Transactions of NAMP 20, (2024) 83-92

Transactions of
The Nigerian Association of
Mathematical Physics
Journal homepage: https://nampjournals.org.ng

DESIGN AND IMPLEMENTATION OF AN EXPERT SYSTEM FOR MEDICAL DIAGNOSIS AND PRESCRIPTION.

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ARTICLE INFO

Article history:
Received xxxxx
Revised xxxxx
Accepted xxxxx
Available online xxxxx

Keywords:
Expert System, Medical Diagnosis, Artificial Intelligence, Knowledge Representation and Prescription.

ABSTRACT

This abstract presents the design and implementation of a sophisticated expert system tailored to the medical domain. Leveraging the power of artificial intelligence and knowledge representation techniques, the system emulates the decision-making prowess of experienced medical professionals. The proposed system encompasses a well-structured knowledge base compiled from authoritative medical sources, encompassing a wide spectrum of symptoms, diseases and treatments. A user-friendly interface that can act as the bridge between the system and healthcare providers has been developed. The developed interface adeptly poses relevant questions, captures input data, and conveys the system's findings in an understandable manner. The transparency of the system's decision-making process is upheld by an explanation mechanism, which justifies diagnoses and treatment suggestions, instilling confidence in end users. Extensive testing and validation against established medical benchmarks ensure the system's reliability and efficacy. As it aligns with the digital transformation of healthcare, this expert system has the potential to provide rapid, consistent, and expert-backed medical diagnoses and prescriptions.

1. INTRODUCTION

The development of an expert system for medical diagnosis and prescription stems from the pressing need to address challenges in the healthcare industry. Traditional methods of diagnosing and prescribing treatments often rely heavily on the expertise of medical professionals, leading to variations in diagnoses, treatment plans, and sometimes delayed interventions. This paper delves into the motivations and context that underscore the significance of designing and implementing such an expert system.

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https://doi.org/10.60787/tnamp.v20.380

In the field of medicine, accurate and consistent diagnoses are critical for effective patient care. However, human diagnostic accuracy can be influenced by factors like fatigue, experience level, and cognitive biases. An expert system, drawing upon an extensive knowledge base and standardized algorithms, has the potential to provide consistent, evidence-based diagnoses that are not swayed by these factors.

The exponential growth of medical knowledge poses challenges for medical professionals to stay up-to-date with the latest research and advancements. An expert system can efficiently assimilate and organize vast amounts of medical information, ensuring that diagnoses and prescriptions are in-line with the most recent medical guidelines and research findings.

The global increase in patient populations, along with the shortage of skilled medical professionals, has placed a strain on healthcare systems. An expert system can alleviate this burden by expediting the diagnostic process and providing preliminary treatment recommendations. This allows medical professionals to focus their expertise on complex cases and specialized care.

Diagnostic errors have been identified as a significant concern in healthcare. These errors can lead to incorrect treatments, delayed interventions, and even patient harm. An expert system's consistent application of diagnostic criteria and evidence-based algorithms can contribute to minimizing such errors, potentially saving lives and reducing healthcare costs [1].

Patients today are more engaged in their healthcare decisions and seek information to better understand their conditions and treatment options. An expert system can provide patients with accessible and comprehensible information about their diagnoses and treatment plans, enabling them to make informed decisions and actively participate in their own care.

The concept of personalized medicine emphasizes tailoring treatment plans to an individual's unique characteristics and medical history. An expert system can analyse a patient's specific profile and suggest treatments that align with their medical background, genetics, and lifestyle, enhancing the efficacy of interventions [2-4].

An expert system's ability to store and retrieve patient data ensures continuity of care, even when patients transition between different healthcare providers. This seamless exchange of information can prevent redundant tests, streamline treatment processes, and improve the overall patient experience. The development of an expert system for medical diagnosis and prescription addresses the challenges and opportunities in modern healthcare by harnessing artificial intelligence and knowledge representation techniques, such a system has the potential to enhance diagnostic accuracy, consistency, and patient outcomes while alleviating the strain on healthcare professionals. This study aims to contribute to the advancement of medical technology and patient-centred care.

In the realm of healthcare, the process of medical diagnosis and prescription is fraught with challenges that necessitate a comprehensive solution. Traditional methods rely heavily on the expertise of individual medical professionals, leading to variations in diagnoses, treatment plans, and potential errors. Furthermore, the overwhelming volume of medical knowledge, the demand for timely interventions, and the need for consistent and evidence-based decisions exacerbate the complexity of the diagnostic process. These challenges point to a critical problem in need of resolution: the lack of a standardized, accurate, and efficient approach to medical diagnosis and prescription. Addressing these challenges requires the development and implementation of an expert system for medical diagnosis and prescription. Such a system would leverage artificial intelligence, knowledge representation techniques, and evidence-based algorithms to provide accurate, consistent, and timely diagnoses and treatment recommendations. By doing so, it aims to bridge the gap between medical expertise and patient care, minimizing diagnostic errors, improving patient outcomes, and streamlining the healthcare process. In light of these issues, this paper therefore aims to design and implement an expert system that addresses the aforementioned

challenges and contributes to the advancement of medical technology, patient-centered care, and healthcare efficiency.

LITERATURE REVIEW

The utilization of expert systems in medical diagnosis and prescription has garnered significant attention due to its potential to enhance diagnostic accuracy, streamline treatment planning, and improve patient outcomes. In the development of expert systems, knowledge representation and the design of the inference engine play pivotal roles. The importance of structured knowledge bases for effective reasoning and decision-making has been emphasized and discussed extensively in [6]. The inference engine, as highlighted by [2], processes patient data using rule-based algorithms, enabling accurate diagnoses and personalized treatment recommendations. Several studies have showcased the capability of expert systems to improve diagnostic accuracy and reduce errors. In the works of [4-5], the effectiveness of an expert system in accurately identifying skin diseases, outperforming non-specialist doctors were demonstrated with some illustrations. Shams et al., [7] illustrated how an expert system successfully detected cardiac arrhythmias, mitigating the risk of misdiagnoses.

The integration of expert systems with electronic health records (EHR) is a crucial consideration. The seamless incorporation of patient history and test results into an expert system's decision-making process were investigated in [7-8]. This integration ensures that the system operates with real-time patient information, contributing to accurate diagnoses and tailored treatment recommendations.

Ethical considerations are paramount in the deployment of medical expert systems. The need for transparency, accountability, and informed consent in the design and implementation process of an expert system have been developed by Tanaka et al., [9]. Adherence to established guidelines and regulatory frameworks is essential to ensure patient safety and uphold privacy. The integration of learning mechanisms within expert systems has shown promising outcomes in a system that continuously updated its knowledge base using data from medical journals, thereby enhancing diagnostic accuracy over time [10]. This adaptability ensures that the system remains relevant and effective in an ever-evolving medical landscape.

User interface design and patient engagement are critical factors for the success of expert systems. Wang et al., [11] stressed the importance of intuitive interfaces for effective communication between the system and medical professionals. The potential of engaging interfaces in empowering patients to actively participate in their healthcare decisions was highlighted in [12-13].

Incorporating expert systems into medical diagnosis and prescription holds immense promise for enhancing healthcare practices. By leveraging advanced technologies, structured knowledge bases, and learning mechanisms, these systems offer the potential to revolutionize diagnostic accuracy, reduce errors, and deliver personalized treatment recommendations.

Nonetheless, ethical considerations, continuous learning, user interface design, and integration with existing healthcare systems remain areas warranting further exploration and refinement.

This paper therefore proposes to make contributions by addressing those challenges posed by the complexity of medical information, diagnostic accuracy, and personalized patient care.

METHODOLOGY

The methodology section of this paper provides a detailed explanation of the system specifications and data collection methods that were employed in the study. This section aims to outline the system design, data design, analysis, and presentation procedures that were used to achieve the project's objectives. The data collection method explains how the data was collected and the methods used to analyze the data. The system maybe developed using .NET framework and Java programming language. In summary, these specifications will guide the development and

implementation of the system to meet the project's objectives. The flowchart in Figure 1 is a well-detailed diagram of the proposed system and the system functionality. Experimental data for this paper was collected through online survey. A survey was conducted online to gather information from relevant stakeholders in the healthcare services, such as emergency technician workers, doctors, nurses, and healthcare providers. The data collected through these methods will be used to inform the design and implementation of the computerized child abuse database management system, as well as to evaluate its effectiveness in improving data collection, management, and sharing in the context of child protection services in Nigeria.

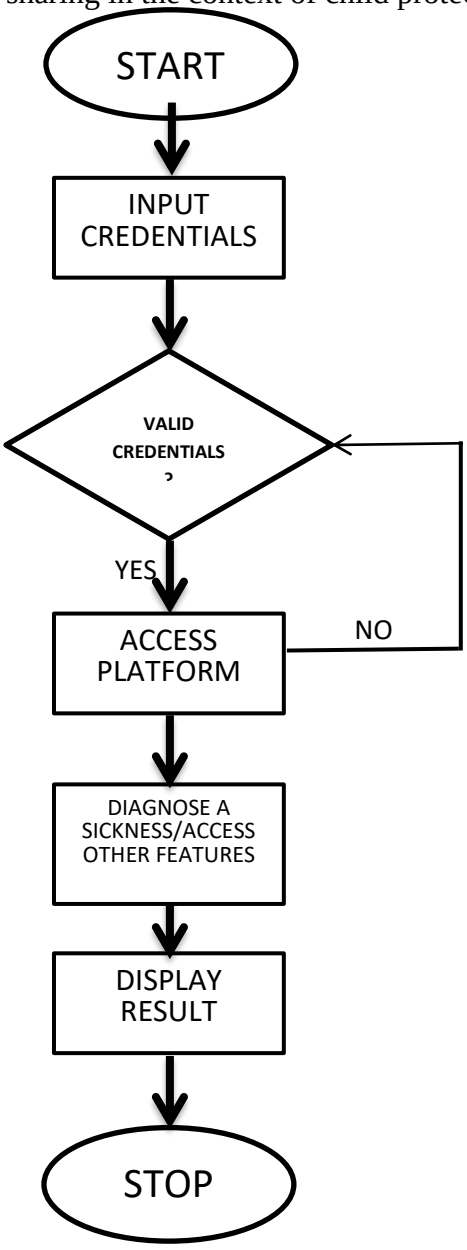

Figure 1: Flowchart of the proposed system

The flowchart presented in Figure 1 begins with the start symbol indicating the initiation of the process. The next step would allow the user to input their credentials and check if the input is valid before proceeding for further processing or otherwise return to the previous menu to repeat the same process. If a valid login detail is input, the user can access the platform, present his/her

information such symptoms to the system and perform desired task. The developed system would use the information provided by the user to diagnose and prescribe for the patients.

Pseudo Code of Proposed System

1. Start
2. Initialize database connection
3. Display main menu options
4. If user selects "diagnosis"

Collect patient's information (name, age, gender, etc.)
Collect symptoms
Display possible sickness/prescription

5. If user selects "work motivation"

Display matching results

6. If user selects "walking challenge"

Display matching results

7. If user selects "relaxing music"

Display matching results

8. If user selects "yoga and meditation videos"

Display matching results

9. If user selects "recipes"

Display matching results

10. If user selects "compute BMI (Body Mass Index)"

Collect necessary credentials (age, gender, height, weight)

11. If user selects "Exit"

Close database connection
End program

The flowchart presented has been used to describe system development using the models and designs given in earlier sections.

Results and Discussion

The proposed system was successfully tested to denote its effectiveness and achievability. The evaluation of the model was done in different ways; Firstly, the system was tested to ensure all the functions specified in the system design are correct. This also involves testing various features of the system to ensure that they are all working correctly. Additionally, the developed system was tested to determine the number of users it can process and also to know if our model has actually answered the research questions stated in the objectives of this research paper. The developed system is quiet different from the previous studies in the sense that only authorized users can gain access into our system since some security measures have been put in place. Furthermore, our system is more efficient in terms of the number of users it can process at a go when compared to other related studies. In this project, we have developed a system that includes patient’s information, diagnosis and treatment in accordance with the traffic and the episodes created during the process. In the end, it provides medical staff the possibility of obtaining information of a statistical nature.

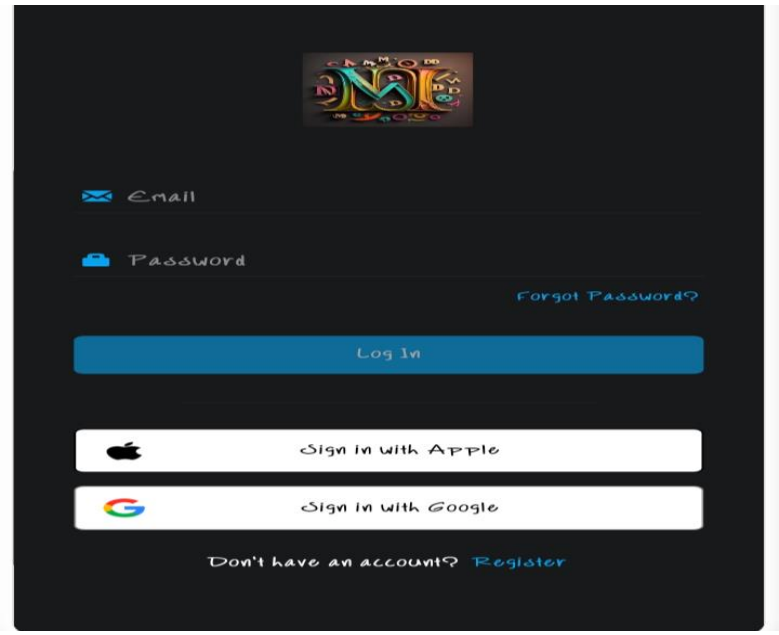

Figure 2: Interface for authorization login page

Figure 2 shows the GUI welcome page, sign in and forgot password of the medical diagnosis system after launching it on a mobile android device. The design interface can cater for those who have the right to sign into the system using username and password. If the user has forgotten his/her password, there is a way to recover or reset the password. The interface is very friendly and flexible with a comprehensive feature of medical diagnosis for different kind of ailments.

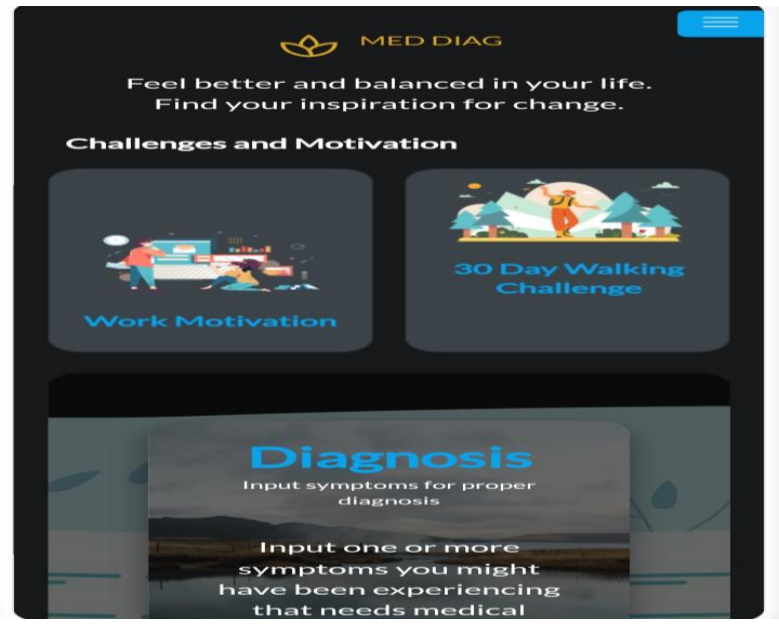

Figure 3: Home Page for Medical Diagnosis

Figure 3 shows the main page, after signing in with the user email and password. The main page shows series of activities that can be carried out by a user, ranging from personal improvements to diagnosis. The dashboard is where the user carries out any activities of their choice. Users can also

choose to stay signed in permanently or sign out after finishing with their choice of activity on the app.

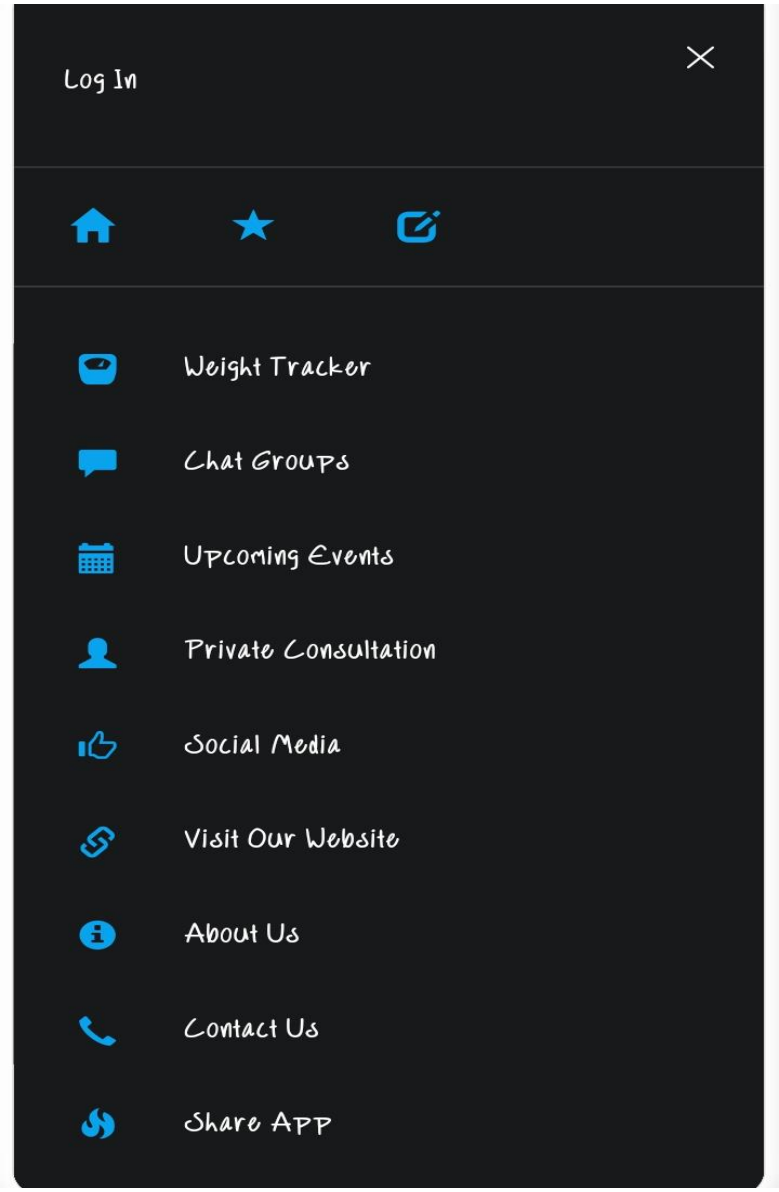

Figure 4: Side Panel showing additional features

In Figure 4, the side panel where users can choose to either calculate their Body Mass Index (BMI), visit our social media page, consult a medical practitioner privately, visit our website, contact us or know more about us. On this app, patient can explore and get all the information they needed to get well. The developed app has the ability to prescribe medications for patients to treat any diseases after proper diagnosis.

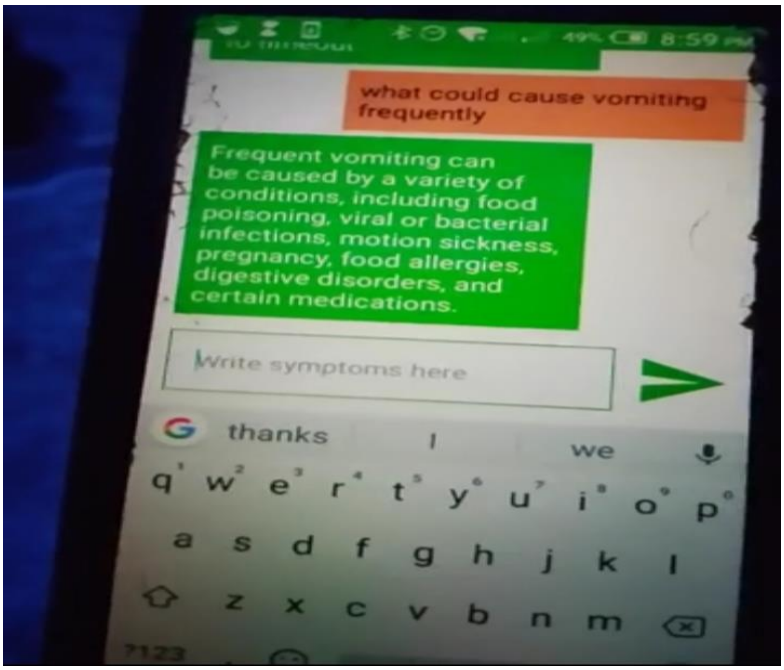

Figure 5: Diagnosis application for patients

The diagnosis app as presented in Figure 5 is currently operational and available for use. Users can access the app to receive medical assessments, evaluations, and recommendations based on the information they input. This digital tool employs algorithms and medical databases to analyze symptoms, medical history, and other relevant data. It aims to assist individuals in understanding potential health issues, but it's important to note that the app's output should not replace professional medical advice and diagnosis from qualified healthcare professionals.

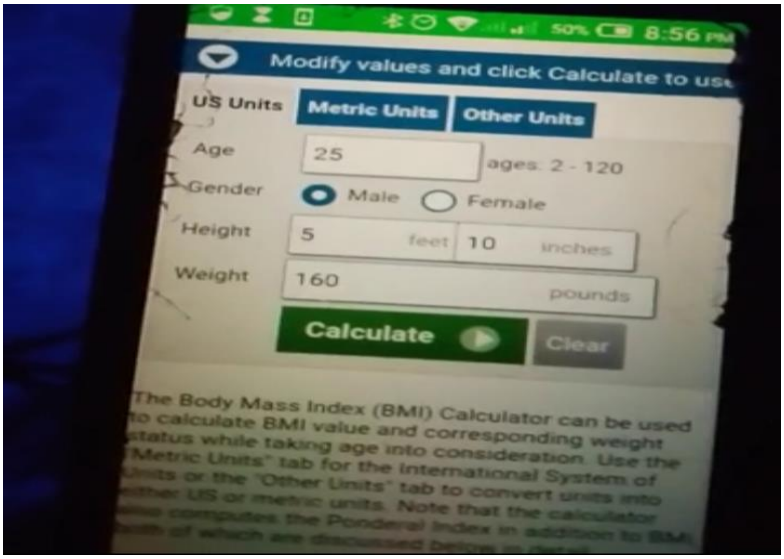

Figure 6; BMI Calculator page for different users

Figure 6 shows the BMI calculation page. BMI is a numerical value derived from a person's weight and height, and it is commonly used as a basic indicator of whether a person's weight falls within

a healthy range. On the BMI calculator page, users can input their weight and height, and the system will apply a formula to calculate their BMI. The result is often categorized into different ranges, such as underweight, normal weight, overweight, and obesity. This tool can provide a quick snapshot of a person's general weight status, but it's essential to remember that BMI is a simplified measurement and doesn't account for factors like muscle mass, bone density, and overall body composition. For accurate health assessments, consulting a healthcare professional is recommended.

To enhance engagement, the page might also include interactive features like a community forum or social media integration where participants can share their experiences, achievements, and challenges. Additionally, the challenge page could provide regular content updates, such as articles on the importance of walking, advice on proper walking techniques, and ways to gradually increase walking intensity. This article aims to educate readers on the importance of adopting healthy lifestyle practices and making informed decisions about their well-being. They might delve into the latest research findings, provide evidence-based recommendations, and debunk common myths and misconceptions related to health and wellness. In order to cater to different interests and needs, the articles are typically categorized or tagged, allowing users to easily navigate and find content relevant to their specific concerns. Some pages also offer features like a search bar, trending topics, or featured articles to highlight particularly relevant or timely content. Interactive elements such as comment sections, social media sharing buttons, and opportunities to subscribe for updates can help foster engagement and a sense of community among users. This can be particularly beneficial for those looking to connect with others who share similar health and wellness goals and interests.

Conclusions

The vision for the use of technology in the field of health in 21th century includes a centralized human-service health system with core of this to the citizens. In such a system, the core is based on continuous medical supervision and is customized according to the needs of citizens who is in the focal point of need. The proposed system has been thoroughly designed and implemented in such a way that it should be suggested for optimal resource usage. Additionally, it is important to ensure system maintenance in order to maximize user access to the system and to make the necessary updates to the system’s software and functionality to meet the growing user demands. We therefore recommend this mobile application for all health workers to add, update, delete and keep patient records. In-patients and Out-patients can have access and view their information and records. The application developed is user friendly and meets all the requirements usability and security of personal data. The good thing about this application is that people are able to access an healthcare system irrespective of their location and schedule. Also, strong emphasis was given on creating an intuitive management environment which the user can handle without requiring any special computer knowledge.

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