A proposal for a chatbot system to support Patient Summary

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***Abstract*— Chatbots have gained popularity in recent years, especially in the healthcare sector, due to their ability to improve patient engagement and satisfaction. In this paper, we present the implementation of a chatbot for a healthcare system that depicts patient summary based on the European guidelines. We used Botpress application and our testing database for EHR information. The chatbot we created is Rule-based and provides to patients and doctors with information regarding medical history, medications, allergies, and vaccinations. Our findings suggest that the chatbot is a useful tool that can improve patient engagement, reduce waiting times, and improve overall healthcare delivery.**

Keywords—Patient Summary, chatbot, ehealth, Rule-based, virtual assistance

I. Introduction

In recent years, the use of chatbots in the healthcare industry has become increasingly popular. Chatbots are computer programs that use artificial intelligence to converse with users in natural language. They are used in a variety of applications, including customer service, marketing, and healthcare. The use of chatbots in healthcare has proven to be a valuable tool for improving patient engagement and satisfaction. Patients can use chatbots to obtain information about their medical history, medication, allergies, and vaccinations.

In this paper, we present the implementation of a chatbot for a healthcare system that depicts patient summary based on the European guidelines. The chatbot is an integral part of the eHealth4U prototype implementation that constitutes a proposal for a national EHR solution based on the EU patient summary [1], [2]. We used Botpress application and a database using MySQL, containing the eHealth4U EHR solution (see Fig. 1). The chatbot we created is rule-based and provides patients with information regarding their medical history, medications, allergies, and vaccinations. The system also allows patients to update their information and request appointments with healthcare providers.

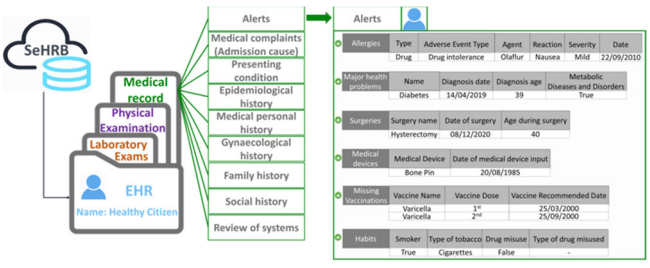

Fig. 1. An example on how a patient's EHR is structured in the eHealth4U system [2].

II. Background

In recent years, technology has played an essential role in healthcare, improving patient outcomes and satisfaction. EHealth is a term used to describe the use of electronic communication and information technology to support and improve health care [3]. Patient Summary is a critical component of eHealth, providing a comprehensive overview of a patient's medical history, medications, allergies, and vaccinations [4]. Chatbots, on the other hand, are computer programs that use artificial intelligence to converse with users in natural language. They are used in a variety of applications, including customer service, marketing, and healthcare. In this paper, we will discuss the implementation of the patient summary chatbot in detail [5].

The patient summary is a key component of eHealth. The patient summary provides healthcare providers with a comprehensive overview of a patient's medical history. The patient summary includes information about a patient's medical conditions, medications, allergies, and vaccinations. The patient summary is a standardized document that is designed to be shared among healthcare providers, improving coordination of care and reducing medical errors.

Chatbots are computer programs that use artificial intelligence to converse with users in natural language. Chatbots are used in a variety of applications, including customer service, marketing, and healthcare. In healthcare, chatbots can improve patient engagement, reduce wait times, and improve healthcare delivery [5].

A. There are two types of chatbots:

Rule-based chatbots: rule-based chatbots use a pre-defined set of rules to respond to user queries. Rule-based chatbots are relatively simple and can only respond to pre-defined queries. Rule-based chatbots are used in customer service applications, such as online banking [7].

Machine learning chatbots: Machine learning chatbots use artificial intelligence to learn from user interactions and improve their responses over time. Machine learning chatbots are more sophisticated than rule-based chatbots and can respond to more complex queries. Machine learning chatbots are used in healthcare applications, such as patient engagement and triage.

In healthcare, rule-based chatbots can be used to provide patients with information about their health conditions, medications, and treatment options. Rule-based chatbots can also be used to provide patients with information about healthcare services and insurance coverage.

Rule-based chatbots are relatively simple to implement, they have some limitations. rule-based chatbots are only able to respond to pre-defined queries, so they cannot provide personalized recommendations or advice. Additionally, rule-based chatbots may not be able to provide accurate responses to complex queries or queries that require context.

III. Implementation

A. Software

We implemented the chatbot using Botpress, an open-source platform that provides a visual interface for building chatbots. We used the MySQL eHealth4U EHR [1], [2] database to store patient information, including medical history, medications, allergies, and vaccinations. The chatbot was designed to provide patients with a simple and user-friendly interface. Patients can interact with the chatbot using natural language, and the chatbot responds with pre-defined answers based on the patient's queries.

To create the patient summary chatbot we chosen the necessary files to download from GitHub and a local server was built. The reason this option was preferred, even though the Botpress cloud allows much easier and faster publishing of the chatbot on the web, is the fact that it was not possible to connect to our base, due to permission restrictions.

B. Requirements

The functional requirements of the system are the following:

- Login - The user must be able to enter the system and register his identity, so that he can be identified.
- Provide assistance - The chatbot must be able to provide assistance to the user at any point in the conversation flow and direct them to find what they are looking for easily and quickly (see Fig. 2).
- Questions - The chatbot must be able to answer all questions about the Patient Summary.
- Exit - The chatbot should terminate the chat flow in case the user asks to log out.

As for the questions that the chatbot can answer in relation to the user's Patient Summary, these have been grouped into categories according to the information they request. The categories are the following:

- Allergies - In this case, the chatbot answers the user how many allergies she/he has and allows him to learn more information about a specific category of allergies (see Fig. 3).
- Vaccinations - In this case, the chatbot tells the user their vaccination history, i.e. what vaccines they have had and when.
- Past diseases - In this case, the chatbot tells the user how many diseases are registered in her/his medical history and if requested informs the user about what diseases they are, how long they lasted and what treatment was followed.

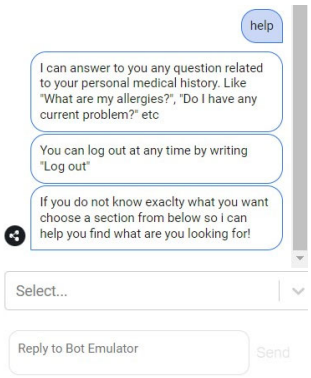

Fig. 2. Example of the chatbot providing asistance to the patient

- Medical Surgeries - In this case, the chatbot tells the user how many surgeries she/he has performed and, if requested, gives the description of each operation, as well as the date it was performed.
- Current problems - In this case, the chatbot tells the user about the current problems which may be allergies, ongoing illnesses, such as chronic conditions or an illness the user is currently experiencing, illnesses the patient has experienced within the last six months, and any addictions (e.g. alcohol addiction). To make it easier to read all of this, the chatbot, if asked about the current problems, shows the user a drop down list containing the mentioned categories and invites the user to choose what they want from the above. If she/he chooses to see her/his allergies then the chatbot responds exactly as it does in the Allergies category explained above. If she/he selects ongoing illnesses, then it displays the illnesses that the patient is still dealing with, if she/he selects last 6 months illnesses, then it returns a list of all the illnesses she/he has experienced within the last six months, and finally if she/he selects social problems (addictions), then the chatbot returns list of patient's dependencies. Possible questions that the user can ask are "What are my current problems?", "Do I have any current problem?". The answer that the chatbot will give is "I want to know about..." and a drop down list with the mentioned categories.
- Medical devices and implants - In this case, the chatbot tells the user how many medical devices and implants he has.
- History of Pregnancy.
- Physical findings.
- Summary of Prescription.

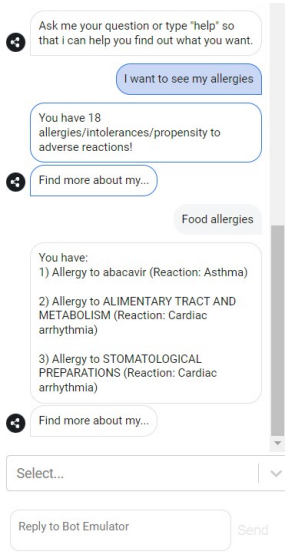

Fig. 3. Example of the chatbot answering what allergies a patient has, based on what is stored in the database

IV. Future Work

In future work, we plan to test our chatbot for healthcare system depicting patient summary on users to evaluate its effectiveness in improving patient engagement and satisfaction. We will recruit participants from different age groups and backgrounds to ensure that our chatbot is accessible and user-friendly for a wide range of patients.

During the testing phase, we will gather feedback from users to identify any areas for improvement in our chatbot. We will also analyze usage data to evaluate the effectiveness of our chatbot in providing patients with quick access to information about their health.

Additionally, we plan to include our chatbot in the mobile application we are currently developing as part of the eHealth4U prototype implementation, named MyeHealthAppCY [9]. By including our chatbot in the MyeHealthAppCY mobile application, we will provide patients with an easy-to-use tool for accessing information about their health. The chatbot will complement other features of the application, such as access to medical records and appointment scheduling, providing patients with a comprehensive suite of tools for managing their health.

Overall, our chatbot for healthcare system depicting patient summary has the potential to improve patient outcomes and increase patient engagement with their healthcare. By including our chatbot in the MyeHealthAppCY mobile application, we aim to provide patients with a user-friendly and accessible tool for accessing information about their health, empowering patients to take control of their health and wellbeing.

V. Conclusion

In conclusion, we have presented the implementation of a chatbot for a healthcare system that depicts patient summary based on the European guidelines. The chatbot provides patients with information regarding their medical history, medications, allergies, and vaccinations. The use of chatbots in healthcare has the potential to improve patient engagement, reduce wait times, and improve overall healthcare delivery. Our findings suggest that the chatbot is a useful tool that can improve patient engagement, reduce wait times, and improve overall healthcare delivery. We believe that the use of chatbots in healthcare will continue to grow, and we look forward to further research in this area.

Acknowledgment

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