

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES MEDICATION CHATBOT

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ABSTRACT

Medication adherence is of utmost importance for many chronic conditions, regardless of the disease type. With rising operational costs, Engaging patients in self-tracking their medication is big challenge. One way to potentially reduce this burden is to use healthcare chatbots to promote wellness throughout all stages of life and also in providing personalized care and improving the overall patient experience-without the need for a customer support team or a physician on the other end. Additionally, they can also suggest the nearby Doctors. Chatbots have proven effectiveness in triggering users to engage in certain activity, such as medication adherence. In this paper, We discuss “Roborto”, a chatbot to create an engaging interactive and intelligent environment for patients and assist in positive lifestyle modification. We introduce a way for patients in self-tracking their medication when-ever necessary. We describe the health, technical and behavioural approaches to the problem of medication and propose a diagnostic and decision support tool

Keywords: :Chatbot, Medication adherence, Healthcare, Behaviour theory, Chronic diseases

I. INTRODUCTION

With the present article we propose “Roborto”, a chatbot model system to increase medication adherence among patients and deterioration in patients condition. The bot uses natural conversation and inline options to help patients understand and manage their medication. Moreover, based on userpre configuration, the bot sends them medication reminder and asks them about their health condition and behavioural state. Finally, the bot design and implementation is based on a behavioural approach to product design. We followed a four step process to design Roborto”chatbot. The four stages of behavior design focus on attention, influencing decision, facilitating action and sustain the behaviour. To the best of our knowledge ,few works with scientific validations and proofs discussed chatbot application for medication adherence .Over the last ten years, we have come to see robots perform and execute jobs that were once exclusive to humans be it, manufacturing cars or filling warehouse orders . As of today, we are no strangers to the fact that there are multiple industries that AI have significantly impacted over the last couple years. However, the integration of AI in health care with a chatbot as your doctor is set to witness a significant paradigms shift. The doctor patient relationship hasn't exactly changed much over the years . Being a patient, if you feel something is off, you go to clinic and talk to the doctor about the problem you are facing. He or she then checks your vitals, scrutinizes a bit, offers a dignosis and prescribes the relevant medication.It acts as as a arbitrator (mediator) between doctor and patient and suggests the required care to be taken regarding medicines, diet etc and also suggests the near by doctors available. It saves the time of patient from consulting doctor for small requirements. To incorporate “inter activeness” and history taking information store regarding the medication. Our medication chatbot helps us to design a virtual real time intelligent bot that can support the patient to recover from illness and diseases caused related to skin.It helps the patient aware which doctor is available related to their disease and also in self monitoring by knowing the required medication. Our medication chatbot deals with the diseases related to illness of all age groups and also the diseases related to skin and general health issues. For example: eczema, measles etc and normal cough, cold etc.Our medications also suggest the doctors related to skin, general physician and also for illness for all age groups , it suggests nearby available dermatologists and also general physician for illness. The advantages of this are Availability and ongoing health monitoring: All healthcare providers are always willing to help their patients and they understand how it is vital to be available if there is urgent need of medical attention. Unfortunately, doctors have limited time nd a lot of patients which doesn't allow them to be available anytime. In their turn, chatbots are there for those who need medical assistance at all time. Furthermore,

virtual assistants may be responsible for reminding users to take their medicine and monitoring a patients health status. Providing information fast when there is not a moment to lose: Emergencies are normal for healthcare which means prompt and correct diagnosis is vitally important. Various healthcare specialists can make the right decision in time in case they are able to obtain the needed patient information easily. That's why a number of modern medical institutions are creating a chatbot which is responsible for internal record keeping. This kind of bots is able to immediately receive important patient information such as prescribed and administered medication, allergies, check-up reports, etc. The Baidu doctor app can be an example of this kind of bots. It is designed to communicate with patients directly and collect information about the state of their health. Additionally, this chatbot can question patients about things like the lasting, severity, and frequency of their symptoms so that to convey this information to specialists for them to be able to make an informed decision on therapy. Gaining the trust of patients: all medical institutions keeping up with advancing technology should be effectively presented online to attract potential patients and maintain their appointments booked . However, the thing is that it might not be easy for patients to look through lots of web pages on health problems and book appointments with no help. As a result, te person communicating with the bot is informed about their possible condition and is offered to visit a medical professional at the hospital shortly. This kind of communication with the chatbot makes individuals trust the hospital without even having visited it yet. scheduling appointments: as we just read in the previous item virtual assistance for healthcare website is a great tool to begin communicating with future possible patients, these bots are effective in particular if it comes to booking visits.The disadvantages of this are: Complex interface- chatbots are often seen to be complicated and require a lot of time to understand users requirement. it is also the poor processing which is not able to filter results in time that can annoy people . In ability to understand-due to fixed programs, chatbots can be stuck if an un saved query is presented in front of them. This can lead to customer dissatisfaction and result in loss. It is also multiple messaging that can be taxing for users and deteriorate the overall experience on the website.

II. LITERATURE SURVEY

A. Abashev, R. Grigoryev, K. Grigorian, and V. Boyko proposed paper on “Programming tools for messenger-based chatbot system organization” the implementation of translational medicine is associated with considerable costs of equipment, staff competence, and doctor patient(DP) and clinic patient(CP) communication. The application of DP and CP systems evolved from email letters to website assistance chat and smartphone apps in context of health paradigm. The rapid development of mobile messengers and chatbot systems had opened new niche for DP and CP communication providing high population penetration rate with perfect capabilities for personalization. This article provides a model of chatbot system organization as well as programming tools for its implementation.[1]

J. F. Allen, D. K. Byron, M. Dzikovska, G. Ferguson, L. Galescu, and A. Stent proposed about conversational human- computer interaction they state that the belief that humans will be able to interact with computers in converational speech has long been a favourite subject in science fiction. This reflects the persistant belief that spoken dialouge would be the most natural and powerful user interface to computers. With recent improvements in computer technology and in speech and language processing, such systems are starting to appear feasible. There are significant technical problems that still need to be solved before speech-driven interfaces become truley conversational. This paper describes the results of a ten year effort building robust spoken dialouge systems at the university of rochester.[2]

A. Fadhil and S. Gabrielli proposed about Addressing challenges in promoting healthy lifestyles: the al-chatbot approach they state that healthy lifestyles promotion is the main objective of primary care interventions, starting from the pediatric age, where overweight is owadays exposing about one third of children to the risk of developing chronic diseases, such as diabeties. Recent years have seen a blast of mHealth apps for health promotion, targeting in particular nutrition and dietary behaviour change. However, reviews show difficulties in the adoption and effective usage of these apps in telemedication and by the population in general, due to lack of evidence based content and stategies provided or lack of sufficient user engagement with the apps.Nutrition apps typically require self reporting of food intake by the user which is often seen as a burden and a case of abandonment of the app. Current wave of research has taken up the challenge of promoting healthy lifestyles with advances in AI.This papr

focus on AI chatbots as an innovative approach offering more simplicity and facilitation long term adherence to health promotion interventions. Conversational assistants provide the advantage of being deployed in smartphones and laptops within a wide variety of applications. We describe an application scenario for an AI chatbot delivering support to nutrition that could help to overcome current limitations of similar mHealth solutions provided for healthy lifestyles and contribute to more effective health interventions in this application domain.[3]

C.-W. Liu, R. Lowe, I. V. Serban, M. Noseworthy, L. Charlin, and J. Pineau. How not to evaluate your dialogue system: An empirical study of unsupervised evaluation metrics for dialogue response generation. In this We investigate evaluation metrics for end-to-end dialogue systems where supervised labels, such as task completion ,are not available. Recent works in end-to-end dialogue systems have adopted metrics from machine translation and text summarization to compare a model's generated response to a single target response. We show that these metrics correlate very weakly or not at all with human judgements of the response quality in both technical and non-technical domains.[4]

L.G. Park, J. Howie-Esquivel, M. Chung, and K. Dracup. A text messaging intervention to promote medication adherence for patients with coronary heart disease: A randomized controlled trial says that Pharmacologic treatment for secondary prevention of coronary heart disease(CHD) is critical to prevent adverse clinical outcomes. In randomized controlled trial. We compared antiplatelet and stain adherence among patients with CHD who recieved: (1) text messages(TM) for medication reminders and education,(2) educational TM only.[5]

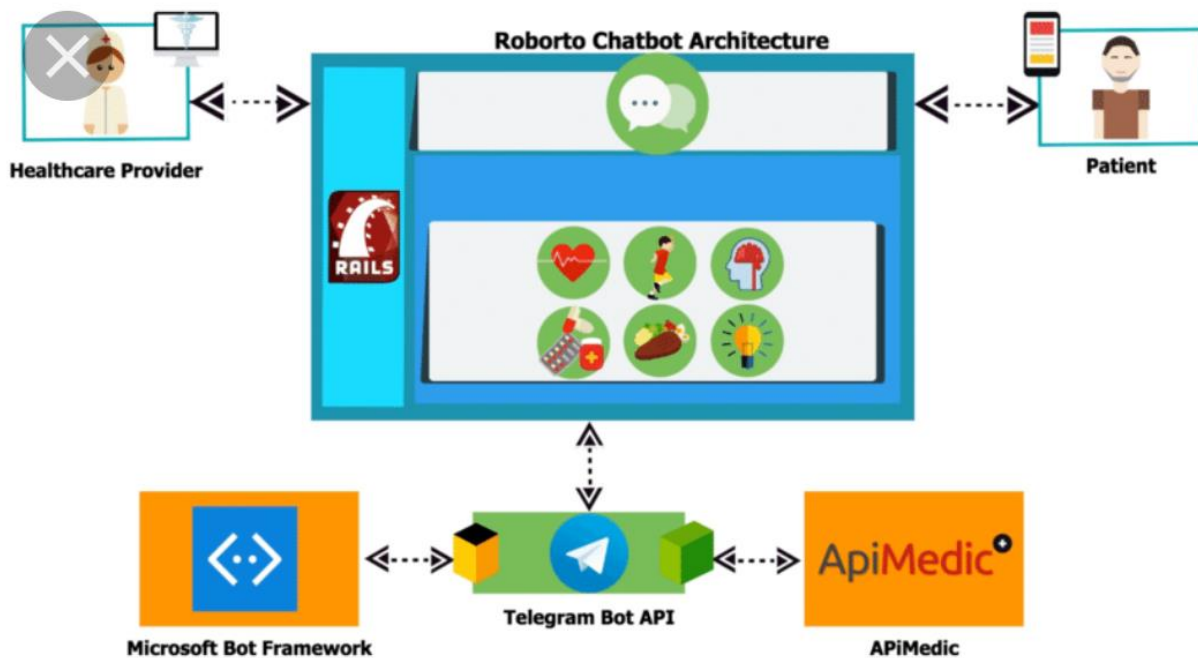
C.Pop-Eleches, H. Thirumurthy, J. P. Habyarimana, J. G. Zivin, M. P. Goldstein, D. De Walque, L. Mackeen, J. Haberer S.Kimaiyo, J. Sidle, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. This article says that there is limited evidence on whether growing mobile phone availability in sub-Saharan Africa can be used to promote high adherence to antiretroviral therapy(ART). This study tested the efficacy of short message service(SMS) reminders on adherence to ART among patients attending a rural clinic in Kenya.[6] **R. E. Sarabi, F. Sadoughi, R.**

J. Orak, and K. Bahaadinbeigy. The effectiveness of mobile phone text messaging in improving medication adherence for patients with chronic diseases: A systematic review. Medication non-adherence is a commonly observed problem in the self-administration of treatment, regardless of the disease type. Text messaging reminders, as electronic reminders, provide an opportunity to improve medication adherence. In this study, We aimed to provide evidence addressing the question of whether text message reminders were effective in improving patients, adherence to medication.[7]

III. PROPOSED METHODOLOGY

Architecture of Medication chatbot

Figure 1:



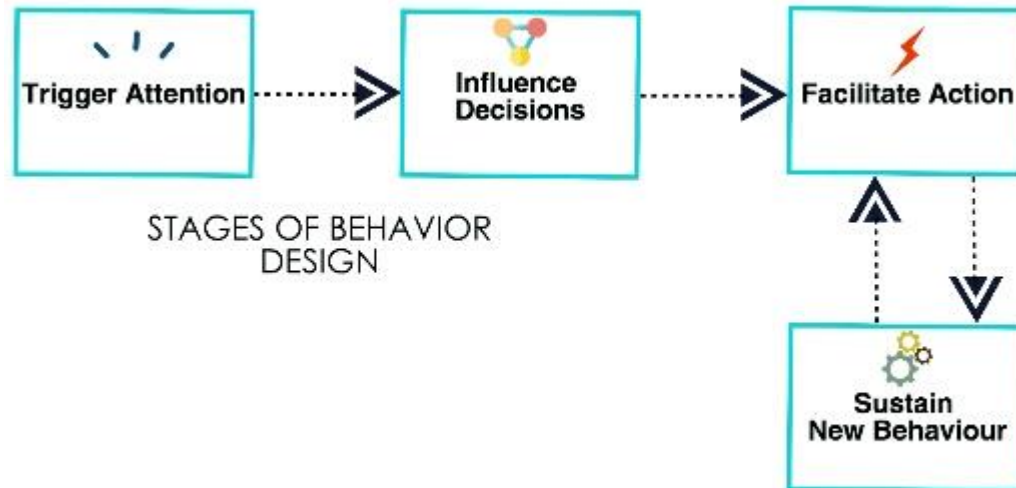
This phase focused on combining the technologies and de-sign aspects together to achieve efficient medication adherence. For the implementation, we developed a chatbot for the patient to track and report their medication, health and emotional condition, along with other lifestyle related parameters(eg: diet and exercise). However, a web-application is developed for the healthcare provider to track patient condition and intervence whenever relevant.

Telegram Bot API: we used the Telegram Bot API for the bot application to connect the bot to our system. The API provides intermediary server that handles all encryption and communication with this server via a simple HTTPS-interface that offers a simplified version of the Telegram API. At the core, messages, commands and requests sent by users are passed to the software running on application server.

Microsoft Bot Framework: To enrich the bot intelligence we use the Microsoft Bot Framework, in this way the acts more human like and responds more intelligently to specific user inquires. The bot framework providers web-services with intelligence and connection using the conversation channel the user authorises.

APiMedic: The disease, symptoms and medical information were all retrieved from the APiMedic. This API provides the knowledge base to our chatbot. For example, symptom checker API allows the integration of symptom checker functionalities in the bot, allowing patients to find out what possible diseases they might have. The integrated application also directs users to more medical information. We developed the web application using Ruby and Ruby on Rails Framework, since it provides flexibility and fast development environment.

Figure 2:



There are four stages basically: Trigger Attention, Influence Decisions, Facilitate Action, Sustain New Behaviour

1. Trigger Attention: The first thing is to consider how to attract users to use the application. Why should healthcare providers or patients use the chatbot? Therefore, the bot should trigger user attention. To achieve this, We need to draw people into the bot with engaging storytelling, and compelling motion design. Moreover, the bot should provide elicit an emotional reaction, such as Surprise, curiosity, or urgency. The chatbot should personalize the content and make it relevant and based on the users behavior, interest and value.

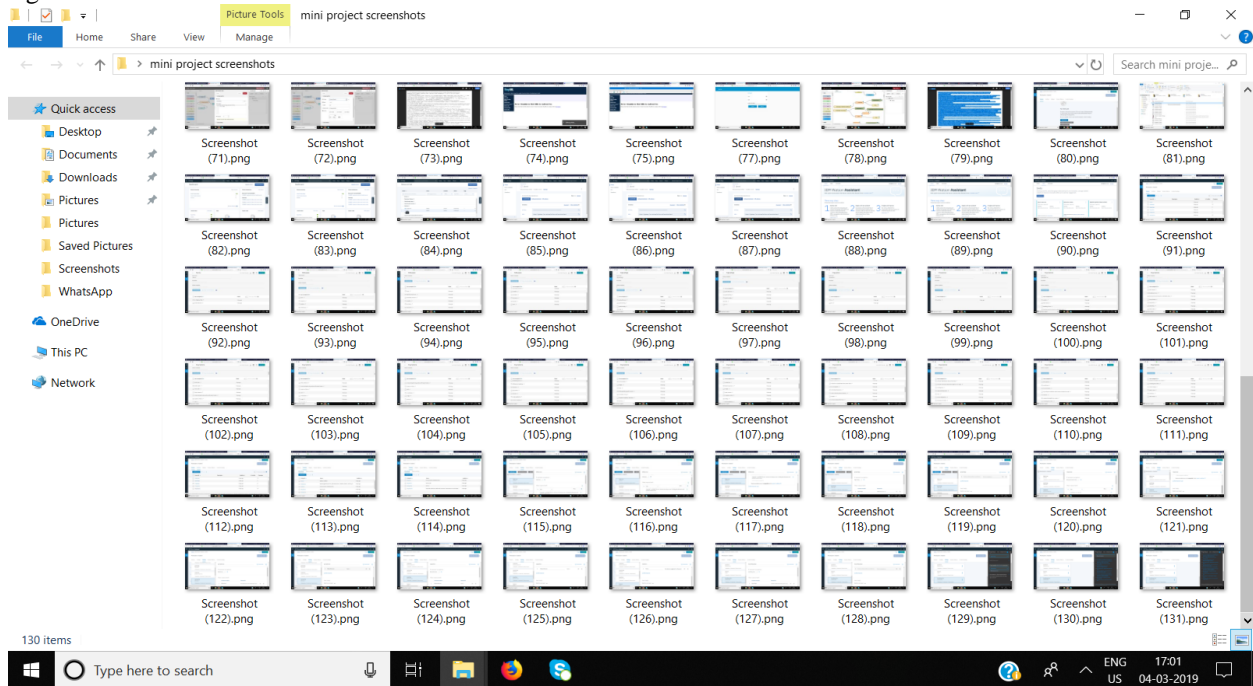
2. Influence Decisions: The chatbot has to present clear argument that nudges them to take action. Therefore, We should provide clear, straightforward content and make the message specific, simple and help patients make an informed choice. Offer recommendations and make the content completing to patients.

3. Facilitate Action: At this stage we should help patients follow through, by creating as easy and barrier-free action as possible. This is achievable by breaking down the action into small, achievable steps. We should identify and address common barriers that prevent patients from taking action. To facilitate the action, one should guide the experience of patient in a certain way. Encourage patients to set goals and commit to actions by sending reminders and follow up on their progress.

4. Sustain New Behaviour: Finally, to achieve a long-lasting impact of medication adherence, we should motivate patients continue the behavior and feel the sense of progress. Emphasising intrinsic motivation can be a technique to build long term behavior change. Research shows that people are drawn to experiences that give them a sense of purpose, social connection, status and self expression. Applying this model of behavioural staging helps identify what stages in the journey are working and which could be better strengthening our designs and mitigating the risk of application abandonment

IV. IMPLEMENTATION

Figure 3:



Firstly open your IBM cloud go to dashboard and then to catalog and type Watson Assistant give some service name and then create it. click on Launch Tool go to Skills create the new skill. Click on add intent give some intent name and then create the intent, give some user examples like (Hi, Hello, Good Morning, Good evening etc) then try it once by clicking on try it box. Go to dialog create one welcome node and then try it again. Click on welcome node add node below open that node and give some name. then click respond with Text enter: I and then try it. click on intent, add intent then give intent name as #enquiry click on create intent. give some user examples like: (what are the symptoms? Or would you like us suggest you the top most doctors?) click on add example. Then go to entities and create once entity with the name @entity give some name to the value and add the synonyms if needed. Then again go to dialog add one node below the greetings node name it as enquiry on multiple responses if needed. We can also give the image to our input by clicking on respond with Image instead of respond with Text. And then try it out once again. Create slots if needed. Continue the process accordingly. Go to skills click on assistant and then add assistant give some as name in this we gave it as Medication Chatbot click on create. Add dialog skill go to add existing skill and then click on the bot which it shows below (which is named as Medication Chatbot) click on preview link and then open the link which it shows below. Finally we can see our output screen there. To create a Node-Red click on settings go to manage palette install node-red dashboard. Now open it from dashboard nodes drag Form node on to the flow, click on the node to modify it. Then take a function node place it in between Form node and assistant node, click on it give name as input parsing. Edit function as `msg.payload=msg.payload.text` and the click on done. Take two text nodes click on it give label name as you and for another node give it as bot click on done. Connect you input to the input parsing output and bot input to the output parsing output. Click on deploy. And then we can perform our operation successfully by continuing it accordingly.

V. RESULT & DISCUSSION

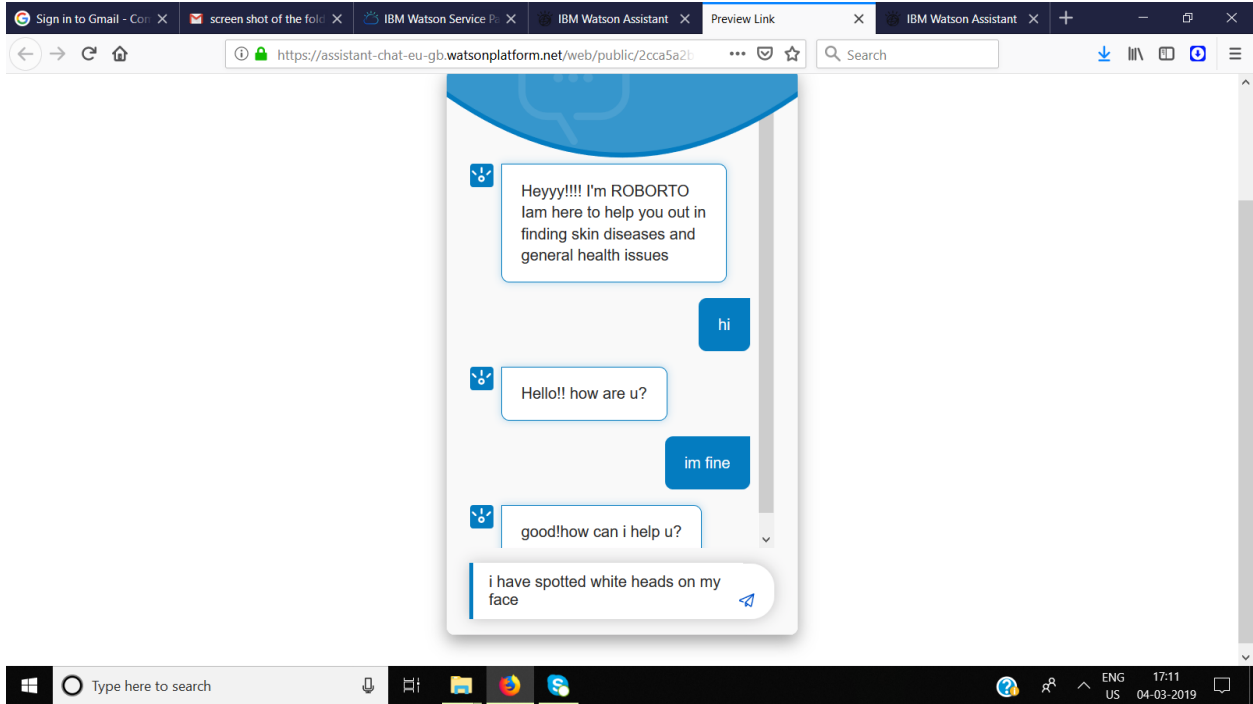


Figure 4: Welcome message

In the IBM Watson assistant we can create our own assistant. The assistant responds in the following manner. Firstly the greetings are given to the assistant bot when we open the preview link it directly gives that Heyyy!! I’m ROBERTO. Iam here to help you out in finding skin diseases and general health issues. Then we need to give input as Hi it gives Hello, How are you? Then the user will give the reply as iam fine. Then the bot respond in the following way good! How can I help you? Then let us assume that user ihas spotted with whiteheads, then he will give input as I have spotted while heads on my face. Then the assistant bot recognize the exact skin disease from which user is suffering from. Bot will give response as the disease of the mentioned symptom is acne would you like us to suggest you a doctor? If user wants to suggest us a doctor then let us assume that he will give input as Yes please!! Then our bot will show the top-most Doctor’s in Hyderabad and shows their Locations accordingly. If user dosen’t want chatbot to suggest him the doctor’s he will obviously No!! the our bot gives reply as It’s ok!! Then, take care!! Finally when the user selects the option of the prescribed doctor of which he want to go to. Our chatbot thank him/her by saying Thankyou!!

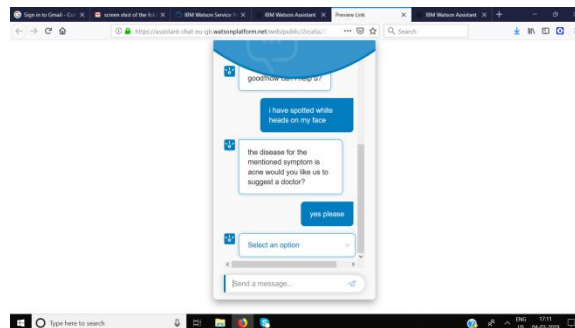


Figure 5: output for the given symptom

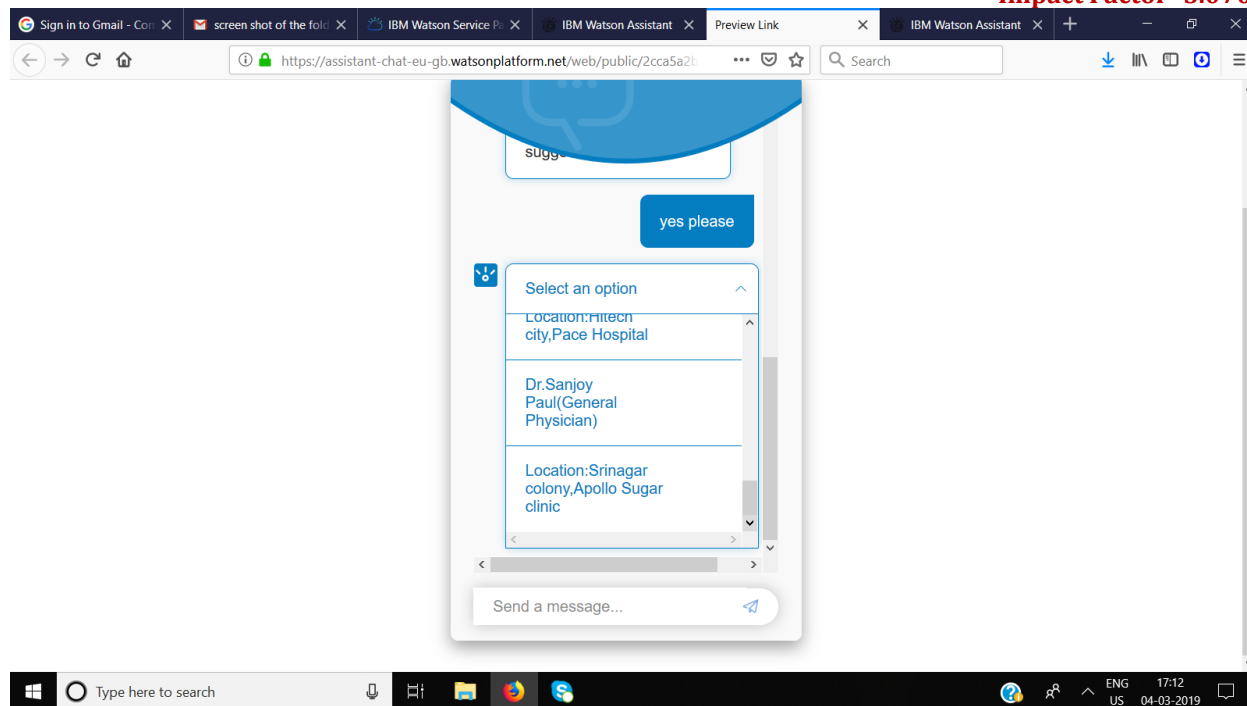


Figure 6: output of bot suggesting the top-most Doctor's and their location

VI. CONCLUSION

In this paper we presented a chatbot application to adhere patients to their medication. The presented model of the chatbot system provides an innovative approach to adhere patients medication and track their condition overtime. Improving patients adherence might be the best approach for tracking chronic conditions effectively. A multidisciplinary approach towards adherence is needed and we need to track not only patients adherence to medication, but also their various lifestyle related activities and most importantly their emotional state. We have covered this study from technical, medical and behavioural points. The next step is to develop the complete prototype and conduct a pilot study to evaluate the effectiveness of the proposed system

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