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DEVELOPMENT AND IMPLEMENTATION OF A NEW PATIENT APPOINTMENT SCHEDULING SYSTEM AT ADUSTECH WUDIL: AN EVALUATION OF USER SATISFACTION AND SYSTEM IMPACT

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ABSTRACT

Globally, the healthcare sector is the pivot and integral part of human lives. Any error committed in the clinic services might lead to defects or the termination of life. In the rapidly evolving field of healthcare, efficient and accessible appointment scheduling plays a crucial role in ensuring timely and quality care for patients. This article is centered around creating a Patient Appointment Scheduling System, with a focus on handling registration and management, as well as managing bookings or making appointments and scheduling sessions at Aliko Dangote University of Science and Technology, Wudil (ADUSTECH Wudil). Identification of the drawbacks of the existing traditional

system leads to the design of a computerized system, which is more user-friendly and GUI-oriented. HTML, PHP, CSS, JavaScript, and MySQL were used for the development. Note that performance was improved to 92% from using the traditional system. Similarly, the productivity of participants increased to 90%. Furthermore, the waiting time for patients to be attended was enhanced to 90% in the proposed system.

Keywords: Patient, Appointment, Booking, Clinic, Doctor.

INTRODUCTION

Globally, the healthcare sector is the pivot and integral part of human lives (Nazia & Ekta, 2014). Any error committed in the clinic services might lead to defects or the termination of life. In the rapidly evolving field of healthcare, efficient and accessible appointment scheduling plays a crucial role in ensuring timely and quality care for patients (Thomas, 2015). Present methods of appointment scheduling, such as phone calls or in-person visits, often result in long waiting times, administrative burdens, and decreased patient satisfaction (Luxenburg et al., 2022). To address these challenges, the Patient Appointment Scheduling System is proposed as a solution to streamline and simplify the appointment scheduling process and improve the overall healthcare experience. The Patient Appointment Scheduling System exploits modern technologies to provide a convenient and user-friendly platform for patients to schedule appointments with healthcare providers (Cayirli & Veral, 2003). By shifting from manual processes to an automated online system, patients can easily access the system at their convenience and book appointments with healthcare providers of their choice. This eliminates the need for time-consuming phone calls or visits to healthcare facilities, reducing waiting times and enhancing accessibility to healthcare services (Thomas, 2015). For healthcare providers, the system offers a dedicated dashboard that allows efficient management of appointment schedules. Healthcare providers can accept or reject appointment requests and reschedule appointments. The implementation of the Patient Appointment Scheduling System brings numerous benefits to both patients and healthcare providers. Patients experience improved convenience, reduced waiting times, and enhanced satisfaction by

having control over their appointment scheduling process. Healthcare providers benefit from optimized resource allocation, streamlined workflows, and increased operational efficiency (Luxenburg et al., 2022). Furthermore, the system facilitates effective communication and collaboration between patients and healthcare providers, leading to better coordination and continuity of care.

The existing manual appointment scheduling process in ADUSTECH Clinic presents numerous challenges and inefficiencies, creating a need for an improved system. Patients often face difficulties in accessing healthcare services due to time-consuming and inconvenient appointment scheduling methods. They encounter long wait times on the phone or in person, leading to frustration and delays in receiving necessary medical care. Therefore, there is a need for a Patient Appointment Scheduling System that can simplify the scheduling process, improve accessibility, and enhance the overall efficiency of healthcare services. Such a system would enable patients to easily book appointments at their convenience and provide doctors with a user-friendly platform to manage appointments effectively.

This project aims to design and implement a Patient Appointment Scheduling System that will enable patients/user to manage their contacts and book appointments. The objectives of the project are:

a) To eliminate the usage of patient appointments that are made manually.
b) Enable patients to book appointments.
c) Allow admin to add doctors and users and manage the scheduled session.
d) Evaluate the impact of the computerized system on appointment scheduling efficiency.

The significance of the study is achieved by simplifying the appointment scheduling process. The system reduces waiting times and eliminates the need for lengthy phone calls or in-person visits. The system would also reduce human errors. This enhances the patient experience, increases satisfaction, and promotes patient engagement in their own healthcare. This design and development are scoped and limited to computerizing patient appointment scheduling software and is limited to work mainly in ADUSTECH Clinic for

staff and student scheduling. The limitations include the following: the system is restricted to only performing booking and scheduling for clinical appointments. It is also limited to booking/appointment only, excluding diagnosis and prescription and any other related clinic management.

LITERATURE REVIEW

This section explores details of the literature reviewed, including some related works on Patient Appointment Scheduling Systems. It is a system through which a patient can access the doctor's website. Through the online software, patients can easily book appointments.

Background of the Study

In the present healthcare system, patients often face challenges and inefficiencies when it comes to scheduling appointments with healthcare providers. Manual or offline appointment scheduling processes can be time-consuming, inconvenient, and prone to errors (Luxenburg et al., 2022). Patients may have to wait for long periods on the phone or physically visit the healthcare facility to schedule an appointment. This can result in frustration, wasted time, and delays in accessing necessary medical care. The primary goal of the Patient Appointment Scheduling System is to simplify and exploit the appointment scheduling process. By moving this process online, patients can access the system anytime and from anywhere, using their computer or mobile device (Cayirli & Veral, 2003). They can view available appointment slots and book appointments with just a few clicks. Other than that, this system will also automate an existing manual appointment-keeping record. This eliminates the need for phone calls or physical visits, saving time and effort for both patients and healthcare providers.

Patient Appointment Scheduling System

A Patient Appointment Scheduling System is a system through which a patient can access the doctor's website, and through online software, patients can easily book appointments. In addition, patients can also provide additional information to the doctor, making the doctor aware

of their situation and giving the doctor time to prepare the necessary information for when the patients arrive (Saleh, 2012). An online scheduling system allows individuals to conveniently and securely book their appointments online. Compared to the usual queuing method, the web-based appointment system could significantly increase patient satisfaction with registration and reduce total waiting time effectively (Greenhalgh et al., 2009).

Electronic Health Record

According to Terry et al. (2005), an Electronic Health Record (EHR) is a modern idea that means collecting electronic health information about individual patients or groups of patients. It is like a digital file that can be shared among different healthcare places through connected computer systems. These files can contain a lot of information, like basic details, medical history, medicines, allergies, vaccination records, test results, X-ray pictures, vital signs, personal facts like age and weight, and even billing details. Its purpose can be understood as a complete record of patient encounters that allows the automation and simplifying of the workflow in healthcare settings and increases safety through evidence-based decision support, quality management, and outcomes reporting (Greenhalgh et al., 2009).

EMR can be defined as the legal patient record created in clinics that is the data source for the EHR (Humbert et al., 2010). It is important to note that an EHR is generated and maintained within an institution, such as a clinic, integrated delivery network, clinic, or physician office, to give patients, physicians, and other health care providers, employers, and payers or insurers access to a patient's medical records across facilities. In the United States (US), Great Britain, and Germany, the concept of a national centralized server model of healthcare data has been poorly received. Issues of privacy and security in such a model have been of concern. Privacy concerns in healthcare apply to both paper and electronic records.

According to the Eckstein et al. (2010), roughly 150 people (from doctors and nurses to technicians and billing clerks) have access to at least part of a patient's records during a cliticization, and 600,000 payers, providers, and other entities that handle providers' billing

data have some access also Health & Medicine (2006-06-26). Recent revelations of "secure" data breaches at centralized data repositories, in banking and other financial institutions, in the retail industry, and from government databases have caused concern about storing Electronic Medical Records (EMR) in a central location. Records that are exchanged over the Internet are subject to the same security concerns as any other type of data transaction over the Internet. According to the Health Insurance Portability and Accountability Act HIPAA1996 (Nosowsky & Giordano, 2006), the US established rules for access, authentications, storage and auditing, and transmittal of EMR. This standard made restrictions for electronic records more than those for paper records.

However, there are concerns as to the adequacy of these standards (Rady et al., 2010). In the European Union (EU), several Directives of the European Parliament and the Council protect the processing and free movement of personal data, including for purposes of health care, European Parliament and Council October 24, 1995 (Commission of the European Communities, 2000). Personal Information Protection and Electronic Documents Act (PIPEDA) was given Royal Assent in Canada on April 13, 2000, to establish rules on the use, disclosure, and collection of personal information. Personal information can be in both non-digital and electronic forms. In 2002, PIPEDA (Austin, 2006) extended to the health sector in Stage 2 of the law's implementation.

There are four provinces where this law does not apply because its privacy law was considered similar to PIPEDA: Alberta, British Columbia, Ontario, and Quebec. One major issue that has risen in the privacy of the US network for EHR is the strategy to secure the privacy of patients. Former US President Bush called for the creation of networks. However, federal investigators report that there is no clear strategy to protect the privacy of patients as the promotion of EMR expands throughout the US.

There is a "jumble of studies and vague policy statements but no overall strategy to ensure that privacy protections would be built into computer networks linking insurers, doctors, clinics and other health care providers" (Bevan et al., 2007). The privacy threat posed by the interoperability of a national network is a key concern. One of the most vocal critics of EMRs, New York University Professor Jacob

M. Appel, has claimed that the number of people who will need to have access to such a truly interoperable national system, which he estimates to be 12 million, will inevitably lead to breaches of privacy on a massive scale.

Electronic Medical Record in Contrast with Paper-Based Record

An EMR is a computerized medical record created in an organization that delivers care, such as a clinic and doctor's appointment (Perlin & Pogach, 2006). EMRs tend to be a part of a local standalone health information system that allows storage, retrieval, and modification of records. Paper-based records are still by far the preferred method of recording patient information for most clinics and practices in Nigeria.

The majority of doctors still find their ease of data entry and low cost hard to part with. However, as easy as it is for doctors to record medical data at the point of care, they require a significant amount of storage space compared to digital records. In the US, most states require physical records to be held for a minimum of seven years. The costs of storage media, such as paper and film, per unit of information differ dramatically from that of electronic storage media. When paper records are stored in different locations, collating them to a single location for review by a healthcare provider is time-consuming and complicated, whereas the process can be simplified with electronic records.

This is particularly true in the case of person-centered records, which are impractical to maintain if not electronic (thus difficult to centralize or federate). When paper-based records are required in multiple locations, copying, faxing, and transporting costs are significant compared to duplication and transfer of digital records. Because of these many "after-entry" benefits, federal and state governments, insurance companies, and other large medical institutions are heavily promoting the adoption of EMR. Correspondingly, congress included a formula of both incentives (up to $44K per physician under Medicare or up to $65K over 6 years under Medicaid) and penalties (i.e., decreased Medicare/Medicaid reimbursements for covered patients to doctors who fail to use EMR's by 2015) for EMR/EHR adoption versus continued use of paper records as part of the American Recovery and Reinvestment Act of 2009.

Review of Health Informatics in Different Countries

Health informatics (also called health care informatics, healthcare informatics, medical informatics, nursing informatics, or biomedical informatics) is a discipline at the intersection of information science, computer science, and health care. It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. Health informatics tools include computers and clinic guidelines, formal medical terminologies, and information and communication systems, which are applied to the areas of nursing, clinic care, dentistry, pharmacy, public health, occupational therapy, and (bio) medical research. Note that informatics was a central part of the Nazia health care system, which included Nazia eugenics as one of its fundamental principles.

New systems and technology, like electronic punch card tabulating and sorting machines and the science of medical statistics, were used to gather, sort, and analyze personal information on a vast scale unseen before in human history. The information was used to determine and eliminate the 'genetically inferior' through sterilization or wholesale murder. Many of the architects of these systems would go on to play a role in the post-war medical informatics field (Kim et al., 2011).

Worldwide use of technology in medicine began in the early 1950s with the rise of computers. In 1949, Gustav Wager established the first professional organization for informatics in Germany. The prehistory, history, and future of medical information and health information technology are discussed in reference. Specialized university departments and Informatics training programs began during the 1960s in France, Germany, Belgium, and The Netherlands.

Medical informatics research units began to appear during the 1970s in Poland and the US. Since then, the development of high-quality health informatics research, education, and infrastructure has been the goal of the US and the EU. Early names for health informatics included medical computing, medical computer science, computer medicine, medical electronic data processing, medical automatic data processing, medical information processing, medical information science, medical software engineering, and medical computer technology. The health informatics community is still growing.

Hence, it is by no means a mature profession, but work in the UK by the voluntary registration body, the UK Council of Health Informatics Professions has suggested eight key constituencies within the domain information project management, ICT, education and research, clinic informatics, health records (service and business-related), health informatics service management.

These constituencies accommodate professionals in and for the NHS, academia, and commercial service and solution providers. Since the 1970s, the most prominent international coordinating body has been the International Medical Informatics Association (IMIA). Even though the idea of using computers in medicine sprouted as technology advanced in the early twentieth century, it was not until the 1950s that informatics made a realistic impact in the US. The earliest use of computation for medicine was for dental projects in the 1950s at the US National Bureau of Standards by Sittig et al. (2006). The next step in the mid-1950s was the development of expert systems such as MYCIN and Internist-I. In 1965, the National Library of Medicine started to use MEDLINE and MEDLARS. At this time, Neil Pappalardo, Curtis Marble, and Robert Greenes developed MUMPS (Massachusetts General Clinic Utility Multi-Programming System) in October, Barnett's Laboratory of Computer Science (Reilly et al., 2003), at Massachusetts General Clinic in Boston (Reilly et al., 2003).

In the 1970s and 1980s, it was the most commonly used programming language for clinic applications. The MUMPS operating system was used to support MUMPS language specifications. As of 2004, a descendent of this system is being used in the US Veterans Affairs (VA) clinic system. The VA has the largest enterprise-wide health information system, which includes an EMR. It is known as the Veterans Health Information Systems and Technology Architecture (VISTA). A graphical user interface known as the Computerized Patient Record System (CPRS) allows healthcare providers to review and update a patient's EMR at any of the VAs in over 1,000 healthcare facilities. In the 1970s, a growing number of commercial vendors began to market practice management and EMR systems. Although many products exist, only a small number of health practitioners use fully featured electronic health care records systems. Homer R. Warner, one of the fathers of medical informatics, Gardner et al. (1999), founded the Department of Medical Informatics at the University of Utah in 1968.

The American Medical Informatics Association (AMIA) has an award named after him on the application of informatics to medicine. Since 1997, the Buenos Aires Biomedical Informatics Group, a non-profit group, has represented the interests of a broad range of clinical and non-clinical professionals working within the Health Informatics sphere. Its purpose is to promote the implementation of computer tools in healthcare activity, scientific research, and health administration, as well as in all areas related to health sciences and biomedical research. Support, promote, and disseminate content-related activities with the management of health information and tools they use under the name of biomedical informatics.

Promote cooperation and exchange of actions generated in the field of biomedical informatics, both in the public and private, national and international level. Interact with all recognized scientists and academics, stimulating the creation of new instances that have the same goal and are inspired by the same purpose.To promote, organize, sponsor, and participate in events and activities for training in computer and information and disseminating developments in this area that might be useful for team members and health-related activities.

The Argentinian health system is very heterogeneous, and because of that, the informatics developments show a heterogeneous stage. A lot of private healthcare centers have developed systems, such as the German Clinic of Buenos Aires, which was one of the first to develop an EHR system. The first applications of computers to medicine and healthcare in Brazil started around 1968, with the installation of the first mainframes in public university clinics and the use of programmable calculators in scientific research applications. Minicomputers, such as the IBM 1130, were installed in several universities. The first applications were developed for them, such as the clinic census in the School of Medicine of Ribeirão Preto and patient master files in the Clinic das Clínicas da Universidade de São Paulo, respectively, at the cities of Ribeirão Preto and São Paulo campi of the University of São Paulo.

METHODOLOGY

This section is concerned with the study of an existing system with the intention of improving it through better procedures and methods. A detailed description of the approach in the determination of system requirements, followed by design techniques deployed.

System Analysis

This is the process of studying a current situation with the intention of improving it through better procedures and methods. Note that it may involve breaking the system into smaller groups to achieve better solutions to the existing problems. It is crucial to have a clear idea about the existing system in order to determine a better solution (Saleh, 2012).

Requirement Analysis Techniques

The goal of gathering, documenting, and eliciting requirements is to understand the exact requirements of the proposed system; the requirements describe what is expected from the system. For this project, several functional and non-functional requirements were captured. The requirements were gathered from different sources, as stated.

Description of the Existing System

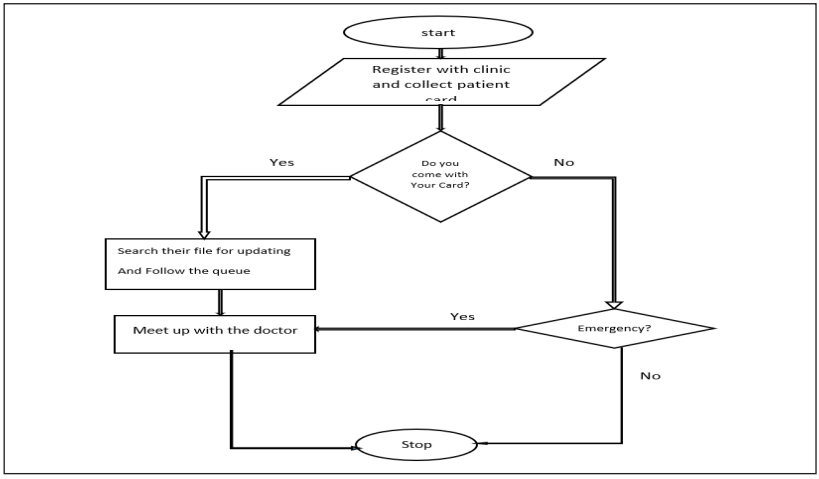
The existing system is a manual process. The process of making an appointment with the doctor is done by following a long queue, which leads to a long time of waiting. The patient must open the file in the clinic, where a card will be issued to him so that he can use it when he wants to see a doctor. A patient must come along with his card so as to be used while searching for his file by the healthcare provider, which also consumes a lot of time and frustration. After that, the patient will follow a long queue, which will be stressful and time-consuming. There are certain advantages to using manual record keeping. However, the best way to do this is to use the computerized method. Another impact of manual systems is on patient service. It will be no good if they are out to lunch or only work part-time.

This operation is borne out of the fact that the manual operations have such shortcomings like:

- Time-consuming * consuming lot of paper files *appointment scheduling challenges
- queue congestion * limited information retrieval

Figure 1

Flowchart of the Existing System



Description Of the Propose System

The proposed system is now an automated system that is capable of allowing the patient to register and make an appointment in their comfort zone. The proposed system, the Patient Appointment Scheduling System, would overcome the drawbacks of the current system. The Patient Appointment Scheduling System will help the university health center register patients and doctors using the computer.

Correspondingly, the proposed system contains the following files.

Patient Registration

Name, Address, Reg number, Date of Birth, Email, Mobile number, Create new password, Confirm password

Add Doctor

Name, Email, Registration number, Telephone, Choose Specialties, Password, Confirm password

Login details Email and Password

Add new session

Session title, Select doctor, Number of patients/Appointment number, Session Date, Schedule time

System Design

System design in a Patient Appointment Scheduling System aims to create an efficient and user-friendly solution that meets the specific needs of patients and the clinic. It addresses questions like how appointments will be booked, rescheduled, or canceled, how patient data will be securely stored, and how the system will display appointment details to both patients and doctors. Essentially, it is about creating a well-thought-out plan for the technology that streamlines and enhances the appointment scheduling process in the Aliko Dangote University of Science and Technology (ADUSTECH) Clinic.

Software Process Model

The software process model is a descriptive and diagrammatical representation of the software lifecycle of the working system patient appointment schedule.

Iterative Software Process Model

In this project, the agile approach is used to build the software. This method is picked because it is flexible and lets everyone, including the patient/doctors using the software, give their input as the work progresses. It also allows the developer to focus on the most important features. The software is quite complex since the Patient Appointment Scheduling System has many different parts. Therefore, the agile approach is the right fit.

Agile is like a step-by-step process for managing projects and making products. What is great about it is that it can easily adapt to changes at any stage. Instead of doing everything all at once, break the work into smaller parts and build it up gradually.

Requirement Elicitation and Analysis

This examines what the system should do and how to make it happen. The first step is figuring out why even the system needs it, which is

an important part of understanding the problem. This whole process is called requirement elicitation and analysis, and it is a vital step when making software. Imagine requirement elicitation and analysis of making an appointment in the clinic. There is a need to know all the steps before we can start building. This step can be challenging because if something is missing, the whole project might not work out.

For the project, we took a close look at every detail of what is necessary to realize that a system is needed that can handle things like signing up, making bookings, scheduling sessions, and automatically assigning tasks online. To make this happen, there is a need to create a user-friendly website that takes care of all these tasks smoothly.

Functional Requirement

Functional requirements are the features that a developer has to implement so that users can accomplish their various tasks. Both the development team and the stakeholders have to be clear about it. To be precise, functional requirements describe system behavior under specific conditions. User registration, booking appointment, Appointment rescheduling and cancellation, Provider selection, Waiting list management, Patient history access, Admin dashboard, Data validation, Search and filter, Time zone handling, Language localization.

Non-Functional Requirement

Non-functional Requirement is a requirement that does not relate to functionality but to attributes such as reliability, efficiency, usability, maintainability, portability, performance, security, availability, compatibility, and response time.

Use Case Diagram

Use case diagram is a diagram scenarios-based techniques that identify the actors in an interaction and describe the interaction itself.

Class diagram

Class diagrams describe the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modeling of object-oriented systems because they

are the only UML diagrams that can be mapped directly with object-oriented languages (Sommerville, 2011).

Figure 2

Use Case Diagram of the Proposed Developed System

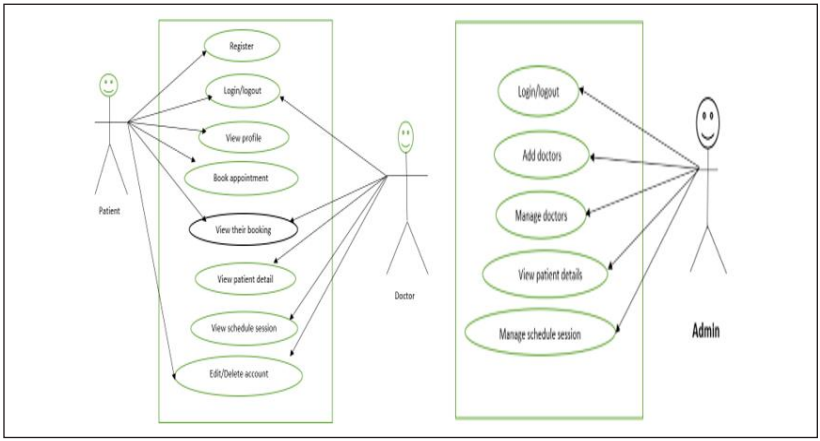
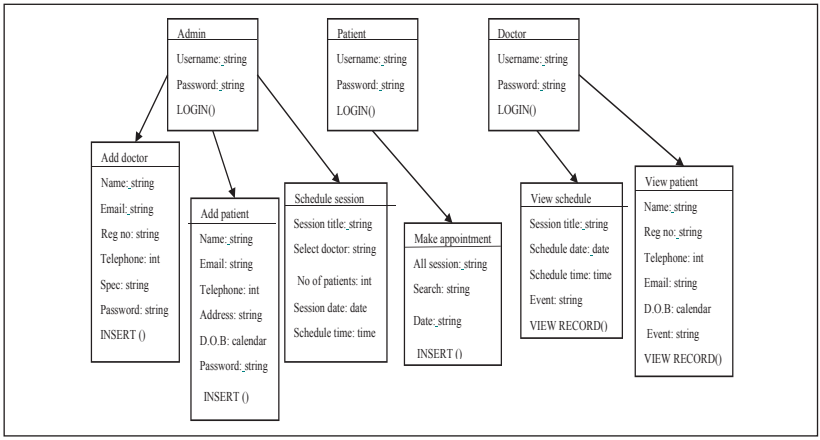


Figure 3

Class Diagram of New System



Database Structure

Database structure refers to the organization and arrangement of data within a database system. It is like the blueprint that defines how data

is stored, accessed, and managed. Other than that, it includes tables with columns and rows to store related information, primary keys for unique identification, and relationships between tables to connect data.

Input Specification

This is where details of input specification will be fully described to guide and assist the user in inputting the data appropriately. The record layout includes: Patient registration table, Doctor registration table, Schedule table, Appointment table, Admin table, Specialties, and Web user table.

Table 1

Patient Registration

FIELD NAME	FIELD TYPE	FIELD SIZE
P_id	int	11
p_email	Varchar	225
P_name	Varchar	225
p_password	Varchar	225
P_address	Varchar	225
P_reg	Varchar	15
P_dob	Date	date
P_tel	Varchar	11

Table 2

Doctor Registration

FIELD NAME	FIELD TYPE	FIELD SIZE
Doc_id	int	11
Doc_email	varchar	225
Doc_name	Varchar	225
Doc_password	Varchar	225
Doc_reg	Varchar	15
Doc_tel	Varchar	11
Specialties	Int	2

Table 3

Schedule Table

FIELD NAME	FIELD TYPE	FIELD SIZE
Schedule_id	int	11
Doc_id	Varchar	225
Title	Varchar	225
Schedule date	Date	DATE
Schedule time	Time	TIME
Nop	Int	4

Table 4

Appointment

FIELD NAME	FIELD TYPE	FIELD SIZE
Appo_id	Int	11
P_id	Int	11
Apponum	Int	3
Schedule_id	Int	10
Appodate	date	Date

System Implementation

This section serves as the core of the project, encompassing the phase where the system is implemented as per the design. Additionally, it includes rigorous system testing to guarantee the effectiveness and efficiency of the newly developed system features, along with a selection of screenshots showcasing the designed software.

System Development

Systems development is the process of defining, designing, testing, and implementing a new software application or program. It could include the internal development of customized systems, the creation of database systems, or the acquisition of third-party-developed software. Written standards and procedures must guide all information systems processing functions. The organization's management must define and implement standards and adopt an appropriate system development life cycle methodology governing the process of developing, acquiring, implementing, and maintaining computerized information systems and related technology.

System Implementation

System implementation: in this system, HTML, CSS, and JavaScript will be used for designing the front end, while the back end uses PHP and the database by MySql. There are admin, patient, and doctors as the actors of the system. Note that admins will be able to manage the system. The patient will be able to register and make a booking, while the doctor will be able to log in to view scheduled sessions and the patient's list of his/her appointments.

System Requirements

System requirement is a combination of hardware and software components that makes work to be carried out. The system requirement for this research work is subdivided into Hardware and Software requirements.

Hardware Requirements

Hardware is the computer equipment and devices that are involved in the function of a computer system together with the software components. Hardware is the physical components of the computer system assembled to interact with the software in order to form a composite system.

The minimum hardware requirements are: CPU Pentium III (886 MHz) processor, RAM (256MB), Colour Monitor, Hard Disk Drive (HDD) of 60GB

Software Requirements

Software is a set of program modules needed to control and coordinate the activities of the hardware device of the computer system. The software requirements are as follows: Operating System (O/S) (e.g., Windows 10), Xammp.

Web application

1. Front-End Development:
   - Implement the web design using HTML, CSS, and JavaScript to create the user interface.
2. Back-End Development:
   - Develop the server-side logic using the programming language PHP.

- Implement features such as user registration, authentication, appointment booking, and database interactions.

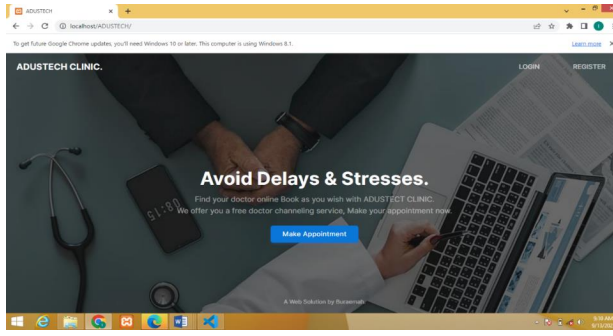
3. Database Integration:
   - Set up a database (MySQL) to store patient information, make booking appointment schedules,

Index

This is where the register button is located, which enables the patient to register, the login button for logging into your dashboard and managing it, and the button for making appointments.

Figure 4

Index Page

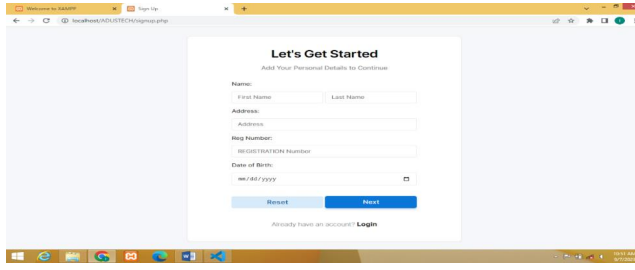


Register Page

This is where the patient will be able to insert his/her details in order to register with the system.

Figure 5

Register Page

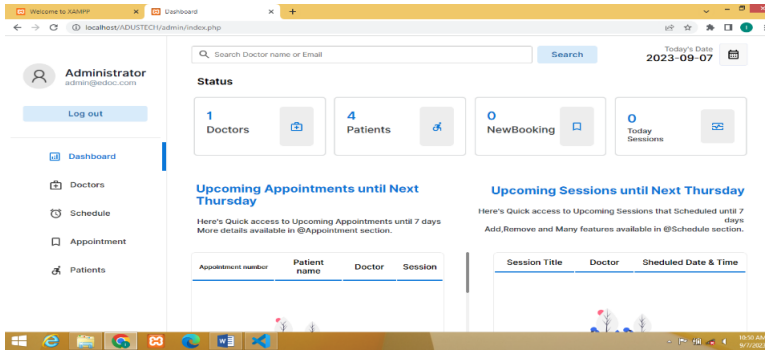


Admin dashboard

This is an admin dashboard where doctors and patients are displayed, as well as other features such as managing doctors, scheduling appointments, and patients.

Figure 6

Admin Dashboard

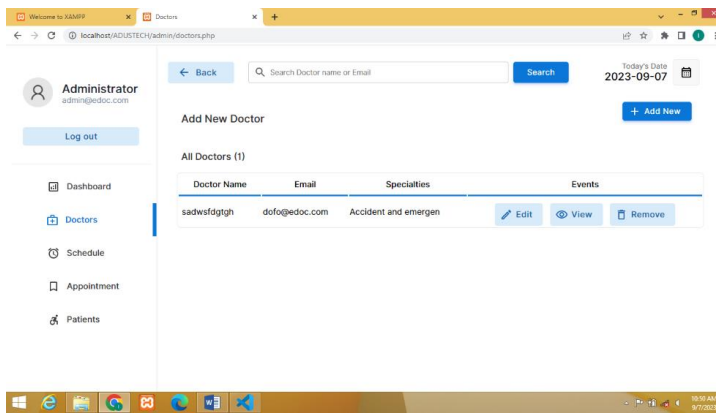


Admin Manage Doctor Page

The admin manage doctor page is where the admin is able to add doctors, set scheduled sessions, and view all the doctors.

Figure 7

Admin Manage Doctor

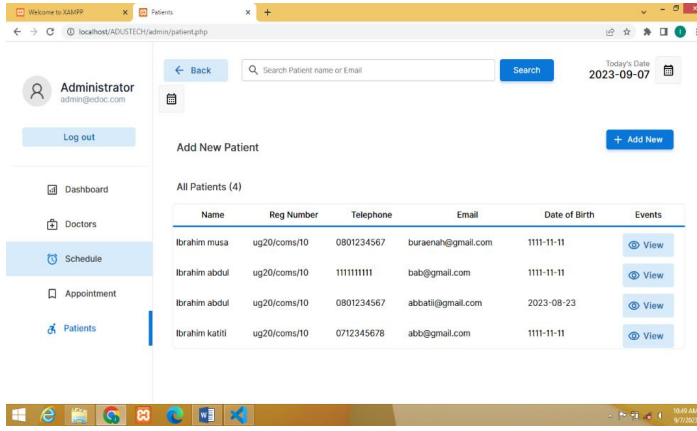


Admin Manage Patient Page

This is where the admin adds patients and views their list.

Figure 8

Admin Manage Patient Page

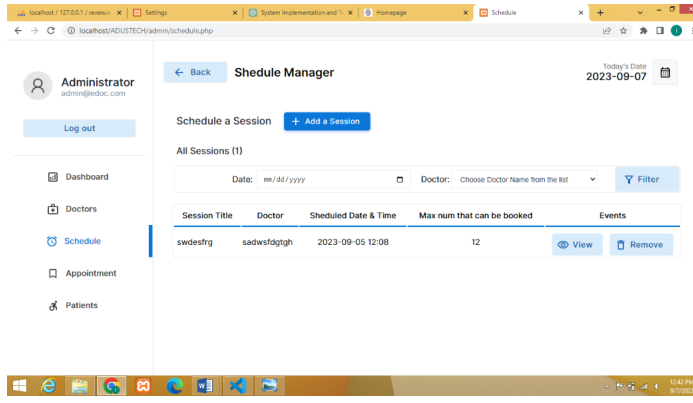


Admin Manage Scheduling System Page

This is where an admin is able to schedule sessions with certain doctors.

Figure 9

Admin Manage Scheduling Session

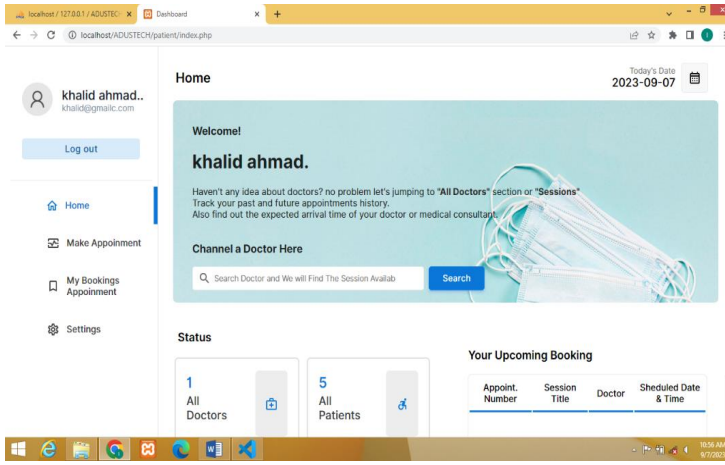


Patient dashboard

This is the page where the patient can access all features required for him, such as booking an appointment, viewing booking history, and managing the account.

Figure 10

Patient Dashboard



System Testing

System testing is a process of testing a fully integrated system to ensure that it aligns with the requirements it was designed to meet. The primary purpose of testing is to detect software failures so that defects may be discovered and corrected. Note that the testing approaches explored in this system are unit and integration testing. During the unit testing, we tested some of the smallest pieces of code, where some students registered and booked an appointment. The system accepts each of his detail insertions if they are valid and rejects them when they are invalid.

Unit Testing

This is where each module of the system is tested separately in order to ensure it is working accordingly. During the unit testing, we tested

some of the smallest pieces of code, where some students tried and registered with the system. The system accepts each of their details insertion if only they are valid and rejects it when it is invalid one after the other. Deploying the developed system to used, user feedback was obtained and analyzed to compare its accuracy and performance with the traditional system. This is explained more under the analysis and discussion of results.

Materials and methods

This study was conducted at ADUSTECH Wudil Clinic, and the study was jointly approved by both the Department of Computer Science and the University Clinic. Permission was equally obtained from the University ethics committee. All the doctors, nurses, staff, and students participated voluntarily.

Assessment tool

The assessment tool was a self-designed questionnaire that consisted of three sections: patient demographic information, satisfaction information, and appointment scheduling information**.** The data obtained from the participants would be kept confidential. These data were collected using a questionnaire between February 2023 to March 2024. Questionnaires filled with missing answers were excluded; likewise, participants who were not willing were not served the questionnaires. A total of 169 questionnaires were issued, and one hundred met the inclusion criteria. Responses were calculated based on percentile ratio. Correspondingly, Jupiter Notebook and Microsoft Excel were utilized to plot the graphical representations of the findings in this study.

ANALYSIS AND DISCUSSION OF RESULT

Figures 11 to 23 below depict statistical analysis of the traditional and proposed system of new patient scheduling and appointment systems. Metrics such as performance, productivity, and waiting time, among others, are compared between the latter and the former. This was achieved based on feedback received from participants after deploying the newly developed and implemented appointment and scheduling system.

From Figures 14 and 20, performance was improved from 44% to 92% from using the traditional to using the proposed system. Similarly, Figures 15 and 21 illustrated that the productivity of doctors, nurses, staff, and students increased from 30% to 90%. Furthermore, patients waiting time to be attended was enhanced from 30% to 90% in the proposed system. Additionally, interactions with patients increased to 60% in the proposed system compared to the 20% recorded in the traditional system.

SUMMARY, CONCLUSION AND RECOMMENDATION

This article is centered around creating a Patient Appointment Scheduling System, with a focus on handling registration and management, as well as managing bookings/making appointments and scheduling sessions at ADUSTECH, Wudil. Identification of the drawbacks of the existing system leads to the designing of a computerized system that enhances the existing system, which is more user-friendly and more GUI-oriented. A statistical analysis of traditional and proposed systems for new patient scheduling and appointment systems was conducted. Metrics such as performance, productivity, waiting time, and others are compared between the latter and the former. This was achieved based on feedback received from participants after deploying the newly developed and implemented appointment and scheduling system.

Figure 11

Frequency of Appointments

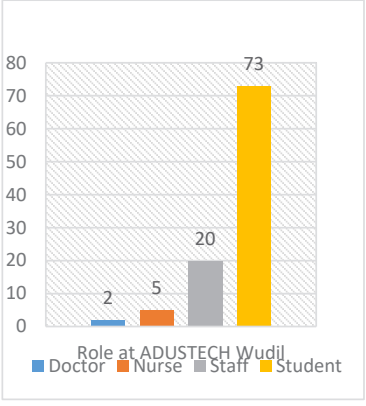


Figure 12

Role of Participants

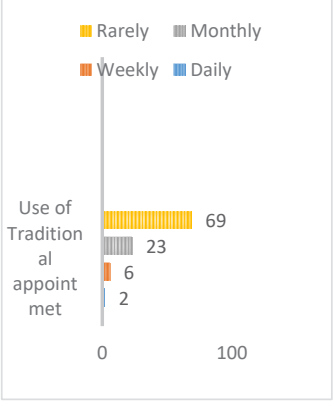


Figure 13

Average Stay in ADUSTECH

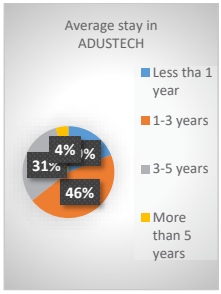


Figure 14

Performance of Old System

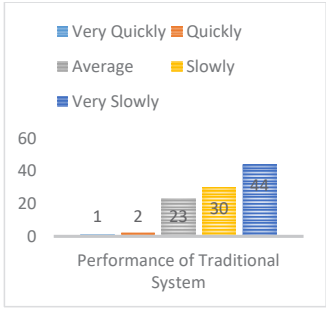


Figure 15

Impact on the Productivity of the Traditional System

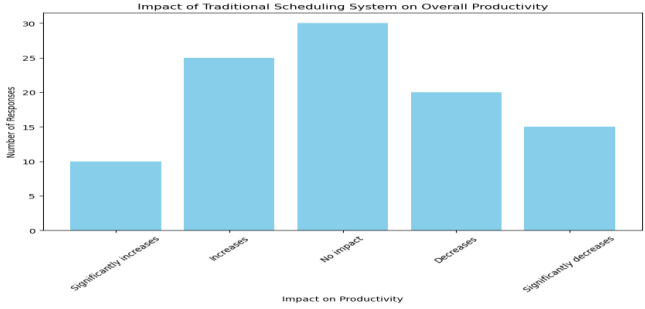


Figure 16

Impact of the Traditional System on Patient Waiting Time

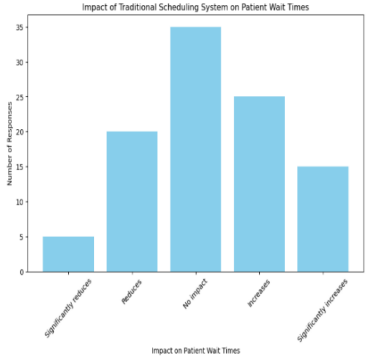


Figure 17

Impact of the Traditional System on Interaction with Patient

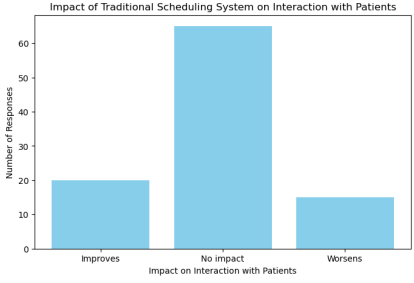


Figure 18

Simplicity of the New System

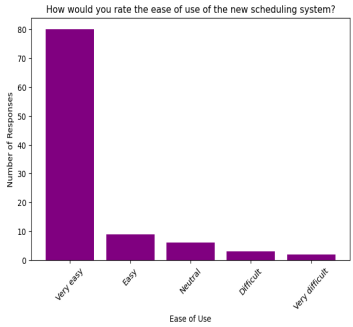


Figure 19

Time Management of the New System

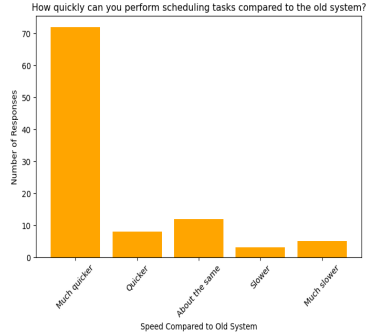


Figure 20

Performance of the New System

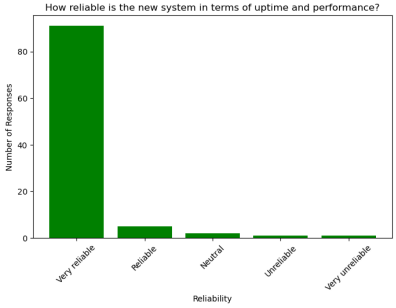


Figure 21

Impact on the Productivity of the New System

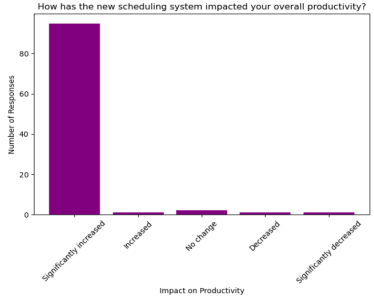


Figure 22

Impact of the New System on Patient Waiting Time

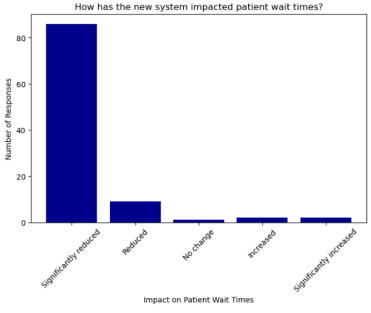
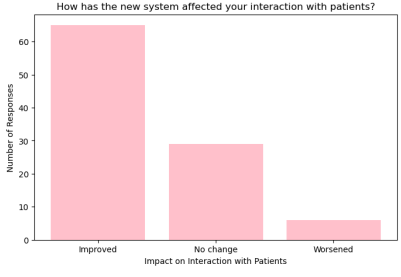


Figure 23

Impact of the New System on Interaction with the Patient



Performance was improved to 92% from using the traditional system. Similarly, the productivity of participants increased to 90%. Furthermore, the waiting time for patients to be attended was enhanced to 90% in the proposed system. In conclusion, the purpose of this study is to enhance the functionality and efficiency of the current system in operation. The primary goal of the Patient Appointment Scheduling System is to simplify the application and management processes at ADUSTECH Clinic, benefiting both students and the responsible administrators. As a result, this system enhances the productivity and dependability of the clinic's registration and management procedures, making them more efficient.

The research work carried out is limited to online bookings by patients for appointments only. It would be better if a full portal were developed for effective and wholesome implementation of diagnosis and prescription in our universities. When this is done, the following modules are recommended to be included in the portal.

- Including other related clinic management tasks such as diagnosis and prescription.
- Adding some features will enable patients to send some feedback.
- Integrate payment gateway in the system.
- Maintaining a central database for accessing all information relating to students.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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