Adaptation, Design And Implementation Of An Online Health System Using B/S Model And JSP Technology In Federal Medical Center Azare Nigeria

Abubakar Ado, Ahmed Aliyu, Zhongwei-he

Abstract: Online health systems have become more popular in recent years by means of incorporating modern computer and telecommunication technologies into health system and objectives to facilitate patient need. In this paper we develop a web-based application that will minimize all paper works and manual records keeping, therefore allowing doctors and staff ease in keeping track of patients medical record, reducing patient's waiting time and increasing the number of patients served and also we presents a study on the assessment of the acceptability of implementation of an online health system in Nigeria's health sector. The evaluation utilized questionnaires to collect information from doctors, Staff and users. The system is design using B/S structure and JSP technology which are frequently used in web-based applications, and discuss how to program in JSP to implement the system in detail, especially the method of database access and data storage in a typical online health system. Practices prove that our online health system works well which is fully automated, user-friendly, time effective, efficient and improved content.

Index Terms: Adaptation, B/S Model, Design, JavaServer Pages, Modules, Online Health, Survey, Web Server.

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1 INTRODUCTION

Now more than ever, people have become more health conscious and are taking necessary steps to ensure that they have a sound body and mind – that is why everyday and every time many people come to clinics or health facility for check-ups their health condition and treatments. And we all know that as the number of patients continually increase managing a clinic can also become increasingly difficult especially if everything is done manually, the solution of these difficulties is the introduction of an online health system. In today's world there is no more space for paperwork with world countries trying to move completely to the digital systems where they can share information and patients' data online, more easily and more effectively, among physicians and medical institutions, as well as recording and updating every patient's health history, reports, analyses and rays. With the fast-paced development of information and communication technology, world countries are in race to apply digital health systems which promise better and improved healthcare services for individuals and communities [1]. The development in digital electronics in the last few decades has helped to develop hardware and software that can be used to improve health service In today's modern age where computer has become a way of life, it is evident that a majority of the developing country's institutions still do not adapt the high technology.

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Particularly in most medical clinic facilities, daily health care transactions are still done on paper. We all know that modern health care centers are now operating at great pace striving to serve as many patients as possible with the best of their abilities. But as the years rolled by the number of patients has grown and various medical cases arise that the manual method of managing patients' records, prescriptions, billing and appointment schedule, is no longer practical. The rapid development of technology and the widening digital divide provides us with the trajectory of the way health delivery systems are lagging behind technological advancements [2]. Today, we can routinely send imaging studies, book appointment, view medical history through the Internet, and carry out live demonstrations and remote consultations through video conferencing [3]. In its earliest applications electronic information systems were mostly used for patient's electronic record keeping, but has advanced into almost all areas of medical discipline, Common applications Computerized Physician Order Entry, Pharmacy Information Systems, Laboratory, Picture Archival and Communication Systems, telemedicine, and many others as these technologies are constantly evolving [4]. Available literature provides common standpoint among various authors that disparities exist in the implementation of hospital information system in developing and developed countries [5, 6]. The lack of access to modern medical health care facilities has compelled many Nigerian patients to seek treatment with traditional healers and patent medicine dealers [7]. A paucity of government policy regarding the implementation of online health systems exists in Nigeria. The lack of strategic government programs has culminated in the poor adoption of hospital information technologies in health care facilities across the country [4]. The consequences of non-adoption of hospital information technologies include possible mix-up with laboratory results, misdiagnosis, medication order errors, and mismanagement of patient's record [7, 8]. Recent research shows that most European countries and the United States are increasingly adopting electronic medical record (EMR) technology to enhance health care outcome and quality while Nigeria lacks robust health care infrastructures and policies for

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implementation of information and communications technology [9]. In the 2005 health data management meeting, a survey of Chief Information Officers in attendance found 74% of participants showing willingness to introduce online health systems in their respective hospital practices as a top priority. The surveyed executives worried about the challenges in implementing effective change management and difficulties in overcoming end-user resistance [10]. Currently, a wide gap exists about the number of hospitals that implements and adapt the online health system functionally available in Nigeria.

2. B/S STRUCTURE AND JSP TECHNOLOGY

2.1 B/S Structure
B/S (Browser/Server) structure is a frequently-used computing model for network applications [11] on web-based platforms. With the increasing maturity of Web technologies, B/S structure has become a replace of common C/S (Client/Server) structure as a new technology. Generally speaking, it consists of three parts: Server side, Client (i.e. Browser here) side and the communication protocols between them. The Server side mainly includes Web server and Database server. The Web server processes users' requests from the Browser side and starts the relevant script codes or application programs; the Database server stores the data and provides users with supports of information processing. Both sides work corporately under some corresponding communication protocols. After Server side completes all the processing tasks, it will send the results to Browser side in the form of standard HTML web pages. The B/S structure is shown in Figure1.
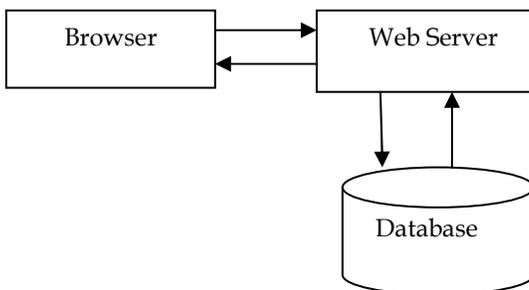

Figure 1 B/S (Browser/Server) Structure

In B/S mode, the client side only needs to install a web browser. Applications and resources are stored in Web server and Database server, which can be downloaded freely when needed. It makes the cost of maintenance and updating the client reduced significantly and all the operations relatively simple. In one word, the legitimate users can use the entire system functions easily just with a web browser.

2.2 JSP Technology
Interactively is what makes the web really useful [12]. Every time a user can type something into web form, an application "out there" interprets user's request and prepares a web page to respond. JavaServer Pages (JSP) is a server-side programming technology that enables the creation of dynamic web pages and applications. This is accomplished by embedding Java code into HTML, XML, DHTML, or other document types. When a client such as a web browser makes a request to the Java application container, which is typically a

web server, the static page is converted behind the scenes, and displayed as dynamic content to the viewer. We prefer to use JSP Technology because it simplifies development by allowing the insertion of Java code directly into standard text files. It is also an independent, cross-platform, portable language that falls in line with the Java motto of 'write once, run anywhere.' Boasting the ability to separate content from the foundation of the page, the language allows programmers to create new code independent of the existing work. JSP is largely considered to be a robust and efficient technology for both the server and client side aspects of programming.

2.3 Data Storage
To be mentioned, although such databases (for instance, SQL Server, My SQL and Oracle) can be chosen as the Database server that is backend, they are primarily designed for the applications with larger scale database where more complex database operating and higher technical level for administrators are required. In our online health system, there is relatively large amount of data. Therefore we prepared to use SQL Server because is more appropriate to take into account due to its apparent advantages of efficient development, complete SQL commands, simple operations and lower cost.

3. DESIGN AND IMPLEMENTATION

3.1 The Overall Architecture of the online Health System
An effective online health system not only can enable patient to book appointment online easily and Doctor view patient medical record freely, but also can enable administration to manage the appointment, patient profile and doctor profile through the network conveniently. That is to say, patient can view their medical record and make book of appointment online through a web browser at anytime and anywhere and thus reduce their waiting time. Doctors can also view their appointments and patient medical record through Internet at anytime and anywhere and thus improve their consultancy methods and reform their working strategies. By this means, the complexity of directly operating Web server and Database server can be reduced greatly. Thus, the development platform based on B/S structure is very suitable for this kind of health system. The system architecture is shown in Figure 2. The structure consists of 3-tier structure. That is the Presentation layer, the logic layer and the Database server layer. Tier 1(presentation layer) it interacts closely with the user, and Administrator while the tier 2(application layer) it holds the business logic and the data access logic and tier 3 (database layer) it store the user data, operational data and meta data.

Figure 2 System Architecture

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3.2 DATA FLOW DIAGRAM FOR OUR ONLINE HEALTH SYSTEM (APPOINTMENT SYSTEM)

The main function of our online health system is to provide the browser to get appointments from a doctor through the internet instead of going there and fixing an appointment and confirmation message is send to the patient about his/her appointment. Doctors can view their appointments and also enter prescription for their patients.
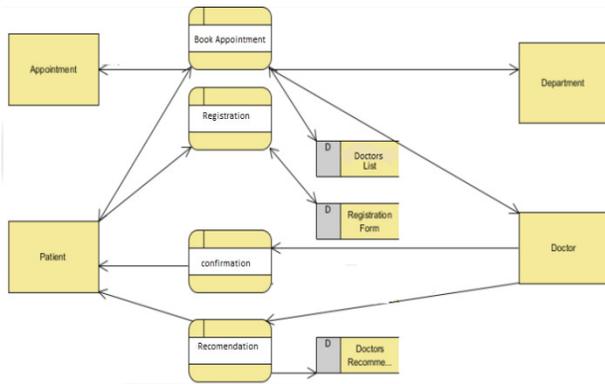

Figure 3 Data Flow Diagram

4. FUNCTIONAL MODULES

There three Main Modules in our online health system which are:

Patient Module.
- User can register freely at any time
- User can Login into his/her account with a Unique Username and password
- User can book an Appointment with a particular doctor and also view their medical record and prescription.

Doctor Module.
- Doctors can login using their unique Username and password.
- Can see their new appointments and also see the previous appointment and view Patient medical record also view list of hospitals for referral.
- Doctors can enter medical detail about a patient like specifying Patient condition, Kind symptom and prescription.

Administrator Module.
- Admin Can register doctors and add new hospitals for referral.
- Can view the Account information for any user and can also view the suggestion (feedbacks) given by different users.
- Can manage Appointment, Doctors, Patient and other services.

4.1 Login Page

This is the Login page through which the admin, Doctor or patient can login by entering a valid Username and Password in order to grant access into the system and if the Username and Password is invalid access will be denied.

Figure 4.1 Admin and Doctors Login Page

New User can not login until he creates an account by clicking **New User** and then fill in the form and submit. Only registered patient can able to book an appointment with a doctor see figure 4.2. General Users are those who have not registered in this site. They can view general information about the Doctors, view the Health Tips, read about online appointment, give their suggestion about this site through our homepage see figure 2.3 and also They can register themselves and become a member.

Figure 4.2 User login page

Figure 2.3 General user homepage

4.2 Welcome Homepage

After patient, user or admin has entered his/her username or password then he/she will be directed to the welcome home page. Patient can book an appointment, view medical record, Doctors and also can edit his/her profile by clicking the links see figure 4.4. Doctors through their welcome home page they can view all their appointment, view hospitals list for recommendation, view patient medical history, enter observation and prescription and also they can edit their profile see figure 4.5 .At   admin welcome home page administrator can add doctor, add new hospital, manage Users, manage doctors and also manage all appointments. See figure 4.6.
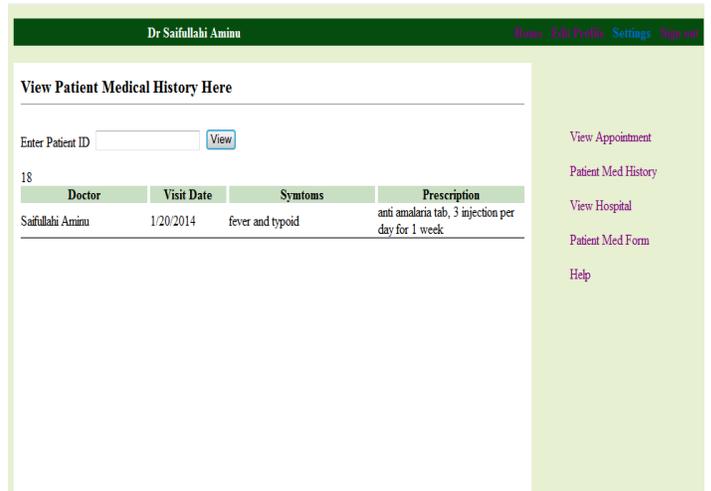

Figure 4.4 Patient welcome home page.

Figure 4.6 Doctors welcome homepage

4.3 Online Appointment page

Patient can book appointment online with a particular doctor by view doctor's profile such as doctor specialty area. After selecting a particular doctor user can proceed by filling in the appointment form by selecting their preferred appointment date, time and doctor. See figure 4.7 after patients make their final choice a message will be send to the user's email about the status of the appointment and user can also click on **appointment** to view the appointment detail.
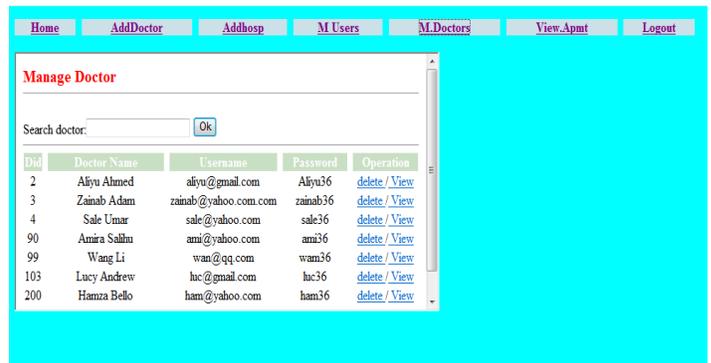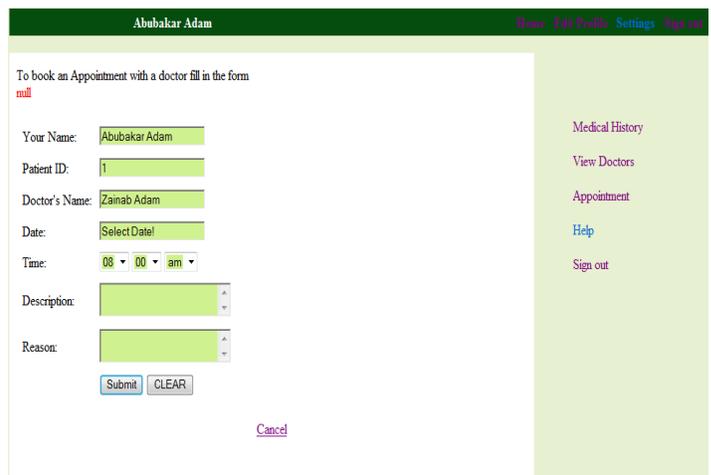

Figure 4.6 welcome admin home page

Figure 4.7 Online Appointment page

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5 SURVEY DESIGN

In order to identify acceptability of the online health system we design questions that reflect both the three categories of people which are medical practitioner, users and administrative staffs. To see how both the three categories of people will response to the proposed online health system, we included these questions in our questionnaire:

Users: Do you welcome our online health system, whereby you can book an appointment with a doctor online and also view your medical record by login into the internet everywhere and anytime?

Medical Practitioners: Do you agree with our online health system where patient can book an appointment with a doctor online, doctor can view medical record of patient and also can enter patient prescription online for feature reference?

Administrator Staffs: do you agree with the online health system whereby you can manage patient record and other related admin work online? In sum each questionnaire consists of 2 short questions. The first question (not numbered) asks whether the participant is a Nigerian. Respondents were asked to indicate, on a scale from "Strongly agree", "Fairly agree" and "Not Agree".

5.1 Survey Result

Out of the 238 responses we received 110 are from users, 55 are from medical practitioners and 73 are from administrative staffs. Table 1 below shows the percentages of the answers that are strongly agree, fairly agree and not agree for both the users, medical practitioners and administrative staffs.

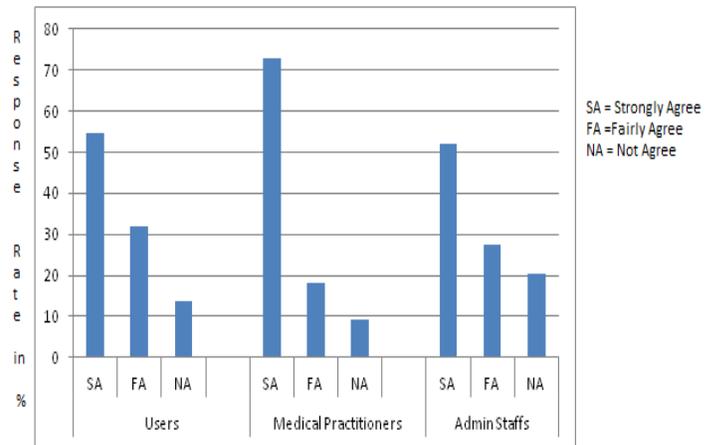| categories	Answer	Percentage
Users	Strongly Agree	54.5%
	Fairly Agree	31.8%
	Not Agree	13.7%
Medical practitioners	Strongly Agree	72.7%
	Fairly Agree	18.2%
	Not Agree	9.1%
Administrative Staffs	Strongly Agree	52.1%
	Fairly Agree	27.4%
	Not Agree	20.5%

Table 1 Percentages of the answers received

Figure 5.1 Survey of Acceptability before Design

5.2 Implementation Result

Figure 5.1 shows the adoption rate of online health System after six months of implementation. The adoption rate of the online health system was gathered from the log record of the online health system. It was increased slowly from 1.50% to 2.20% to 3.1% to 4.5% to 5.4% then 6.40% at five, six, seven, eight, nine and ten months after the online health system went live. The patient throughput in the medical centre per day is around 300 people, among them 10 to 20 people made their appointments and views their medical record online in the 5th to 10th month after the online health system was implemented, respectively.
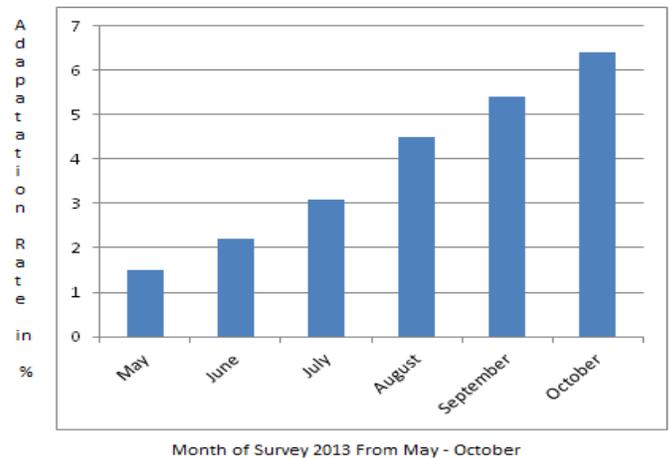

Figure 5.2 Adaptation Rate after Design

5.3 Discussion of Results

From Figure 5.2, it show the overall adoption rate of the online Health system had slowly increased from 1.50% to 6.40% over the six months survey period. This shows that only the innovators in the patient population had adopted the IT innovation that is the online health system. However from figure 5.1 it shows that user has 54.5% strongly agree, 31.8% fairly agree while 13.7% do not agree, it also shows that Medical Practitioners has 72.7% strongly agree, 18.2% fairly agree while 9.1% do not agree and lastly shows that Administrative Users has 52.51% strongly agree, 27.4% fairly agree while 20.5% do not agree. Express their intention to accept the online health system. From the two results we

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obtained this indicate that Internet- health system is far from the reach of the general public in Nigeria, where the survey and study website was implemented. It shows that 58% of the user (user, medical practitioners and Admin staff) strongly agree to the online health system, also 27.3% of the user (user, medical practitioners and Admin staff) fairly agree and finally 14.7% of the user (user, medical practitioners and Admin staff) do not agree.

5 CONCLUSION

The design and implementation of the online health system is described in this paper. Based on B/S structure and JSP Technology. We successfully implement the online health system and we are able to capture data. We conducted survey to find out people views by asking them to express their opinion on the online health system we also captured the adaptation rate after implementing the system. Base on the survey result and adaptation rate, shows that the internet health system is far from reach of public in Nigeria. This study serves as a preliminary study for the future analysis of acceptance and usage of integrated online health system and also our preliminary findings are highly valuable for the decision makers charged with the responsibility of implementing E-health system to consider in designing their strategies and plans for the introduction of the E-Health system in Nigeria.

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