Patient Centric Interactive Mobile Health (mHealth) Care Information Platform

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This study is focused on the development of a Patient-Centric Interactive Mobile Health (mHealth) Information Platform aimed at enhancing healthcare timely accessibility, patient engagement and communication, particularly in underserved and resource limited areas. This study eradicates the challenges of the current traditional health information system including limited access to healthcare information; patients struggle to access accurate, real time, and personalized medical information and Poor Communication Channels with health care provider. Object-Oriented Analysis and Design Methodology (OOADM), is the adopted methodology for analyzing the system, while My Structured Query Language (MySQL) was used for the Database design, the Hypertext Preprocessor (PHP) is language for developing the platform. Result indicate that the system improves healthcare delivery efficiency and empowers patients to play an active role in managing their Multilingual support and tailored UX for older adults and illiterate users are essential recommended for further research and broader effectiveness of the platform.

ABSTRACT

Keywords: Patient-Centric; mHealth-Care; Interactive Systems

Introduction

Mobile technology has revolutionized the healthcare industry, offering opportunities to extend services beyond traditional clinical settings and undergoing a digital transformation, driven by the increasing need to provide accessible, timely, and patient-centered care. Access to real-time healthcare information and communication with healthcare providers is limited, particularly in rural or underserved areas. Traditional healthcare systems often involve long waiting times, paperwork, and poor follow-up, leading to suboptimal patient experiences. According to Mustapha et al. (2024) Mobile health (mHealth) solutions have emerged as a viable alternative to bridge this gap by leveraging the widespread penetration of mobile devices to create an interactive platform that supports timely health information dissemination, remote patient participation, and personalized care delivery.

This study focus on the development of patient centric interactive mhealth information platform to promote patient's health information accessibility, user engagement, and improved health outcomes, especially in resource-limited localities. With the following functionalities:

a. To design a user-friendly mobile application that allows patients to access personalized healthcare information, appointment schedules, and medical resources.
b. To enable real-time communication between patients and healthcare professionals through integrated messaging or chat functionality within the mobile platform.

Mobile-based applications play a pivotal role in promoting healthier lifestyles, improving medication adherence, and offering unique opportunities for patients to enhance the management of their healthcare. These applications provide essential support for individuals in carrying out self-management tasks, enabling them to monitor their health proactively and engage with healthcare services on their own terms.

Problem Statement

Even with significant progress in healthcare technologies, various obstacles continue to hinder efficient healthcare delivery, especially in settings with limited resources, major problems that motivated this study include: Limited Access to Healthcare Information; many patients struggle to access accurate, real time, and personalized medical information, and Poor Communication Channels in which Traditional communication methods between patients and healthcare providers are often inadequate or delayed limiting the patient active engagement in managing their own health.

With both the advantages and limitations of current mobile-based healthcare solutions in view, it becomes imperative to optimize these systems for broader usability. Torbjornsen et al. (2019) emphasize the importance of designing mobile health applications that are user-centric and tailored to meet the diverse needs of patients. To this end, this study seeks to identify the key features that patients value in healthcare mobile applications, with the goal of developing an interactive system that maximizes usability, accessibility, and effectiveness for all user groups.

Literature Review

Healthcare Information Systems:

Li et al. (2024) Healthcare Information Systems (HIS) as integrated frameworks designed to collect, store, manage, and transmit patient health data. These systems enhance healthcare efficiency and quality by enabling data-driven decision-making, streamlining clinical workflows, and improving communication between healthcare providers and patients. HIS can range from simple record-keeping systems to complex, integrated platforms that include Electronic Health Records (EHRs), decision support systems, telemedicine solutions, and mobile health (mHealth) applications (Alenoghena et al., 2022).

Traditionally, healthcare information systems were used primarily within hospitals and clinical environments for administrative and clinical purposes. However, the evolution of technology particularly mobile computing has expanded the scope of HIS beyond institutional settings to include patient-centered and community-based care.

Modern HIS now support remote monitoring, virtual consultations, automated alerts, health education, and personal health tracking, all of which contribute to improved patient engagement and outcomes.

Mobile Health:

Mobile Health (mHealth) is the application of mobile devices and wireless technologies such as smartphones, tablets and wearables to facilitate healthcare delivery, patient monitoring, health education, and disease management. According to the World Health Organization (WHO), mHealth enhances healthcare delivery through remote monitoring, patient education, disease surveillance, and communication. Key benefits of mHealth include:

  i.   Accessibility**:** Services reach remote and underserved areas
  ii.   Real-time data**:** Live updates on health metrics
  iii. Personalization**:** Tailored health notifications and suggestions

Interactive Systems in Healthcare:

To enhance personalized healthcare delivery, healthcare institutions are increasingly utilizing information technology to design interactive systems that facilitate a holistic and tailored patient management approach (Bhati et al., 2023). These systems often utilize mobile or web-based platforms to involve patients actively in their own healthcare journeys. Aldekhyyel *et al.* (2019) describe patient interactive systems as technologies that facilitate health self-management, communication, education, or even entertainment and distraction for patients particularly in inpatient settings.

Interactive healthcare systems are designed to promote active patient engagement through bidirectional communication, real-time feedback, and intuitive, user-centric interfaces. According to the findings of Mateo Clement (2025), these systems typically incorporate the following components:

  i.   intelligent chatbots for patient triage and addressing frequently asked questions
  ii.   integrated appointment scheduling functionalities
  iii. Structured feedback collection mechanisms
  iv.   Voice-enabled interfaces to support accessibility and hands-free interaction.

Agbeyangi and Lukose (2025) examined the role of telemedicine in enhancing healthcare delivery across Sub-Saharan Africa, with a particular focus on underserved rural populations. Their findings revealed that mobile-based teleconsultation platforms significantly improved access to medical expertise and reduced delays associated with travel. The study emphasized the necessity of designing telehealth applications that are contextually adaptive and responsive to the specific needs of users in low-resource settings.

In a related vein, Peng et al. (2020) explored the adoption of wearable devices and mobile health (mHealth) applications for self-monitoring of health and lifestyle behaviors. The study found that regular use of these tools was correlated with increased health literacy and greater patient proactivity in managing chronic conditions. However, the authors also identified a critical gap: the lack of seamless integration between patient-generated data and clinical systems, which poses a barrier to achieving fully coordinated and data-informed care.

Mehraeen et al. (2022) assessed the usability of mobile health applications among elderly patients. Their study confirmed that while mobile applications can improve healthcare access and self-management, older users often face usability challenges due to physical and cognitive limitations.

Methodology

The Object-Oriented Analysis and Design Methodology (OOADM) was adopted. This methodology emphasizes the use of models and diagrams to define system structure and behavior, facilitating better alignment between requirements and implementation. The emphasis of OOADM on modularity, reusability, and scalability which is critical for mobile applications. It also supports incremental development and reuse of system components. The methodology follows the Unified Modeling Language (UML) to visually represent the system processes and interactions.

Analysis of the Proposed System

The proposed system is a patient centric interactive mhealth information platform designed to address the shortcomings of traditional healthcare information systems. It integrates real-time chat (AI chatbot), appointment scheduling, personal health record access, automated notifications, and voice interaction. The application provides a user-friendly interface with consideration for elderly and low-literacy users. The application is accessible via smartphones and tablets, with much concentration on patience.

High-Level Model of the Interactive mHealth Platform:

The high-level model of the proposed system is based on the **Object-Oriented Analysis and Design Methodology (OOADM),** ensuring a modular, extensible, and reusable architecture.
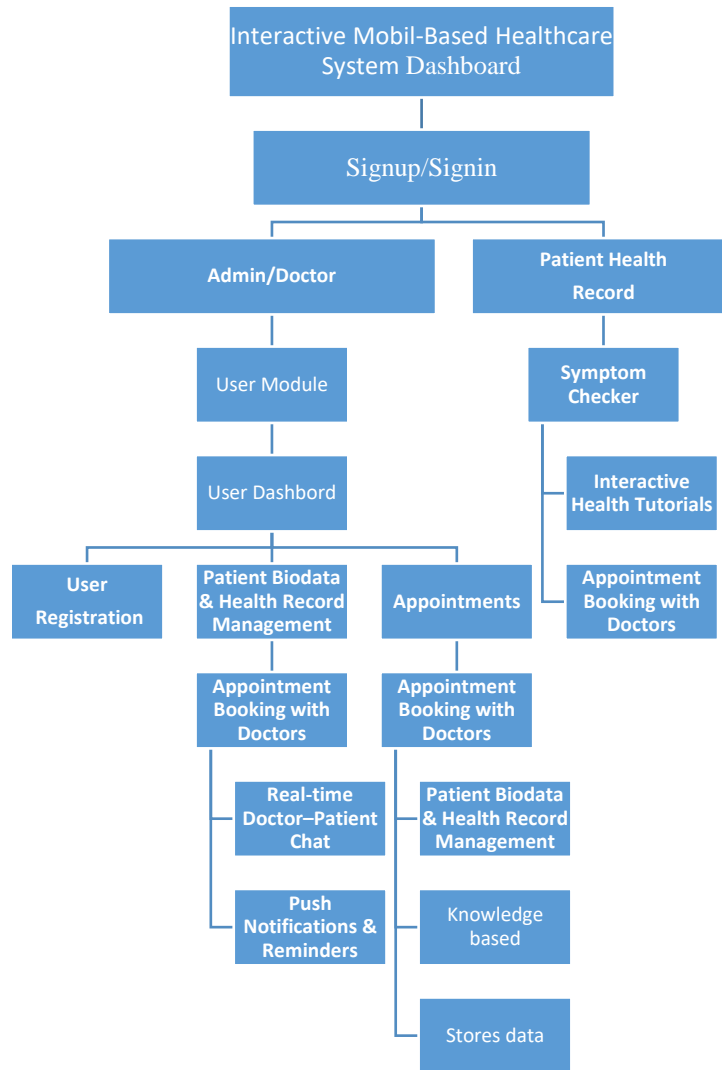
Fig 1: High-Level Model of the Interactive mHealth Platform

System Design

Main Menu

The Main Menu, serves as the central navigation hub of patient centric interactive mhealth information platform. It is designed to provide intuitive access to all major functionalities of the platform, ensuring that users patients, healthcare providers, and administrators can quickly locate and use the services they need.

The main menu is organized using a user-friendly layout that includes clearly labeled icons or buttons for each submenu. Depending on the access level (e.g., patient or admin), users are presented with role-specific options upon successful login. The control center is developed to be responsive and accessible across a wide range of mobile devices.
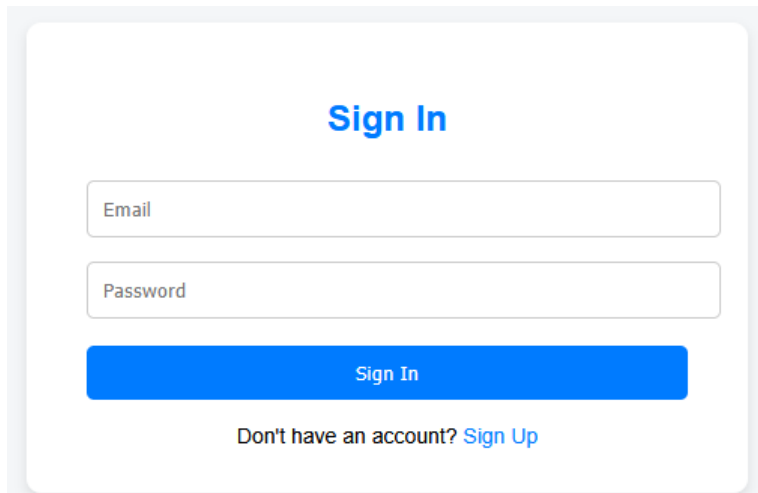
Fig 2: Sign in/Sign up

Patient Registration Subsystem
a.   Enables new users to sign up by providing biodata, contact information, and medical history.
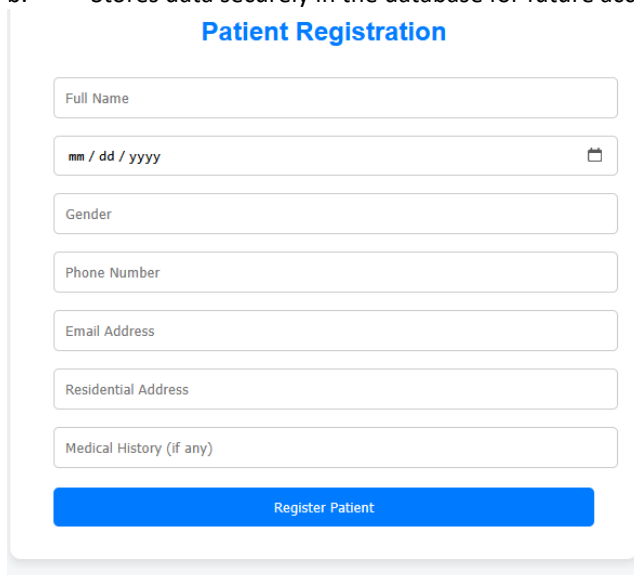b.   Stores data securely in the database for future access and authentication.

Fig 3: Patient Registration Subsystem

The Main Menu include:
  i.   **Dashboard:** Displays an overview of the user's profile, recent interactions, and notifications.
 ii.   **Health Records:** Provides access to personal medical history, lab results, prescriptions, and visit summaries.
iii.   **Appointment Management:** Allows users to book, reschedule, or cancel appointments with healthcare providers.
 iv.   **Real-time Chatbot:** Offers automated responses and support for common health inquiries.
  v.   **Messages/Notifications:** Notifies users of new messages, reminders, alerts, and health tips.
 vi.   **Settings:** Enables customization of user preferences, password updates, and notification controls.
vii.   **Admin Panel (for authorized users):** Grants access to backend functions such as user management, system logs, and report generation
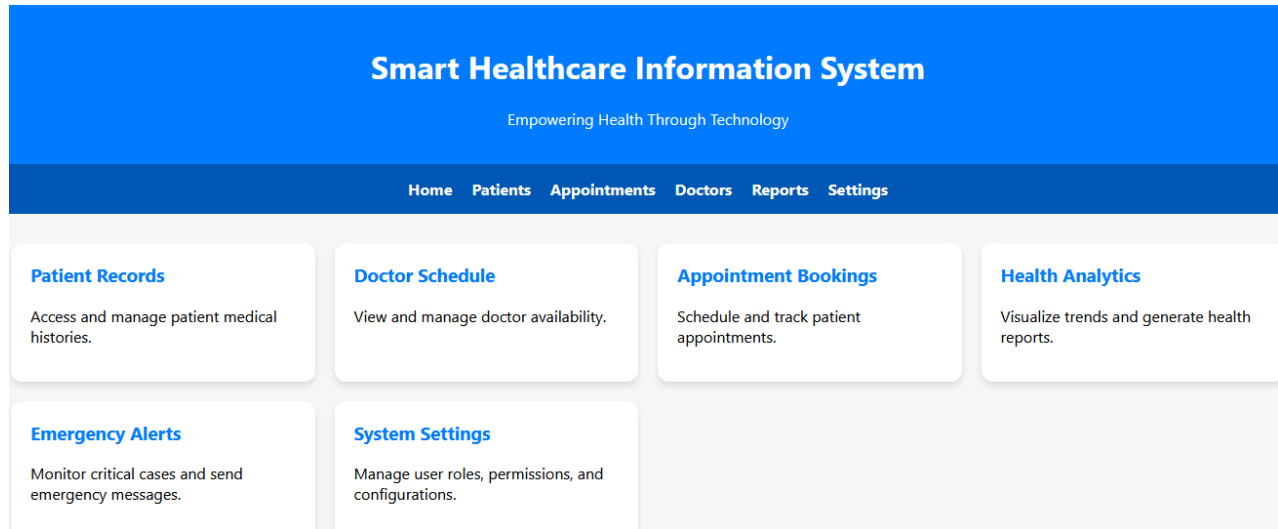
Fig 4: The Main Menu

Database Development Tool

For the development of the system's database, MySQL database management system (DBMS) was utilized. It is a robust, reliable, and widely used open-source DBMS, well-suited for handling large-scale healthcare data efficiently. MySQL allows for structured data storage, optimized queries, and supports the ACID properties required for data integrity and reliability.

Table 1: Users Table Design

Field Name	Data Type	Constraints	Description
user_id	INT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier for each user
full_name	VARCHAR(100)	NOT NULL	Full name of the user
Email	VARCHAR(100)	NOT NULL, UNIQUE	Email used for login
password_hash	VARCHAR(255)	NOT NULL	Hashed password
phone_number	VARCHAR(15)		Optional contact number
Role	ENUM	('patient', 'doctor', 'admin')	Defines the user's role
created_at	DATETIME	DEFAULT CURRENT_TIMESTAMP	Account creation time
Status	ENUM	('active', 'inactive')	User account status

Appointments Table: Contains Details about Patient Appointments

Table 2: Appointments Table

Field Name	Data Type	Constraints	Description
appointment_id	INT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier for each appointment
patient_id	INT	FOREIGN KEY → Users(user_id)	ID of the patient booking the appointment
provider_id	INT	FOREIGN KEY → Users(user_id) (optional)	ID of the assigned healthcare provider
department	VARCHAR(50)	NOT NULL	Department selected for the appointment
appointment_time	DATETIME	NOT NULL	Date and time of the appointment
reason	TEXT		Optional reason for the appointment
phone	VARCHAR(20)	NOT NULL	Contact phone number
email	VARCHAR(100)	NOT NULL	Contact email
status	VARCHAR(20)	DEFAULT 'Pending'	Appointment status (Pending, Confirmed, etc.)

Medications Table: Tracks prescribed medications, dosages, and schedules and related details

Table 3: Medications Table

Field Name	Data Type	Constraints	Description
medication_id	INT	PRIMARY KEY, AUTO_INCREMENT	Unique identifier for each medication record
patient_id	INT	FOREIGN KEY → Users(user_id)	ID of the patient prescribed the medication
medication_name	VARCHAR(100)	NOT NULL	Name of the prescribed medication
dosage	VARCHAR(50)	NOT NULL	Dosage prescribed (e.g., 500mg, 10ml, etc.)
frequency	VARCHAR(50)	NOT NULL	How often to take the medication (e.g., Twice a day)
start_date	DATE	NOT NULL	Start date of medication
end_date	DATE		End date (if applicable)
prescribed_by	VARCHAR(100)	NOT NULL	Name or ID of the doctor who prescribed it
notes	TEXT		Additional instructions or remarks

Conclusion and Recommendation

The Patient Centric Interactive Mhealth Information Platform has the potential to revolutionize healthcare delivery by offering accessible, timely, and patient-centered services. Through telemedicine, health tracking, and medication management, the system provides a significant opportunity to enhance patient engagement, optimize healthcare resources, and improve health outcomes. The mobile platform empowers patients to take control of their health by providing real-time access to information, support, and communication with healthcare providers.

The findings from the implementation and testing of the system indicate that it is a practical and effective solution for addressing the challenges faced by patients and healthcare providers, particularly in remote or underserved areas.

There are several areas recommended for future research to enhance capabilities and effectiveness of this system, including:

Multilingual Support: Since healthcare access issues are often region-specific, introducing multilingual support within the system could extend its reach to a wider global audience, especially in regions with diverse languages and dialects.

User Experience (UX) for Older Adults: Although the system is designed to be user-friendly, research on improving the user interface (UI) and user experience (UX) specifically for elderly users with limited technological skills could help in increasing adoption rates among this demographic.

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