

Design of content of a chatbot to assist to caregivers of alzaihmer's pacients

Diseño de contenido de un chatbot para asistir a cuidadores de pacientes con alzahimer

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Abstract: The study addresses the use of information and communication technologies (ICT) to assist caregivers of Alzheimer's patients. It proposes the development of a chatbot, called RecuerdoBot, as a support tool. The article details the methodology used for its creation, highlighting the design of content and a first version of the chatbot capable of classifying symptoms into categories such as psychological, behavioral and physical emergencies. This virtual assistant, guided by healthcare professionals, is part of a broader project aimed at providing information, resources and emotional support to patients and caregivers. The research seeks to alleviate the high burden faced by caregivers, preserving their health and quality of life.

Keywords: Chatbot; Alzheimer's; Caregiver; Urgency; ICT.

Resumen: El estudio aborda el uso de tecnologías de la información y comunicación (TIC) para asistir a cuidadores de pacientes con Alzheimer. Se plantea el desarrollo de un chatbot, llamado RecuerdoBot, como herramienta de apoyo. El artículo detalla la metodología empleada para su creación, destacando el diseño de contenido y una primera versión del chatbot capaz de clasificar síntomas en categorías como urgencias psicológicas, conductuales y físicas. Este asistente virtual, guiado por profesionales de la salud, forma parte de un proyecto más amplio destinado a brindar información, recursos y apoyo emocional a pacientes y cuidadores. La investigación busca aliviar la alta carga que enfrentan los cuidadores, preservando su salud y calidad de vida.

Palabras clave: Chatbot; Alzheimer; Cuidador; Urgencia; TIC.

1. INTRODUCTION

Alzheimer's disease (AD) is the leading cause of dementia in the world, which is increasing in parallel with population aging. AD leads to the destruction of the sufferer's personal consciousness, and this cognitive and behavioral deterioration has a direct impact on the caregivers of these patients, who are mostly immediate family members [1].

In addition to fulfilling their jobs and personal responsibilities, caregivers handle a high overload in dealing with symptoms of various kinds that Alzheimer's patients may present. In the present study, the question arises: to what extent would a tool such as a chatbot help caregivers when a psychological, behavioral or physical emergency arises in Alzheimer's patients?

A chatbot is a conversational agent that uses artificial intelligence to interact with users and provide information or assistance [2].

Chatbots have proven to be very effective in a variety of fields, including providing information and support to patients with chronic diseases, promoting a healthy lifestyle, and even assisting with oncology applications [3]. However, dedicated chatbots that can address the unique needs and concerns of Alzheimer's caregivers are currently lacking in Colombia.

A chatbot solution can provide a highly customizable, low-cost emotional support solution that can scale to thousands of caregivers at a time. This can have a significant impact on the overall well-being and quality of life of both caregivers and people with Alzheimer's [4].

The chatbot can provide caregivers with educational resources about Alzheimer's disease, including information about its symptoms, stages and available treatment options. This will enable caregivers to better understand the disease and make informed decisions about caring for their loved ones.

In addition, the chatbot can offer tips and practical strategies for managing challenging behaviors commonly associated with AD, such as aggression, wandering and other approaches as a way to improve communication and engagement with people with Alzheimer's. Through interactive conversations, the chatbot can guide caregivers on techniques to redirect negative behaviors and

enhance positive interactions, ultimately improving the overall caregiving experience.

This paper presents the methodology to create the chatbot named RecuerdameBot, the results of the initial stages, especially the content design, and the chatbot prototype that classifies the symptomatology of patients in psychological, behavioral and physical emergencies. The content of the virtual assistant is guided by a group of health professionals as part of the macro-project "Development of a multimodal intervention with emphasis on anosognosia for the treatment of Alzheimer's disease, through ICT", which seeks to provide information, resources and emotional support to the patient and caregiver dyad.

2. METHODOLOGY

In correspondence to the requirements of the macroproject "Development of a multimodal intervention with emphasis on anosognosia for the treatment of Alzheimer's disease, through ICT", in terms of having greater control through a guided menu that guarantees the reliability of the answers under the responsibility of the project's medical team, a virtual assistant is programmed without the use of Artificial Intelligence (AI) following the stages below in Figure 1.

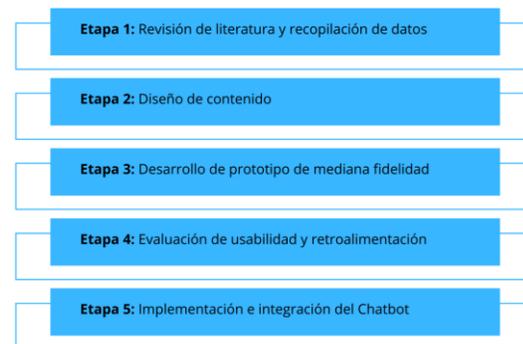


Fig. 1. Chatbot Development Methodology

However, the development of a virtual assistant with the use of AI trained with the content of the chatbot is agreed, adding in the last stage an activity that consists in the comparison of the usability of the two chatbots. The integration refers to the linking of the chatbot to the macroproject's Web Platform that integrates different support and help components for both patients and caregivers, which was named RecuerdaMe.

2.1. Tools for chatbot development

To create the chatbot without incorporating artificial intelligence, the Python programming language was used along with the following libraries.

- ✓ **NLTK (Natural Language Toolkit):** NLTK is a Python library used for natural language processing.
- ✓ **Scikit-learn:** Scikit-learn is a Python library used for machine learning and data processing.
- ✓ **PySide6:** PySide6 is a library that allows the creation of graphical user interfaces in Python.

In the case of AI chatbot development, it was carried out on Telegram's botFather, which is an official Telegram bot. In addition, the implementation of an OpenAI GPT-3 model called DaVinci was used, which is a large language model (LLM) that can be used to create chatbots that can provide information and support to users. The aforementioned model was customized by Fine-tuning, which is a machine learning process used to improve the performance of an already trained machine learning model.

3. RELATED WORK

Chatbots have seen an increase in their use in healthcare over the last decade and have been shown to be especially effective in the treatment of mental health disorders and chronic illnesses. In [5] the aim was to investigate the feasibility and utility of a short-term intervention, specifically a mobile device-based interactive chatbot application, to alleviate symptoms of attention deficit. Some work investigates the existing electronic health care structure involving complex interaction with human machines and proposes an alternative method: a chat interface configured to act and interact with patients like a human being [6].

Alzheimer's disease affects about 60-70% of people suffering from dementia. This scenario has motivated the study and development of tools that provide a more appropriate treatment to patients. To avoid overburdening the medical team and facilitate both diagnosis and patient follow-up, chatbots can be used. Several works show this possibility, [7] is an initial study of the application of chatbots in the health area, especially help in the monitoring and

treatment of patients with Alzheimer's disease. Chatbot focused on natural language processing of patients, in [8] show that capturing the speech and language pattern of AD patients can contribute to early diagnosis and longitudinal studies of the disease in the future.

In [9] a comparative analysis of chatbots and development tools is performed with the aim of determining what features and characteristics a chatbot for people with Alzheimer's disease should have. The work in [4] proposes a mobile application called AlzBot with the implementation of a chatbot as a support tool for both caregivers and Alzheimer's patients, its development follows an extreme programming methodology. One of the works that identify commercially available chatbots designed to be used by people with dementia and their caregivers and evaluate their quality in terms of features and content is [10].

Following a methodology similar to the present work, in [11], interviews were developed in care facilities and research articles were consulted to find potential ways to use chatbots. A prototype chatbot was developed in Telegram that acted as a means of communication between caregivers and dementia patients, then interviews were conducted to explore other areas of improvement for the chatbot. The work in [12] develops design ideas for implementing solutions to help informal caregivers care for people with disabilities at home by employing conversational agents. Their recommendations will prove valuable in improving the content of Remember Me Bot.

HIGEA is a conversational agent to help detect caregiver overload in patients with AD, incorporating psychological test questions into informal conversations, which aims to increase adherence to use and avoid user bias. A proof of concept was developed and the results show that the system is useful and effective. Its elements and features can be a basis for improving the present work [13]. An AI assistant called Alzaid is performed in [14], its objective is to promote social support in informal caregivers of people with dementia by providing them with information and strengthening coping strategies for problem solving and emotional regulation to reduce levels of overload, anxiety and depression.

A recent study [15] explored the potential of a GPT-3-driven chatbot to detect Alzheimer's disease from transcribed conversations. The chatbot successfully discriminated between transcripts from Alzheimer's patients and healthy volunteers, with an accuracy of 80%. This finding suggests that AI-based chatbots could be used as early detection tools for Alzheimer's disease, complementing traditional methods such as cognitive testing and neuroimaging.

In [5], the use of chatbots for symptom monitoring and provision of personalized real-time interventions for Alzheimer's patients is explored, showing significant improvements in symptom management and quality of life for patients and their caregivers.

4. RESULTS

4.1. Stage 1. Literature review and data collection

This phase involved a thorough review of the literature related to Alzheimer's disease and the needs that caregivers of these patients may have. The objective of this stage was to identify the key factors that should be considered when designing content for a chatbot to support caregivers of AD patients. The results of the review identified the following key factors:

- ✓ Contextual appropriateness: Content should be relevant to the specific needs of Alzheimer's caregivers.
- ✓ Accessibility: Content should be easy to understand and use.
- ✓ Usefulness: content should be useful to caregivers.
- ✓ Effectiveness: content should be effective in reducing caregiver stress and burden.

In addition to the literature search, we chose to conduct interviews with caregivers of Alzheimer's patients. These conversations provided a comprehensive and detailed understanding of the experiences, challenges, and concerns faced by caregivers on a day-to-day basis. Through these interviews, the following four urgencies were identified to be addressed in the chatbot content:

- ✓ Psychological emergencies such as: apathy, quietness, anxiety, sadness, confusion.
- ✓ Behavioral Emergencies such as: physical or verbal aggression, social or sexual disinhibition.

- ✓ Physical Emergencies such as: risk factors for falls, recommended exercises, fall avoidance, epilepsy, seizures.
- ✓ Missing person emergencies such as: how to act if the patient is missing, where to report, poster design.

4.2. Stage 2. Content design

A conversational guide is a document or set of instructions that defines how conversations between a chatbot or virtual assistant and users should be conducted.

Table 1: Conversational guide format

Item	Description
Chatbot objectives: Before starting, you should be clear about the chatbot's objectives.	-What is the main purpose of the chatbot? -What objectives should you meet in the conversations?
Target Audience: Understand who the chatbot users will be.	-Describes who are the users that the chatbot is targeting. -What knowledge or experience do users have? -What questions or needs might they have?
Tone and Style: the way a chatbot communicates with users.	-Defines the tone of voice that the chatbot should maintain in conversations (friendly, formal, professional, etc.). -Specify the communication style to be used (simplicity, humor, empathy, etc.).
Conversation Flow: This is the predefined structure that describes how a conversation between a chatbot and a user unfolds.	-Design a conversation flow that represents typical interactions between the chatbot and users. -It includes an opening greeting, possible questions and answers for different scenarios, and a closing.
Rules and Constraints: These are the pre-established guidelines and constraints that govern the chatbot's behavior and capabilities.	-Establish clear rules that determine how the chatbot should respond in different situations. -Indicate the limitations of the chatbot and what it cannot do.
Error Handling: These are the strategies and predefined responses that the chatbot uses when it cannot understand or	-Defines how the chatbot should handle error situations or misunderstandings.

handle a user's question or request properly.

-Specifies how it should help users solve problems.

Human Operator

Integration: The process and guidelines that are established to enable the transition of the conversation from the chatbot to a human being in situations where the chatbot cannot fully meet the user's needs.

-If relevant, explain when and how human operators should intervene in conversations.

terms, Figure 3 shows the response to the caregiver placing the keyword "violent".

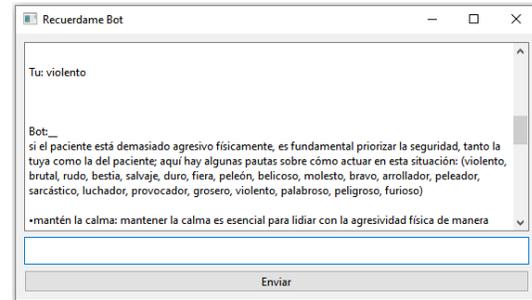


Fig. 3. Chatbot querying with keywords

These guides are essential to ensure that the interactions are effective, consistent and satisfactory for users. The development of conversational guides for the use of a chatbot without the use of AI implies a more manual and rule-based approach. As a communication mechanism between the medical expert staff providing the content and the chatbot developer staff, a conversational guide format is designed, as evidenced in Table 1.

4.3. Stage 3. Medium fidelity prototype development

4.3.1. Prototype without AI

The chatbot prototype was built under Python programming language under the name Recuerdame Bot, a shared directory was generated in the cloud with the chatbot content in .txt format and its executable file. Figure 2 below shows the initial screenshot of the chatbot with a welcome message and options 1 to 4 to address one of the emergencies identified in the previous stages.

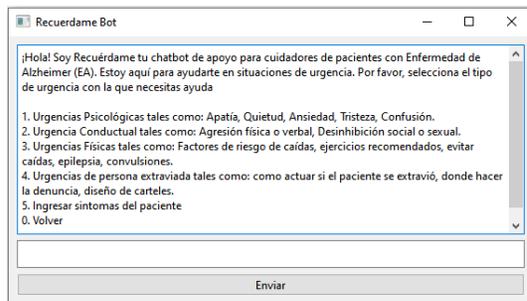


Fig. 2. Chatbot querying with guided menu

The option "5. Enter patient symptoms" is presented as an alternative in case the caregiver wants to enter a keyword and from there go directly to all the information related to the term available in the chatbot content. To program this option it was necessary to elaborate a list of possible synonymous

4.3.2. AI Prototype

The chatbot was implemented in Telegram's botFather. The botFather is an official Telegram bot that allows users to create and manage their own bots. "Remember Me Bot" was the name assigned to the chatbot, and this uses the implementation of an OpenAI GPT-3 model, which is used to provide information and support to caregivers. Figure 4 shows the initial screenshot of the chatbot with a greeting message that leads the caregiver to make a description of the patient's condition, and thus be able to attend to one of the identified emergencies.

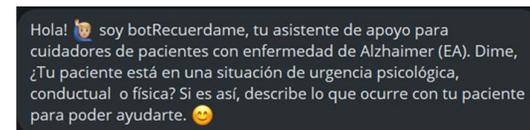


Fig. 4. Chatbot presentation and situation description request.

The model can answer questions about Alzheimer's disease, provide tips for patient care, and generate creative content in order to guide caregivers as evidenced in Figure 5.

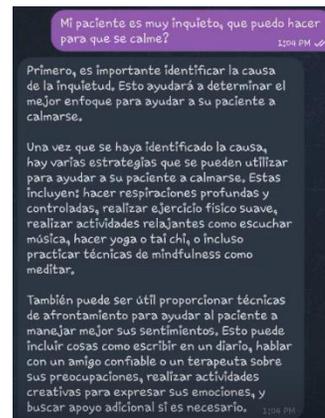


Fig. 5. Chatbot querying by means of situation description.

4.4. Stage 4. Usability evaluation and feedback

For the evaluation of the prototype we had the collaboration of the group of professionals who are part of the macro-project "Development of a multimodal intervention with emphasis on anosognosia for the treatment of Alzheimer's Disease, through Information and Communication Technologies (ICT)". This group of experts in the health field has played a key role in guiding and validating the information gathered, ensuring that the content of the chatbot is accurate and appropriate for the needs of Alzheimer's caregivers. As such, testing of the prototype was conducted with caregivers with extensive experience. The usability study focused on the following aspects:

Ease of use: Caregivers evaluated the chatbot's ease of use in terms of its design, navigation and interaction.

Relevance: Caregivers assessed the relevance of the content provided in terms of its accuracy, usefulness and timeliness.

Usefulness: Caregivers rated the usefulness of the content provided in terms of its ability to help them manage emergency situations.

Currently, the project is awaiting final recommendations regarding the chatbot's usability by caregivers of Alzheimer's patients. Feedback from testing will play a crucial role in refining the assistant and identifying areas for improvement to ensure that the chatbot is an effective and useful tool for caregivers.

Similarly, the last stage will consist of migrating the chatbot to an online platform, which will allow it to be called from the Web solution that integrates all the components of the macroproject, as shown in Figure 6.



Fig. 6. RecuerdaMe main site interface.

And as an added value we will also compare the solutions without AI and with AI. The advantages and disadvantages of the two versions of the chatbot have been identified beforehand, as shown in Table 2.

Table 2: Comparative Chatbot without AI vs. with AI

No AI	With AI
Can be run on simpler hardware	It requires more powerful hardware and infrastructure.
It may be more secure in terms of privacy.	There is a concern about data privacy.
Less costly to implement and maintain	Implementation and maintenance can result in higher costs
It is programmed with predefined rules or scripts that may be suitable for your purpose.	If you have a limited scope, AI becomes unnecessary
The complexity of tasks that the wizard can perform is limited.	Its learning capability allows it to include more possible response options for users

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