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An Efficient Doctor-Patient Portal : Web-Based Medical Appointment Systems

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Abstract
Through the use of a secure internet application, a patient portal gives patients 24/7 access to their personal health information. In addition to securely communicating with their healthcare providers, patients may examine their recent visit details, prescriptions, lab and exam results, and doctor appointments. Many attempts have been made to create efficient patient portals, but they have not been able to fully solve the concerns of cost, security, and compliance. In light of this, the research's objectives are to develop a safe patient portal that grants access to patient data, put in place all the security features that are needed for a healthcare system, and secure patient data using industry-standard encryption methods. Patient portals are becoming increasingly popular worldwide even though their impact on individual health and health system efficiency is still unclear.

Objective
In addition to examining user characteristics, attitudes, and satisfaction, the purpose of this systematic review was to synthesize the data about the influence of patient portals on health outcomes and health care efficiency.

Keywords: Doctor-Patient Portal, Persistent Engagement, Wellbeing Data Administration, Secure Informing, Online Appointment Planning, Medicine Administration, Healthcare Innovation, Computerized Wellbeing, Patient-Centered Care, Information Security in Healthcare

1. Introduction

a. Background of Web-Based Appointment System

Medical visits have traditionally been scheduled in person or over the phone with schedulers. Based on verbal exchanges with actual individuals, these techniques provide the greatest amount of adaptability in challenging circumstances. [1]. Medical visits have traditionally been scheduled in person or over the phone with schedulers. Based on verbal exchanges with actual individuals, these techniques provide the greatest amount of adaptability in challenging circumstances [2,3]. The capacity of patients to schedule appointments with the appropriate health service providers at the appropriate time affects their level of satisfaction with the process [4]. In this regard, patient portals are believed to provide safe access to health-related data as well as communication and information sharing between patients and doctors. Patient portals are a relatively new technology that is always being improved. Numerous varieties are published annually, which might account for the paucity of studies in this field [5]. Patients can access their health information

and contact their healthcare professionals at any time using a secure Web-based service called a patient portal [6]. Because of the government incentive program for the implementation of electronic health records, meaningful use (MU) standards [7] have played a major role in driving the rise of patient portals in the United States. Both the practitioner and patients should actively use the site in order to comply with MU's standards and obtain its rewards [8].

b. Aims of the Study

Web-based appointment systems are becoming more and more popular, but a thorough analysis of their possible advantages has not yet been conducted. Examining the existing research on Web-based medical appointment systems, with a focus on the possible advantages for both patients and providers, was the aim of this study. Along with examining the advantages and difficulties of implementation, we also wish to determine which services or parts of them are the most successful. This work does not aim to evaluate the literature on basic ideas of medical scheduling or system design, since they have already been examined and reviewed by Gupta et al. [9] and Cayirli et al. [10]. As far as we are aware, this study is the first comprehensive analysis of the literature on the effects of using Web-based medical scheduling systems.

2. Related Work

In the past, people have mostly used telephone or in-person contacts to contact schedulers in order to make medical appointments. The study's methods are based on verbal exchanges with people, which allows for a great deal of flexibility in complex situations [11]. However, using traditional methods that rely on schedulers limits how quickly appointments may be confirmed. This restriction depends on the effectiveness of schedulers and phone communication in addition to the availability of appointment times [12]. The Internet has emerged as a new tool for appointment booking in recent years. In academic circles, the study on online appointment scheduling has attracted a lot of interest. Several studies have used surveys to gauge customer happiness, and the results show that having Web-based appointment scheduling is a highly important feature.
Additionally, most patients indicated that they planned to utilize this service again in the future [13.]. An administrator grants access to the Web based doctor patient portal through the use of a login and password. This guarantees that the information is safely protected and that only authorized users may access it.

A hospital management system must be put in place in order to store and manage a variety of crucial data, including staff information, patient data, and doctor details, among others. It is best to schedule an appointment and wait till the doctor is available in order to get a medical checkup. Making an appointment with a doctor has been easier thanks to developments in mobile technology. By connecting with the user's calendar and preserving pertinent appointment data, the mobile application makes appointment scheduling easier. Alerts are sent to the user at the pre-selected time before to the planned appointment. This application is made to be simple to use and accomplish its intended purpose. The administrator of this system will be in charge of overseeing the data relating to patients and physicians.

The appointment services may be easily integrated into healthcare providers' current management systems and are hosted on internet infrastructure. Proprietary appointment systems, which are part of the patient portals seen on provider websites, are another type of appointment service [14].

3. Challenges of Doctor-Patient Portals

While doctor-patient portals offer many advantages, there are also challenges that must be addressed for successful implementation.

A. Digital Literacy

Not all patients are comfortable using technology, which can create barriers to access. Healthcare providers must offer support and training to help patients navigate these portals effectively.

B. Data Security

Ensuring the security of personal health information is critical. Providers must implement robust security measures to protect sensitive data from breaches, ensuring patient trust and compliance with regulations.

C. Integration with Existing Systems

Integrating portals with existing electronic health record (EHR) systems is essential for accurate and up-to-date information management. Successful integration is crucial for maintaining the integrity of patient data across platforms.

4. Implementation of Best Practices

To ensure successful implementation of doctor-patient portals, healthcare organizations should consider the following best practices:

A. User Training and Support

Offering training sessions and user support enhances patients' ability to navigate the portal, increasing overall satisfaction and adoption rates.

B. Feedback Mechanisms

Gathering patient and provider feedback helps to continuously improve the portal's functionality and user experience, addressing any pain points and optimizing usability.

C. Security Protocols

Implementing stringent security protocols, including encryption and multi-factor authentication, is necessary to safeguard patient information and comply with legal regulations.

5. Methodology

1.Needs Assessment and Stakeholder Engagement:

Conduct a thorough needs assessment involving healthcare providers, patients, and IT specialists to identify requirements and expectations. Engage stakeholders in discussions to ensure the portal meets the specific needs of all users.

2. Platform Selection and Customization:

Select a suitable portal platform that aligns with organizational goals and patient needs. Customize the portal's features and user interface to enhance usability and ensure it integrates seamlessly with existing electronic health record (EHR) systems.

3.User Training and Support:

Develop and implement comprehensive training programs for both patients and healthcare staff to familiarize them with the portal's functionalities. Provide ongoing support through help desks, tutorials, and FAQs to assist users in navigating the platform effectively.

4.Evaluation and Continuous Improvement:

Establish metrics to evaluate the portal's effectiveness, such as user engagement rates, patient satisfaction, and security incidents. Regularly gather feedback from users and stakeholders to identify areas for improvement and implement necessary updates to enhance functionality and user experience.

6. Literature Review

a) Waiting Time

The operational definition of waiting time, according to Fernandes et al. (year), is the amount of time a person waits for a certain activity to occur. Waiting time is the amount of time that goes between a patient arriving at a clinic or service location and their meeting with a doctor, which leads to the prescription being issued. Two different definitions of waiting time have been used in earlier research. The first definition of waiting time is the period of time that begins when a patient shows up for their appointment and lasts until the patient consults with the doctor. The second definition includes the time frame starting when a patient shows up to make an appointment and ending when they get their prescribed prescription following a visit with a healthcare provider. Over time, developing countries have been more concerned about the problem of long wait times at medical facilities. To assess the effects of introducing a block appointment system, an experimental research was carried out in a South African health facility. The purpose of the study was to measure the amount of time patients had to wait over the course of a week before and after the appointment system was implemented.

The results showed that individuals with acute medical conditions who had previously scheduled visits waited less time than those who did not. Additionally, it has been said that patients who are on a regular and repeating medication regimen or who do not require a consultation with the doctor do not benefit from the appointment system [21]. Afterwards, it was discovered that the block appointment system only shortens wait times for patients who are really ill, not for other people.

b) Appointment Delay

Prior research has demonstrated a distinct and direct link between appointment delays and subsequent cancellations. The time that passes between a patient's appointment request and their consultation with a medical expert is referred to as the appointment delay. There are more appointments as a result of longer appointment wait times. There will be a discussion on cancellations. The time between the first appointment request and the planned doctor's check-up or session should be as short as possible to reduce

the likelihood of appointment cancellations or no-shows. The practice of lessening this discrepancy is sometimes known as advance access policy or open access (OA), and it has since acquired a lot of support and is now a crucial part of ongoing research initiatives.

During their experimental studies, the researchers experienced both positive and negative results. Some practitioners strongly endorsed the introduction of OA and voiced support for its implementation. On the other hand, some practitioners disagreed with the use of OA and held other opinions.

C) Managing Patients' Appointment System

To efficiently monitor and cut down on patient wait times, the medical facility employs a patient appointment management system. These kinds of software are used by certain medical clinics but not by others. When compared to medical facilities without any appointment applications, those that use these apps frequently report shorter wait times. Patients feel humiliated and believe that the situation is unfair when they are forced to wait more than an hour for their planned medical examination.Patients may use the amount of waiting time they must suffer to gauge the quality of a medical institution. Therefore, it is now essential to consider factors like "timesaving" and "minimization of idle time" while creating a patient appointment system. Klassen (2002) states that the seriousness of the case and the demands of the patient should be taken into consideration when arranging the doctor's time and patient visits.

d) Waiting for Registration

People who visit a clinic or hospital must register at a designated counter before they may get medical care. Establishing a consultation line where people wait patiently for their turn is the main goal of this phase. This serves as the root reason of the lengthy wait times that many people endure before registering at the front desk and seeing the doctor. According to the findings of a 2017 study, the main cause of lengthy lines at the registration counter is the existence of a single person who handles both registration and appointment distribution (BA, A. 2017).

Another well-established issue that contributes to excessive wait times in healthcare institutions, such as hospitals and clinics, is improper staffing. The best way to deal with this problem is thought to be to use an online booking system. By eliminating the need for a bigger registration desk staff and cutting down on patient wait times, this strategy may save money.

7. Proposed Work

The author of the study paper "Web Based Doctor Patient Portal," has attempted to solve the problems with India's present healthcare system. My project's goal was to create a platform that would allow medical experts and patients to seek treatment together. People who have worked in the sector for a long time or who are new to it can register themselves using this application. In this way, people are given the chance to get to know a desired healthcare provider and make well-informed judgments about their choice. Users of this tool may learn more and view the professional profiles of all licensed physicians in a variety of specialties [16]. It is essential for the user to comprehend how this software operates and be aware of the technologies utilized in its execution. To improve understanding, a thorough description of the system is given by carefully describing each stage-

a. Html/Html5

Hypertext Markup Language, or HTML for short, is a common markup language used to create and organize online pages. Web pages are developed using this programming language. This programming language not only makes it easier to create flexible and dynamic websites, but it also supports a number of other languages, like CSS, PHP, and JavaScript. One may consider HTML5, as shown in Figure 1, to be an updated version of the HTML standard [26]. New features, more characteristics, recently added HTML elements, full CSS3 compatibility, video and audio capabilities, and 2D/3D graphics are all supported by the platform. These capabilities facilitate the easy development and incorporation of creative elements into websites for both users and web developers.

b. PHP

One popular server-side programming language that's frequently used to create dynamic websites is PHP. The resource is easily accessible and free in several versions. This software program may run on a variety of platforms and operating systems, such as Windows, UNIX, and macOS. The program code is run after the program is executed since it is a scripting language. Desktop application development may also make use of PHP. PHP's interoperability with MySQL, which has been chosen as our project's preferred database management system, is one of the reasons we chose it as the programming language. The smooth integration of images and PDF files is made possible by the PHP programming language.

c. Web Server

A web server's main job is to facilitate communication between a web application's client-side and server-side components.

Web pages are stored, processed, and sent to the client-side in order to do this. Generally speaking, an HTTP request for a certain resource is made by the web browser to initiate communication with a server. The content of the requested resource is then provided by the server in response. The WAMP service hosts the Apache HTTP server, which was chosen for this project. Many project initiatives utilize the Apache HTTP server as web server software.

d. 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 1 illustrates the architectural design of the system, while the specific details on the technologies used in this application are provided. We are now developing a web-based appointment system in India that will enable people to keep an electronic medical record and make appointments online. People were able to register online, find nearby healthcare providers using a computer browser, and make appointments from the convenience of their homes. This system may be used by two different types of players: the user actor, also known as the patient, who can register, look for physicians, and make appointments. With a special username and password, the administrative actor—a doctor or physician—can access the system. Patients can request appointments with them, and following each visit, they can update the patient's medical record.

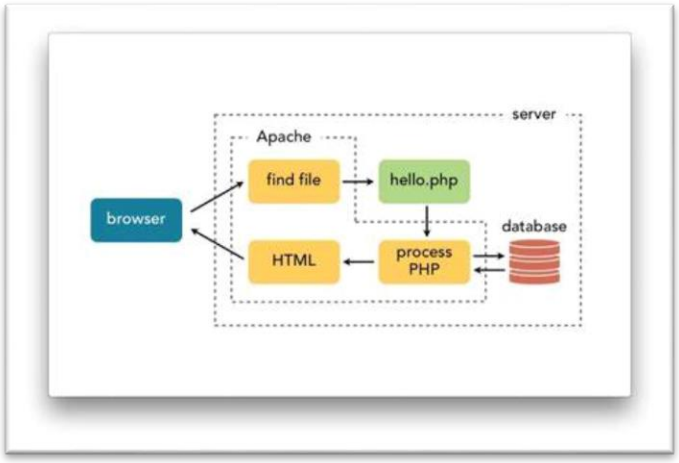

Fig.1 Workflow of proposed system architecture

1.1 Class Diagram

Numerous properties, such as ID, name, age, and address, are included in the "patient" class and reflect the data of each registered patient in figure 2. The user class has a number of methods that people utilize, such as retrieving appointments and viewing and generating personal medical records, among others. In a similar vein, the class "doctor" has the attributes "id," "name," "department," and "address," which collectively record the essential data about individuals who are registered as physicians in the system. These techniques involve scheduling an appointment, doing physical tests, and gaining access to each patient's medical data [17]. The numerous tasks carried out by individuals who have registered as doctors within the system are included in the aforementioned strategies. The parameters of date and time in the "appointment" class provide the day and time of the patient user's doctor's appointment. In addition to the methods "addDoctor" and "deleteDoctor" for managing physicians and "addDepartment" and "deleteDepartment" for managing departments, the class "Department" also has the properties "id" and "name." It is mandatory for all medical professionals to belong to a certain department type. The "report" class has a variety of methods, including creating reports and writing prescriptions. In the end, the class "admin" includes the methods related to user management as well as the characteristics of id and name.

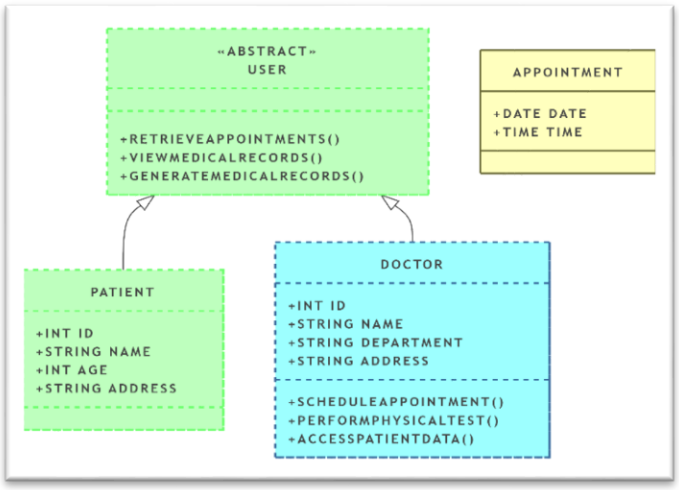

Fig2-Class diagram for proposed system

1.2 ER Diagram

The doctor, patient, appointment, administrator, and other entities are separate from each other in the figure. People, animals, plants, events, and companies are just a few examples of the various forms that an entity may take. Entities with similar characteristics are grouped to form entity sets. As seen in Figure 3, these entities have connections that result in a relationship. "One to one," "one to many," or "many to many" [18] are the possible classifications for the links. A doctor-department relationship is an example of a "one to many" relationship, where a department may have several physicians connected with it, but each doctor is only linked with one department.

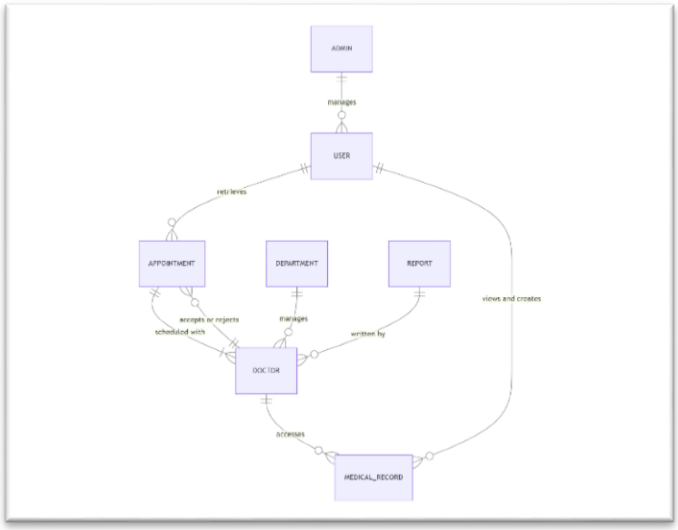

Fig3-ER diagram for proposed system

8. Results

Using a doctor-patient portal to make an appointment is a simple and practical procedure. The portal allows patients to examine available time slots, choose a time and date that works best for them, and check in at any time.

Patients can confirm their appointment with a single click after choosing one, and they will receive an email or message within the site immediately. In addition to removing the need for phone calls, this feature enables patients to effectively manage their appointments, including rescheduling or canceling as needed.

9. Outcome

An interface that is simple and easy to use has been created. This interface makes it easier for users to log in and schedule appointments, gives administrative staff the power to approve or reject requests, and lets doctors examine and manage appointment requests.

The following source [19] has a list of eminent physicians who specialize in a certain field of medicine. Figure 4 illustrates the system's homepage, which enables the administrator, physician, and patient to access their own accounts by choosing the relevant tabs.

Fig4-Homepage of the application

The addition of the Services page, as seen in figure 5, offers a chance to learn more about the caliber of the hospital and its services.

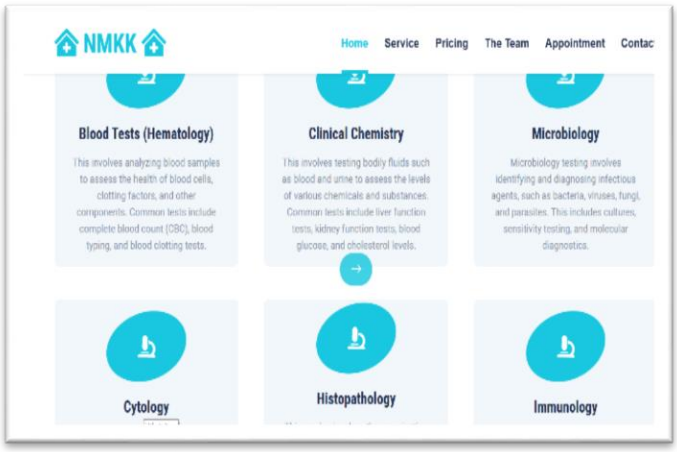

Fig5-Service provided

The current module makes it easier for patients to create accounts, make appointments with medical experts, and view their appointment histories. As seen in figure 6, the registration screen on the homepage asks users to enter their first and last names, email address, phone number, password, and gender using input fields.

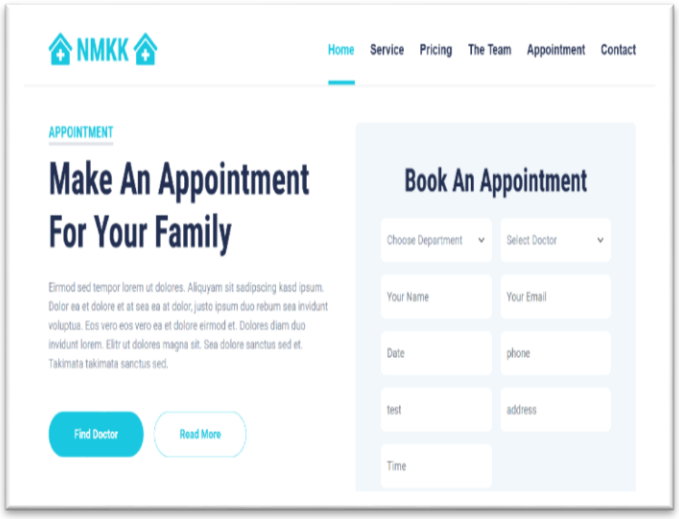

Fig6- Registration for making an appointment

The administrator has the ability to view and retrieve detailed appointment data, including the particulars of each patient's visit with their assigned doctor. The information displayed in Figure 7 includes test name, appointment date, time, and test details in addition to the patient's information.

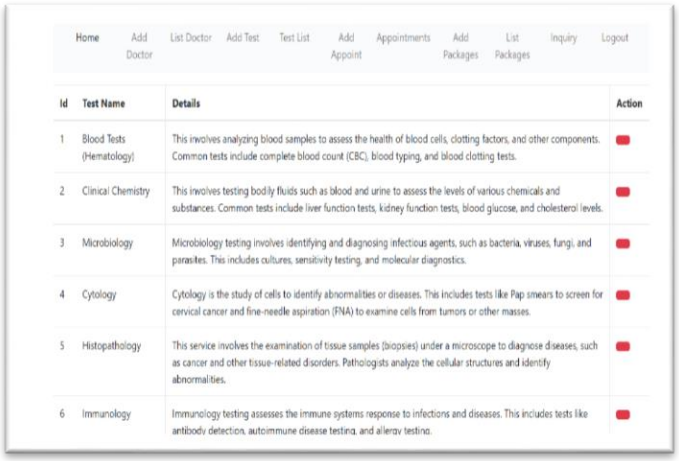

Fig7- Proposed system data records

10. Conclusion

Doctor-patient entrances are crucial tools that improve interaction and communication in the medical field. Healthcare providers can optimize the advantages of these entries for all patients by addressing issues with advanced education, information security, and integration with current frameworks. Prove is generally positive in terms of wellbeing outcomes, and consistent access can improve the doctor-patient relationship, advance mindfulness of wellbeing, and increase treatment adherence. Whether using understanding entries improves wellness benefit utilization and effectiveness is still unclear.By bridging the geographic gap between patients and doctors, the deployment of a web-based system might improve patient time management and provide more thorough and timely medical care. The quality of communication between healthcare providers and patients is improved by the use of online terminals, which make it easier for them to share vital information. Any system's development usually consists of three basic steps: planning,

designing, and testing. Selecting the right technologies to employ in the system's creation became essential once the basic requirements had been determined. In order to achieve this goal, I looked for help from internet sites and carefully analyzed current web apps with similar features. The system and its operating dynamics are better explained through the use of entity-relationship diagrams, class diagrams, and use case diagrams. Providing a thorough depiction of the system's operation and succinctly and clearly articulating the unique requirements of every user are the main goals of use case diagram creation.

A hospital's appointment and registration procedures may be effectively managed and overseen, making it possible to easily track patient flow to medical professionals. The administrator takes on the duty of supervising the physicians and the patients, ensuring a smooth experience for everyone.

This specific convenience helps to lessen emotions of weariness and irritation in modern culture. In India, the usage of health applications to improve communication between patients and doctors is on the rise. Applications that help people maintain their well-being should be encouraged by the government.

11. Future Works

Because of its intrinsic dynamic nature, the web-based system is always evolving. As a result of the phenomenon's steady advancement throughout time, people now enjoy more accessibility and ease. The relationship and connection between patients and healthcare professionals might be improved by this innovative web application. This technology is thought to have the ability to develop much further in the future. Improved functionality and an improved user experience will be included in the upcoming upgrades.

Our system's UI is easy to use in its present version. But in subsequent versions, we're determined to make our system even more user-friendly.

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