

MEDICAL CONSULTATION PLATFORM WITH STATISTICAL ANALYSIS

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Abstract--- This paper deals with the problem of medical error, which is the third leading cause of death in the world. A medical error occurs when primary care providers or medical providers don't have proper clinical data and medical history of the patient such as diagnoses, medications, problems, progress notes. In such cases, the doctor fails to understand the complete medical history of the patient which includes the patient's previous medications or some other sorts of complications like allergies, and in turn prescribes wrong medicines, which leads to medical error.

The problem of medical error can be solved by providing the complete medical history of the patient in a summarized way to the doctor keeping the privacy of the patient.

In our paper, a cross-platform mobile-based application made using Flutter is built for the patient, and a web application made using Angular is built for the doctor which deals with the problem of medical error by providing digital paperless prescriptions for the patient.

Since huge amounts of data can be collected here, Machine Learning Algorithms are used for predicting the disease and also for analyzing the trends of the diseases which will give more insights to the doctors, to make them better understand the patient.

Keywords: Medical Error, Digital Paperless Prescription, Flutter, Angular, Privacy, Prevention, Machine Learning

I. INTRODUCTION

This paper deals with the problem of medical error, which is the 3rd most common cause of death in the world. According to a study by [15], John Hopkins University more than 250,000 people lost their lives due to medical errors in

2015 only in the US. The problem of medical error is solved by providing more details of the patient such as previous medication, allergies of the patient in a summarized way to the doctor to make him understand the patient in a better way. Providing a Digital Paperless Prescription to the patient would also help to reduce the medical error done at the pharmaceutical level. Also, the patients will not be required to carry their prescriptions with them, which will automatically be available at the convenience of their mobile phones.

Providing the solution to the above problem will lead to privacy issues. This paper also takes care of the privacy of the medical prescriptions of the patient by giving access to the patient with whom and till what time, he wants to share his medical history, through the secret generated by the patient in the mobile application.

Post pandemic prevention will become an important aspect of human life. In this project, all the prescription data is analyzed using suitable machine learning to give more insights to the doctor to provide some preventive measures for the patients.

The end product will be a mobile-based application for the patient and a Web Application for the doctor. Google Flutter (Cross Platform Native Mobile Application Framework) is used to build the mobile application for the patient. Angular which is easily maintainable because of its component-based architecture is used for building the web application for the doctor. Here, Firebase is used as a backend server for both Flutter and Angular. Python is used for effective statistical analysis of the patient prescription to help

doctors to understand the patient more effectively and efficiently.

II. LITERATURE SURVEY

Leonard Berlin. [1] This is a review of medical errors, malpractice, and defensive medicine. The number of malpractice lawsuits increased at a geometric rate beginning in the 1960s and the 1970s physicians began practicing defensive medicine, which led physicians to order unnecessary radiology exams and tests. In the past 20 years, the number of malpractice lawsuits has been decreasing, but the practice of defensive medicine has continued. Unnecessary exams and tests increase the likelihood of overdiagnosis and overtreatment, i.e., a new kind of error of commission. Saad Dahlwani, Ritesh G Menezes, Mohammad Ajmal Khan, Abu Waris, Saifullah, Mirza Muhammad Naseer. [2] This is a review of the studies ongoing to solve the issue of medical negligence.

The annual productivity of medical negligence research was increasing gradually. The most productive period for medical negligence research was 2011-2020. There are already several efforts underway to solve this problem, but the pace of solving the 3rd most dangerous problem i.e. medical error needs to be increased. Anupama Goel. [3] This paper is a comparative study of American and Indian laws and policies dealing with medical negligence cases. While American laws aim at a quick and effective reparation of injury suffered by a patient and his family, the Indian laws are more amorphous and can potentially result in a multi-faceted attack on the erring doctor. Courts, particularly the Indian Supreme Court, have often tilted the balance in favor of the patient and his family. This may have serious consequences on the morale of the medical profession, as well as the quality of healthcare, which is ultimately provided to the citizens. Hassan Khader Y Almathami, Khin Than Win, Elena Vlahu-Gjorgievska. [4] aimed to investigate the barriers and facilitators that influence the use of online consultations. The systematic literature review identified several external and internal facilitators and barriers to Home Online Health Consultations. The review claims that there was a wide audience facilitated by online consultation but still this was a very big barrier for many people. Ajeet Pal Singh, Hari Shanker Joshi, Arun Singh, Medhavi Agarwal, Palveen Kaur. [5] This paper is a review of Online Medical

Consultations. It puts a doctor in the difficult situation of making a diagnosis without a proper understanding of the patient's medical history and social context, in addition to removing the opportunity to conduct a physical examination. Irina E. Kalabikhina, Dasha A. Matyushina [6] The population must be involved in the execution of the new "telemedicine" law. The expansion of innovative medical consulting procedures should be done in a scientifically sound manner. The purpose of this study is to change the public's perception of online consultation. There were fifty semi-structured interviews, analyses used in script analysis. The main findings include a picture of the public's consumers' attitude towards online medical consultations, as well as the structure of the hurdles to their development. Yefei Yang, Xiaofei Zhang, Peter K.C. Lee. [7] Analyzing behavior patterns of 77,248 patients for the 2014-2015 online health platform report, the time of response, depth of interaction, and content of service during the first consultation process have a significant effect on patients' subsequent consultations. In various periods of doctor's response time, service content and interaction depth, the effects on patient satisfaction are also different. Results provide a management overview of patient consultation management and satisfaction concerning time and type of service. Yingying Miao, Tong Cui, and Bin Jiang. [8] In Internet technology, mobile payments, and big data, many Internet companies rely on their advantages. Begin to join mobile physician layout ranks. If there are many mobile platforms, a mobile service platform is crucial to enhancing user experience by understanding the patients' most urgent emotional needs to identify the best fit for patients' needs. Aqsa Fatima, Ricardo Colomo-Palacios. [9] The security and privacy of patient data is the most significant barrier with access inside the healthcare industry when it comes to the execution of Healthcare Information Systems (HIS). Several studies have recently been undertaken to address security dangers and many solutions have been proposed for the protection of data and privacy. The systemic review of mapping to learn more about HIS security. Analyze the security perspective and some important issues to be addressed for digital technologies to be successfully used in

healthcare. Shivansh Shukla. [10] More incidents of medical negligence are recorded especially in pro bono cases where these medical camps are funded by the Government for the benefit of underprivileged ones. But the poor beneficiaries turned victims can't seek any relief through the Consumer Protection Act because of absence of consideration on their part. Christopher A Alarcon-Ruiz, Paula Heredia. [11] The waiting time and consultation time variables are grouped for association analysis and the results show that patient satisfaction was stronger in the first 90 min of waiting time and in the first 15 min of consultation time. These parameters should be taken into the system while designing the system. Lesley Dornan, Kanokporn Pinyopornpanish. [12] It was based on hospital provider electronic records with a component of implementation, utilisation, or evaluation for health systems or at least beyond direct patient care using three interactive components. The barriers in the implementation of Electronic Health Record are lack of efficient planning, evaluation of current data collection methods, and limitations in information technology training for healthcare professionals. Inconsistent power supplies also led to difficulties in EHR system implementation for patients. Munyaradzi C. Katurura, Liezel Cilliers. [13] The framework chosen was suitable for conducting a qualitative synthesis of data and allowed the researcher to conduct several iterations through the data sources to identify all relevant information. Investing in alternative infrastructure facilities, retaining the information, communicating with technology professionals and encouraging the participation of all stakeholders in the development process is a tedious process. Effy Vayena, Alessandro Blasimme, I. Glenn Cohen. [14] Machine Learning models are used in the clinical setting by healthcare professionals, or embedded in smart devices through the internet of things, and are used for disease management of chronic conditions. Addressing ethical and regulatory issues such as data protection requirements, minimizing the effects of bias (recall bias), being effectively regulated, and achieving transparency for avoiding unnecessary risks will restrict further growth of Machine Learning models.

III. EXISTING SYSTEM

The medical system in the majority part of India still works traditionally. The doctor writes a prescription on paper, which might get lost, and

newer medication is done based on the memory of the patient which might lead to a lot of medical errors.

There were some problems with online consultations such as limited consultation, the complexity of cases due to which we need to improve offline consultation. Online consultation failed to build the trust of patients, due to which patients often change their doctor after the first consultation, and also follow up ratio is very less. It puts doctors in a difficult situation in prescribing the medicines to the patient without physically identifying the problems of the patient well.

In some big hospitals and clinics doctors provide patients with an ID and all the data is stored digitally, that too has limited scope to that particular hospital only.

IV. PROBLEM STATEMENT

There is a need to develop a system that would be able to solve the problem of medical error as well as give some insights to the doctor to make him/her better understand the patient.

V. PROPOSED SYSTEM

The system proposes a mobile application platform for the patient and a web application for the doctors, which stores the complete medical history of the patient keeping the privacy of the patient records. It provides a summarized view of the medical track record of the patient and gives some insights to the doctor to help him understand the condition of the patient with the help of statistical analysis.

There are five modules in the project are:

1. Patient/Doctor Registration
2. Patient Medical Record
3. Secret Code Generation
4. Prescription
5. Statistical Analysis

1) Patient/Doctor's Registration:

In the registration module, the patient's first name, email id, password will be asked at the time of registration. The password can be a combination of alphabets and digits. Once the registration is successful, the patient is allotted an ID. The patient can enter his credentials into the login page to enter into the mobile application. In the same way, doctors can also register into the system by providing their field of specialization. The doctors can also provide

their address and contact information so that patients can easily locate the clinic for offline consultation. After successful registration, the doctor is allotted an ID. The doctor can use this to enter into the web application.

2) Patient Medical Record:

Initially, no medical records will be visible on the homepage of the mobile application. Once the user clicks on the Show Prescription option, the entire medical history of the patient will be displayed. The patient's medical record includes the entire prescriptions of the patient to date. It will also display the different medications and their dosage sorted in terms of consultation dates. The patient can view the available doctors based on their specialization under the List of Doctors tab. The contact number and the address of the clinic will be displayed along with the name of the doctor. The patient can choose any doctor based on the nearest location or any other parameter for offline consultation.

3) Secret Code Generation:

The patient has the privilege to generate a secret code that consists of 6 characters. It can be a combination of alphabets and digits. The patient can share the code with the concerned doctor so that he/she can enter the code to view all the previous prescriptions of the patient. Thus, the privacy of the patient is maintained since he/she can choose the person with whom he/she wants to share the data. The concerned doctor can view the

dosage of each of the medications that the patient has already taken which can help him/her to analyze the condition of the patient in a better way.

4) Prescription:

The doctor can enter the new prescription for the patient with the help of the secret code generated earlier. The prescription includes the description of the patient's situation, the timeline for each of the medicine. Once the data is submitted, it will be stored in the firebase. The patient can find the new prescription in the mobile application under the Show Prescription tab.

5) Statistical Analysis:

The statistical analysis of different diseases is done with the help of Machine Learning ensembling techniques such as Bootstrap Aggregation (Bagging), Random Forest Classifier. The data is preprocessed where the missing values are replaced with the mean of the feature column. The numerical variables are standardized and the categorical variables are dummified. Then the data is split into training and test set in the ratio (70:30) and the model has trained accordingly. The ensemble techniques are applied which gives a boost in accuracy for predicting the risk of disease. The doctor can view the trends and patterns of different diseases with the help of pie charts, bar plots, distribution plots.

The doctor can view the prescription. The doctor can view the statistical analysis to understand the condition of the patient in a better way.

VLSYSTEM FRAMEWORK

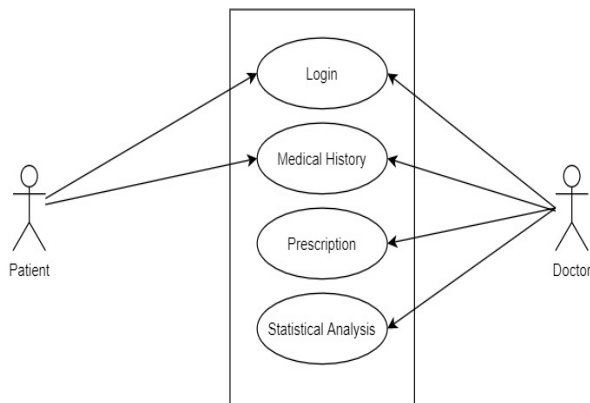


Figure 1. Use Case Diagram

Figure 1 shows the use case diagram where the patient and doctors are the two actors interacting with the system. The doctor/patient should be able to log in to the system. The patient can view his/her medical record. The doctor can view the previous medical records and can draft a new

VII. SYSTEM ARCHITECTURE

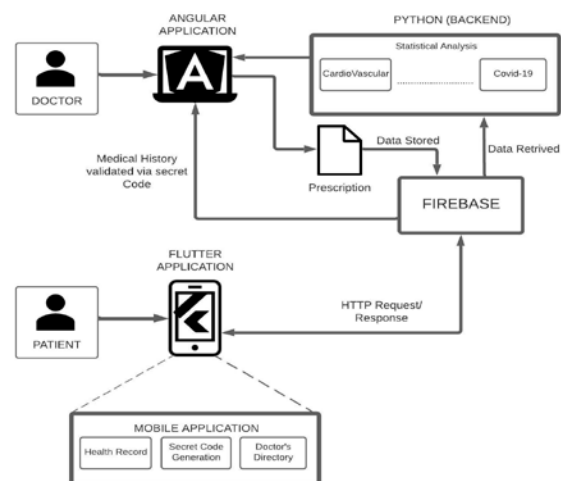


Figure 2. Architecture Diagram

Figure 2 shows the architecture diagram where the patient and doctor are the users. The patient will interact with the mobile application made using flutter which runs both on Android as well as iOS. The patient has the features of viewing medical history, doctor's directory, and generating a secret code used to share medical history with the doctor. The doctor will interact with our Angular Application where the doctor has the features of writing prescriptions to the patient, viewing the medical history of the patient verified by a secret code given by the patient, and analyzing the patient based on the statistical analysis.

VIII. RESULTS

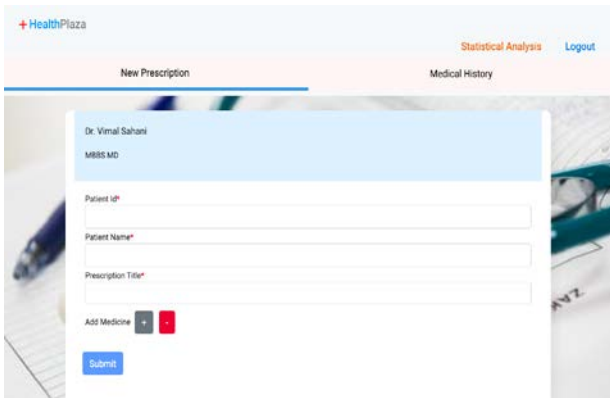


Figure 3. Write Prescription

Figure 3 shows the web-application for the doctor where the doctor will be able to prescribe medicine to the patient.



Figure 4. Patient Prescription

Figure 4 shows the mobile application for the patient where the complete medical history of the patient which includes all the previous prescriptions is clearly shown.

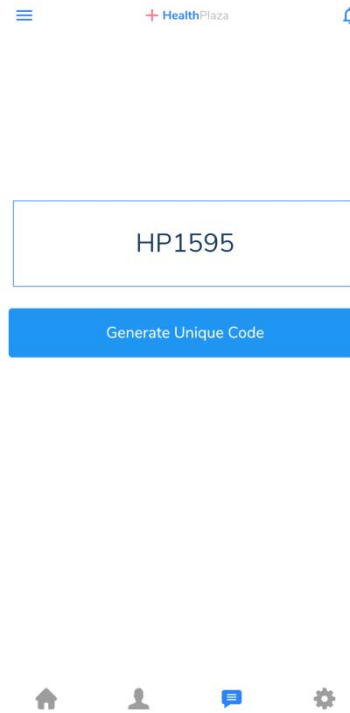


Figure 5. Secret Code Generation

Figure 5 shows the generation of secret code in the mobile app of the patient. This code will be shared by the patient to the doctor to access the medical history of the patient.

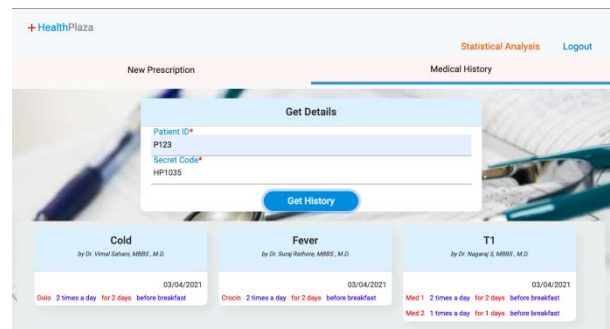


Figure 6. Patient Medical History

Figure 6 shows the web application where the doctor will be able to view the medical history of any particular patient just by entering the patient id and the secret code shared by the patient.

IX. APPLICATIONS

1. This system will replace the traditional medical system with a very effective digital medical system.
2. For patients, this system will act as a one-step solution for all their medical needs, at the convenience of their mobile phones.
3. The Web Application will be used by doctors which helps them to understand more about the patient very easily just by making a couple of clicks.
4. It will help the doctors to analyze the data and provide the proper preventive measures to the patients, which in turn helps mankind.

X. CONCLUSION

In this paper, we addressed many challenging issues related to online consultation platforms. This system has the potential to solve the 3rd leading problem of medical deaths i.e. Medical Error to a very large extent. Based on previous research, we have proposed a system that will give the power of a patient's medical history to the patient rather than the doctor. Statistical analysis proves that this system will be very helpful in taking proper preventive measures at an early stage.

XI. FUTURE ENHANCEMENT

Future work includes the addition of Pharmacy and Pathology Centers into the system, which will make the system a one-stop solution for all the medical needs of the patient. The addition of calendar sync to the system will send notifications to the patient when it's time to take their medication. The schedule of follow-up appointments can also be added.

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