real-time queue visibility, automated notifications, and data-driven decision-making. Based on these findings, the proposed system is designed to address the limitations of existing solutions by providing a secure, scalable, and domain-adaptable virtual queue management platform.

III. PROBLEM STATEMENT

The existing admission queue management process in many institutions is manual and inefficient. Students must stand in long physical queues without

knowing their exact waiting time. Administrators struggle to control crowds, manage priorities, and maintain accurate records. Manual systems are prone to errors, delays, and lack transparency.

There is no provision for remote token generation, real-time queue updates, or automated notifications. The absence of analytics makes it difficult for institutions to analyze peak hours and improve future processes. Hence, there is a need for a digital queue management system that automates admissions, ensures fairness, and improves efficiency.

IV. PROPOSED SYSTEM

The proposed Virtual Queue Management System replaces physical queues with a digital platform accessible via web browsers. Users can register online or through kiosks and receive a unique queue token. The system continuously updates queue positions and estimated waiting times.

Administrators can manage multiple queues, prioritize specific cases, and monitor real-time status through a dashboard. The system supports notifications through SMS or email to inform users when their turn approaches. Secure authentication and role-based access control ensure data privacy and system integrity.

V. METHODOLOGY

The development of the system follows a structured methodology:

1. Requirement Analysis: Identifying user and administrator requirements.
2. System Design: Designing system architecture, database schema, and UML diagrams.
3. Implementation: Developing frontend and backend modules.
4. Testing: Conducting unit and integration testing.
5. Deployment: Hosting on a local or cloud server and monitoring performance.

The system uses Flask for backend logic, MySQL for data storage, and HTML, CSS, and JavaScript for frontend design.

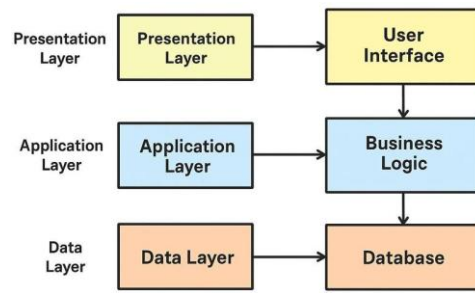


Fig.1.System Architecture

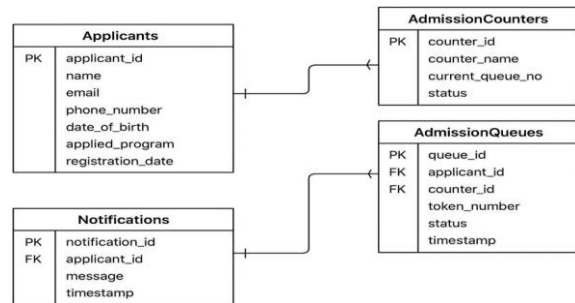


Fig.2.Use case diagram

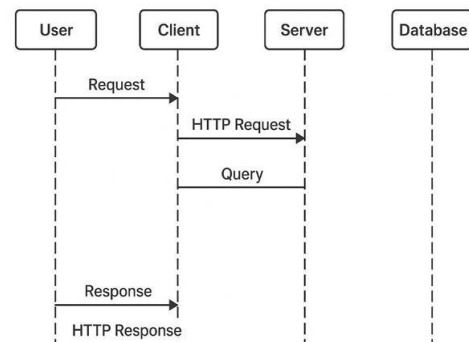


Fig.3.sequence diagram

VI. SYSTEM DESIGN

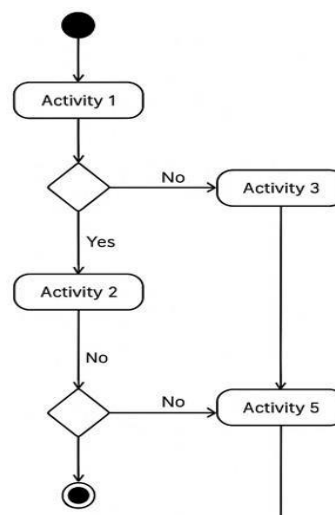


Fig.4.Activity diagram

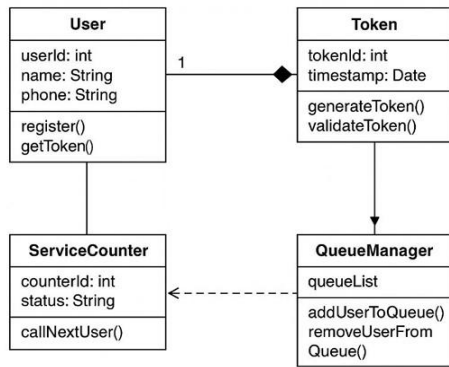


Fig.5.Class diagram

The system architecture consists of three layers: presentation layer, application layer, and data layer. The presentation layer provides interfaces for users and administrators. The application layer handles token generation, queue management, and notifications. The data layer stores user details, queue status, and logs securely.

VII. IMPLEMENTATION

The system is implemented using Python Flask framework for backend processing. Flask routes manage user registration, token generation, queue updates, and admin actions. The frontend is developed using HTML, CSS, and JavaScript to provide a responsive user interface.

MySQL is used as the database to store user information, tokens, queue status, and activity logs. Admin dashboards display real-time queue information and analytics. Notification services alert users about their queue status, reducing unnecessary waiting.

VIII. RESULTS AND DISCUSSION

The system was tested under simulated admission scenarios. Results indicate a significant reduction in waiting time and improved transparency. Users were able to track their queue position accurately, and administrators found it easier to manage queues.

The system effectively minimized overcrowding and reduced manual workload. Analytics generated by the system helped identify peak admission hours and optimize resource allocation.

IX. CONCLUSION

The Virtual Queue Management System successfully digitizes and automates admission queue handling. It

enhances user experience, improves operational efficiency, and ensures fairness. The system is scalable and adaptable for various service domains.

Future enhancements include mobile application integration, AI-based waiting time prediction, voice notifications for accessibility, and multi-campus support.

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REFERENCES

- [1] K. C. LAUDON AND J. P. LAUDON, MANAGEMENT INFORMATION SYSTEMS, 16TH ED., PEARSON, 2020.
- [2] R. STAIR AND G. REYNOLDS, PRINCIPLES OF INFORMATION SYSTEMS, CENGAGE LEARNING, 2020.
- [3] H. AL-SAMARRAIE ET AL., "A SYSTEMATIC REVIEW OF DIGITAL QUEUE MANAGEMENT," COMPUTERS IN HUMAN BEHAVIOR, VOL. 71, 2017.
- [4] G. KAUR AND S. AGGARWAL, "QUEUE MANAGEMENT SYSTEMS: A REVIEW," INTERNATIONAL JOURNAL OF COMPUTER APPLICATIONS, VOL. 174, 2021.
- [5] R. SHARMA AND S. BANSAL, "DIGITAL QUEUE SYSTEMS IN EDUCATION," JOURNAL OF EDUCATION AND PRACTICE, VOL. 11, NO. 21, 2020.