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Development of a Chatbot to Encourage the Use of Assistive Technologies and Reduce the Rate of Discontinuance

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***Abstract*—** *Assistive Technology is an interdisciplinary group of tools that assists people with impairment. Even though 30% of people that use these discontinued using them, complicating their autonomy, quality of life, and social inclusion. For that, a prototype of Chatbot was developed to assist individuals with impairment to increase their adherence to Assistive Technologies. Chatbots are virtual assistants that interact with their users through messages, images, videos, and sounds, using an Artificial Intelligence tool named Natural Language Processing to simulate a person. It can be used in smartphones, computers, and other devices. This prototype was developed in the BLiP® platform, introducing a Knowledge Base with all the essential information about Assistive Technologies. The prototype assessment consisted of the White Box (Structural) and the Black Box (Functional) tests. The prototype was tested and presented a great flow of conversation and no errors in the structure. Besides the benefits provided, Chatbots cannot substitute a healthcare professional but only assist. Chatbots can be potential assistants that will increase and improve healthcare treatments.*

I. INTRODUCTION

Assistive technology (AT) is an interdisciplinary group of products, resources, methods, strategies, practices, laws, and services that assist individuals with special needs in achieving autonomy, independence, accessibility, quality of life, and social inclusion. [1, 2, 3]

These technologies aim at reducing or eliminating the limitations faced by the visually impaired so that they can better experience the different aspects of their lives, both professional and personal.[2]

ATs used for the visually impaired are divided into optical or non-optical resources, electronic resources, and software/applications. These resources are used mainly to improve reading, writing, manual work, mobility, professional activities, and leisure.[3]

Some examples of ATs worth mentioning are adjustable tilt desks, proper illumination for reading, writing, reading guides, glasses, magnifiers, telescopes, device cameras built into a cell phone or other devices to magnify objects, Windows® accessibility system, Braille system, blindness canes and guide dogs.[2, 3]

A literature review from 2015 concluded that 30% of those using any AT discontinued using it within the first five years of use, and some never even got to use it consistently. In 2018, Mission et al. demonstrated that the rate of AT discontinuance use is high, but it is hard to

determine the reasons since the discontinuance varies according to the AT type. [4, 5]

The principal reasons that lead to AT discontinuance are the appearance, ergonomic issues, design of the product, user's physical condition, lack of information and training, pain, functional limitations, preference for another AT or use of other remaining capabilities, heavy weight, changes in AT condition, trouble to use, discomfort, inadequacy, dissatisfaction and excessive noise.[3, 4]

Aiming to reduce the high rates of AT discontinuance, a prototype of a Chatbot was developed to assist patients undergoing ophthalmologic treatment. The goal is to increase the adherence of AT, either through reinforcing the importance of AT use or giving advice about adaptation to the technology.

Chatbots are virtual assistants that simulate a conversation using an Artificial Intelligence (AI) tool called Natural Language Processing (NLP), which identifies the morphological, semantic, syntactic, and pragmatic aspects of the language delivering a more human-like and objective conversation.[6]

The knowledge base of the chatbot has to be developed to provide answers that are coherent and objective. It consists of information available through the subject review and the knowledge acquired from previous interactions with its users.[6]

Chatbots in the medical field can be beneficial since it provides personalized assessment, 24/7 availability, less wait time in lines, decrease in unnecessary presential visits, increase in medical services reach to remote communities, scheduling, appointment or medication reminders, less cost, practicality and ability to answer to the most frequently asked questions quickly. [7, 8]

II. METHODS

2.1. DEVELOPMENT OF KNOWLEDGE BASE

The knowledge base was developed by collecting information from assistive technology in general and in ophthalmology too. Then, this information was fed into the prototype. We also inserted the fundamental questions that the users could ask, such as treatment, scheduling, and address. This phase did not involve any human beings, except for the developer, who came up with the possible questions.

2.2. CHATBOT DEVELOPMENT

Firstly, to develop a chatbot, it is necessary to produce a Specialist System (SS). SS is a system trained to solve problems that only the specialist in that field would solve. Therefore, the knowledge base has to be developed from dense literature research and assessment of most commonly asked questions.

After developing the knowledge base, it will be loaded in the platform BLiP® to the prototype development. It is essential to evolve a friendly conversation on the chatbot to be more interesting for the users.

2.3. SOFTWARE VALIDATION TEST

For the software validation, the validation tests, known as the White Box test and the Black Box test, were selected.[9]

The White Box test is a structural test that developers use to access the development platform and verify every step to find possible errors and fix them. The Black Box test is a functional software test. In this test, developers act as a user to verify if the software is working by testing all possible functions and applications. It enables the assessment of expected answers or results.[9]

III. RESULTS

3.1. KNOWLEDGE BASE DEVELOPED

The prototype knowledge base was developed based on the literature review about visual rehabilitation, assistive technologies, and discontinuance causes. This review results in an extensive and reliable database. Therefore, the information offered by the chatbot is reliable and objective, making the prototype trustworthy.

Table 1 shows some examples of frequently questions asked by individuals with or at risk of visual impairment interested in using assistive technology and are undergoing ophthalmologic treatment. Additionally, questions were added in the chatbot setting to serve as examples.

Table.1: Examples of Frequently Asked Questions.

What is visual impairment?
What caused my visual impairment?
Am I under the risk of becoming blind?
What is assistive technology?
What is the rate of discontinuance of assistive technology?
What is assistive technology in ophthalmology?
Am I able to recover any vision from doing visual rehabilitation?
With these resources, am I going to see clearly again and be able to resume my daily activities, such as sewing, read books or the Bible, watch TV?
What are non-optical resources?

What are the electronic resources?
What is software or application?
Where can I purchase this kind of technology?
How much does this technology cost?
Hello, did you use your assistive technology today?
Why did you not use it?
Can I help you?
Scheduling
What is the address?
What is the phone number for direct contact?

3.2. CHATBOT PROTOTYPE STRUCTURE

Figure 1 shows the prototype flowchart.

Initially, the main questions and answers were inserted in the prototype. To evolved it, the prototype interacted with different users to identify possible new interactions. If there were other questions, objective and trustworthy answers were formulated to increase the prototype knowledge base. Variations of the same expressions as “how are you?” or “are you doing well?” are recognized semantically the same due to an AI tool called NLP.

Figure 2 presents an example of the prototype conversation. In the figure, it is possible to recognize a personal conversation and not a formal one.

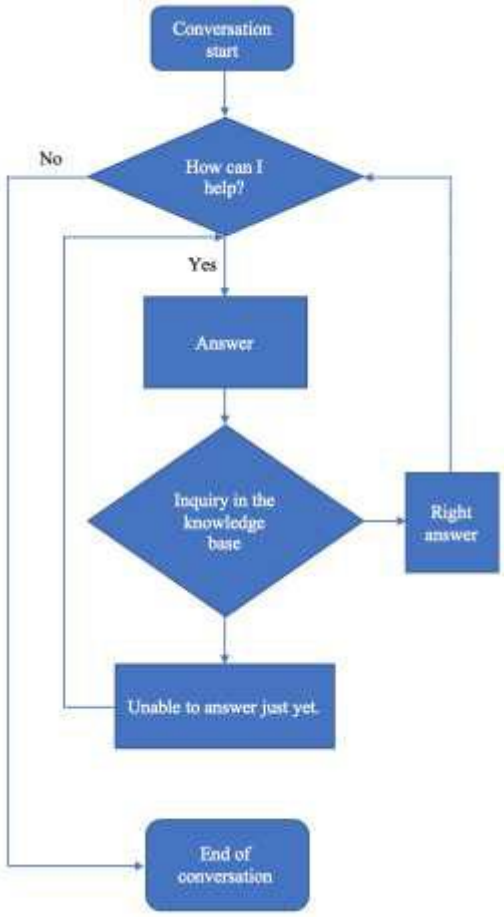

Fig.1: The Prototype Flowchart Structure.

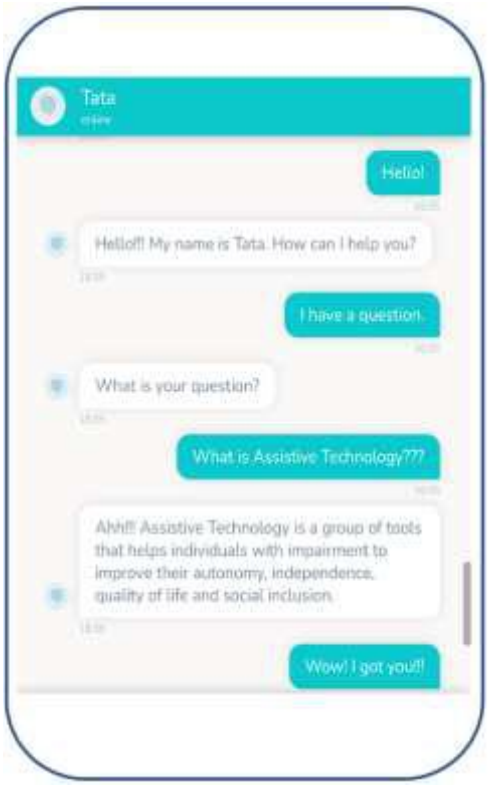

Fig.2. Example of Prototype Conversation.

3.3. VALIDATION TEST

In the White Box text, the developer accessed the prototype's structure and code inside the BLiP® platform. All the steps during the prototype build-up were double-checked to identify possible flaws and enable corrections.

During the Black Box test, the developer acted as a user and interacted with the prototype multiple times to evaluate the functionality of all possible interactions.

The prototype did not present any errors or problems during the tests, but that does not preclude the need for periodical updates and tests with the chatbot.

IV. DISCUSSION

The chatbot prototype is still in the initial phases of development, and for that reason, we did not test with final users. The initial phase consists of the software validation. Additionally, it is essential to verify the software's usefulness in healthcare assistance.[10]

Despite the amount of information loaded in the prototype knowledge base, it is necessary to periodically reevaluate, update and correct possible mistakes to keep the chatbot efficient in the environment in which it will be used.[11]

Since the chatbot prototype can be used 24/7, it would be a helpful tool to assist patients who need to ask questions or solve problems related to the assistive technology at any time, avoiding the unnecessary commute to health care units.[12]

Chatbots will not replace healthcare professionals. Chatbots can aid in the support and information services to patients, making them faster and readily available. Services like triage, frequently asked questions, and wait queue can be easily offered via chatbot.[13, 14]

V. CONCLUSION

The results found in this study demonstrated that chatbots are a potential virtual assistant to increase and improve healthcare treatments and procedures.

For that, Chatbots can help 24 hours per day, do not have physical and emotional limits, avoid patients dislocating unnecessarily, and be accessed anywhere using a device.

Therefore, patients with any impairment can be helped using chatbots to increase their adherence to Assistive Technology, improving their quality of life, autonomy, and social inclusion.

Besides its benefits, chatbots cannot substitute healthcare professionals but only increase their performance and attendance.

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