Chatbot to Simplify Customer Interaction in e-Commerce Channels of Retail Companies

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Abstract. Today, e-commerce has become the main channel of the retail sector, however, the abandonment of online shopping has also increased. This is because it is difficult for customers to navigate the website and they feel the unavailability of a sales consultant to guide them and resolve their doubts. The objective of this study is to propose a chatbot that allows to finish the purchases, improving the user experience in the process of buying online. In addition, it will be validated through acceptance tests to verify in what percentage it simplifies customers’ interaction during the whole online purchase process and customer service.

Keywords: Chatbot · DialogFlow · E-commerce · Retail

1 Introduction

The e-commerce use has seen a 55% growth in 2020 due to global crisis originated by the covid-19 pandemic, since most of the people remain in quarantine, they prefer online shopping that allows them to have the products delivered to home and feel safer\(^1\). In the case of Peru, the impact of Internet sales has experienced significant growth in recent years, since in 2018 Peru has reached approximate sales of 4 billion dollars\(^2\). Likewise, in 2017 according to the study conducted by Ipsos, which reports that 10% of Peruvians have made an order, reservation or purchase of any product or service on the web\(^3\).

Although e-commerce has increased and become the main channel in the retail sector, this does not allow the development of a personal relationship between the customer and the seller [1]. According to the study conducted by Klie, 77% of users leave the shopping cart before completing their purchase [2]. Therefore, the main issue is the abandonment in the process of purchase in e-commerce, this is reflected in the most recent study by Statista that according

\(^1\) Guillem Sanz - https://cutt.ly/auyjDlS.
\(^2\) Linio - https://www.linio.com.pe/sp/indice-ecommerce.
\(^3\) Ipsos - https://www.ipsos.com/es-pe/comercio-electronico-2017.

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to statistics in 2019 the rate of abandonment of online shopping carts is 69.57% of customers who failed to complete the purchase\(^4\).

This problem is due to factors in the purchasing process and the poor experience when interacting with the web e-commerce channel, among them we highlight that websites are difficult to navigate and the unavailability of an assistant during the purchasing process \(^3\).

According to Concha \(^4\) that surveyed 180 people that bought food through an application and website, 39% made it online in 1 to 2 h and 37% in 30 min to 1 h. In addition, structurally, most of websites display information by sections with links, dificulting visitors to open these links one by one, making the process less interactive and taking time for the client in finding the required information \(^5\). Because of that, the first stage of the online shopping experience, which is browsing product information and placing the order, becomes the most important of the online purchase.

Our main goal is to develop a chatbot that simplifies the interaction with the user when making an online purchases in the retail sector and thus reduce the time of purchase and the amount of interactions. A chatbot can help complement customer services by answering repetitive queries without any limitations and is available 24 h a day \(^6\). Virtual agents save time, facilitate the purchase procedure and influence the customer’s decision making \(^7\). Many businesses are also using them to improve communication with their target audience so that they can recommend products and make purchases online \(^8\).

For Gartner\(^5\), in 2020, 85% of customer interactions with the business will be done through virtual assistants thus requiring the information in a more personalized way (text or voice) during the whole purchase process \(^9\). The focus of our work is on proposing a new e-commerce channel to the convenience stores in the retail sector in Peru. This sector was divided because, in recent years, convenience stores have had a great impact on the Retail sector, in 2019, 17.3% of households in the country visited this new channel and in 2018 sales were 60 million dollars and it is projected that by 2022, 220 million dollars in sales will be obtained according to the consulting firm Euromonitor International \(^10\).

Our contributions are as follows:

- A framework for improving the user experience and streamlines the purchasing process by chatbot management.
- An improvement of user interactions number that leads to a faster service.
- An improvement of service time by retails.

For this work, in Sect. 2, a review of the concepts contained in the solution is presented then an explanation our main contribution. After, Sect. 3 validates the solution with proposed scenarios and list some related works and briefly discuss them. Finally, Sect. 4 describes the conclusions and future work.

\(^4\) Statista - https://cutt.ly/ouyljXe.
\(^5\) https://gtnt.it/2NE5vDZ.
2 Material and Method

A literature review was conducted to analyze and discuss fundamental concepts for a better understanding of the study.

2.1 Chatbot

A chatbot is a software implemented through artificial intelligence in which users can communicate by having conversations, the bots can receive as input text or uservoice, understanding the natural language [5]. Likewise, chatbots use a natural language processing system (NLP) that contains defined questions and answers. Also, chatbots are defined as systems that interpret and respond using case-based logic [9]. They can have animated images, interactive avatars or human faces that imitate a salesperson [11].

**Definition 1 (Chatbot [12]).** Chatbots are computer programs that interact through NLP interfaces [12] that allow actions to be carried out (e.g., product information), being electronic agents that are available all the time, enabling to make better use of the customer time.

Although their functioning is based on the interpretation of natural language, it also relies on defined conversational flows such as artificial intelligence or decision trees [12]. In the same way, chatbots respond through artificial intelligence to defined rules [13] adding that chat services are provided through mobile applications and messaging [14], and they could perform on e-commerce sites as service agents [15]. Chatbots are classified into three different types:

i) **Conversational chatbots**: supported by a knowledge base where information is analyzed to answer given queries.

ii) **Task-oriented chatbots**: also called service-based chatbots, intended to help customers to complete a defined activity such as buying a product or booking a service.

iii) **Social chatbots**: seek to communicate with other users to make recommendations [16].

2.2 Dialogflow

Dialogflow is a chatbot platform developed by Google Cloud, chosen after a comparative analysis\(^6\) as the most suitable for the development of this project.

One of the main characteristics of Dialogflow is that it allows the user’s query to coincide with the most appropriate attempt through the information contained in the user input. Another important feature is that it facilitates integration with various social network and messaging applications. In [17] the main chatbot platforms are compared, and it is concluded that Dialogflow is the most complete framework, highlighting the characteristics of the attempt and the

\(^6\) Globalme - [https://www.globalme.net/blog/lex-vs-dialogflow-vs-watson-vs-rasa/](https://www.globalme.net/blog/lex-vs-dialogflow-vs-watson-vs-rasa/)
recognition of the entity. Dialogflow was also chosen as the best platform due to its compatibility with messaging applications such as Facebook [9].

The chatbot architecture is mainly composed of natural language processing (NLP) techniques relying on Machine Learning to understand a user’s input and decide what intent they want to perform [10].

According to Icapps, for a computer to analyze, understand and extract meaning from human language it requires NLP. After the NLP technique is finished, another process called Natural Language Understanding (NLU) is performed to identify the user’s intention [12]. Dialogflow’s architecture is primarily composed of Entities, Intents, and Context.

i) Entities can be fields, data, or text describing just about anything—a time, place, person, item, number, etc.

ii) An Intent is the result of matching Entities through a recognition engine that is based on training sentences, in order to identify the user’s intent. An intent contains information in the text that can be extracted according to defined rules [10], more precisely a greeting, display a menu, consult promotions, place orders, etc. [13].

iii) A Context has grouped parameters that define the assignment of Entities to training sentences that have information to extract and store [10]. A Context also helps to extract semantic parts of texts to find unknown information and provide a more appropriate answer [8].

2.3 Customer Experience

Chatbots help to improve customer satisfaction during the purchase and service process [15]. Nevertheless, customer satisfaction requires a further study of customer experience.

Definition 2 (Customer Experience [18]). The subjective response of an actor to the elements of the service, which arise during the process of purchase and use, through imagination or memory.

Likewise, Richardson [19] states that the customer experience is the quality of the experience he has when interacting with a website. Nevertheless, in [20], Jain et al. mention that the experience is the formation of attitudes, perceptions and feelings that are formed in the decision-making process and during the entire flow that leads to emotional and behavioral responses.

Chatbots act as a service interface that helps clients make decisions more quickly by impacting on their experience [11]. The perception of chatbot usage is key to determine the customer experience, being relevant the answers to the information requirements. It is also mentioned that they can always improve this experience with the feeling of being served by a virtual agent.

In [21], the authors claim that providing chatbot information and helping to save customer time is the main motivation for using chatbot and has a great

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7 Icapps - https://icapps.com/blog/linguistics-behind-chatbots.
impact on customer perception. The availability at any time is very important, as it is numerically shown that 91% of dissatisfied customers do not require services from the business again [16].

In [13], it is mentioned that chatbots can improve the customer experience in different sectors through process automation such as in e-commerce and education. This is the case for e-commerce, if they manage to fulfill their expectations in an immediate way, such as resolving complaints, returns and product exchange with the customer. Similarly, when customers find your services or products through the chatbot and exceed their expectations, customers perceive high satisfaction in their online shopping experience [7].

2.4 Implementation

For the implementation, the following phases were carried out:

- First, product and store location information were collected for convenience and the database was modeled.
- Secondly, the web application was created under the Laravel framework\(^8\) and developed in PHP. The Web backend is connected to the MySQL database and develop all the functional requirements for an e-commerce.
- Thirdly, the integration and connection of the web page (chatbot interface) with Dialogflow’s conversational agent through Google’s API allowing authentication to make HTTPS requests was carried out. Likewise, entities, intentions and contexts were created and carried out in the training of the chatbot. Finally, it was deployed on the website and chatbot in a hosting hosted on Google Cloud Platform.

2.5 Solution Overview

Figure 1 shows the integrated architecture of the solution which is a chatbot integrated with a web system. When the user enters a website and interacts with the chatbot interface, when the user performs a query with the chatbot interface, this query is taken by the Backend Bot Request logic component which performs the query to the Dialogflow agent, authenticating itself through the Dialogflow API. This query enters the Data processing, where through the NLP that transforms from text to machine language, this component understands the captured query and transforms it into information.

Then, it enters the decision engine where the true intention of the user is identified according to the Entities, Intents and the Context where the user-expression is located [16]. Each intention has a defined Fulfillment, and when it has a match, Dialogflow will make an http webhook request\(^9\) sending output data with a JSON object that contains information about the matching intention [17], this request is authenticated by the Dialogflow API to the website backend [9].

\(^8\) https://laravel.com/.
\(^9\) Webhook service -https://bit.ly/2YI4Qr9.
After the webhook component receives the request, it performs the assigned functionality in the backend (i.e., consult product, consult opening hours, show shopping cart, recommend nearest store, list orders, etc.).

For each request, a query is made to the database supported by MySQL. The backend service then responds to the request with instructions on what it should do and show Dialogflow. Dialogflow can also answer simple text questions from the knowledge base without having to make a request.

Finally, the response manager gets the answer by transforming it from machine language to text and displaying the final answer to the user through the chatbot interface window.

3 Results and Discussions

Validating our goal of optimizing the purchase process, requires user acceptance tests, where the target audience tests the solution in a real environment. The objective is not to verify that it meets the functional requirements but to ensure that the software meets the customer’s needs.

The indicators for this validation are:

- \( ID_1 \): Average user-time to perform a scenario.
- \( ID_2 \): Average amount of user-interactions for a scenario.
Table 1. Test scenarios

| ID | Scenario   | Description                                                                 |
|----|------------|-----------------------------------------------------------------------------|
| $E_1$ | Scenario 1 | 20 users made a product delivery price inquiry on the Plaza Vea site        |
| $E_2$ | Scenario 2 | 20 users made a purchase of 3 products on the Plaza Vea site                 |
| $E_3$ | Scenario 3 | 20 users made a product delivery price inquiry through the chatbot          |
| $E_4$ | Scenario 4 | 20 users made a purchase of 3 products through the chatbot                   |

3.1 Experimental Protocol

Our validation consists of performing user acceptance tests on 20 people between the ages of 25 and 34 who make online shopping at a supermarket website and usually attend the store for convenience.

This age range might seem arbitrary, but it has been proven by the *Lima Chamber of Commerce (CCL)*$^{10, 11}$ that 43.7% of online shopping in Peru is made by people in this range. These users will test 4 scenarios, where the goal is to compare traditional e-commerce purchase process with (or without) the chatbot. Table 1 shows 4 proposed acceptance test scenarios, where users used a traditional e-commerce website and the chatbot.

3.2 Comparison of Indicators by Scenario

The results of the indicators in each scenario are compared and in Fig. 2 you can see the difference between Plaza Vea e-commerce indicators and the average chatbot indicators. A customer takes around 20 s to make a query through the chatbot against 175 s of traditional e-commerce. Likewise, the average number of customer interactions for consulting the delivery price in a chatbot is 3 interactions, simplifying 13 interactions compared to the website.

Furthermore, in scenario 4 an online purchase of 3 products through the chatbot take 150 s (resp. 265 for scenario 2) and 19 interactions (resp. 28 for scenario 2). In Table 2, the reduction of the average purchase time by 43% and the amount of average purchase interactions by 32% are confirmed. Also, for the metrics in the process of customer service is reduced the average time by 88% and the number of average interactions by 80%, showing optimization of both processes through the chatbot.

Nevertheless, reducing interactions does not necessarily implies a better user acceptance. It is convenient to perform User Experience tests. To carry out this experiment we asked 20 students from the University of Applied Sciences (UPC). Most of the participants were still undergraduate students with an age range of 20 to 26 years. Most of these participants mentioned not having a

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$^{10}$ Andina - https://andina.pe/agencia/noticia-internet-compras-online-llegarian-a-2800-millones-este-ano-757732.aspx.

$^{11}$ Gestión - https://gestion.pe/economia/compras-internet-llegarian-us-2-800-millones-ano-ccl-e-commerce-compras-online-nndc-272332-noticia/.
Fig. 2. Comparison of indicators

Table 2. Results for success metrics

| Predefined metric                                      | Expected | Result |
|--------------------------------------------------------|----------|--------|
| Reduction of average customer service time             | 50%      | 88%    |
| Reduction of average number of interactions in customer service | 50%      | 80%    |
| Reduction of average time in online shopping           | 30%      | 43%    |
| Reduction of average number of interactions in online shopping | 30%      | 32%    |

previous experience with chatbots in online shopping. Based on the previously conducted interaction, participants were asked to conduct a 10-question survey. These questions were taken to measure certain features of the interaction developed. We asked the participants what they thought was the interaction regarding the satisfaction of performed purchase tasks, did they find it satisfying or not (see Fig. 3).

3.3 Discussion

SuperAgent is a service chatbot that obtains public information about products, services, comments, questions and answers from various e-commerce sites in order to answer users’ frequently asked questions (FAQ), freeing up the workload of the support staff [6]. Sambot is a chatbot of Samsung Iot Showcase website, it contains a botmaster that enhances its knowledge base capability to answer FAQ about Samsung products, also recommends and self-completes questions [5]. Both, SuperAgent and Sambot are mainly used for answering FAQ. Unlike these, our proposal, additionally to FAQ, also guides the customer until finishing the purchase order, by recommending improvements to customer experience (e.g., the closest store to you according to your location). Although this chatbot is
hosted on a website, [22] recommends that chatbot be integrated into messaging and social networking applications to improve the quality and user experience.

4 Conclusion

The current pandemic will lead people to make more online shopping, thus sales in e-commerce will increase, this is a great opportunity for chatbots to help this by accompanying customers throughout the purchase process and solving queries instantly. As demonstrated, the chatbot improves the user experience and streamlines the purchasing process. Due to the conjuncture of the pandemic, people are doing more online purchases in e-commerce will increase, this is a great opportunity for chatbots to help make purchases online by accompanying throughout the purchase process and solving queries instantly. As shown in Fig. 2, the chatbot optimized the purchase process reducing the purchase time by 32% and the number of interactions by 43%, exceeding the expected value of the previously proposed metric.

Our proposal can also be integrated with messaging applications, such as Facebook, so purchases can be made directly from the application, without a web page. In addition, new applications and payment functionalities may be added for a future upgrade. Therefore, a future work aiming at expanding tests with the proposed chatbot should be performed, expanding the sample size and applying this proposal to other kinds of retails, or even using blockchain for retail databases [23].

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