Chatbot Implementation to Collect Data on Possible COVID-19 Cases and Release the Pressure on the Primary Health Care System

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Abstract—Nowadays, the evolution of artificial intelligence is present in almost every field of the modern science and technology, because it is a powerful tool for analysis and quick decision making, enabling capacity to automate various processes in companies, government institutions, or research groups through one of the preferred techniques for automated software processes. Thus, the use of this kind tool has allowed us to develop a Chatbot (robot) that has the ability to simulate the conversation with a human being, to answer very specific questions [1].

Artificial intelligence has the ability to acquire, and achieve goals in the computer world, trying to emulate the way human intelligence process information. Currently, there are several creations in Chatbot that allows automating recurring processes, can decrease the response times of an activity, guarantee the availability of the service, and or omit the presence of a person, and it is very useful for process where there is a certain type of prevented behavior.

In the health area, it is essential to have an assistant who knows how to give information at any time of the day, specially in a worldwide pandemic crises, but in funny hours is more complicated to have an online attendant to answer specific questions about the illness.

The present work shows the results of an implementation of a Chatbot based on Artificial Intelligence to help the Medical Department at UDLA University in Ecuador, to detect possible cases of COVID-19, and for help to alleviate the saturated health system, and more importantly to collect information to prevent the dissemination of the infectious disease, we have created a platform to interact with possible infected persons who get the support from the University facilities.

Index Terms—Covid-19, Chatbot, Data collection, Telemedicine, Health Care.

I. INTRODUCTION

In early 2020, China and the rest of the world have been threatened by the new Covid-19 pandemic, which has killed thousands of people around the world; Mainly because it is a highly infectious disease, which has unleashed a problem in public health systems with the collection of evidence and possible suspected cases of Covid-19.

Both in the news reports, as well as in academic and scientific reports have demonstrated the need for telemedicine and tele-helath, the Public Health Ministry of Ecuador began with some plan in the so called number to help people which is a possible suspected cases of Covid-19 [2]. Therefore, this gave the fundamental idea of create a web Chabot to help online doctors who were overwhelmed by the large number of cases they have to handle. Therefore, this tool seems like a very useful method to serve a broader spectrum of potential patients.

The use of the web to obtain information about the pandemic and general information about the virus, makes the Chatbot a very effective way to meet these objectives; and therefore, from the beginning of the interaction with him, a reliable information of Covid-19 given by a team of professionals in the medical area. On the other hand, it also provides a sense of advancement and technological innovation, and also helps the Health System to alleviate saturation problems that arise from the outbreak [3].

This type of applications to reduce pressure in health systems are being implemented around the world, and can be used as a reliable source of information by professionals in the area, to avoid problems with self-medication or the collective panic that generally occurs. for fake news, or malicious news. Some related works can be consulate in the following references [4] [5].

II. COVID-19 OUTBREAK

In late 2019, a new type of Coronavirus began making people sick with flu-like symptoms. The disease is called Coronavirus-19 or COVID-19 for short [6]. Some people may have the following symptoms:

- Sore throat
- Shaking chills
- Constant shaking with chills
- Muscle pain
- Headache
- Loss of sense of taste and smell

Experts from the Pan American Health Organization (PAHO) have begun to train the region's health authorities in the principles of risk communication during public health emergencies [7]. This risk in communication focuses on communicating in real-time dangers that can threaten the population, with reliable sources from authorities and experts. This communication also considers the perception people have about the disease, which may sometimes not coincide with that of the experts, particularly when it comes to a changing and uncertain scenario.

By providing accurate, fast and frequent information in

a language that people understand and through reliable channels, people will be able to make decisions and adopt positive behaviors to protect themselves and their loved ones from diseases such as Covid-19 [8].

According to the Ecuadorian Ministry of Health as of August 3, 2020 there are 87.963 confirmed cases, in the main provinces such as Guayas (Most populated province in Ecuador) there are 17.629 confirmed cases, in Pichincha (Central province in Ecuador) there are 15.191 confirmed cases [16]. Current information indicates that 80 % of people who were infected with COVID-19 had mild flu-like symptoms and recovered. The remaining 20 % experienced more severe symptoms and of these, 5 % were critical and required hospitalization, and respiratory assistance. About 2.3 % of the people with this virus infection died. Most of the deaths occurred in older adults with pre-existing conditions.

The population can take a series of simple steps to reduce their risk of infection. The three main measures are: washing your hands with soap and water frequently, covering your mouth and nose with the crook of your elbow or tissue when coughing or sneezing, and avoiding close contact with people who have symptoms similar to those of the flu.[12]

III. PROBLEM

The willingness to stay at home, to prevent the spread of Covid-19 in Ecuador, worries several citizens with diseases that are not necessarily associated with respiratory diseases. That prompted a group of doctors to make their phone numbers available to anyone who needs care during the health emergency. They provide the service at no cost, through WhatsApp, phone call or video call.

There are several medical centers of different specialties, which provide services in various parts of the country. They joined this plan to helps vulnerable population, which began on Monday, March 30, 2020. Among the staff currently online are general practitioners, dentists, a psychologist, an audiology specialist, a speech therapist and a gynecologist and obstetrician . Each doctor attends from his telephone line, Monday through Friday, from 09:00 to 12:00 and from 14:00 to 16:00 at the University facilities.

Medical centers do not only receive calls from patients with respiratory symptoms who believe they carry Covid-19. Many of the cases are also common flu or allergic crisis and the Coronavirus is ruled out completely. The great demand for possible infections of the virus that exists in the population when discovering if they are carriers of the virus, has been a great limitation for the health system.

First, we have tried to understand the speed of spread of this new disease. With this, a map was made using data models that indicated the speed of contagion, and also of the deceased persons reported by each Country Ministry of Health that are members of the WHO. In the following figure, we can see a representation of the deceased reported until July 2020 due to this virus.
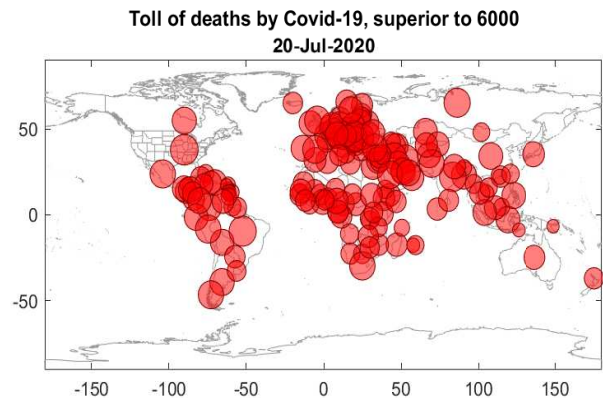

Fig. 1. World map with the count of deaths from Covid-19 until the month of July.

This graph only shows the final result. However, it is very interesting to see the running map, and the depicts how the contagion and lethality related to this virus grow very quickly. And it shows, in a way, the need to expand the manner of requesting information if you suspect the symptoms of this virus.

Then, the mathematical function that could explain the rapid growth of the spread of this disease was modeled. The first 70 days of registration of the disease in Ecuador were taken, data obtained from the WHO databases [15], registered by the ministries of health of each country. In Figure 2, you can see the growth of the disease, the red line is the interpolation function, we try to interpolate by exponential growth. The error function was set as a function of type chi^2, this type of probability distribution is more sophisticated than the mean square error, and is widely used as hypothesis testing. As the first results showed some type of exponential increase in the outbreak, but then the process slows down and a linear growth approximation is more appropriate. In the graph on the left of Figure 2, it can be seen in a logarithmic environment plotted, while on the right this results are depicted as linear. Possibly this growth is slowed by isolation measures, or even more likely by the ability of ministries to carry out more tests, within all this there is a field that is outside our area of study.

Therefore, the rapid growth of infections makes it very useful to use alternative tools such as the Chatbot case to alleviate pressure on primary care systems.

IV. PROPOSED SOLUTION

The solution focuses on the implementation of a Chatbot that will help to register possible cases of covid-19, and helps the system outside of typical working hours. The project proposes to integrate the web services of the UDLA University
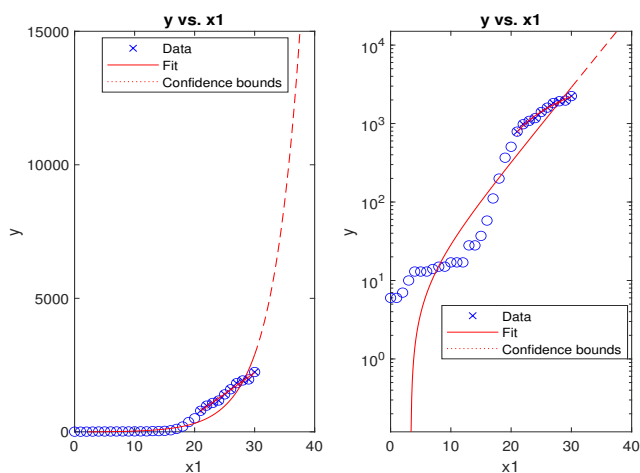
Fig. 2. The first 70 first cases of Covid-19 registered in Ecuador, and modeled using the exponential equation.

health system into the architecture. On the other hand, it collects this information to create a cognitive knowledge base. The Chatbot then connects directly to the web page, using a previously studied decision tree focused on natural language processing with ramifications for machine learning [10], the objective is to define the dialogue through modules of information on suspected cases of the Covid-19 virus and frequently asked questions.

To choose the Chatbot assistant whose tools are coupled to the proposal, three options were designated and the use of the Snatchbot platform was determined, which is intuitively integrated into the creation of a chat with tools that provide all the necessary functions. To complete the Chatbot tests, satisfaction and effectiveness of response to users are taken as parameters [9].

A. Chatbot

The Chatbot is a mechanism that has advanced along with artificial intelligence through a type of machine learning similar to natural language, which has grown to such an extent that they can be classified according to the service they provide [11]. Among the different types of chatbots we have:

- Sales chat, which are oriented to the trade of products or services of various companies that have longed to implement these innovative assistants.
- The customer support chat is aimed at solving questions posed by customers about a specific product or service.
- Chat content or news, it has been possible to carry out an inclusion of channels with instant messages whose main objective is to send abundant content through various channels.
- In telemedicine to get very reliable information for a complicated item like the health care, and this information is got from a medical staff of experts in the area.

In the same way, the development of these chats has resulted in an infinity of systems within the Internet, generally the world is involved in their use due to the good management of applications such as: Google Now from Google, Siri from Apple, among others. [10]

B. Architecture and procedure

Snatchbot offers an innovative platform designed to streamline business communication flows with a single message-based interface. SnatchBot's omnichannel platform allows users to specify the channels through which they would like to connect. The company's tools support the entire lifecycle of a bot, from development and testing to publishing, monitoring, and completion with tracking. This bot offers robust administrative tools and enterprise-level security that meet all regulatory mandates [10].

The SnatchBot authoring platform enables businesses to publish chatbots on mobile devices, web applications, and chat services such as Facebook Messenger, SnatchApp (SnatchBot's proprietary messaging application), Skype, WeChat, Line, Viber, Telegram Messenger, Twilio SMS, and others.[13] Bot conversations can be designed to be simple, multiple choice, or action button based. They can then be published on various platforms once they are ready. This makes it relevant to industries like airlines, IT, education, insurance, etc.

Registration on the platform is carried out in a standard way, without any restrictions and with the normal data requested by any other website. Their plans are dynamic if you want to use paid features that incorporate design plugins and a greater openness to the width of users the bot can support at the same time.[13]

C. Features and Benefits for a Chatbot for Corona Virus response

- **Discard the option of having a person who is connected continuously:** This Chatbot will have the ability to answer user inquiries 365 days a year and at any time. In addition, this bot can offer relevant data on general information associated with the Covid-19 virus, however, *this system does not replace the judgment of health professionals.*

- **Provides automatic and immediate responses:** speed, solvency and interactivity are the most relevant characteristics of this bot. It is used to being answered automatically with the least possible effort, especially when it comes to a health emergency. As the waiting time increases, the chances of risk increase. The times in which important information is answered and delivered are decisive factors when making a change in the health environment. There is no doubt the importance of integrating and incorporating this type of service through a Chatbot in health emergencies.

- **Save processes and optimize time:** In a state where the symptoms of a possible contagion have similar questions, predefined questions can be set to save time. Many of the frequently asked questions can appear in a search pages

related to the virus, users do not spend time looking for the answer, and it is because of this reaction mode that the chat becomes a very versatile tool to automate the questions of the users. These potential patients will receive a quick and easy response, saving them tedious minutes of searching, which can result in irrelevant information. Implementing this bot as a communication alternative in healthcare channels will make it easier for users to find immediate answers to common questions.

In the following Figure 3 we can see a summary graph of the decision tree, obviously the graph is much longer, but for reasons of space we place the most pertinent part, in which a sequence of questions suggested by the staff of medics in charge of the tele-health at University, this is very important because it was made by an interdisciplinary group of experts who provide reliable information.
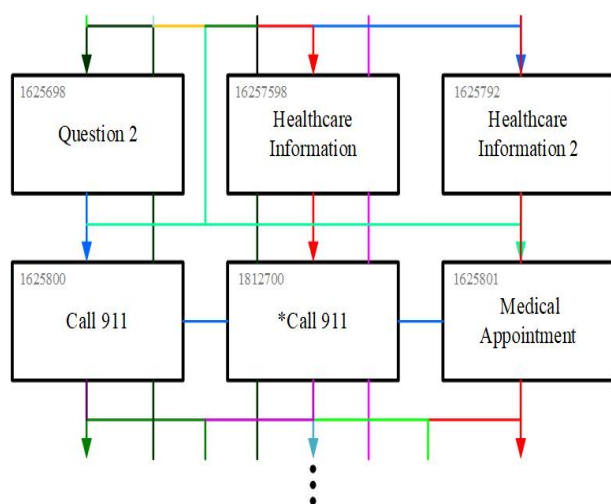

Fig. 3. Decision tree, based on medical experts recommendations at UDLA

D. Analysis of results

The initialization window is presented on the manager's home screen, where the Chatbot with its respective decision tree was created. As we can see in the Figure 4 .
The whole case study was carried out and the decision tree was analyzed, as well as the limitations of the Chatbot, so when implementing it, the type of interaction that the user will have and the different levels of forms that are presented in a normal conversation were established.
Once created, it was possible to configure the necessary parameters and present a drop-down menu that has all the functions of the Chatbot for the management and development of the project.
Each of these modules offers management, distribution, configuration, and adaptability functions that will enrich the way in which the Chatbot is integrated into one or more pages or social networks.
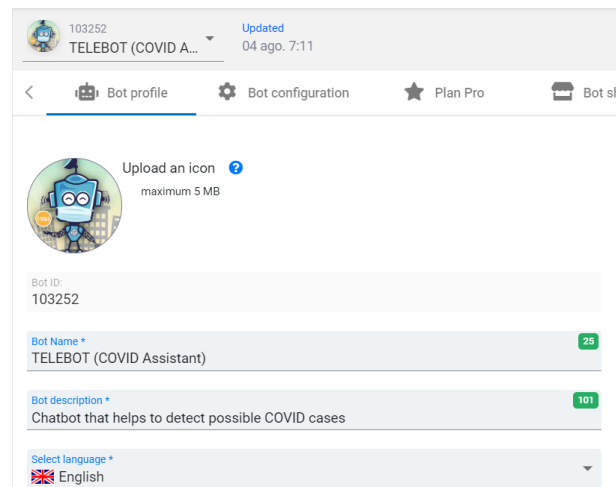

Fig. 4. Chatbot module presentation

The manager allows you to observe in real time all the exchanged messages and the use they are giving the Chatbot as shown in Figure 5.

Fig. 5. Message board

Everything that the user interacts with the Chatbot will be saved in the manager's database, helping to observe all this data as a report, with various filters to apply and review them as required; either exporting to an external database or in csv format, this is shown in the Figure 6 .
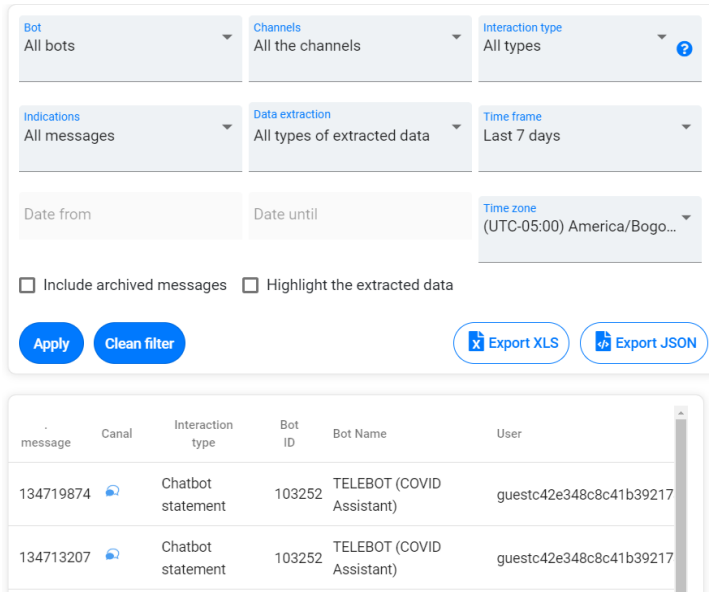
Fig. 6. Chatbot reports

The Chatbot is working on the page http://telesalud.udla.edu.ec/, in which it is fully integrated.
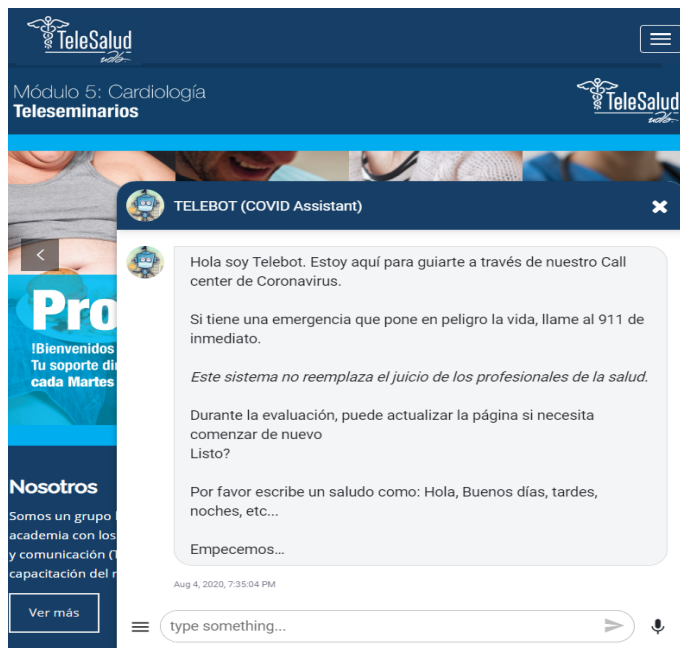

Fig. 7. http://telesalud.udla.edu.ec/

Finally, once the Chatbot was implemented over the Universidad De las Américas' website, a survey was carried out among the first users who interacted with it, yielding the following results depicted in the Figure 8. There were several other questions in the survey, but the most important was

about the usefulness of the tool, were 92% of the participants said this kind of tool is very useful, specifically the reliable information provided by the tool. On the other hand, the question about the comfort of using the web tool, in general it was a positive reaction with a 49%, but we can improve it because the 46% of the interaction said the experience was regular.
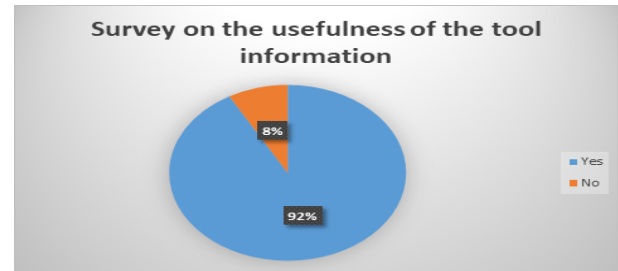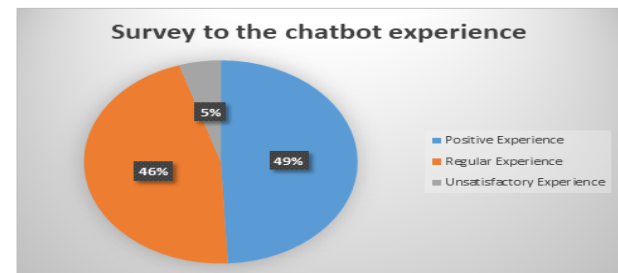
Fig. 8. Survey result:(a)Answer if the following information was useful,(b) The answer to the experience of the Chatbot

V. CONCLUSION

Chatbot innovation represents a new way for companies to serve users. A Chatbot transforms the interaction between a person and a computer, executing a series of tasks through a conversation, leaving aside traditional interfaces.

To implement an institutional Chatbot it is necessary to analyze the processes of organizations, to understand the work and expressions of people. With this step, the proposed general objective has been fulfilled in a comprehensive manner and with optimistic results for the detection of possible cases of virus infection.

The implementation of this Chatbot shows the following important bearings:

- The operational load of the staff willing to talk with patients who may have symptoms decreases, due to the fact that users make their queries in a guided and direct way through the Chatbot, without having the need to communicate with a person.
- Prospective patients or people with symptoms have a new means of accessing medical services.
- The times in which a relevant solution is given improve drastically, due to having an assistant with enough knowledge to give a first diagnosis. Thus, this tool can

give some automated information about people requiring information.

- The departamental heads in medicine are very keen in Chatbot implementation for applications in areas other than this one.
- As we can see in the Figure 8 the response to the usefulness of the tool in general was positive. However, a lot of improvements could be carried out, specially to reduce the time needed for the patients to get the specific information.

  Our solution compared to [5], shows that this type of software system can help developing countries to take advantage of technological tools to obtain more adequate information, especially in medical emergencies. However, one of the main problems is the lack of exploitation by people by this type of elements, so it would be convenient to use a kind of solution for social networks, which are more interactive with users, and can capture better the attention of the public at risk.

VI. FUTURE WORK

Chatbot and tele-care technology has a great future hand in hand since thanks to constant technological and scientific advancement, updating information allows the Chatbot to expand its fields of care, giving way to new consultations and different medical specializations for its care, as well such as expanding your knowledge base with new scientific information about Covid-19. On the other hand, head staff are keen on the new technological implementations to prevent the new infections nearby the University campus, sharing information with 2.0 tools.

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