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# **MAKERERE UNIVERSITY BUSINESS SCHOOL**

## **DEVELOPING A HOSPITAL INFORMATION MANAGEMENT SYSTEM FOR AMSAM CLINIC, KAMPALA DISTRICT**

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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, declare that to the best of our knowledge, this proposal is our original 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 is submitted with my approval as supervisor and my signature is attached here

Signed.....

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## SECTION ONE

### INTRODUCTION

#### 1.1 Background of the Project

Uganda is pursuing a national agenda for digital health, prioritizing electronic medical records (EMR), interoperability, data governance and analytics to strengthen service delivery and management decision making (Ministry of Health Uganda, 2022; Ministry of Health Uganda, 2024). Despite these efforts, many facilities, especially at the primary care level, still rely on paper-based systems that contribute to delays, inaccurate records, and limited access to timely reports for planning (Ahebwa, Musinguzi, & Mabuwa, 2023; Mugisha, Tusim, & Kato, 2023). Evidence from Ugandan tertiary settings shows that integrated hospital management systems (HIMS) can streamline workflows in registration, appointments, billing, pharmacy, laboratory and reporting, improving operational performance and quality of care (Nabukenya and Muvinyo, 2021).

Amsam Clinic, located in Kataza, Kampala, experiences these system challenges, including manual records handling and fragmented reporting (AfricaBizInfo, n.d.). Implementing an efficient hospital management system aligned to national standards using platforms such as UgandaIMR+ and DHIS2 reporting integration will help centralize patient data, standardize workflows, and generate management reports to support clinic leadership (UgandaIMR+, n.d.; CPHL, 2024; Ministry of Health, 2023). Through better access controls and secure backups, the system can reduce errors, increase data security and improve the reliability of information for decision making (Ministry of Health Uganda, 2022; Ministry of Health, 2024).

Given that the clinic operates with a paper-based process, the transition to a digital system needs to be handled carefully. A gradual change is required that supports a temporary hybrid workflow (both paper and digital) and protects continuity throughout the implementation. Fortunately the clinic can take advantage of existing open source EMR options built on PHP/MySQL that provide enough flexibility to adapt to its specific operational constraints and resource constraints. (UgandaMR) Overall, these factors provide a strong, practical case for a hospital management system at Amsam Clinic.



## **1.2 Problem statement**

Modern information management systems in hospitals guarantee accuracy and efficiency in handling patient records, thereby improving hospital operations and delivery of services. However, according to Dr Anyembazi Ivan, a staff member at Amsam Clinic, the clinic still operates mainly on a manual, paper-based system for managing information related to patients, medical records and administrative data. Records are then stored in physical files, leaving them vulnerable to loss and, in addition, manual systems contribute to delays in patient care and potentially compromise data privacy. Low quality of health services, inefficient operations, and loss of trust from patients are associated with continued reliance on such systems by hospitals. Therefore, a computerized hospital information management system can provide efficiency, accuracy, and security in handling patient and hospital records, enabling the clinic to serve the community with greater efficacy.

## **1.3 Project Goal and Objectives**

### **1.3.1 Project Objective**

This project aims to design and develop an information management system that would improve the handling of data at Amsam Clinic.

### **1.3.2 Project Objectives**

- i. To study and analyze the present information management system used by Amsam Clinic.
- ii. To identify the essentials needed in designing a digital health information management system for the hospital.
- iii. To design and develop the digital health information management system for the hospital.
- iv. To test the digital health information management system that has been developed.

## **1.4 Expected Impact of the Project**

The new system will enable Amsam Clinic to provide better care to patients as the time to access patient records will be faster, allowing doctors to make more informed decisions; Patient confidentiality will be improved and reports will be provided on time, which will improve decision making in management. By working on this project, we hope to improve our technical skills when designing systems, our problem-solving skills when attempting to solve a real-world challenge, and our research skills.

### **1.5 Project Assumptions**

**Assumption 1:** The team assumes maximum participation from all its members and that everybody will actively collaborate well with each other.

**Assumption 2:** The engagement will have constant access to the internet to facilitate the operation of the information management system.

**Assumption 3:** The project academic supervisors are assumed to provide guidance, timely feedback, and support throughout the project.

**Assumption 4:** The team assumes that the needed hardware like laptops and the necessary software to develop the information system are available and affordable.

## SECTION TWO

### LITERATURE REVIEW

#### 2.0 Introduction

Digital technologies have become a global imperative to transform healthcare delivery, especially in low- and middle-income countries where resources are limited, and inefficiencies in manual systems prevent optimal service delivery. In Uganda, digital health is expressed in the vision of the Ministry of Health as a way to ensure that quality, efficiency and equity are enhanced with adequate health information management systems. Amsam Clinic, a small health facility located in Kampala, currently relies on a mostly manual, paper-based information management system which reflects the broader challenges faced by many similar institutions across the country (Public Health in Africa, 2023). This literature review is organized around four research objectives: a) to study and analyze the prevalent information management system implemented by Amsam Clinic; b) Establishing the necessary requirements for designing a hospital's digital health information management system; c) Design and develop digital health information management system for the hospital; and d) testing the developed digital health information management system.

The evidence reviewed included journals, government policy documents, case studies and technical guidelines in relation to the Ugandan context. It draws extensively on recent studies and national strategies, including the Uganda Digital Health Strategy 2022-2027, with lessons drawn from similar features and digital health initiatives in the region. The review concludes by synthesizing key findings and recommendations tailored to the needs of AMSM clinics.

#### 2.1 Analysis of Current Information Management System

Uganda's health care system is represented by both public and private providers, with the key regulatory body being the Ministry of Health. Health facilities are organized in a hierarchical structure from the village level to national referral hospitals. Smaller clinics, such as Amsam Clinic, generally operate at the lowest level of this hierarchy as private entities. Public health in Africa, 2023. At all levels, managing patient data and administrative data is a challenge.

Despite national efforts toward digitizing health information, most lower level facilities, including small hospitals and clinics, still rely on paper-based systems for patient registration, clinical documentation, laboratory results, and reporting. These are manual processes involving standardized forms and registers such as Medical Form Five (MF5) and various monthly and annual reporting tools advanced by the Ministry of Health. Data collected on paper are subsequently aggregated and submitted to district health offices and ultimately to the Ministry of Health, often through the District Health Information Software 2-DHIS2 platform (UNCST, 2023, CPHL, 2024).

## 2.2 Challenges of Manual, Paper-Based Systems

Reliance on manual, paper-based information management in Ugandan hospitals and health clinics introduces many inefficiencies and risks. Patient records are typically kept in physical files, often sorted by date or department, making retrieval slow and prone to errors, affecting continuity of care and complicating audits or clinical reviews. Manual entry also increases the potential for errors and discrepancies, with health workers often reporting that it is difficult to maintain complete and accurate records. In addition, various registers and forms record data, some overlapping; Therefore, this leads to duplication of forms and increases administrative burden. Similarly, paper-based reports presented at higher administrative levels are slow, delaying the availability of such data needed for planning and resource allocation. Physical records are equally vulnerable to loss, damage and unauthorized access; This raises security and privacy concerns for both patients and staff.

Mugisha et al. (2023) noted that in urban clinics in Kampala, manual record-keeping significantly increased waiting times for patients and led to many other inefficiencies within service delivery. Similar challenges also emerged in rural areas, where staff shortages, high patient flow and lack of some facilities made the situation worse (BMJ Open, 2021).

## 2.3 Information Management in Comparable Facilities

Comparison of information management practices in facilities such as Kampala International University Teaching Hospital and Case Clinic indicates a range from entirely manual to both paper and digital systems. Most clinical and administrative functions depend on paper-based

documentation. Progress toward fully digital systems is often hindered by infrastructure limitations, lack of interoperability, and limited training of staff (Academia.edu, 2018).

Thus, and given that Amsam Clinic is a small private clinic in Kampala, all of these challenges are likely to be reflected in it. It is open 24 hours a day and provides various outpatient and possibly some inpatient services, including manually registering patients for consultation, such as clinical documentation, billing and reporting.

## **2.4 Requirements for A Digital Health Information System**

The design of a digital HIMS for Amsam Clinic will be achieved by a proper understanding of the clinic's workflows, data requirements, and reporting obligations. Key functional requirements include the ability to handle patient registration and management, where patient biodata is captured in detail, such as name, age, sex, and contact information, with unique patient identifiers (Ministry of Health, 2023). Clinical documentation should capture examinations, diagnoses, laboratory results, and treatment/medication prescriptions with structured data entry for analysis and reporting capabilities (SourceCodester, 2020). To that end, appointment scheduling is to be provided for the optimization of patient flow. In regard to that, billing and financial management features shall be able to track services offered, payments, and insurance claims. Inventory and pharmacy management functionalities are necessary for drug stock management. Additionally, the system shall provide regular reports for internal use and also report externally to DHIS2 and the Ministry of Health among others (UgandaEMR+, n.d.).

In addition to functionality, non-functional requirements ensure that the system is secure, reliable, and user-friendly. Strong security and privacy measures should be taken, including user authentication, encryption and audit trails as per the Data Protection and Privacy Act, 2019 and Health Ministry standards. The interface should be accessible to users with different levels of technical skills with easy navigation and minimal complexity in data entry. Equally important is interoperability for data exchange with national platforms such as DHIS2 and laboratory systems using standards such as HL7, FHIR and API. The system must be flexible to accommodate future growth. The system must ensure high availability and reliability through stable infrastructure, regular data backups, and disaster recovery mechanisms. The required hardware, software and connectivity should be defined in the infrastructure requirements to ensure ease of operation.

Finally, adequate training, user manuals, and ongoing technical support are needed to increase effective adoption and long-term system sustainability.

## **2.5 Legal, Ethical, and Governance Considerations**

The digital hospital management system for Amsam Clinic will be installed and implemented in line with national and international standards governing the management of health data. This requires clear data ownership, informed consent by patients prior to collection, and an overview of patients' rights in accessing and correcting their medical records. Data sharing and use agreements are needed as a means to standardize sharing with parties outside the institution. Similarly, there is a need to put in place appropriate governance mechanisms to provide roles and responsibilities related to data management, system administration and continuous monitoring of compliance with a view to ensuring accountability and integrity in the management of health information.

## **2.6 Design And Development Of The System**

### **2.6.1 Design Approaches And Methodologies**

The design and development of AMSM Clinic's digital HIMS should be guided by established principles in software engineering. The process should begin with need assessment and stakeholder engagement in view of the current workflow, data requirements and operational challenges, followed by detailed requirements specification where both functional and non-functional requirements should be documented using use case diagrams, entity-relationship diagrams and process flowcharts. The architecture of the system, potentially a Web-based client-server model using languages such as PHP, MySQL, HTML, CSS, and JavaScript, should be chosen to balance cost, scalability, and ease of maintenance. Human-centered design principles should guide interface development with the aim of intuitiveness through iterative prototyping and user feedback. The system should be developed modularly, consisting of components such as patient registration, clinical documentation, pharmacy, and billing, allowing phased implementation and scalability. Finally, strong security measures such as encryption, access controls and regular audits of data should be integrated right from the development stage to ensure compliance with the Data Protection and Privacy Act and Health Ministry guidelines.

### **2.6.2 Technology Choices And Infrastructure**

Case studies from Ugandan hospitals can be used to show the feasibility of deploying web-based HIMS using open-source technologies like PHP, MySQL, and HTML/CSS for the front end,

using local or cloud-based servers for data storage 1011. The UgandaEMR+ platform, which is developed from OpenMRS, is broadly used in over 1,900 facilities and offers customizable modules for patient management, pharmacy, laboratory, and reporting (UgandaEMR+, n.d.). For small clinics such as Amsam, a lightweight, modular system that can operate offline and synchronize with central servers when connectivity is available is ideal.

Minimum hardware requirements normally include computers that have at least 1.8 GHz processors, 256 MB RAM, 15 GB disk space, and reliable power supply. Network infrastructure should support local area networking and, where possible, internet connectivity for data exchange and remote support.

## **2.7 Testing And Evaluation of the System**

### **2.7.1 Testing Methodologies**

Testing is an important phase of the development and deployment of a digital health system to ensure it meets the functional requirements, is reliable, and is acceptable to end users. Different testing methods are suggested to meet the above objectives: Unit testing, testing of individual components to ensure that they act as expected; Integration testing, which checks interactions both between modules and with external systems like laboratories and pharmacies for seamless data flow and interoperability. According to the Ministry of Health (2024), UAT involves real end users, including clinicians and administrators, testing the system in real conditions as those present in the natural environment. The focus will be based on the evaluation of usability, workflow fit, and satisfaction with system output. Performance and scalability testing considers the time it takes for the system to respond, its reliability under load conditions, and its ability to handle increasing volumes of data or a growing number of users. Security testing evaluates access controls, encryption, and vulnerability to unauthorized access or breaches. Testing should be iterative; feedback loops must allow for continuous improvement and refinement of the system to accommodate emerging needs and user experiences.

## **2.8 Summary of Literature Review**

Secondary data will be obtained from existing literature including academic journals, books, credible websites, newspapers, and institutional reports. These materials provide a 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 tool of data collection. A literature review will also be carried out to analyze available timetable generation and attendance tracking systems. Such a review shall, therefore, inform the design strategy by pinpointing best practices and common pitfalls of similar systems (Creswell & Creswell, 2018).

#### 3.4.1 Interviews

Semi-structured interviews with students will be conducted across different faculties at MUBS. This method is quite helpful for this qualitative approach, as the students' experiences, challenges, and suggestions concerning class attendance can be discussed in greater detail. Individual interviews are appropriate for obtaining elaborate information and clarifying ambiguities (Kvale & Brinkmann, 2009).

### 3.5 System Analysis and Design Approaches

In the project, system development will be done through the adoption of a prototyping approach. Prototyping is a method where one iteratively creates a working model in order to acquire user feedback to refine system requirements before the actual implementation. This approach is important because it helps to bridge the gap in communication between system developers and users in making sure that the final product will meet user needs (O'Brien & Marakas, 2011; Camburn et al., 2017).

It is also referred to as Rapid Application Development or RAD, which focuses on speed and flexibility in system design. Prototyping has seen much application in the field of software engineering to minimize development time through 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, particularly in the development of systems like attendance tracking, where requirements are likely to change over a period of time. Some major advantages include:

Earlier User Feedback: Interaction between the users and the system starts off early, and as such, design flaws and functional gaps become immediately detected. This is of prime importance in attendance systems, where features like real-time tracking and automated reporting are very essential and may, of course, change during their development (Pressman, 2014).

Improved user involvement: The prototype helps in continuous user engagement; the feeling of ownership and satisfaction concerning the final product is assured. Besides, this is an efficient way of involving 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 the place where rapid adjustments can be made as requirements are continually changing. A very good instance is how institutions may start with a manual mode of attendance and then shift to biometric or even mobile-based systems, an integration that may be supported smoothly by prototyping.

This is especially important in systems where usability and accuracy are crucial. Finding issues much earlier reduces the likelihood of costly revisions 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 shall study the current working of the attendance management processes at Makerere University Business School. That is, checking on the challenges faced by

both students and staff, and looking for possible practical solutions to try and help. The users, such as lecturers, administrators, and students, will also outline key system requirements. These may include features like 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 the 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 functionality for users to view history, generate reports, and set up alerts for irregular patterns or absenteeism. 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 should be able to scale up for large volumes of data and simultaneous users without lag. It should safely implement data integrity and security through encryption and backups at periodic intervals. It needs to have a user-friendly interface and intuitive navigation for adoption. The application has to be compatible with different devices for cross-platform access. It shall ensure high availability with minimal down times and audit trails for accountability at different levels, in accordance with 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:.

## SECTION THREE

### RESEARCH METHODS

#### 3.0project Methods

#### 3.1 Research Design

The project team will be undertaking the Design Science Research Approach. This has been chosen because it is the most suitable method for developing and testing of an information system. The research will begin with identification of the clinic's existing challenges in handling patient data and then define a practical solution that aims at developing a functional prototype of a hospital information management system.

##### 3.1.1 A table illustrating the Design Science Research Approach

Design Science Research Stage	Proposed Methods	Expected Results
Problem Identification	-Observation -Interviews -Meetings	To gain an understanding of the existing system being used by Amsam Clinic
2. Objectives	-Group discussions	To get clear goals and achievable objectives for the research project
3.Design and development	Appropriate software such as PHP, MySQL, CSS,Js, Microsoft Excel Hardware such as Computers and Smartphones Design Tools such as ... for ERD's	-Conceptual design -Logical design -Physical design -Prototype of the system
4. Demonstration	To test the hospital information management system that has been developed	-Confirmation that the system performs its core functions effectively. -Identification of any usability issues. -Evidence that the system meets the objectives defined earlier.
5. Evaluation	Presentation of the system and final report to the respective supervisors	Successful defense of the system to supervisors and faculty.

**Stage 1: Problem Identification:** This consists of the identification of a problem that Amsam Clinic faces using a range of problem identification techniques. These will include interviews of hospital employees such as doctors and nurses, and observation by the researchers. From these, the researchers will brainstorm on the most pressing issues facing the clinic and develop a digital hospital system to solve the problem for Amsam.

**Stage 2: Objectives:** This is where the researchers will define and state the objectives of the project. For this project, four objectives have been chosen. These include studying and analyzing the current information management system used by Amsam Clinic, identifying the necessary requirements for designing the system, designing and developing the actual system and testing the system.

**Stage 3: Design and development:** The prototype of the system will be developed in this stage by translating the clinic needs and research objectives into a system. Design involves outlining

**Stage 4: Demonstration:** The team shall then test the developed system with sample data to demonstrate how it can be used under real-world conditions; this will help verify the functionality of the system and show how it will effectively address the problems identified in the research.

**Stage 5: Evaluation:** In this stage, the team will present the project work to the respective supervisors, and feedback will be given where it is due.

### 3.2 Project Organization (Client)

**Client:** Amsam Clinic

**Users:** Nurses, Clinic receptionists, Clinic managers, Doctors

### 3.3 Sources of Project Data

#### 3.3.1 Primary Data

- Company documents like no confidential data, hospital logs, attendance schedules
- Observation: This involves allocating specific days to be on site and observe the conditions of the current information system of the clinic.
- Interviews. Setting up structured interviews with administrators, staff, and patients if possible.

### 3.3.2 Secondary Data

- Ministry of Health Reports and WHO Publications
- Research and Media articles

### 3.4 System Analysis and Design Approaches

Object-oriented design approach is used in this project. It is a design approach where software systems are modeled as a collection of objects that interact with each other, each object representing an entity or concept from the real world. Depending on the project, these objects could include things like patients, appointments, and medical records.

The object-oriented approach shows how people think about the clinic: from patients and appointments to invoices. These naturally behave like separate entities with their own data and functions. Modeling these real-world things as classes makes the system easier to understand and allows requirements to be described in relatable terms that clinic staff can validate.

The approach, on the other hand, gives the system more organization and flexibility. For instance, if new services or even departments are opened within a clinic in the near future, they can be added easily into the system without developing the entire system anew. Another benefit is that sensitive data like patient information will be kept more secure through encapsulation, which means only specified parts of the system have access to such data.

If we are to compare the structured design to object-oriented design, structured design is more focused on processes and data flow than real-world entities. For a project at hand, this may be difficult to maintain when the system will grow, and since hospitals and clinics have many evolving needs, object-oriented design provides a more practical and adaptable foundation for this project.

#### 3.4.1 Design Techniques

- Use Case Diagrams to capture actors and primary workflows.
- Class Diagrams to model domain entities, like Patient, Encounter, Prescription, Inventory Item, Invoice.
- Entity Relationship Diagrams for persistent data structures and normalization of the clinical database.

- Sequence and Activity Diagrams to show, over time, interactions for critical processes such as medication dispensing or payment posting.
- User Journey Maps and Wireframes to design screens that match clinical tasks and minimize data entry overhead.
- Component and Deployment Diagrams: To plan the separation of services for scalability and hosting.

### 3.5 Expected Project Constraints

The team is expected to go through the following constraints during the course of the project;

- a) The team may lack enough programming skills required for the development of the system. Thus, the team is planning group discussions with professional programmers who will guide each member in adding to their skills and developing quality software.
- b) Inability to obtain literature and data about the area of study may hinder the project. The team intends to obtain as much information about the study area as possible through online sources.
- c) The project may be affected by inability to get the latest software programs to design the system. The team plans to source for the most appropriate software that can be used to solve the problem.

### 3.6 Ethical Considerations

In developing the hospital management system for Amsam Clinic, we realized that protecting patient privacy and data security at all stages of work is paramount. Thus the following ethical considerations guide us:

- a) Informed consent: Before conducting interviews or observations, we will seek permission from all intended participants. Each participant will be informed about the purpose of the project and their right to withdraw at any time without any consequences.
- B) Confidentiality. All information related to patients obtained during the project will be kept confidential. We will avoid collecting very personal information unless necessary and any data used for display will be completely anonymous. The system will provide secure login features so that only authorized users can view sensitive records.

c) Accountability and transparency. All our processes and decisions within the project will be clearly documented to ensure that the clinic and our supervisors understand what we are doing and remain accountable in ethical conduct.

### 3.7 Timeline and Milestones

Milestone	Timeline
Includes selection of a topic, preliminary research, proposal writing, and supervisor approval.	August (Weeks 3–4):
Start writing the full project proposal, get background information, and conduct a literature review	September (Weeks 1–4)
Systems analysis-define requirements, collect data, and analyze the problem.	October (Weeks 1–2):
System design: Develop system models, data flow diagrams, database design, and user interface sketches.	October (Weeks 3–4):
System development: implement the core modules; perform preliminary testing	November (Weeks 1–2):
System testing, evaluation, report writing, and final submission	Weeks 3–4: November



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