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Development of a Web Based Medical Record System with SMS and E-Mail Notifications

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Abstract: Efficient management of medical records is fundamental to the delivery of high-quality healthcare services. However, many healthcare institutions, particularly in developing countries, continue to rely on fragmented and paper-based record systems, which are characterized by inefficiency, data redundancy, limited accessibility, and poor communication channels. The aim of the study was to design and implementation of an integrated medical record management system enhanced with Short Message Service (SMS) and email notification functionalities. The proposed system adopted a centralized database architecture that ensured a secured storage and efficient management of patients' information. The system was developed using Python for backend logic, PHP for server-side scripting, MySQL as the relational database management system, and RESTful APIs for integrating SMS and email services. The development process followed a structured methodology, including system analysis, design, implementation, and testing phases. Emphasis was placed on data integrity, system scalability, and security through authentication and role-based access control mechanisms. To evaluate system performance, key metrics such as response time, data retrieval speed, system usability, and notification delivery success rate were assessed. The system achieved an average response time of less than 2 seconds, a data retrieval accuracy rate of 98%, and a notification delivery success rate of 95%. Usability testing, conducted with healthcare staff, indicated a high level of user satisfaction and ease of use. Findings from the study demonstrate that the developed system significantly reduces data processing time, minimizes errors associated with manual record-keeping, and enhances patient engagement through automated communication. The integration of SMS and email notifications proved effective in reducing missed appointments and improving adherence to medical schedules. This study contributed to the advancement of digital healthcare systems by demonstrating the effectiveness of integrating modern web technologies and communication APIs into medical record management. It is therefore recommended that healthcare institutions adopt such systems to improve operational efficiency, good data management practices, and overall quality of healthcare delivery.

Keyword: *MYSQL, RESTful, SMS, APIs, PHP, Server, Html.*

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I. INTRODUCTION

➢ *Background of the Study*

Medical records are among the vital tools that hospitals require in order to attain the missions and visions of the respective hospitals. The terms medical record, health record, and medical chart are used somewhat interchangeably to describe the systematic documentation of a single patient's medical history and care across time within one particular health care provider's jurisdiction (Adeyeye 2024). With timely access to adequate medical records, medical treatment of a patient becomes easier, faster, more accurate, more efficient and more effective. Indeed, the importance of medical records cannot be overemphasized.

Many healthcare institutions, still rely heavily on manual or semi-digital systems for managing patients' medical records. These traditional methods are often inefficient, prone to errors, and vulnerable to data loss, leading to poor record management and delays in patient care.

The aim of this study is to design and implement an online medical record information system with SMS and email notifications.

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The objectives of the study are to develop:

- A database of patients' medical records using My SQL to facilitate easy access to a patient's record from any location in the world.
- A module that will authenticate the users of the proposed system. This module will ensure that only authorized users are allowed to access the system using Python and My SQL.
- A module using RESTful APIs that will manage schedules, appointment reminder, appointment confirmation, and cancelation or rescheduling of appointment using SMS and email notification.

This study focused on the design and development of a medical record management system capable of storing patient information and sending automated SMS and email notifications to patients and next of kin related to appointments, treatment updates, and reminders.

This study will be quite significant to doctors, patients and laboratory scientists in the following ways:

- The proposed system will help doctors to offer the best quality of medical care to patients since they can easily view the patients' medical records online. Also, doctors will be able to manage their schedules and give patients updates regarding the schedules using SMS or email. By so doing, there will be no cases of class in schedules missed schedules.
- The system will help patients to obtain quality medical care by enabling them to easily share their medical records with their new doctors. Also, they will be able to view their test results without going back to the hospital. Moreover, they will be able to receive SMS or email notification concerning their schedules and thus avoid missing their schedules.
- Laboratory scientists will equally benefit from this study because it will help them to easily send their test results to doctors and patients without spending much time or stressing themselves.

II. ANALYSIS OF THE PROPOSED SYSTEM

The users of the proposed medical record information management system with SMS and email notification include:

- Patient
- Doctor
- Laboratory scientist

The system allows the patient to:

- Register
- Login
- Manage schedules using SMS and email notification
- Enter patient bio-data
- Enter symptoms
- View result of diagnosis via SMS and email
- View prescriptions via SMS and email

- Schedule Management: The system allows a patient to book, reschedule or cancel an appointment with a doctor. Often, these are done with the clerical staff but on few occasions, they are done directly with the doctor.
- Supplying Patient Bio-Data: Upon visiting the hospital, the patient supplies his/her bio-data to the clerical staff.
- Getting Diagnosed: The patient supplies his/her symptoms to the doctor and allows the doctor to examine him/her physically, mentally and otherwise.
- Viewing Result of Diagnosis: The patient views the disease(s) suspected by the doctor and the laboratory test result (if any) to back up the claims.
- Viewing Prescriptions: The patient views the prescriptions of the doctor.

➢ *The System Allows the Clerical Staff to:*

- Manage patient file
- Manage schedule

✓ Patient File Management: The clerical staff creates, updates, maintains and destroys patient bio-data and medical records as the case may be.
✓ Schedule Management: The clerical staff manages appointments between the patient and the doctor. The clerical staff informs the patient and the doctor of a new, rescheduled or canceled appointment usually via physical call, phone call or SMS.

➢ *The System Allows the Doctor to:*

- Manage schedule
- Diagnose patient
- View laboratory test result
- Prescribe drugs for the patient

✓ Schedule Management: The doctor manages his/her appointments with the patient directly or through the clerical staff. The doctor can schedule, reschedule or cancel an appointment with the patient.
✓ Patient Diagnosis: The doctor enquires the symptoms of the patient and also, if necessary, examines the patient physically, psychologically and otherwise. Based on the symptoms observed, the doctor may decide to recommend a laboratory test for the patient.
✓ Viewing Laboratory Test Result: If a laboratory test was recommended, the doctor views the result of the laboratory test as sent by the laboratory scientist.
✓ Drug Prescription: Based on the symptoms observed and the result of the laboratory test (if any), the doctor prescribes some drugs and practices for the patient.

➢ *The System Allows the Laboratory Scientist to:*

- Get patient's record and sample
- Test patient's sample
- Publish result of laboratory test

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- ✓ Getting the Patient's Record and Sample: The laboratory scientist gets the sample (blood, stool, urine, etc) of the patient and some of the patient's records (like ID, name, etc) to uniquely identify the patient's sample.
- ✓ Testing Patient's Sample: The laboratory scientist analyzes the patient's sample in the laboratory.
- ✓ Publishing of Laboratory Result: The laboratory scientist publishes the test result of the patient for use by the doctor and the patient.

➢ *Input Analysis of the Existing System*

Input data required in the existing system include patient's bio-data, symptoms, sample data and schedule requests. In the existing system, paper forms are used to get these data. Sample input forms of the existing system are shown in the following figures 1 to 4.

- *Input Analysis of the Proposed System*

Input data required in the proposed system include registration data, login data, patient's bio-data, symptoms, sample record and schedule request information. In the proposed system, HTML forms are used to collect these data and saved in the system's database for processing.

- *Patient Bio-Data Form*

Figure 1 below shows a patient's bio-data form in the existing medical record information management system. The form allows a patient to enter his/her bio-data information such as name, date of birth, sex and marital status. It also allows the patient to enter his/her contact information and next of kin information.

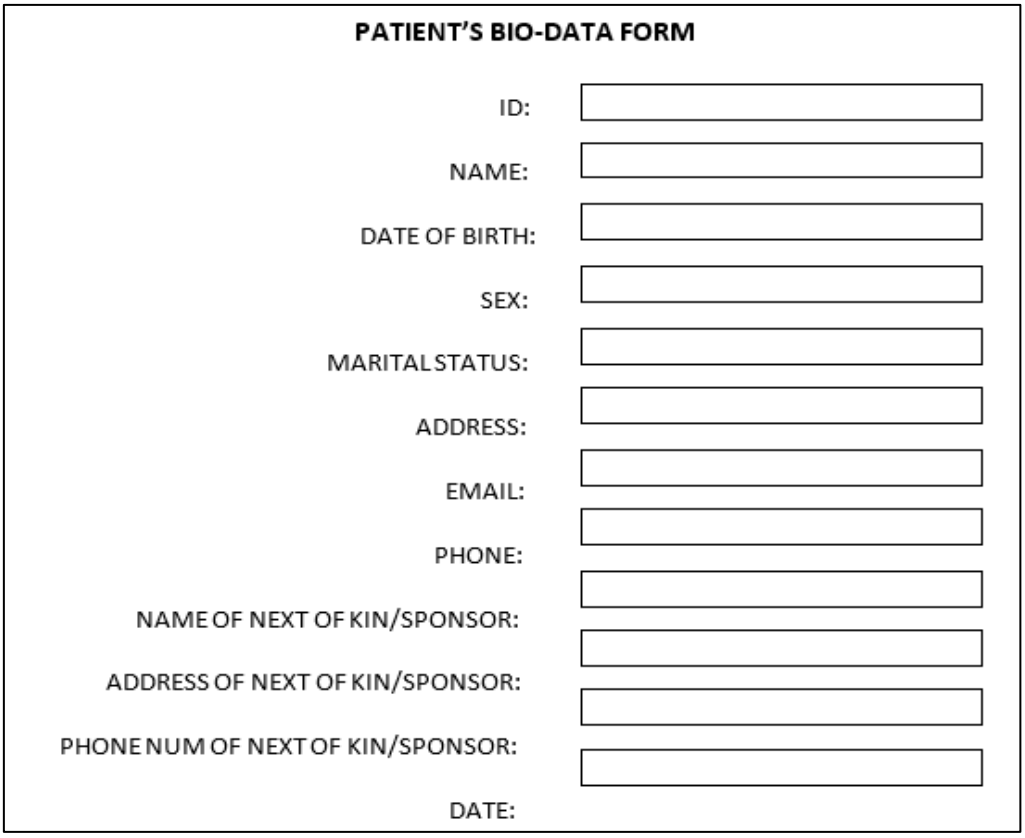


Fig 1 Patient's Bio-Data Form of the Existing System

- *Output Analysis of the Proposed System*

In the proposed system, forms, labels and alert boxes are used to show output information such as success messages, error messages, doctor's prescriptions, patient's laboratory test results and schedule updates.

➢ *Process Flow in the Proposed System*

As shown in Figure 4 below, a user is expected to register or login in order to access the other modules in the system. During login, based on the login data supplied, the system grants each user his/her merited privileges as a patient, laboratory scientist or doctor.

When logged in as a patient, a user is privileged to manage his/her schedules with a doctor. Furthermore, the patient can update his/her bio-data, enter symptoms, view laboratory test result (if any), view doctor's prescriptions, logout and exit the system.

When logged in as a laboratory scientist, the user can select a particular patient, enter the patient's laboratory test result (if any), logout and exit the system.

When logged in as a doctor, the user can manage his/her schedules with a patient. Moreover, the doctor can view a patient's bio-data and symptoms, recommend a laboratory test (if necessary), make prescriptions, logout and exit the system.

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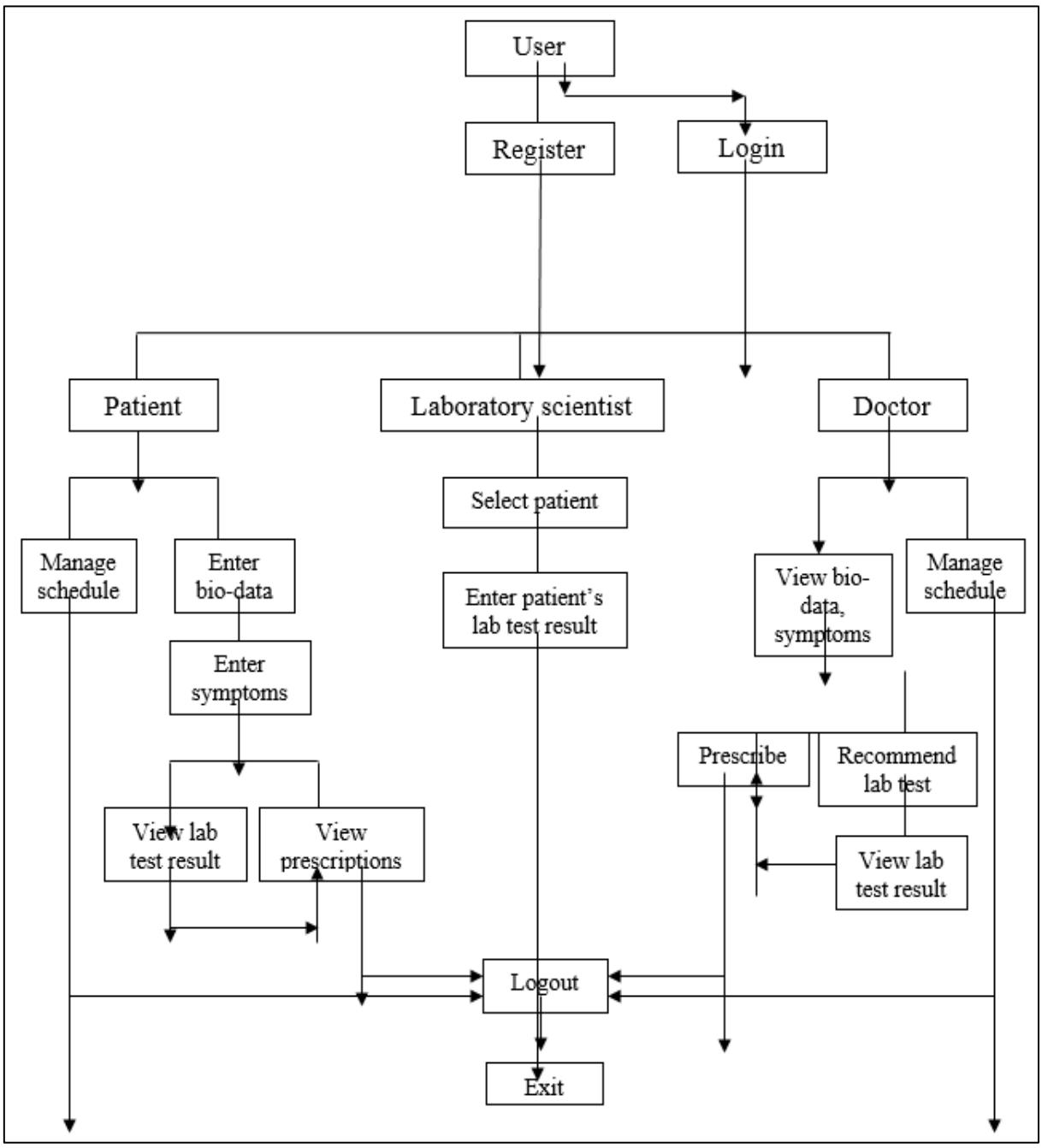


Fig 2 Process Flow Diagram of the Proposed System

- *Use Case Diagram of the Proposed System*

Figure 2 shows the use case diagram of the proposed online medical record information system. As clearly shown in Figure 5, the system is made up of three classes of users viz Patient, Doctor and Lab Scientist. The system allows the patient to register or login, enter bio-data, pay, enter symptoms, view lab result, view prescriptions, manage schedule and logout. The doctor is allowed to register, login, view patient's bio-data, view patient's symptoms, view patient's lab result, make prescriptions, manage schedules and logout. The lab scientist can register, login, select a patient, enter patient's lab test result and logout.

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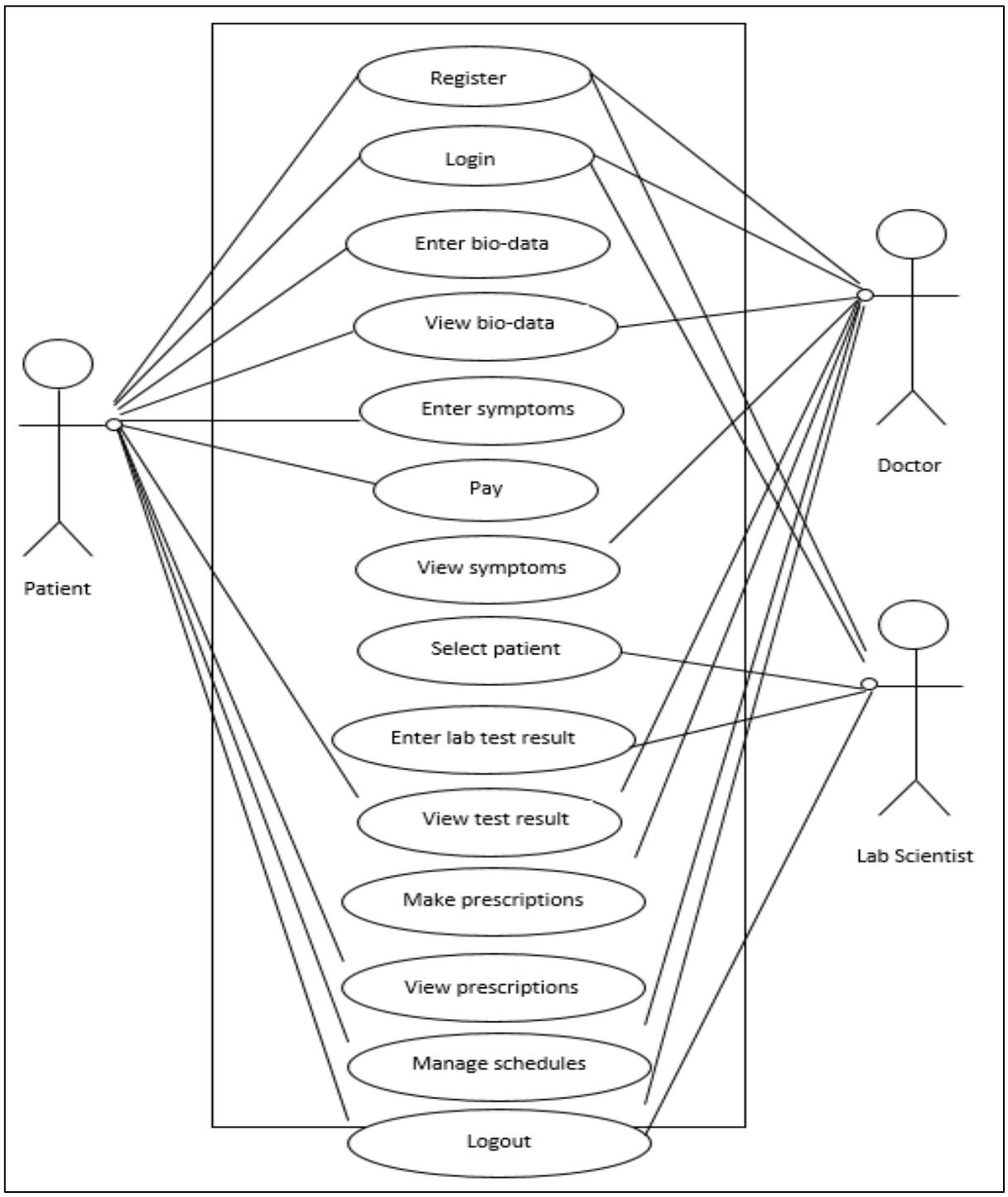


Fig 3 Use Case Diagram of the Proposed System

Figure 3 shows the system flowchart of the proposed system. The figure indicates that every user is required to register and login in order to access the other modules of the system. When logged in successfully, a user is redirected to the pages that suit his/her role as a patient, lab scientist or doctor. A patient can update bio-data, pay, manage schedules, enter symptoms and view prescriptions (including lab test result if any). When logged in as a lab scientist, the user can enter lab test result. When logged in as a doctor, the user can manage his/her schedules, view symptoms and enter prescriptions.

- *Implementation*

The system was implemented as a web application accessible from any browser. The interface comprises registration and login pages, role-specific dashboards, bio-data and symptom forms, a scheduling interface, prescription and laboratory result forms, and alert messages. Authentication logic is written in Python against the MySQL database, PHP handles server-side scripting, and notifications are dispatched through RESTful API calls to the SMS and e-mail services.

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III. RESULTS AND DISCUSSION

➢ *System Performance*

Table 1 Summarises the Evaluation Results.

Metric	Result
Average response time	Under 2 seconds
Data retrieval accuracy	98%
Notification delivery success rate	95%
Usability (healthcare staff)	High satisfaction and ease of use

➢ *Discussion*

The sub-2-second response time shows that the centralised database and layered architecture support responsive access to records, addressing the slow retrieval associated with paper files (Ulrich, 2020). The 98% retrieval accuracy indicates that structured storage and unique patient IDs reduce the redundancy and inconsistency reported by Fielding (2020). The 95% notification delivery rate shows that automated SMS and e-mail channels are a workable replacement for informal verbal or paper communication (Noraziani et al., 2019), and the integration was effective in reducing missed appointments and improving adherence to medical schedules. Role-based access control and authentication address the confidentiality concerns raised by Louw et al. (2024). Usability results from healthcare staff suggest that the system can be adopted without extensive.

IV. CONCLUSION

This study designed and implemented a web-based medical record management system with SMS and e-mail notification, built on Python, PHP, MySQL and RESTful APIs. The system achieved fast response times, high retrieval accuracy and a high notification delivery rate, and was well received by healthcare staff. It reduces processing time and manual record-keeping errors and improves patient engagement.

RECOMMENDATIONS

It is recommended that healthcare institutions adopt such systems to improve operational efficiency and data management, and that adoption be supported by staff training and reliable connectivity. Future work may add mobile applications, interoperability with national health information standards, offline support for low-connectivity areas, stronger encryption and audit logging, and larger multi-site evaluation.

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