DESIGN AND IMPLEMENTATION OF OUTPATIENT MANAGEMENT SYSTEM

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Abstract

People are much aware of the fact that, "to keep body in a good health is a duty; otherwise we shall not be able to keep our mind strong and clear". The well-known avenues for seeking medical attention are hospitals and clinics. Both administrators and doctors in these lifesaving avenues spend an awful lot of time handling and manually processing patients' medical records, and other related details. Handling this kind of activities is becoming harder and harder, due to the exponential growth of the number of patients that are trooping into both government and private hospitals seeking for medical attention. Globalization and modern-day innovations have led to the intensive use of Information and Communication Technology (ICT) in minimizing problems and easing most of our day-to-day activities to which medical activities are no exception. With this in mind, then, there is the quest of developing sophisticated tools to ease these onerous and tedious tasks. This paper titled "Design and Implementation of Outpatient Management System" presents the research, design and implementation of intuitive software in this regard. The software was developed by adopting the waterfall model and using Visual Basic .NET (VB .NET) as development tool. Furthermore, it is based on the popular 3-tier architecture pattern, consisting of the presentation tier (user interface); logic tier (business rules translated into a concrete implementation); and the database/storage tier (for storing patients' details). The work has presented a promising serene hospital environment, where records are kept in computerized forms for easier and quicker access thereby minimizing the waiting and consultation times of patients in a hospital.

Keywords: ICT, Patient, Software, Hospital

Introduction

Before Healthcare System came into practice, keeping proper records of the daily activities of hospitals, patients' information, maintenance schedule of equipment in hospitals, as well as the allocation and usage of funds happened to be a difficult and hectic task. This resulted in waste of money, time and manpower. Healthcare System is an information management system designed to help manage administrative, clinical and financial aspects of our modern day hospitals. It helps in monitoring and controlling hospitals' daily transactions, as well as their overall performances. Hospital Management System enables access to the right information and automation of complex tasks, hence allowing staff to spend more time caring for patients than any other related but less important task.

Research on outpatient clinics shows that waiting times are patients' main dissatisfaction with hospital services. According to doctors and other personnel, overtime and peak workloads are potential threats to the quality of services offered by hospitals across the globe. This research focuses on outpatient scheduling as a means of solving these problems for outpatient clinics, with the overall aim of enhancing the services provided by these clinics. According to [4, 5, 6] access time is the time between the patient's request for an appointment and his arrival at the outpatient clinic. A patient's internal waiting time is the period between the scheduled starting time and the actual starting time of his consultation. Waiting time due to a patient's early arrival is extracted from the internal waiting time, since it is not a consequence of the appointment system.

To address the above mentioned problems, there is the thirst of automating the entire process, to help patients book for appointments and access their medical records online. This will significantly reduce the number of missed appointments, unnecessary outpatient queue at the clinics, and long waiting time. The system will enable the outpatients to login with their number to appointment booking interface and view the scheduling calendar for the available receptionist, available time and room number of the available physicians. Then book an appointment by selecting from the list of available personnel's that conform to the patient time. This paper titled "Design and Implementation of Outpatient Management System" presents the research, design and implementation of intuitive software in this regard. The software was developed using Visual Basic .NET (VB .NET).

Background

Waiting Time

Waiting time simply means a period of time which one must wait in order for a specific action to occur, after that action is requested or mandated. Patients' waiting time has been defined as "the length of time from when the patient entered the outpatient clinic to the time the patient actually received his or her prescription" [1]. It is defined as the total time from registration until consultation with a doctor. There were two waiting times, the first is time taken to see a receptionist and the second is time to obtain medicine [2]. This paper deals with the waiting time to see physicians.

Long waiting times are a serious problem for patients using urban health centers in developing countries. A block appointment system was introduced and evaluated in a large South African health center. Waiting times of all patients were measured over one-week period before and after the implementation of appointments. Focus groups and individual interviews were conducted with staff and patients. After introducing appointments, patients

with acute and chronic illnesses and having appointments had significantly shorter waits time than similar patients without appointments [1].

Patients' Appointment System

A patient appointment system or appointment schedule for health care center started long time ago. Management of patients' appointments has earlier works and has developed simplified queuing models and fairly static scheduling conditions. Another attempt was made to calculate the waiting time between patient and doctor using the mathematical queuing models to minimize waiting time [3]. However; traditionally, the appointment system has considered that the doctor time is more important than patient time. So an appointment system was designed to minimize the doctor idle time but current designing of an appointment system is based on decisive factors with respect to both the patient and doctor [4].

Appointment Delay

Past research shows that the longer the appointment delay which is defined as the time between the day a patient requests an appointment and her actual appointment date, the higher the chances that he/she will cancel or not show up. This suggests an obvious way of minimizing no-shows and cancellations: this is done by asking the patients to come right away or make appointment requests on the day they want to be seen. This is called an open access (OA) or advanced access policy, and of late it has become a popular paradigm in practice and the subject of active research. Several authors report on their experiences in implementing OA, both positive and negative. Some practitioners strongly advocate OA, and there are some who are strongly against it [5].

Managing Patients' Appointment System

According to a study [6], managing patient appointment system is a computer application used to manage and reduce the patient waiting time in the health care center. Some health care centers do not use any appointment system. So it has a longer average patients' waiting time than the health care center that adopts the patients' appointment system. While patients can wait for more than one hour to be attended to by a physician in a health care center, they also can feel that they are being disregarded and treated unfairly. So when patients are given the time of appointment in a health care center, they can evaluate the quality of service in the center [6].

Hence, developing patients' appointment process for health care centers necessitates the use of a sophisticated queuing model that captures much of the real system's features (saving time, reducing idle time, etc.). Therefore, the appointment schedule represents the real situation in the health care centre faced by patient appointment schedulers. On the other hand, the standard practice for scheduling and processing patient appointments are based on the nature of treatments of the patients and that better approaches more sensitive to patient needs are desirable [6].

Online Booking System

An online system is also known as a web based system. A web is made up of page that is commonly known as web page or web site, and a web site is a computer program that runs a web server that provides access to a group of related web pages. A system is a set of independent components working together to achieve a common objective. Therefore a web based system is a system that is accessible over the internet by a user in order to achieve a particular task for a given purpose. The Internet is a system that is use to connect computers and computer networks. It helps to link millions of computer networks all over the world and it allows the users to get information stored on other computers from a long distance. A web-based appointment system is used in Taiwan; everyone is required to enroll in the national health insurance program. When one needs health service, he shows his health insurance card to doctors in a hospital to start with. There are several ways of making an appointment. A person can either go to the hospital directly for consultation day by day or make an appointment from home through phone call or email if his condition is not emergent [5, 6]. The Internet provides a wide range of technologies that enable hospitals to communicate with their patients. Recently, as the prevalence of Internet increasing, many hospitals initiated the website appointment system. Electronic patient-provider communication promises to improve efficiency and effectiveness of clinical care [7].

Existing Hospital Appointment Schemes

One application developed to manage patients' appointment scheduling has used exponential Inter arrival times. This model assumes that the exponential enter arrival times could not be directly validated by date, and it is limited due to the nature of the appointment scheduling [8]. Since appointments are scheduled in the future, the exact model of call arrivals will only have limited impact on measures related to the time between the call and the appointment time. For this reason, the challenge for making appointment system is designing a suitable system based on the health care procedure environment [9]. Hence, the appointment provider in the health care center can schedule a patient into an appropriate time slot on a given day.

Methodology

In order to achieve the objectives of this research, the researchers personally went to Get Well Women and Children Hospitals situated in the ancient city of Kano, Nigeria, for requirements gathering. Also as a follow up, the researchers interviewed 4 physicians and 10 patients in order to assess the manual appointment and booking method. In addition, data on appointment booking and schedule were collected through structured and unstructured personal interview. Some of the forms used in the outpatient clinics on appointment booking were also collected and were used as a guide in order to develop the online medical appointment booking system. The system is a network application based on 3-tier architectural design, implemented using VB .NET (for the interfaces and logic) and Microsoft Structure Query Language (SQL) (for storage).

Software Development Metholodogy

The Waterfall Model was first Process Model to be introduced; it is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed fully before the next phase can begin. This type of model is basically used for the project which is limited and there are no uncertain requirements. At the end of each phase, a review takes place to determine if the project is on

the right path and whether or not to continue or discard the project. In this model the testing starts only after the development is complete. In waterfall model phases do not overlap.

Diagram of Waterfall-model:
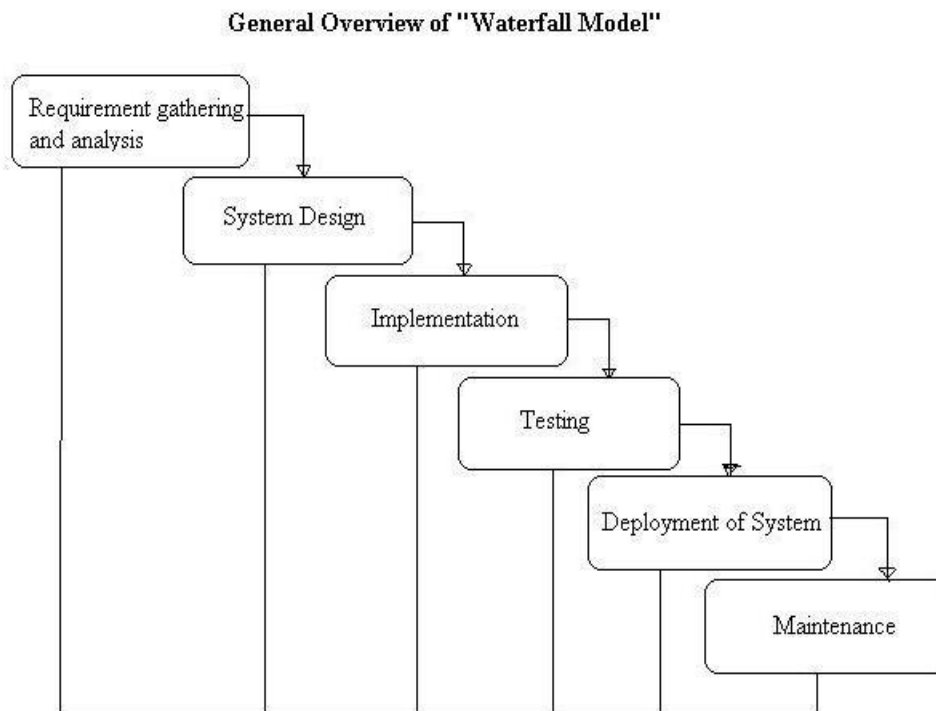
Figure 1: water fall model

Advantages of waterfall model
i. This model is simple and easy to understand and use.
ii. It is easy to manage due to the rigidity of the model, each phase has specific deliverables and a review process.
iii. In this model, phases are processed and completed one at a time, that is, phases do not overlap.
iv. Waterfall model works well for smaller projects where requirements are very well understood.

Use-case Diagram

The use case diagram is used in presenting the system requirements of any proposed system. A use case is a realistic description of the workflow of the system and it is used to explicitly describe the intentions and actions of users. The use case diagram, which present the system requirements are used to show how the proposed system work in practice. The interaction

between actor and use cases are also described using use case diagram. The use case diagram of the medical appointment booking system is presented in figure 2 below.
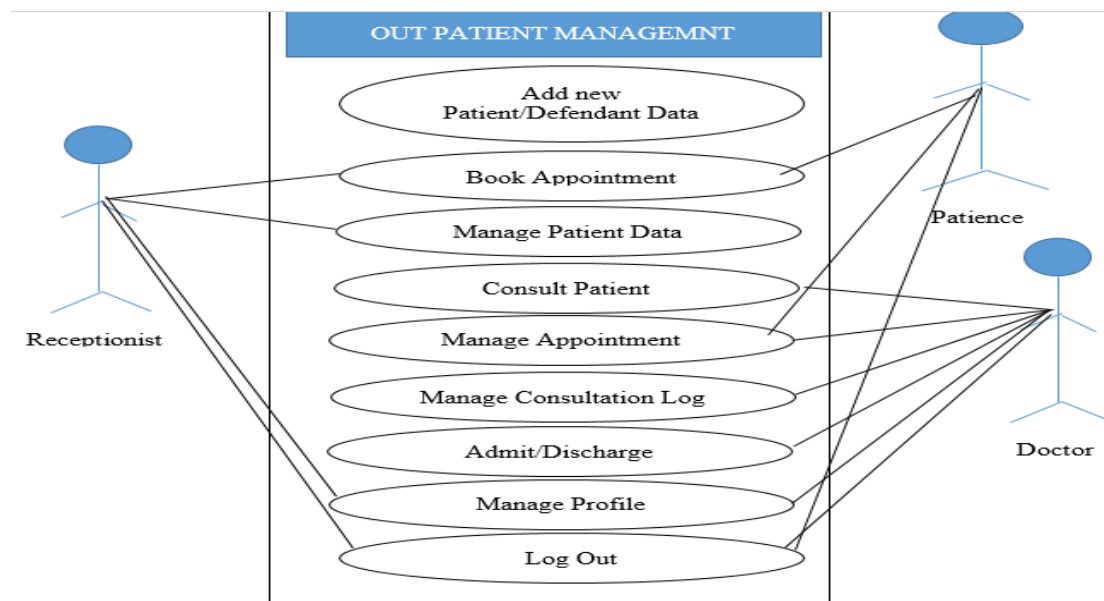

Figure 2: Use-case Diagram of the Proposed System

The Online Medical Appointment Booking System

The user interface allows the user to navigate the system and communicate with the database. The system interface design is simple enough to be the use for anyone with little knowledge of computer operation. Furthermore, it is user friendly and made easy to use through the use of Windows, Interface Menu and Pointing devices (WIMP), which is very important in computer graphics design. The inputs to the online medical appointment booking system are captured through the user interfaces available in administrator's account and the individual patient's account. A login Menu, which contains a user-friendly interface for capturing valid registration code, username and password, is available for each patient to logging in to their various accounts. In each patient account, data pertain to the patient and available doctor are entered and appointment booked are submitted. All these captured data are stored in the database.

Patient Registration Menu

There is need for every new patient to register before they can access the system, a patient must have a username and password which they will use to login before they can book for medical appointment. Any patient that does not register will not be allowed to access appointment booking Menu because to login to the appointment Menu requires a username and a password.

Patient Activity Menu
The patient activity Menu which is depicted in figure 5 displays the list of link of operation that a patient can perform with the system; the following are the activities a patient can perform.

- Appointment Booking
- View Appointment Report
- Log Out

Patience Input Specification

Patience Inputs can be described as raw materials that put into system for processing. The system can accept input from keyboards, mouse or touch pad. The System will collect Patient raw data as shown in figure 3

Figure 3: Patient Data Input Form (**Source**: Own Design 2016)

Patient Data Form provides input to the system in which user is to fill out all necessary details of the patient for the doctor to view during the consultation and for record keeping purpose.

Figure 4: Defendant Data Input Form (**Source**: Own Design 2016)

A defendant is a sub child or sub file attached to a Patient whom he referencing as Family, Company or group file. Any Individual patient can be a dependee while defendant ID is derived from depended ID. The figure above describes all the necessary input needed to fill out dependent form.

Figure 5: Appointments Booking Inputs (**Source**: Own Design 2016)

Output Specification

An output is the information provided as a result after input data have been processed. The output input is set to be printed or view for retrieval purpose. The major output information is patients' records and consultation page as shown in figure 6.

Figure 6: Patient Data Card (**Source**: Own Design 2016)

The figure 6 above is an automated Data Card printed after a successful registration of new Patient (Individual or Defendant). The receptionist will print the form and issued it to the Patient for referencing purpose. Each visitation, a patient is expected to issue his Unique ID to doctor for him to retrieve his Personnel details.

Doctor Function

Doctor function is carried out by Doctor whom will consult people through their consultation details that are understandable by any other concern doctor. Also doctor can view patient details and see his consultation history. In addition, doctors can manage their appointments, reschedule them or approve them upon their decisions.

Conclusion

With the development of Healthcare medical appointment booking system, patients are able to book and manage their own appointment with ease. They will be reminded of their appointments via SMS/email that will be promptly sent to them before their appointment date. The system itself also provides a quick view of their appointment at the Home page. These functions could indirectly help to reduce the number of missed medical appointments and patients no-show up for their appointment. Patients would be notified via SMS/email if their appointment were affected, when there is urgent needs of the service provider at other place or in case of any situation that can result to the absence of the service provider.

Patients could also track and monitor their appointment record with this system. However, the display of bio-data such as X-rays and laboratory results are not included in the system due to technical constrain. The system will not be able to diagnose or prescribe drug for usage. The system is mainly designed to facilitate appointment booking between the patient and the health personnel. In compensation, additional modules such as Announcement, Medical case record and block/unblock schedule will further enhance the usability and functionality of the system and allow a flexible management of patients appointment.

The system delegates some administrative work to the patients by allowing them to manage their own appointment and personal profiles. Time will not be wasted on converting paper-based appointment record into electronic-based. The system further helps to reduces healthcare personnel workload by allowing them to generate medical reports easily. They could now maximize their competence and allocate more time to maximize service quality.

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