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Doctor Appointment Booking System Using Content Based Filtering Recommendation

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***Abstract* - MedicalHelpNet portal is an online doctor's appointment booking system. The system makes it easy to manage various doctors based on their availability. It is a smart web application. Initially all the doctors are needed to be registered in the portal. After registering the doctors can login through the system using their own login credentials. The doctor dashboard contains the appointments placed by different patients. The doctor can accept or reject the appointment. This status will be sent to the patient portal. The doctor can also update the completion status of the appointment. Similarly, patient should also be registered to login through the system. The patient can search and select a doctor to book appointment. The patient can also chat with the doctor. Additionally, a FirstAid Bot and a diet page is also included in this application. The FirstAid Bot will give all the first aid tips to the requested user. The diet page will show all the dieting tips.**

INTRODUCTION

The Medicare industry is one of the rapidly growing industries in the world, because new diseases are identified very fast. People tend to visit hospital when they got a disease. To visit a hospital, people need to book appointment before visiting. In the previous years, booking appointment is a difficult task. People have to book appointment by dialing to the hospital or visiting the hospital itself. Dialing the hospital need some research for getting the hospital contact number. And sometimes, the hospital lines will be busy, So on continuous dialing the person can get the hospital line. In the hospital point of view, the appointment booing is done manually, it needs some human source. And also scheduling the appointment in a busy hospital manually is a difficult process. And also, the ringing phones may also disturb the patients admitted in that hospital. Visiting the hospital has its own disadvantage. If the patient is near to that hospital, it is fine to visit hospital for booking appointment, or else the patient has to travel a long distance to book the appointment and also, he/she have to travel the same distance on the appointment day. And also, the patients have to wait in the long queue for a long time which is an irritating process. In the hospital point of view visiting the hospital also needs some human source. Also, it makes the crowd in the hospital, so that some new problem may arise. To conclude this entire problem an online medical appointment booking system comes into act. Using this system people can book their appointments from anywhere and anytime. They can select any doctors and book their appointments at their time of comfort. They can view the doctor's complete profile, ratings and reviews and if the patient is satisfied with the doctor, then he/she can book the appointment.

LITERATURE REVIEW

In the year 2016, the paper "A Doctor Appointment Application System" was published in the International Journal of Computer Science and Information Security by Shafaq Malik, Nargis Bini and Sehrish khan [2]. The main concept behind this system is to make the appointment booking process easy and in reduced time. It also relieves the patient from standing in a long queue for booking the appointment. This system is an android application. The advantage of this system is it books appointment for the patient. The disadvantage of this system is it cannot do online consultation.

Another paper named Medical Patient Appointment Management published in the year 2019 in IEEE Xplore by Ayman Odeh, Rghad Abdelhadi and Hussien Odeh [1]. The main objective of this system is to reduce the time consumed in booking the appointment by standing in queue for a long time. This is developed using Artificial Intelligence for suggesting doctors. The main

advantage of this system is they can directly consult a specialized doctor. The disadvantage is that there is no first aid chat bot and diet plan in this system.

Deepti Ameta and et al [3] discuss about automatic alarm ringing system where there is an interaction between doctor and patient. Here the patient will get details about doctor availability by using a smart user interface. There is a scheduled remainder which gives warning to the user about their health. The patient can also search doctor wise according to his disease. Interaction with doctor and patient can be implemented in future using video calls.

Jin Wang and et al [4] implemented Markov decision process and adaptive chain modelling.These algorithms can dynamically capture patient preferences, update the value of being a state, and thus improve the appointment decisions.

Jagannath Aghav and et al [5] provides a brief state-of-the-art overview of 'Health Track' smartphone app which is used with wearable biosensors for health monitoring and prognosis of user using biosensor. They provide a quick assessment of how sick someone is and how urgently they need medical care. The advantages are that tracking the vital signs is quick, painless and cheap.

PROPOSED SYSTEM

The proposed system brings all the hospital and private clinics under a common platform. When this is implemented, the patients can easily search for the doctor, whom they are looking for. And can book their appointment at ease. More over patient may feel more comfortable to register and search for a specific doctor based on specialty, location, gender, fees etc.

In the patient page all the available doctors will be listed or the patient can use filter to select the doctor. So, after selecting the doctor, the patient can select a comfortable time slot from the available slots and book the appointment by giving their medical issue as illness.

The doctor will approve the appointment. So that the patient can visit the doctor on the particular day. So, by using this system there is no need to stand in the queue to get appointment to visit doctor. According to our schedule the doctor appointment will be fixed by the patient itself. In case of any emergency for the patient can chat with doctor to get emergency instructions.

Secondly, an online chat has to be created, where the patient can chat with the doctor. If the medical issue is small, the appointment can be booked in online chat and the issue can be sorted out easily. If the medical issue is serious the patient can book the appointment for visiting the hospital.

FIG 1: COMMON FEATURES OF DOCTOR APPOINTMENT SYSTEM.

The above figure 1 represents the overall features which are to be solved in our proposed system. The main idea is to have a proper user interface to implement all the above.

OBJECTIVES

The objectives of the system are

- The patients do not have to wait in queue to book the doctor's appointment.
- It also includes first aid tips for emergencies.
- It includes diet plan for patients.
- Both the doctor and patient can make complaints and resolve their query.

MODULES

Admin: Initially the admin gets logged in to the system with his login credentials. In the admin's dashboard he/she can view his functionality. The admin has to manage the registered doctors and registered patients. The admin should also manage the appointment booked by the patients with the respective doctor. The admin can view the complaints from the doctor and patient and have to respond to those complaints.

Doctor: Initially the doctor has to be registered into the system. While registering the doctor have to give necessary details like, personal details, specialty, experience, slot timings, fees etc. After registering the doctor can log in to the system, and in the doctor's dashboard he/she can view the appointments booked by the patients. The doctor can approve or reject the appointment requested by the patient. And the doctor should give the completion status of the appointment. The Doctor can view the review and rating given by patients. The Doctor can also give some suggestions or complaints to the admin, patients can also give complaint to the doctor, the doctor can view and reply to the patient. In any emergency situation the doctor can chat with patients to give some suggestions.

Patient: First the patient has to register into the system. After registering the patient can log in to the portal using his/her own login credentials. In the patient dashboard the patient can view his/her previously booked appointments. The patient can view the doctor details, search for the doctor and can also use filter to select a doctor and book the appointment at the time of comfort. After completing the appointment, the patient can give ratings and reviews to the doctors. The patient can also make a complaint about the doctor to the admin if needed.

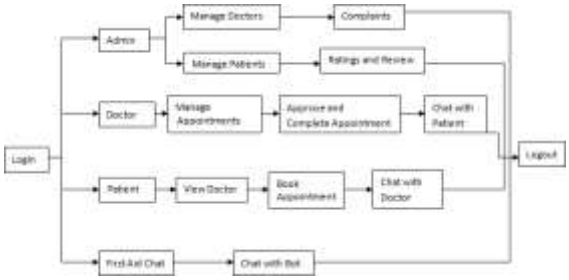
FirstAid Bot: This FirstAid Bot gives basic first aid tips in several emergency situations and the precaution to be taken in such emergency situations.

Diet Page: The Diet Page consists of several diet tips which may be useful to different types of patients

PROCESS

The basic process is shown below in figure 1 which shows the modular description of the process step by step.

FIG 1: LIST OF MODULES



This system contains four modules viz (Admin, Doctor, Patient and FirstAid Chat) Bot. The admin module contains three sections, they are Queries, Patient and Doctor. The Queries section contains the queries from the doctors and patients. Once the doctor or patient post a query, it will be displayed in the admin module (only the non-replied queries). The admin will also reply to those queries in this section. The patient section contains the appointment details of all the patients, the appointment's approval status and completion status and all the registered patient's list. It also contains the queries form the patients and their status of reply.

The doctor section contains the details of the registered doctor and the queries from the doctor and their status of reply. The admin can also view, edit his/her profile and also change the password.

The Doctor module's dashboard contains appointment details. When a patient books an appointment, the appointment request will be posted in the doctor's dashboard. The doctor can accept or reject the appointment. If accepted he/she have to post the completion status, whether the appointment have been completed or cancelled. The doctor can also view the patient's details via their appointment request. The doctor can give complaints or suggestions to the admin, He/She can also view the complaints about them given by the patient and the admin's reply. The doctor can view the profile, edit the profile, change the profile picture, update the certificates, update the gallery and update appointment slot timings. And finally, when the appointment is completed, the patients can give the rating and reviews to the doctor. The doctor can view the rating and reviews.

The Patient module's home page contains the previously booked appointments their completion status and the appointment's complete details. If the appointment is approved and the visit is completed the patient can give ratings and reviews to the doctor. The patient can give complaint to the doctor, and can also view the complaints to the patients about the doctor. The patient module's dashboard contains the list of all doctors, where the patient can choose a doctor to book an appointment. The patient can book the appointment in three different ways. The first way is to search the doctor via search bar by giving the doctor's name, hospital name or and book the appointment. The second way is to search the doctor via specialty filter option. The final way is to search the doctor in the list of doctors available. After selecting the doctor the patient can select the date and time of the appointment. By providing the illness the appointment will be booked. The approval and completion status will be updated by the doctor.

The doctor and patient can also chat with eachother. To use this option, both the doctor and the patient have to be logged into the system. The patient can select the doctor and chat. The doctor can reply to the patient.

The FirstAid ChatBot gives the first aid tips in some medical emergency situations. When the user gives the problem (the medical issue) the chatbot will give the precaution and first aid tip to be done immediately.

And finally the Diet plan. This Diet plan contains the dietary tips for the heart patients, lung diseased patients, kidney failure patients etc. It also gives some tips for yoga and stress related tips.

FUNCTIONS

REGISTRATION

Doctor Registration: The Doctors can register themselves by submitting the required documents. The Doctors will be verified by the Administrator by using medicine degree certificate, hospital license etc.

Patient Registration: The Patients can also register themselves, and book their appointments and also chat with the doctor.

Searching Doctor

The Patient can search for the doctor using some filters like name, specialty and gender.

Booking Appointment

After Searching Doctor, the Patient can book the appointment in the slot in which they are comfortable at.

Chatting:

The Patient can also chat with the doctor with whom the appointment has been booked and clarify their doubts.

First Aid Bot:

The First Aid Bot gives necessary first aid tips in some emergency conditions.

ALGORITHMS USED

Interval Portioning Algorithm

```
Sort the intervals by their start times, breaking ties arbitrarily
Let I_1, I_2, ..., I_n denote the intervals in this order
For j = 1, 2, 3, ..., n
  For each interval I_i that precedes I_j in sorted order and overlaps it
     Exclude the label of I_i from consideration for I_j
  Endfor
  If there is any label from {1, 2, ..., d} that has not been excluded then
    Assign a nonexcluded label to I_j
  Else
    Leave I_j unlabeled
  Endif
Endfor
```

Binary Sort Algorithm

Binary Insertion Sort is used to sort the doctors based on the ratings given by the patients. It sorts the doctors in descending order, so that the highest rated doctor will be displayed first.

Content Based Filtering

Content based filtering algorithm is used in this work for filtering doctor opinion for various patients for a specific disease and compare symptoms of same disease.

IMPLEMENTATION

The user will first visit the web application. The home page of the application is shown in figure 2. It asks to select whether the user is a patient or a doctor. So that the user can select his own.

FIG 2
LOGIN SELECTION PAGE

whether the user is a patient or a doctor he/she have to register in the portal. The registration for the doctor includes the details like personal information, academic information, location of the hospital, hospital open and close timings, appointment slot details, doctor's degree certificate, hospital license etc.

The registration page of the doctor is shown below in figure 3

FIG 3
DOCTOR REGISTRATION PAGE

After registration the doctor or patient can log in to this system using his/her own login credentials. The Doctor login page is shown below in figure 4.

FIG 4
DOCTORS LOGIN PAGE

The Patient login page is shown below in figure 5. The Patient can log in to the system using his/her own login credentials.

FIG 5: PATIENT LOGIN PAGE

When the doctor logs into the doctor dashboard the home page of the doctor is displayed as shown below in figure 6. It contains the details of the appointments booked by the patients for the respective doctor. The doctor can give complaints or suggestions to the admin. He can also view the complaints about him. The Doctor can view the medical history of the patient.

FIG 6: DOCTORS DASHBOARD

The profile page of the doctor is shown below in figure 7. By clicking the view profile button in the doctor's home page the doctor can view his/her profile completely. The doctor can also edit his/her own profile by clicking edit profile button. After editing he/she can click save changes, so that the changes will be saved.

The patient dashboard is shown below in figure 8. In Patient module, when the patient logs into the system, the patient dashboard is displayed. It contains the details of his/her appointment details, the status of approval and completion. The patient can also make a complaint about the doctor to the admin.

FIG 7: DOCTOR PROFILE PAGE

FIG 8: PATIENT DASHBOARD

The medical history page is shown in figure 9. The medical history of the patient can also be viewed. The medical history contains name, age, gender, illness, the appointment details like doctor name, hospital name, appointment date and time.

FIG 9 PATIENT APPOINTMENT PAGE

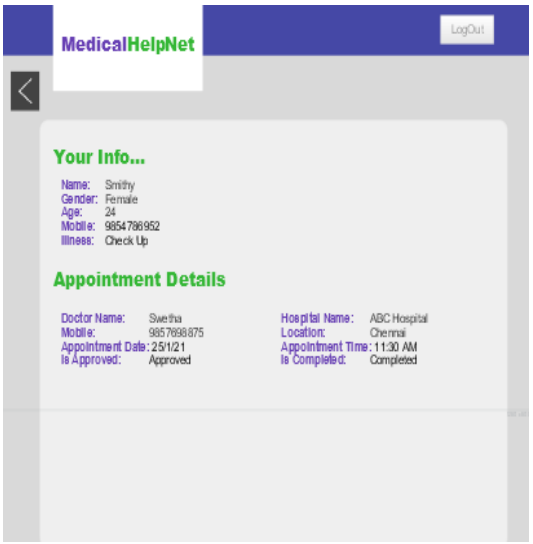
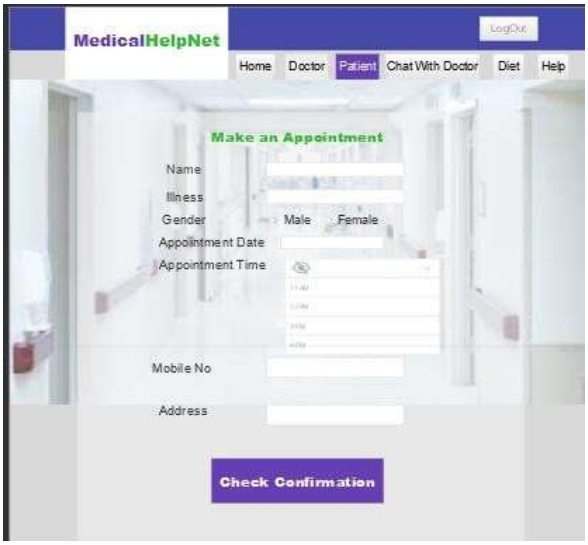


FIG 10 SEARCH DOCTOR PAGE.

The appointment booking page is shown below in figure 11. The patient can view the doctor's complete profile and book their appointments by giving their name illness gender appointment date and time, contact details and location and click check confirmation.

FIG 11. APPOINTMENT BOOKING PAGE



To chat with the doctor both the patient and doctor have to log in to the system. When the patient logs into the system he/she will see the list of available doctors. He/She can select any doctor and make a chat with them. When the doctor logs in, he/she will see the message from the patient. The chat history is also available as shown in figure 12.

The first aid chat bot as shown in figure 13, gives some medical assistance in any medical emergency situations. When a person ask for a medical help in emergency situation the chat bot will give the solution for the particular problem.

FIG 12 DOCTOR PATIENT CHAT PAGE

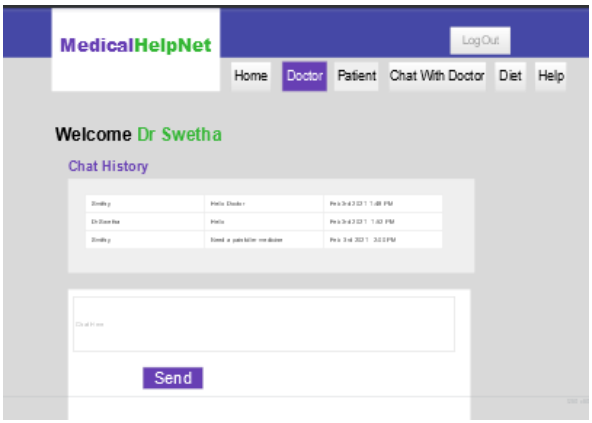
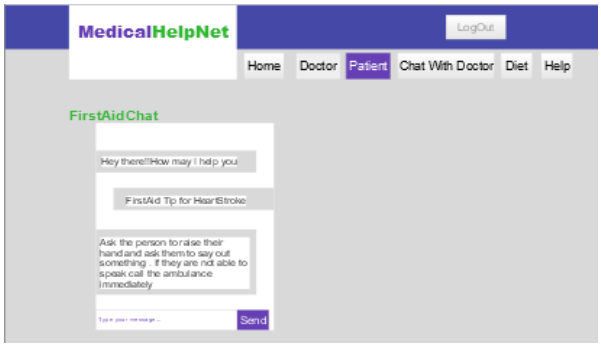


FIG 13 FIRST AID CHAT BOT PAGE



Finally, the diet page displays some dietary tips to be followed by different types of patients like heart patients, lung disease patients, kidney failure patients etc. This page also gives some tips like yoga related tips, stress related tips.

CONCLUSION

The main goal of the system is to manage the doctor's and patient's time. And also, to reduce the time consumed for booking appointment in hospitals. This was implemented effectively using content-based filtering algorithm, binary search algorithm and Greedy algorithm.

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