Remedy: The doctors' information system that provides useful doctors' information to patients in the third world countries

Abstract

Understanding the healthcare practice in third world countries such as Bangladesh, and India is important for evaluating web based user interface "Remedy". This paper describes an existing problem in common people's access to healthcare in third world countries in a brief. Then the paper proposes a data and user driven interface "Remedy," which can effectively address the problem by allowing people to find a suitable doctor near him quickly and making an appointment with him. I look at using both doctors' data and hospital data. My user study shows that 83% (five out of six users) believe that remedy can be very useful to reduce the current gap in the healthcare practice considering its data driven features. The user study also indicates scopes of improvements in a few areas such as search process, error display, and security features. Overall this paper presents a user interface model that has feasibility and potentiality to address the challenge of common peoples' access problem to healthcare.

Introduction

In a recent study in India it is stated that the main challenge is common peoples' access to healthcare [11]. In order to improve their healthcare, India's National Rural Health Mission has increased allocation by 40% to improve healthcare access to common people [11]. In a study on healthcare system in Bangladesh, it is found that scarcity of quality doctors in remote areas is a big issue [7]. However, telecommunication is quite advanced there and internet is available. As a result, it is found in a recent study that telemedicine projects are receiving some positive response [7]. In this context a data driven doctors' information system can be very meaningful to increase common peoples' access to healthcare.

The minimum standard of doctor to population ratio is expected as 1:1000 by High Level Expert Group (HLEG) for Universal Health Coverage, where in India this ratio is 1:6300 [7]. Since many third world countries are over-populated, there is an incredible queue almost everywhere. Therefore, everyday there is a huge list of patients that a doctor needs to attend. As a result, he often cannot afford to give as much time to an individual patient that a doctor in a developed country can afford to give. A doctor often needs to prescribe his patients in a few minutes based on their symptoms and some basic test results. Consequently, some patients are mistreated by less efficient doctors. Keeping that background in mind, availability of the doctors' information, along with their ratings, reviews and availability could be very useful for patients who are seeking the right doctor.

Medical system is insurance based in the USA. When people fall sick, they call insurance companies to find the doctor or go to a hospital where their insurance cards are accepted. However, it is not the case in third world countries. In a recent study in Bangladesh it is found that a large share (88%) of employment in Bangladesh is in the informal sector (that is not monitored or taxed by any form of government). As a result, inclusion of these workers in health insurance is a big challenge [8]. Due to lack of information people often randomly go to any hospital without knowing the information such as the doctors' rating, their availability or fees. This paper builds with the goal of improving methods for patient-doctor communication through an efficient user interface of doctors' information system.

Background

The following sections provide background on peripheral qualitative measures for doctors' management system in healthcare in the context of third world countries.

An integrated health care system framework

A cost-effective and sustainable healthcare information system relies on the ability to collect, process, and transform healthcare data into information, knowledge, and action. Data driven, mobile and cloud enabled healthcare systems are essential for providing cost effective and quality healthcare support to people [5]. Enabling patients to make informed doctor selection and appointments in the quickest possible time in third world countries will result in positive changes in their healthcare systems. This paper explores the importance of Doctors' management system as an essential part of this health care system framework.

In the evolution of computer systems in the field of healthcare, diagnostic systems were introduced first and then systems to guide doctors for treatment. The information system called "House Officer Information and Scheduling System (HOISS)" was designed to guide junior medical staff in their decisions about the investigation of common medical problems [13]. It was found in a later study on HOISS that the system influences decisions concerning investigations by comparing the management of similar groups of patients at two hospitals [12]. This paper adopts a similar idea to guide patients in their decisions about the doctor selections and making appointments. If patients can compare similar doctors in terms of some parameters such as their ranking based on reviews, fees, hospital affiliation, office hours, or availability, it can make the decision process faster, easier and more efficient.

In context of the third world countries, a doctors' management system needs to be included as a part of such integrated medical information system. Even if a patient cannot visit the hospital, proper medical treatment needs to be available by analyzing the patient's medical history and diagnosis process in the remote area [9]. However, the integrated system is incomplete without a doctors' management system as part of it. Incident reporting systems (IRS) are complex information technology (IT) tools used to determine how harm occurs, and guide the development of strategies to reduce risk and prevent further occurrences, with some success [4]. Linking a data driven doctors' management system with IRS

as a part of integrated medical information system would enable easier and more effective track of incidents and provide more efficient healthcare to people.

Bringing better quality in health care

Quality systems for doctors can help to make the audit process easier in a timely and professional manner. It also helps to bring transparency and to strive for better healthcare service towards patients [10]. A doctors' management system can not only be useful for patient-doctor communication but also in doctor audit, tracking doctors' performance, and eventually improving the quality of service.

Computer based patient record systems (CPRS) have brought evolution in terms of saving time and money, improving patient care, and improving overall job satisfaction for clinicians [3]. The idea of a doctors' information system can be thought as an extension of this concept following the same design guidelines such as using a large display, providing useful links to relevant knowledge, eliminating redundancy etc. In health economics, ambiguity is usually handled through sensitivity analysis [2]. Treatment decisions come from both patients' side and doctors' side. However, the patients' side ambiguity is rarely addressed to be solved. If a patient goes to a doctor after reviewing their expertise area, ratings, feedback then those ambiguity and risk factors can be reduced.

In treatment, the decisions made by the doctor, surgeon, patient and parents of the patient are critical. They are the major stakeholders in medical decision making [1]. When the topic of improving medical decisions come, more emphasis is usually given on the decision making process of doctor, surgeon or medical board. However, the topic of patients' decision making process is often ignored. That is why it is important to concentrate in that area for the sake of overall improvement of healthcare.
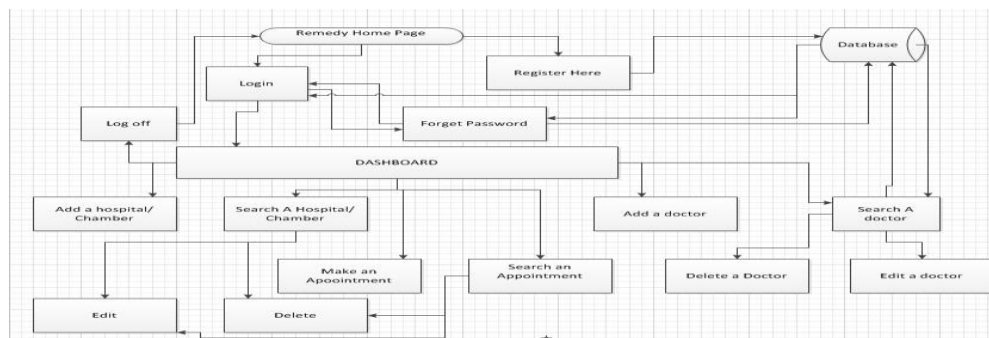

Figure 1: Control Flow Diagram of Remedy

REMEDY

Remedy is a prototype doctors' information system interface with following features: registration and login, add a doctor, search a doctor, make an appointment, search an appointment, add a hospital, search a hospital, add a chamber, and search a chamber. Control flow diagram of Remedy is shown in Figure 1. Technology wise Java Servlet, Java Script, JSP, and JDBC were used in front end user interface for the

project. Besides, Tomcat Application server was used to execute the program, and MYSQL was used in back end database.

Registration and login

Users can register themselves and log in from here. A user can register himself by providing his name, user name, email address, password, and answering two secret questions, that can be used to retrieve his credentials in future. Remedy does not allow duplicate user name and if user name already exists, it throws an error that "User name already exists." Missing "@"sign or missing dot sign before domain name triggers an error message that "Invalid email address" and remains on the registration page so that the user can correct information. There are two security questions that a new user needs to answer and those answers are used to retrieve login credentials. There is a "Forget Password" button in the login page. If a user clicks on it, he is asked his email id, and security questions. Appropriate answer of those three questions displays his login credentials. After successful login, the user is directed to dashboard in the way Figure 2 displays.
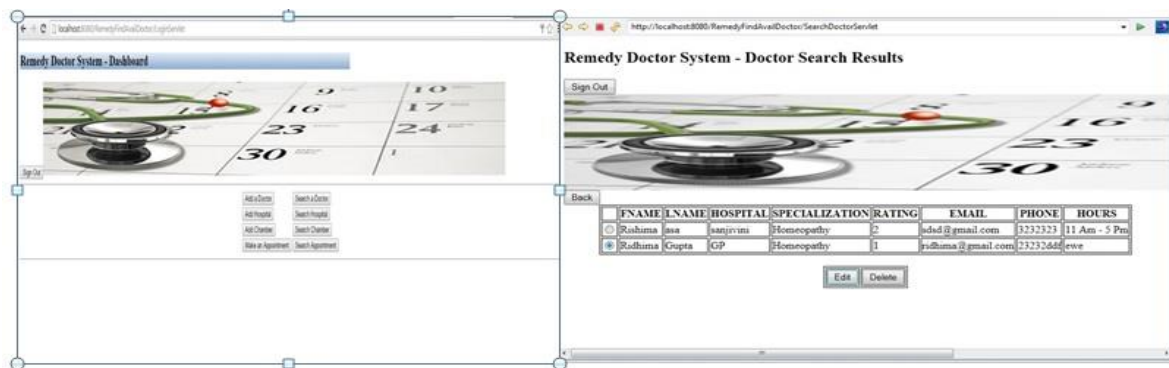

Figure 2: Dashboard of Remedy & Doctor Search Result Window

Add and search doctor's information, hospital, and doctor's chamber information

The user can add a doctor's record from "Add Doctor" option and by filling up doctor's information such as his name, contact phone number, hospital affiliation, specialty, work phone and email. American standard phone number is accepted only and anything else would trigger error message and asks the user to provide correct number. When a user searches for doctors' information, request is matched with the database information. Successful retrieval displays doctor's information and otherwise displays error message that "no record found". The user can select a doctor by selecting a radio button beside the doctor's information from search page and perform edit and delete operation as depicted in figure 2. The database is updated accordingly. In the exact same manner hospital and doctors' office information can be added, deleted, or updated using "Remedy."

Make and search doctor's information conceal

One of the crucial functions that a user can perform using Remedy is "Make an Appointment." He can make an appointment from "Make an Appointment" option and by filling up doctor's name, patient name, chamber address (doctor's office is called doctor's chamber in some third world countries),

appointment date, and appointment time. The doctor's name and chamber address should match with previous database record for doctor's information. The appointment information is then stored in doctor table in MYSQL database and when a user searches for a specific appointment information, he can request a search by providing doctor's name and patient name. Successful retrieval displays appointment information and otherwise displays error message that "no record found." If search result is found, user can select an appointment by selecting a radio button beside the appointment information and perform edit and cancel operation. The database is updated accordingly.

Evaluation of the system

In the evaluation study I collected data from six participants (2 females, 4 males) in the age group between late 20's and early 30's. Among them two are software quality engineer working in the industry currently, one is working as a developer, two are graduate students from Drexel university computer science department and one is a graduate student with general computer knowledge but not from a computer science background. The goal of this evaluation was to get feedback on the features of Remedy, lenience in terms of time consumption, evaluating the system in terms its response when it receives erroneous input, evaluating security feature such as retrieve password method and overall effectiveness of the system to solve the problem. The smoke test had specific direction to test every key feature and for every other question the user was given either a yes/no choice or multiple choices (such as they were asked to select a point between 0-10, where 0 means worst and 10 means best for some specific feature/question) to select. There was also a comment place, where they could write additional comments.

Analysis and result

The smoke test (testing basic functionality of the system) passed successfully with all of them, where the users were able to register themselves, retrieve his password, add a doctor, search a doctor, add a hospital, search a hospital information make an appointment, search an appointment, edit and delete appointment information. Participants were asked that how much time it takes to perform a function successfully for some given functions. Only in case of "search an appointment" it took longer time than expectation for 83% (five out of six users) of them. The reason is that there are four parameters (doctor's name, patient name, date, time) to match for searching an appointment in existing system. Therefore, when they provide inaccurate input in any of the fields, it triggers the error message that "no record found."   In every other case all of them could perform the task in reasonable time (10-45 seconds depending on the feature). Five out of six users (83%) believe that Remedy can be useful to find a doctor and make an appointment for many people in third world countries. One of them thinks that it will not bring significant difference as right now anybody can add or delete any information in the system. Appropriate error message was reported to be triggered in every case of invalid email or phone number. However, two of them commented that error message needs to be displayed in an improved way in the registration page.
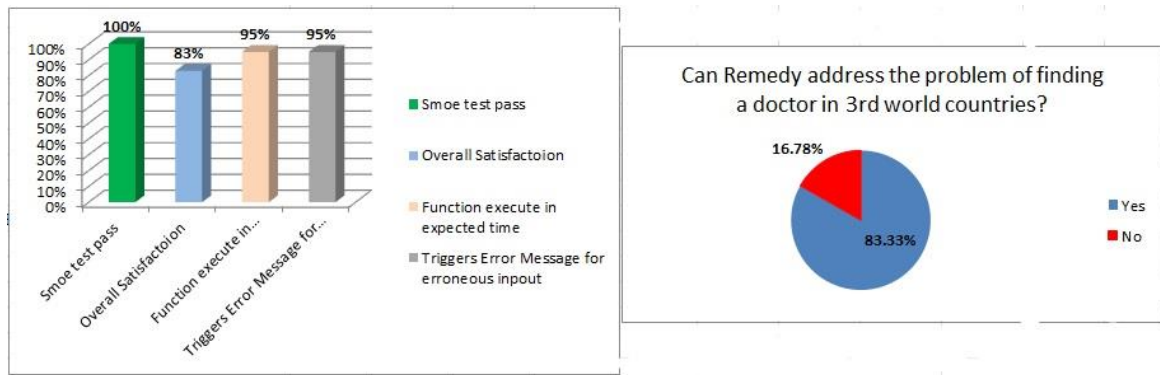
Figure 3: Evaluation of remedy to solve the problem

Discussion and Future Works

Due to shortage of time it was not feasible to create different users with different privileges. However, keeping it open and allowing anybody to modify (just like Wikipedia) also seem to be a good idea and still serves the purpose of providing useful doctors' information to users, that can fasten their decision process in a critical time, when they look for a doctor but unsure where to go. A hospital usually has many departments and there are many areas of specialization. However, this prototype was implemented only on few departments and doctor records with few specializations were inserted and tested. In future I plan to create more departments and put more data in database for many doctors with diversity in their specialization. I also would like to improve the appearance of the interface, so that it looks more lucrative to users. Error messages are triggering for providing invalid email address, however it is not displaying in a very nice way and overlapping with the email text box. In future I plan to fix this display problem. I also plan to improve the security features of the system by encrypting the password information in database. I also plan to make the procedure of searching an appointment simpler as per user feedback.

Conclusion

I developed user driven interface components in Remedy to allow simple user interface interactions in order to provide useful doctors' information to the people of third world countries. Adding and searching records were performed using connectivity with MYSQL database. User studies indicated qualitative benefits of using the system as well as indicated few scopes of improvements especially in searching an appointment process. As future work, I plan to extend or improve the features based on user feedback, enrich the database and experiment the usefulness of using Remedy in short scale (i.e. my village in Bangladesh).

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Appendix:

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Outside interest: International relations, and tourism