Final Year Project
Report On

Health Care Chatbot

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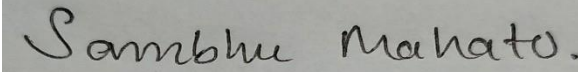**Kolkata, India**
2020 – 2021

Declaration by the Students

We, Bishal Das & Sambhu Mahato, hereby declare that this project report entitled "Health Care Chatbot" contains only the work completed by us as a part of the Bachelor of Engineering course, during the year 2020-2021, under the supervision of Asst. Prof. Utpal Kumar Ray, Department of Information Technology, Jadavpur University.

All information, materials and methods that are not original to this work have been properly referenced and cited. All information in this document have been obtained and presented in accordance with academic rules and ethical conduct. We also declare that no part of this project work has been submitted for the award of any other degree prior to this date.

Signature:

Date: 05.06.21

Signature:

Date: 05.06.21

Certificate

   This is to certify that the project entitled Health Care Chatbot carried out by Bishal Das and Sambhu Mahato and submitted to the Jadavpur University during the year 2020-21 for the award of the degree of Bachelors of Engineering (Information Technology), is a bona fide record of work done by them under my supervision.

Signature of the supervisor : *Utpal Kr. Ray*

Date : 05.06.21

Acknowledgement

We are very happy to present before you our project titled "Health Care Chatbot" . However we would not have been successful without the help of some people. Firstly we are grateful to Asst. Prof. Utpal Kr. Ray without whose guidance and supervision our project would not havebeen possible. Next we would thank our parents whose affection and care was a constant source of inspiration for us. Next we would like to thank our dear friends whose comments and constructive criticism madeus rectify various loopholes in our project.

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Abstract

Healthcare is essential for a good life. Unfortunately, consultation with a doctor can be difficult to obtain, especially if we need advice on non-life threatening problems. The proposed idea is to create a system with ArtificialIntelligence that can meet the requirements. Medical chatbot is built with medical applications having the potential to reduce healthcare cost and improvesaccessibility to medical knowledge. Some chatbots are compact medical reference books, which are useful for patients and for those who want to learn more about health. The real benefit of the chatbot is to provide advice and information for an healthy life. A text-to-text diagnosis bot engages patients in conversation about their medical issues and provides a personalized diagnosis based on their symptoms. Hence, people will have an idea about their health and have the right protection.

Keywords- Chatbot, Artificial Intelligence, Text-to-text diagnosis

CONTENTS

CHAPTER 1: INTRODUCTION

Artificial Intelligence gives the supreme power to mimic the human way of thinking and behaving to a computer. Chatbot's are such kind of computer programs that interact with users using natural language. Chatbot works basically on Artificial Intelligence. Using this capability we have decided to add somecontribution to the Health Informatics.

Our project builds a text-to-text conversational agent that diagnosis patients explaining their condition using natural language. The bot asks for relevant information, e.g., name, and requests a list of symptoms. The system remembers past responses and asks progressively more specific questions in order to obtain a good diagnosis. The three primary components of our system are (1) identification and extraction of symptoms from the conversation with the user, (2) accurate mapping of extracted symptoms to documented symptoms and (3) Specifying the disease and referring to an appropriate specialist if necessary. In its current form, our bot's best application would be as a preliminary diagnosis tool that patients could use to assess their symptoms before going to the doctor, perhaps using the bot's specialist referral feature to choose the right care provider.

CHAPTER 2: <u>LITERATURE REVIEW</u>

We have collected some health-care based research paper and studied them thoroughly. We learned the importance of chatbot in healthcare system and how it is being implemented. They are listed below as follows:

2.1 APPLICATION OF SYNONOUS TEXT-BASED DIALOGUE SYSTEM IN MENTAL HEALTH INTERVENTIONS [1]

In this paper it reviews the current evidence for the feasibility andeffectiveness of online one-on-one mental health interventions that use text-based synchronous chat. This review provides an evaluation of individual synchronous Web-based chat technologies as a mode of psychological intervention and support. Based on the current evidence of the application of this technology in this area of mental health research, we see tentative support for this mode of intervention.

2.2 DR.VDOC: A MEDICAL CHATBOT THAT ACTS AS A VIRTUAL DOCTOR [2]

In this paper the chatbot will act as a virtual doctor and makes possible for the patient to interact with virtual doctor. Natural language processing and pattern matching algorithm for the development of this chatbot. It is developed using the python Language. Based on the survey given it is found that the number of correct answer given by chatbot 80% and incorrect/ambiguous answer given is 20%. From this survey of chatbot and analysis of the result suggested that this software can be used for teaching and as a virtual doctor for awareness and primary care.

2.3 DESIGNING A CHATBOT FOR DIABETICS PATIENTS [3]

This paper proposed an idea to develop a chatbot that will function as virtual diabetes physician to do a basic diagnosis on diabetic patients. There was aneffective usage of a chatbot in medical field proven by the success of VPbot. VPbot simulates patients that medical students can "interview" through a web- based interface. A pattern-matching process will be done in order for chatbot to detect keywords from patient's input sentence. It will Create an array of possible input to be match (sentence, phrase and words) by using Sequence Words Deleted (SWD) technique. Here the conversation to be controlled by chatbot rather than by user (likes any other chatbot program) by making the user remain to the conversation topic and not to enter any irrelevant input, and if they do, chatbot will response that the input was not understandable and keep repeating the previous question until the keywords is detected.

2.4 A NOVEL APPROACH FOR MEDICAL ASSISTANT USING TRAINED CHATBOT [4]

This paper proposed an idea in which the AI can predict the diseases based on the symptoms and give the list of available treatments If a person's body is analyzed periodically, it is possible to predict any possible problem even before they start to cause any damage to the body. It has some problems such as research and implementation costs, and government regulations are also challenges which are critical to the successful implementation of personalized medicine, but not addressed by the algorithms discussed in this paper.

2.5 MEDCHATBOT: AN UMLS BASED CHATBOT FOR MEDICAL STUDENTS [5]

This paper describes the development of a chatbot for medical students, that is based on the open source AIML based Chatterbean. The AIML based chatbot is customized to convert natural language queries into relevant SQL queries. A total of 97 question samples were collected and then those questions were divided into categories depending on the type of question. The resultant categories were ranked according to the number of questions in each category. The majority of questions were based on what is query, comprising 47% of the posed questions. The remaining categories comprised less than 7% each of the total questions. The system has not been specially designed for the task of supporting natural dialog in chatbots or, providing responses to student queries.

2.6 MEDICAL PREDICTIONS SYSTEM [6]

This paper proposed an idea to offer predictions about patients infected with hepatitis virus. A tool made to suggest a decision is able to extract information from other solved cases so it can obtain experience and can also take into consideration the results of the last researches, but won't be able to replace the most important factor in decision making: human judgment.Therefore, the final decision has to be made by a human expert. These systems are created only to suggest a solution.

2.7 CONDITIONAL ENTROPY BASED RETRIVEL MODEL IN PATIENT-CARER CONERSATIONAL CASES
[7]

This paper suggest that Bot Assistants can be an efficient and low-cost solution to Patient Care.A new Conditional Entropy Retrieval Based model is proposed and also an Attitude Modeling based on Popitz Powers. Natural language processing is a field of computer science, artificial intelligence, and computational linguistics concerned with the interactions between computers and human, natural, languages. The latest trend applies Deep Learning on Natural Language Processing, with DeepMind one of the most widely known, currently belonging to Google Deep Mind and Microsoft's Zo Chatbot. The algorithm successfully retrieves the suitable answer with a high success rate in the patient-Bot Assistant dialogueinteraction. The results show that even in small training datasets, this method outperforms up to date methods for automated communication. The issue here is, it requires a compact Adjacency Matrix based on the dialogues.

2.8 TOWARDS A CHATBOT FOR DIGITAL COUNSELLING [8]

This paper proposed an idea to design a chatbot to be used within mental health counselling. The demo chatbot has been created to provide a more interactive way of leading the user into the PDF worksheets, and asking them which areas they would like to receive information on. The method implemented here is the use of Emoji's. By incorporating mental health screening tools into a chatbot interface, the user can have a more interactive and user-friendly experience. It produce 60% of accuracy. The issue here is to maintain the ethical considerations.

2.9 TABLE ON LITERATURE REVIEW

S.NO	ARTICLE TITLE	JOURNAL	TECHNIQUES & ALGORITHMS	RESULT	ISSUES	YEAR OF PUBLICATION
1	Application of synonous text-based dialogue system in mental health interventions	Medical Internet Research , volume: 19	Web-based chat technologies arecompared.	The review provides an evaluation of individual synchronous Web-based chat technologies as a mode of psychological intervention and support.	The issue of whether these technologies are cost effective in clinical practice remains a consideration for future research studies.	2017
2	Dr.Vdoc: Amedical chatbot thatacts as a virtual doctor	Medical Science and Technology , Volume: 6	Natural language processing and pattern matching algorithm.	80% of accuracy.	The full consultation is given at a free of cost, which is not a good practice.	2017
3	Designing aChatbot for diabetics patients	ACM Transaction on Managemet Information Systems (TMIS), Volume 4, Issue 2	Sequence WordsDeleted (SWD) technique. Pattern matching algorithm.	The conversation is to be controlled by chatbot rather than by user	Keep repeating the previous question until the keywords is detected.	2015
4	A Novel approach formedical assistant using trained chatbot	Internationl Conference on Inventive Communication and Computational Technology	Natural language processing and pattern matching algorithm.	It is possible to predict any possibleproblem even before they start to cause any damage to the body.	Provides the prescription and composition of medicine without consultation of a doctor.	2017

5	Medical chatbot: An UMLS based chatbotfor medical students	International Journal of Computer Applications Volume 55–No.17	Web-based chat technologies are compared.	47% of accuracy	The system has not been specially designed for the task of supporting natural dialog in chatbots	2016
6	Medical predictions system	International Journal of Engineering Research and Applications, ISSN: 2248-9622 ,Vol. 2, Issue 3	Natural language processing.	These systems arecreated only to suggest a solution.	Won't be able to replace the most important factor in decision making.	2015
7	Conditional entropy based Retrivel model in Patient-Carer Conersationalcases	IEEE 30th International conference on Computer-Based Medical System	Natural Language Processing.	The results show that even in small training datasets, this method outperforms up todate methods for automated communication.	The issue here is,it requires a compact Adjacency Matrix based on the dialogues.	2017
8	Towards a chatbot for digital counselling	Medical Internet Research, 4(1), pp. e3.	Natural language processing and pattern matching algorithm.	60% of accuracy	The issue here is to maintain the ethical considerations.	2017

CHAPTER 3: PROPOSED METHODOLOGY

The proposed system will work as a healthcare application. The chatbot will use NLP to understand the user query. Once the bot understands the initial symptoms it will ask to follow up questions and try to make a diagnosis based on user answers. The system uses a decision tree algorithm and follows a top-down approach to help form an accurate diagnosis. The initial symptom entered will form the root of the decision tree. The bot will then ask to follow up questions which will help ruling out other diseases with similar symptoms. The system makes a questionnaire-based approach to question the user and then the decision tree is traversed accordingly until a leaf node is reached. The leaf node will contain the diagnosis formed.
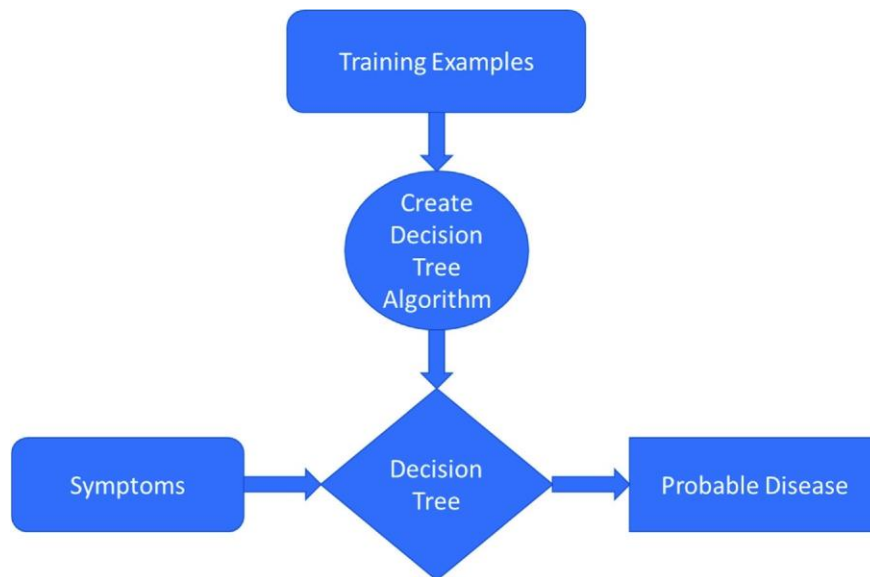
System Architecture

DECISION TREE

They are the most popular choice for prediction as well as classification because not only are they simple to understand but can also be very powerful. The decision tree gets it's name from it's tree like structure where the nodes denote a test, in our case a symptom and the branch denotes the outcome (if the user has that symptom or not) and the leaf nodes hold a possible diagnosis. In our system the chatbot needs to make a decision based on each user input for example if the user enters he/she has fever then how will the bot respond? How will the user be cross questioned or how we will arrive at a diagnosis. The decision tree algorithm helps us perform this function. The decision making is the main module of our system. The decision making is very important for the functioning of the system as well as the accuracy of the results. The system will be perception based and will bedependent on the user input at each step. The decision tree algorithm will help us traverse to find a solution by matching the user input with the symptoms at each level. If no match is found the system will continue the loop until the end or a leaf node of the tree is reached. Decision tree is a supervised learning algorithm hence the motive is to create a training model which will then be used to predict value of target (in our case the possible disease) by learning decision rules the data already fed to the system(training data).

The dataset[9] used is in a tabular format which states about hundreds diseases along with their symptoms. It was hard to find an accurate medical dataset therefore, the dataset has been curated to ensure that only general diseases are listed with accurate symptoms to ensure efficiency in disease diagnosis.
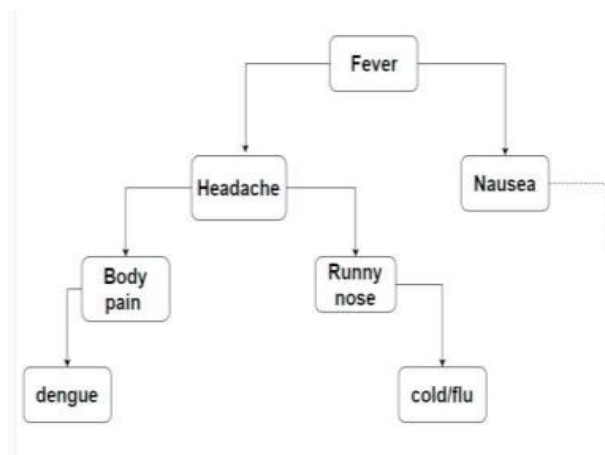
A POSSIBLE STRUCTURE OF THE DECISION TREE

CHAPTER 4: Implementation

Below are the snapshots of the data-set which is used to train and test the Model.

< **symptom_precaution.csv** (3.41 KB)

Detail   Compact   Column

About this file

Disease and the precautions to take.

⚠ Disease	⚠ Precaution_1	⚠ Precaution_2	⚠ Precaution_3	⚠ Precaution_4
Diseases experienced	precaution to take	precaution to take	precaution to take	precaution to take
41 unique values	Consult nearest hos... 7% avoid fatty spicy food 7% Other (35) 85%	exercise 7% consult nearest hos... 5% Other (36) 88%	consult doctor 15% eat healthy 10% Other (31) 76%	follow up 15% medication 15% Other (29) 71%
Drug Reaction	stop irritation	consult nearest hospital	stop taking drug	follow up
Malaria	Consult nearest hospital	avoid oily food	avoid non veg food	keep mosquitos out
Allergy	apply calamine	cover area with bandage		use ice to compress itching
Hypothyroidism	reduce stress	exercise	eat healthy	get proper sleep
Psoriasis	wash hands with warm soapy water	stop bleeding using pressure	consult doctor	salt baths
GERD	avoid fatty spicy food	avoid lying down after eating	maintain healthy weight	exercise
Chronic cholestasis	cold baths	anti itch medicine	consult doctor	eat healthy

< **dataset.csv** (617.38 KB)   ⬇ ⊹

Detail   Compact   Column   10 of 18 columns ⌄

About this file

Disease with its symptoms.

⚠ Disease	⚠ Symptom_1	⚠ Symptom_2	⚠ Symptom_3	⚠ Symptom_4	⚠ Symptom_5	⚠ Symptom_6
Diseases that may be present	the symptoms experienced during the disease	the symptoms experienced during the disease	the symptoms experienced during the disease	the symptoms experienced during the disease	the symptoms experienced during the disease	the symptoms experienced dur the disease
41 unique values	vomiting 17% fatigue 14% Other (3408) 69%	vomiting 18% fatigue 8% Other (3648) 74%	fatigue 15% high_fever 7% Other (3870) 79%	high_fever 8% [null] 7% Other (4194) 85%	[null] 25% headache 7% Other (3366) 68%	[null] nausea Other (2544)
Fungal infection	itching	skin_rash	nodal_skin_eruptions	dischromic _patches		
Fungal infection	skin_rash	nodal_skin_eruptions	dischromic _patches			
Fungal infection	itching	nodal_skin_eruptions	dischromic _patches			
Fungal infection	itching	skin_rash	dischromic _patches			
Fungal infection	itching	skin_rash	nodal_skin_eruptions			
Fungal infection	skin_rash	nodal_skin_eruptions	dischromic _patches			
Fungal infection	itching	nodal_skin_eruptions	dischromic _patches			
Fungal infection	itching	skin_rash	dischromic _patches			

Code snippet of modules that are used are as follows:

```
import pandas as pd
import pyttsx3
from sklearn import preprocessing
from sklearn.tree import DecisionTreeClassifier, _tree
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_val_score
from sklearn.svm import SVC
import csv
import warnings
```

Code Snippet:

This part of the code collects data and analyses them:

```
training = pd.read_csv('Training.csv')
testing = pd.read_csv('Testing.csv')
cols = training.columns
cols = cols[:-1]
x = training[cols]
y = training['prognosis']
y1 = y

reduced_data = training.groupby(training['prognosis']).max()

# mapping strings to numbers
le = preprocessing.LabelEncoder()
le.fit(y)
y = le.transform(y)
```

Training is done at this part and Model is created:

```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.33, random_state=42)
testx = testing[cols]
testy = testing['prognosis']
testy = le.transform(testy)


clf1 = DecisionTreeClassifier()
clf = clf1.fit(x_train, y_train)
scores = cross_val_score(clf, x_test, y_test, cv=3)


model = SVC()
model.fit(x_train, y_train)
print('Model is Ready!!!!!!!!!!!!!!!!')
importances = clf.feature_importances_
indices = np.argsort(importances)[::-1]
features = cols
```

The below function is called to give the actual output:

```
tree_to_code(clf,cols)
```

CHAPTER 5: RESULTS

The proposed system is a working prototype with about 50 symptoms and 100 diseases and performs diagnosis at several layers of the decision tree using. The algorithm forms the decision tree with the various symptoms and then uses that to cross question the user.

- o Round Trip Time: The response time of the system was found to be 10ms to 20ms depending on the number of symptoms.
- o Accuracy: The proposed system gave an accuracy of 75 correct answers for every 100 queries for common diseases. The accuracy was found to be 75%.
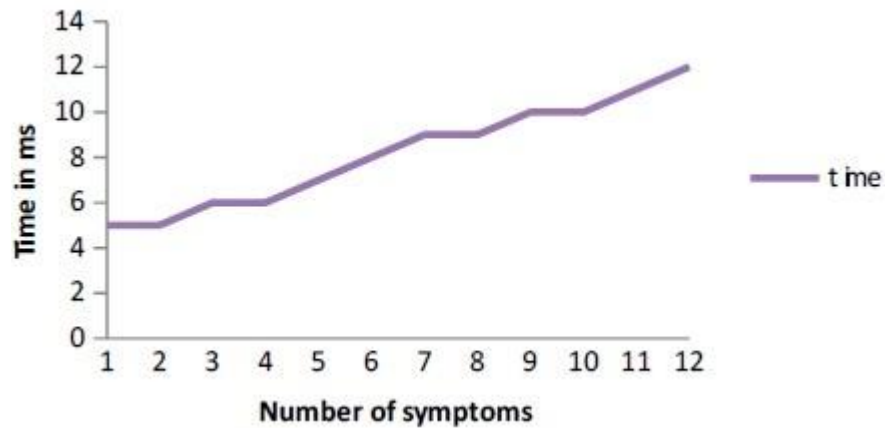
ROUND TRIP TIME

SCREENSHOT 1: User is giving what he/she is feeling, as input and as a result some symptoms are listed.

```
PROBLEMS  1    OUTPUT    DEBUG CONSOLE    TERMINAL                                    2: Python

 Model is Ready!!!!!!!!!!!!!!!!
 Your Name
                                              -> Hulk

 hello  Hulk
 Enter the symptom you are experiencing
                                              -> pain

 searches related to input:
 0  )  joint_pain
 1  )  stomach_pain
 2  )  pain_behind_the_eyes
 3  )  back_pain
 4  )  abdominal_pain
 5  )  chest_pain
 6  )  pain_during_bowel_movements
 7  )  pain_in_anal_region
 8  )  neck_pain
 9  )  knee_pain
 10 )  hip_joint_pain
 11 )  muscle_pain
 12 )  belly_pain
 13 )  painful_walking
 Select the one you meant (0 - {num}):
                                              -> █
```

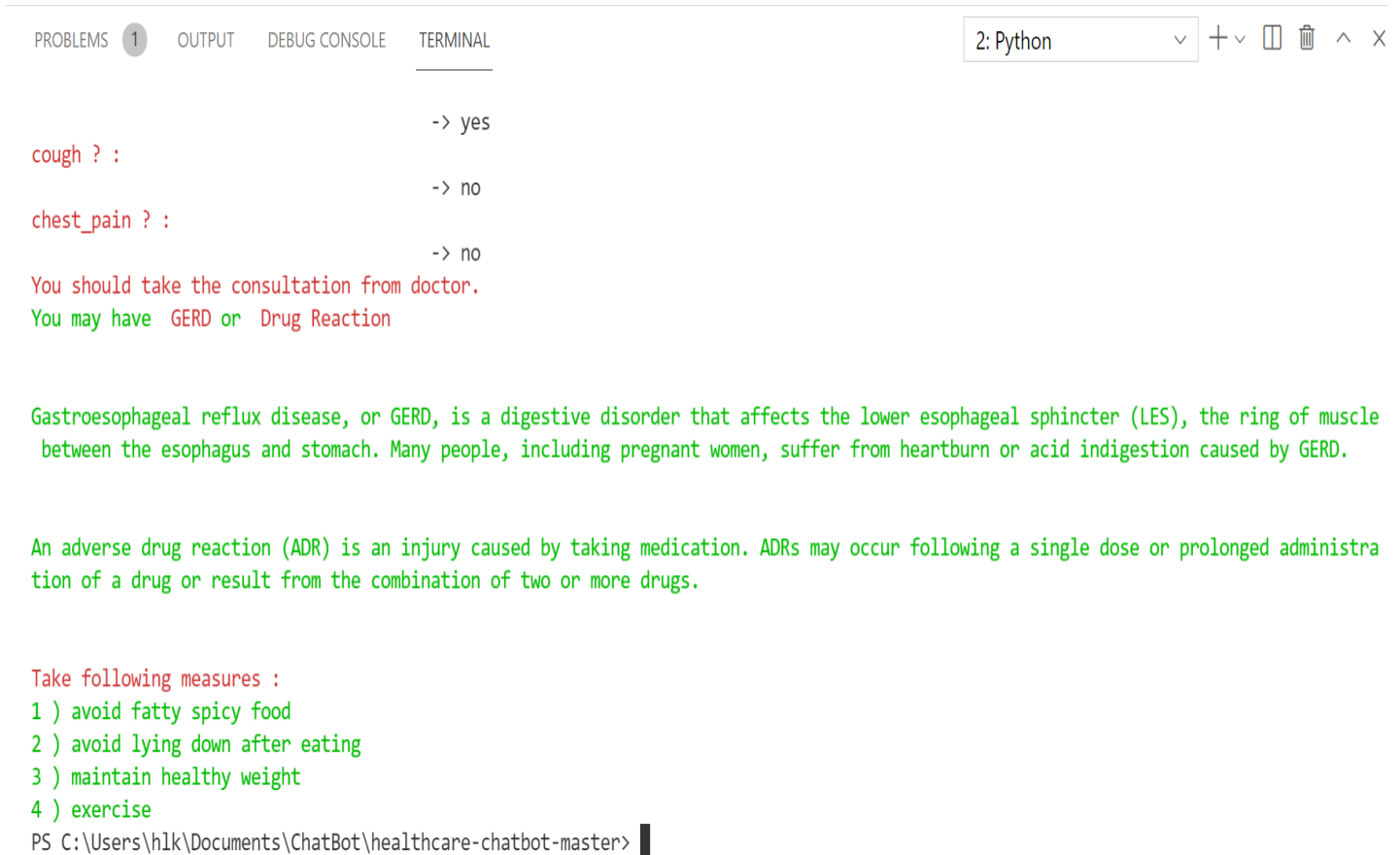**SCREENSHOT 2: More questions are being asked by the chatbot to give an appropriate solution to the user.**

```
PROBLEMS  1    OUTPUT    DEBUG CONSOLE    TERMINAL               2: Python          ∨  + ∨  ▯  🗑  ∧  ✕

Select the one you meant (0 - {num}):
                                    -> 1
Okay. From how many days ? :
                                    -> 5
Are you experiencing any
stomach_pain ? :
                                    -> yes
acidity ? :
                                    -> yes
ulcers_on_tongue ? :
                                    -> no
vomiting ? :
                                    -> yes
cough ? :
                                    -> no
chest_pain ? :
                                    -> no
You should take the consultation from doctor.
You may have  GERD or  Drug Reaction


Gastroesophageal reflux disease, or GERD, is a digestive disorder that affects the lower esophageal sphincter (LES), the ring of muscle
 between the esophagus and stomach. Many people, including pregnant women, suffer from heartburn or acid indigestion caused by GERD.
```

SCREENSHOT 3 : If the chatbot finds an appropriate solution of the disease then feedback is given the user otherwise if suggest to visit to doctor.

```
PROBLEMS  1    OUTPUT    DEBUG CONSOLE    TERMINAL                                          2: Python        ∨  + ∨  ⬚  🗑  ∧  X

                                         -> yes
cough ? :
                                         -> no
chest_pain ? :
                                         -> no
You should take the consultation from doctor.
You may have  GERD or  Drug Reaction


Gastroesophageal reflux disease, or GERD, is a digestive disorder that affects the lower esophageal sphincter (LES), the ring of muscle
 between the esophagus and stomach. Many people, including pregnant women, suffer from heartburn or acid indigestion caused by GERD.


An adverse drug reaction (ADR) is an injury caused by taking medication. ADRs may occur following a single dose or prolonged administra
tion of a drug or result from the combination of two or more drugs.


Take following measures :
1 ) avoid fatty spicy food
2 ) avoid lying down after eating
3 ) maintain healthy weight
4 ) exercise
PS C:\Users\hlk\Documents\ChatBot\healthcare-chatbot-master> |
```

CHAPTER 6: CONCLUSION

The review concludes that the usage of Chatbot is user friendly and can be used by any person who knows how to type in their own language in mobile app or desktop version. A medical chatbot provides personalized diagnoses based on symptoms. In the future, the bot's symptom recognition and diagnosis performance could be greatly improved by adding support for more medical features, such as location, duration, and intensity of symptoms, and more detailed symptom description.

CHAPTER 7: Future Scope

Chat bots are a thing of the future which is yet to uncover its potential but with its rising popularity and craze among companies, they are bound to stay here for long. Machine learning has changed the way companies were communicating with their customers. With new platforms to build various types of chat bots being introduced, it is of great excitement to witness the growth of a new domain in technology while surpassing the previous threshold.

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[4] Divya Madhu,Neeraj Jain C. J, Elmy Sebastain, Shinoy Shaji, Anandhu Ajayakumar," **A Novel Approach for Medical Assistance Using Trained Chatbot**",International Conference on Inventive Communication and Computational Technologies(ICICCT 2017).

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[8] Gillian Cameron, David Cameron, Gavin Megaw, Raymond Bond,Maurice Mulvenna ,Siobhan O'Neill, Cherie Armour, Michael McTear, "**Towards a chatbot for digital counselling**", Journal of Medical Internet Research, 4(1), pp. e3.

[9]   https://www.kaggle.com/itachi9604/disease-symptom-description-dataset?select=Symptom-severity.csv

<u>APPENDIX</u>

Through a series of questions about symptoms it diagnosis the health condition of patient.

Language : python.

modules used : scikit-learn, pandas, numpy, termpcolor.

Model : Decision Tree

Local Setup:

   It can be executed in windows as well as in Linux machine

1. Open command prompt/vs code and locate folder. run 'pip install -r requirements.txt'

2. Run chat_bot.py