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RESEARCH PAPER

Secure Dynamic Interactive Blood Bank based on Cognitive Computing

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ABSTRACT

Cognitive based (Chatbot) blood bank provides a communication platform among the stakeholders of blood bank. In the past, the blood recipient will have to contact the blood bank and the blood donors individually, which is a time-consuming process. To address this issue, this paper proposes a Secure Dynamic Interactive Blood Bank based on Cognitive Computing, which can fulfill the blood request of the needy with without much difficulty. Hence, the proposed work aims to overcome this problem by requesting the recipient to simply send a message to a chatbot. The motivated individuals who are willing to donate blood can register their name by interacting with the chatbot. If the requested blood group is available at the blood bank/registered donor, then the recipient will get contact details of the blood bank/registered donors available at that instant. Donor data will be maintained in Cloud database. The proposed system is a cognitive chatbot, which acts as a communication platform among the stakeholders such as blood bank, blood donor, and the needy. This system is built using cognitive technology of Google; it makes conversations using chatbots very similar to human conversations, thereby making the proposed system more efficient than the existing ones.

KEYWORDS: *Cognitive computing; Chatbots; Machine learning; Natural language processing; IBM Bluemix; Google's api.ai.*

1. Introduction

Blood is a non-replenishable entity, the only source of which is humans. Timely availability of quality blood is a crucial requirement for sustaining healthcare services. Therefore, maintaining the quality of blood and identifying Professional Donors represent a major responsibility of blood banks. NACO (National AIDS Control Organization) and NABH (National Accreditation Board for hospitals and Healthcare Providers) have provided guidelines for ensuring the quality of blood and identifying Professional Donors [1]. Moreover, manually monitoring standards and identifying professional donors is a challenging job. Blood is the most important and critical element in human life. According to the bible, blood refers to life every year that a nation requires about 4-5 crore units of blood out of which major 40 Lakh units of blood are available. There are several blood banks around the world; however, they are not offering any contact between the donor and the needy, which is often seen as a disadvantage and leads possibly to one's death. This paper aims to beat this communication barrier by providing a blood bank chatbot. This automated application is proposed to bring voluntary blood donors and the needy onto a common platform

According to the recent statistics of a blood bank in India, someone needs blood every two seconds. More than 38,000 blood donations are required every day. A total of 30 million blood components are transfused each year. The average red blood cell transfusion is approximately 3 pints. The blood type most often requested by hospitals is Type O. Sickle cell patients can require frequent blood transfusions throughout their lives. More than 1 million new people are diagnosed with cancer each year. A single car accident victim can require as many as 100 units of blood.

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We studied various existing blood bank systems ([2],[3],[4]) in which they will provide a direct communication link between the voluntary blood donor and the person who requires blood with a promising embedded application [2]. The importance and non-replenishable nature of blood motivated us to build a cognitive chatbot. This study developed a platform to connect donors to blood banks and hospitals mutually to minimize the death rate due to unavailability of blood information worldwide. The proposed system can intimate the availability to the needy instantly with minimal effort.

Contributions

- **Natural Language Processing**
  We have built an efficient **Interactive Blood Bank system based on** Natural Language Understanding Module to understand the needy request in his natural language to serve him/her best.
- **Donor data Security using IBM Cloud**
  IBM Cloud uses the best security algorithms to ensure optimum security of the data, hence making the donor data impenetrable and not prone to fraudulent usage.
- **Dynamic Donor Data/Providing Acknowledged Donors** by taking acknowledgement from the donors and sending their details to the patients.
- **Donors** can also go in and cancel – and then the bot will check with other people and update the requester of the donor change.
- **Optimal response rate**

2. Backgrand Technologies

Natural language processing

Natural Language Processing (NLP) is the ability of a computer program to understand human language as it is spoken. NLP is a component of artificial intelligence. It is proved through research that humans tend to make mistakes under stress and tension. In the existing system, the needy should type a particular format to get the data that makes it hard for a person in such mental state to give such data in such formats which is why we are using NLP ([12],[14]) to understand what the user says in his/her natural language.

Machine learning

Machine learning is a type of Artificial Intelligence (AI) that allows chatbot software applications ([13],[15]) to accurately predict outcomes without being explicitly programmed. The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output value in an acceptable range. Through machine learning, one can use conversation datasets to understand what kind of responses we should ask a user for and to increase the efficiency of Natural Language Processing.

Database as service cloud

Database as a Service (DBaaS) is a cloud computing service model that provides users with some form of access to a database without the need for setting up physical hardware, installing software or configuration for performance. Using Cloud Database provides faster access to the data so that we can easily contact the user in no time and we can provide security for the user.

3. Proposed Framework

In this section, the proposed framework is given for blood bank chatbot. Further, the technologies ([9], [12], [17], [18], [19]) used in this framework are explained in detail. To build a blood bank chatbot, different conversational chatbots are studied ([9], [10], [11], [16]). Further, the development chatbots are considered for the health domain ([5], [6]).

Technologies involved in the framework:

Various technologies involved in the proposed framework are described in the following.

Api.ai

Using Google's Dialog Flow, we will build a Natural Language Understanding Module that can be included into any app. This is included into our Facebook application to make human-like conversations possible through a simple platform. A user can interact with the chatbot on the Facebook page

IBM cloud

The proposed system will work with node JS as a backend and it will be deployed to the IBM cloud ([7], [17], [19]) so that it can provide scalability, flexibility, and accuracy.

IBM database

IBM Cloudant ([8], [18]) as a database is used, which provides easy access API's so that data can be transported from the cloud securely.

Node JS

Node JS is used as the backend. Since node JS is asynchronous, its capabilities will help serve requests individually and faster.

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Fulfillment / Web-hooks: Using fulfillment and web-hooks, one can do the callbacks and post back works easily with Facebook since Facebook is being used as the frontend platform [20].

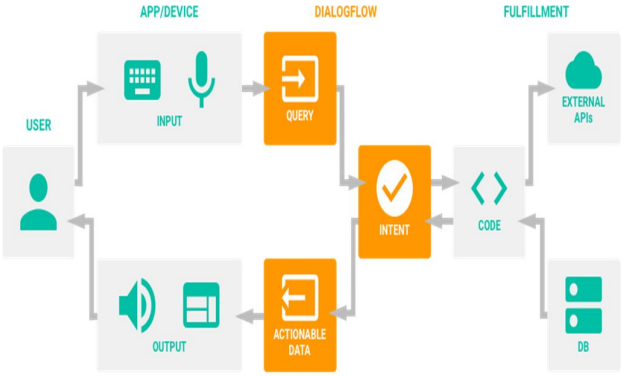


Fig. 1. Architecture of secured blood bank chatbot

Facebook

Since Facebook is used by many people and it has become the most accessible community in the world, we are using Facebook to integrate our chatbot.

Architecture

As indicated in Fig. 1, when a user interacts with the chatbot through voice / text, it will go to dialog flow for querying and, using NLP and ML, it processes the user query and understands the intent after that it transforms natural user requests into actionable data. This transformation occurs when a user input matches one of the intents inside your agent. Intents are the predefined or developer-defined components of agents that process a user's request. Agents can also be designed to manage a conversation flow in a specific way. This can be done with the help of contexts, intent priorities, slot filling, responsibilities, and fulfillment via web-hook. Finally, after taking necessary actions, the response data will be sent back to the user.

4. Results

This section presents the implementation details with screenshots and the detailed working model of the donor phase and the needy phase is explained here, too. The response time graphs are elaborated in this section.

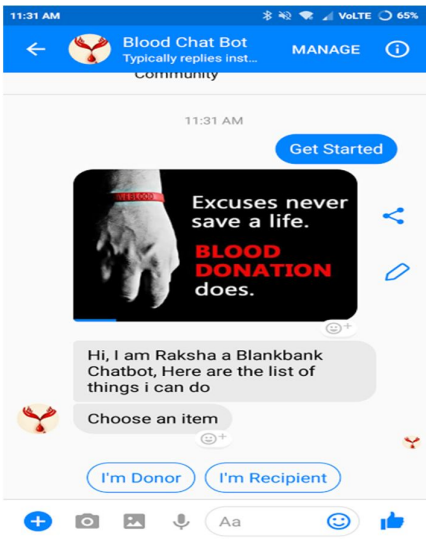


Fig. 2 Get Started on Facebook

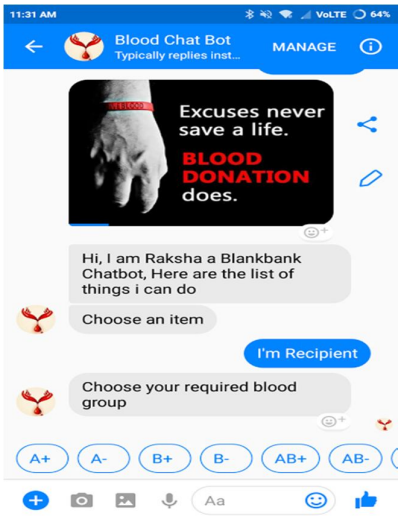


Fig. 3. Requesting blood

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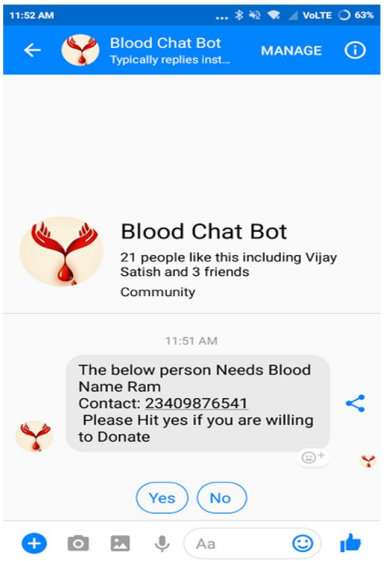


Fig. 4. Donor acknowledgement

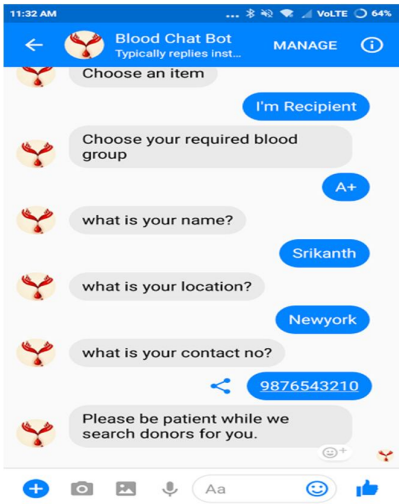


Fig. 5. Donation request

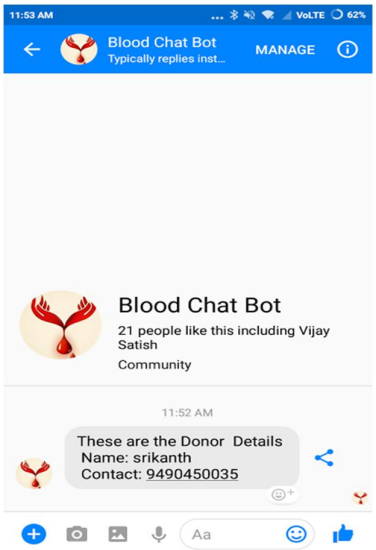


Fig. 6. Donation Details

As part of analyzing system efficiency, a graph between numbers of the needy versus response time of the system is drawn, as shown in Figs. 4, 5, 6.

Case 1: when it is less than the threshold (Available donors at that instant), the graph is linearly static.

Case 2: When the number of the needy is larger than the threshold, the response time increases exponentially.

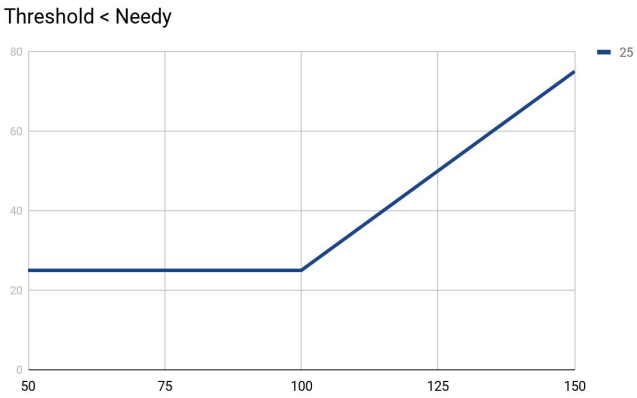


Fig.7. Response time graph

Slowly, the more donors the system starts to get, the more efficient it becomes with respect to donors.

5. Conclusion

This study established a Secure Dynamic Interactive Blood Bank based on Cognitive

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Computing to fulfill the requirement of blood to the patients/victims without rushing to the blood bank to determine the availability of the blood. One can simply send a message to the page on Facebook. When the new request is received, the Chatbot will check for the availability of the specified blood group; if not available, then it will send a list of eligible donors along with their contact numbers from the blood bank. Voluntarily motivated people may also register for blood donation using the same chatbot. This system is efficient in terms of time complexity to reduce death rate due to unavailability of available blood donor information.

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