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Doctor's Appointment Booking System Using Recommendation Model

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Abstract— In today's world, health is turning into the spinal cord of each individual's way of life. Suitable health check-up for various health-related problems, every individual needs a specialist Doctor to treat them appropriately. To give ease in accessing the sources to the individuals about the doctors according to their requirements and for the doctors to get ease in accessing their patients and their data, by considering these challenges the idea of this work has been advanced with the use of recommendation system. The application will be used by both; the patients as well as the doctors. The patient will Sign-In for getting the required field of service from the specialist doctors that are available and, the doctors will Sign-In for accessing the patients that are to be treated via appointments made from the application used by the patient's side.

Keywords— Recommendation System.

I. INTRODUCTION

Mobile technology evolved swiftly for the past few years and is growing in popularity. Its adaption rate is rapid in the healthcare sector as many physicians and nurses use iPads and smartphones to aid hospital rounds, communicate, and guide the patients in treatment recommendations. The world health organization (WHO) introduced 'mHealth' as "medical and public health practice supported by mobile devices" and it is something that has the power to metamorphose the way healthcare is delivered. The doctor's application is developed without using any extra device and no payment for this service. This app will help the patients and the doctors to interact for an appointment at any time using mobile with good internet which will reduce the time and hassle of doctors and patients. The doctor's app uses the trained recommendation model which recommends the doctors to a user based on the user's symptoms. The recommendation system makes the application user friendly and handy so that anyone with adequate knowledge of mobile can use this application easily. The application record patient's information in digital format for future usage. This application is used by both doctors and patients. The doctors use this application to accept the appointments, decline the appointments, or to handover the patients. The patients use this application to book an appointment, to search the specialist, or to contact the doctors by email or call.

The rest of the paper is organized as follows: Section I contains the introduction of the application. Section II deals with the related work consisting of the existing work. Section III deals with the proposed work which describes working of the recommendation system and contains the block diagram followed by the working of the application. Section IV explains the pros and cons of the application. Section V analyses the requirements (hardware and software requirements) that are needed for the working of the application. Section VI explains the result of the analysis done from the block diagram. And Section VII concludes the research work with future scope.

II. RELATED WORK

There are several researches works which have adapted an ease in doctor's appointment booking for patients. In dec 2017, a study by **Md. Abdul Majid** in "Smart Doctors Appointment and Prescription System [1]", online appointment technique is used for booking the appointments. The patient can search the doctor and book their appointment. Hence, this study performs only the booking of appointments.

A similar sort of study by **Chaitanya Kusurkar** in "Android Application for Doctor's Appointment [2]", where the patient will book the appointment from their mobile phones. The patient can view the doctor's schedule as well. On the other hand, the doctor can accept or reject the appointment depending upon the doctor's availability. Additionally, the patient will get a message 2 hours prior to the appointment timing as a sort of reminder.

III. PROPOSED WORK

The main idea of this study is to use the Recommendation Model for advancement in ease for the patients. Not every patient will know about the required doctor for the treatment to avail in emergency times. This challenge will be overcome by the recommendation system which will recommend the doctors available for the required treatment to the patient when the patient enters the disease/problem.

The doctors available will be showcased in a well order manner by the ratings given by the earlier patients. The technique of Recommendation System is detailed as follows.

- *Recommendation System:*

Recommender Systems have assumed increasingly more position in our lives from e-commerce to online commercial, recommender frameworks are today unavoidable in our day-to-day online journeys. In a general way, Recommender Systems are the algorithms that focus on suggesting relevant choices to users. Doctor Recommender Systems are one of the new overarching technologies for extracting supplementary information for a patient from healthcare data. These systems find suggested doctors by calculating the similarities of patient's choices. Therefore, they play a vital role in the clinical sector. The doctor Recommender System is based on predictive analytics which predicts and recommends appropriate doctors to the patients. This system can be applied to explicit applications. The doctor-based Recommender System is a decision-making system that recommends appropriate doctor's information to patients. By using this system, patients are recommended about the specialist doctors for a specific disease for avoiding the health risk, and then the patient can book the appointment for that specific doctor.

- *Phases in recommendation system:*

(1) Information Collection Phase: This phase is used to gather important information about the patients and then it generates a specific patient medical ID for every patient depending upon the patient's characteristics. A recommender system is built upon the data which is assembled in a variety of paths, such as explicit feedback, implicit feedback, and hybrid feedback.

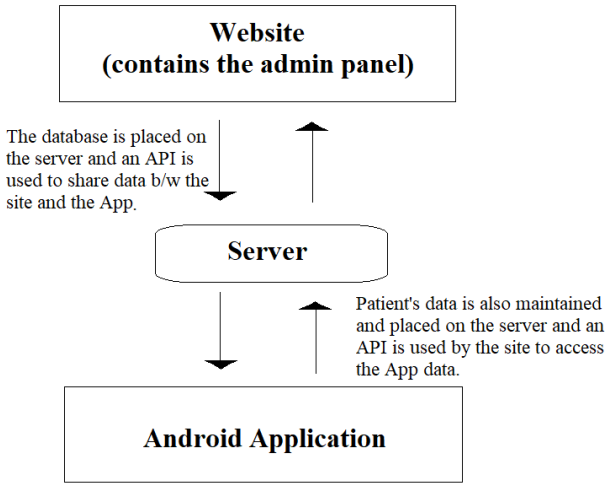
(2) Learning Phase: This phase examines the information that is assembled in the earlier phase as the data put in and then operates on this feedback by deploying a learning algorithm that results in patterns, this phase delivers recommendations for a given set of data.

(3) Prediction/Recommender Phase: Doctors are now given the set of recommended patients in this phase. By inspecting the feedback gathered in the information collection phase, a prediction by the data available can be done through this model. The data-driven method is used to apply data mining and machine learning procedures to take out the intellect from the miscellaneous data. It then gives individual recommenders depending on the past learning experience and the patterns that are drawn out from the clinical data. A compound of information retrieval and machine learning can then be used for the medical database categorizing. The overall collaborative-based filtering Doctor Recommender System consists of the following stages:

i. *Training Phase:* This phase includes information assortment and gathering. However, the nonappearance of appropriate tools for the assortment and gathering of data will hamper the entire procedure. The entire procedure includes gathering different information and data of patients, demographic information of patients, diagnoses, research, clinical tests, patient's health record, real-time data from the hospitals and clinics so that the real-time data collection can upgrade the viability of the recommender.
ii. *Patient Profile Generation:* During this stage, for each patient, a patient profile is generated which contains various data. For every patient, there is going to be a health record reporting the patient's clinical history. This record contains data from different sources, including the patient, doctors, hospitals, laboratory tests, CT scans, X-rays, etc. If the new patient is admitted, at that point the entire process begins from the earliest starting point, i.e., from the preparation of information data and also the creation of a new health record of the patient. In the case of an existing patient, the system refreshes the record according to prerequisites.
iii. *Sentiment Analysis:* To help the patient-based recommender for the clinical services, it is obvious to make sure the patient trusts the entire system, i.e., system reliability to maintain security and confidentiality of the data of a patient. Data which is or not adequate medical data that is acquired from patients is personal and should not be abused.
iv. *Recommender:* From the withdrawn of rules and patient factors, proposals can be generated. Patients will then receive personalized suggestions.
v. *Privacy Preservation:* The System requires the mixing of different clinical data to upgrade the recommender quality so that healthcare improves. In this way, guaranteeing the protection of a patient's data assumes an indispensable job in clinical research. In the proposed method, there will be the integrity of this data that will be kept up while personal identity is viably protected.

- *Working of the application:*

Android is an open-source operating system (Linux based) which is used to build many applications for mobile devices that promotes the individual's tasks easily and faster. The front-end design is simple and user-friendly. The user first downloads the application and installs it on their device. Once the application is installed, it will remain on the user's device until the user uninstalls it. When the user clicks on the application icon, the splash screen that contains the application name and logo will be displayed on the user screen. After that couple of choices are displayed on the screen; First is 'User', and the second is 'Doctor'. Henceforth after clicking on 'User' option, two options i.e., 'Login' and 'Sign-up' will be displayed on the screen. A neophyte user will need to Sign-up and the old user will Log-in for further use of the application.



(*Block Diagram 1*)

For Sign-up option, the user will fill its data in the fields like name, mobile no, email, address, password, confirm password, and then the user will click on the Sign-up button. After signing up, a unique medical ID will be generated for the user where the user will fill the personal details like age, weight, height, ongoing treatments. The user can also upload their old reports, X-rays, etc. All the information provided by the user will be saved on the database. Different validation checks are provided to passwords, email, mobile no field. For Login, users can use mobile no/email and password. If the user forgets a password the link to change the password will be sent to either on their registered mobile no or the email. Users can view their history or personal data anytime.

After login, the main screen will be displayed which will be containing different options like hospitals, doctors, search, history, settings, appointments. If the user selects the option 'Hospital', then all the registered hospitals will be displayed to the user. If the user selects any hospital from the list of hospitals shown, then the details of that particular hospital like name, address, phone numbers, doctors available, and timings will be displayed. Users can select any particular doctor and view the details of the doctor by clicking on the available doctors or by selecting the 'Doctors' option from the main screen. The list of the available doctors will be displayed to the user. Users can view the details of the doctors like phone no, mobile no, address of the hospital he is working, timings, specialty, and appointment. Users can contact the doctor by making a call by clicking on the telephone number of the hospital provided, or the patient can also send an email by clicking on the doctor's email address. Moreover, the user will also get the location of the hospital using google maps if the user clicks on the location icon. This will bring an ease to the availability of the hospitals nearby the patient's location by just one click. By clicking on the book appointment button, calendar and time slots will be displayed. If the user clicks on any particular date then the details of that day like, whether the doctor is available or not, whether the appointments are available or not, and the available time slots will be displayed. The user has to send a request for an appointment by selecting a day or time. Then the central database gets updated accordingly. The user will get a confirmation message "appointment booked" if the appointment is successfully registered in the database. The user can book the appointment anywhere, anytime. By clicking the 'Search' option on the main screen, the user can search for any hospital or doctor from this application. The 'History' option on the main screen will display the history of user like earlier booked appointments or cancelled appointments. The settings option will display the options like your activity, notification, privacy, security, account, help, about. The appointments option will show the booked appointments of the user. The user gets logged out by clicking on the 'Sign out' button on the menu screen. The recommendation of doctors and hospitals will be displayed on the screen as per the recommendation model. The user can give ratings and reviews to the hospitals or doctor services. The doctors can use the same application by downloading and installing it on their device. Further, the doctor will click on the 'Doctor' option which appears after the splash screen. Then there are two options: Log-in and Sign-up. If the doctor already has an account, then the doctor will log in to the account. If not, then the doctor will sign up for the account. If the doctor clicks on 'Log-in', the application will ask for the email/phone number and password. By clicking on 'Sign-up', the fields like doctor's name, degree, specialty, address, hospital address, timeslot, mobile no, email, password, confirm password should be filled correctly and precisely. After this 'Verify' button will be displayed. After clicking on the verify, this information is sent to the admin who verifies the doctor's information and then gives the application access to the doctor by setting the permissions on the server within the 24 hours. Admin will be the Government of India which will have all the records of the doctors and will have the rights to cross-check the doctor's documents at the time of verification. Until then, the doctor can only have read permission and doctor's any information will not appear on the application. After getting permission from the admin, doctor can confirm the appointments, cancel the appointments, handover the appointments, and can see the appointments day and date wise. The doctor will hand over the appointments to other doctors if he is not able to appoint his patients due to some emergency in his schedule. User/patient has all rights to change their doctor or cancel the appointment. If in any case the doctor hands over his appointments, then the patient can either go to the handover doctor for a check-up or cancel the appointment. Doctors can see the ratings and reviews given by the users. Doctors can log out from the application anytime they want by clicking on the Sign-out option. The appointments and doctor's registration are managed by the admin. Admin can view doctors, patient's records, and feedback also. All the data of the registered doctors and patients, and the data regarding the appointments are placed on the server database and monitored by the Admin.

IV. WHY THIS SYTEM IS USED

A. Advantages:

- It will help the users to locate the nearby hospitals by using GPS.
- Reduce wastage of time of citizens for searching the hospital or a doctor.
- Users will get the most rated doctors and hospitals sequentially.
- Users can manually choose between those available hospitals or doctors.
- User-friendly Application.
- Reduces data loss.
- Increases security of data.
- Trustworthy.

B. Disadvantages:

- System is available for only English language.
- User will require an active internet connection and an android smartphone for using this app.

V. REQUIREMENT ANALYSIS

1. Software Requirements:

- Data helper database.
- Android Studio.

2. Hardware Requirements:

- Android or iOS device with depth sensing camera.
- For iPhone: Processor - A10 or latter.
- For Android: Processor - Snapdragon 636 or later, Ram -4GB or more.

VI. RESULT

From the above *Block diagram (1)*, it is shown that the server is the middle part of the application which will interact with the website and the application. The server will receive the database (containing information about the hospitals and the doctors) from the website (which contains the admin panel) and then an API will be used to share the data between the application and the site. And similarly, by the use of this API, patient's data can be accessed by the website with the use of server from the android application.

VII. CONCLUSION AND FUTURE SCOPE

The proposed method is useful for the doctors to see their appointments so that they can manage their time as per the schedule. Also, it is useful for the patients as they can apply and fill the form by sitting at home as it becomes a tedious job to go to the hospital again and fill the form.
This method of recommendation model outcomes the drawbacks of previous studies and enhances the advancement of technique to bring an ease to the patients at their fingertip. The loss of data due to file misplace or any other human error is reduced, and the data of patients is safely stored.

This application has a couple of limitations which will be overcome in future studies. The first one is that this application is available in only one language i.e., English. By making the application available in other languages, this will reach out to each and every corner of the world in future studies.

The second limitation that will be overcome is that the application will be made platform independent. These are the limitations that will be overcome in coming future.

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