www.editada.org

International Journal of Combinatorial Optimization Problems and Informatics, 15(4), Nov 2024, 149-162. ISSN: 2007-1558.
https://doi.org/10.61467/2007.1558.2024.v15i4.484

Application of Artificial Intelligence for the Design of a Virtual Assistant (Chatbot) as an innovative approach in user service: Social Security Center No.102

María E. Dominguez-Tabera[1], *Mayra L. González-Mosqueda*[2], *Karla Martínez-Tapia*[2], *Eric Simancas-Acevedo*[3], *Eric León-Olivares*[4], *Katia Lorena Aviles-Coyoli*[5], *Daniel Robles-Camarillo*[3]

[1]Tecnológico Nacional de México-Instituto Tecnológico de Pachuca - Estudiante del PE de Licenciatura en Administración
[2]Tecnológico Nacional de México - Instituto Tecnológico de Pachuca, PTC- Departamento de Ciencias Económico Administrativas
[3]Universidad Politécnica de Pachuca – Profesor Investigador - Dirección de Investigación Innovación y Posgrado (DIIP)
[4]Tecnológico Nacional de México - Instituto Tecnológico de Pachuca, Departamento de Sistemas y Computación
[5]Tecnológico Nacional de México - Instituto Tecnológico de Pachuca, Departamento de Ingeniería Industrial

E-mails: l19201122@pachuca.tecnm.mx, karla.mt@pachuca.tecnm.mx, ericsimancas@upp.edu.mx, eric.lo@pachuca.tecnm.mx, katia.ac@pachuca.tecnm.mx, danielrc@upp.edu.mx
*corresponding author: mayra.gm@pachuca.tecnm.mx

Abstract. The "Social Security Center No.102" has a deficiency in customer service, which has caused problems such as low user satisfaction, bad reputation, long waiting times for answers and loss of customers.
The objective of this project is to demonstrate that the design and implementation of a virtual assistant (Chatbot) optimizes the service to users of the organization.
As for the design of the method, the research is considered mixed, applied and technological; and depending on the level of research, it is descriptive, explanatory, cross-sectional, non-experimental and field. A stratified population sample of 380 people was considered, to whom a "questionnaire" type data collection instrument was applied, consisting of 4 sections and 24 items.
Based on the results obtained, it was shown that the Chatbot improved efficiency by 64.4% and effectiveness by 63.1% in the provision of customer service to users.
Keywords: Virtual assistant, chatbot, customer service and users.

Article Information
Received Jul 26, 2024
Accepted Oct 11, 2024

1 Introduction

The quality of service and attention to users is essential for the success of any company, as it not only meets the needs and expectations of users, but also strengthens their loyalty and trust with the company. In Mexico, the problem of customer service in companies engaged in activities that contribute to health care persists as a significant challenge. According to an article published by the National Institute of Public Health [2022], Mexico "Perception of the quality of care of health services in Mexico" mentions that the main reasons that define the good quality of care are associated with personal treatment with 23.2%, improvement in health with 11.9%, and the technical preparation of the personnel with 10.2%.

The "Social Security Center No.102" is a basic operational unit of organization for the provision of services in the field of institutional social benefits insurance, for the promotion of health, prevention of diseases and accidents, as well as the improvement of the well-being and quality of life of people; located in Ciudad Sahagún, Hgo. From a diagnostic study, a deficiency of attention to users was detected, because they have had problems clarifying their doubts regarding the services offered by the center. The problem is generally due to a series of factors such as: the lack of planning and time within the company to attend to users, the lack of a person in charge of answering questions, as well as the lack of updating in systems and technology. This problem brings with it certain drawbacks such as: decrease in course enrollment, lack of knowledge of the service offered, decrease in the accessibility of the service, as well as low income.

The purpose of this research is to explore the application of artificial intelligence in the design and implementation of a virtual assistant (chatbot) as an innovative solution to optimize the service to users of the Social Security Center No.102. Through the use of natural language processing (NLP) and machine learning techniques, the aim is to design a chatbot that can understand and respond to user queries more quickly and accurately, providing a personalized service available 24 hours a day, providing real-time support, answering common questions and solving simple problems.

In today's digital age, technological transformation is reshaping the way organizations interact with their users. Customer service has evolved significantly with the adoption of advanced technologies, among which artificial intelligence (AI) stands out. AI, with its ability to learn and adapt, has opened up new possibilities to improve efficiency and effectiveness in customer service. In this context, virtual assistants, commonly known as chatbots, emerge as powerful tools that can revolutionize the user experience.

Chatbots have become an essential tool to improve customer service in Mexico, reflecting a growing trend towards digitization and automation of processes. According to a report by [Statista 2023], approximately 30% of companies in Mexico have implemented some type of chatbot to improve customer service. A study by [Oracle Research, 2023], indicates that 80% of customers in Mexico prefer to interact with chatbots for simple tasks and quick queries, due to the speed and 24/7 availability offered by these systems. Chatbots in Mexico have proven to be efficient in resolving basic and repetitive queries, with a resolution rate of up to 70% without the need for human intervention. This frees up human agents to handle more complex and personalized queries.

This study will examine how artificial intelligence can be integrated into virtual assistants to improve the quality of customer service and increase user satisfaction. The main characteristic of this project is to optimize the user service through technological tools, given that inefficient customer service causes waiting times to respond to frequently asked questions to be very long or that the information is incomplete; In addition, the impact of this technology on the satisfaction of its users is evaluated, highlighting the competitive advantages it can offer.

2 State of the art and description of the problem

In this section, attention is focused on the development of the conceptualizations that underpin the study. The first element of analysis related to user service is contextualized: concept, importance and the benefits it provides to an organization. Subsequently, the second element of study is introduced: virtual assistants, especially "the chatbot", which was applied as a prognostic control strategy to address the problem mentioned above.

2.1 Customer-user support

In the context of business administration and service delivery, customer service is a fundamental concept. It refers to an organization's ability to meet needs, solve problems, and help its customers effectively and efficiently. Customer service must be related to the organizational culture and not only to the user service teams, that is, all employees must be aware of the importance of providing exceptional service.

To understand the elements implied by the context of "customer service", the following definition is mentioned:

> It can be understood as the service provided by companies that offer services and/or market products to customers to satisfy their needs, among which are: making complaints, claims or suggestions; express concerns or doubts about the product or service purchased or require additional information. [Gómez & Ediciones, 2023, p.14].

From the above, it can be concluded that the elements considered key in the "customer service" process are the following (Fig. 1):

Fig 1. Elements that make up the user's satisfaction of attention.

It is important to mention that customer service aims to respond to queries, manage complaints and promote the proper use of the products sold by a company or business. Therefore, the main difference between customer service and customer service is that the service is not aimed at solving a specific technical problem, but rather is concerned with remaining attentive to the demands and needs of customers and offering useful answers in an agile way [Douglas, 2024].

Customer service can be carried out through different means: face-to-face, telephone, online, etc., always adapting to the needs of customers. However, a high-quality service is optimized through the use of innovative technologies and efficient processes. The response is faster and more accurate thanks to the automation of routine tasks and system integration. By achieving a quality service in the attention of its users, the advantages obtained, as described by the author [López, 2020] are limited to the improvement in user loyalty, greater breadth by increasing the customer portfolio and improvement of the company's image and reputation. (Fig.2)

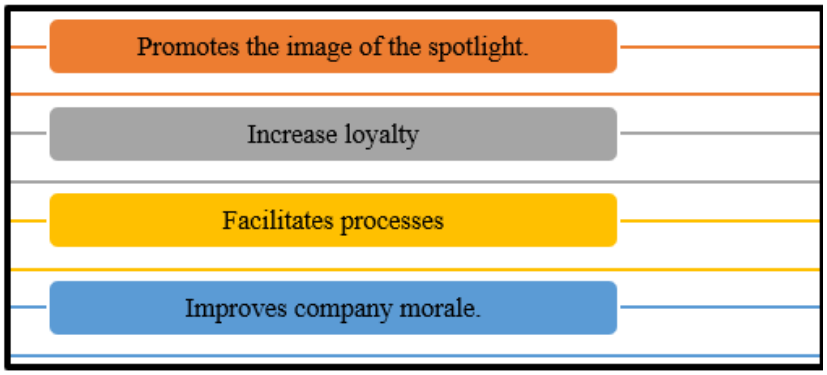

Fig 2. Benefits of good customer service.

The importance of offering quality customer service lies in a series of fundamental factors that involve both users and the organization, such as: the direct contribution to customer satisfaction. Users are more satisfied and experience positive experiences when they receive quick responses, effective solutions, and friendly treatment. In addition, this stimulates loyalty, as users who are satisfied with the service are more likely to remain loyal to the organization and repeat purchases or

interactions. On the other hand, positive interactions between the organization and the user lead to favorable feedback, recommendations, and a positive perception, which can attract new users.

Quality in user service is not only about complying with established standards, but also about exceeding user expectations through a constant commitment to improvement and excellence in all aspects of user-organization interaction, being precisely in this context, where the use of technology becomes an indispensable innovative resource. High-quality customer service not only generates a good customer experience, it also becomes a key factor in differentiating itself from competitors and a strategic investment that improves the company's profitability and sustainable growth.

2.2 Virtual assistants

Virtual assistants, powered by artificial intelligence, have seen significant growth in a wide range of applications, such as in customer service. A virtual assistant is a tool used to perform specific tasks or provide information through natural interactions with users.

Considering the definition of [Dorfman et al., 2011] they state that: "A Virtual Assistant is a set of computer programs capable of interacting with human beings through natural language, instead of a graphical interface/GUI like Windows or a command line in style" [p.4].

Below (Table 1) [Zavala, 2020; Martínez, 2019], are the top virtual assistants that have left a significant mark on the technology and business industry, highlighting their unique features, advantages, and disadvantages for users interacting with digital information and services.

Table 1. Main virtual assistants

Assistant	Siri	Alexa	Google Assistant
Functional Features	• Search for information about the weather, restaurants, movies, etc. • Make a post on Facebook, Twitter. Control home automation devices.	• Make online purchases. • Amazon shipment tracking. Control home automation devices	• Make online purchases. • Amazon shipment tracking. Control home automation devices
Advantages	• Available in more than 20 languages, counting the most common such as English, Spanish, French or Chinese.	• Creating Custom Activities • "Amazon Skills" • Adjustment of activation options. • More "Humanized" Voice	• Versatility of use in different Hardware (Smartphones, Tablets, Exclusive Devices, etc.) Widely used software (Android) • Perform multiple activities with a single command. • High capacity for correct responses
Disadvantages	• Only compatible with Apple products	• Limited to only 5 languages.	• Incorrect interpretation of commandos

Virtual assistants are AI-based computer programs that mimic human interaction in order to provide services, respond to queries, complete specific tasks, or facilitate communication between users and systems, using technologies such as machine learning and speech recognition.

The Chatbot

A chatbot stores information that it uses to respond to user queries. Therefore, it is defined as software that executes repetitive and structured tasks in order to simplify interactions between humans and machines [Parada, 2020]. Its main objective is to provide information, assistance, entertainment or perform specific tasks.

A bot is defined as:

> An artificial intelligence software designed to perform a series of tasks on its own and without the help of humans such as making a reservation at a restaurant, marking a date on the calendar or collecting and displaying information

> to users. The most frequent model is that of the chatbot, a robot capable of simulating a conversation with a person and therefore they are increasingly present in messaging applications. [Μαρτίνεζ, 2019, π.16]

Another conceptualization of Chatbot is the one suggested by [Arteaga & Quimiz, 2022] where they define it as:

> A computer program that can be talked to via text, chat windows, or voice. Also known as talkbot, bot, or interactive agent, these programs are used in dialogue systems for various practical purposes, such as customer service (p.4)

The recent incorporation of chatbots in several organizations for user service reflects the need to use them to improve processes. One of the main reasons for their implementation is the ease with which they can be integrated into messaging platforms such as WhatsApp or Facebook, which allows conversations or queries to be streamlined.
Chatbots have grown in popularity in recent years, because they can hold conversations that are increasingly human-like. In this way, companies can optimize their resources: time and money, since the basic objective of bots is to become intermediaries by helping users to be more productive and solve tasks for different purposes [Pinilla 2020]. Therefore, they are a very powerful marketing tool that businesses are starting to use to attract new customers.

Among the main benefits offered by chatbots are: their ability to manage a large number of conversations simultaneously and their availability 24 hours a day to respond to user queries. In addition, they are programmed to personalize the user experience, allowing them to resolve their doubts at any time and without delays in response (Urrutia, 2020). As it is a text conversation, they use short and direct language to obtain better results. They are able to answer, take actions, request more information, or respond with instructions to handle errors. Finally, they do not require to be downloaded or take up space in the cell phone's memory.

In de following image (Fig.3), is a summary of the main benefits of using chatbots:

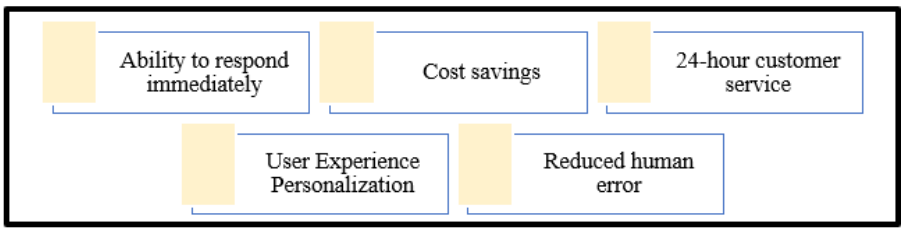

Fig. 3. Benefits of a chatbot.

Some other benefits are associated with: reduction of waiting times, increase in customer satisfaction and therefore a decrease in complaints. In this way, it helps the company to maintain and strengthen the ties between it and customers, because they feel that their concerns or queries are heard and that the company can provide an additional channel to interact. [Rivas, 2021]

Therefore, the implementation of a chatbot in a company that requires constant attention to the customer service department, provides a competitive advantage because it allows users to receive immediate attention and at any time; as well as, automate the processes of answering frequently asked questions and filter cases that need the attention of a human assistant.

3 Methodology and data

The research was carried out at the Social Security Center No. 102, an institution located in the city of Sahagún in the state of Hidalgo. It was created in 1982, dedicated to providing care and services of promotion and education for health, physical culture, sports, job training and cultural activities, as well as fairs and campaigns for health care. It currently has 2,858 registered users, reported at the beginning of the research in January 2024. The micro and macro location can be seen in the following image (Fig. 4):

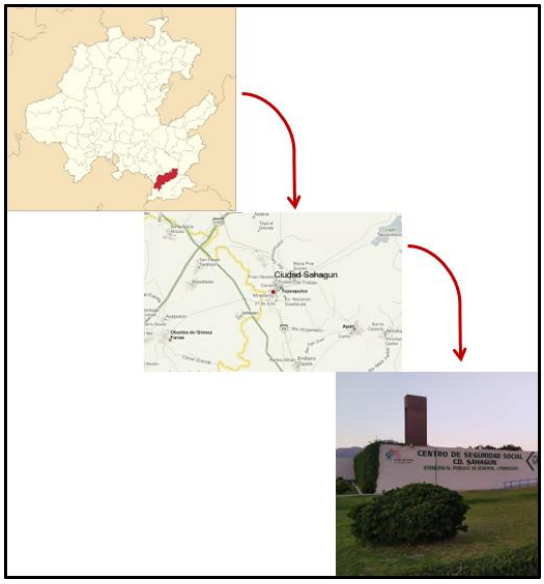

Fig. 4. Location of the Social Security Center No.102 Ciudad Sahagún, Hgo.

Based on the general objective of the research aimed at achieving an optimization in the quality of care to users, the delimitation of the study population is carried out, considering the main localities surrounding the reference institution, these being: Tepeapulco, Sahagún, Los Cides and Irolo. According to the results presented by the INEGI Population and Housing Census [2023], the size of the population was determined, made up of a total of 51,064 inhabitants (Table 2), whose inclusion criterion was the age between 15 and 69 years.

Table 2. Delimitation of the study population

Zone	Population	Female Population	Male population	Female population selected by age range from 15 to 69 years	Male population selected by age range from 15 to 69 years
Tepeapulco	16,368	8,558	7,810	6,686	5,842
Cd. Sahagún	31,737	16,647	15,090	13,378	11,837
Los Cides	1,080	535	545	391	416
Irolo	1,879	992	887	733	655
Total	**51,064**	26,732	24,332	21,188	18,750

For the calculation of the sample, the formula for finite populations was used, obtaining a sample population composed of a total of 380 people. See the procedure in the following image (Fig. 5)

Simple Calculación for finite populations

$$n = \frac{N * Z^2 * p * q}{e^2 * (N-1) + Z^2 * p * q}$$

$$n = \frac{(39{,}938)(1.96^2)(.50)(.50)}{((.05^2)(39{,}938-1)) + (1.96^2)(.50).50)}$$

$$n = \frac{38{,}356.4552}{100.8029} = 380$$

Fig. 5. Calculation of the population sample

Subsequently, the proportion of people to be analyzed by each of the three municipalities was determined by means of stratified probabilistic sampling, which was obtained by calculating the constant (nH), which results from dividing the sample obtained by the study population. This determined a stratified population divided as follows (Table 3):

Table 3. Stratified sample size by municipality

Population	Sample size by strata
Tepeapulco	119
Cd. Sahagún	240
Los Cides	8
Irolo	13
Total	**380**

The cross-sectional study, covering the period from January to June 2024, was divided into three phases of work: diagnostic detection, design and development, finally the intervention; the latter being the stage of application of the chatbot strategy.

The obtaining of information for the first phase "preliminary diagnosis", as well as for the verification of post-intervention results, on the state and perception of the users regarding the care received and their perspective on their interaction with the virtual assistant, was carried out through the design and application of the questionnaire-type data collection instrument called: "*Chatbot as a strategic tool in user service*", made up of a total of 4 sections (personal data, user service, virtual assistant and satisfaction in service) and 24 items; applied to the sample population of customers and/or users of the service, coming from the aforementioned municipalities. SPSS statistical software was used to process the statistical data.

Below is the matrix that indicates the detection of internal and external problems, derived from the first application of the instrument in its diagnostic phase. From this, the design of various strategies aimed at helping in the solution of the problems is proposed, which are part of the virtual assistance tool. In (table 4), the SWOT analysis can be seen:

Table 4. Weaknesses, threats and strategies of the organization "Social Security Center No.102"

	Weaknesses		Threats
1	Inefficient customer service	**1**	Negative reputation
2	Slow response time	**2**	Competitors with more efficient customer services
3	Unclear information provided	**3**	Competitors with faster response times can capture customers
4	Low recommendation of workshops		
5	Inefficient use of technologies for customer service.		Competitors working with advanced technologies
6	Inefficient response to frequently asked questions from users	**4**	
1	Chatbot design that provides attention to users.		
2	Provide 24/7 user support through a chatbot.		
3	Programming a chatbot to provide clear and comprehensive information about the workshops offered		
4	Actively promote the chatbot to users as a convenient and efficient option to gain insight into the workshops offered		
5	Incorporate buttons into the chatbot design that provide specific information about the workshops offered.		
6	Make use of a digital artificial intelligence platform to design a user service chatbot.		

In the phase corresponding to "design and development", intervention strategies were created, trying to address each of the various indicators of the study variables associated with: user service, satisfaction with the care received and the virtual assistant. (View Fig. 6)

Phase II	Design and Development					
		No.	Problem	Strategy	Variable	Indicator
And				**User Support**		
	1	1	Inefficient customer service	Chatbot design that provides attention to users.	VD-1 Customer Support	Number of complaints in customer service
				Satisfaction with the care received		
T	2	2	Low number of registrations due to the inefficient service to users provided by the organization	Actively promote the chatbot to users as a convenient and efficient option to gain insight into the workshops offered	VD-2 Satisfaction with care received	Number of users enrolled in courses.
A		3	Long response times to users.	Create a chatbot that provides 24/7 support	VD-2 Satisfaction with care received	Average response time
P				**Virtual assistants**		
A		4	Inefficient use of technologies for customer service.	Look for the best platform to design a customer service chatbot.	VI-1 Virtual Assistants	Percentage of satisfaction in accuracy of answers
S	3	5	Inefficient information material	Create eye-catching content for the chatbot.	VI-1 Virtual Assistants	Percentage of relevant content
		6	Inefficient response to frequently asked questions from users	Incorporate buttons into the chatbot design that provide specific information about the workshops offered.	VI-1 Virtual Assistants	Difficulty receiving complete information

Fig. 6. Design and development phase: strategies, variables and indicators

Strategy 1 and 4: *Design a chatbot that provides attention to users.*

A chatbot was designed to improve and address the problem of inefficient use of technology for user support. The open source platform used for its creation was "*botpress*", the decision of choice lay in its flexibility, customization capacity, its wide range of content including images, videos and links; as well as a wide variety of features that facilitate the implementation of automated conversation solutions, thus adapting to the needs of the project.

This virtual assistant houses all the detailed information about each of the workshops offered by the "Social Security Center No. 102", so that users can receive adequate and complete attention, such as: answers to frequently asked questions, information about available services and any other updated and accurate information that is useful for users. The structure and flows of conversation were designed (Fig.7), paying main attention to its clarity and coherence. This creates a more satisfying and efficient customer service experience by providing quick and easy access to the necessary information.

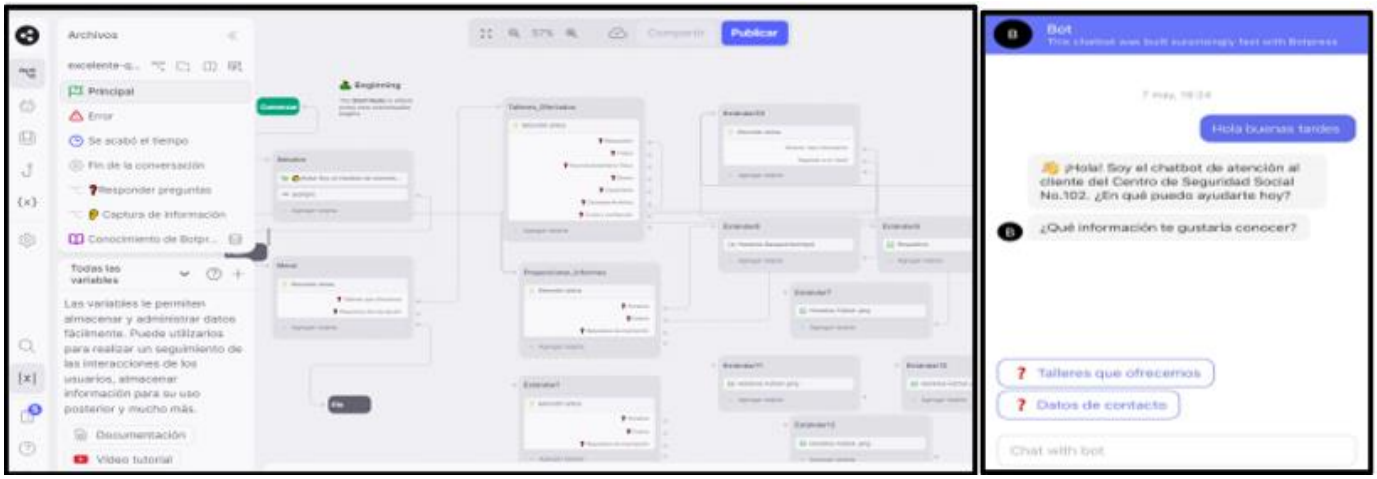

Fig 7. Chatbot flow design and publication.

Strategy 2: *Actively promote the chatbot to users as a convenient and efficient option to gain insight into the workshops offered.*

To increase the registrations of future users, the use of a chatbot was actively promoted as a convenient and efficient option to obtain information about the workshops offered. The strategy included the creation and distribution of an informational brochure with a QR code that directs the chatbot.

The design of the brochure, inspired by the authors' recommendations (Arone & Ticllahuanaco, 2022), focuses on highlighting the benefits of the chatbot, underlining its speed, convenience, and ease of use to access information. In addition to the QR code, clear instructions on how to use the chatbot are provided. This strategy is aimed at increasing the visibility of the bot and facilitating its adoption by users (Fig.8). The brochures were distributed in the four stratification zones mentioned to ensure effective results.

Fig. 8. Chatbot flyer.

Strategy 3: *24/7 care.*

The virtual assistant perfectly addresses the problem of "long response times to users", since it is available to the public 24 hours a day, 7 days a week from its publication. That way, during hours when there are no staff available to answer queries in real time, the chatbot provides automatic responses to frequently asked questions. This availability was implemented to ensure better acceptance by users and so that they can access information quickly and efficiently anytime they need it. This proactive communication was essential to increase the user's confidence in the workshops offered and the attention to their needs at any time, significantly improving their experience and satisfaction with the service provided.

Strategy 5: *Creating engaging content for the chatbot*

As part of the strategy to improve the informative material provided to the user, engaging content was developed and applied in the chatbot. This strategy was executed using the Canva platform, which offers creative visual resources to capture users' attention. Specific images and videos were created for each of the workshops offered, providing the corresponding information in a visually attractive and effective way. (Fig.9)

Fig. 9. Content development: Brochure and videos.

Within the virtual assistant, engaging content was posted specifically designed to engage users from the moment it was launched. This content included a welcome message, relevant and useful FAQs, as well as information about the services and workshops available at the social security center. The above can be seen in the (Fig. 10):

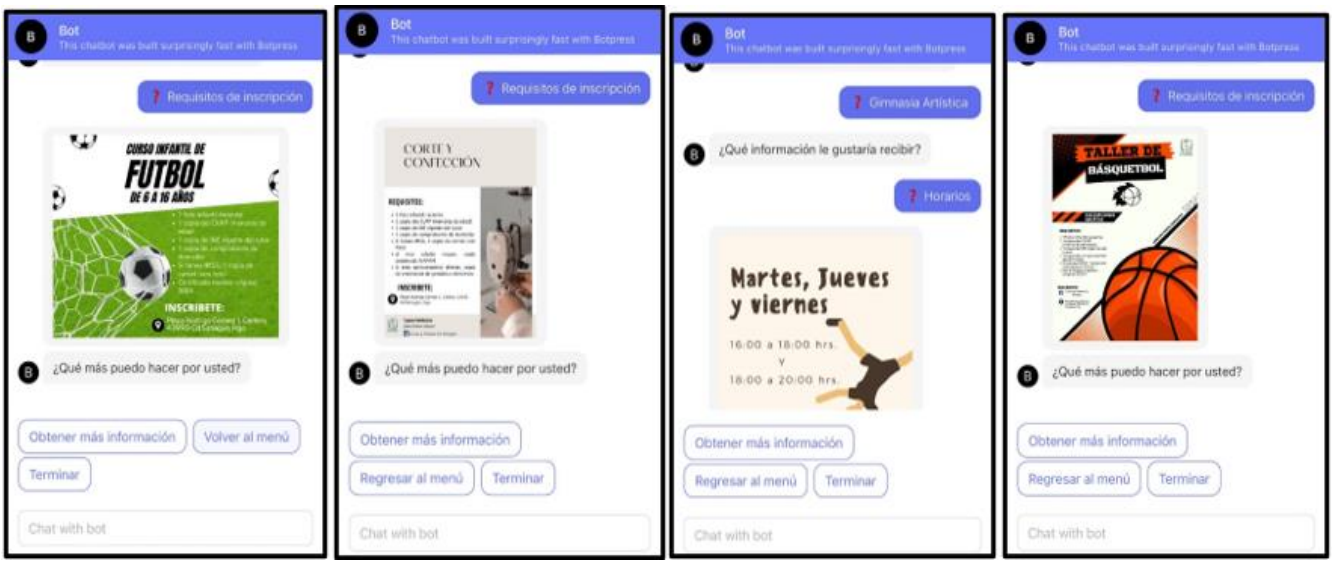

Fig 10. Posting content, images, and videos within the Chatbot.

Strategy 6: *Incorporating Interactive Elements*

Interactive elements such as quick response buttons, menu options, and useful links were incorporated to facilitate navigation and user interaction with the virtual assistant (chatbot) (Fig.11). These buttons will give you direct access to relevant information about the workshops offered, schedules, costs, and specific requirements. On the other hand, a dedicated section was included so that users can easily find the contact numbers and address of the organization.

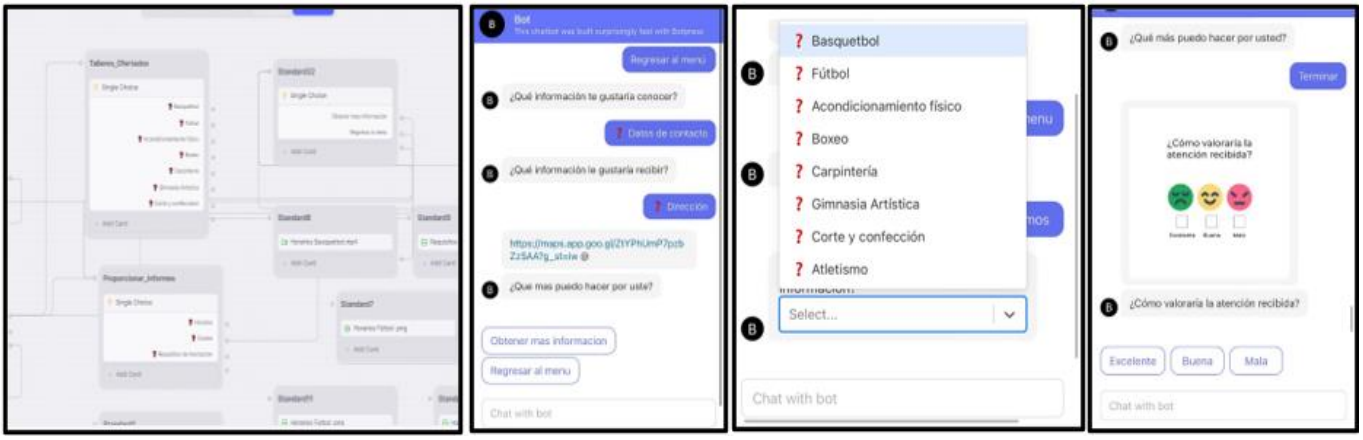

Fig 11. Interactive Chatbot buttons.

4 Analysis of results

In order to determine the effectiveness of the strategies used and applied in the virtual assistant, the data collection tool (mentioned above) was applied for the second time to 102 new active users, processing the information in the SPSS program. Among the most relevant information obtained, with the implementation of the chatbot, the following can be observed:

Context

- Of the participating users, 58.7% of the analyzed population belong to the female sex and 41.3% to the male gender, which indicates that most of the users are women.
- The two areas with the highest influx in the contracting of the services offered are: Ciudad Sahagún and Tepeapulco, represented by 42.3% and 39.4% respectively.
- The age range that most requests services is between 15 and 25 years old, represented by 26%, and 48 to 58 years old, with 31.7%.
- The representative occupation of this group of users corresponds to: 34.6% in work activity, 31.7% housewives and 26.9% students. The rest of the population are retirees.

Regarding the attention to the problems detected, thanks to the implementation of the virtual assistant (Chatbot) and its impact on the analysis indicators, the following was described (table 6):

Table 6. Analysis of indicators: Before and after the application of Chatbol

Problem	Before	After
Inefficient customer service	Number of complaints per month (30 to 38 complaints) No clarity on: Opening hours: (3 to 8) Costs (25 to 32) Requirements (30-38) **100%**	Number of complaints per month (1 to 8 complaints) No clarity on: Opening hours: (1 to 4) Costs (3 to 8) Requirements (1-8) **21.1%** **It decreased by 78.9%**
Low number of registrations	Enrolled users 3 to 5 people per week	Enrolled users 5 to 8 people per week **Increased by 60%**

Long response times to users	Waiting time 20 to 30 min waiting time	Waiting time Instantly **Improved 100%**
Inefficient use of technologies for customer service.	Percentage of satisfaction in accuracy of answers Satisfaction: 5.8% Use of Facebook Platform	Percentage of satisfaction in accuracy of answers Satisfaction: 71.1% **It increased by 65.3%** Facebook Virtual assistant with artificial intelligence (chatbot)
Inefficient information material	Percentage of relevant content 5.8% clear and complete information	Percentage of relevant content 69.2% of clear and complete information. **Improved by 63.4%**
Inefficient response to frequently asked questions from users	Difficulty receiving complete information 96.3% difficulty in finding complete information	Difficulty receiving complete information 29.8% difficulty in finding complete information **Decreased difficulty by 66.5%**

With respect to the deficiencies that exist in the tools that were implemented in the "Social Security Center No. 102" in the attention to users, it was possible to identify that they did not make use of technologists to make the process of service to their users more efficient, which resulted in long response times. in addition, the only platform and means to receive information without having to go personally to the institution was via Facebook. These deficiencies generated disinterest in users. With the implementation of the chatbot, the WhatsApp instant messaging platform was used to send the information created in the virtual assistant, thus expanding the technological possibilities.

Aloof. Attention to users

- The most common needs and frequently asked questions of users, detected from the instruments applied, are associated with: schedules (33.8%), costs (36.4%) and workshop registration requirements (29.8%). Such information helped develop the appropriate content and design of the virtual assistant effectively.
- As for the most valued aspects in the service, the clarity in the information provided and the speed in the response stand out, represented by 36.1% and 63.9% respectively.
- 100% of users consider the service they receive to be of great importance.

Aloof. Virtual Assistant Chatbot

- Prior to contracting the service, 92.3% of the new users maintained interaction with the virtual assistant, which means that only 7.7% did not maintain communication with this tool.
- 98.1% of users consider the chatbot to be a very convenient tool to provide initial support to the user.
- It was determined that the instant messaging platform "WhatsApp" is the most used to receive information through the chatbot, with 64.4% of users preferring it.
- 98% of users say they are "very satisfied" with the customer service provided by the virtual assistant "chatbot".

5 Conclusions

The following are the most relevant conclusions of the research, obtained from the implementation of the various intervention strategies associated with the creation of the virtual assistant "chatbot" and its impact on the improvement of user service:

- It improved by **83.4%** the user's perception regarding the ease of contacting the customer service team, to receive truthful and timely information.

- As for the general effectiveness in the user service, it improved by **84.3%** considering only the service offered by the chatbot assistance and by **63.1%** taking into account virtual and face-to-face assistance**.** The above based on the results obtained in the following indicators:
  - Response time: exclusive use of chatbot 100%; chatbot and face-to-face executive engagement improved by 58.4%
  - Accuracy in information: exclusive use of chatbot 100%; chatbot and in-person executive participation improved 65.3%
  - Problem solving: exclusive use of chatbot 52.9%; chatbot and face-to-face executive participation improved by 65.6%.

- After inspecting the virtual assistant (chatbot) with the support of the person responsible for dissemination of activities, it was possible to verify that the information it provides to users is **100%** accurate and updated with respect to the costs, requirements, contact details, address of the institution, schedules and workshops that are currently offered.

- The level of satisfaction with the customer service increased by **69.9%.**

- The percentage of recommendation of the workshops offered, based on the experience of the users regarding the attention received by the virtual assistant, was increased, achieving an improvement of **64.7%** in the level of recommendation.

- The use of the chatbot as a communication tool with users and the actions in the design of content, contributed to the improvement of the efficiency of the quality of service in user service by **64.4%.** The above based on the results obtained in the following indicators:
  - User satisfaction level: with chatbot and executive participation, it improved by 69.9%
  - Informative quality in relevant content: with chatbot participation and canva tool 63.4%
  - New users enrolled: with chatbot and face-to-face executive participation increased by 60%

- Regarding the design of content for the virtual assistant (chatbot), Canva's platform was a useful tool, as it allowed:
  - The attractive design of user interfaces, the inclusion of interactive buttons, menus and other graphic elements (images, videos and content links), improved the interaction with the user.
  - The creation of infographics (digital marketing material) with clear and visual information; which were integrated into the chatbot to explain concepts in a simple way.
  - Design custom visuals such as icons and graphics, which were then integrated into the chatbot's responses to make them more engaging and easier to understand.
  - Finally, it allowed the creation of animations used in the chatbot's responses, to capture greater attention from the user, achieving a more dynamic and entertaining interaction.

Considering all these factors, it can be concluded that the design and implementation of the virtual assistant managed to significantly favor the quality of the service to users in the "Social Security Center No.102" Ciudad Sahagún, Hidalgo. The effective application of these strategies not only contributed to the reduction of the problems detected in the organization, but also substantially improved efficiency and effectiveness both in the attention to users and in the general provision of its services.

As for the competitive advantages it generated, greater scalability can be seen, because the chatbot made it possible to serve users without the need for the Social Security Center to increase its staff. By collecting valuable insights into user interactions, it allowed for substantial improvement in the marketing strategy. Definitely, thanks to fast, accurate and personalized service, the overall customer experience was improved, which led to greater user loyalty and retention. Finally, the adoption of these advanced technologies gave the Institution an image as an innovator and leader in its sector, which can be a key differentiator in a competitive market.

References

Arone Becerra, J. M., & Ticllahuanaco Ccansaya, B. (2022). Chatbot for customer service in the legal department at Estudio Rodríguez Angobaldo.

Arteaga, M. A. P., Plúa, C. R. C., Lucas, H. B. D., & Quimiz, L. R. M. (2022). Chatbots for sales and customer service. TechInnovation Journal, 1(1), 107-116.

Dorfman, M., Grondona, A., Mazza, N., & Mazza, P. (2011). Virtual Class Assistants as a complement to face-to-face university education. In IX Symposium on the Information Society (SSI 2011)(XL JAIIO, Córdoba, August 29 to September 2, 2011)

Douglas da Silva Web Content & SEO Associate LATAM. (February 23, 2024). Difference between customer service and customer service (GUIDE). Retrieved from https://www.zendesk.com.mx/blog/diferencia-servicio-atencion-al-cliente/

Gómez, C. A. T., & Ediciones, E. (2023). Customer/consumer service management-2nd edition. Ecoe Ediciones.

López, J. V. G. (2020). *COMT004PO-Fundamentals of customer service*. Editorial Elearning, SL.

Martínez Carpio, J. A. (2019). Development of a Virtual Assistant (Chatbot) for the automation of Customer Service (Bachelor's thesis, University of Guayaquil. Faculty of Mathematical and Physical Sciences. Computer Systems Engineering Degree).

Parada, W. D. V. (2020). Automatic generation of Chatbot and its integration with emerging iot-blockchain technologies. ACOFI Board of Directors 2018-2020 Presidency, 219.

Pinilla Gómez, V. (2020). Design and implementation of a chatbot for IDbox's software. Méndez Pelayo International University.

Ramírez Martínez, W. O. (2021). Virtual assistant to support customer service in legal consultations in the labor field at the Romero law firm.

Rivas Villatoro, L. M. (2021). Proposal to improve customer service management through a chatbot-type virtual assistant to strengthen the performance of the service of the continuing education project at the Caribbean Campus of the University of Costa Rica.

Urrutia Ortiz, G. G. (2020). Study of the benefits of the use of chatbots in the user service processes of the comprehensive academic system of the Technical University of Babahoyo (Bachelor's thesis, Babahoyo, UTB-FAFI 2020).

Zavala Valdez, M. A. (2020). Chatbot for customer service of the company Deltron SA 2020.

Statista. (2023). *Ranking of the countries with the highest number of (AI) jobs in Latin America and the Caribbean in 2023*. Statista digital magazine. Retrieved from https://es.statista.com/estadisticas/1382643/principales-paises-usuarios-chatgpt-en-latinoamerica/

Statistical formula for the sample calculation in finite populations: http://www.bioestadistico.com/index.php?option=com_content&view=article&id=153:calculodel-tamano-de-la-muestra-para-estimar-parametros-categoricos-en-poblacionesfinitas&catid=46:calculo-del-tamano-de-la-muestra&Itemid=21.