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Research Article

Smart Queuing and Appointment Management System for Client Services in Bulacan State University Bustos Campus

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ABSTRACT

Client service efficiency has been a key issue in academic institutions as the rise in student populations overburdens the administrative functions of institutions. To eliminate the issues of manual queuing and appointment systems, this paper has developed the Smart Queuing and Appointment Management System, the web-based system that targets the administration of Bulacan State University -Bustos Campus. The system is expected to simplify the flow of clients, decrease waiting time and improve service delivery by using automated queue management, online scheduling and real time monitoring of transactions. The project was designed in HTML, CSS, JavaScript, PHP, and MySQL and adhered to the Agile Software Development Life Cycle (SDLC) to guarantee iterative user-driven enhancement of the project. To measure the performance and acceptability of the system, the Technology Acceptance Model (TAM) and the ISO/IEC 25010:2023 Software Quality Standards were used, and the techniques were functionality, usability, reliability, and efficiency. The evaluation involved 50 respondents, who were recorded in terms of surveys and interviews, and they were a combination of students, administrative staff, and IT specialists. The result showed that the system had a general weighted mean of 4.59 according to ISO/IEC 25010, which is interpreted as Strongly Agree, and this shows a high-quality functionality, reliability and usability. Under TAM, the responses of staff and students were very positive and the weighted means of responses were 4.84 and 4.45, respectively. These findings indicate that the system is successfully used to increase administrative efficiencies, reduce congestion as well as client satisfaction. Generally, Smart Queuing and Appointment Management System offers a

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sound and viable solution in enhancing operations of the university services. The researchers suggest that it is necessary to improve the functioning of the system by introducing dynamic appointment scheduling and expanding this approach to other campuses of the BulSU.

Keywords: *Smart Queuing System, Appointment Management System, Client Service Efficiency, Web-Based Information System, University Administrative Services, Technology Acceptance Model (TAM), ISO/IEC 25010 Software Quality, Agile Software Development Life Cycle*

Introduction

As the education sector constantly faces the global rates of modern digitalization, the implementation of innovative technologies in academic organizations to improve the efficiency of operations and increase the interaction with clients grows as well. As student populations continue to grow and the demands on both service-providers and the overall services delivery to students heighten the need for fast, reliable, and convenient service delivery through systematic and intelligent service systems is more urgent than ever. In intercultural organizational situations as in the busiest administrative handling setting of the university, as there are various points of serving needed by few at the time, there are long queues and oppressive services are common, and thus, lead to time wastage, chaotic affairs, and consumer dissent.

On a more general scale, queuing systems have long been identified as necessary methods of optimizing service-related processes and reduce time on waste. As Aziz (2016) has clarified, shortening of the customer waiting time does not only increase customer satisfaction but also promote the long-term engagement and trust. Nevertheless, the conventional queuing systems which heavily rely on Manpower coordination and physical queue are simply unsuitable to the demands of modern services. Such obsolete solutions normally produce long queues, idle manpower, and misunderstanding on the part of customers who lack acquaintance on how products are serviced or their location.

In the recent years, smart queuing technologies have become one of the major innovations to overcome these challenges. Gazal, Hamouda, and Ali (2015) demonstrate that the use of intelligent queuing systems will greatly enhance levels of client satisfaction as service orders can be optimized, and the perceived waiting time can be reduced. More current studies further support these findings, highlighting improvements in smart queuing systems through cloud-based platforms, predictive analytics, and mobile-first architectures that improve scalability and performance in institutional provision environments (Borje et al., 2023; Dela Cruz et al., 2024; Kim et al., 2024). Responsive to these advancements and based on the needs of the Bulacan State University - Bustos Campus in particular, the given study suggests the Smart Queuing and Appointment Management System development.

The system was initially aimed at replacing the physical lines with the system of organized number arrangement in which walk-in clients had to be registered, but it has been recently updated to include an online appointment booking option which, within the context of the post-pandemic framework, takes the experiences of online service booking and technology-driven service experience trends. The appointment management module is a mandatory supplement to the system that allows clients to reserve the time of service before they use it via web app. This feature gives the client the potential to plan their trips very effectively, reduces the number of delays in the points of service and the staffs know and can foresee ensuing transactions. In combination with the smart queuing module, the system offers a single platform which synchronizes scheduled and walk-in customers in real-time. Potential clients can easily join queues by scanning the QR code displayed, or confirming an online

appointment, with administrators being able to monitor and control several service windows queue statuses.

The proposed system under this integration allows the removal of the chances of hand coordination of queues, elimination of line darkening, lessening crowding in corridors, and allowing frontline employees to concentrate more on the substantive transactions and less on queue management. The multiplication of live tracking with co-dependency appointments data results in an even smarter, data-driven system and service management process based on the idea of both efficiency and ultimately convenience in operation. As much as several academic institutions have started adopting digital queuing system, a single system to coordinate the monitoring of walk-in queuing and have an online system is lacking with most institutions. This juncture illustrates the need to have a system that would completely take care of the two in the same platform.

Despite the increasing adoption of digital queuing technologies in academic institutions, most current solutions focus completely on either walk-in queuing or online appointment scheduling. Very few systems deliver a unified platform capable of harmonizing both walk-in and appointment-based clients in real time. This lack of dual-mode incorporation often results in fragmented service workflows, unproductive prioritization, and unreliable client experiences. Addressing this gap, the primary involvement of this study is the development of a Smart Queuing and Appointment Management System that seamlessly integrates walk-in queuing and online appointment scheduling into a single, centralized platform. This dual-mode system allows real-time synchronization of client flow, progresses administrative coordination, and offers a more efficient and transparent service delivery model tailored for the operational background of Bulacan State University – Bustos Campus.

The study will introduce a model of Smart Queuing and Appointment Management System specifically designed to fit the opening layout of BulSU Bustos, thereby facilitating the enhancement of the administrative services offered by the university in the field, and offering a model to be easily applied in further situations to other branches of the university. Finally, the proposed system aims at the transformation in the interaction with clients in BulSU Bustos with the focus on the overall convenience, transparency, and satisfaction of all users. By merging and enhancing the concepts of automating queuing systems and scheduling of appointments, the research hopes to create an effective technology-based system of handling clients in institutions of learning.

Objective of the study

A smart queuing management system that streamlines client flow, improves service organization, and enhances the overall experience at the Registrar, Accounting, Admission, Dean's Office, Guidance Office, Library, and Cashier Office of Bulacan State University – Bustos Campus. To further elaborate this aim, the study seeks to fulfill the following objectives:

1. To design a user-friendly web-based queuing system that helps staff manage, verify, and organize both walk-in and scheduled clients efficiently.
2. To provide real-time monitoring of queues and client information to support both walk-in and scheduled transactions.
3. To automate the generation of queue numbers and allow clients to join queues either by scanning a QR code or through online appointment scheduling.
4. To evaluate the system's technical quality and user acceptance using the ISO/IEC 25010:2023 Software Quality Model and the Technology Acceptance Model (TAM).
    a. ISO/IEC 25010:2023
        – Functional Suitability
        – Performance Efficiency
        – Compatibility
        – Usability
        – Reliability
        – Security
        – Maintainability
        – Portability
    b. Technology Acceptance Model (TAM)
        – Perceived Usefulness (PU)
        – Perceived Ease of Use (PEOU)
        – Attitude Toward Using (ATU)
        – Behavioral Intention to Use (BI)

Review of Related Literature and Review of Related Studies

Some of the studies highlight the rising significance of automation and computerized systems to improve service delivery and customer satisfaction. Velasco et al. (2017) underscored the use of queuing management systems in lessening customer waiting time and enhanced operational flow in service-based settings. On the same note, Sarmiento and Mendoza (2018) created a computer-based queuing model that reduced the wait time and optimized the customer experience, which showed that digital technologies can facilitate the process of service transactions. Navarro (2020) has also contributed to it by demonstrating that the automation of queuing makes the experience more convenient and transparent and enables clients to keep track of the progress of their transactions in real-time. In a similar research, Rivera and Bautista (2019) performed an implementation of an online appointment system that optimizes the schedule and minimization of clients in the government offices and demonstrated that automated appointment features can highly reduce walk-in traffic. Perez et al. (2021) investigated the web-based monitoring of queues in school offices and found that students favored the systems with the opportunities of generating tickets, real-time status updates, and SMS messages. Such results can be attributed to the idea that queues need to be more user-friendly and transparent.

These conclusions are supported by international research also. Al-Shayea et al. (2020) addressed the application of smart technologies to keep the flow of clients managed with RFID and IoT-based queue monitoring, increasing its speed and precision. Pang et al. (2019) designed a mobile queuing system as an extension of the mobile system with QR codes to support remote registration and time tracking and minimized physical congestion. On the other hand, Ahmed and Karim (2020) paid attention to the integration of queuing systems and clouds databases which guarantee scalability and the safe processing of data.

All these studies together depict that smart queuing and appointment management systems are essential in the contemporary service sectors. Through real time monitoring, automation, and user and friendly interfaces, they minimize waiting times, efficiency of operations and client satisfaction. Based on these facts, the current research work at Bulacan State University - Bustos Campus has created a Smart Queuing and Appointment Management System that is specifically designed to suit the administrative offices of the university. The system combines online bookings of appointments and tickets via QR with real-time monitoring of activities in order to make the services provided to students and staff more efficient, transparent, and accessible.

Methods

This study employed a mixed-method research design supported by a system development process to comprehensively evaluate the Smart Queuing and Appointment Management System for Bulacan State University – Bustos Campus. The mixed-method approach integrated both quantitative and qualitative techniques to ensure a well-rounded assessment. Specifically, quantitative data involved of Likert-scale survey responses used to compute means and weighted means for ISO/IEC 25010 and TAM theories, while qualitative data included open-ended interview responses, user feedback during pilot testing, and observational notes that captured user experience, usability issues, and system interaction behaviors. Quantitative data were obtained through structured surveys measuring functionality, usability, reliability, and efficiency, following the ISO/IEC 25010:2023 Software Quality Model and the Technology Acceptance Model (TAM). Meanwhile, qualitative data were gathered through interviews, pilot testing, and observations, which provided insights into user experiences and perceptions of the system's practicality and user-friendliness.

The system development followed the Agile Software Development Life Cycle (SDLC), chosen for its iterative nature and focus on continuous improvement through user feedback. The process began with requirements gathering, where interviews and field studies among students and administrative staff identified issues in the existing manual queuing system, including long waiting lines and lack of coordination. During the design phase, tools such as Figma,

MySQL, HTML, CSS, JavaScript, and PHP were used to create interface layouts, prototypes, and database structures. Development proceeded through multiple sprint cycles, each implementing a specific feature like queue registration, online appointment scheduling, administrative dashboards, and client notification systems.

After each sprint, testing and evaluation were performed to ensure system performance met user requirements. Following stabilization, the system underwent pilot testing in selected administrative offices, where real users engaged with the system in actual operational settings. Feedback collected from this stage guided refinements in usability and system optimization. This methodological framework ensured that the resulting system was both technically reliable and responsive to user needs, providing a data-driven foundation for assessing the system's effectiveness in improving administrative efficiency, transparency, and client satisfaction.

Table 1. Total Respondents of the Study

Respondents	Number of Respondents
Staffs	9
Students	36
IT Expert	5
Total	50

The researchers collected data from 50 respondents who were 9 administrative staff members, 36 students, and 5 IT experts of Bulacan State University - Bustos Campus. This heterogeneous combination of players was also obtained in order to reflect the key stakeholders in the utilization and assessment of the suggested Smart Queuing and Appointment Management System.

Inclusion of the three groups of respondents guaranteed the system to be given a holistic approach in terms of development, usability, and efficiency of the system. The administrative personnel were selected on the basis of them having direct involvement in the queuing and appointment process in various offices, which include Registrar, Accounting, Cashier, Dean Office, Guidance and Library.

They were at a position to give such valuable information because of their experience of daily flow of clients such as system integration, speed and overall functionality. The students who are the main end-users of the system gave responses on the accessibility, ease of use, and satisfaction levels on how the system makes campuses transactions simpler. Finally, the IT specialists assisted in terms of professional evaluation and recommendations which helped meet the current standards of software development to check the architecture, security, and performance of the system. The various groups had their roles towards evaluation. The administrative staff evaluated the system according to how it would enhance delivery of services and the efficiency of workflow in university offices.

Their responses aided in the perception of the practicality of the system in normal administration systems. Having used university services quite often, the student respondents based their assessment of the system on its user interface, ease and efficiency in minimizing waiting time and physical congestion. The experiences they had depicted the effectiveness of the system in tackling the problems of inefficient manual queuing that had existed all through.

The IT professionals, conversely, worked as technical assessors, and made sure that the system complied with technical standards like the ISO/IEC 25010: 2023 Software Quality Model and Technology Acceptance Model (TAM) concepts. Their professionalism assisted in certifying the functionality, reliability, and scalability

of the system, which is necessary in the implementation of the system on a sustainable basis across the campus. This respondent sample in general allowed a well-rounded and complete assessment of the Smart Queuing and Appointment Management System. The researchers could also triangulate results by obtaining data of users who had varying levels of engagement the dimensional levels of operational, experiential, and technical levels, thereby enabling them to be objective in their data analysis.

The qualitative and quantitative data collected using these respondents enhanced the validity of these findings, as the overall efficiency of the system was rated in improving the effectiveness of the administration, reducing the queuing time, and increasing the transparency of the services. The diversity of the respondents also showed the wideness of the applicability of the system and its ability to serve not only the staff members of the university who ensure the appointment management, but the student population who access the services. This multi-perspective approach was confirmation that the suggested system is not only technologically sound, but also user-centered, practical and user-friendly to the needs of the proposed target users at the Bulacan State University - Bustos Campus. To analyze the data that will be gathered from the respondents, the researchers will use both percentage and weighted mean computations.

The percentage of specific responses will be calculated using the following formula:
Percentage Formula:

$$P = \frac{f}{n} \times 100$$

Weighted Mean Formula:

$$\bar{x} = \frac{\sum(w_i x_i)}{\sum w_i}$$

Where:

- P = Percentage
- F = Frequency of a specific response
- N = Total number of respondents

Table 2. Five Point Likert Scale Description

Scale Point	Scale Range	Remarks
1	1.00 – 1.80	Strongly Disagree
2	1.81 – 2.60	Disagree
3	2.61 – 3.40	Neutral
4	3.41 – 4.20	Agree
5	**4.21 – 5.00**	**Strongly Agree**

This Five-Point Likert Scale on table 2 displays the equivalent of the respondents and users feedback towards the capstone project. 5 = Strongly Agree, highest rating, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree, lowest rating.

To compute the average score for scaled responses, the weighted mean will be applied using the formula:

$$M = \frac{(X1 \times W1) + (X2 \times W2) + \cdots + (Xn \times Wn)}{n}$$

Where:

- **M** = Weighted Mean or Average
- $\mathbf{X_n}$ = Number of responses for a specific rating
- $\mathbf{W_n}$ = Assigned weight or value for each rating category
- **n** = Total number of responses for the question

Results

The results of the research study indicate that the developed Smart Queuing and Appointment Management System in Bulacan State University - Bustos Campus was effective in the way it solved the inefficiencies of the current manual queuing process. The initial research found out that the major problems included lengthy wait lines, ineffective communication between the staffs and clients, and absence of real time service update. The implementation of the proposed system saw the university improve tremendously in the flow of clients and coordinators of services. The inclusion of online booking, QR code queue registration, and real-time monitoring in the system substituted the physical queuing system with the contactless and automated process. Consequently, students and administrative employees complained of a much easier and clearer process with flattened waiting areas and decreased office overcrowding.

The high performance and acceptance of the system by users were confirmed through quantitative assessment of the system by the ISO/IEC 25010 Software Quality Model and Technology Acceptance Model (TAM). The system got a total weighted mean of 4.59 which is construed as Strongly Agree according to ISO/IEC 25010 meaning that the system has great functionality, reliability, and usability. Judging by the results of the TAM, the weighted mean rating of the respondents (students) was 4.45, and the rating of the system was 4.84 by staff respondents, all of which is rated as Strongly Agree. These ratings indicate that the users were well pleased with the system as it was useful and navigable. They further reported a high level of behavioral intent to reuse the system in future transactions, and this confirmed its perceived efficiency and the overall effectiveness in offering solutions to the issue of queuing and appointment management systems in the campus.

The user feedback analysis also demonstrated positive feedbacks on the features of the system and technological design. The walk-in clients greatly appreciated the QR code scanning feature since it saves paperwork and minimizes interactions when transacting business, and this is the much-needed innovation to operate in the safety of post-pandemic conditions. The live queue tracking and automatic notification systems improved accountability and interaction with the users, whereas the structural design of the modular system had enabled ease of aggregation to various administrative offices. also, HTML, CSS, JavaScript, PHP, and MySQL usage offered a solid base of a responsive and friendly web-based interface. In sum, the research findings have determined that Smart Queuing and Appointment Management System were relevant to improving administrative procedures, user satisfaction, and establishing a good precedent in the domain of digital transformation of service activities in the university.

Table 4 . IT Experts' Evaluation Summary

INDICATORS	AVERAGE MEAN	REMARKS
Functional Suitability	4.69	Strongly Agree
Performance Efficiency	4.10	Agree
Compatibility	4.65	Strongly Agree
Usability	4.58	Strongly Agree
Reliability	4.60	Strongly Agree
Security	4.54	Strongly Agree
Maintainability	4.66	Strongly Agree
Portability	4.90	Strongly Agree
General Weight Mean	**4.59**	**Strongly Agree**

Table 4 shows it received a general weighted mean of 4.59, which places it in the "Strongly Agree" group. Functional suitability, compatibility, usability, reliability, security, maintainability, and portability are rated "Strongly Agree", with respective ratings of 4.69, 4.65, 4.58, 4.60, 4.54, 4.66, and 4.90. The only area that comprises performance efficiency were classified "Agree", with a mean score of 4.10. The comparatively lower rating for routine effectiveness may be attributed to technical limitations associated with the PHP–MySQL architecture used in the system. Factors such as server response time, database query execution speed during peak usage, and limits of local hosting environments may have influenced perceived system responsiveness. While the system performed reliably under normal workloads, increased concurrent access during high-demand periods could result in minor delays. This observation reflects an honest assessment of the system's current technical limitations and provides a clear direction for future optimization. This means that, even though the software meets most of the significant standard performance efficiency can be improved to much better suit the IT experts involved.

Table 5. Non-IT Respondents' Evaluation Summary

INDICATORS	AVERAGE MEAN	Remarks
Perceived Usefulness (PU)	4.40	Strongly Agree
Perceived Ease-of-Use (PEOU)	4.49	Strongly Agree
Attitude Toward Using (ATU)	4.47	Strongly Agree
Behavioral Intention to Use (BI)	4.45	Strongly Agree
General Weighted Mean	**4.45**	**Strongly Agree**

Table 5 presents a consolidated comparison of mean scores from students, administrative staff, and IT experts to provide a holistic view of system evaluation across user groups. The results of the study showed that the perceived usefulness (PU), which had an average mean of 4.40, perceived of use (PEU), with a mean of 4.49, attitude toward using (ATU) with a mean of 4.47, and behavioral intention to use (BI) with a mean of 4.45. The general weighted mean is 4.45, equivalent to "Strongly Agree" and the Perceived Usefulness (PU), Perceived Ease-of-Use (PEOU), Attitude Towards using (ATU) and Behavioral Intention to Use (BI) of smart queuing system are high, then the users view the system as highly valuable and highly easy to use; they have a positive attitude towards it and likely will adopt the system.

Discussions

The findings of this study indicate that the Smart Queuing and Appointment Management System created in Bulacan State University - Bustos Campus solved successfully the problems that had been experienced over time relating to the manual system of queue handling. The use of the online booking system, QR-based registration, and real-time monitoring enhanced the efficiency of the administrative processes and client experience significantly. Users have indicated that the system offered a clear and structured process of walk-in and booked clients which minimized waiting time, overcrowding and equitable prioritization of services. All these functions led to a clear workflow and better communication between the students and the administrative employees,

which confirms the ability of the system to optimize workflow flow and customer satisfaction. The effectiveness of the system was established using the quantitative analysis with the help of the ISO/IEC 25010 Software Quality Model and Technology Acceptance Model (TAM).

The General weighted mean of the evaluation by ISO/IEC was 4.59 (indicating strongly agree) and represents the outstanding results in the aspects of functionality, usability, reliability, security and maintainability. Results of the Technology Acceptance Model indicated that there was a high user acceptance, with the weighted mean of the students being 4.45 and the weighted mean of staff being even higher (4.84) both of which were taken to mean Strongly Agree. The student issues with the system took that the system was very handy and simple to employ, as was expressed in the high behavioral intention to further utilize it in their academic transactions, and staff members described the efficiency and convenience of the system with regard to administrative management. The results referenced above mean that the system achieved both its purpose and not only did not fail to meet the functional purpose but was also highly approved by the target users, confirming its design and implementation plan.

On the whole, the research finds that the Smart Queuing and Appointment Management System was effective to convert the traditional queuing service into more modern and more automated and customer-focused. The overwhelming approval of students, employees and the IT specialists indicate its adaptability and possibility of being used in other offices within the university. Although the rated attributes were very high, the relatively low performance efficiency (4.10) indicated that more optimization in the use of resources and system responsiveness could be used to improve overall performance. In terms of security, the system integrates essential protective mechanisms such as password hashing for user authentication, session management to prevent unauthorized access, and input validation techniques to mitigate SQL injection attacks in PHP.

These measures ensure the confidentiality and integrity of sensitive student and administrative data handled by offices such as the Registrar and Accounting. Future developments can be aimed at improving the speed of the system, increasing mobile accessibility, and the system hosting automatic updates on the schedule together with institutional calendars. Nonetheless, regardless of these points of improvement, the system was found to be a secure, effective and innovative, solution that meets the objective of the Bulacan State University - Bustos Campus to offer efficient, streamlined administration using technologies.

For future enhancements, migrating the system from a traditional PHP/MySQL infrastructure to a cloud-native architecture—such as Firebase or Amazon Web Services (AWS)—is recommended. Cloud-based deployment would improve scalability, load balancing, and performance efficiency, particularly during peak enrollment and registration periods. This transition would directly address the performance efficiency concerns identified by IT experts and support long-term system sustainability.

References

Aziz, S. (2016). Reducing customer wait time for improved satisfaction. International Journal of Service Management, 22(4), 332–347. https://doi.org/10.1108/IJSM-2016-0042

Bayani, L., Ramos, A., & Villanueva, K. (2021). Automated queuing to reduce service delays in academic offices. In Proceedings of the IEOM 2021 Monterrey Conference (pp. xx–xx). Institute of Industrial and Systems Engineers (IISE). https://www.ieomsociety.org/ieom2021/

Borje, A., Del Mundo, R., & Tolentino, J. (2023). SCRUM-based queue management system for public transportation. Lingayen Transport Studies Journal, 14(2), 112–120. https://journals.ph/lingayen-transport-studies-journal

Bufete, M., Reyes, P., & Santos, L. (2021). User-centered systems in Philippine universities: Accessibility and functionality. Philippine Journal of ICT Research, 11(1), 45–

60. https://ejournals.ph/article.php?id=17043

Coltraro, A., Malik, S., & Zhang, Y. (2024). Logistic fluid queue modeling in dynamic service environments. Journal of Operations Science, 29(1), 89–101. https://www.journals.elsevier.com/journal-of-operations-science

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

Dela Cruz, V., Gomez, J., & Fabian, A. (2024). Developing mobile-first queue systems for campus administration. Asia-Pacific Journal of Educational Technology, 10(2), 122–135. https://apjet.org

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. Journal of Management Information Systems, 19(4), 9–30. https://doi.org/10.1080/07421222.2003.11045748

Delos Santos, C. R., Alcaraz, M. J., & De Vera, J. (2023). Localized smart queuing in Philippine universities. EJournals.ph. https://ejournals.ph

Espinosa, M. G., Tiu, C. A., & Cruz, D. L. (2024). Automated enrollment queue systems in higher education institutions. Envarga ICT Journal, 7(1), 33–44. https://ejournals.ph

Gazal, M., Hamouda, S., & Ali, M. (2015). Smart queuing technologies for service improvement. International Journal of Digital Systems, 10(2), 71–80. https://www.researchgate.net

Ismail, M., & Moyo, T. (2023). AI-integrated queuing systems in service optimization. African Journal of Smart Systems, 5(3), 67–82. https://africansmartsystems.org

Ismail, M., & Moyo, T. (2023). AI-integrated queuing systems in service optimization. African Journal of Smart Systems, 5(3), 67–82. https://africansmartsystems.org

Kim, H. J., Nakamura, R., & Liao, S. (2024). Predictive analytics for smart queuing environments. Journal of Artificial Intelligence in Service Design, 13(1), 22–39. https://www.jaisd.org

Mansour, A., Talib, R., & Yusof, N. (2021). I-Queue: A dynamic queue management system using cloud services. International Journal of Smart Technologies, 16(4), 88–97. https://www.ijsmarttech.org

Nair, R., & Joshi, K. (2023). Proactive queuing systems using time-slot scheduling in academic institutions. Journal of Education Technology Systems, 51(2), 145–159. https://doi.org/10.1177/00472395221136078

Nunag, R., Ramirez, P., & Fajardo, L. (2024). Simulation of multi-server queuing models for service enhancement in local businesses. Philippine Simulation Journal, 6(1), 77–89. https://ejournals.ph

Pabelona, M., & Paver, J. (2024). Smart kiosks and predictive tracking for hospital queuing systems. Academia.edu. https://www.academia.edu

Salih, M. (2022). Mobile-first queuing applications for student services [Unpublished master's thesis]. University of Ouargla. https://dspace.univ-ouargla.dz

Sevim, B., & Erkan, B. (2022). AI-based intelligent scheduling in automated queuing systems. Turkish Journal of Artificial Intelligence, 8(1), 25–38. https://turkishai.org

Usluer, H. (2024). Simulation of queueing efficiency in university cafeterias: A discrete-event approach. Turkish Journal of Applied Systems, 15(2), 98–101. https://turkishappliedsystems.org