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Proposal of a Chatbot Model using Machine Learning for Car Dealers (Sales and Maintenance)

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Abstract

The evolution of technology has allowed the automation of industrial, commercial, and other processes for optimizing tasks and reducing time and costs in industrial processes. The chatbot software is a clear example of this, because it is used to perform different tasks such as solving doubts to users, providing information, support in purchases or transactions and providing better customer service. This study analyzes how the application of artificial intelligence can be used to optimize the customer service process in car dealers, both for the commercial area and for vehicle maintenance.

Keywords: *Automation, artificial intelligence, process optimization, automotive industry, chatbot.*

1. Introduction

Nowadays, artificial intelligence has a direct impact on the daily life, which is evidenced by the changes it has brought about in employment and working conditions. An accurate definition of it would be the combination of algorithms, which try to simulate some actions of humans or go beyond human intelligence. The best of all is that it is open to many aspects and can provide various solutions, as in the case of customer service using chatbots, which according to the Gartner consulting firm would be implemented in 84% of companies by 2020 [3].

In this context, the use of artificial intelligence is applied in fields such as medicine, education, finance and, to a great extent, in the automotive industry, where it has a wide field for its development. There are cases in the automotive industry where artificial intelligence is essential for an optimal development of activities, among them the supply chain, vehicle manufacturing, quality control and customer service.

In the automotive sector, the last few years have seen four main trends when acquiring a vehicle, such as autonomous driving, electrification, connectivity, and shared mobility, so that AI applied to this industry can improve the user experience, optimize the workflow in manufacturing and maintenance and streamline and increase innovation processes. In the case of the driver experience, the automotive industry has integrated multiple AI-driven technologies such as computer vision, language processing and process automation, to have a safer and more autonomous driving. Similarly, it is possible to monitor the driver by means of a software integrated to the vehicle that allows to automatically adjust the

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seat, mirrors and temperature of the vehicle and the position of the head. The opening of the eyes will also allow the software to detect signs of drowsiness and generate an alert. In the case of vehicle manufacturing, the constant increase in competition has prompted manufacturers to acquire new equipment to improve process efficiency and product quality, as well as to optimize workflows by identifying faults and improving controls.

According to Zendesk's annual CX Trends 2022 study [4], it indicates that, at present, 88% of consumers who previously had questions about these technologies accept them, and if they are applied correctly, they generate tools that save time when contacting a company to carry out any procedure. However, it is of vital importance to clarify that in many occasions human participation is required to complete the customer experience, so that chatbots, instead of being a tool that replaces humans, are a tool that completes the user service process.

2. State of the art

2.1 Machine learning and natural language processing

Machine learning is a data analysis method that allows analytical systems to learn while solving different problems. It is based on the idea that analytical systems can recognize patterns and subsequently make decisions with minimal human intervention. It is vitally important to note that the history of completed dialogues between users is employed for the training of automatic communication between the chatbot and the user [1].

Currently, chatbots have generalized their use for two types of interfaces: in messaging platforms and in social networks. Due to the proliferation of chatbot platforms and various technological advances, the use and programming of this web application has increased; however, it is not common for users to have an interaction with chatbots that possess artificial intelligence. The most common reasons for the unpopularity of these chatbots are the complex and tedious learning processes that reduce the effectiveness of chatbots and users' trust in them. Today, there is a wide variety of machine learning algorithms for chatbot creation powered by artificial intelligence, which have their own strengths and weaknesses and are designed for problem solving [1].

Machine learning and natural language processing (NLP) are fields of technology that are related to artificial intelligence (AI). PLN aims to understand the natural language of the user with whom the software is interacting, such understanding, allows a program, such as a chatbot, to interpret the input data and through different algorithms, develop and convert it into human language, by using artificial intelligence, the machine can memorize and use its algorithms through controlled and uncontrolled learning [2]. Supervised learning assigns an output function to the data so that newer samples of the data produce the same output for that “learned” interpretation [1] while unsupervised learning means discovering new patterns in the data without prior information or learning [3].

3. Method

3.1 Needs identification

For identifying the needs covered by the chatbot, the following groups of potential users were initially established: the dealer who provides the service and the dealer's customers for both vehicle purchase and maintenance (users).

To identify the needs, a meeting was held with sales managers of dealers in Bogota, who explained the requirements that the industry must meet for effective communication with their customers and what information they would like the customer to consult in a chatbot of these conditions. These requirements are the main queries to be resolved through the

chatbot, the needs are based on the fact that the dealer does not have a customer satisfaction indicator, the quality of customer service is not known at the time of purchasing a vehicle or requesting information on a vehicle under maintenance. It is of vital importance to highlight that, in some dealers, their chatbot uses a basic programming language, which does not allow the customer to obtain an answer without communicating with an advisor. Additionally, for dealers, it is imperative that the chatbot redirects to WhatsApp from their website, to make communication with the customer easier and to allow sending photos of the vehicles.

The dealer customers are the users of the chatbot, therefore, the study of needs conducted by the CRM department and customers of some dealers and interviews were conducted with different customers. These two studies allowed to establish the needs of the future user of the chatbot when making a purchase or manage the maintenance of their vehicle. With the information obtained, the priority was established as the solution to the following questions presented by the customer, which were grouped into two specific sets:

Sales:

- How soon will the vehicle arrive?
- How can I finance the vehicle?
- What colors is the vehicle available in?
- With which banks can I arrange financing for a vehicle purchase?
- What are the dealership's hours of operation?
- What should I do if I want to buy my vehicle for the first time?

Maintenance:

- How is the vehicle repair process going?
- When can I pick up my vehicle?
- What accessories or parts are available for my vehicle?
- How can I schedule an appointment at the dealership?
- Don't block the chatbot if a user has made a wrong operation.

3.2 Decision making flowchart.

As shown in Figure 1, the fundamental and differentiating part of the chatbot is the decision making when receiving queries from the user because it is a programmed application that allows the entry of information to be analyzed by algorithms that subsequently provide the required response, most chatbots have a display menu in which the user chooses his need and have no other type of interaction. In this case, a system was designed for the user to write his needs in text format and the chatbot identifies his needs. This process is shown in Figure 1, the user includes a text and the chatbot must identify his need to give an answer; in case it does not succeed, it will request feedback to understand and be able to improve its future answers.

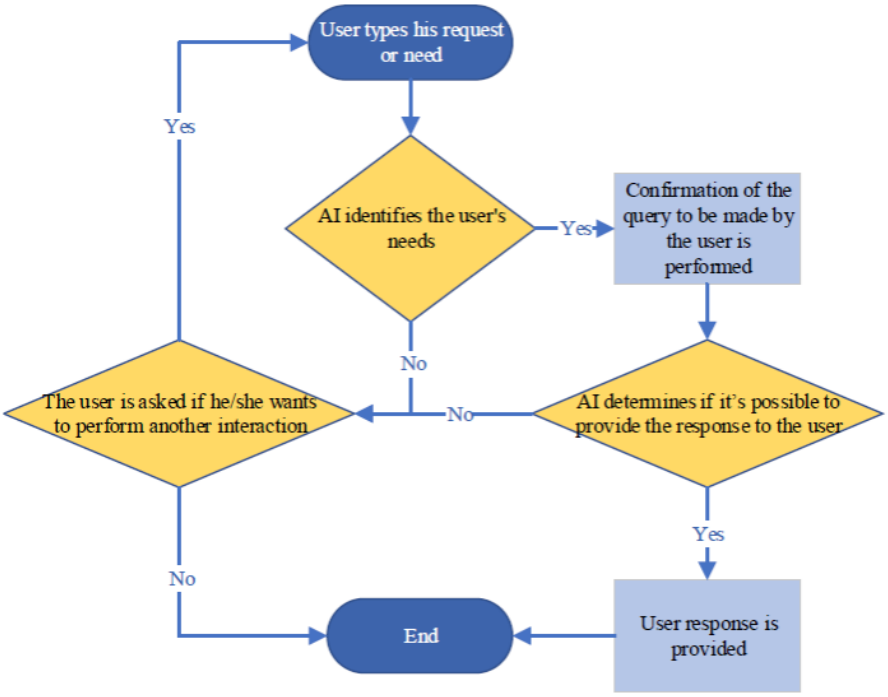

Figure 1. Decision-making flowchart (own elaboration)

3.3 User flowchart

Figure 2 shows that the procedure starts from the first contact the user with the dealer's website, where he/she can select the chatbot option and start the interaction. It is of utmost importance to highlight that for the user-chatbot procedure to be effective, the user must fill in the required credentials so that the process can continue in a personalized way and taking into account that, in the case of maintenance, these credentials will be the ones that will allow the user to navigate in the database to know the status of the vehicle in the workshop. Since it is a system where the user can interact in a personalized way with the chatbot, a series of decisions are made by the user, in such a way that the development of the consultation does not become a traditional process but allows the user to obtain an open interaction with the chatbot.

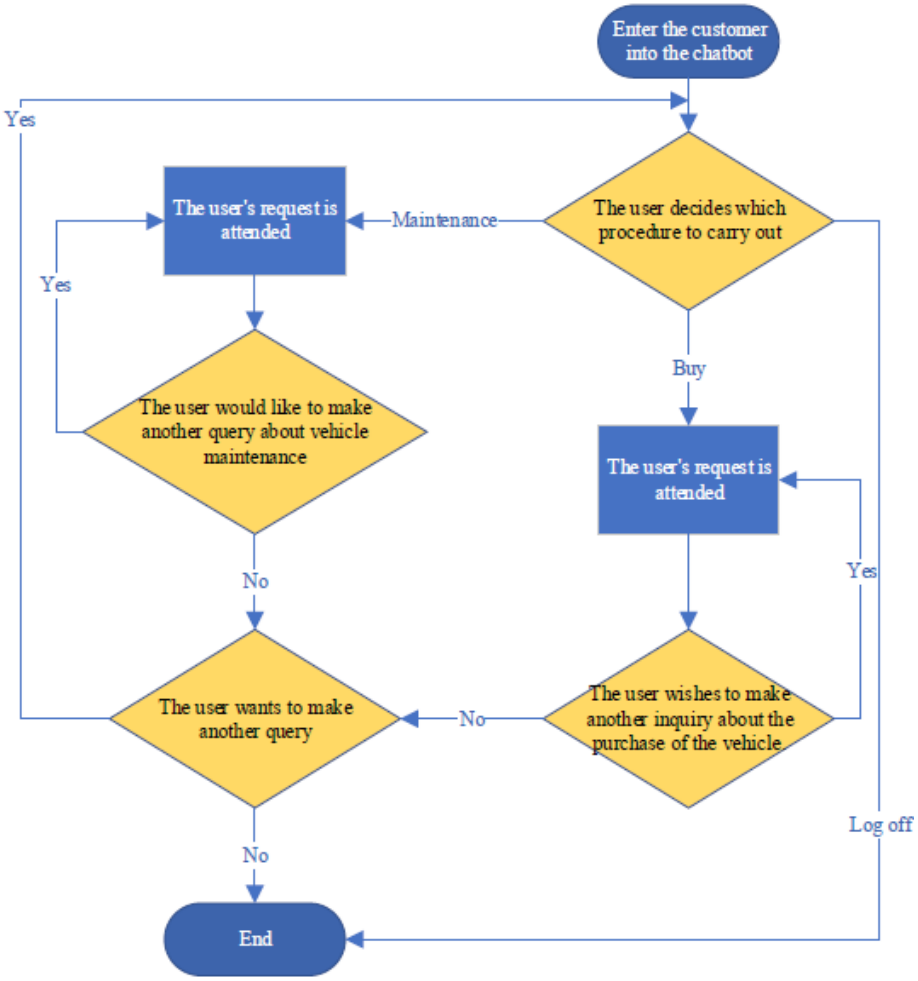

Figure 2. User flow diagram (own elaboration)

3.4 General chatbot flowchart

As shown in Figure 3, once the initial contact process between user and chatbot is completed, an input message is established by the application, where the user's needs are consulted so that later, according to the key words and phrases described by the user, the artificial intelligence determines which phase of the procedure performed by the application should be carried out.

- Phase I: Motor Vehicle Sales Process
- Phase II: Vehicle maintenance process
- Phase III: Unidentified process

In the process, artificial intelligence allows the user to obtain answers to the service requested and simultaneously provides feedback on the information entered to generate constant learning.

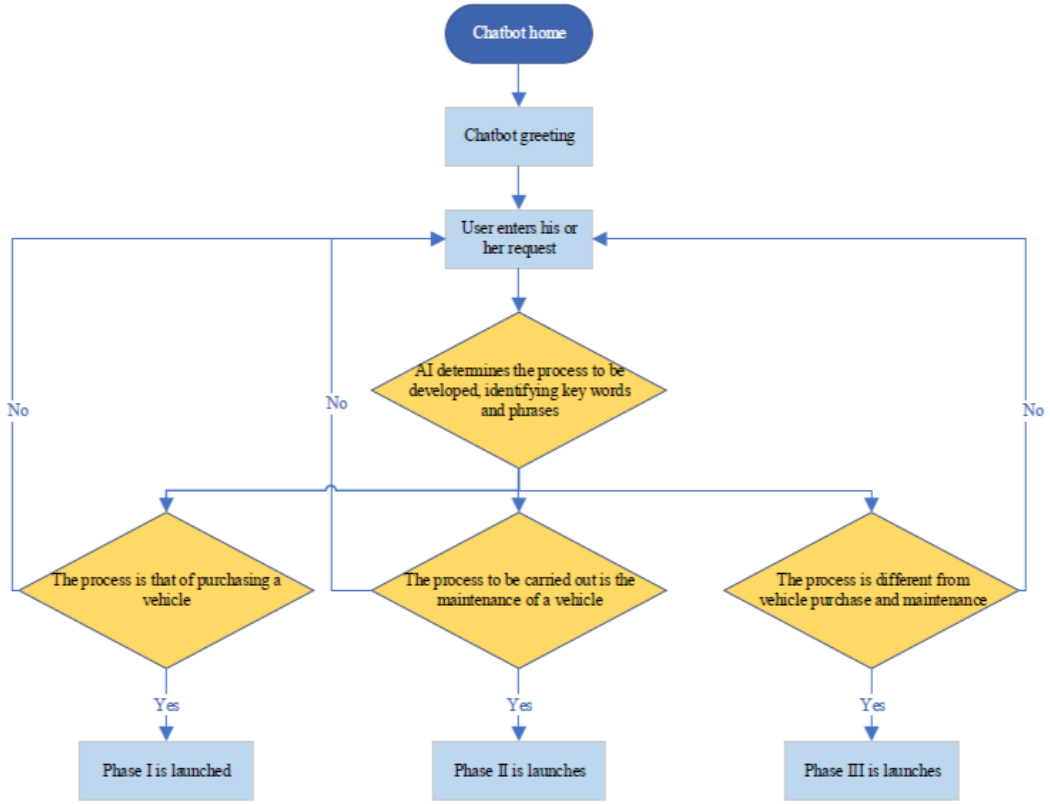

Figura 3. Fase inicial del chatbot (autoría propia)

3.4.1 Phase I: Motor vehicle sale process

Figures 4, 5 and 6 show that once the purchase process is identified, the user is asked about the desired features of the vehicle, the Artificial Intelligence proceeds to identify the information provided by the user by means of keywords and phrases. As it is a personalized query, the chatbot performs the verification of each decision made by the user, so that the answer provided is the one required; therefore, if the information is correct, it proceeds to show the vehicles that match the characteristics previously provided and the user is asked to indicate which is the vehicle of his interest.

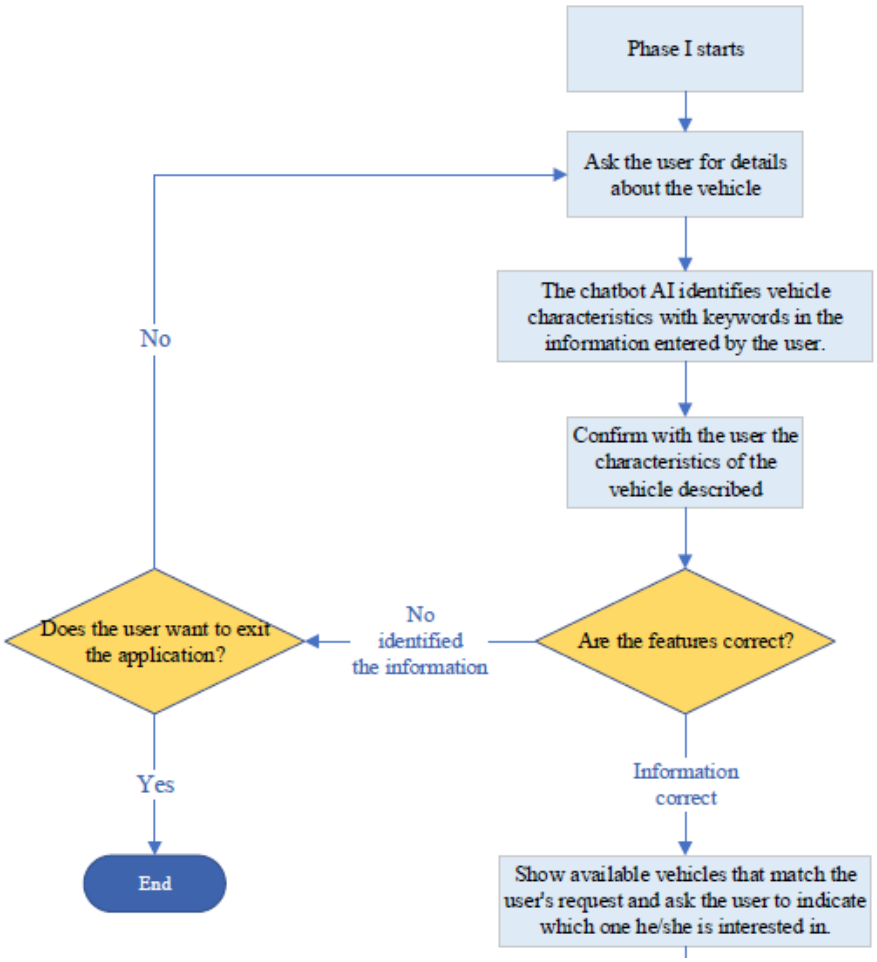

Figure 4. Phase I: Vehicle sale process (own elaboration)

Once the user selects the vehicle, the chatbot requests contact information, verifies that the information provided by the user is complete; if the information provided is complete, the user is asked if they are interested in separating the vehicle, emphasizing that they can get a discount. In this case, for both answers, both positive and negative, the user is directed to contact directly with the personalized advisor, hours of operation and location.

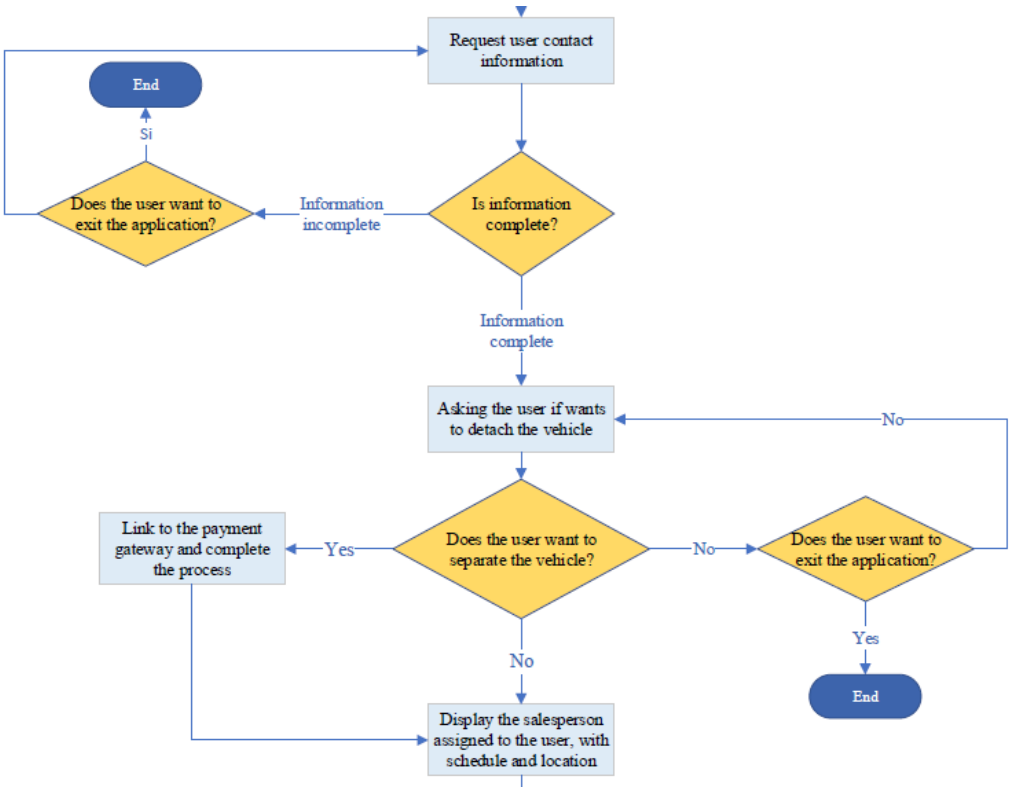

Figure 5. Phase I: Vehicle sale process (own elaboration)

Finally, at the end of phase I, the user is asked if he/she wants to perform another interaction, if the user does not want to finish the interaction, the user is automatically directed to the beginning of the phase where he/she must specify the characteristics with which he/she wants his/her vehicle, otherwise a thank you is made and the interaction is finished.

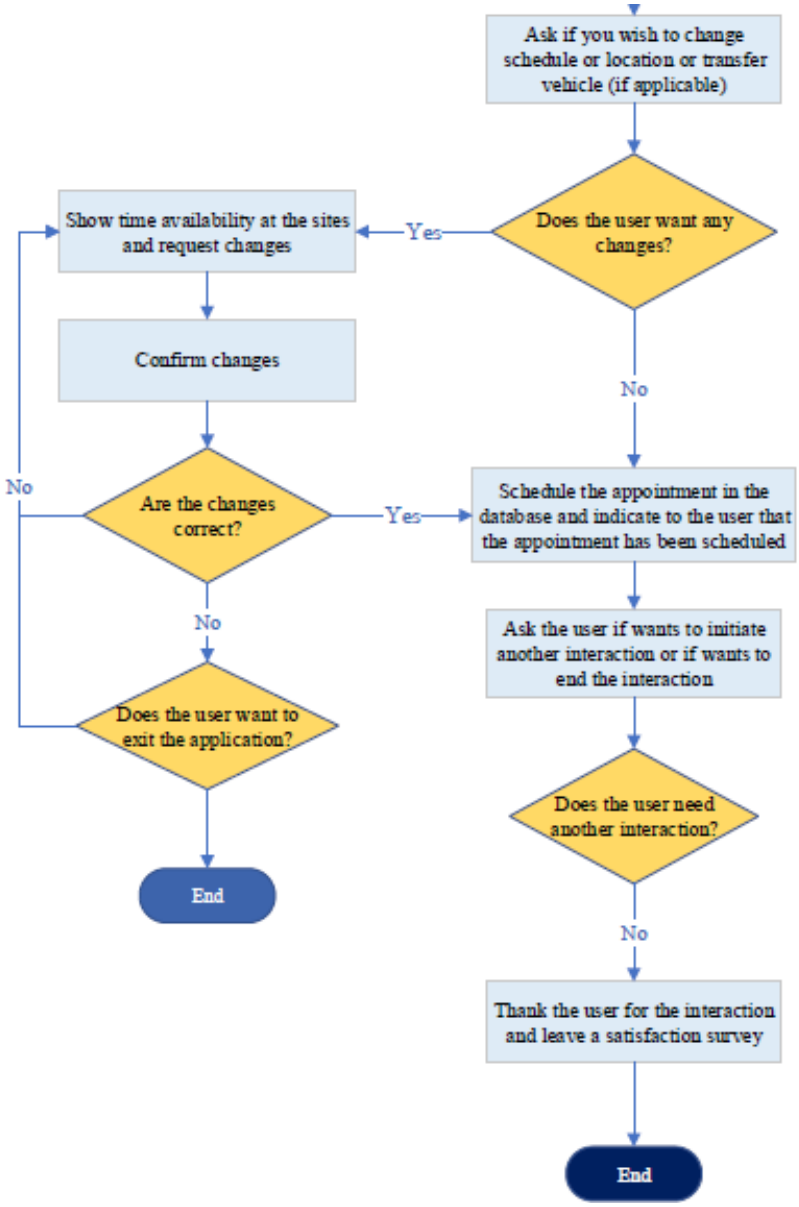

Figure 6. Phase I: Vehicle sale process (own elaboration)

3.4.2 Phase II: Vehicle maintenance process

As shown in Figure 7, once the artificial intelligence has determined that the process to be performed is maintenance, the user is asked to identify himself by entering the credentials previously provided by the concessionaire. The artificial intelligence verifies the information provided by the user, if the information is incorrect, the user is asked to enter the credentials again, if the credentials are correct, the user is asked what information is required for his vehicle, according to the answer provided, the AI identifies one or more items of interest (date of departure, diagnosis, photo, spare parts, etc.) to provide information to the user.

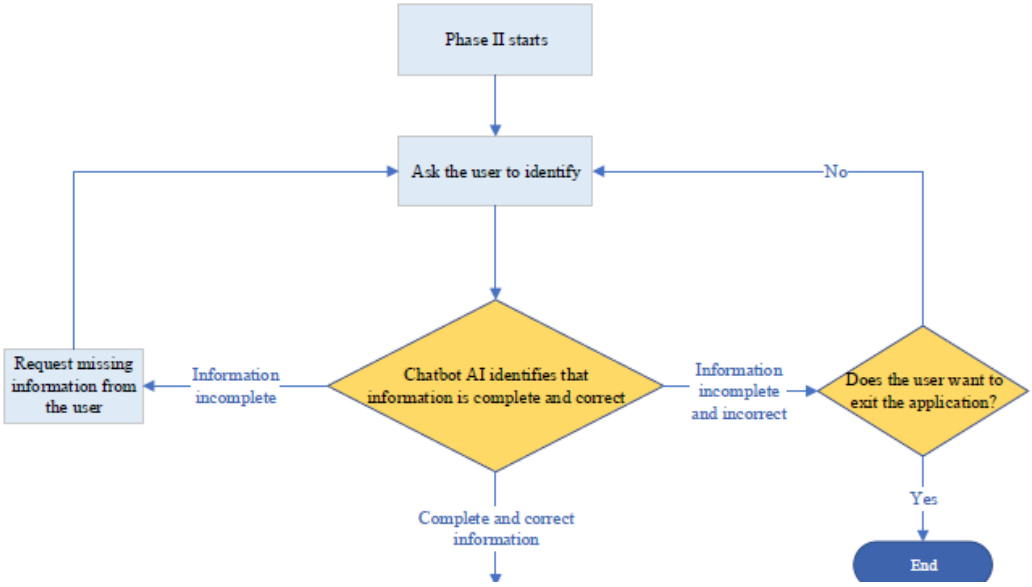

Figure 7. Phase II: Vehicle maintenance process (own elaboration)

As can be seen in Figure 8, the information requested by the user is confirmed, and if the user is not satisfied with the information provided, the type of information that can be provided through the chatbot is indicated. On the other hand, if the confirmation is positive, the information requested is shown to the user and then the query and verification of whether more information is required is performed. Finally, once it is confirmed that the user does not require more information about the vehicle, phase II is completed. If the user wishes to perform another interaction, the user is automatically redirected to the beginning of the process where the user must specify what information he/she requires about his/her vehicle, otherwise a thank you is made, and the interaction is finished.

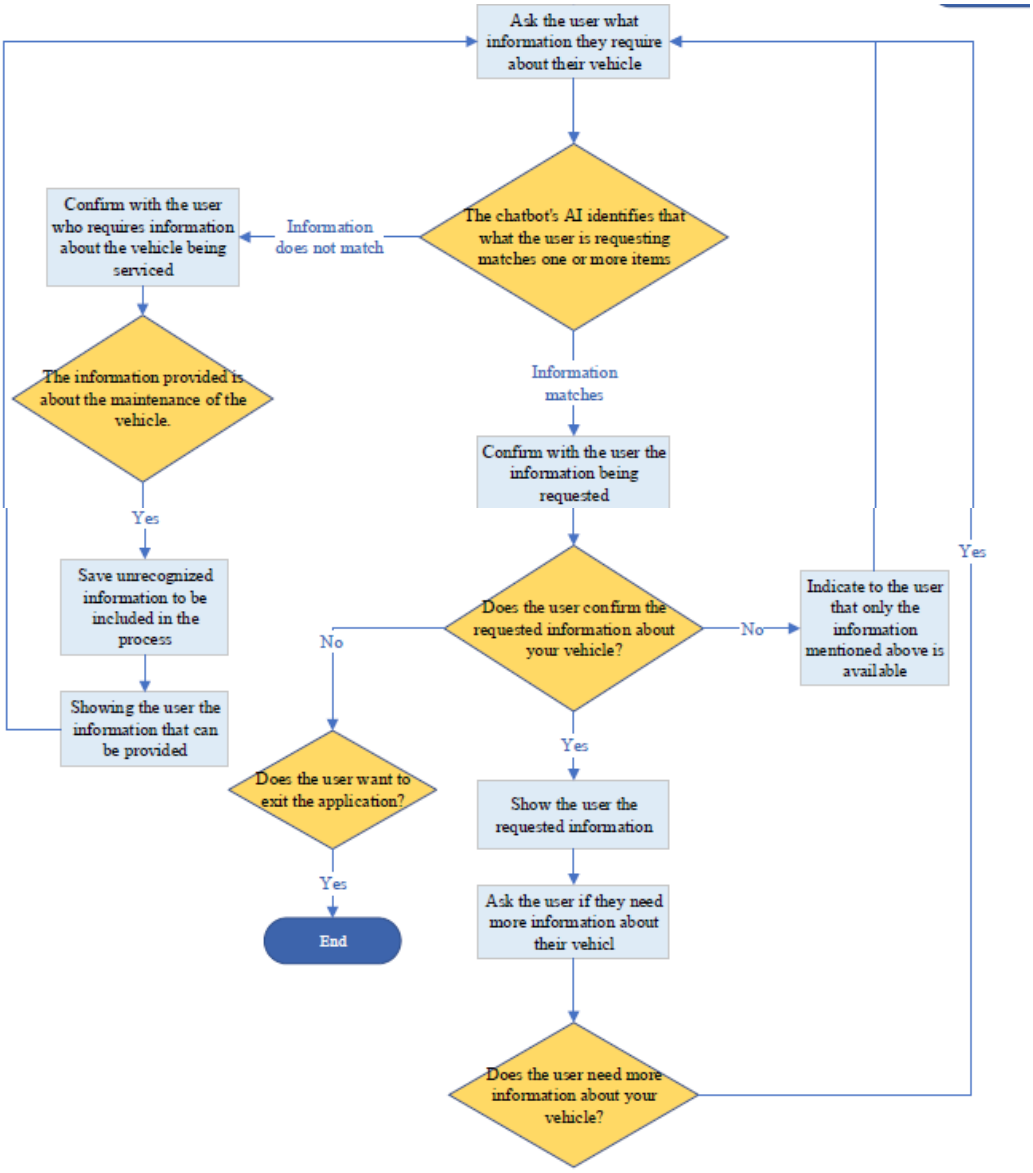

Figure 8. Phase II: Vehicle maintenance process (own elaboration)

3.4.3 Phase III: Unidentified process

According to Figure 9, it is evident that once the artificial intelligence analyzes the key words and phrases and does not recognize the procedure required by the user and indicates that the requirement is for vehicle purchase or maintenance, the chatbot stores the unrecognized information to perform an automated learning process and thus include such information in future sales and maintenance processes.

If the user requires a process other than the sale and maintenance of vehicles, the chatbot will indicate that the chatbot is only designed to cover these two processes, it proceeds to ask the user what specifically required, then the information is stored to leave it open to the advisor who will contact the user to provide personalized attention.

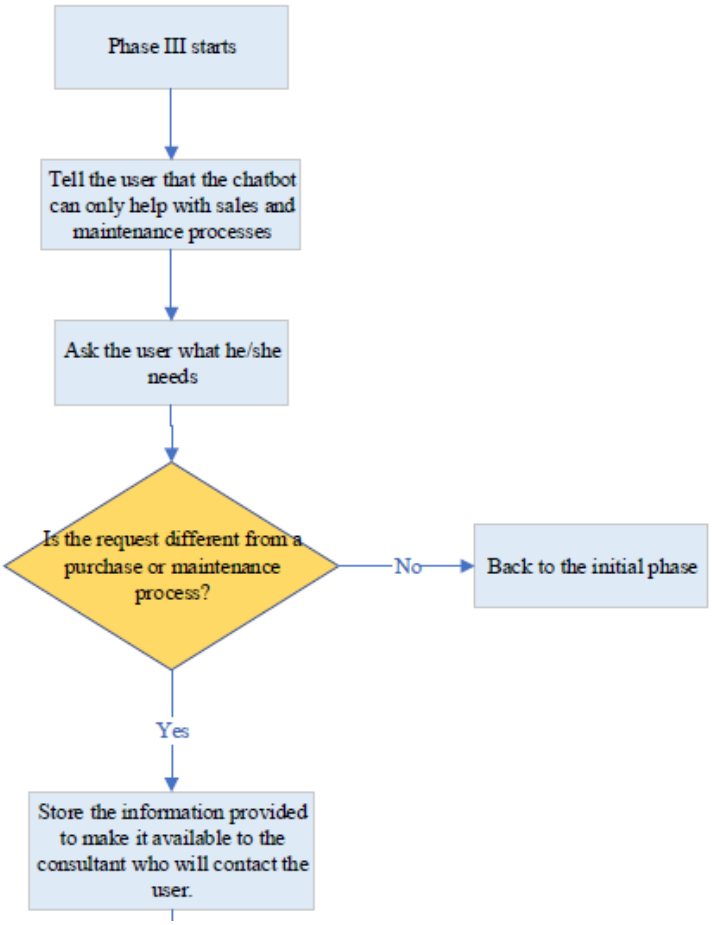

Figure 9. Phase III: Unidentified process (own elaboration)

The user is asked if he/she really wants to be contacted by the advisor to help him/her with the application. If the user wishes to be contacted by an advisor, he/she will be asked for the contact information, then the verification that the information provided is correct is performed, the user is informed that he/she will be contacted by an advisor in the following two working days.

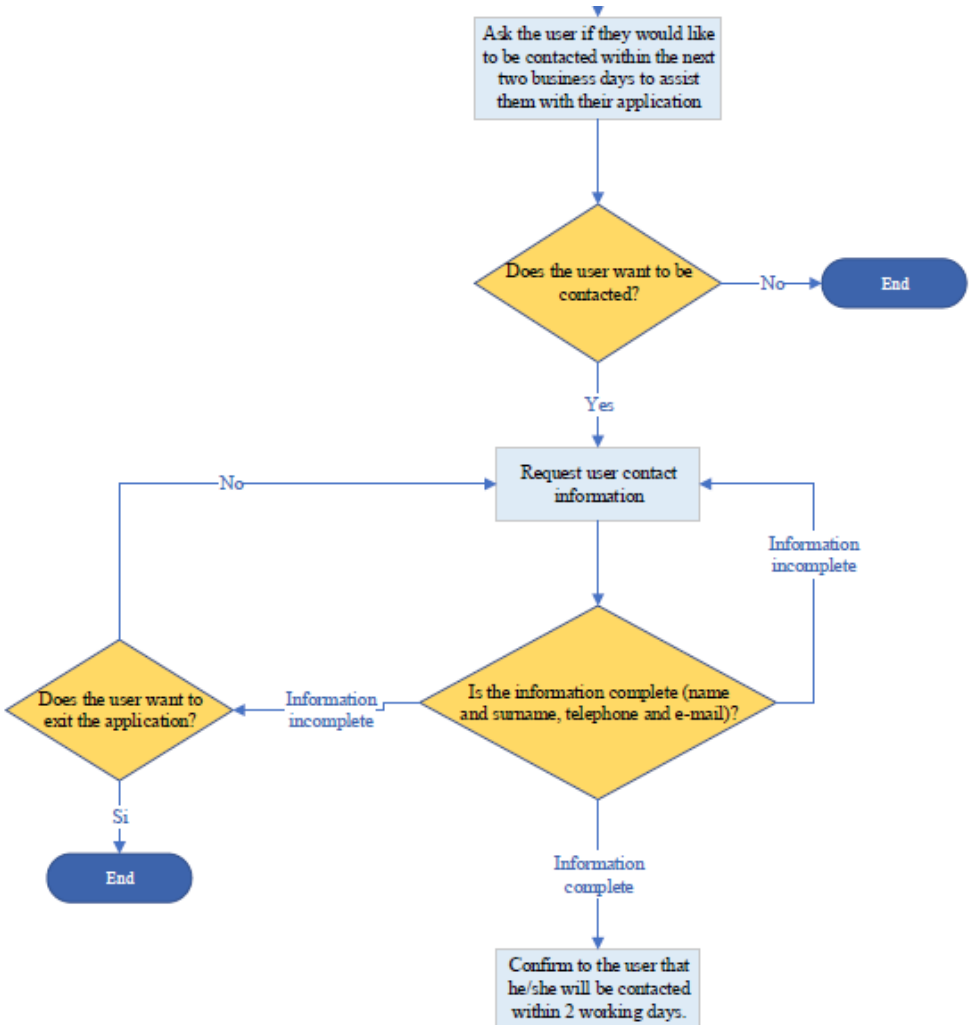

Figure 10. Phase III: Unidentified process (own elaboration)

3.4.4 Final phase of the chatbot

Once the information is registered, the user will be contacted in approximately two working days and also, if the user does not wish to be contacted, the respective phases will be completed. The user is asked if he/she wants to make another interaction, if the user does not want to end the interaction, the user is automatically redirected to the beginning of the initial phase where the user must specify what requirement he/she is requesting, otherwise a thank you message is sent and the interaction is ended.

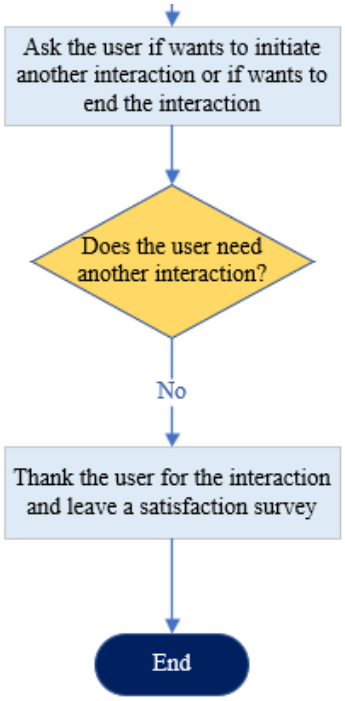

Figure 11. Final phase of the chatbot (own elaboration)

4. Application and results

The chatbot in this project was developed using Dialogflow, which is a tool for building chatbots capable of understanding natural language and provides the infrastructure to recreate conversations and structure dialogues for interacting with the user in a fluid way. Such a tool stands out from its competitors by covering a wide range of conversational interfaces: Google Home, wearables, cars, phones, etc. [5]. It currently supports more than 14 languages and is increasingly capable of handling abbreviations and typos. The chatbot was programmed to maintain a smooth conversation and at the same time identify key information to carry out the aforementioned artificial intelligence processes based on machine learning and natural language processing. Below are some of the results of tests that were performed on the chatbot.

As shown in Figure 12, the chatbot responds at the beginning of the conversation indicating the information it can provide. In addition, the chatbot AI processes are observed since the user greets indicating his name, the chatbot identifies him and returns the greeting with the indicated name. Figure 8 also shows the user intends to buy a vehicle and the chatbot identifies and confirms with the user if he wants to initiate a vehicle purchase process.

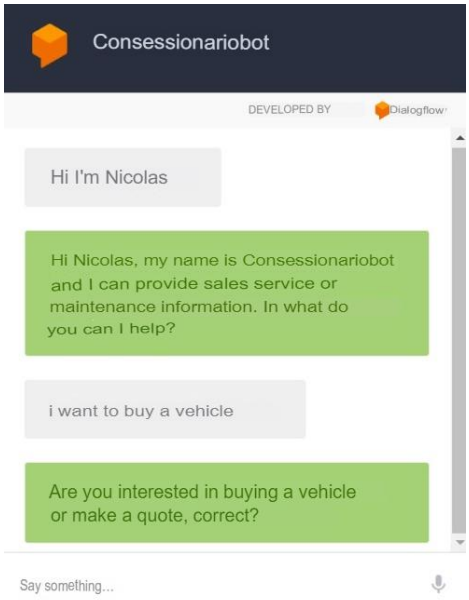

Figure 12. Example of the beginning of the sales process conversation (own elaboration).

On the other hand, and continuing with the sales process, Figure 13 shows an example of how users can request information on available vehicles by indicating the characteristics they want or need for their vehicle, after confirming that they want to initiate a purchase or quotation process. The chatbot can identify 9 general parameters as indicated by the user, which are: vehicle model, color, transmission, traction, vehicle type, fuel type, power, displacement and passenger capacity. It should be clarified that this chatbot proposal considers only these 9 parameters since it was made in a general way, but at the time of applying it to a specific company or brand it is possible to modify the parameters and adjust to the needs of the same company. It should be noted that thanks to the AI processes performed by the chatbot, users have freedom of writing when making the request, it does not necessarily have to be very formal or only with short phrases or menus, since the chatbot identifies the parameters that are important. Looking at the examples in the figures above even if a "short story" is written, the chatbot is able to extract the information of value for the sales process in these cases.

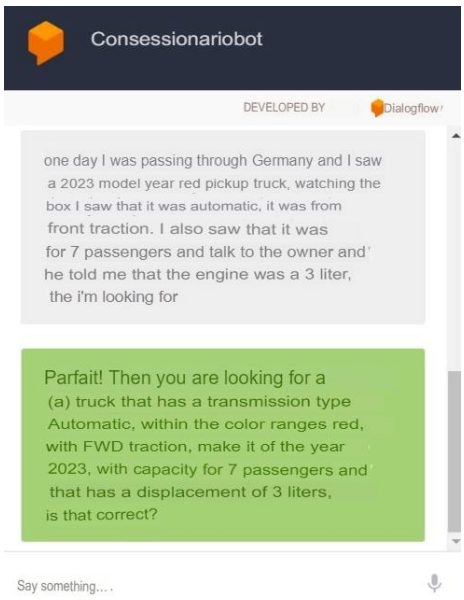

Figure 13. Example of sales process conversation (own elaboration)

Figures 14 and 15 show the final part of the sales-type conversation, where after confirming with the user the requirements he needs in his vehicle, he is shown the available vehicle options that match these needs indicating the price, then the user chooses an option and the chatbot indicates that he must give some data to relate that intention to purchase a vehicle with his information. After this, internally the chatbot sends the information about the user's requirements and preferences to the database to assign a commercial advisor to contact the customer. Finally, the chatbot informs the user that he will be contacted and also indicates if there is another process in which it can help him, to end the conversation.

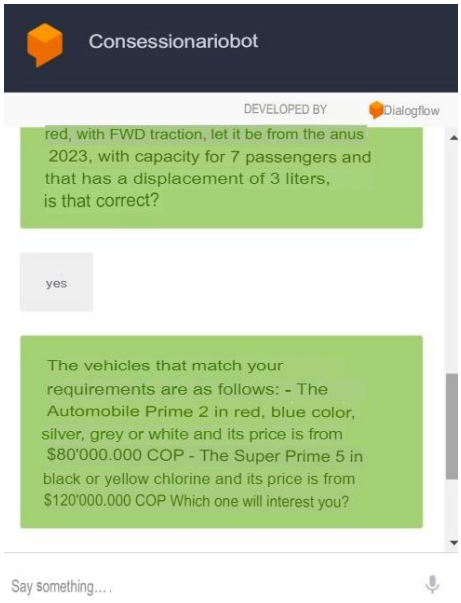

Figure 14. Example of a sales process conversation (own elaboration).

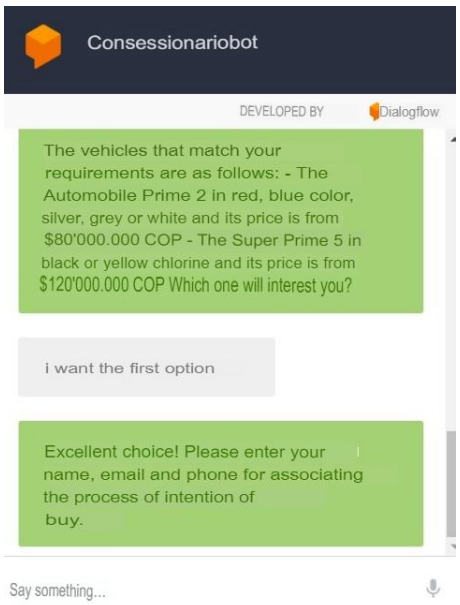

Figure 15. Example of sales process conversation (own elaboration).

It can be seen in Figures 16 and 17 that the same thing happens for this process with the identification of keywords to define which process to initiate with the user, in this case with compound keywords such as “I have my vehicle in the workshop” or “I left my vehicle in maintenance”, among others. Then comes a confirmation or verification of identity, both of the person in charge of the vehicle and of the vehicle itself, but it should

be noted that in the example and within the chatbot programming. Only these two parameters (name of the owner or person in charge of the vehicle and vehicle license plates) were established as necessary to access the vehicle status information. Also, considering that this information can be understood as sensitive information for users, and also to provide more security to them, instead of these two parameters, could be generated unique credentials for customers or access with other methods such as OTP (One Time Passcode), alternatives that were not chosen because there was no real sample information or databases to develop this alternative.

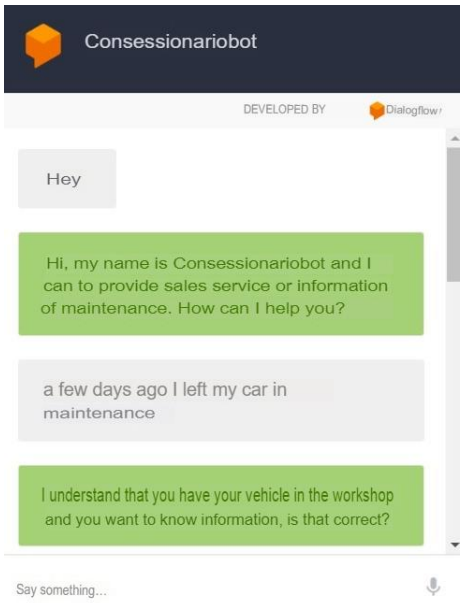

Figure 16. Example of maintenance process conversation (own elaboration).

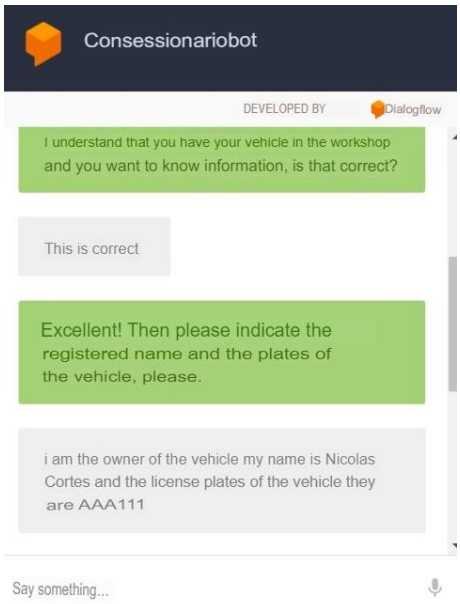

Figure 17. Example of maintenance process conversation (own elaboration).

When identifying the information that the user wants to know about the vehicle, several parameters were taken into account since there are multiple reasons why a vehicle may enter the workshop, so the most important parameters that the chatbot takes into account are the estimated cost, the date of completion or when the user can pick up the vehicle, what processes have been performed, if it has been replaced, among others. It can be observed, within the examples of the indicated figures that, depending on the user's

request, the chatbot displays the information it recognizes and matches the requests made. As in the case of sales, the scope of this process can be increased by adding the possibility of sending images of the vehicle or sending brief and understandable summaries for the general public about the processes that have been performed and the reason for such processes. The handling of this information and the process is shown in Figure 18.

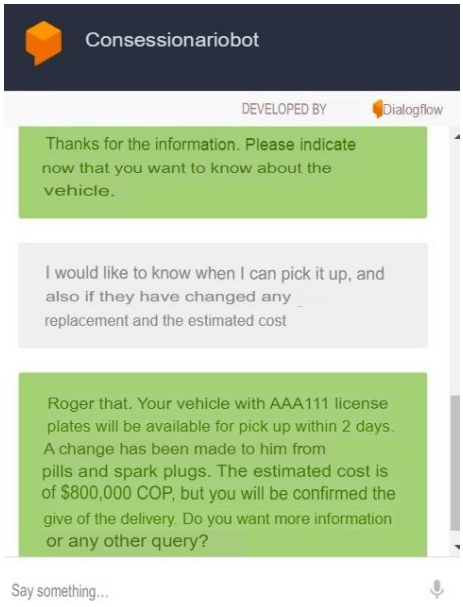

Figure 18. Example of maintenance process conversation (own elaboration).

In general, it can be seen that the chatbot, as the conversation progresses, gathers key information for the process that it identifies as being developed and that the user himself confirms it, and it is also worth noting that the conversation is not interrupted with a menu-type response, but has a high fluency which is possible thanks to the tools that drive the chatbot (AI, ML, NLP) which in the end is more dynamic and effective than the menu-type chatbot.

5. Conclusions

In conclusion, this project has demonstrated the potential and effectiveness of a chatbot developed at Dialogflow for automotive dealerships. Through the implementation of this artificial intelligence system, it has been possible to significantly improve the customer experience by providing fast and accurate answers to their queries and requests.

The designed chatbot has proven to be able to understand natural language and respond in a coherent way, which has generated a fluid and natural interaction with users. In addition, thanks to the integration with the pilot dealer's database, the chatbot has been able to provide updated information on vehicle models, technical characteristics, prices and availability, among other relevant aspects.

The results obtained showed that the chatbot can contribute to streamlining the customer service process, easing the workload of dealership staff and allowing them to focus on more complex and personalized tasks.

However, it is important to note that developing and deploying a successful chatbot requires careful planning and configuration. It is critical to ensure a solid and up-to-date knowledge base, as well as an effective strategy for handling unexpected situations or complex queries that may exceed the chatbot's capabilities.

In summary, the chatbot implemented at Dialogflow has proven to be a promising tool for improving the customer experience at automotive dealerships. Its ability to provide fast and accurate responses, along with its smooth and natural interaction, has facilitated communication between customers and the dealership. With proper development and careful configuration, chatbots can continue to evolve and play an increasingly important role in the automotive industry and beyond.

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