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HealthConnect: Multilingual Smart Healthcare Management Application to Improve the Interaction between the Patient and a Doctor

Ms. Khairnar Ishwari[1], Ms. Rutuja Salunkhe[2], Mr. Virajsinh Rajput[3], Ms. Sisode Khushi[4], Prof. K. T. Borse[5]
Students, Computer Engineering, R C Patel Institute of Technology, Shirpur, India [1,2,3,4]
Professor, Computer Engineering, R C Patel Institute of Technology, Shirpur, India[5]

Abstract: *Healthcare systems in towns and rural areas have a lot of problems. For example they do a job of handling appointments medical records are all over the place people speak different languages and it is hard for people to get medical help from far away. HealthConnect is a way to manage healthcare that can help with these problems. It is a website that people can use to talk to their doctors and manage their care. The people who made HealthConnect used tools like React.js, Vite and Supabase to build it. This means that patients and doctors can now talk to each other easily. Patients can make appointments. Everyone can see what is going on. Doctors can also give patients prescriptions and medical records are kept safe. HealthConnect is trying to make healthcare better, for people who live in towns and rural areas. The HealthConnect platform has two dashboards, one for patients and one for doctors. This makes it easy for HealthConnect users to use and understand. HealthConnect is available in two languages, English and Marathi. This means people who do not speak English can use HealthConnect too. HealthConnect also has a computer program that can talk to users it is like a robot that can give health advice and help users find what they need. Users can even have video meetings, with doctors using Google Meet, which's a safe and secure way to meet online. This paper presents the design, methodology, implementation, and outcomes of HealthConnect, highlighting its potential to improve healthcare accessibility, efficiency, and patient engagement.*

Keywords: Supabase, Health, Rural, Multilingual

I. INTRODUCTION

The digital technologies are evolving rapidly and it is impacting various fields particularly healthcare. A large number of small health care systems continue to do things the old way with all these new technologies. They manipulate processes to book appointments so as to keep track of medical records as well as doctors and patients communicating. This may bring about numerous issues such as waiting time things not being completed on time and medical records being lost or incomplete. It also complicates the situation of people being aware of what happens with their healthcare. The sphere of healthcare is among the spheres that technologies are altering the most. Healthcare providers are not helped by these issues. It also makes the experience of the patients worse. There is an under-quality of care provided to the patients. Due to these concerns, healthcare providers are forced to work. This has an influence on the patients and the healthcare providers. It is the quality of care that suffers most in cases of problems such as this one.[11]

There are issues with digital healthcare solutions. Among the problems, the fact that individuals use a multitude of languages is one. This is a challenge to the adoption of digital healthcare solutions across the board particularly in towns and cities with smaller populations.[1]

The majority of healthcare websites and applications are developed to address English-speaking people. This implies that individuals who are not fluent in English cannot use them. Instead, they would prefer their language.

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This communication issue prevents individuals to access technology to receive healthcare. It is also tantamount to the fact that there are certain people who are not provided with access to healthcare as other people. Digital healthcare solutions are failing to assist all people due to the language issue.

HealthConnect is designed to address these issues. It achieves this through providing individuals with a secure and convenient healthcare system. This system makes patients and doctors communicate with one another. It also allows patients to make reservations through the internet. Check the schedule of doctors in real time. The patients are also able to access their prescriptions online. HealthConnect comes in both English and Marathi. This implies that a larger number of people will use HealthConnect since it is bi-lingual. HealthConnect simplifies the life of language-speaking people. HealthConnect is an application, which is offered to individuals, who would prefer to take care of their health online. Moreover, the platform offers an extension of healthcare to the physical clinical environment thanks to remote meetings with the doctor via video and AI-based advice, which facilitates access to medical care in time and enhances continuity of care. HealthConnect assists in making healthcare more responsive, accessible, and patient-centered through the combination of intelligent automation and user-centered design.[3],[4]

II. LITERATURE SURVEY

There are also a number of studies that have examined the creation of digital healthcare management systems and how these systems can be used to automate the scheduling of appointments, maintain electronic health records (EHRs), and provide telemedicine capabilities. Such systems are meant to enhance the efficiency of operations and the decrease of the administration overheads in hospitals and clinics. Nonetheless, the majority of the available hospital management systems aim at large healthcare organizations and are oriented on the administration aspects, not paying much attention to the user experience. Consequently, they tend to have unintuitive interfaces and do not support multiple languages, which restricts the ability of patients and health professionals to use them in local and language-diverse environments.[5]

Telemedicine platforms have also been adopted widely particularly after health crises that were witnessed around the world which brought to the fore the importance of accessing healthcare remotely. Although the platforms offer the ability to consult virtually and diagnose remotely, most of them are limited by their reliance on expensive infrastructure and maintaining high costs, which are not as viable in small clinics and local practitioners. There is also the problem of complex user processes and little integration with appointment systems and medical record management making them less effective as a full healthcare solutions.[6]

The recent studies associated with AI-based chatbots in the medical field have already shown that this type of technology can provide initial medical care, help patients with symptom evaluation, decrease the number of patients in healthcare institutions, and improve patient interaction in general. Although these merits are present, the majority of chatbot-based systems are language-limited, and do not focus on local communities with multicultural linguistic backgrounds. On the same note, it is not just that video consultation tools are not integrated with more extensive health care management systems, but they are frequently delivered as single services and not in alignment with the ubiquitous video consultation tools.[7]

HealthConnect responds to these shortcomings by providing a single, lightweight and scalable web-based healthcare management system. Combining appointment booking, digital prescription services, multilingual access, chatbot-based support, and secure video conferencing in one platform, HealthConnect offers a comprehensive solution to the requirements of the local and regional healthcare settings. Such combined strategy makes it easier to use, more accessible and efficient and affordable and scalable.[6]

III. METHODOLOGY

The HealthConnect platform was developed in a systematic and modular approach, in order to make sure that the development is scalable, usable, secure, and accessible. The methodology should have met the functional and non functional needs of a current healthcare management system as well as meet the linguistic diversity and real-time reactivity of the system.

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Requirement Analysis

The first step was in-depth research on requirements based on the research of current healthcare processes and the interactions between patients and physicians. The functional requirements were patient registration, doctor profile management, appointment scheduling, real-time availability, digital prescription-handling, and secure medical records storage. Non-functional requirements were based on data security, access control depending on the role, scalability of the system, multilingual platform, and simplicity in use by the non-technical users.

System Architecture Design

The architecture of HealthConnect was developed as a client server architecture with a distinct frontend, backend, and database layer. The frontend customer interface has been built with React.js and Vite in order to be fast to render and interact with users. Supabase was used as the back-end-as-a-service to handle authentication, database operation and real-time data synchronization. Role-based dashboards were introduced in order to provide different access to the patients and doctors.

Database Design and Management.

A hierarchical relational database plan was defined that would contain user profiles, appointments, prescriptions and consultation records. The PostgreSQL database that Supabase used was to ensure the consistency and reliability of data. Row-Level Security (RLS) policies were installed in order to limit access to data depending on user roles, and to provide confidentiality of medical information of high value.

Implementation of Multilingual Support.

To overcome the language barrier, the English and Marathi bilingual support was implemented into the platform. This was done by introducing a dynamic language switching mechanism where the users could interact with the system using their own language. This will improve accessibility and usability of regional users who might not be conversant with English.

Scheduling and Management of Appointments.

The appointment scheduling module allows patients to view the availability of doctors in real-time and make appointments with the help of an easy-to-use interface. Physicians will have the opportunity to accept, reject and reschedule appointments through their dashboard. Live updates provide tracking between patient and doctor positions, eliminating scheduling issues and enhancing visibility.

AI Chatbot Integration

The platform was also equipped with an AI-driven chatbot that could be used to offer real-time support when navigating the system, on matters that involved appointments, as well as general health tips. The chatbot decreases the reliance on the human support and provides a higher degree of engagement by providing instant replies. It is also a virtual assistant to first time users and enhances onboarding and usability.

Video Consultation Integration.

The ability to provide clinics with secure video consultation was incorporated through the use of external meeting services in order to spread the services of a clinic beyond physical locations. This aspect enables the doctors and patients to carry out remote consultation and thus care continuity and access to medical care by the users in remote or underserved regions.

Security and Access Control

The methodology involved critical elements such as security. The authentication of the user was done using the secure authentication of Supabase. The use of role based access control and Row-Level Security policies meant that the patients and doctors were only allowed access to the data they had the permission to view. All the sensitive processes were secured to ensure data integrity and confidentiality.

Testing and Validation

The platform went through systematic testing, such as unit testing of each and every component, integration testing of the interaction between modules, and system testing to ensure entire user workflows. The testing was aimed at making sure that multilingual assistance, appointment booking, the work of chatbots, and video-based consultations would be reliable in various conditions.

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IV. IMPLEMENTATION

HealthConnect was deployed as a scalable, user friendly and secure web based application of healthcare management. The execution was based on the module development, real-time data processing, multilingualism, and easy integration of smart features to improve healthcare services provision.

Frontend Implementation

React.js was used to write the frontend of HealthConnect on vite, and the frontend provides high performance, high load speed, and responsiveness to users. They used a component based architecture to enhance maintainability and reusability. Patients and doctors had separate user interfaces, which had role-specific functionality in the form of dedicated dashboards.

Through an easy-to-use interface, patients are able to register, search through doctor profiles, check availability, make appointments as well as view prescriptions. Physicians are able to control their schedules, accept or reject the reservation, and create electronic prescriptions. The user interface has been developed keeping the aspect of accessibility in consideration, in which a clear navigation, minimum complexity, and both English and Marathi languages are supported.

Database Implementation Backend.

Supabase was used to implement the backend services and is an authentication, database management, and real-time data synchronization tool. The user profiles, appointment records, medical prescriptions, and the details of the consultations were stored in the PostgreSQL database of Supabase. The tables in the database were normalized to guarantee consistency of the data and effective querying.

Role-based authentication was used to identify patient and doctor users. Row-Level Security (RLS) policies were applied to ensure that only authorized records could be accessed by the users and the data remained confidential and compliant with the healthcare data protection regulations.

Making of appointments and scheduling.

The appointment scheduling module was also applied with the help of real-time database listeners that enabled real-time updates on the patient and doctor dashboards. Patients will be able to choose time slots available and make appointment requests, and doctors will be notified in real-time to accept appointments or decline them or reschedule them. This live synchronization minimizes the scheduling conflicts and enhances operational efficiencies.

Electronic Prescription System.

Physicians are able to create and revise online prescriptions directly on their dashboard. The database keeps the prescriptions in a safe place and patients can also access it instantly. This removes the use of paper based prescriptions, minimizes mistakes caused by illegible handwriting and the continuity of medical records across consultations.

Multilingual Support Incorporation.

The concept of multilingual support was applied through the dynamic content rendering and the language specific resource files. Any user can alternate English and Marathi any time when interacting with the system. Such implementation implies that every element of the user interface, message, and notification will be presented in the chosen language with the same consistency and enhance the level of accessibility among users in the region.

AI Chatbot Implementation

The platform was equipped with an AI-powered chatbot to help users with appointment requests, navigation on the system, and general health-related advice. The chatbot is able to make use of the user inputs and give contextual responses, eliminating reliance on human help. This will help in the involvement of the user and also help in the overall usability of the system especially to first time users.

Integration of Video Consultation.

Secure video consultation functionality was installed to facilitate remote healthcare services by introducing online meeting services. When the appointment is confirmed, a video consultation connection is created and sent to the patient and physician. This allows smooth remote consultations without violating privacy and access.

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Data Protection and Security.

Security was taken into consideration during all implementation phases. The safety of medical sensitive data is guaranteed by secure authentication processes, encrypted data storage and controlled access by role-based permissions. The transactions of all databases are authenticated to avoid unauthorized access or manipulation of data.

Testing and Deployment

The platform was also tested thoroughly, the frontend components, the API used in the backend and end to end testing were all tested. Company Reliability testing was done to make sure the appointment booking, chatbot, multilingual support and video consultations were reliable. After testing, the system was implemented on a cloud infrastructure which could be scaled and made continuously available.

V. CONCLUSION

HealthConnect shows the successful use of the latest web technologies to enhance healthcare service provision by resolving the widespread issues of manual processing of bookings, disjointed medical records, language barriers, and deficient access to distant care. The combination of centralized appointment booking, electronic prescription administration, dual-role dashboards, and a safe data processing system into one platform will also streamline the process of operation and increase the efficiency and transparency of the system to patients and doctors alike. Multilingual support (English and Marathi) ensures accessibility and inclusivity, especially in local contexts, whereas AI-based chatbot support and video consult services allow extending the level of care beyond brick-and-mortar sites and enhance patient interaction. In general, HealthConnect is a scalable, user-friendly, and affordable healthcare management system that will help the local healthcare systems to be digitalized and will be able to base further technological progress on it.

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