FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 10 No. 12, June, 2026, pp 287 – 295
DOI: https://doi.org/10.33003/fjs-2026-1012-4925

Design and Evaluation of an Interactive Mobile Application Platform for Elderly Care and Support

[1]Chioma Virginia Anikwe, *[1,2]Henry Friday Nweke, and [1,2]Ignatius Nwoyibe Ogbaga

[1]Computer Science Department, David Umahi Federal University of Health Sciences, Uburu, Ebonyi State, Nigeria.
[2]Institute for Machine Learning, Robotics and Artificial Intelligence Research, David Umahi Federal University of Health Sciences, Uburu, Ebonyi State, Nigeria.

*Corresponding authors' email: nwekehf@dufuhs.edu.ng

ABSTRACT

This study presents the development of a Mobile-Based Health Monitoring System (M-HMSE) designed to enhance real-time healthcare delivery for the elderly in rural areas. The system incorporates mobile functionality and a NoSQL database (MongoDB) to develop a system that enables users to register and track their health outcomes. The key modules of the system include the ability to register patients and caregivers, manage hospital and doctor information, profile diseases, and generate personalized recommendations. The user interface was developed in Java and Eclipse, enabling seamless interaction between healthcare providers and patients. Database architecture enables the effective storage and retrieval of data, thereby enhancing the system's scalability and performance. The mobile-based system enables efficient medical care and support for the elderly, ensuring proactive, technology-driven healthcare. The interactive mobile application platform utilizes remote monitoring and intelligent diagnosis assistance, thereby contributing to improved medical outcomes. The deployment of the system demonstrated its ability to deliver alerts and monitor the vital signs of elderly individuals, as well as its potential for large-scale health monitoring.

Received: 16th May 2026
Accepted: 21st July 2026
Published: 4th August 2026

Keywords: Health Monitoring; Healthcare Delivery, Mobile Application; Elderly Care; Database Design

INTRODUCTION

To satisfy the demands of the expanding human population and rising medical costs, cost-effective and intelligent healthcare has become more prevalent (WTW, 2024). The use of technology to improve patient quality of life and care has produced encouraging outcomes in recent advancements in personal and mobile healthcare (Anikwe *et al*., 2025; Nweke et al, 2026). The technologically driven mechanism in the 21st century makes it easy to achieve optimal efficiency in healthcare service delivery. Internet of Things (IoT) based wearable devices, such as smartwatches, smartphones, and smart glasses embedded with sensors such as Electrocardiographs (ECG), gyroscopes, accelerometers, etc., have been shown to provide important technologically driven approaches to tackle health-related issues for people living in rural and urban areas (Thacharodi et al., 2024). As a result, the biomedical community is becoming increasingly interested in personalized and mobile healthcare (Mor, 2025; Shiwani *et al.*, 2023; Anikwe-Onyiwa et al, 2026).

Hence, health monitoring is best described as the periodic observation of changes that provide information on an individual's welfare. Health monitoring helps to observe individuals to see if their health condition changes as a result of being exposed to particular health risks that come with running a business or project (Puertos, 2025). Accordingly, mobile health (m-Health) is the act of deploying a portable technological mechanism such as smartphones, wearables, handheld devices, and other automated-based sensors for mobile health monitoring and care systems and to support public health in telemedicine practice (Siddiqui *et al*., 2025; Hong, 2024; Chinonso *et al*., 2021). The Internet of Things (IoT) can also be defined as an integrated communication environment of interconnected devices and platforms that engages both the virtual and physical worlds (Choudhary, 2024; Mansour *et al*., 2023).

The evolution of Wireless Sensor Networks (WSNs) and mobile apps has given rise to the implementation of technology-based health monitoring systems. These mobile-based apps track the patient's heart rate in real time and alert the user when a health problem manifests itself. The doctors and family members may then receive information on the patient's health status from the mobile app (Yuvaraja *et al*., 2024; Al-Aubidy *et al*., 2017; Benoy, 2023). Access to, delivery of, and management of health information in our settings are being transformed by the rise of mobile IoT and applications (Kumar et al., 2023; de Souza Ferreira *et al*., 2024). Mobile apps can also help with self-management tasks, including offering instructional materials (Nweke et al, 2026) and aiding in problem-solving and self-regulation (Goel and Taneja, 2023; Nweke *et al*, 2024).

Even though lots of mobile apps such as health and fitness trackers with calorie counters, health mate, total health tracking, instant heart rate monitor and pulse checker, and cardiograph, heart rate have been developed for monitoring various health-related issues and physiological signals, none have been implemented for monitoring elderly people, especially in rural areas (Marino *et al.*, 2019). In this paper, a mobile-based health monitoring system (MHMS) is implemented for efficient health monitoring, vital signs capturing, health awareness, and information dissemination, interaction with doctors, recommendations, and healthcare check-ups for elderly people in rural and urban locations. Furthermore, the system provides a module to visualize and

recommend appropriate lifestyle changes to improve the health and well-being of people in rural areas.
The contributions of this study to the current body of knowledge include implementing a module to capture patients' and caregivers' details to enable quick access to care and medical emergencies and developing a model that succinctly captures the functionalities of each module of the system, activities, and the sequential data flow. In addition, the study evaluates the effectiveness of the system to capture and store patients, medical officers, and caregivers' details and provide appropriate health outcomes recommendations.
The remaining sections of the paper are as follows: Section 2 presents the methodology, Section 3 discusses the results of the implementation, and Section 4 outlines the evaluations of the system. Section 5 concludes the paper.

MATERIALS AND METHODS

The methodology adopted to design and develop the mobile-based health monitoring system for the elderly is Object-Oriented Analysis and Design (OOAD). Object-oriented analysis and design are a practical process of analyzing and designing applications using visual modelling. The model allows developers to incorporate different functionalities and requirements of the system. The methodology helps to streamline software design and development by considering the software model as a set of objects, classes, and methods, and linking them during implementation. It has been shown to produce superior performance in software design compared to structured analysis and design. The method helps to reduce complexity and identify design elements (Rahayu *et al*, 2021). In addition, the method is easy to understand and modify according to changes in requirements. Also, during the development process, it makes it efficient and effective, thereby reducing the cost and time. It creates a conceptual model of the object to develop and supports scalable, reliable, and robust software. The proposed methodology involves the collection of medical record data, preprocessing of the collected data through transmission, and integration of the data for analysis and decision-making in the health monitoring system presented in this study. One of the important tools for object-oriented modeling is the Unified Modeling Language (UML). It provides a graphical visualization of the system using models such as a use case diagram, class diagram, activity diagram, and sequence diagram (Mukherjee, 2016). The UML tools used to model the mobile-based health monitoring system are explained in subsequent sections of the paper.

Mobile application platform for elderly care and support

The proposed system's architecture comprises elderly people, family members, doctors, mobile phones, an application programming interface (API), the internet, a database, a hospital, and short message services (SMS). In addition, elderly people are the target users of the system whose vital signs are to be monitored. The family members or caregivers should, therefore, assist the elderly in effectively utilizing the health monitoring mobile app. The data collected from the elderly people using the implemented mobile application is sent to hospitals via an application programming interface (API), where doctors can access the data through a central database. The data are then analyzed, and based on the analysis's findings, doctors study it and make recommendations. Figure 1 depicts the architecture of the system's design.

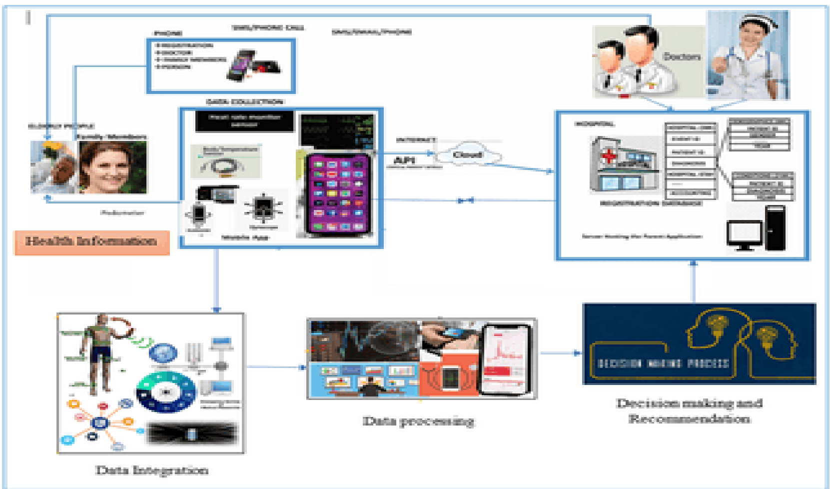

Figure 1: Architecture of the Elderly Health Monitoring System

System modeling

Health monitoring is a phenomenon whereby changes that occur from time to time, which give information about the general well-being of a patient, are observed. The model health monitoring system was modelled using the use case, activities, class, and sequence diagrams as explained in the subsections below.

Use Case Diagram

Use cases are employed to build a process model that shows the activities that the user of the system performs more formally. In Figure 2, we clearly show four (4) actors: hospital, doctor, patient, and caregiver. Note that the actors are not part of the system; rather, they represent any user who must interact with the system. An actor can perform certain operations on the system. As illustrated in Figure 2, the actor provides services to the *system.*

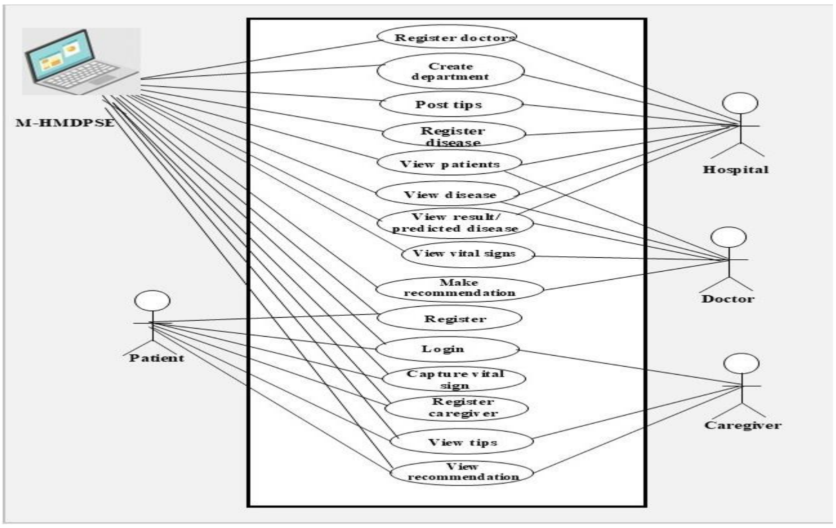

Figure 2: Use Case Diagram

The system has four key actors with specific roles to play to come up with effective monitoring and management of health. The Hospital *Administrator* is the one who is in charge of the whole system because he/she handles the doctors, registers diseases, offers health advice, and manages the user access rights. As a medical consultant or working as a staff member, the *Doctor* maintains the patient records, oversees vital signs, gives medical advice, and changes their login details. With the primary user being the *Patient*, it can self-register, provide personal healthcare information, assign a caregiver, and get health tips as well as doctor recommendations. The *Caregiver* is usually a relative or family member who takes care of the patient by logging in to the system to examine useful tips and to observe the health status of the patient, hence having continuous care.

Activity diagram

The activity diagram represents the dynamic nature of the envisaged system. The activity diagram for the mobile-based health monitoring framework covers all the various steps taken to complete each task to enable the patients to have optimal health and the hospital management to live up to standards.

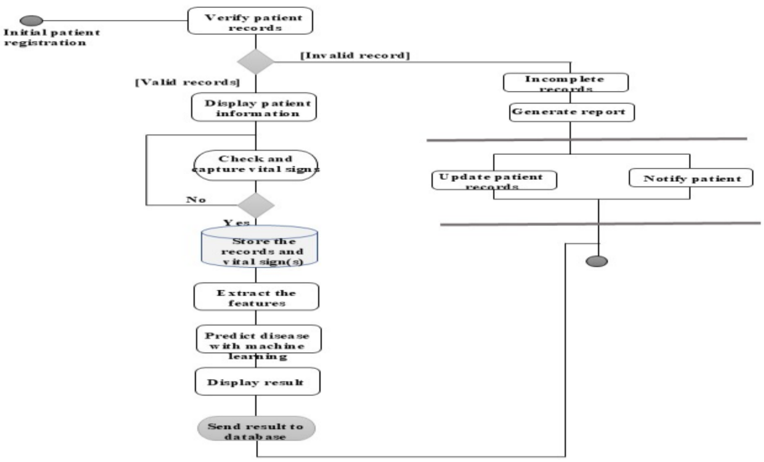

Figure 3: System Activity Diagram

The process of health monitoring starts by registering the patient, followed by verification of the patient's records to check their accuracy and completeness. In case of any discrepancy, any reports are produced, and the patient is notified to update his/her information. After verification, the system shows the patient's form, where it is possible to monitor the vital signs and record them in the database. The data collected is processed for decision-making by the hospital management, and doctors may review and act accordingly. Figure 3 depicts the activity diagram of the system.

Class model

The UML class model displays the intended system's structural flow, taking properties and operations into account. For instance, the class model now includes attributes like association, aggregation, and inheritance in the form of subclasses. The complete class modelling for monitoring the elderly is shown in Figure 4. The class model contains nine (9) major classes, such as patient registration, caregiver, hospital, doctor, department, vital signs, disease, tips, and recommendations. The patient’s registration details have multiple associations with the type of locality, either urban or rural-based dwellers. The patient’s health check is carried out to capture their vital signs, and data is pre-processed and necessary features are extracted. All records that are demographic, historical, and medical data are stored in the database. The data or records are modeled for decision-making and follow-up consultation by medical officers. The result is presented, and action is taken by the necessary agency or consultant.

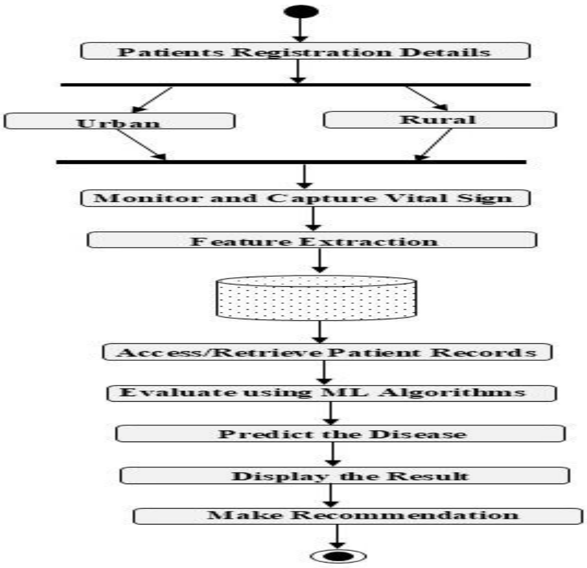

Figure 4: System Class Diagram

Sequence Diagram

The sequence diagram, which is a set of objects and messages for a patient mobile-based health monitoring system, is shown in Figure 5. It shows six (6) objects, such as patients, capturing vital signs, and disease, accessing patient records, predicting disease, and making recommendations. Therefore, the arrow and message are used to communicate information between two objects. From the diagram in Figure 5, the patient registers for medical checkups after the system validation and then proceeds to capture vital signs with the help of caregivers. The identified disease is recorded. In addition, the entire patient records or results are saved, modelled, and accessed for efficient recommendations based on the available historical, demographic, and medical records or data.

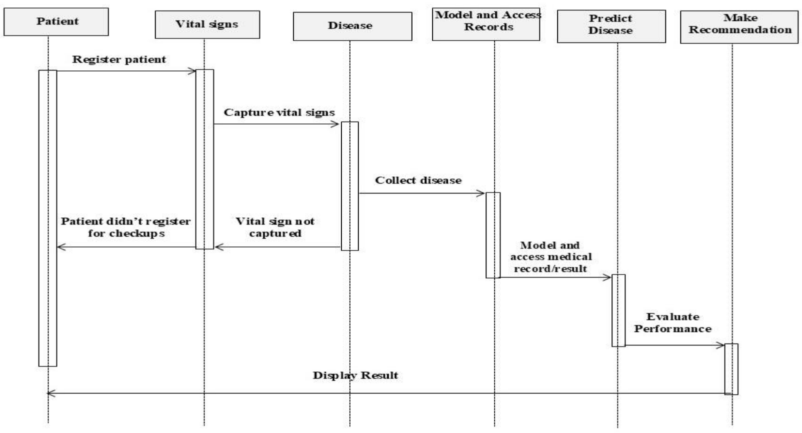

Figure 5: System Sequence Diagram

Database Design

The creation of an extensive database data model is required for database specification design. Because of its ability to contain multiple information repositories where relational and referential integrity are dominant, the suggested system uses MongoDB as its NoSQL database. The Health Monitoring System database is known as *hms_db* and contains 8 tables with information on patients, caregivers, doctors, hospitals, departments, diseases, vital signs, advice, and suggestions. Some of these tables are explained below.

i. *Patient table*: The table contains the elderly people's details. The information recorded using the table includes a unique identification number, hospital number, name, email, address, gender, etc. This information is collected during registration.
ii. *Caregiver table*: The table outlines the registration details of a family member who is the primary caregiver to the elderly people. The information collected includes names, addresses, phone numbers, email addresses, etc.
iii. *Doctor and medical officers table*: This captures all the details of the health workers in the hospital using fields such as identification number, names, address, phone numbers, gender, qualification, area of specialization, etc.
iv. *Hospital table*: The hospital table captures information about the hospital/clinic frequently visited by the

elderly individual. The information collected includes hospital identification number, location, name, address, website, etc.

Figure 6 shows the entity relationship diagram of the system. The entity relationship diagram enables developers to illustrate how the tables in the database of the system relate to each other. An entity relationship diagram has three major components and includes the entities, attributes, and relationships. The entities represent the instances of the tables in the database, such as doctors, patients, caregivers, etc., while attributes are the elements within the entities. The relationship depicts an association between different entities, which might be one-to-one, one-to-many, or many-to-many.

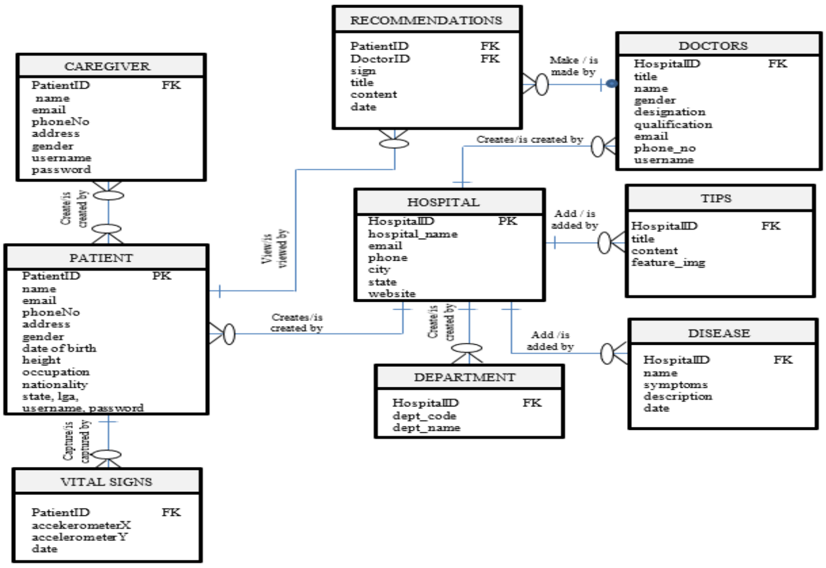

Figure 6: Entity relationship diagram

RESULTS AND DISCUSSION

The implementation of the mobile-based health monitoring system for the elderly was done using Eclipse and Java programming languages. After the implementation, several screens were developed and captured. The software integration screenshot is presented in Figures 7-13 and explained below.

Input Login Validation Screen

The form provides the user with a column for entering necessary login details before gaining access to the system and then proceeding to use the mobile health monitoring application. The login page is used by the system administrators and doctors to log in to the system.

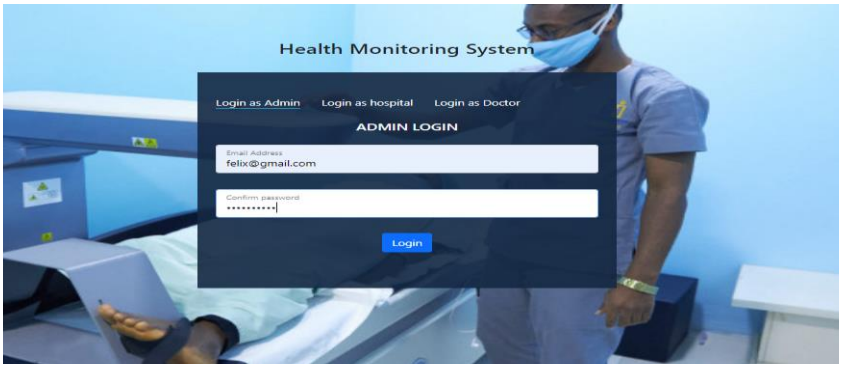

Figure 7: The Input Validation Login

Patient Mobile App Registration Form

This form is used by the patient to register/create an account in the system

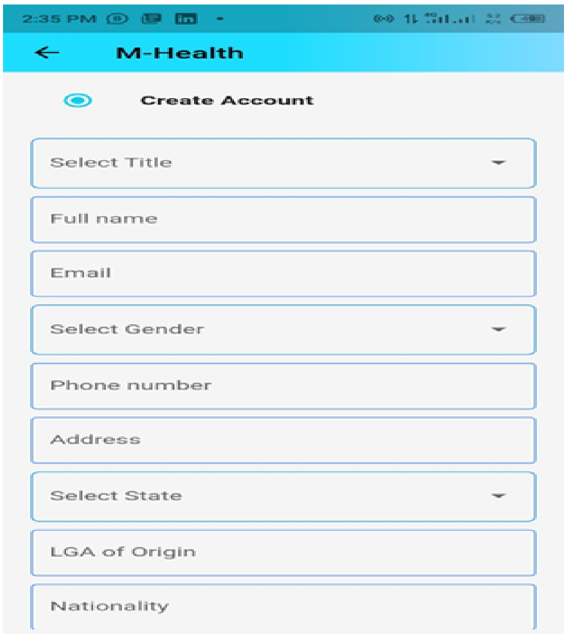

Figure 8: The Patient Registration

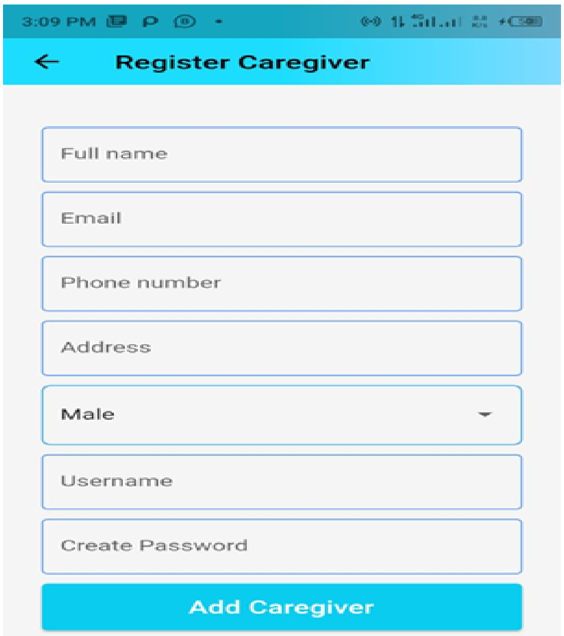

Figure 9: The Screenshot of the Caregiver Form

Caregiver Mobile App Registration Form and Add Hospital
This form is used by the caregiver to register/create an account in the system

Add Hospital
This page is used by the admin to create hospital details in the system.

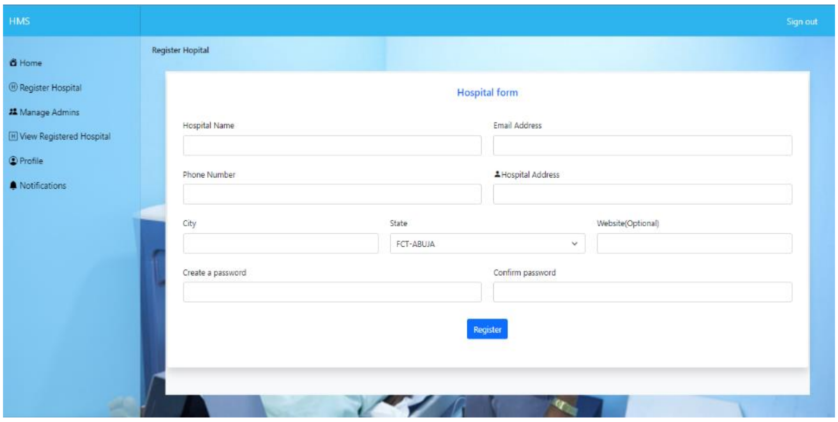

Figure 10: The Screenshot of the Hospital Form

Vital Signs List/Details
This page lists and displays selected patient vital signs' details to the system doctors.

Figure 11: Vital Signs Details Screen Form

Registered Disease List/Details
This page lists and displays selected patient vital signs' details to the system doctors.

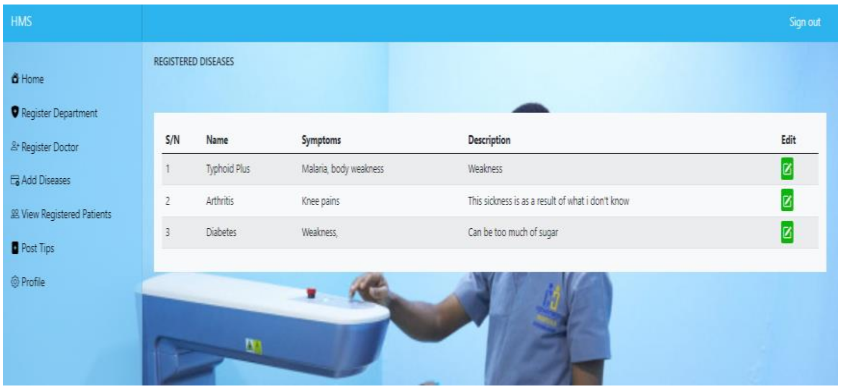

Figure 12: Registered Disease Details Screen Form

Recommendations List/Details
This page lists and displays selected patient vital signs recommendation details to the system doctors.

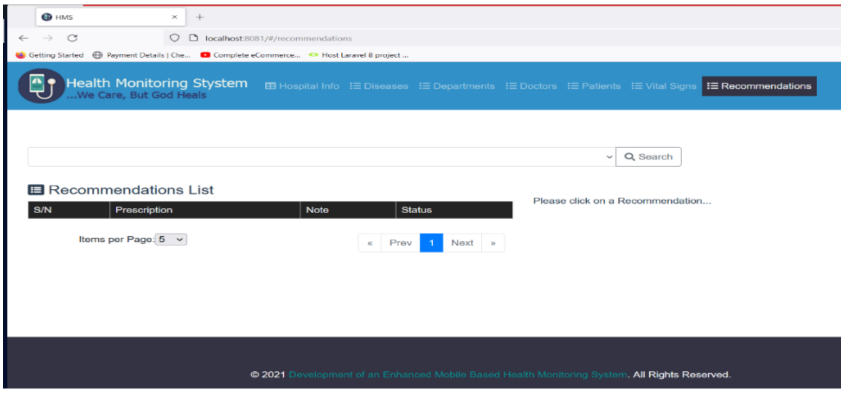

Figure 13: Recommendations Details Screen Form

Validation Testing and Evaluation
The implemented mobile-based health monitoring system for the elderly is a combination of applications on mobile phones and real-time data processing. It can monitor and trace the vital signs of a patient. Doctors can monitor health indicators remotely through such a system and get alerts and notifications through an easy-to-use interface. An important aspect is the development and retrieval of patient logs, which allow thorough record-keeping and analysis thereafter. Through an interface, the log file can be navigated by the user (patient or caregiver), who can filter the health records by date, week, or a custom search criterion. The operational functionality of the application was tested in terms of the anticipated vs. actual setting of the various key app modules, i.e., logins, registration, user information maintenance, and dashboard navigation, and is summarized in Table 1.

Table 1: Expected Result versus Actual Result

Module	Expected Test Result	Actual Test Result
Dashboard	Expected to find links to other modules on the page	The dashboard showed a platform with linkages to each of the modules in the mobile health monitoring system.
Login	Expected to see the login form so that users can sign in or sign up	It is anticipated that clicking on it would bring up a form where users can sign up or sign in.
Register/new user	When clicked, control is expected to be transferred to the registration form for new users to provide the necessary information for access registration.	Control was transferred to the registration form.
Hospital	When clicked, the user is expected to view the hospital form for registration.	The hospital-registered details were displayed.
Disease	The user is expected to view and enter disease information when they click.	The registered disease details were displayed.
Doctor	When clicked, the user is expected to view and add the doctor's details	The registered doctor's details were displayed
Patient	When clicked, the user might open and enter the patient's information.	The registered patient details were displayed.

Module	**Expected Test Result**	**Actual Test Result**
Caregiver	The user could open and enter the caregiver's information by clicking.	The registered caregiver's details were displayed.

The conversion approach that was embraced in the implementation of the system involved a wholesome plan that comprised data collection, system specification, and an orderly conversion approach to work. The preparation of data required reformatting and confirmation of data that would be uploaded into the system, with great priority given to accuracy and avoidance of error during operation. The implementation of the system may also be through direct conversion, in which the old system is replaced completely at a time, or through a parallel and phased process where switching takes place as historical and the new systems are both being used. In terms of location, the conversion might begin with a pilot site before rolling out system-wide, while module-based conversion allows selective activation of different functional components, ensuring minimal disruption during implementation.
Following successful conversion, the installation process required several technical steps, including server setup, extraction of necessary files, and initiating backend services using command-line tools like *npm*. After installation, user training became a priority to ensure smooth system adoption. All stakeholders, such as doctors, hospital staff, patients, and caregivers, were given training sessions supported with manuals and user guides. Security training was emphasized to prevent data breaches. For broader accessibility, online tutorials and live support were made available to assist users in navigating the application independently, fostering digital literacy and system confidence among the user community.

CONCLUSION

In this paper, the description, development, and assessment of a Mobile-Based Health Monitoring System (M-HMSE) are presented, which aims to improve real-time patient monitoring and offer personalized healthcare. The system utilizes mobile technology, MongoDB (a NoSQL database), and machine learning models to efficiently capture, store, analyze, and interpret the health conditions of patients using vital signs and historical medical data. The sequence diagram shows the functional sequence of several essential elements of the system that include patients, caregivers, doctors, and hospital administrators. An effective database design was created, where tables are linked to each other, serving the needs of patient registration, caregiver management, hospital administration, disease profiling, and the creation of recommendations. MongoDB allowed efficient management of the data and the use of the data in case of increasing data size and intricacy, common to a health system.
Java and Eclipse technologies were utilized in defining the user interface, which was convenient and easy for users to register, log in, enter their data, and obtain results. System testing also ensured that system modules worked as required, and the real output was close to the stipulated system requirements. The findings revealed that the system had the potential to remotely monitor vital signs, assist in diagnostics, and give recommendations in a ready-to-action form to treat the disease to medical practitioners.
Future developments may aim to embed wearable devices at the real-time level, implementing machine learning models to predict types and courses of disease, and scale up to large levels within healthcare networks in low-resource environments.

REFERENCES

Al-Aubidy, K. M., Derbas, A. M., & Al-Mutairi, A. W. (2017). Real-time healthcare monitoring system using wireless sensor network. International Journal of Digital Signals and Smart Systems, 1(1), 26–42. https://www.philadelphia.edu.jo/academics/kaubaidy/uploads/IJDSSS.pdf

Anikwe, C. V., Nweke, H. F., Ikegwu, A. C., & Ndukwe, O. E. (2025). Deploying machine learning methods for health monitoring and cardiovascular disease prediction. Journal of Basics and Applied Sciences Research, 3(3), 132–143. https://dx.doi.org/10.4314/jobasr.v3i3.15

Anikwe-Onyiwa, C. V., Nweke, H. F., & Mba, U. E. (2026). Heart Disease Diagnosis and Prediction Using Naïve Bayes and Gradient Boosting Machine Learning Models. International Journal of Advances in Computer Science and Technology, volume 15, No. 5. Pp 31-38. https://www.warse.org/IJACST/current-detiles

Benoy, S. (2023). Wireless sensor networks for healthcare monitoring: Challenges and opportunities. Journal of Biomedical Systems & Emerging Technologies, 10(2), 163. https://www.hilarispublisher.com/open-access/wireless-sensor-networks-for-healthcare-monitoring-challenges-and-opportunities-98539.html

Chinonso, E. A., Okemiri, H. A., & Anikwe, C. V. (2021). Vehicle monitoring system based on IoT, using 4G/LTE. International Journal of Engineering and Management Research, 11(4), 6–14. https://ssrn.com/abstract=3902487

Choudhary, A. (2024). Internet of Things: A comprehensive overview, architectures, applications, simulation tools, challenges and future directions. Discover Internet of Things, 4(31). https://doi.org/10.1007/s43926-024-00084-3

De Souza Ferreira, E., de Oliveira, A. H. M., Dias, M. A., et al. (2024). Mobile solution and chronic diseases: Development and implementation of a mobile application and digital platform for monitoring and managing health care. BMC Health Services Research, 24, Article 1009. https://doi.org/10.1186/s12913-024-11505-y

Goel, A., & Taneja, U. (2023). Mobile health applications for health-care delivery: Trends, opportunities, and challenges. Journal of Public Health. https://doi.org/10.1007/s10389-023-02165-z

Hong, W. (2024). Advances and opportunities of mobile health in the postpandemic era: Smartphonization of wearable devices and wearable deviceization of smartphones. JMIR mHealth and uHealth, 12(1), e48803. https://doi.org/10.2196/48803

Kumar, D., Hasan, Y., & Afroz, S. (2023). Mobile health monitoring system: A comprehensive review. International Journal of Research Publication and Reviews, 4(6), 1922–1954. https://doi.org/10.55248/gengpi.4.623.45128

Mansour, M., Gamal, A., Ahmed, A. I., Said, L. A., Elbaz, A., Herencsar, N., & Soltan, A. (2023). Internet of Things: A comprehensive overview on protocols, architectures, technologies, simulation tools, and future directions. Energies, 16(8), 3465. https://doi.org/10.3390/en16083465

Marino, M. M., Rienzo, M., Serra, N., Marino, N., Ricciotti, R., Mazzariello, L., Leonetti, C. A., Ceraldi, M. P., Casamassimi, A., Capocelli, F., Martone, G., & Caracciolo, A. L. (2019). Mobile screening units for the early detection of breast cancer and cardiovascular disease: A pilot telemedicine study in Southern Italy. Telemedicine and e-Health, 25(4), 287–294. https://doi.org/10.1089/tmj.2018.0328

Mor, M. (2025). The biomedical industry steps into the era of personalized healthcare. CTech. https://www.calcalistech.com/ctechnews/article/skk61uxdkg

Mukherjee, M. (2016). Object-Oriented Analysis and Design. *International Journal of Advanced engineering and management*, *1*(1), 18-24. https://dx.doi.org/10.24999/IJOAEM/01010003

Nweke, H. F., Ogbaga, I. N., Anikwe-Onyiwa, C. V., Ikegwu, C. A., Ugwu, E. G, & Nwafor, A. C. (2026). Advancing Mobile Application Technology for Learning: Assessing the Role of Capacity Building and Training Intervention in Improving Undergraduate Students' Knowledge. Journal of Xi'an Shiyou University, Natural Science Edition, vol. 22, Issue 5. pp. 1- 16. https://www.xisdxjxsu.asia/viewarticle.php?aid=3976

Nweke, H. F., Ikegwu, A. C., Nwafor, C. A., and Ogbaga, I. N. (2024). Smartphone-based Human Activity Recognition Using Artificial Intelligence Methods and Orientation-Invariant Features. *Nigeria Computer Society: International Conference on Technological Solutions for Smart Economy, SmartEco2024*, vol. 35, pp. 1–8, 2024. https://library.ncs.org.ng/download/smartphone-based-human-activity-recognition-using-artificial-intelligence-methods-and-orientation-invariant-features/

Nweke, H. F., Ugwu, G. E., Anikwe, C. V., Ogbaga, I. N., & Okorie, C. C. (2026). Design and Implementation of an Artificial Intelligence-based Mobile Application for Diabetes Risk Prediction. Direct Research Journal of Engineering and Information Technology, 14(2), 1-10. https://doi.org/10.26765/DRJEIT27570748

Puertos, E. (2025, February 27). Monitoring health and safety in the workplace: Best practices for ensuring compliance and employee well-being. Sustainable Business Toolkit. https://www.sustainablebusinesstoolkit.com/monitoring-health-and-safety-in-the-workplace/

Rahayu, D., Hilman, A., Susanto, B., & Nugraha, Y. (2021). Design of E-Rent System with an Object-Oriented Analysis and Design Method (Case Study at PT XYZ Rent). *RISTEC: Research in Information Systems and Technology*, *2*(2), 85-101. https://journal.institutpendidikan.ac.id/index.php/ristec/article/view/92

Shiwani, M. A., Chico, T. J. A., Ciravegna, F., & Mihaylova, L. (2023). Continuous monitoring of health and mobility indicators in patients with cardiovascular disease: A review of recent technologies. Sensors, 23(12), 5752. https://doi.org/10.3390/s23125752

Siddiqui, S., Khan, A. A., Khattak, M. A. K., & Sosan, R. (2025). Mobile health (m-Health). In Connected Health Insights for Sustainable Development (pp. 51–68). Springer. https://doi.org/10.1007/978-3-031-81433-4_4

Thacharodi, A., Singh, P., Ahmed, Z. H. T., Kumar, R. R. S., Maqbool, M., Hassan, S., Meenatchi, R., & Neha, V. (2024). Revolutionizing healthcare and medicine: The impact of modern technologies for a healthier future—A comprehensive review. Health Care Science, 3(2), 329–349. https://doi.org/10.1002/hcs2.115

WTW. (2024). The global healthcare cost surge: Challenges and implications. HealthManagement.org. https://healthmanagement.org/c/hospital/News/the-global-healthcare-cost-surge-challenges-and-implications

Yuvaraja, M., Ramesh, R., Priya, R., & Dhanasekar, J. (2024). Wireless body sensor networks for real-time healthcare monitoring: A cost-effective and energy-efficient approach. Angiotherapy, 8(7), 1–13. https://doi.org/10.25163/angiotherapy.879796