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A Web-Based Medical Appointment Scheduling with SMS Alert Notification System

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ABSTRACT

Lengthy waiting times for registering and booking an appointment to see a doctor is challenging in Nigeria, particularly in government hospitals. Also, missed healthcare appointments are the main cause of preventable incompetence that affects a patient's wellbeing and medication results, as there is no machinery to notice patients when appointments are deferred or canceled. To address these issues, a web-based medical appointment scheduling system with SMS alert notification using the University of Calabar Teaching Hospital (UCTH) as a case study is proposed. This study adopted the Structured System Analysis and Design Methodology in the development of the system. MySQL was used to design the database for this study and the proposed system was implemented using PHP programming language. A web-based medical appointment scheduling with an SMS alert notification system was developed and implemented in this study. The developed system will improve appointment scheduling in hospitals to simplify patients' and doctors' tasks and eliminate missed appointments with the help of the reminder component. In the upcoming, the system can be developed to direct appointment applications to another hospital where doctors with similar medical proficiency are working. Furthermore, the provision of automated SMS alerts as notifications as the appointed day draws near or reaches is a fundamental characteristic of the developed system.

KEYWORDS: Appointment, Web-Based, Notification, Medical Appointment Scheduling, SMS Alerts, Online Appointment system

1 Introduction

The eHealth initiative using information systems and communication technologies to enhance health-care services is a new field presently being established worldwide and has marginal ingenuity in Nigeria. According to West [1], the growth and high rate of subscriptions to mobile phones and the advancement of new technologies into these phones allow the usage of these devices for health-care services.

According to Masud [2], missed healthcare appointments are the main cause of preventable ineffectiveness that affects a patient's wellbeing and medication consequences. Information on non-attendance differ; though, several studies in the world reliably state that non-attendance frequency is normally between 15 and 50 in the outpatient department of any hospitals, both in underdeveloped,

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developing, and developed nations. According to Hylton and Sankaranarayanan [3], the effects of non-attendance comprise of enlarged appointments hanging on time, augmented cost of healthcare distribution, underutilization of tools and workers, decreased appointment obtainability, and diminished patient gratification and unconstructive correlations amid the patients and the medical personnel.

Deepti, Kalpana, and Palak in [4] opined that in this speedy motivated civilization, where the present atmosphere in the healthcare subdivision requires effectiveness and patient gratification in healthcare provision, there is a demand for a cohesive healthcare scheme to intercede and give harmonious upkeep for inpatients and outpatients. A Web-Based Medical Appointment Scheduling and Notification System via mobile devices become an absolute solution for delivering effective booking and well-timed accessibility to healthcare facilities. Although outpatient clinics' mean inner waiting time is protracted, physicians often have an idle period, as a result of patients who missed or late for their appointments, and this triggers a slothful period for physicians, leading to provisional underutilization of hospital capability. Breaches in the appointment timetables likewise trigger underutilization of the doctors' time and patient main dissatisfaction with hospital service is traced to prolong waiting time and missed appointments (Zhu, Heng, and Teow [5]).

Many studies have substantiated the efficacy of current notification schemes in diverse facility surroundings. Nevertheless, investigation till-date focuses on the usage of notification methods in a specific service context or machinery instead of fusing knowledge crosswise diverse frameworks and healthcare services as stated by Symey, Sankaranarayanan, and Binti-Sait [6]. This research explores the effectiveness of a mobile-based reminder/alert system across different contexts in healthcare delivery. The web-based appointment system will save time, and eliminate wastage of time in waiting lines. Moreover, the automatic appointment notification in the suggested system likewise keeps time as clinic workers would not be needed to call and send SMS to patients notifying them of their appointments. A web-based appointment scheduling with an SMS alert notification scheme permits for 24 hours expedient timetabling and patients can create engagements without physically show up at hospitals, which is only possible throughout operational times. It also figures out the background features that signify that the alert systems are being engaged sub-optimally.

Based on the foregoing, an effective web-based medical appointment scheduling with an SMS alert notification system is very significant in hospitals to guarantee resourceful service delivery of all the health sectors in Nigeria.

2 Problem Statement

The following specific problems are associated with the existing system:

(i) Inability to book appointments remotely and lack of a well-defined alert notification system to remind patients and doctors of their appointments;
(ii) Inadequate and porous security system to secure patient personal information;
(iii) Long stay in queues and waiting room to see a physician; and
(iv) The inefficient and increased cost of health care delivery and services.

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3 Objectives of the Study

The purpose of this study is to develop a web-based medical appointment scheduling with an SMS alert notification system that can eliminate missed healthcare appointments and provides the machinery to notice patients when appointments are adjourned or canceled.

The main objectives of the study include:

(i) Provides a platform to book appointment remotely and integrate SMS alert notification to remind patients and doctors of the status of their appointments;
(ii) Provide adequate security system to protect patient medical records, since every registered patient and physician has a unique username and password for login;
(iii) Provision of a system that will drastically reduce or eradicate several missed appointments and queues of patients; and
(iv) Developing a system that will reduce or completely get rid of waiting time, idle time, and missed appointments that are cost-effective or less expensive in delivery health care services.

4 Related Works

Thomas [7] built a decision support system instrument for appointment timetabling to lessen patient absentee Frequency in an outpatient department. Gowthem and Kaliyamurthie [8] suggested an intelligent appointment booking technique that enables proper management of patients' engagements by providing a dais for patients to call off or postpone an appointment through the incorporation of disseminated medical structures into a set of dependable and suitable services available through a web browser but lack appointment reminder notification. Choudhari1, et.al [9] recommended a portable application for appointment reservations utilizing android phones that ease appointment reservation procedure with the doctor. Zhang [10] suggests an online patient engagement timetabling scheme using web service structural design that enables the development of incorporated healthcare information systems for hospitals. Kerdvibulvech and Win [11] propose a dentist's online booking system that helps to set aside time and exertion of the operators in safe and suitable manners as patients can easily reserve and verify their appointment timetable. It also enables the administrator to check the patient's requests, manage the appointment schedule, and manage the patient's information. Liu, Ziya, and Kulkarni [12] in their paper titled "Dynamic Scheduling of Outpatient Appointments under Patient No-shows and Cancellations", suggesting a context for experiential vigorous strategies for scheduling patient appointments, considering that patients can revoke or postpone their appointments. Zhang [10] technologically advanced a web-based appointment scheme using intelligent agents that can effectively manage appointments and update the calendar accordingly. Wang and Gupta [13] recommended a technique for appointment schemes with patient Predilections that mechanically modernize patients' favorites to enhance reservation verdicts. However, all these studies lack an appointment reminder notification feature, in which the proposed system is successfully integrated.

5 Research Methodology

Various methods were used to collect information about the existing system. The methods used for the collection of information in this study are interviews, questionnaires, internet, books, and requirements

determination. The observation method was also employed to obtain information about how the hospital schedule appointments for patients. The requirements determination involves the collection of information about how the system should operate. The requirements determination activity is seen as the most difficult part of systems analysis. It involves gathering and documenting of true and real requirements for the system being developed.

The research adopted the Structured System Analysis and Design Methodology (**SSADM)** for its analysis and design**.** This methodology is adopted because it provides users or software developers with vibrant, simply comprehensible documentation comprising of numerous graphic depictions of the system.

5.1 Analysis of the Existing Medical Appointment Systems

The existing system is manually operated as registration and booking of medical appointments required physical presence. This process is tedious and time-consuming as the scheduling schemes are ineffective. The system requires the services of an office assistant to manually or semi-automatically registered and booked appointments for patients with no provision for a notification feature that will remind patients of their appointments as the date draw near or reaches. This process is exposed to human errors that can lead to substantial inadequacies in a distinctive healthcare facility. Brenk [14] observed that the usage of current event scheduling methods decreases mistakes; however, they are still established with old-style procedures. The handbook registering procedure can lead to data duplication and increases the amount of work for health workers. Additionally, there is a propensity to continually enroll patients who have previously been enrolled in the past, if searching for their particulars becomes a colossal duty.

5.1.1 Problems of the Existing System

Observation of the case study method was employed, which helps to explain the problems encountered by the existing system. The following problems were observed in the existing system:

(i) Increases the number of non-arrivers and unexploited appointments which in turn delays presentation of health services, resulting in chronic conditions ultimately leading to complications, unnecessary suffering, and eventually death.
(ii) Negative relationships between patients and staff (doctors).
(iii) Increased appointment waiting time.
(iv) The increased cost of health care delivery.

5.2 Analysis of the Proposed System

The appointment scheduling scheme is the most valuable achievement for automating Medical facilities and processes in Nigerian hospitals. The proposed system permits outpatients to enroll their details electronically, book, and discard appointments. Figure 1 portrays the block diagram of the proposed patient appointment scheduling registration process.

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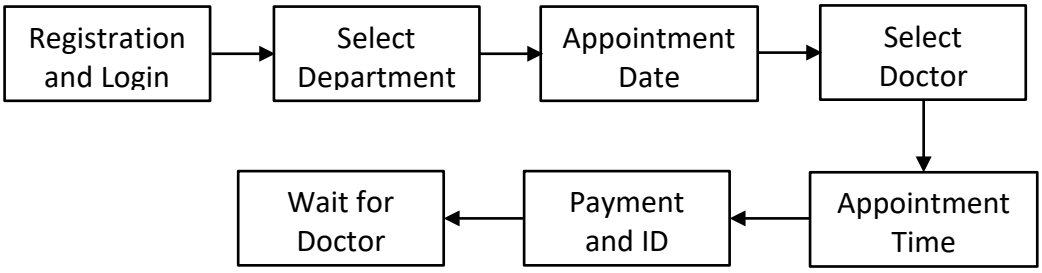


Figure 1: Block Diagram of the Proposed Appointment Registration Process

5.2.1 Justifications for the Proposed System

Below are the reasons for developing the proposed system:

(i) Eliminating unnecessary patients queue at the clinics;
(ii) Eliminating all absentees and wasted appointments;
(iii) High-speed alert notification once appointments are made or cancel; and
(iv) Provide adequate security to patient medical records, since every registered patient and physicians have a unique username and password for login.

5.2.2 High-Level Model of the Proposed System

Figure 2 is a high-level diagram of the proposed web-based medical appointment scheduling with an SMS alert notification system.

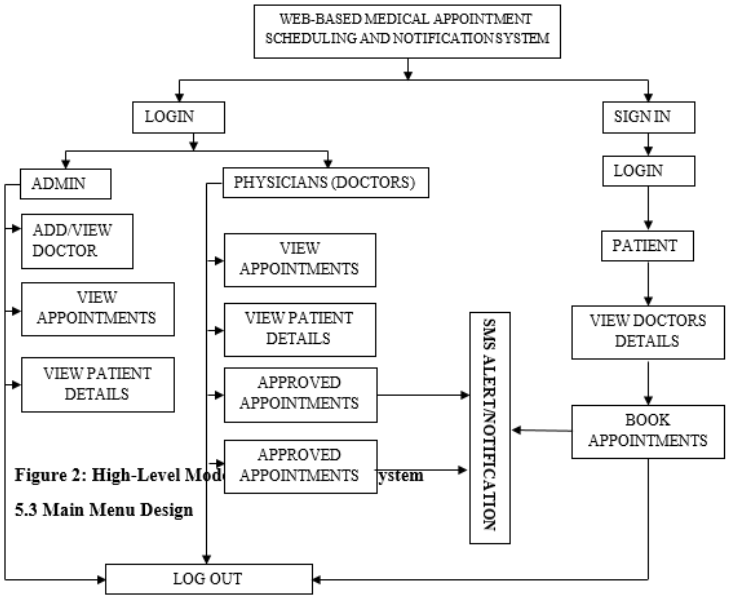


Figure 2: High-Level Model of the Proposed System

5.3 Main Menu Design

The main menu carries a high-level design of the system. It is the control center that loads all other modules. The main menu also called the home page for this system is developed as a web application,

using the language of the web. This system is made up of more than one interface which is loaded from the home page to bring about its full functionality.

Home Page: This page showcases the background of the system and contains other pages.

About: This is a module that describes the history, product, and services offered and show the terms and conditions of the system.

Contact: Contact provides contact information about the system. It shows its physical address, electronic address (e-mail), phone numbers.

Login: This interface has three login pages; admin, doctors, and patients.

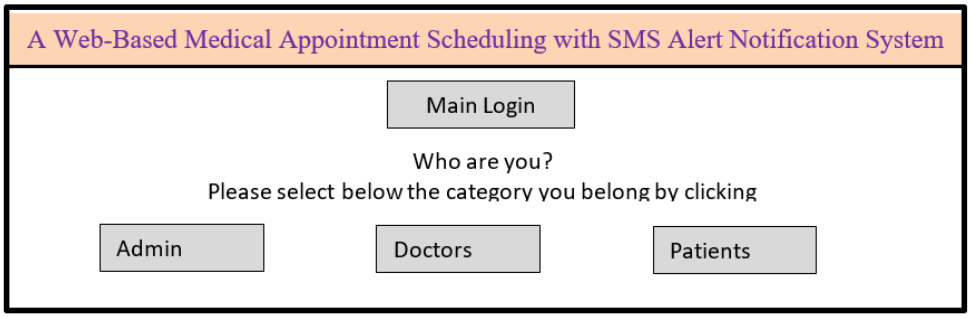


Figure 3: Login Control Panel

Admin login: This module is used only by a recognized administrator to log in and monitor the system.

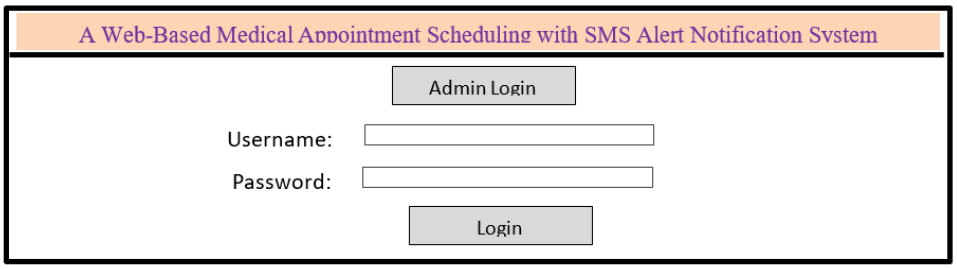


Figure 4: Admin Login

Doctor Login: This module provides authorization to a registered doctor sign in by an administrator.

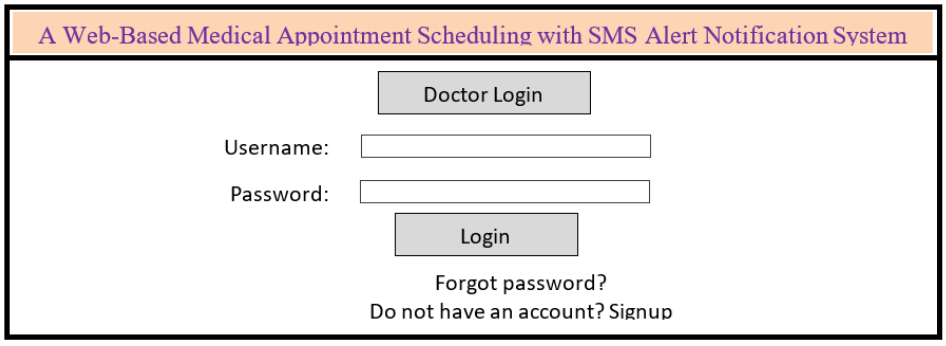


Figure 5: Doctors Login

Patient Login: This module is used by a patient after agreeing to the terms and conditions and signing properly into the system.

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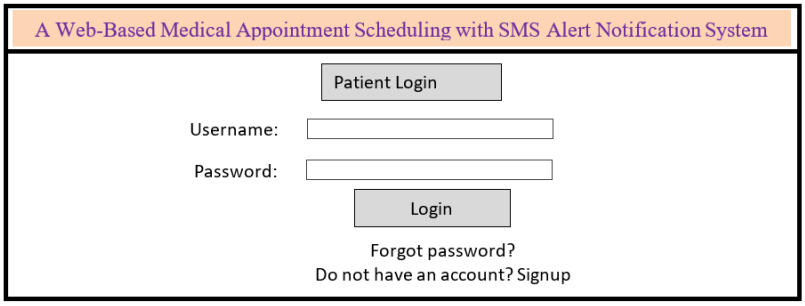


Figure 6: Patient Login

Sign in: This module provides registration to a client into the system if agreed to the terms and conditions. It gives the user a registration form to input personal information to be submitted to the database.

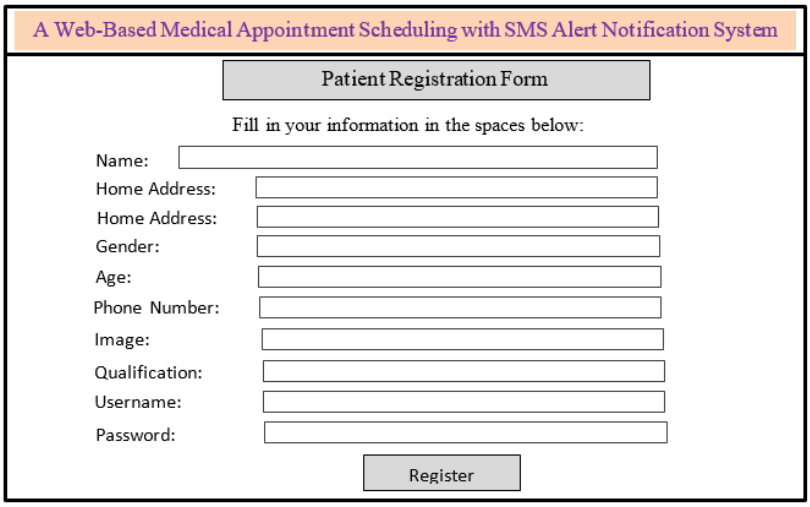


Figure 7: Patient Registration Page

Book Appointment: This page allows a patient who logs in to book an engagement with any available doctor.

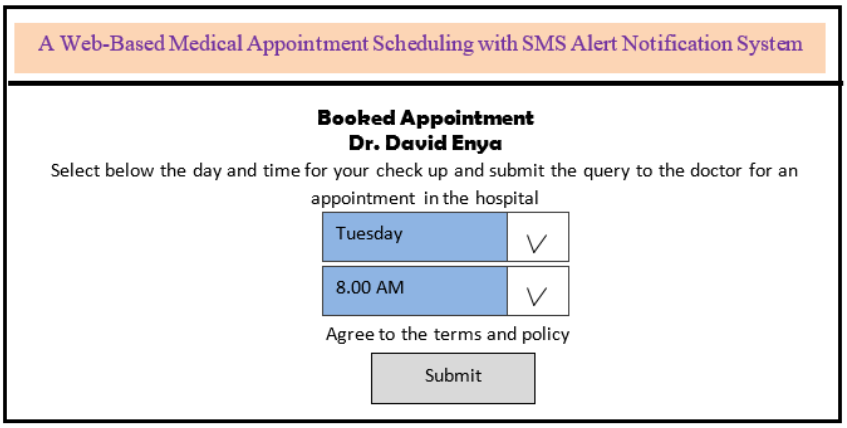


Figure 8: Booked Appointment Page

6 Results and Discussion

The results obtained from the implementation of the new system are discussed below:

6.1 Welcome Page

The welcome page enables the admin or manager of the system to log in and manipulate the system. It consists of the manager login, admin login, home page and locate us page.

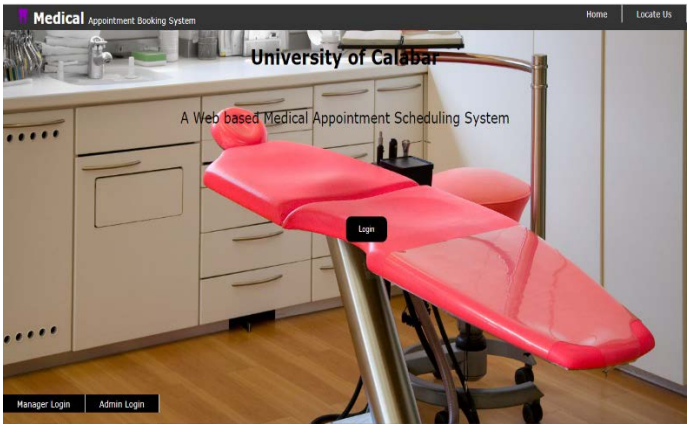


Figure 9: Welcome Page

6.2 Login Interface

This module enables the admin or manager, and the user to login to the system.



Figure 10: Admin, Manager, and User Log-in Page

6.3 Principal Menu Interface

This is also called the home page is the control center that loads all other modules. It consists of a book appointment module, show appointment module, cancels appointment module, locate us module, and the logout module.

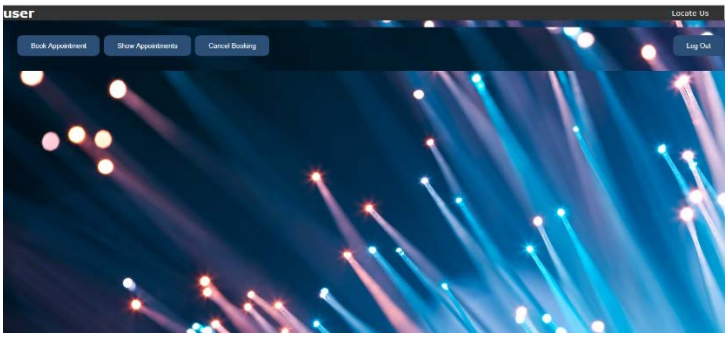


Figure 11: Main Menu Interface

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6.4 Appointment Booking Interface

This interface allows a patient who logs in to book an appointment with any available doctor.



Figure 12: Appointment Booking Interface

6.5 Cancel Appointment Interface

This page enables patients to cancel an appointment at any point in time.

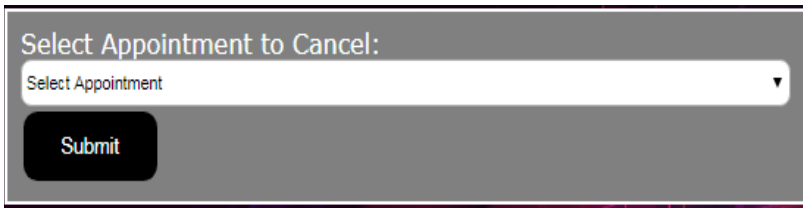


Figure 13: Cancel Appointment Interface

6.6 Manager Home Page

This module ensures that the manager or admin change or view booking status and also log out of the system.

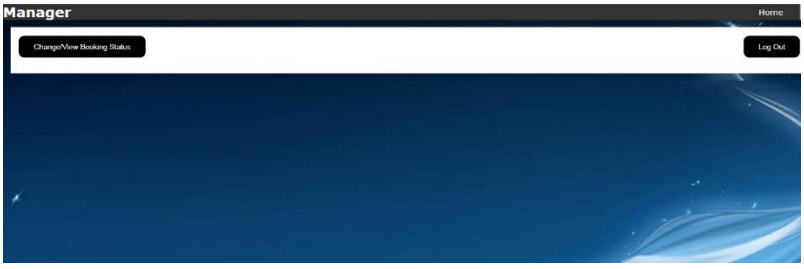


Figure 14: Manager Home Page

6.7 Admin Mode Interface

This interface enables the doctor, manager, and user to log out of the system.

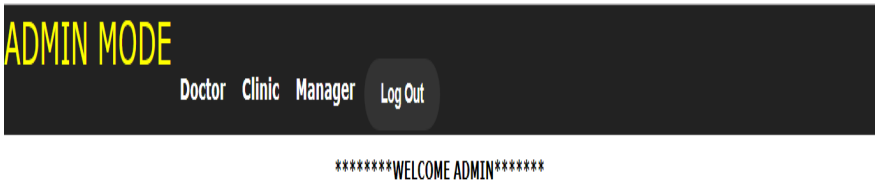


Figure 15: Admin Interface

7 Conclusion

In this study, a web-based medical appointment scheduling with an SMS alert notification system was developed, which incorporates both a booking system and an SMS alert notification system. The developed system can eliminate missed healthcare appointments and provides the machinery to notice patients when appointments are suspended or canceled. It provides a platform to book appointments remotely and has an adequate security feature to protect patient medical records since every registered patient and physician has a unique username and password for login. The system will drastically reduce or eradicate the several no-shows, missed-appointments, and queues of patients; and get rid of waiting time, idle time, and missed appointments. The developed system is cost-effective or less expensive in delivering health care services and helps to increase health care efficiency, effectiveness, and quality.

Based on the findings of this study, it is recommended for all owners of medical facilities such as hospitals and clinics both public and private, to key into this modern trend of rendering medical services used in developed nations to improve their service delivery.

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