Smart Web Based Medical Appointment Booking System

Naushad Ahmad[1*], Vinayak Pandey[2], Sandeep Harijan[3], Shubhum Kumar Kannojia[4], Shipra Singh[5]

[1*]Scholar (B.Tech Final Year) Computer Science & Engineering, B. N. College of Engineering & Technology, Lucknow

[2] Scholar (B.Tech Final Year) Computer Science & Engineering, B. N. College of Engineering & Technology, Lucknow

[3] Scholar (B.Tech Final Year) Computer Science & Engineering, B. N. College of Engineering & Technology, Lucknow

[4] Scholar (B.Tech Final Year) Computer Science & Engineering, B. N. College of Engineering & Technology, Lucknow

[5]Assistant Professor, Department of Computer Science & Engineering, B. N. College of Engineering & Technology, Lucknow

Abstract: With the fast advancement of technology, there is a noticeable trend towards the replacement of manual processes with automated alternatives. Currently, a significant number of individuals are encountering various forms of medical ailments. A significant portion of the population lacks knowledge on the identification of highly skilled medical practitioners who can effectively address their health concerns. Furthermore, individuals often lack direct means of communication with healthcare professionals to seek consultation regarding their specific health issues. Within this context, our objective is to provide an efficient and streamlined appointment system that facilitates ease, speed, and convenience for both doctors and patients. Although India is classified as a developing nation, with a significant population of internet users residing inside its borders. For individuals to establish a connection with their preferred healthcare professionals over the internet, a nexus is required. With the objective in mind, we have devised a strategy to construct a website that facilitates the scheduling of appointments. The doctor is a web-based programme that facilitates registration and login for both doctors and patients under the administration of an administrator. Medical practitioners have the option to complete the registration process by providing their essential information, such as their availability schedule, professional category, and other relevant facts. Upon completing the registration process, the doctor is able to access their account by providing their designated username and password. The physician can see patient requests and subsequently sends notifications to patients on appointment availability. This service will provide prompt assistance to individuals from both domestic and international locations, enabling them to save time and effort. This method facilitates individuals in obtaining information on the schedule of doctors' counselling sessions, enabling them to conveniently schedule appointments at their preferred time. A well-organized and appropriately classified list will enhance user satisfaction and facilitate the navigation process for those seeking specific healthcare providers.

Keywords: Online Appointment System (OAS), Healthcare, Hospital Scheduling, Patients, Web Server.

1. Introduction

The use of an Online Appointment System is prevalent in industrialized nations worldwide. The healthcare system incorporates a web-based interface that enables users to schedule appointments with doctors over the internet, via a web browser. The popularity of online doctor's appointments is on the rise due to the convenience and efficiency it offers to clients. The increasing demands of modern life have made it more difficult to get in-person doctor consultations and effectively manage one's healthcare needs [1]. In order to accomplish this objective, individuals need a significant amount of time to physically visit a hospital and make an appointment. The primary objective of this study is to enhance the convenience and satisfaction of patients throughout the process of scheduling appointments with healthcare providers. Additionally, it aims to address the challenges that patients often encounter while attempting to arrange appointments [2]. In the context of online appointment scheduling, the user navigates to a designated website where they proceed to choose a certain time and

day for their desired appointment. Subsequently, they proceed to schedule a meeting with a specific doctor of their choice. It is important to note that all relevant data pertaining to these appointments is diligently stored and managed inside a database system. The proposal under consideration is an intelligent web-based appointment booking system. The objective of this project is to develop a doctor-patient handling management system that aims to enhance the efficiency of physicians' work and facilitate patients in booking doctor appointments and accessing their medical status. The solution enables healthcare professionals to effectively manage their appointment scheduling using an online platform. Patients have the opportunity to schedule vacant time slots using an online platform, and these slots are thereafter allocated and held under their own names. The system is responsible for the management of appointment data for several physicians, including a range of dates and hours. Every moment a patient consults a physician, their medical record is recorded and kept in the database by the doctor. In the future, when a person accesses their account, they will have the ability to see their whole medical history at any necessary moment. Simultaneously, a physician can study a patient's previous medical records during the patient's appointment. This technology furthermore provides consumers with the capability to cancel their appointment at any moment [6]. The implementation of this approach caters to persons seeking treatment from city practitioners. In order to participate, people must first establish an account using the registration form and thereafter enter their medical history. After completing the registration process [7].

2. Related Work

Historically, the process of scheduling medical appointments has mostly relied on individuals contacting schedulers either via telephone communication or in-person interactions. The approaches used in this study are grounded on interpersonal verbal interactions with individuals, hence affording a high degree of adaptability in intricate circumstances [8]. Nevertheless, the reliance on schedulers in conventional techniques imposes limitations on the promptness of securing appointments. This constraint is not just determined by the availability of appointment slots, but also by the efficiency of schedulers and telephone communication [9]. The happiness of patients with the process of scheduling appointments is contingent upon their capacity to schedule appointments with appropriate healthcare providers at the appropriate time [10]. In recent times, the Internet has developed as an additional avenue for scheduling appointments. The study on web-based appointment scheduling has garnered significant attention in academic circles. Multiple studies have been undertaken to assess satisfaction levels via questionnaires, revealing that the inclusion of Web-based appointment booking is a very significant feature. Furthermore, the majority of patients expressed their intention to use this service in the future [11]. Digvijay et al. (2012) conducted a study on the administration of hospitals with the aim of developing software that is user-friendly, easily comprehensible, and efficient in its performance. The system encompasses the gathering of patient information and physician information. The system is responsible for both the storage and retrieval of data as needed. The hospital management system allows access via the use of a username and password, which is granted by an administrator. This ensures that the data is securely safeguarded and may only be accessed for authorised purposes. The implementation of a hospital management system is essential for the purpose of storing and managing various important information, such as patient data, doctor details, and staff information, among others. Therefore, via the implementation of these projects, the tasks become more manageable and result in significant time savings. The study conducted by Malik et al. [13] In order to have a medical examination, it is advisable to wait until the doctor is accessible and get an appointment. With the advancements in mobile technology, obtaining an appointment with a doctor has become more convenient. The mobile application facilitates the scheduling of appointments by storing the relevant appointment information and integrating it with the user's calendar. The user receives alerts according to the predetermined time selected before to the scheduled appointment. This programme is designed to be user-friendly and straightforward in its intended function. In this system, the administrator will be responsible for managing the information pertaining to doctors and patients.

The appointment services are hosted on cloud infrastructure and have the capability to be seamlessly incorporated into the existing management systems of healthcare providers. Another kind of appointment service is known as proprietary appointment systems, which are included within the patient portals seen on providers' websites [14]. A patient portal refers to a secure online service that enables patients to conveniently access their health information and engage in communication with their healthcare professionals at any given moment [15]. According to Adebayo Peter Idowu et al. [16], a significant number of patients fail to attend their scheduled medical visits, resulting in a waste of both patient and doctor time. In contemporary culture, individuals have the ability to secure appointments with medical professionals via the use of online booking systems. This programme allows users to independently choose a doctor of their choice. It provides comprehensive information on doctors and hospitals. Patients have the ability to independently handle their own appointments. Participants will get a reminder via SMS or email prior to their scheduled appointment date. This category of tasks has the potential to mitigate the inefficiency associated with appointment scheduling. In situations of urgency, it is feasible to readily schedule appointments. The use of this technology results in a reduction in time required for both patients and doctors. Nazia S and Ekta Sarda (2017) demonstrate that an online appointment system is a user-friendly system that allows patients to conveniently visit a website and schedule their appointments. By using this approach, patients are able to provide supplementary information to the doctor upon their arrival, so allowing the doctor enough time to prepare the necessary information. The use of an online appointment system may aid both staff members and patients. The purpose of implementing online appointment scheduling is to provide a more streamlined and convenient process for patients and doctors when arranging appointments. A novel approach has been devised with the aim of enhancing the efficiency and quality of providing a web-based appointment system, hence mitigating waiting time. In this study, a system for patient appointment and scheduling is developed [18]. The frontend of the system is implemented using AngularJS, while the client-server requests are managed using the Ajax framework. The backend of the system is supported by Sqlite3 and MYSQL databases [19].

3. Literature Review

3.1 Waiting Time

According to Fernandes et al. (year), waiting time is operationally defined as the duration a person remains in a state of anticipation until a certain action takes place. The concept of waiting time encompasses the duration between a patient's arrival at a clinic or service point and their consultation with a physician, resulting in the issuance of a prescription. In previous studies, the concept of waiting time has been defined in two distinct ways. Initially, waiting time refers to the temporal interval that starts when a person arrives for their scheduled appointment and continues until said individual has a consultation with the medical practitioner. The second definition encompasses the period of time beginning when a person arrives to schedule an appointment and concluding with the receipt of prescribed medication after consultation with a medical professional. The issue of extended waiting times at medical clinics has emerged as a significant concern in developing nations throughout the course of time. An experimental study was conducted at a health clinic in South Africa to evaluate the impact of implementing a block appointment system. The study aimed to quantify the waiting time experienced by patients over a one-week period before and after the introduction of the appointment system. In the course of the experiment, interviews were conducted with focus-group participants, staff members, and patients. The findings revealed that acute medically unwell patients who had made previous appointments had shorter waiting times in comparison to those who did not have appointments. Furthermore, it has been said that the appointment system [21] does not provide any advantages for patients who do not need a consultation with the doctor or who are on a regular and recurring prescription regimen. Subsequently, it was discerned that the block appointment method confers reduced waiting times only for patients experiencing acute illness, while failing to provide the same benefit for other individuals.

3.2 Appointment Delay

Previous study has shown a clear and direct correlation between the delay of appointments and subsequent cancellations of these appointments. Appointment delay refers to the duration that starts when a person makes a request for an appointment and concludes upon their consultation with a healthcare professional. Increased appointment delays result in a higher number of appointments. The topic of cancellations will be discussed. In order to mitigate the occurrence of appointment cancellations or no-shows, it is advisable to minimize the temporal interval between the initial appointment request and the scheduled doctor's check-up or session. The act of reducing this disparity is often referred to as open access (OA) or advance access policy, which has since gained significant traction and become an integral component of current research endeavors. The researchers encountered both favorable and unfavorable outcomes throughout their experimental investigations. Certain practitioners expressed support for the implementation of OA and provided strong endorsements for its adoption. Conversely, other practitioners held opposing views and expressed their disagreement with the implementation of OA.

3.3 Managing Patients' Appointment System

The health care institution uses a patient appointment management system to effectively oversee and reduce patient waiting times. Certain healthcare clinics use these types of software, while others do not. Medical clinics that use such apps often experience reduced waiting times in comparison to medical clinics that do not employ any appointment application. Patients who are had to wait for more than an hour for their scheduled medical check-up have feelings of humiliation and see the situation as unjust. The assessment of a medical facility's quality may be determined by patients by their evaluation of the duration of waiting time they are required to endure. Hence, it has become imperative to take into account elements such as "timesaving" and "minimization of idle time" during the development of a patient appointment system. According to Klassen (2002), the scheduling of doctor's time and patient appointments is expected to be based on the severity of the case and the patient's needs. There has been a growing impetus to acknowledge the need for improved care services of higher quality. The emergence of online appointment systems has become a significant outcome in the field of healthcare services, due to the progress in information technology and the critical nature of medical treatment. These systems have shown themselves to be effective and timely in delivering healthcare services efficiently. In the past, appointment requests were often made using phone calls, emails, or faxes. However, with the progress of technology and the internet, there has been a shift towards utilizing dedicated online appointment systems for this purpose.

3.4 Waiting for Registration

Before seeking medical attention, individuals visiting a clinic or hospital are required to complete the registration process at a designated counter. The primary objective of this phase is to establish a queue for consultations, whereby individuals patiently await their time. This is the underlying cause for the extensive waiting periods experienced by several individuals prior to their registration at the reception desk and subsequent consultation with the physician. To minimize user waiting time, it is essential that the registration process be efficient and user-friendly. The results of a study conducted in 2017 indicate that the presence of a single employee responsible for both registration and appointment distribution is the primary factor contributing to the occurrence of long queues at the registration counter (BA, A. 2017). Insufficient staffing is an additional well-established factor contributing to prolonged waiting periods in healthcare facilities, including hospitals and medical clinics. Utilizing an online booking system is considered the most optimal approach for addressing this issue. This approach has the potential to provide cost savings by reducing the need for a larger workforce at the registration desk, while concurrently mitigating patient wait times.

4. Existing System

In India, there exists a significant prevalence of privately-owned medical clinics and hospitals. Physicians operate independent medical practices whereby they provide consultations to patients throughout flexible hours, including evenings and many other times, depending upon their own schedules. Certain entities have widespread popularity and recognition, whereas others possess a more limited degree of familiarity among individuals. This circumstance presents a formidable obstacle for novice professionals, as their limited recognition among individuals persists while possessing a commendable scholarly foundation. On the contrary, patients have challenges when it comes to locating and selecting a physician in proximity. Unscheduled appointments, extended waiting times, and reliance on physical medical records are prevalent challenges encountered by individuals seeking healthcare services in India.

5. Proposed Work

In the research paper titled "Smart Web Based Medical Appointment and Database Management System," the author has tried to address the issues associated with the current healthcare system in India. The aim of my endeavor was to provide a platform that facilitates the convergence of both healthcare professionals and those seeking medical treatment. In this application, individuals who are either new to the field or have been employed for an extended period could register themselves. In this manner, individuals are given the opportunity to familiarize themselves with and make informed decisions on the selection of a preferred healthcare practitioner. This programme enables users to gain knowledge and access the professional profiles of all registered doctors across several specializations [23]. The doctor's profile has details pertaining to their professional experience, licensure, educational history, clinic hours, working schedule, clinic accessibility, and patient testimonials as well. Individuals would have the capability to schedule appointments from the comfort of their own residences. The customer has the option to choose a physician near their location, or one who has more professional expertise or garners more favorable ratings from other patients. New individuals entering the profession may readily use the site and begin scheduling appointments without the need of costly advertising. When enrolling as a patient, individuals could provide comprehensive medical history to ensure the avoidance of any omissions. It is necessary to retain or transport one's medical records while attending a medical examination. Whenever a user schedules an appointment, the physician is able to conveniently get the patient's profile and make updates to their medical record. The practice of scheduling appointments for patients has been in existence for a considerable period. The primary purpose of developing the appointment system was to reduce the amount of idle time experienced by physicians, since it was believed that the time of doctors had more value than the waiting time of patients. However, it was subsequently recognized that the significance of reducing the duration of patient waiting is equivalent to that of the physician's time. In the current development of an appointment system, equal weight is placed on both the idle time of doctors and the waiting time of patients [25]. The scheduling of patients encompasses several objectives, such as enhancing the provision of high-quality healthcare services, minimizing the idle time of physicians and nurses, and minimizing patient waiting times. The objective of this project is to develop a Smart Web-Based Medical Appointment and Database Management System. Understanding the functioning of this programme and being knowledgeable about the technologies used in its implementation are crucial for the user. To enhance comprehension, a comprehensive depiction of the system is provided by outlining each phase in meticulous detail.

5.1 Html/Html5

HTML, an acronym for Hypertext Markup Language, is a standard markup language used for creating and structuring web pages. This programming language is used in the development of web pages. In addition to facilitating the creation of interactive and responsive sites, this programming language also provides support for several other languages such as CSS, PHP, JavaScript, among others. The HTML5, as seen in Figure 1, may be regarded as a revised iteration of the HTML standard [26]. The platform provides support for novel functionalities, additional attributes, newly introduced HTML elements, comprehensive CSS3 compatibility, video, and audio capabilities, as well as 2D/3D graphics. These features assist both users and web developers in the seamless creation and integration of innovative aspects into websites.
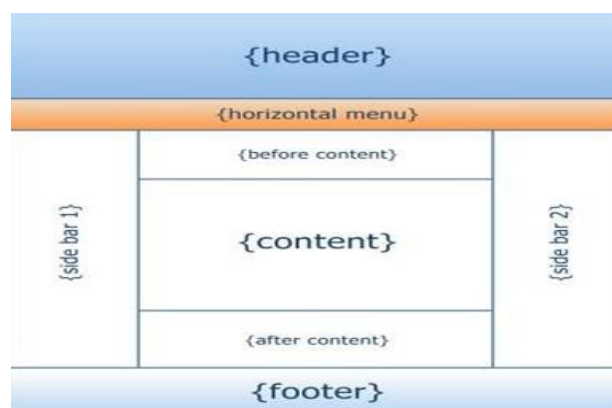
Figure 1: The structure of the Html/Html5

5.2 PHP

PHP is a prevalent server-side programming language that is often used in the development of dynamic web sites. The resource is readily available in several iterations at no cost. This software application has the capability to operate on several operating systems, including macOS, Windows, and UNIX, as well as diverse platforms. Due to its nature as a scripting language, the programme code is executed after the program's execution. PHP may also be used in the development of desktop apps. One of the rationales for selecting PHP as the programming language for our project is from its compatibility with MySQL, which has been designated as the preferred database management system for our project. The PHP programming language facilitates the seamless integration of pictures and PDF files into HTML sites. Figure 2 illustrates the operational processes of the web server.
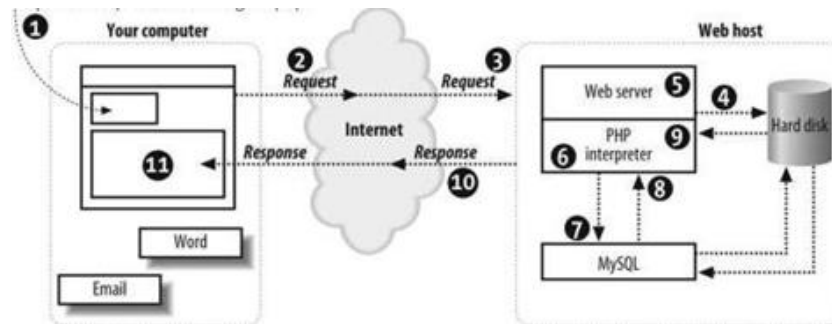
Figure 2: Demonstrating how the Web Server Operates using PHP

5.3 MySql

MySql is an open-source database system that facilitates the cost-effective deployment of dependable, high-performance, and scalable web-based and embedded database applications. The system in question may be classified as a relational database management system (RDBMS). The programme exhibits exceptional performance and has the capability to scale effectively in order to accommodate the requirements of both users and data [27]. MySql is implemented using the programming languages C and C++, so ensuring compatibility with a wide range of operating systems that are prevalent globally. To effectively handle this kind of data, it is necessary to use a database management system, such as MySQL, which facilitates the retrieval of data and enables various operations such as data addition, deletion, and modification. Given that MySQL is classified as a relational database management system (RDBMS), it adheres to the practice of storing data in separate tables rather than consolidating it under a singular repository. The process of storing and organizing data into tables enhances the efficiency of accessing, retrieving, and manipulating data, hence improving the speed and flexibility of data management.

5.4 Web Server

The primary function of a web server is to provide communication between the client-side and server-side components of a web application. This is achieved via the storage, processing, and delivery of web pages to the client-side. Typically, the process of communication between a web browser and a server starts with the web browser submitting an HTTP request for a particular resource. Subsequently, the server responds by providing the requested resource's content. The Apache HTTP server was selected for this project, and it is hosted on the WAMP service. The Apache HTTP server is widely used as web server software in several project endeavors.

5.5 The Proposed System Architecture

The system architecture of this system is partitioned into two distinct components. The two components may be distinguished as the client side and the server side. The client-side refers to the user interface, while the server-side encompasses the integration of web pages developed using PHP and the MySQL database. PHP pages include SQL queries that facilitate access to databases. Figure 3 illustrates the architectural design of the system, while the specific details on the technologies used in this application are provided.

Figure 3: Proposed System Architecture

In India, we are now in the process of creating a web-based appointment system that allows individuals to schedule appointments online and maintain an electronic medical record. Individuals could register electronically, use a web browser to locate healthcare providers in close proximity, and schedule appointments from the comfort of their own residences. There are two distinct categories of players using this system: the user actor, also referred to as the patient, who could register inside the system, search for doctors, and schedule appointments. The administrative actor, namely a doctor or physician, is able to access the system by using a unique login and password. They have the capability to accept appointment requests from patients and then update the patient's medical record after each visit.

5.5.1 Use Cases

To elucidate the enhanced perspective and operational capabilities of the system, the use of use case diagrams has been selected. The use of a use case diagram has significance in documenting the system's requirements and specifying its functionality. Use case diagrams provide a more comprehensive representation of the manner in which the user interacts with the system shown in figure 4.
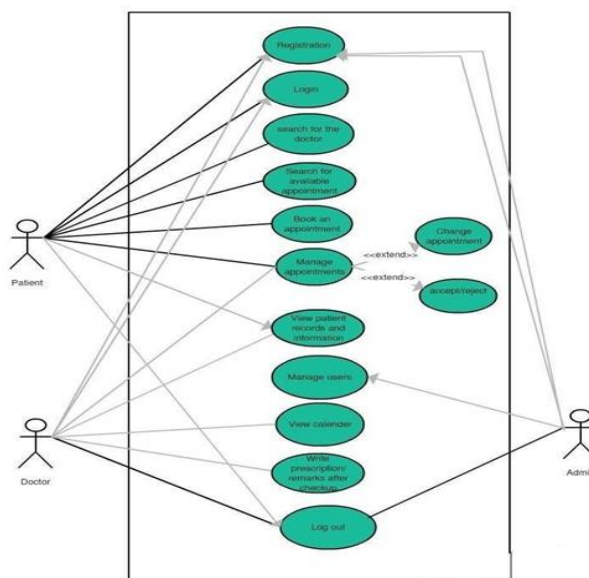
Figure 4: Proposed System Use Case Diagram

5.5.2   Class Diagram

The "patient" class encompasses many attributes, including id, name, age, and address, which represent the information of all the registered patients shown in figure 5. The user class encompasses several methods that are executed by individuals, including but not limited to retrieving appointments, viewing and creating personal medical records. Similarly, the class "doctor" encompasses the parameters id, name, department, and address, which together store the necessary information of people who are enrolled as doctors inside the system. The methods include accepting or rejecting an appointment, conducting patient examinations, and accessing the medical records of any patient [28]. The aforementioned techniques include the many functions that are executed by users who have been registered as doctors inside the system. The "appointment" class has the parameters of date and time, which provide the specified time and day for the patient user's appointment with the doctor. The class "Department" has the attributes "id" and "name", as well as the methods "addDoctor" and "deleteDoctor" for managing doctors, and the methods "addDepartment" and "deleteDepartment" for managing departments. All medical practitioners are required to be affiliated with a certain department category. The "report" class encompasses several approaches, such as writing reports or prescribing medication. The class "admin" ultimately encompasses the attributes of id and name, as well as the methods associated with managing users.
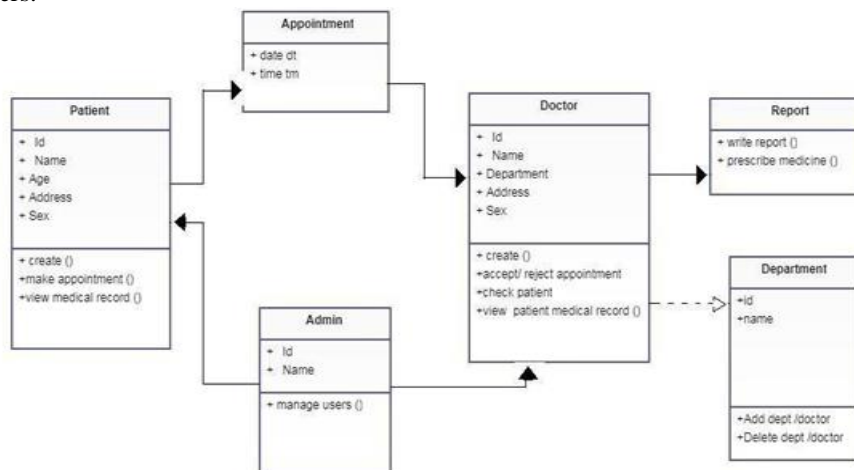

Figure 5: Proposed System Class Diagram

5.5.3   *ER Diagram*

In the shown diagram, the doctor, patient, appointment, admin, and other entities are distinct from one another. An entity may include several forms, including people, animals, plants, events, or corporations. Entity sets are formed by grouping entities that have common properties. These entities exhibit interconnections that give rise to a relationship as seen in Figure 6. The connections in question may be classified as "one to one," "one to many," or "many to many" [29]. An example of a "one to many" connection may be seen between a doctor and a department, whereby a single department may have several physicians associated with it, yet each doctor is exclusively affiliated with a single department.
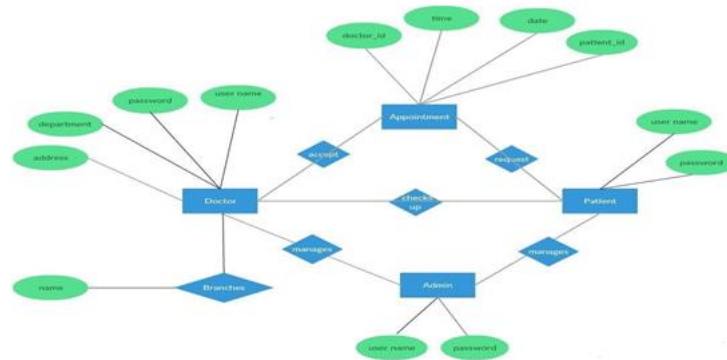
Figure 6: Proposed System ER Diagram

6. Outcome

A straightforward and intuitive interface has been developed. This interface facilitates user login and appointment booking, enables physicians to review and manage appointment requests, and provides administrative personnel the authority to accept or reject such requests. The list of distinguished medical professionals specializing in a certain area of medicine may be seen at the following source [30]. The system has a homepage that allows the patient, doctor, and administrator to access their respective accounts by selecting the appropriate tabs, as seen in figure 7.
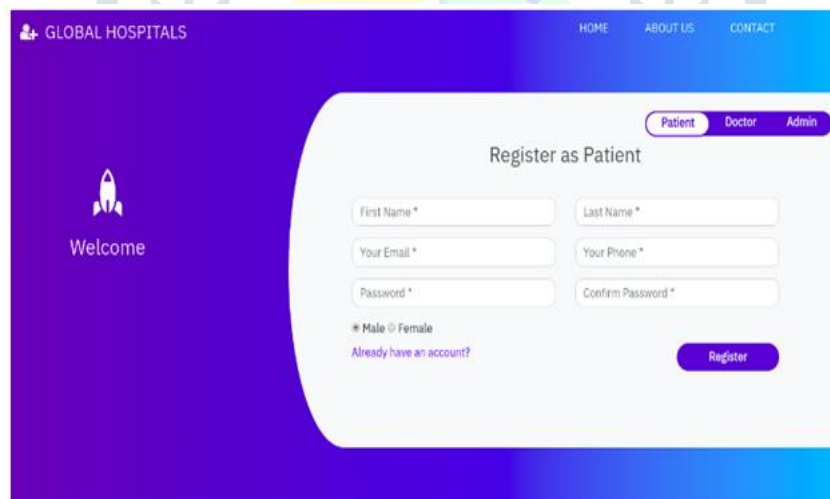

Figure 7: Home' Page of Proposed System

The inclusion of the 'About Us' page, as seen in figure 8, provides an opportunity to get more insights into the hospital's level of quality and the range of services it offers.
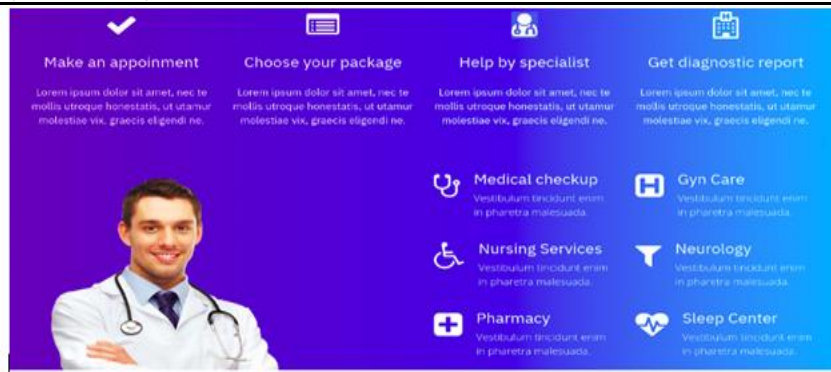
Figure 8: About Us of Proposed System

The present module facilitates the creation of patient accounts, the scheduling of appointments with healthcare professionals, and access to their appointment records. On the homepage, the registration screen prompts patients to provide their First Name, Last Name, Email ID, Contact Number, Password, and pick their gender using radio buttons, as seen in figure 9.
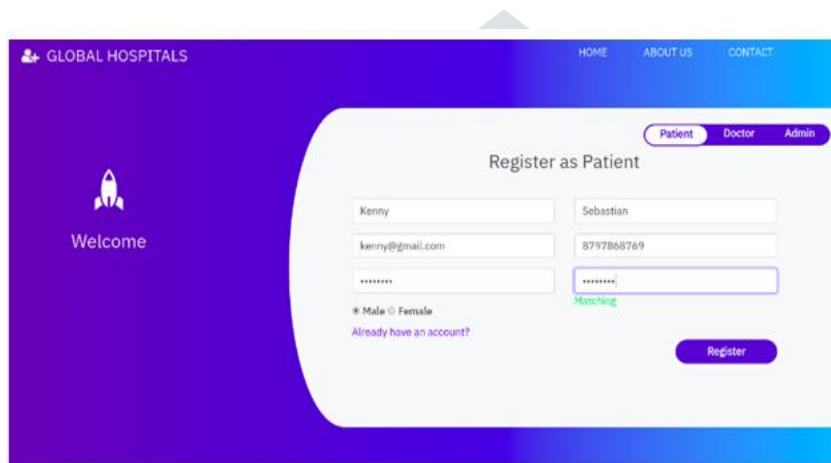

Figure 9: Patient Module of Proposed System

The administrator has the capability to access and see comprehensive information on appointments, which includes the specific specifics of patients' appointments with their corresponding physicians. The data shown in Figure 10 encompasses the patients' First Name, Last Name, Email, and Contact Number, as well as the doctor's name, Appointment Date, Time, and Consultancy Fees.

Figure 10: View the Appointment lists of Proposed System

7. Conclusion

The implementation of a web-based system has the potential to optimize time management for patients and bridge the geographical divide between physicians and patients, resulting in expedited and comprehensive medical services. The use of online terminals facilitates the exchange of essential information between medical professionals and those seeking healthcare services, hence enhancing the quality of their contact. Typically, the development of any system involves three fundamental stages: planning, design, and the testing phase. Once the fundamental criteria for the system had been established, it became imperative to choose the appropriate technologies to use in its construction. To accomplish this objective, I sought assistance from online resources and conducted a thorough examination of pre-existing

web apps with comparable functionalities. The use of use case diagrams, class diagrams, and entity-relationship diagrams serves to enhance the elucidation of the system and its operational dynamics. The primary objective of creating a use case diagram is to provide a comprehensive representation of the system's functionality and to document the specific needs of each user in a clear and concise manner. A class diagram was created in order to elucidate the interconnections and functionalities of various entities. Consequently, not only do customers experience time savings, but the overall efficiency of the appointment booking process is enhanced. The use of this programme enables the physician to effectively manage and monitor their individualized timetable. The registration and appointment process of a hospital may be efficiently administered and supervised, enabling straightforward monitoring of patient flow to healthcare providers. The administrator assumes responsibility for overseeing both the doctors and the patients, so providing a seamless experience for all parties involved. In contemporary society, this particular convenience serves to mitigate feelings of fatigue and annoyance. The use of health apps facilitating doctor-patient communication is seeing an upward trend in India. The government should promote the use of applications that facilitate individuals in maintaining their well-being.

8. Future Works

The web-based system is inherently dynamic and subject to constant development. The phenomenon exhibits gradual progress over time, resulting in enhanced accessibility and convenience for individuals. This online application has the potential to be a groundbreaking tool that might enhance the rapport and connection between healthcare providers and their patients. It is believed that there is potential for further advancement of this technology in the future. The next updates will include enhanced functionality and an upgraded user interface. The current iteration of our system exhibits a user-friendly interface. However, we are committed to further enhancing the user-friendliness of our system in future iterations.

References:

[1] Jones R, Menon-Johansson A, Waters AM, Sullivan AK. eTriage - a novel, web-based triage and booking service: enabling timely access to sexual health clinics. Int J STD AIDS., 21(1):30–33, 2010

[2] Denizard-Thompson NM, Feiereisel KB, Stevens SF, Miller DP, Wofford JL. The digital divide at an urban community health center: implications for quality improvement and health care access. J Community Health, 36(3):456–460, 2011

[3] Zhang X, Yu P, Yan J, Hu H, Goureia N. Patients' perceptions of web self-service applications in primary healthcare. Stud Health Technol Inform, 178:242–249, 2012

[4] Y. Perwej, Dr. Nikhat Akhtar, Neha kulshrestha, Pavan Mishra, "A Methodical Analysis of Medical Internet of Things (MIoT) Security and Privacy in Current and Future Trends", Journal of Emerging Technologies and Innovative Research (JETIR), ISSN-2349-5162, Volume 09, Issue 1, Pages 346 - 371, January 2022, DOI: 10.6084/m9.figshare.JETIR2201346

[5] N. Akhtar, Saima Rahman, Halima Sadia, Yusuf Perwej, "A Holistic Analysis of Medical Internet of Things (MIoT)", Journal of Information and Computational Science (JOICS), ISSN: 1548 - 7741, Volume 11, Issue 4, Pages 209 - 222, April 2021, DOI: 10.12733/JICS.2021/V11I3.535569.31023

[6] Malik, Shafaq & Bibi, Nargis & Khan, Sehrish & Sultana, Razia & Rauf, Sadaf, "Mr. Doc: A Doctor Appointment Application System", International Journal of Computer Science and Information Security,. 14. 452-460, 2016

[7] John Lekan, Akinode,"Design and Implementation of a Patient Appointment and Scheduling System", 4. 16-23. 10.17148/IARJSET.2017.41203, 2017

[8] Zhang X, Yu P, Yan J. Patients' adoption of the e-appointment scheduling service: a case study in primary healthcare. Stud Health Technol Inform, 204:176–181, 2014

[9] Online scheduling applications may improve customer satisfaction, but setup is not always easy. Internet Healthc Strateg, 6(5):1–5, 2004

[10] Wang W, Gupta D. Adaptive appointment systems with patient preferences. Manuf Serv Oper Manag, 13(3):373–389, 2011

[11] Tang PC, Black W, Buchanan J, Young CY, Hooper D, Lane SR, Love B, Mitchell C, Smith N, Turnbull JR. PAMFOnline: integrating EHealth with an electronic medical record system. AMIA Annu Symp Proc; AMIA Annual Symposium; November 8, Washington, DC. 2003. pp. 644–648, 2003

[12] Digvijay H. Gadhari,Yadnyesh P. Kadam,Prof. Parineeta Suman,"Hospital Management System" ,IJREAM, Vol-01, Issue 11, FEB 2016.

[13] Shafaq Malik,Nargis Bibi,Sehrish Khan,Razia Sultana, Sadaf Abdul Rauf,"Mr.Doc: A Doctor Appointment Application System". International Journal of Computer Science and Information Security, 14(12):452-460, December 2016

[14] Clingan SA. Going online: the role of web-based initiatives in health information technology. J Med Pract Manage, 26(4):225–227, 2011

[15] Healthit. [2016-09-26]. What is a patient portal? https://www.healthit.gov/providers-professionals/faqs/what-patient-portal

[16] Adebayo Peter Idowu, Olajide Olusegun Adeosun, and Kehinde Oladipo Williams, "Dependable Online Appointment Booking System For Nhis Outpatient In Nigerian Teaching Hospitals" IJCSIT Vol 6, No 4, August 2014

[17] Nazia S, EktaSarda," Online Appointment Scheduling System for Hospitals–An Analytical Study" ,IJIET, Vol. 4 Issue 1 August 2014

[18]. John Lekan, Akinode,"Design and Implementation of a Patient Appointment and Scheduling System", 4. 16-23, 2017, DOI: 10.17148/IARJSET.2017.41203

[19] Y. Perwej, "The Ambient Scrutinize of Scheduling Algorithms in Big Data Territory", International Journal of Advanced Research (IJAR), ISSN 2320-5407, Volume 6, Issue 3, Pages 241-258, March 2018, DOI: 10.21474/IJAR01/6672

[20] Bailey, N.T.J., A Study of Queues and Appointment Systems in Hospital Out-Patient Departments, with Special Reference to Waiting-Times. Journal of the Royal Statistical Societ.Series B (Methodological), 14(2): p. 185-199, 1952

[21] Firoj Parwej, Nikhat Akhtar,Y. Perwej, "An Empirical Analysis of Web of Things (WoT)", International Journal of Advanced Research in Computer Science (IJARCS), ISSN: 0976-5697, Volume 10, No. 3, Pages 32-40, May 2019, DOI: 10.26483/ijarcs.v10i3.6434

[22] Bin Mu, Feng Xiao, Shijin Yuan "A Rule-based Disease Self-inspection and Hospital Registration Recommendation System", Software Engineering and Service Science (ICSESS), 2012 IEEE 3rd International Conference, 22-24 June 2012

[23] Y. Perwej, Firoj Parwej, Nikhat Akhtar, "An Intelligent Cardiac Ailment Prediction Using Efficient ROCK Algorithm and K- Means & C4.5 Algorithm", European Journal of Engineering Research and Science (EJERS), Bruxelles, Belgium, ISSN: 2506-8016 (Online), Vol. 3, No. 12, Pages 126 – 134, December 2018, DOI: 10.24018/ejers.2018.3.12.989

[24] Arthur Hylton III and Suresh Sankara narayanan "Application of Intelligent Agents in Hospital Appointment Scheduling System" International Journal of Computer Theory and Engineering, Vol 4, pp. 625-630, August 2012

[25] Y. Perwej, Mohammed Y. Alzahrani , F. A. Mazarbhuiya, Md. Husamuddin, "The State of the Art Cardiac Illness Prediction Using Novel Data Mining Technique", International Journal of Engineering Sciences & Research Technology (IJESRT), ISSN: 2277-9655, Volume 7, Issue 2, Pages 725-739, 2018, DOI: 10.5281/zenodo.1184068

[26] Programming: Programming Quick Start Box Set - HTML, Javascript & CSS by Willian Fischer

[27] Nikhat A, Nazia Tabassum, Asif Perwej, Y. Perwej," Data Analytics and Visualization Using Tableau Utilitarian for COVID-19 (Coronavirus)", Global Journal of Engineering and Technology Advances (GJETA), ISSN : 2582-5003, Volume 3, Issue 2, Pages 28-50, 2020, DOI: 10.30574/gjeta.2020.3.2.0029

[28] Armfield NR, Bradford M, Bradford NK. The clinical use of Skype for which patients, with which problems and in which settings? A snapshot review of the literature, 84:737–42, 2015, doi:10.1016/j.ijmedinf.2015.06.00

[29] D. Ir M. R. Johari Dato Mohd Ghazali, N. Hazilah Abd Manaf, A. Hassan Asaari Abdullah, A. Abu Bakar, F. Salikin, M. Umapathy, et al., "Hospital waiting time: the forgotten premise of healthcare service delivery?", International journal of health care quality assurance, vol. 24, no. 7, pp. 506-522, 2011

[30] O. Stan, C. Avram, I. Stefan and A. Astilean, "Integrated innovative solutions to improve healthcare scheduling", Automation Quality and Testing Robotics (AQTR) 2016 IEEE International Conference on, pp. 1-6, 2016