GPS BASED MEDICINE INFORMATOR

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Abstract - *Situations have arisen, that having internet at our disposal, we tend to find the answers of most of our queries online. One such frequent searches includes disease symptoms and its possible cures. Many times common people do not have medical knowledge of the functionality a particular medication can provide. Searching online is the far stretched process that can be used for the recognition of the same. We are focusing on integrating the search of the medicines, its usages and the closest pharmacy locations, at one single platform. A platform having the database contents of the medicine, the cost of it, illness that it can be prescribed for along with the pharmacies where the medicine is available. Having the ease of getting the required information at a single place, rather than penetrating through series of web links to get the information. Our goal is to make healthcare understandable, accessible and convenient.*

***Key Words*: Naïve Bayes Classifier, Rule Based approach, Negation, Hybrid Methods, Optical character recognition, Location.**

1. INTRODUCTION

The growth of internet and mobile technology has made getting information easier than ever. This rapidly changing business environment is largely been driven by new breed users, who are inclined towards adopting technology which is- quick, easy-to-use, readily available. For instance any required information is been searched on internet, for that is available at finger tips. Considering India to be searching for the topics related to medicine information more than other countries according to the trending searches on google, we are attempting to infuse various parts of the medicine and healthcare departments. The user has the feature to type or directly click an image of the medicine and search it, to get the required information. Additionally, the application will also show the end-user the availability of that medicine in his locality and the pharmacy in which he will be able to find the medicine. Giving the following information of basic cure to common ailments, the user would have the ease to acquire the medicines from the closest pharmacy, avoiding the places which will not have the medicines, saving further time and efforts. Designing an application which doesnt only help the end-user, but also the other nodes related to the medical domain. Categorically, the seller, the prescriber and the consumer; each one using the application for relatively

different purpose with their own benefits. Additional, interactive chat bot shall be at user service at all times for the chatting with the concerned doctor. Predefined bot can take user inputs and then set an appointment or online consultation based on the problem the user is facing.

1.1 Proposed Idea

Medicine Locator is a mobile application useful for the users aiming to find medicine related data for various medical fields. The main aim of the project is the development of a Medicine Locator Application focusing on medicine contents, symptoms that medication can be used for and also the possible pharmacies where that medicine shall be available. Saving the user from the hassle of running one chemist store to another when in need of specific medicine! Our app brings to you an online medicine platform, which can be accessed for all health needs. You can also get the health related consultation with the best doctors nearby We are focused towards making healthcare accessible and affordable and so give you plenty of options in terms of medicine substitutes. The application will be using an API for medicine database which will contain data such as the medicine name, contents and the information which will be retrieved from this database whenever that particular name of medicine has been searched into the application Another database is also used to keep a track of the basic interaction the user will have with the chat bot and the symptoms specified by him to find the relevant doctor to sought the illness the user is facing. With respect to different modules or node of medical field, Medicine Locator application can be used for various purposes, all under one single application. Medicine Locator application also helps to have personal interactions with the doctors for common ailments, so the consultation happens at user leisure. Also, not waiting for queue to get the appointment of the doctor. If the illness needs personal checkup, appointment can be booked with the recommended doctor as per the needs. With us, you can know about the composition of medicines prescribed to you by your doctor and search for its same but equally effective substitute, along with the symptoms it can be used for. Taking the stress away from the users, when making recovery easier and faster. Many times the doctor may not prescribe a medicine because he may not be sure as to that medicine is available in his proximity or not. In such cases the doctor can use the app to find whether the pharmacies present in his locality has availability of that medicine. If not then he can prescribe some other substitute for that medicine.

1.2 Proposed Algorithms

Sentiment Analysis in our application will be used to give ratings to the doctors depending on the various feedbacks/reviews received from the customers. This method of rating has various advantages such as:

• Scalability: Sentiment analysis allows to process data at scale in an efficient and cost-effective way i.e. it becomes difficult to read all of the data present especially if it's a large set.

• Consistent criteria: Humans do not observe clear criteria for evaluating the sentiment of a piece of text when judging the sentiment for that particular piece of text. It's a subjective task which is heavily influenced by personal experiences, thoughts, and beliefs. By using a centralized sentiment analysis system, companies can apply the same criteria to all of their data. This helps to reduce errors and improve data consistency. There are different algorithms and methods in which sentiment analysis can be implemented. These include automated methods, Rule Based methods and Hybrid methods. The one we will be using in our project is a hybrid method wherein well be using a combination of both Rule Based as well as automated method. For automated method well be using Naive Bayes algorithm and for Rule Based method well be using a simple counter algorithm which will count the number of positive and negative words along with some additional negation and emotion words to improve the accuracy.

2. WORKING OF ALGORITHMS

Naive Bayes classifier: Naive Bayes has been studied extensively since the 1950s. In Naive Bayes algorithm words are classified into two classes positive and negative and are conditionally independent of each other. This is a type of Supervised Machine Learning Algorithm. Hence, we'll need a Dataset with proper labelling of positive and negative review. Once we receive the positive and negative reviews, we can move on to extract the features out of this dataset. The first thing to be done in this will be to change the form of the sentences to more meaningful words. For this the first step would be to perform word tokenization. Tokenization is splitting up of the strings into words. The second step is to lemmatize it. Lemmatization returns the root form of any particular word eg. Signing - Sing, Studying - Study, Studies - Study. Then we remove all the Stop-words. Stop-words are just the words which does not provide any sentiment meaning to the sentences eg. 'a', 'the', 'above', 'behind' etc. Now once we have all the important features, we can now start the extraction of these features. For the extraction purposes we'll be using Bag-Of-Words Model – The bag-of-words model is commonly used in methods of document classification where the (frequency of) occurrence of each word is used as a training feature of the classifier. Once we have the most used words from the list, we'll then be taking

into consideration the reviews and the labels provided along with the most frequent occurring words. This will be the training set for the Naive Bayes classifier model. Once the model is trained it can then be used to find the sentiment of the new review passed onto it. It will provide the results in terms of a probability value denoted by Nb. Naive Bayes classifier can be further explained as:
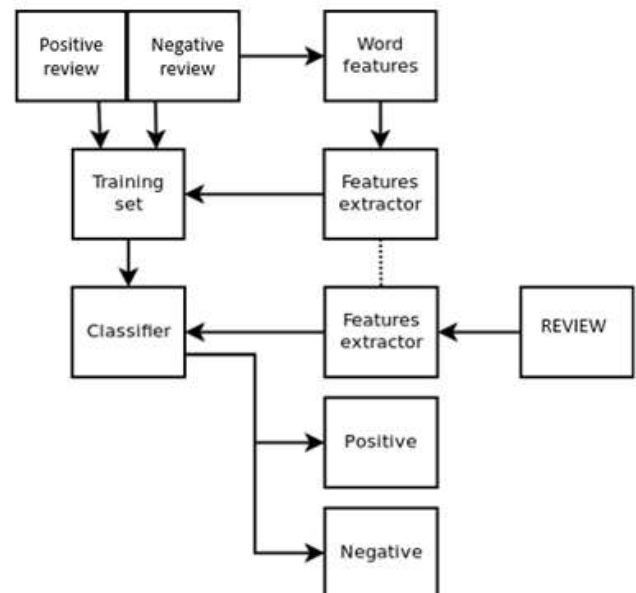

Figure 1: Naive Bayes Classifier

Rule Based Approach: The second approach is a rule-based system. Usually, rule-based approaches define a set of rules that identify subjectivity, polarity, or the subject of an opinion. In our case we'll be using three dictionaries for this purpose which are a Sentiment Dictionary, Sentiment Degree Dictionary and a Negation Dictionary. The sentiment dictionary will consist a list of all the positive and negative words.

Term	Description
S_C	Sentiment Calculation
N_B	Naive Bayes Probability
N_C	Number of clauses
R_w	Total No. of positive words – Total No. of negative words
ND	Negation Factor
D_w	Degree of Sentiment
N_s	Normalize sentiment score

Figure 2: Rule Based Approach

Negation Dictionary will consist of all the negation words such as 'not', 'no', 'unlike', etc. And finally Sentiment Degree Dictionary will consist of words which are divided into different levels starting from L1 till L5 where L1 which contain all the high emotion words such as 'most', 'best', 'greatest', 'absolutely', etc. followed by L2 and so on till L5. Now the review to be evaluated will be taken into consideration. The first step here will be to tokenize the sentence and then to tokenize words from each sentence. It is important to note down the number of sentences (Nc). Then once each sentence is separated into different words these words can now be used to determine the sentiment using the various dictionaries present. It will check the number of positive words and negative words using the Sentiment Dictionary. Once the count of positive(P) and negative(N) words are found the next step is to find the difference between them given by Rw=P-N. Similarly the algorithms then counts the number of Negation words present which is given by ND. And finally the degree of the word is found using the Sentiment Degree Dictionary denoted by Dw. Then we find the effective sentiment polarity by using the formula:

$$S(r) = ((-1)^{ND}) + Rw + Dw$$

This is to be found for each sentence separately. Now comes the step where we'll be merging the two systems. This will be done by using following formula:

$$Sc = (Nb/Nc) * \sum [((-1)^{ND} + Dw + Rw]$$

$$Ns = (10/[1 + e^{(-Sc)}]) - 5$$

Normalize sentiment score (Ns) will be the final rating for the particular review. It will be in a range from 0-5. For our purposes we will be creating our own datasets manually which will include reviews given by the patients to the doctors. Feedbacks/Reviews for creation of datasets can be found from various online sources such as HealthGrades.com, RateMDs.com, Vitals.com, etc. It will be similar to what is shown below:
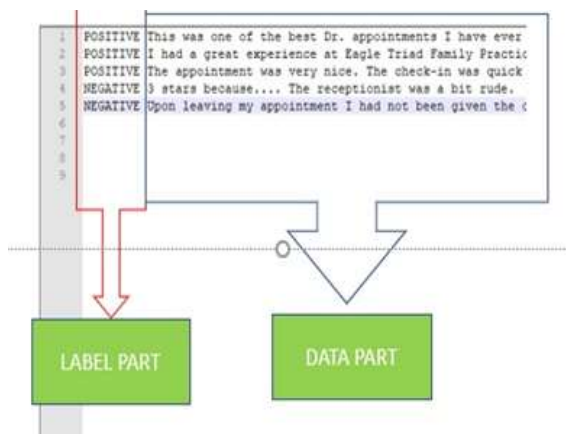

Figure 3: Datasets for the sentiment analysis

Algorithm for Location Based Search of the Pharmacies:

1. Dijkstra algorithm, plays a tiny part in finding the routes, and was initially used in year 1959. Along with the other improvements the dijkstras is now integrated with various other optimized algorithms. For algorithm, Dijkstra adds to the map technology using the idea of a priority queue. Computing a route a long way across a large map can be expensive and slow.

2. Astar has been a very important concept in traditional AI, and many route calculation algorithms include it. Astar may provide a larger performance advantage for graphs, but not much for road networks.

3. Algorithms to perform geocoding and reverse geocoding: Geocoding is the process of transforming a description of a location—such as a pair of coordinates, an address, or a name of a place—to a location on the earth's surface. Reverse geocoding is the place name can be processed using back (reverse) coding of a point location (latitude, longitude) to the name. Most of these algorithms have already been implemented with many more optimizations and more efficient algorithms in many applications. Since we need the most optimal and efficient way to detect the locations, we'll be making use of Google Maps API in which we'll be specifically making use of Maps SDK for Android, Directions API along with additional APIs for more efficient usage.

Text Recognition(OCR):

It is one such system that allows us to scan printed, typewritten or hand written text (numerals, letters or symbols) and/or convert scanned image in the file of plain text or a word document. Difficulty faced in OCR is that sometimes it is not able to recognize every text present in the image for reasons like having a shiny surface, or bad lighting etc. In that cases what we can do is that there will be a separate file in which the word which is more relatable to the text will be stored, and after the deep search is finished , names from those file will be displayed to the user , from which he can choose which medicine it was. Also if we use this technique there is a possibility that this algorithm might consider words such as 'a', 'the', 'is' etc, which are most likely to repeat. So to avoid considering those words, there will be a file which will have all the words which are repeating and a search will be performed to eliminate those words.

```
binarySearch(int low,int high,int key)
{
    while(low<=high)
    {
        int mid=(low+high)/2;
        if(a[mid]<key)
        {
            low=mid+1;
        }
        else if(a[mid]>key)
        {
            high=mid-1;
        }
        else
        {
            return mid;
        }
    }
    return -1;          //key not found
}
```


Figure 4: Working of binary search Algorithm

In OCR the following procedure is been followed to identify the medicine name. First user takes a snapshot of the medicine packet, where he/she is shown a preview of that image and two options will be given. One will be continue with the image and second will be delete image. If user thinks that the image is good enough, he will continue with it and if user thinks that image is distorted, than he might take another snapshot of the medicine and will proceed with that. Now once OCR gets the image, it will find out all the possible words from that image and an AlertDialog box will be shown to the user, which mainly will contain all the words detected by OCR. User will select the word which closely matches its medicine name and that input will be given to firebase to locate any medicine name related to that selected word. Firebase will revert back with all the medicine name that blend with the given input and another AlertDialog box will be shown containing medicine names. User then selects from that AlertDialog box and he will get all the details of the medicine. Search bar with AutoComplete Function: Another way to get medicine details is by searching in the provided search bar. Search bar contains an AutoComplete functions which predicts medicine names based on user's input. AutoComplete listens for any change in the input and if there is any subtle change, it will call firebase immediately for the data and the data will be stored in an array which will be displayed through RecyclerView.

Sign In/Sign up: A Sign in/Sign up facility is been provided for user as well as doctor. A sign in for user is mainly to store personal details of the user, so that when user contacts a doctor , his/her personal details are been given to the doctor(not all) so that doctor might find it easier to contact a user. Sign in facility is given to doctor so that, suppose a user needs doctor's clinic address, user can get it easily. Another reason is that, after a small talk with the chat bot, it suggests user with recommended doctors list. So when a user selects any doctor from it, that doctor should be notified that he/she has been chosen by the user. All the authentication is been done by firebase itself, and to store user/doctor details it uses real-time database and when a particular email/password is entered, firebase created unique user ID which is linked to that particular user/doctor.

Chat Bot:

1. Multinational Naive Bayes: This algorithm will separate each word and will match the word to its respected intent. At the end the intent which has maximum score is selected and the responses within it will be displayed.

2. Decision Tree Algorithm: In decision tree algorithm, basically a question will be asked and will be provided with related options. A user needs to select it from that particular options which will take him to the next part of conversation.

3. Artificial Neural Networks: Each sentence is broken down into different words and each word then is used as input for the neural networks. The weighted connections are then calculated by different iterations through the training data thousands of times. Each time improving the weights to making it accurate. Algorithm used here will be feed forward neural network algorithm. For chatbot, Service used is Dialogflow. In Dialogflow, basically it contains intents, Responses, Entities. So in Intent part, it will contain similar set of things. Like a welcome part, wherein it will have some sample inputs, Entities and responses to that text. In entities part, it will carry data, such as name, date etc which can be used for displaying in response part. In response part, there will be different types of responses related to that topic. So now, first chatbot will ask some basic questions giving multiple choices. User will select it from that options. This will be carried out for some simple questions. When there will be a part where user needs to enter text, over there multinational naïve bayes algorithm will be used and will be sorted out to different intents based on symptom. At last all that data will be combined and chatbot will give some recommendation for doctor, wherein user will select one of them, and that combined data will be forwarded to doctor, where in he can just analyze the data and response according to it.
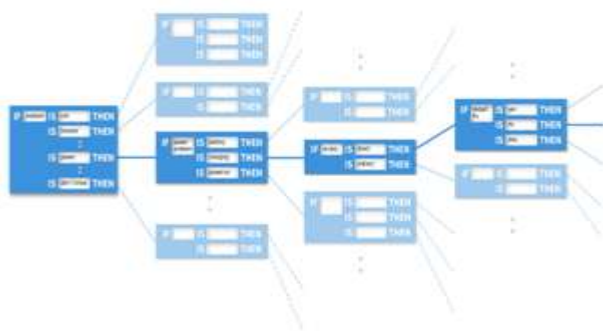

Figure 5: chat bot data extraction

Chat Bot will be basically used to gather all the basic data , which doctor needs to know so that time is saved. Mainly chat bot will be working on decision tree algorithm , where in several questions will be asked (MCQ) and their response will lead to the next questions. All this data will be stored in a file and later doctor can refer that file and act accordingly. Dialog flow is been used to create Chat Bot where in Intents will have similar type of questions, Entity will contain the data , and Responses will have different response to that particular query. Firebase database will be used later-on to store data from entities to a server.

3. APPLICATION OUTPUT

OCR (Text Recognition)
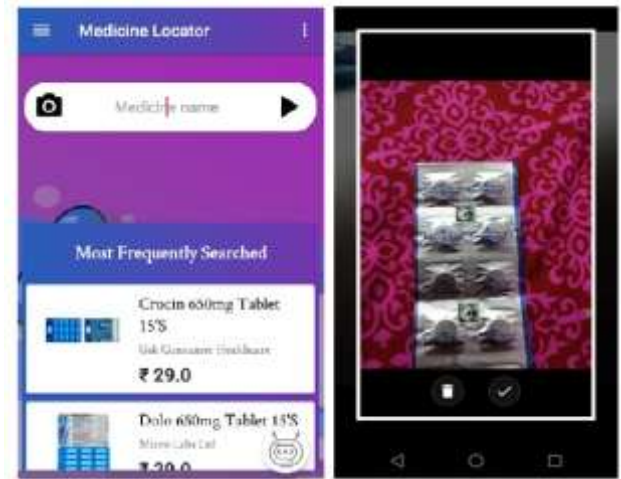
Now for scanning a medicine, there will a button given which has a camera icon on it. On clicking it, first it will ask for camera permission and then mobile camera will be opened, and a user will be able to click medicine picture. After that an option will be given to keep this image or to discard it and click another image. If user clicks on delete icon button, the image will be deleted and user will be able to click another image. If the user clicks on confirm icon, after that OCR will recognize all the words present in the image and will be shown to the user. After that user will select the word which resembles the medicine name that he scanned. Once the user does that, all the medicines related to that word will be shown.

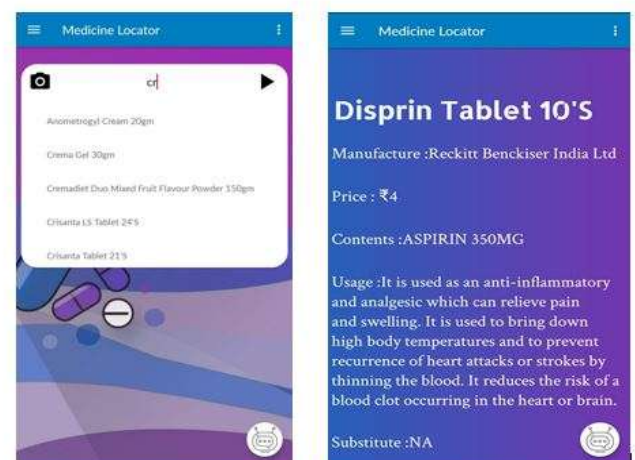After that user can select that medicine name and respective details will be shown to the user.

Figure 6: The OCR screen- with autocomplete feature

Chat Bot:

In Chat Bot the basic data which a doctor needs to know is combined, so that the time is saved. Chat bot asks certain question and based on that it selects certain data and combines and creates a final message which the chat bot sends to the doctor. Now when user describes his/her symptoms, chat bot basically identifies it , and suppose chat bot finds out that the symptoms points out to some common problems, them it will suggest some medicine by itself And suppose it finds out that the user need doctor's attention based on symptoms, then it will basically tell a user to select a category and based on rating it will list doctor of that type.
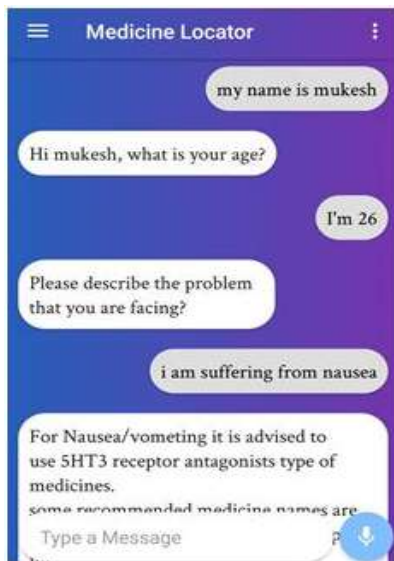

Figure 7: Chat bot Screen

Later user will select the doctor from that given option, and the integrated message will be mailed to the doctor along with user's basic details. Once doctor suggests something to the user, a feedback pop up will appear on users screen and user can give that doctors feedback over it.

Figure 8: The email which is composed and sent to the doctor

After a specified time frame a pop-up will be which will ask the user about their experience with the respective doctor, the user's input will be then stored in database and further the sentiment analysis will be used on it to determine the ratings of that doctor.
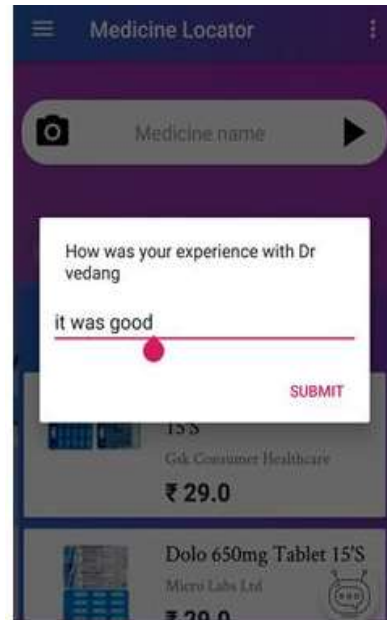

Figure 9: The feedback screen

Automated Rating from Feedbacks (Sentiment Analysis): Feedbacks will be taken from the users for each doctor. Once the feedback is received it is then converted into a sentiment value which then finally will be converted into ratings. These ratings are set after merging the Naïve Bayes and Rule Based approach. For normalizing the rating value between 0-5 we will be using the formula.

$$Ns=(10/[1+e^{(-Sc)}])-5$$

where Sc is the value of Sentiment Calculation after the merge. Finally we will find the average of all the rating value for each doctor and then provide a final star rating to the doctor out of 5.. Which will work in the backend of the application.

Displaying pharmacy on the Maps:

Pharmacy will have to first register into our application and fill a form which will include the details of the pharmacy, address and its location coordinates. This data will be stored in our Firebase Database. Only registered pharmacies will be eligible to be shown into our application. Pharmacies will be displayed on the maps only if that pharmacy has the availability of medicines which the user wants to search i.e. if the medicine name is present in the database or if the stock of a particular medicine is not zero. Searching for availability of medicine "Actizo DT 40mg Tablet" will display only Pharmacy8 on the maps since Pharmacy7 doesn't have that

medicine in its inventory. If the stock of that medicine in Pharmacy8 would have been 0 then it wouldn't have been displayed on the maps. Once selected the user will be navigated till the destination location.

The closest pharmacy will be search and app navigation will be provided if the user choose the "show route" option.
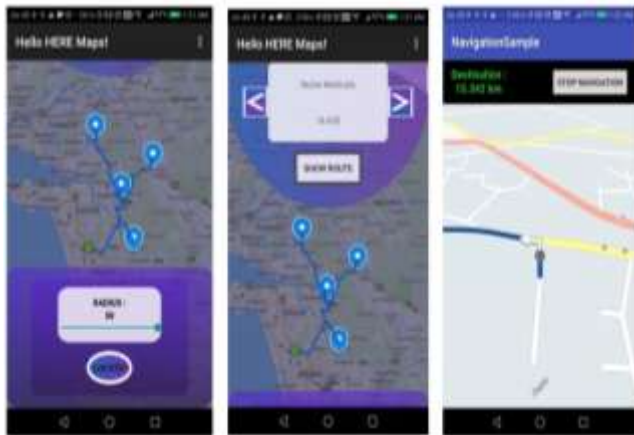

Figure 10: Pharmacy Location based radius screen

4. CONCLUSION

The application "Medicine Locator" scans the medicine name, or takes typed input of the name compares database and gives relevant results. Users are able to locate pharmacies near them where they can find the medicine they are looking out for, all time assistance is provided in the application with the help of chat bot .Doctors are prescribed from the top ratings provided by user in their area of expertise. Initially the study of implementation of various modules involved in medicine Locator was studied and the requirements of the different modules was analyzed. Different research papers are used as reference for the study of Opinion Mining and the different approaches used for its implementation. Basic implementation of Optical Character recognition, Sentiment Analysis, Chat bot and Location was successfully carried out, by the end of November 2018.Additionally, we have learnt android studio, LaTex software, Dialog Flow, Adobe XD and Firebase Database, Along with various technologies and API's used in the mobile application. The study of implementation of various modules involved in medicine Locator was planned based on its UI/UX part. Detailed study of the database was carried out and the basic implementation of divided modules was tried. Medicine database was created, Pharmacy data was added. Further enhancements were made based on the sterilized search rate and the application overall size was reduced significantly using Fragments. Chat bot was trained according to the requirements of our medicine locator application, and the database was created to save the user details. Datasets that are to be used in the searching of the medicine, the users login/sign and Sentiment Analysis.

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