

Designing a Home Health Provisioning System

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Abstract—A Home Health Provisioning System (HHPS) is not widely prevalent in India as in the developed countries like US. HHPS allows patients' emergency services and routine primary healthcare services without them actually visiting the hospitals. It can be a boon to the aged people and to the handicaps who are facing with the difficulty of transportation. This paper presents an HHPS designed for the Indian customers. This system will contribute to the overall health of the patients by providing more personalized care. The practicing physicians in HHPS will establish a more solid physician-patient relationship by having a provision for longer appointments and round the clock access to doctors. The consultation can be either by video conferencing or the patient can send a detailed health description using web page tabs. The doctor then performs the diagnosis and sends the report to the patient, with necessary medical advices.

Keywords-Health records, HHPS, privacy, smart healthcare, smart home.

I. INTRODUCTION

All Healthcare systems have undergone many transitions over the last decade. These include migration from institutionalized settings to the home and everyday life, conventional medical care being replaced with self-care, trained nurses being replaced with untrained people, and organized medical wards being replaced with cluttered homes [1]. The homes are getting recognized as important destination for healthcare, signalling the focus shift towards patients and their community [2].

India is the second most populous country in the world and may exceed the population of China by 2030s. The investment in healthcare in India is not rising with the same pace as the population, which is posing a severe threat to proper management of diseases due to lack of infrastructure. The life expectancy of people in India is on the increase, which can cause additional load on the healthcare infrastructure with increased old age patients. Though the World Health Organization (WHO) stipulated minimum doctor to patient ratio is 1:1000, in India there are only 0.7 doctors per 1000 patients [3].

The number of diabetes patients in India is about 63 million, and India is the home to 60 per cent of the world's heart patients [4]. Also, millions of Indians die each year from communicable and non-communicable diseases. In addition to infrastructure issues, lack of skilled medical practitioners is a big bottleneck in India. The healthcare sector expects about 7.4 million strong workforces in 2022 compared to 3.5 million in 2013 [5].

The healthcare spending in India as a percentage of GDP has reduced from 4.4% in 2000 to 4.0 percent in 2010 [6]. The total spending on IT by US hospitals in 2011 was \$79-80 billion as compared to \$305 million in India [7]. However, India's healthcare IT market is expected to reach \$1.45 billion in 2018, more than three times the figures in 2012 [7].

The penetration of Electronic Health Record (EHR) in India in 2013 was 13.5% [7]. The EHR adoption trends has been higher among the medium to large sized hospitals because they had larger budgets as compared to smaller sized hospitals [8]. The Asia-Pacific region accounted for 18% of the Global EHR

market in 2015 [9]. Similar growth of EHR adoption in India is expected in the coming years.

The rural population in India represents 70% of the total and they have limited access to health care facilities [10]. It is interesting to note that the government hospital beds in the urban areas are more than twice the number of beds in rural areas [10]. The availability of specialist doctors is limited in India [11] and they are not accessible to the rural population.

II. RELATED LITERATURE

Healthcare providers now implement strategies to improve the quality of care for all patients through focusing on patient safety, reducing medical errors, establishing evidence-based guidelines, and lowering the rate of unnecessary and preventable intervention [12]. However, multiple challenges are associated with healthcare [13]. The aged patients are often constrained to get proper healthcare access because of their inability to move. For the working community, the access to primary healthcare services remains constrained during the office hours.

The adoption of technology can help address many of these issues by increasing the modes of communication among the rural, aged and the working population. Home health provisioning systems (HHPS) are systems where physicians provide routine, emergent, as well as enhanced healthcare services at the patient's home, at her convenience for a premium [14]. HHPS physicians can provide specialized services also such as specialist consultancy, house calls, round the clock doctor access, same day appointments, coordinated hospital care, and private waiting rooms [15]. Many of these services are non-available in traditional physician practice.

HHPS helps patients to access healthcare services from their homes. It would also reduce the burden on the doctors during hospital visits, as they would be able to address the issues of critical patients in need. Although it has been prevalent in many developed countries, it is yet to become popular in the developing countries like India. The HHPS has many advantages to the patients which include increased personalized attention [16], increased satisfaction, reduced errors, more convenience, no wait time, staying away from other patients with communicable diseases, value for money

[17], etc. HHPS offers advantages to the service providers also which include extra income without much investment, reduced errors, less crowding, better utilization of the infrastructure and the physicians, etc. The patients could be given the opportunity to receive answers to the follow-up queries through ICT devices.

III. THE PROPOSED SYSTEM

The scope of this system is to provide the users with online healthcare support. One of the important goals of this HHPS is to ensure that all ill people, including the elderly, rural and disabled will receive high quality, personalized, and compassionate care. People in rural areas, homes, and work shifts can benefit accessing this medical consultation online. Since the doctors' prescription is online, even if the prescription is lost, it could be recovered by again logging in. The patient can choose the doctor from a pool of specialists/hospitals.

Our HHPS is recommended for those (i) who cannot leave the house and are too sick to go to the doctors(ii) who live in other places and not at home, and (iii) employed people who do not have time for in-person consultancy. This could be used by people who are always on the move or always busy and do not have the time to go to doctors to get a medical certificate, which they need to produce for work (limited to known patients). This is also useful to get medical prescriptions for patients for those medical conditions they are embarrassed to share about. For example, it is embarrassing for many patients to make an in-person consultation on sexual health, erectile dysfunction, weight problem, or cosmetic problems like acne. This system offers a greater level of patient privacy.

The HHPS is helpful in taking a second medical opinion in case of a requirement. By consulting a doctor who treats with a different approach, it is possible for a patient to get a second opinion in case the first consultation was a physical visit. A patient can conveniently get a second opinion with HHPS when he/ she is not satisfied by the first consultation and advice. This system could save money for those who spend a lot of money in visiting doctors for conditions, which are simple, like bronchitis or athletes foot, for example. The doctors can be chosen based on the language, gender, specialty or hospital affiliation. Special services could be possible at a premium payment. The HHPS database contains the EHRs of all patients registered.

IV. SYSTEM DESIGN

There are three major modules in the system, which are (i) Admin Module (ii) Patient Module, and (iii) Doctor Module. The frontend software uses WAMP, which is more interactive. The backend uses MYSQL database, which is open source. The patient records are stored using MYSQL. We have chosen Windows 10 operating system for its wider support. The communication interfaces are designed to perform online consultation from any place by using a web browser. We are using simple forms for the Admin login, Patient registration, Doctor registration, etc. Payment options include credit/ debit cards, net banking and systems like Paytm. The use of HTTPS (HTTP + SSL) makes all data entry secure.

A. Admin Dataflow Diagram

The Admin monitors the entire system. He/she ensures that only authenticated doctors can register in the system by

providing a unique username and password while adding a new doctor. The Admin adds new departments. Admin can view the schedule of all doctors. Figure 1 shows the admin dataflow diagram.

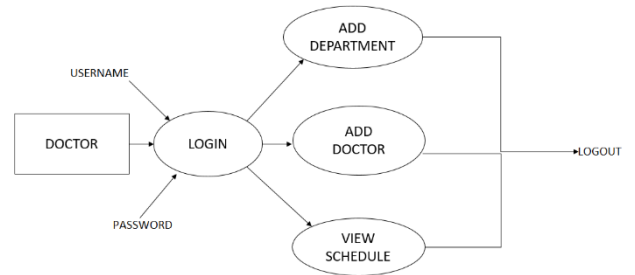


Figure 1. Admin dataflow diagram.

B. Patient Dataflow Diagram

A patient can register by creating a unique username and password, with one-time password (OTP) verification. The patient can then select the department and the respective doctor that the patient prefers to consult. In case of emergency or has an already booked time slot, the patient can directly go for an online consultation. Otherwise he/she can book an appointment from the available time slots of the doctor. After making the payment, the advice/prescription is provided to the patient. Figure 2 shows the patient dataflow diagram.

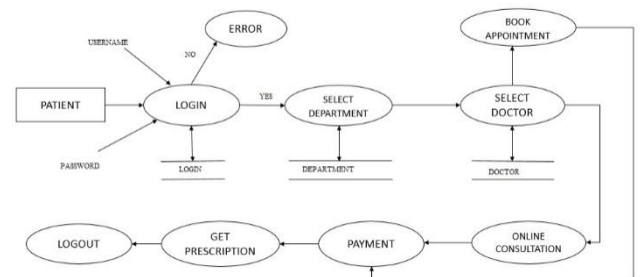


Figure 2. Patient dataflow diagram.

C. Doctor Dataflow Diagram

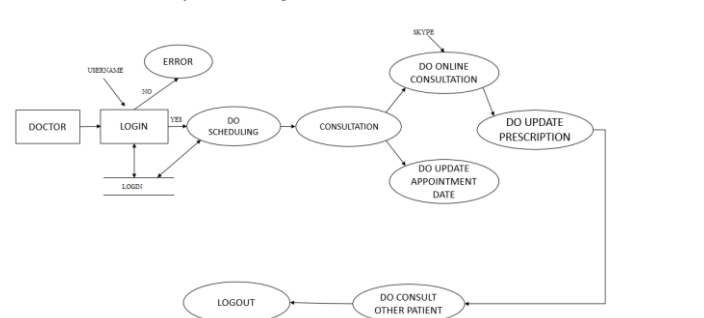


Figure 3. Doctor dataflow diagram.

The doctor can login into the system using his/her username and password, with OTP verification. A Doctor can publish his/her schedule one week in advance with the time slots during which he/she will be available. The Doctor can view all the appointments booked by his/her patients. If any appointment has been booked for that time slot, then doctor

consults his patient through a video call (skype).After consultation, doctor updates the prescription for the respective patient. Figure 3 shows the doctor dataflow diagram.

V. RESULTS

The HHPS creates a win-win situation for both patients and the healthcare service providers. Our HHPS was tested with dummy data and found to be satisfactory. It generates the facility for online consultation, billing and backups as per the requirements. Figures 4 to 10 show some screenshots of the HHPS. This system takes care of the requirements of a medium sized hospital and is capable to provide effective storage of information related to patients.

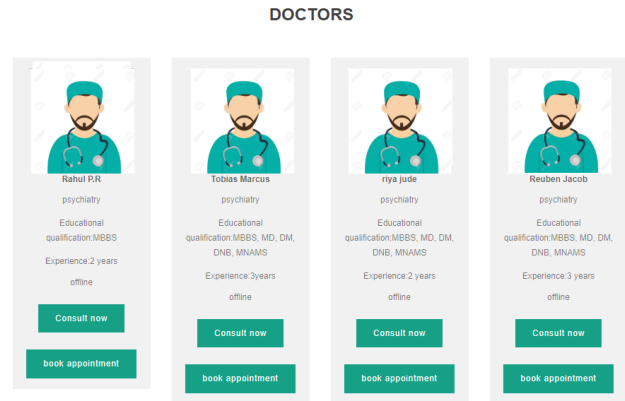


Figure 7. HHPS doctor choices.



Figure 4. HHPS front page.

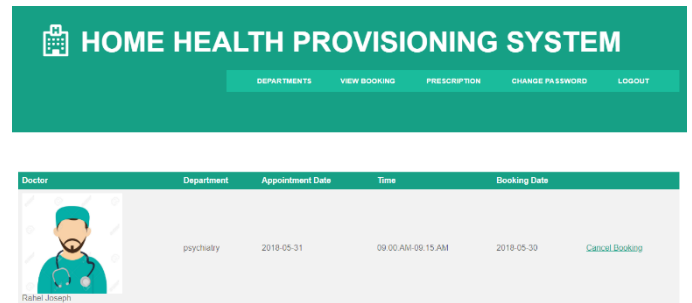


Figure 8. Doctor booking.

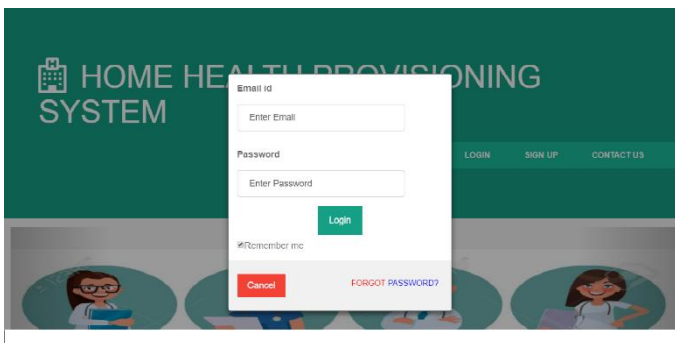


Figure 5. HHPS Login.

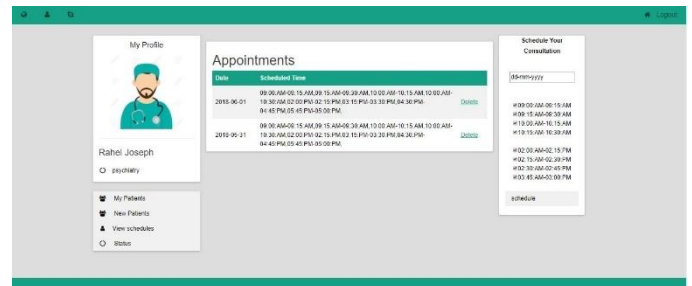


Figure 9. Doctor schedule.

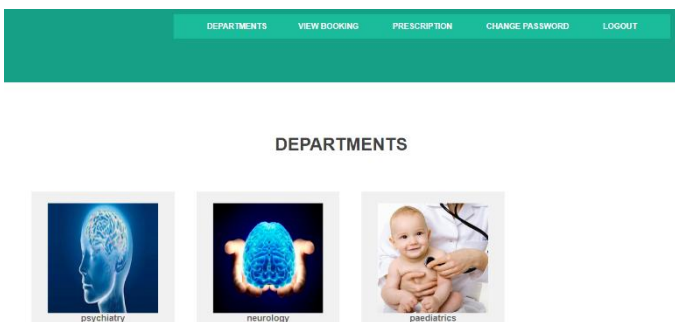


Figure 6. HHPS departments.

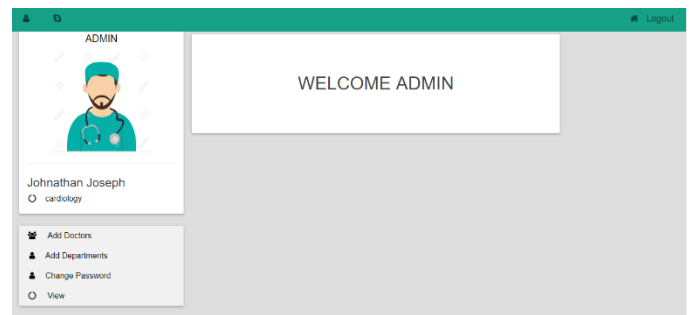


Figure 10. Admin page.

VI. CONCLUSIONS

The HHPS intends to support patients of old age, with disability to move around, located at remote areas or who are working in offices with no time for medical consultations. This is also useful for people to take second opinion on medical advices or for consultancy on medical problems where the patients would like to avoid in-person checkup. HHPS creates opportunity for hospitals to serve more number of people with less number of physicians. It creates an opportunity for the doctors to earn extra income without much investment in time and effort. HHPS could be more effective than the conventional consultancy system because it allows establishing a more solid physician-patient relationship by having provision for longer appointments and 24-hrs access to doctors. HHPS is to be owned by a consociation of doctors or hospitals.

Some of the potential challenges to HHPS adoption include sharing of patients' data securely among hospitals, patient's inability to report the symptoms correctly, and lack of quality internet infrastructure in countries like India. Health literacy and computer literacy are also challenges in the adoption of HHPS in India. The scope of HHPS will expand when internet of things (IoT) integrates personal health tracking devices such as weight scales, personal health scanners, and blood pressure and sugar monitoring devices into the HHPS with the help of mobile apps and cloud services.

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