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MAKERERE UNIVERSITY BUSINESS SCHOOL
FACULTY OF COMPUTING AND INFORMATICS
PROJECT PROPOSAL FOR THE AWARD OF BACHELOR'S DEGREE
IN BUSINESS COMPUTING

DESIGNING A QUEUE MANAGEMENT SYSTEM FOR AMSAM
MEDICAL CLINIC

By

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Supervised by:

A Project Proposal Submitted to the Faculty of Computing & Informatics of Makerere University Business School in Partial Fulfillment of the Requirements for the Award of the Degree of Bachelor of Business Computing of Makerere University

November, 2025

DECLARATION

we, the undersigned, declare that to the best of our knowledge, this proposal is our original piece of work, and has never been published and/or submitted for any award in any other University or Higher Institution of Learning.

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APPROVAL

This project proposal has been submitted with my approval as supervisor and my signature is here appended:

Signed.....

Date:

Ms. Stella Kyalimpa

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1. INTRODUCTION

1.1. Project Background

Almost every area has been computerized in modern times due to the rise of digitalization. When reviewing hospitals and other healthcare establishments (e.g. clinics) in developing countries, an essential aspect of digitalization is in most of the service offerings. To this end, we will concentrate our attention here on Queue systems. Queue systems are the systems that facilitate the organization of others and how they are done given limited resources such as staff that need to be worked up on. We see queues at patient check-ins in the hospital. With digitization of these queue systems all service centers benefit from providing orderly environments and good conditions for their clients. Queue systems include the creation of a line of patients queuing for patients, using tickets to temporarily fill up for each of them. Kumar and Rahman noted the benefits of such systems for patient satisfaction as well as clinic efficiency. (Kumar & Rahman, 2022). Uganda, as a developing country is still in the process of implementing digitalized queue system, thus, many hospitals and clinics are overcrowded, noisy and disorderly. This way, the service delivery could be better; compliance of patients would be enhanced, and patient waiting time would be reduced through using a digitalized queue system. (Nabukenya & Luyombya, 2023)

Amsam Medical Clinic for example, this project, under study is one of several medical facilities in Uganda that have not embraced the digitalized queue system. It still relies on the manual techniques of a receptionist calling out patient names while waiting in a long line, among other patients. It is considered biased, and some patients view this way as unfair. This is a project to design and implement a digitalized queue management system to automate the patient check-in, enhancing not only staff morale but patient morale as well.

1.2. Problem statement

Automated Queue Management Systems help cut patient wait time and create better service provision. This frees up staff time to concentrate on the provision of high quality care, rather than on managing how patients check in. Unfortunately, Amsam Medical Clinic calls on patients when they are to receive their service manually. Patients line up physically waiting for their turn. This causes staff members, such as the receptionists, to get tired and confused, increasing their stress levels, that in turn leads them to snapping at the patients or choosing the wrong patient. Patients then find these errors biased or unfair. If Amsam Medical Clinic

still goes with the manual method and does not change it, it causes more patient dissatisfaction and decreased morale of staff hence it will cause poor performance and lead to lose the patients to other clinics with more orderly queue systems. An automated Queue Management System will help to manage patient queues, register and check patients in, thus allowing staff the time to have more pressing patient-related duties and the patients work along more.

1.3. Project Goal and Objectives

1.3.1. Project Goal

This project seeks to design and develop an automated Queue Management System for Amsam Medical Clinic in order to reduce patients' wait time and improve service delivery.

1.3.2. Project Objectives

- a) To analyze the existing patient queue management process at Amsam Medical Clinic.
- b) To identify key inefficiencies, bottlenecks, and specific user requirements at Amsam Medical Clinic.
- c) To design and develop a functional web-based Queue Management System prototype.
- d) To test, validate, and implement the developed system at Amsam Medical Clinic, ensuring its functionality, usability, and reliability.

1.3.3. Project Scope Summary

The scope of this project uses on QMSs in hospitals and how to create a solution for this problem in Amsam Medical Clinic. The objectives are to find a viable solution for the queue management problem in Amsam Clinic, design and develop the solution and implement the solution. Key activities that will be carried out are; data collection, data analysis, system design, system implementation, and deployment along with testing and carrying out maintenance. The project deliverables are as follows; a project report, structured interview sample, project budget plan, User Acceptance Test report, and an automated QMS system.

1.4. Anticipated Significance of Project

The automated Queue Management System will solve problems of disorganized patient check-ins and registration by creating an organized system that automatically registers and checks patients. This new system will boost the overall morale of the staff that was burdened by the check-in and registration process, the new system will give a new competitive edge to the clinic hence increasing patient turnout.

The team will learn how to deploy and test a new system by implementing and testing the system they have built. The team will also learn new skills is collecting data from a real-world scenario.

1.5. Project Assumptions

The project will be established on the following key assumptions:

- i. **Resource Availability:** It is assumed that the resources like software, hardware, Internet access, and power will be available, accessible and stable during the project's lifespan.
- ii. **Stakeholder Cooperation:** It is assumed that the various stakeholders like the sample population of the patients and staff at Amsam will be, available and fully cooperative for as long as the project exists.
- iii. **Support from supervisor:** It is assumed that the team's allocated supervisor will be available, approachable, insightful and direct to the team's progress, mistakes and queries.
- iv. **Team availability and comparability:** It is assumed that all five members of the group will offer full cooperation and always be available at any one time when their contribution is required. Team members will be assumed to offer 100% effort.

2. REVIEW OF LITERATURE

2.1. Introduction

Queue Management Systems (QMS) are technologies that are designed to facilitate the planning and management of customer flow in the service environment. Through fairness, transparency and efficiency, the primary objective is to decrease wait times as well as enhance the standard of service rendered with the customer experience (Morales, 2024). In the past, queues were dealt with through paper queues or in-line tickets, with customers becoming anxious and restless with no other control over customers. Digital Queue Management Systems (D-QMS) which are considered to be efficient are an implementation of multiple customer interfaces, check-ins that involve customer priority queues, real-time customer waiting times and delivery systems communication with clients to know when it's their turn to be seen (RSIconcepts, 2024); (Qminder, 2025). Queue Management Systems are based on the basic principles of Operations Research and Queuing Theory which is relevant on system building that may manage service demand variability (both healthcare included).

2.2. Digital QMS within the Healthcare Sector

QMS (Healthcare Queue Management Systems) are important as the patients are generally hyper-vulnerable and vulnerable ones. Extensive research indicates that long waiting periods lead to patient dissatisfaction. By comparison, many health care providers are adopting digital QMS platforms, which can allow quick integration with appointment scheduling and EHR; thereby prioritizing urgent cases. According to many studies, QMS platforms which provide the facilities to patients on where the patient is likely to be in the queue and what the expected wait time might be are statistically beneficial, and by doing so significantly decrease wait time and complaining; as well as, increase patient satisfaction. (DoctoPlus, 2025; RSIconcepts, 2024). Especially, in Uganda, a developing country, where there are few or no health information systems, the use of a standalone QMS will positively impact patient flow management in an almost immediate manner. (NoQ, 2025), (RSIconcepts, 2024).

2.3. Benefits and Challenges of QMS Implementation

There is many advantage of the digital QMS. Patients expect shorter waiting times, which brings them some sense of equity, since they receive a real-time SMS message and can escape to a different destination as soon as they receive the message. Some advantages to digital solutions include: Improved digital user experience, customer satisfaction, data security of the user, and seamless integration into the process. (RSI concepts, 2024), (DoctoPlus, 2025). Digital QMS also enables the healthcare professional to automate most of the tasks, such as waiting time management and patient check-in, so that professionals can spend more time on the important tasks that their job demands. In addition, the digital QMS becomes a gold store of critical data in order to aid in business strategy, as well as to point out points that need improving. (RSI concepts, 2024)(DoctoPlus, 2025). Some challenges when it comes to adopting a digital QMS as it covers; cost; resistance on part of staff and patients, and technical issues (downtime). (Al-Ashwal, 2022). Reliability in the internet and different levels of digital literacy will make it difficult for implementation in developing countries. Its implementation will be successful only with successful change management, sufficient training in terms of the use of AI by users, and systems developed as per user requirements. (Best Practices in Queue Management for Healthcare, 2024)

2.4. System Design Considerations for Healthcare QMS

These QMS for health care are designed based on the important factors. For instance, usability is the ultimate concern for the patient and staff alike as it encourages a straightforward and easy-to-use interface that is accessible across devices. (RSI concepts, 2024). Furthermore, a modular architecture could allow for reliability and scalability since it isolates functions such as checking in and receiving notifications. (Dennis, Wixom, & Roth, 2024). Last but not least, data security and patient confidentiality are needed, including the use of encryption and adherence to health care regulation. (Best Practices in Queue Management for Healthcare, 2024)

The system should identify multiple patient types and provide priority queuing for emergency patients. Standard design techniques such as UML Use Cases and wireframes will aid in designing a clear and functional system (Dennis, Wixom, & Roth, 2024). a safe and easy-to-use QMS for health care.

2.5. Conclusion of Literature Review

The Digital Queue Management System improves the efficiency of service sectors, but most importantly, it enhances the customer experience. The systems reduce wait time and improve resource utilization; however, the success of the implementation of such systems depend on the elimination or reduction of several barriers to successful implementation (i.e., acceptance

of users and limitations created by technology). As such, the development of a digital queue management system that is both user-friendly and an effective tool for Amsam Medical Clinic is contingent upon research insights that provide guidance for the methodological approach used to develop the system and ultimately lead to a practical and effective product.

3. PROJECT METHODS

In this part, we describe the selected detailed method of the "Design and Implementation of a Queue Management System for Amsam Medical Clinic" project. The logical ideals that guide the study are summarized in this chapter, the design methodology is described, the sources and methods of data collection are introduced, along with the methodology adopted to develop the system, and the ethical questions associated with the study are addressed..

3.1. Research Design/Research Approach

In this approach, the team will attempt to build the Queue Management System, by identifying business requirements at Amsam Medical Clinic and thereby defining an effective solution to the existing problem of inefficient patient flow. As per Design Science Research (Kroop, 2025) where researchers are encouraged to create artifacts and test them, the research team will build logical designs of the proposed system, as well as develop a functioning prototype for an online based Queue Management System that improves patient flow at clinics. Recent developments in queue management technology for healthcare settings demonstrate the practical benefits of real-time data processing and AI-driven scheduling to optimize patient flow (DoctoPlus, 2025). Emerging trends in healthcare queue management emphasize integration of cloud computing, virtual queues, and IoT to enhance system responsiveness (The Future of Queue Management Systems, 2025). The DSR process model provides a clear, iterative framework for this project, as illustrated and explained in the table below.

| | | | |
|---|---|---|---|
|  Page 15 of 23 - AI Writing Submission | Research Objective Addressed | Proposed Methods & Activities | Expected Output/Deliverable |
| 1. Problem Identification & Motivation | a) To analyze the existing processes | <ul style="list-style-type: none"> • Direct observation • Interviews with clinic staff. | <ul style="list-style-type: none"> • Detailed report on the current system's problems with suggested solutions. |
| 2. Definition of Objectives for a Solution | a) To identify key inefficiencies, bottlenecks, and specific user requirements. | <ul style="list-style-type: none"> • Analysis of data, • Group discussions • Structured interviews with clinical staff | <ul style="list-style-type: none"> • List of specific, measurable system requirements and a clear set of project objectives. • List of functional and non-functional requirements |
| 3. Design & Development | b) To design and develop a prototype. | <ul style="list-style-type: none"> • System design (UML and ERD diagrams) • Coding using the Laravel framework | <ul style="list-style-type: none"> • Sample code with images. • Fully-functional web-based prototype |
| 4. Demonstration | c) To test, validate, and implement the prototype | <ul style="list-style-type: none"> • Installation of the system • Conducting user acceptance and integration testing | <ul style="list-style-type: none"> • User Acceptance Test reports • Feedback reports • Functional system • UAT sign-off. |

| DSR Stage | Research Objective Addressed | Proposed Methods & Activities | Expected Output/Deliverable |
|-------------------------|-------------------------------------|--|---|
| 5. Evaluation | c) To test, validate, and implement | <ul style="list-style-type: none"> • Presenting the final report for evaluation • Debugging system • Monitoring system performance | <ul style="list-style-type: none"> • Complete project report • Debug report • An evaluation report |
| 6. Communication | All Objectives | <ul style="list-style-type: none"> • Compiling the final project report, • Creating documentation • Presenting the project to supervisors and faculty | <ul style="list-style-type: none"> • Final project dissertation, • Technical documentation • Project presentation. |

3.2. Project Organization [Client]

The project is being undertaken for Amsam Medical Clinic, located in Kampala. The users of the system will be the clinical staff and patients of Amsam Medical Clinic. The total population of stakeholders is estimated to be 14 staff members and an average of 30 daily patients.

3.3 Sampling Design/Sampling Technique

This study will employ a mixed sampling approach, combining purposive sampling for clinic staff and simple random sampling for patients. This design is appropriate because the development of queue management system requires insights from individuals who directly participate in the patient flow, as well as feedback from actual service users.

Purposive sampling will be used to select key stakeholders and clinical staff who have direct responsibility in managing or interacting with the current queuing procedures. Total number of 14 staff members will be purposively selected, including 4 administrative stakeholders, 6 nurses and 4 doctors. These participants are chosen specifically because they possess critical operational knowledge, experience with the existing patient flow and informed perspectives on the inefficiencies that need to be addressed. Their expertise makes them the most suitable sources of accurate and relevant information for designing an effective queue management system for Amsam medical clinic.

The study will involve a total number of 14 participants, which is appropriate for the scope of this project and sufficient for generating meaningful insights. This sampling strategy ensures the collection of reliable operational data from staff and unbiased user feedback from patients, ultimately supporting the development of practical and user-centered queue management system for Amsam Medical clinic.

3.4 Sources of Data

For this project, both primary and secondary data sources will be used. Primary data will be obtained from having face-to-face interactions with the chosen sample space of Amsam clinic staff and patients. The team will conduct both structured and unstructured interviews to get different perspectives on the current queue system. For secondary data, the team will use

different resources like magazines, newspapers, online posts and published articles and school textbooks in the library to collect information on Queue management systems of the past and present.

3.4.1. Requirement Elicitation [Data collection] Techniques]

The team will collect data in the following ways; primary data will be collected through direct interviews and interactions with the chosen sample population and secondary data will be collected from reading previous research papers, newspapers, watching news and textbooks to get information about queue management systems.

3.4.2. System Analysis and Design Approaches

The team will use the Structured Systems Analysis and Design Method (SSADM) because it's simple, clear and organized structure. SSADM focuses on providing enough details before beginning the development of the system. Since SSADM allows users to go forward after the details are complete, incidents like going beyond the scope or introducing new itinerary are minimized unlike the agile approach where, risk of the going beyond the scope is high because it is highly flexible, so a student is likely to experience scope creep before even realizing it.

3.4.3. Design Techniques

The team will use Entity-Relationship Diagrams (ERD), Use Case scenarios and Activity diagrams to explain relationships in the project between entities. Entity relationship diagrams will explain relationships between, the patients or visitors, staff, and the administration. Some functionalities include, scheduling appointments, canceling appointments, and updating service status among many others. Activities will include call calling the customer, sending and receiving messages among others.

3.5. Anticipated Project Constraints

- i. **Time Constraint:** The team may not have enough time to complete the project especially since the Waterfall Approach will be adopted. That team will follow the proposed Gantt chart strictly and manage time appropriately.

- ii. **Technical Skill Constraint:** The team may lack expertise coding skills for some complex coding areas. The team will utilize online materials like some Chatbots and inquire from lecturers in order to improve and advance on their coding skills.
- iii. **Access to knowledge:** The team may not be adequately knowledgeable about some concepts in the research project like Literature Review. The team will research online, use textbooks and consult from lecturers to gain more insightful knowledge about the project.

3.6. Project Development Process

A linear sequential model approach will be adopted throughout the project life cycle. The team will focus on the Waterfall Approach which, emphasizes the need for detailed iterations for every stage and also focuses on the fact that one stage builds on another in order to go to next stage i.e. the previous stage must be completed. The following are the stages that will be followed under Waterfall Approach: Requirement collection - requirement analysis - system design - implementation - testing - deployment.

3.7. Ethical Considerations

This study will be conducted in accordance with established research ethics to ensure the protection, dignity, and rights of all participants involved in the investigation.

Informed consent: All participants, including clinic staff and patients, will be informed about the purpose of the study, the procedures involved, and their voluntary participation. Written or verbal consent will be obtained before collecting any data. Participants will be allowed to withdraw from the study at any time without any negative consequences

Confidentiality and privacy: the study will ensure that all personal information gathered from participants remains confidential. No names or identifiable details will be disclosed in the final report. Data will be coded and stored securely accessible only to the researcher. Information collected will be used solely for academic and system design requirements.

3.8. Timeline & Milestones

A detailed Gantt chart is provided in Appendix III. Key milestones include:

- **Week 3:** Completion of collecting stakeholder information.
- **Week 7:** Completion of system design and start of development.
- **Week 12:** Completion of a functional prototype.

- **Week 14:** Completion of User Acceptance Testing and final project report compilation.

Disclosure and Declaration Statement:

The project team will use generative AI tools, such as ChatGPT, under the strict guidance of our supervisor to improve the proposal and to research some difficult code. Our team has no conflicts of interest regarding this project.

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Appendices

Appendix I: Proposed Project Budget

| Item Description | Quantity | Unit Cost (UGX) | Total Cost (UGX) | Notes |
|--|----------|-----------------|------------------|-------------------------|
| Software & Development | | | | |
| Domain Name & Basic Hosting (1 yr) | 1 | 150,000 | 150,000 | Optional, for live demo |
| Communication & Logistics | | | | |
| Transport to Clinic (Data Collection) | 10 trips | 10,000 | 100,000 | |
| Communication (Airtime/Data) | Lump Sum | - | 100,000 | For team coordination |
| Documentation | | | | |
| Printing & Binding (Proposal & Report) | 2 sets | 30,000 | 60,000 | |

| Item Description | Quantity | Unit Cost (UGX) | Total Cost (UGX) | Notes |
|--------------------|----------|-----------------|------------------|-------------------------|
| Contingency | Lump Sum | - | 50,000 | For unforeseen expenses |
| TOTAL | | | 460,000 | |

Appendix II: Data Collection Tools you intend to use

- **Interview Guide for Clinic Staff:** A set of open-ended questions for the clinic manager, receptionists, and nurses to understand current challenges and system requirements.
- **Observation Checklist:** A structured form to record observations on patient flow, peak times, and bottlenecks in the current manual system.

Appendix III: Schedule of Activities/Gannt Chart

A high-level Gannt chart will be generated in Microsoft Project, outlining the 15-week timeline with tasks for each phase of the DSR process, dependencies, and milestones.