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MAKERERE UNIVERSITY BUSINESS SCHOOL
DEVELOPING AN ATTENDANCE TRACKING SYSTEM FOR
MAKERERE UNIVERSITY BUSINESS SCHOOL

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**A PROJECT PROPOSAL SUBMITTED TO THE FACULTY OF COMPUTING &
INFORMATICS OF MAKERERE UNIVERSITY BUSINESS SCHOOL IN PARTIAL
FULFILLMENT FOR THE AWARD OF THE DEGREE OF BACHELOR OF
BUSINESS COMPUTING OF MAKERERE UNIVERSITY**

NOVEMBER, 2025

DECLARATION

We, the undersigned, hereby declare that to the best of our knowledge, this report 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 for examination with my approval as an academic supervisor, and my signature is appended here:

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SECTION ONE

1.0 Introduction

This section covers the background of the project, the statement of the problem, the objectives of the project, the scope, expected significance, and limitations. The paper justifies the need for the development of an Automated Attendance Tracking System at Makerere University Business School, thereby underlining the need for technological innovation in attendance management among students.

1.1 Project Background

The attendance tracking system is an automated tool developed to record and manages student attendance accurately in educational institutions. These systems usually use fingerprint or facial recognition) biometric scanners, radio-frequency identification, and mobile applications to automate attendance processes, thereby eliminating the manual methods of keeping attendance records. According to Kumar et al. (2017), ATS assists administrators in observing attendance trends, determining low-attendance students, and providing them with focused interventions to increase engagement and academic performance. Some other features include automatic reporting, notifications, and analytics. These features will enable teachers to make more informed decisions about teaching methods that are most effective, which shall be further refined continuously with data-driven decisions.

Manual attendance management is becoming increasingly difficult, especially in institutions with large student populations. Traditional methods include roll call and paper sign-in, which are inefficient and prone to tampering. Such practices continue to waste valuable teaching time and jeopardize academic integrity. Biometric systems provide security through unique physical traits that prevent proxy presence, thereby increasing efficiency in operations.

Attendance marking is considered the most significant feature of classroom management, whereby students' participation in academic activities as well as benefits from instructional engagement is ensured. Most institutions require students to attend classes to a minimum threshold, usually 80% or above, as one of the eligibility criteria to sit for the final examination. Conventionally, attendance is marked by either roll call or a show of hands, or by some form of paper-based sign-in, very inefficient and unsuitable for large classes. This method consumes

precious teaching time and is very much prone to manipulation, including proxy attendance in which one student signs in on behalf of another student

The challenges associated with these have brought up biometric systems to relieve these by depending on unique physical characteristics, such as fingerprints or facial features, to authenticate student attendance. Biometric systems therefore prevent fraud in the record of attendance, smoothening operations in general. Moreover, apart from decreasing the manual effort of the teacher, automated attendance using biometric techniques ensures correctness and tamper-proof recording. Advanced applications may also include tracking seating position, as done by Yang et al. (2019), and are able to classify gender by detecting the face, according to Poornima et al. (2017), thus further enhancing their application in classroom analysis and management.

An effective ATS can support increased academic accountability, decrease the administrative burden, and contribute to student success at MUBS. On one hand, scholarship has identified regular attendance monitoring as inextricably linked to positive academic performance (Crede et al., 2010), and automation decreases administrative burdens and errors (Diamond & Irwin, 2013). On the other hand, attendance tracking in digital format enables timely identification of at-risk students, and it aids in maintaining institutional policies and regulations (Chen & Lin, 2008; Almari et al., 2020).

1.2 Statement of the Problem

MUBS has an attendance tracking system that is currently manual and paper-based. Therefore, the system shows inefficiencies, inaccuracies and other administrative challenges. This antiquated approach makes monitoring student attendance ineffective, impairs academic integrity, and complicates compliance with university regulations. Although digitization has been proposed for some processes, there is no system integration with other educational tools, leading to data fragmentation and increased workload (Smith & Jones, 2021). In addition, lost records, delays in reporting, and inadequate real-time visibility have further worsened the problem (Nguyen, 2022). As such, a comprehensive ATS that applies technology to enhance data accuracy, operations efficiency, and academic performance becomes highly relevant (Baker et al., 2019; Kauffman, 2020).

1.3 Project Goal and Objectives

1.3.1 Project Objective

The goal of this project is to design and develop an automated Attendance Tracking System to help MUBS improve the process of monitoring students' attendance and enhance overall student participation.

1.3.2 Project Objectives

- i. To study and analyze the current attendance tracking system used at Makerere University Business School.
- ii. To design an advanced, technology-based attendance tracking system suitable for MUBS.
- iii. To implement the proposed attendance tracking system in the university environment.
- iv. Testing and validation regarding the functionality, reliability, and effectiveness of the developed system.

1.3.3 Project Scope

This project entails the design and development of an attendance tracking system for Makerere University Business School. The system shall:

- i. Automate the attendance recording process for lectures and academic activities.
- ii. The system should interface easily and without problems with existing academic and administrative systems.
- iii. Offer real-time data analytics and reporting capabilities.
 - i. Provide secure access and protection of data for students and faculty alike.
 - ii. Improve the efficiency, accuracy, and transparency of managing attendance throughout the organization.

1.4 Expected Impact of the Project

- i. The introduction of the ATS will greatly reduce the time and effort required to record attendance, consequently freeing educators and students to focus more on academic engagement.
- ii. Automation will minimize human errors associated with manual attendance methods, ensuring data accuracy and reliability.

- iii. Real-time access to attendance records will enable timely interventions for absenteeism and support improved student engagement.
- iv. Integrated analytics will provide actionable insights on attendance trends that will help in strategizing student retention and improving academic performance.

1.5 Project Assumptions

- i. It is assumed that faculty and students will be receptive to adopting the new system and that they will get adequate training for effectively using it.
- ii. The project assumes that MUBS has the required technical infrastructure such as hardware and internet connectivity to deploy the system.
- iii. The system should conform to the relevant data protection legislation and institutional policies, ensuring privacy and security of student information.
- iv. Ongoing support and partnership from key stakeholders, such as university administration and faculty, are requisite to successful development and implementation.

SECTION TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews related literature in line with the project objectives that are focused on designing, developing, and managing Attendance Tracking Systems at university levels. The literature review will seek to discuss the technological foundations, implementation strategies, and administrative implications for the ATS to provide an academic background for the proposed system at Makerere University Business School.

2.1 Attendance Tracking System (ATS)

ATS presents a socio-technical solution for automating the recording, certification, and reporting process of students' attendance within all academic activities. The system comprises both hardware components like RFID/NFC readers, biometric scanners, and GPS, and software platforms that include mobile apps, learning management systems, and analytics dashboards, capable of replacing manual roll calls and paper attendance registers.

Modern institutions of higher education are implementing ATS for record accuracy and timeliness, fraud reduction by means of biometric authentication, real-time reporting for monitoring in academics, and retention strategies. This position is supported by Ali et al. (2022) and Salih Ali et al. (2022). Key features include automated verification, proxy detection, remote access, and integrating it with administrative tools for academic assessment and compliance.

2.2 Attendance Tracking System ATS Management

Effective management of ATS involves the use of automation and digital technologies in managing operational efficiency and strategic decisions within educational institutions. ATS has gained recognition as an important tool for improving institutional performance compared to other traditional approaches, which are based on manual methods.

This will include core management practices of selecting reliable tracking technologies such as biometrics, RFID and mobile apps that guarantee data integrity and avoid time fraud. It should also be integrated with platforms like HRIS and LMS for effective data flow and reduction in administrative redundancies.

Some of the growing trends in the management of ATS include real-time analysis on attendance patterns such as chronic lateness or extreme absenteeism. The resulting insights are used to inform workforce planning and educational interventions. Secondly, attendance policies should be clearly stated, and training also provided to ensure consistent use of the system and therefore compliance.

One of the most significant challenges in managing ATS involves data privacy, especially whenever biometric data is involved. Privacy regulations demand that institutions use encryption, role-based access controls, and periodic audits of their systems. ATS also face technical challenges when integrating with legacy systems, a task that involves robust APIs and scalable infrastructure..

2.3 Attendance Tracking Systems (ATS) in Universities

Attendance tracking systems automate and streamline traditional manual processes, moving from time-consuming paper-based methods to real-time digital solutions. These systems allow proper and timely record keeping, avoiding errors associated with manual data entry and the possibility of attendance sheets being misplaced, as identified by Al-Dabbagh (2024). Key functionalities include automated report generation, absence calculations and documentation such as warning letters, which go a long way towards reducing administrative workload, as identified by SEAtS Software (2024).

Modern ATS solutions integrate smoothly with LMS and SIS, creating a large ecosystem for managing student data. The integration facilitates tracking of attendance related to lectures, assessments, workshops and campus events; therefore, it provides a centralized solution regarding institutional attendance management. Presence Radar, 2025.

Attendance data serves as the backbone of predictive analytics and early intervention strategies. As documented by Crede et al., regular attendance is correlated with performance in a way that is almost consistently striking across research studies. (2010). With real-time visibility into attendance patterns, instructors and advisors identify students with persistent absences so that intervention can occur before overall academic performance declines. Where systems have notification features, they can alert students and staff when attendance limits are breached, promoting accountability and timely support. Digital ATS solutions use biometric authentication

and geo-fencing to address problems related to proxy presence. This ensures actual physical presence of the student at specified locations before any recording of attendance, thereby safeguarding academic integrity. Geo-fencing may specifically utilize GPS-enabled mobile applications that will verify a location to prevent remote or fraudulent check-ins.

The ATS also serves as a strategic tool for data collection to inform institutional planning. This generates comprehensive analysis on trends, such as extreme absenteeism or low attendance across subjects, informing decisions on scheduling and resource allocation. Furthermore, ATS enables compliance with external regulations, especially visa requirements by foreign students, by providing objective and tamper-proof attendance records (OneTap, 2025).

2.4 Design of Attendance Tracking System (ATS)

In the design of an ATS, a strong structural, functional, and technical framework should be developed to ensure effectiveness in data capture, processing, and reporting. Analyses of requirements for the design of the system encompass the needs of these stakeholders-administrators, lecturers, and students themselves. This encompasses the definition of parameters regarding attendance-class sessions or event participation-and the appropriate data input, ranging from biometric identification, RFID tags, and QR codes to mobile-based verification (Opeke et al., 2025).

This is followed by a detailed design of the system architecture, showing how core modules-the user interface, database, and processing engine-interact. The database design should be scalable to maintain data integrity and store data securely for real-time analytics, enabling easy retrieval of attendance records.

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2.4.1 Implementing the Attendance Tracking System (ATS)

In the implementation phase, detailed design specifications are translated into an operational system through the software development process, hardware integration, and onboarding of users. Development begins with coding and configuring the system components, using web or mobile-based frameworks such as Python, Java, or PHP for the back end and React or Angular for the front-end interface (Ivoya et al., 2025).

The system includes various hardware components, such as fingerprint scanners, RFID readers, or cameras for facial recognition. These have been integrated and tested for compatibility and accuracy of data capture. Deployment involves installation of the system on an institutional server or cloud platform, configuration of network settings, and assigning user roles and permissions. If attendance records were previously kept, data migration may be necessary to ensure continuity.

Testing includes the critical phase of unit testing, integration testing, and UAT, which guarantees that the system works reliably under various conditions. Performance issues and bugs are detected and fixed before full deployment.

Successful implementation is equally about user training and change management. Furthermore, administrators, faculty, and students should be trained to interact with the system for best results. Continuous monitoring and feedback helps in iterative improvement. Institutions must provide regular maintenance programs with respect to software updates, hardware servicing and enhancement of data security. As noted by Alavi et al. (2022), successful implementation will not only ensure the success of the technology but also organizational-wide diffusion, thereby increasing accountability and operational efficiency.

2.4.2 Importance of Attendance Tracking Systems (ATS)

Attendance tracking systems play an important role in enhancing administrative efficiency, observing academic performance and institutional accountability in universities. Many traditional attendance monitoring methods involving roll call and paper sign-in are time-consuming, error-prone, and subject to manipulation, making records unreliable and reducing instructional time. Some modern ATS solutions include biometric identification, RFID cards, QR codes, and geolocation-based check-in. These will provide real-time and tamper-proof attendance data. These technologies reduce human error and administrative overhead while increasing data reliability. Attendance data is a key predictor of student success, as it provides early warning and initiated targeted intervention. Attendance tracking analytics can be automated, as ATS can integrate into learning management systems and institutional databases, through which better decisions can be made and overall transparency can be achieved in compliance and reporting processes. This will ensure that evidence-based practices pave the way for student retention strategies and academic planning.

2.5 Challenges in Designing and Implementing ATS

While useful, the design and deployment of ATS in university environments presents significant obstacles across technical, organizational, and ethical dimensions. These include ensuring that the system has adequate accuracy and reliability across a wide range of environmental variables related to lighting, network latency and facial recognition and device compatibility for sensor-based systems. Additionally, there is integration with prevalent LMSs and student databases, which requires secure APIs and interoperability of data. This brings with it ethical and privacy concerns as well as collecting biometric or geolocation data under data protection laws such as the GDPR. Institutions should consider consent, data minimization and its secure storage. According to the Information Commissioner's Office [ICO] (2024), large-scale deployment in developing regions is often hindered by financial and infrastructural factors; Poor availability of quality power and internet connectivity makes it challenging to achieve real-time synchronization of data and system reliability. Where there is no good governance and stakeholder engagement, it can result in user resistance, technical failures and privacy violations.

2.5.1 Overcoming the challenges

Universities should apply a multi-layered approach: one that includes systems design, stakeholder engagement, and strengthening ethical and legal standards. Hybrid System Architecture The best technical solution is to adopt a hybrid architecture that can integrate different mechanisms for authentication, such as RFID cards, biometric verification—for example, fingerprint and facial recognition—and mobile-based check-in.

This multi-layered approach increases the reliability of the system by introducing a fallback mechanism in case one of the methods fails or is unavailable. It also significantly reduces the risk of fraudulent attendance practices such as proxy sign-in, as each student's identity must be verified through a unique biometric or device-based credential (Mikalyu et al., 2025). Therefore, hybrid systems are particularly useful in diverse institutional environments where infrastructure and user preferences may differ radically.

Edge computing and local caching To reduce this reliance on constant Internet connectivity, especially on unstable networks, universities can adopt the use of edge computing and local caching mechanisms. Edge computing allows data processing closer to the source – for example, on local devices and servers – reducing latency and ensuring that presence information is captured even when there is a temporary network outage.

Local caching stores attendance records offline and then synchronizes with the central database once connectivity is restored. This approach will ensure absolutely no disruption in functionality and data integrity, therefore making ATS viable in both urban and rural educational settings (Touzen et al., 2024). Privacy and data security measures. This will mean that universities will have to put in place robust privacy safeguards given the sensitivity of biometric and geolocation data.

Performing a DPIA will help identify and mitigate risks associated with data collection and processing. Some anonymization techniques in use include conversion to encrypted templates and not storing raw images for biometric data. Such activities will increase privacy and make it practically impossible to steal the identity of the respondent. Encryption protocols and restrictions based on role-based access protect data from being accessed by those without authority. Compliance with international standards, such as the General Data Protection

Regulation, will now provide assurance that an organization is discharging its ethical responsibilities while remaining within the legal framework.

Pilot testing and iterative refinement Therefore, implementation of ATS should be considered only after universities have pilot tested the system in a few selected departments or faculties before fully deploying it. This will provide an opportunity to test the system functionality, user experience and technical performance in real life. Feedback from students, faculty, and administrators in the pilot phase can be used to provide necessary adjustments to the system design, user interface, and operational protocols.

Pilot testing also informs about cost-effectiveness and scalability, thus enabling institutions to make decisions on wider implementation based on data obtained from the process. Governance, training and communication The long-term success of ATS initiatives depends on sustained governance and capacity building. Systems need to be audited regularly to identify vulnerabilities and ensure compliance with institutional policies. Comprehensive training programs should be designed at all levels for staff and students to increase digital literacy and proper use of the system.

Transparency in communication about the purpose, benefits and safeguards offered by ATS builds trust among stakeholders; This, in fact, contributes to greater acceptance by its users. Mechanisms to obtain students' feedback, address any concerns they have, and act on their suggestions also help develop a culture of collaboration and continuous improvement. 2.6 Conclusion In summary, the design and implementation of attendance tracking systems has been an integral part of university operations in the modern world. When deployed effectively, ATS promotes administrative efficiency, academic monitoring, and provides actionable data for institutional planning. In any case, implementation requires addressing technical, ethical, and structural challenges through privacy-conscious design and inclusive governance and iterative evaluation. Therefore, future research should focus on developing interoperable ATS frameworks that are low-cost, privacy-preserving, and adaptable to diverse institutional contexts. Such systems will promote equity, transparency and trust among all stakeholders in higher education.

SECTION THREE

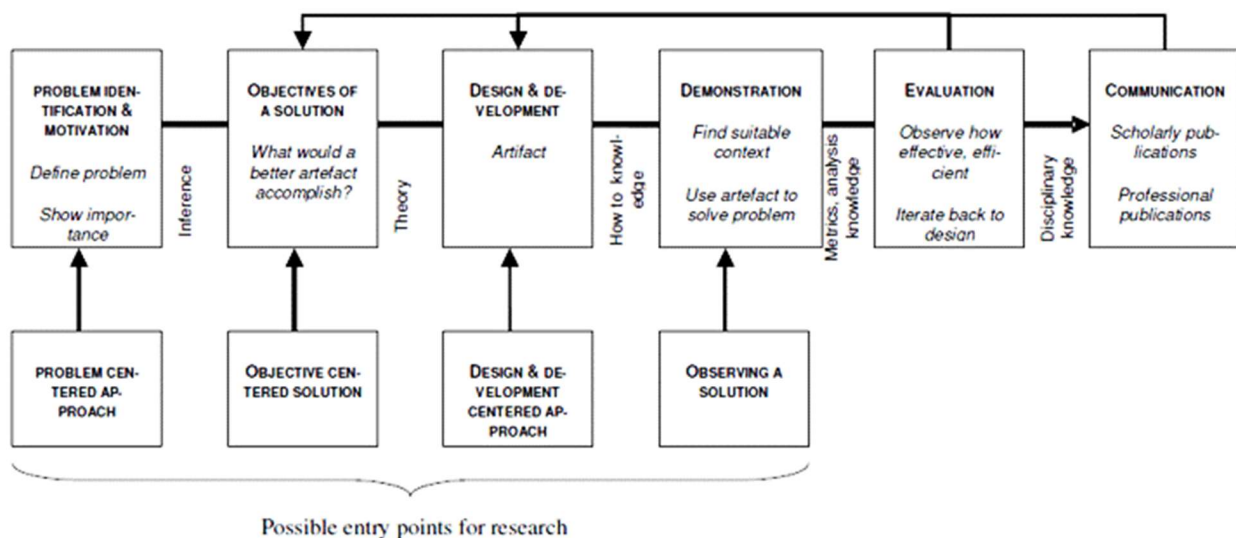
RESEARCH METHODOLOGY

3.0 Introduction

This chapter highlights the comprehensive, selected methodologies that will be applied to the study and methods and techniques the researcher has employed to be able to attain the specific objectives of the study. In addition, it involves the research design, referring to tools, approaches, processes, and techniques used in research study.

3.1 Research Design

This project will be done using the Design Science Research approach. In turn, the design knowledge will help research and practice carry out systematic and scientific designing of the artefact in future projects (Dominik, 2022). This design and application can again generate design-oriented knowledge contributing to a DSR knowledge corpus Hevner et al. 2004.



Source: DSR Process Model of Peffers et al., 2008

DSR Stage	Research Objective to be addressed	Proposed Methods	Expected Results
Problem Identification/ Motivation	To study and analyze the current attendance tracking system used by Makerere University Business School.	Meetings Interviews	<ul style="list-style-type: none"> Strengths and weaknesses of the current system.
Definition of Objectives	To study and analyze the current attendance tracking system used by Makerere University Business School	Meetings Participatory Appraisal	<ul style="list-style-type: none"> Well defined project objectives
Design and Development	To design and develop an attendance tracking system for Makerere University Business School	Using various programming languages like PHP, MySQL, and JavaScript among others.	<ul style="list-style-type: none"> Logical Design of the system System elaboration diagrams A prototype design.
Demonstration	To test the system that has been developed.	Prototype design	<ul style="list-style-type: none"> A test run for the designed and developed system.
Evaluation	Presentation of the system and project report to supervisors for evaluation	Power point presentation Video demonstration	<ul style="list-style-type: none"> Presentation of the system to supervisors.
Communication	Completion of Project Report, upload on e-learning. Presentation of the system to the academic supervisors.	Presentation through Video Demonstrations, and Physical Screen Sharing.	<ul style="list-style-type: none"> Completion of project report and submission of the system.

3.2 Project Organization

The targeted population for the study is 300 students of different faculties at MUBS, since all of these categories of students are directly involved in scheduling and attending school academically. Therefore, they would have relevant insights to inform this study. In addition, their responses cover a wide representation because of the diverse faculties, adding strength to the generalization of the research outcome.

3.2.1 Sampling Technique

This study will use a simple random sampling strategy, which involves the random selection of participants from the population of interest. This method ensures an equal chance of selection for every student, minimizing selection bias while increasing the representation of the sample accordingly. According to Walliman (2011), a simple random sample is thus effective in educational research when the population can be considered homogeneous regarding exposure to the subject of study.

3.3 Sources of Project Data

Both primary and secondary data sources will be used for the project:

Primary data will be obtained directly through structured questionnaires and interviews. This is original data, because it is unprocessed; This gives a direct reflection of the current challenges and expectations of users in attendance tracking.

Secondary data will be obtained from existing literature including academic journals, books, reliable websites, newspapers and institutional reports. These materials provide the contextual and theoretical basis for the study.

3.4 Instruments of Data Collection

Quantitative and qualitative data will be captured using a structured questionnaire as the primary instrument of data collection. A literature review will also be conducted to analyze available timetable generation and attendance tracking systems. Therefore, such a review will inform design strategy by pointing out best practices and common pitfalls of similar systems (Creswell and Creswell, 2018).

3.4.1 Interviews

Semi-structured interviews will be conducted with students in various faculties at MUBS. This method is quite helpful for this qualitative approach, as students' experiences, challenges and suggestions related to class attendance can be discussed in more detail. Personal interviews are appropriate to obtain detailed information and clarify ambiguities (Quale and Brinkman, 2009).

3.5 System Analysis and Design Approaches

In the project, system development will be carried out by adopting prototyping approach. Prototyping is a method where a working model is iteratively created to obtain user feedback to refine system requirements before actual implementation. This approach is important because it helps bridge the gap in communication between system developers and users to ensure that the final product will meet user needs (O'Brien and Marakas, 2011; Camburn et al., 2017).

Also known as rapid application development, or RAD, it focuses on speed and flexibility in system design. Prototyping has seen much use in the field of software engineering to reduce development time by increasing user satisfaction.

3.5.1 Steps involved in the Prototyping Approach

Requirement Gathering and Initial Planning: Initial requirements are gathered through stakeholders' consultation and literature review. Major features may include, but are not limited to, attendance logging, reporting tools, user-friendly interface, amongst others.

(Dennis, Wixom, & Roth, 2015) **Initial Prototype Development:** A simple core prototype will be developed with the use of RAD tools that will include core functionalities such as manual attendance entry and basic reporting.

Testing by Students, Faculty, and Administrators

The prototype will be tested by students, faculty, and administrators. In addition, their feedback on usability, functionality, and design will also be solicited.

Refining the Prototype: Based on users' input, the prototype shall be refined by including such features as biometric integrations, notifications, and enhanced UI/UX. **Repeat Process:** This process of feedback and refinement will continue until the system meets the expectations of

users. With each iteration, there are new features added including real-time dashboards and administrative controls (Sommerville, 2011).

Development of the Final System: The prototype, after validation, shall be converted into a fully functional system, thoroughly tested, and deployed institution-wide.

3.5.2 Advantages of Prototyping Approach in System Design

Prototyping has many advantages, especially in the development of systems like attendance tracking, where requirements are likely to change over time. Some of the key benefits include:

User feedback first: Interactions between users and the system begin early, and as such, design flaws and functional gaps are immediately known. This is extremely important in attendance systems, where features such as real-time tracking and automated reporting are very essential and, of course, may change during their development (Pressman, 2014).

Better user engagement: Prototyping helps in continuous user engagement; A feeling of ownership and satisfaction regarding the final product is ensured. Furthermore, it is an effective way to involve all concerned, including teachers and administrators, to ensure that the system reflects the needs of real users.

Flexibility and adaptability: Due to the iterative nature of prototyping, this is where rapid adjustments can be made as requirements are constantly changing. A very good example is how institutions can start with a manual way of attendance and then move to biometric or even mobile-based systems, an integration that can be easily supported by prototyping.

This is especially important in systems where usability and accuracy are important. Finding issues early reduces the likelihood of costly modifications later in the development cycle; Hence, it creates cost and time efficiency.

User-Centered Design: Prototyping ensures that the system meets user expectations. Features such as ease of navigation, report generation, and data entry have all been consolidated through constant feedback, thereby making the user very comfortable with the system. Pressman, 2014

3.6 Requirement Elicitation

First of all, we will analyze the data we have collected, then formulate a number of requirements, namely user requirement, system hardware software attribute. These were grouped as user, functional, non-functional and systems requirements.

3.6.1 User Requirements

During data collection, we will study the current functioning of attendance management processes at Makerere University Business School. That is, to examine the challenges faced by both students and staff and look for possible practical solutions to try and help. Users, such as lecturers, administrators and students, will also outline key system requirements. These may include features such as the ability to search for scheduled lectures, track attendance records, and generate attendance reports.

3.6.2 Functional and Non-Functional Requirements of an Attendance Tracking

System A functional attendance tracking system will be able to provide several core functionalities that will ensure accurate and efficient tracking of attendance, including, but not limited to, ensuring user authentication for secure access, recording and updating attendance data, and supporting multiple users such as students, teachers, and administrators. Additionally, it will provide users with the functionality to view history, generate reports, and set alerts for irregular patterns or absences.

It should also support biometric devices or RFID scanners for automated check-in and mobile and web interfaces for ease of access. Non-functional requirements define the performance, usability, and reliability of the system. The system must be able to scale to large amounts of data and simultaneous users without any lag. It must securely enforce data integrity and security through encryption and periodic backups.

Its adoption requires user-friendly interfaces and intuitive navigation. The application needs to be compatible with different devices for cross-platform access. This will ensure high availability with minimum down time and audit trails for accountability at various levels, as per institutional policy.

3.7 System Requirements

This section covers hardware specification and software requirements that would be needed for running the system efficiently and effectively. The system requires the following software and hardware requirements:

3.7.1 Software Requirements

Table 1: Software Requirements

Software	Minimum System requirement
Operating System	Windows XP or later versions
Programming	HTML, CSS, JavaScript, PHP
Database Management System	WampServer, PhpMyAdmin with MySQL
Server	WAMP or XAMPP
Web design	Macromedia Dreamweaver and Adobe Photoshop

3.7.2 Hardware Requirements

Table 2: Hardware Requirement:

Hardware	Minimum System requirement
Processor	2.60 GHz or higher
Ram	16 GB
Disk Space	1 TB
CPU	Intel Core i7 or higher

3.8 Design Techniques

Entity-Relationship Diagram (ERD) and Enhanced ERD (EERD)

ERDs are fundamental database design concepts that represent entities, attributes, and relationships. ERDs are extensions of ERDs by incorporating advanced concepts such as specialization, generalization, and aggregation, thus making them more suitable for complex systems (Li and Chen, 2009). These diagrams also ensure data normalization, reduce data redundancy, and increase query performance, hence ensuring that the architecture of the database is correct (Kaiku, 2024).

Data Flow Diagrams (DFD)

DFDs model the flow of data within a system to show interactions between processes, data stores, and external entities. They can be divided into three categories based on their complexity and detail: reference (level 0), level 1, and level 2 diagrams. Data flow diagrams are useful in identifying inefficiencies in system development and optimizing workflows (Arwa, 2024).

3.9 Expected Project Limitations

- i. Some respondents were only available during working hours, limiting the depth of responses.
- ii. Planning interviews involved multiple appointments, making the data collection process lengthy.
- iii. Not all participants had complete knowledge about the topic, although sufficient information was gathered.
- iv. Supporting the meeting with outside resources reduced the financial burdens of transportation and printing.
- v. The approval process to conduct research was time consuming and required a lot of follow-up.

3.10 Ethical Considerations

- i. A formal letter of introduction from the faculty will be obtained to validate the academic nature of the research.
- ii. Informed consent will be sought from all participants with a clear explanation of the objectives of the study.
- iii. Maintaining confidentiality and privacy for respondents.
- iv. All scholarly sources will be cited appropriately to maintain academic integrity and avoid plagiarism.

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APPENDICES

Appendix I: Proposed work plan using the Ghant chart

Activity	April 2025	May 2025	Sep 2025	Oct 2025	Feb 2026	Mar 2026
Investigating the Current System						
Related literature collection						
Requirements gathering for a new system						
New system design						
Developing new system						
System testing						
User training						
System implementation						

Appendix II: Estimated budget

ITEM	PRICE (UGX)
Paper (printing reports, documentation)	20,000
Airtime (communication, internet bundles)	50,000
Pens & Stationery	10,000
Transport- meetings, field visits	150,000
Questionnaires (data collection)	50,000
Computer (development workstation)	1,000,000
Flash Drives (data backup)	50,000
Software Licenses: database, IDE tools	200,000
Training & Workshops (user orientation)	200,000
Contingency (unexpected costs)	270,000
TOTAL	2,000,000