

Enhancing EU Services with Chatbot Design: A Model Proposal and Analysis for Efficient Implementation

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Abstract:

This paper discusses the increasing popularity of chatbots and their integration into users' daily lives, as well as their use in various social channels and by organizations to support human support efforts. The paper presents a chatbot model design to aid decision makers in identifying important steps in chatbot semantic architecture, along with real-world use case scenarios and information diagrams. A proposed framework for data collection and analysis in chatbot development is also presented, with the aim of helping organizations implement and use chatbots to create unique and personalized user experiences. The findings of this study are expected to provide valuable insights for stakeholders, users, and organizations as technology continues to evolve.

Keywords: *conversational interfaces, chatbots, user experience, artificial intelligence, design process, European Union services.*

1. Introduction

A chatbot is a type of computer program that enables individuals to interact with machines through written or voice messages. It operates independently of a human and provides answers based on predefined commands and machine learning. Through interactions, chatbots can grow in scope and relevance over time. They can help improve the customer experience, lower administrative barriers, and increase citizen satisfaction. Due to the lack of a common approach across European countries when it comes to exchanging information about public services, it is difficult to provide cross-border services. With the development of chatbots, public administrations can now improve their efficiency and provide more effective and personalized services to their citizens (European Commission, 2023; JoinUp, 2019).

A chatbot can also be used to fill a wide range of gaps in an organization's operations, such as user/citizen/customer support. They can also provide a low-cost solution to fulfil the needs of users (Chatbots Magazine, 2017; Medium, 2017).

The paper aims to provide an implementation of a chatbot for an EU service. This paper provides a comprehensive overview of the various steps involved in e-commerce, logistics, and off-premises sales. The authors of this study developed a chatbot which can be embedded on websites and uses a multi-path rule-based answering and questioning method using the Botsociety.io web application.

2. Literature Review

A literature review was conducted to identify the key features of a chatbot framework that should be able to support and adapt to different types of interactions. It should also have a set of features that are designed to help users develop their skills. Some of these include self-awareness, IQ, memory, and purity (Wei et al., 2018).

Studies have shown the importance of machine learning and interactivity in developing effective chatbots suggesting the use of sequence neural networks and frameworks that follow an assistive model. A cognitive framework for developing effective chatbots states that these should have five components including a dialog manager, an inference engine, a planner, an alternative solutions provider, and an external services interface. A dialog manager controls the flow of natural language and the interaction between the user and the bot. A framework should also include an inference engine that extracts user intentions, a knowledge base that supports scheduling and conclusions, a planner that performs users' orders, and an external services interface that completes tasks (Discover.bot 2019; Telang, 2018).

It has been stated that a number of chatbot frameworks rely on If-This-then-That as their main approach. This approach is not ideal for the cost-effectiveness of the programs and may not be suitable for the various stakeholder groups. There are several features that can be considered when it comes to developing a chatbot framework. They also talked about other features that are commonly used in the development of chatbots, such as the ability to match intents using standard methods and the communicational features of the platform. In addition, they noted that there are various features that allow developers to create effective and efficient chatbot applications. Some of these include the ability to support different languages, the pricing, and the usability of the platform (Srivastava & Prabhakar, 2019).

A framework based on these features was developed and used to classify different types of chatbots. These include Input/Output, Understanding, and Timing (Braun & Matthes, 2019).

In addition, the characteristics of a chatbot framework are also important when it comes to developing it. These include the type of interaction, the direction, the predictability, and the communication channel (Paikari & Van Der Hoek, 2018).

3. Chatbot Architecture

3.1. Chatbot and user experience

Due to the increasing number of people using chatbot technology, it has become a common practice for governments and businesses to allow their employees to interact with these virtual assistants. This technology has the potential to transform the way organizations interact with their users. New age entrepreneurs and decision-makers are also looking into how to improve the efficiency of their operations by implementing chatbot technology. Modern organizations are trying to automate various processes to improve their efficiency. In the areas of user service, chatbots are being used to create massive benefits and speed up the process. They can also help them fulfil the demands of an omnichannel experience (Chatbot, 2022).

The rise of chatbot technology has the potential to transform the way organizations interact with their customers. It can help them establish a more personalized and engaging experience by facilitating large-scale conversations between users and organizations. To gain a better user experience, it's important to thoroughly assess the capabilities of the chatbot technology. Through their interactions with users, chatbots can help them find the ideal product or service for their needs. Machine learning models are being used in the development of various chatbot platforms. These tools can gather information and providing reports that are insightful. These types of intelligent chatbots can outperform their traditional counterparts when it comes to responding to complex requests and providing personalized suggestions (Sproutsocial, 2023).

In spite of the benefits that come with integrating artificial intelligence in chatbot technology, it appears that chatbots are still in their early stages of development and have not yet fully utilized their potential in enhancing user experience. Majority of the chatbot applications are pre-programmed with limited responses and replies (Dale, 2016).

As technology advances, individuals have become more accustomed to digital transactions and they now desire more advanced options, such as voice searches. Artificial intelligence will contribute to user satisfaction by enhancing personalization and improving chatbot capabilities in processing and utilizing user data (Hubspot, 2023).

3.2. Chatbot categories

There are two types of chatbots: AI-powered and rule-based. Rule-based chatbots are those that follow predefined rules and provide scripted responses. On the other hand, AI-powered ones use natural language processing and machine learning to improve their responses (Misischia et al., 2022).

3.3. Chatbot architecture

Regarding the design of a government service chatbot, the European Interoperability Reference Architecture (EIRA) model provides a set of building blocks that are required to develop e-government systems. This provides a vocabulary for people working on system development and architecture. It uses the ArchiMate framework for modelling (JoinUp, 2019a).

The SAT or Solution Architecture Template is an extension to the EIRA that provides guidance to architects on how to develop solutions for a specific industry. It features a variety of components, such as a motivation section that explains the goals and principles of the project, a list of supported functionalities, and a description of the overall solution. This section of the EIRA features the core architecture building blocks, which are designed to provide a set of views and functionalities that are specific to a particular type of architecture. It also includes a narrative for the selected architecture building blocks. The goal of the SAT is to provide guidance on how to build an interoperability framework for the public sector, specifically for the chatbot architecture. This ensures that both the public and private sectors have a common understanding of how to work together (JoinUp, 2019b).

Despite their wide knowledge base, chatbots can still learn from their mistakes. They can store all the relevant data they encounter in their systems for future use, and they can also analyze and fix their errors in case they interact with humans. Although they can be built on various networks and machine learning techniques, only the ones that use AI can explain how they come up with the right conclusions. A user interfaces for communication, a digital assistant for dialogue management, interaction recording and API's and a knowledge base for the core

systems, the customer relationship management tools, external systems, and analytics are the most essential parts of a chatbot architecture (Lowry, 2017; Toots et al., 2017) (Figure 1).

In addition to remembering a user's information, chatbots can also alter their tone of voice depending on the topic of the discussion they're interacting with. A chatbot that's designed to be well-designed can suggest different products and services, as well as provide solutions based on past interactions. Figure 2 demonstrates a basic chatbot architecture flow chart including all the interacting users, information exchange, services, and systems (Pryss, 2019) (Figure 1).

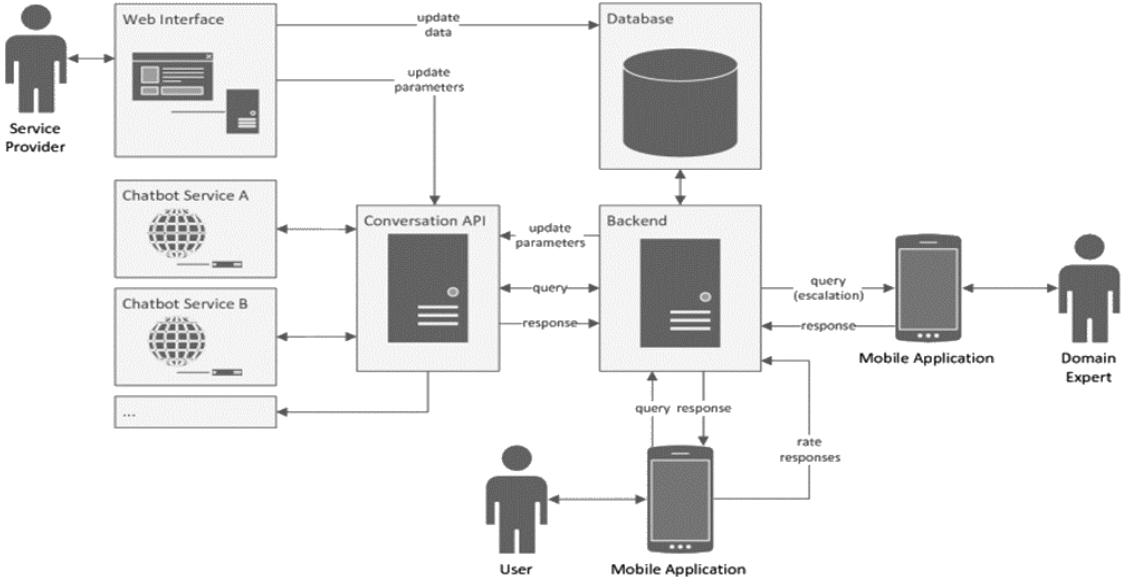


Figure 2. Chatbot Architecture

4. Chatbot Design

4.1. Chatbot use case scenario

The initial design plan was built based on the official website of the European Union, which lacks a chatbot service. “Your Europe” website gives information to European citizens and informs them of their rights and obligations within the European Union (Your Europe, 2023).

The design and the implementation chatbot phases, were focused on the practical issue of e-commerce, distance and off-premises selling, as it is a strictly regulated area and has a great deal of information on each phase of action of a potential seller. Therefore, it is very likely that the citizens in interest will have many questions regarding how they should work on these issues. A wide variety of information is available, regarding distance contracts with customers, confirmation of contracts, cancellations, as well as ways and rules of shipping. In addition, the citizen concerned can be informed about the differentiation of legislation of B2B contracts, as well as on what type of transactions the above rules apply. The implementation of the chatbot

for this EU service was intended to cover every possible question of a citizen concerned and was carried out with the assistance of the tool Botsociety.io (Botsociety, 2022).

A basic UML diagram has been drawn to represent the actions of the actors referring to the user and the administrator. The basic actor’s actions are described in Table 1. Figure 1 demonstrates the use case diagram for the basic actors’ actions.

Use Case Diagram Actors	
Actor	Description
User	Someone who uses the system to engage in a conversation
Administrator	The administrator of the system. Allowed to carry out administrative tasks

Table 1. Actor Documentation

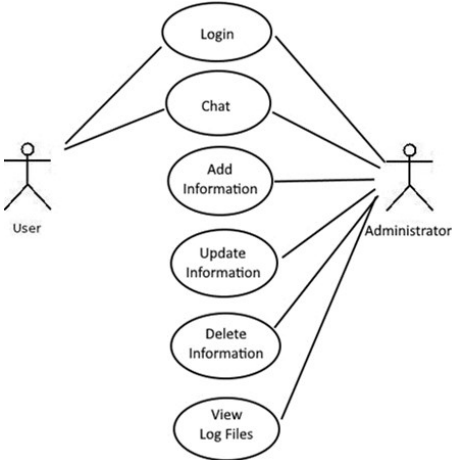


Figure 1. Use case diagram

4.2. Chatbot decision tree

Figure 3 demonstrated the chatbot’s predetermined decisions through a decision tree regarding the possible choices a user can make during the interaction with the chatbot. The decisions are based on the options that Europa.eu portal provides (Your Europe, 2023).

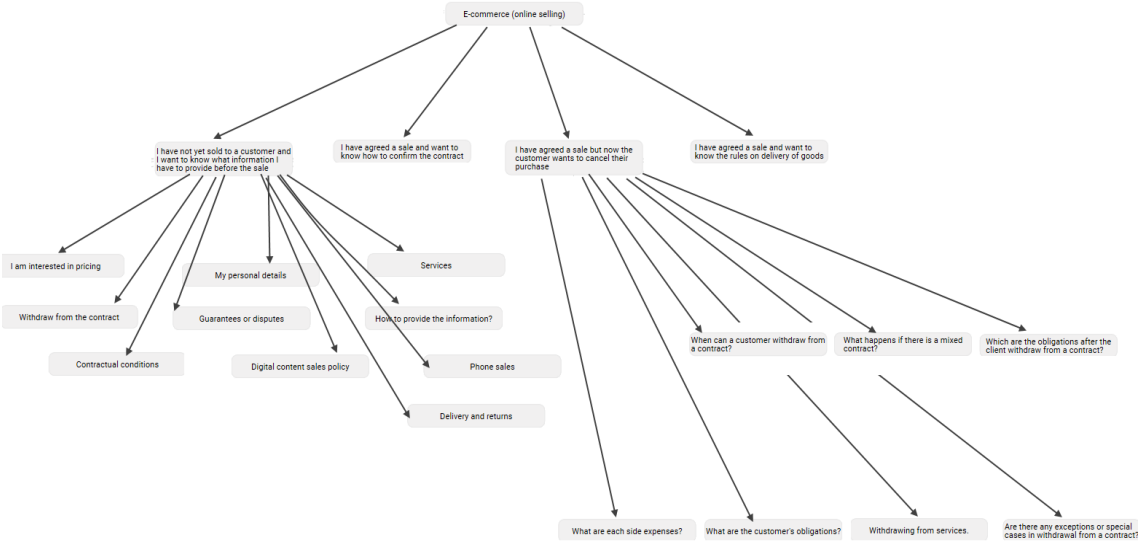


Figure 3. Chatbot decision tree implementation

4.3. Chatbot flowchart

Figures 4-9 represent the flow of the information as it goes through the chatbot parts within the chatbot. Thus, a generic Figure 5 shows the size and the complexity of such effort using the Botsociety platform flowchart generator. Due to the simplicity and structural nature of the EU services fully rule-based chatbot is designed based on specific rules avoiding applying any artificial intelligence architecture. The most representative figures represent the upper sections of the flowchart avoiding going deep into detailed information.



Figure 4. E-commerce, distance and off-premises selling chatbot's implementation flowchart

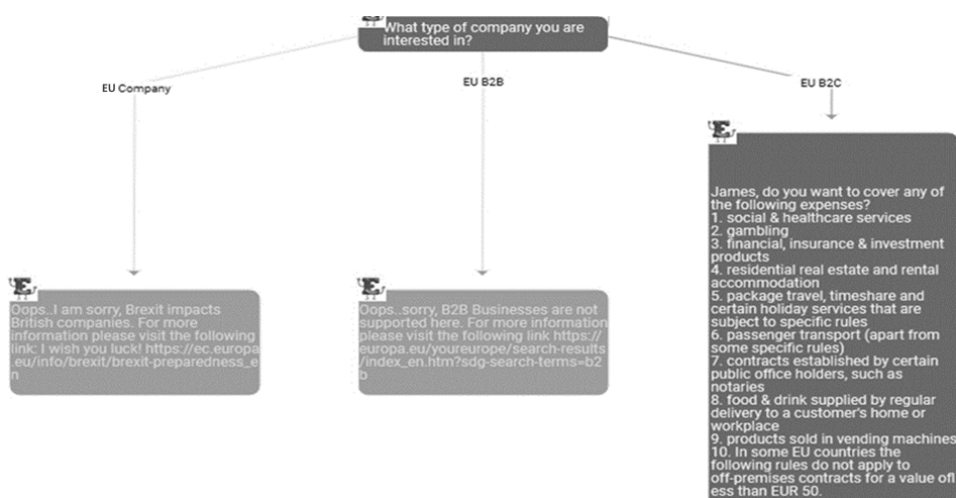


Figure 5. Select the type of business

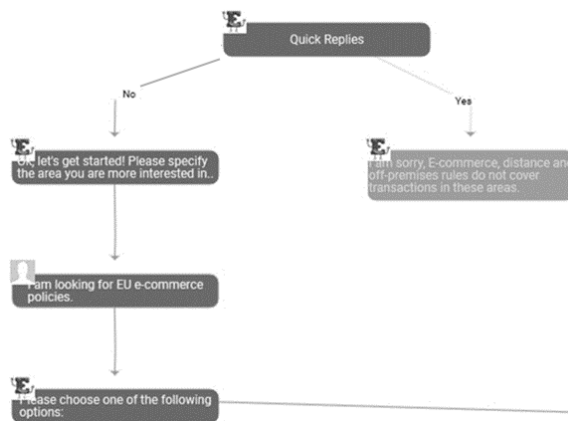


Figure 6. Chatbot quick replies

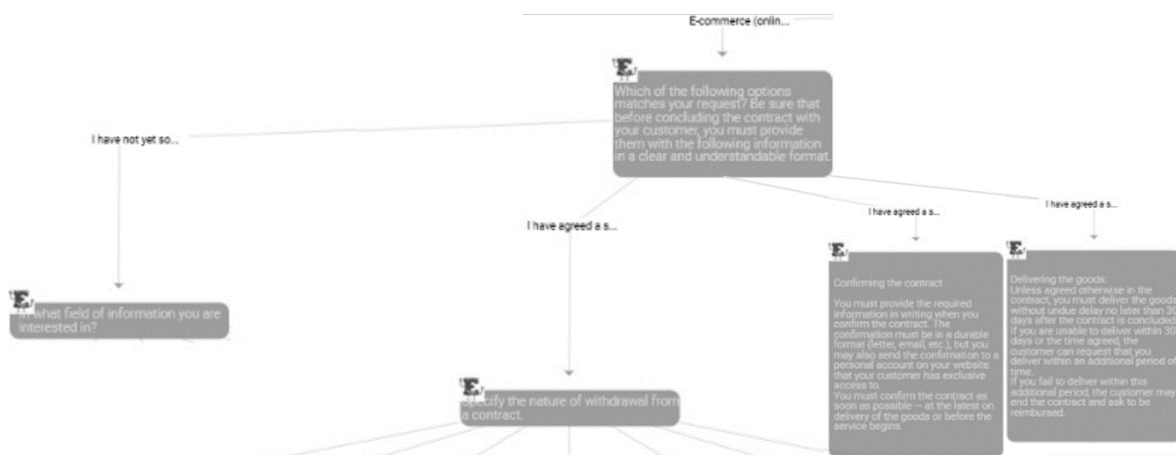


Figure 7. Alternative paths for e-commerce (online selling)

4.4. Chatbot interface

The interface aims to keep it as simple and efficient as possible. The technical features of the chatbot implementation include color selection, chatbot name, images, responsiveness, several mobile models' resolutions and website chatbot. The selected colors are the same as the European Union portal colors. Its logo is represented by an animated letter “E” which comes from the word “Europe”. It is designed to be responsive to perform in different types of devices.

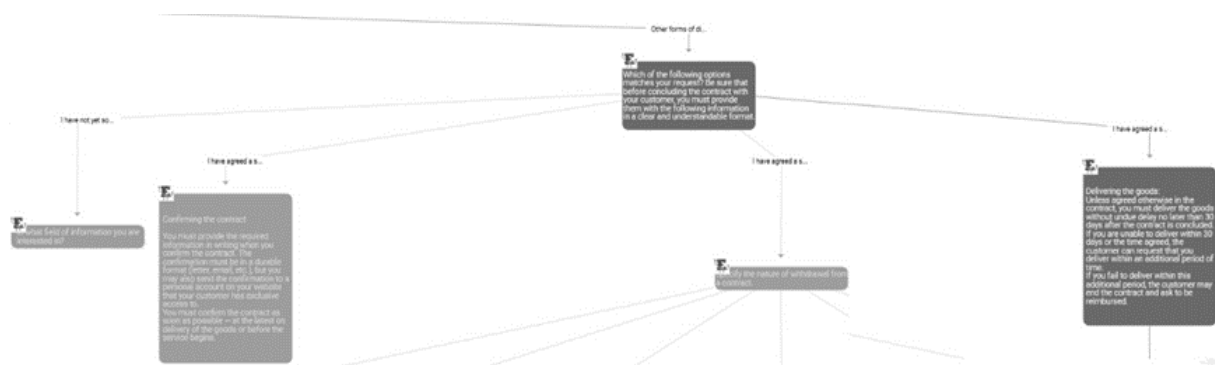


Figure 8. Alternative paths for other forms of distance and off-premises selling

5. Discussion

This study describes a model for developing public service chatbots which can help improve the user experience by reducing the time it takes to find information and other services. They can also help support the Digital Single Market Strategy three pillars, which include society, economy, and access. In Europe, the potential of chatbot networks to improve the environment and economy is significant. One of the next steps is to transfer end users to the member states' chatbots. Public service chatbots implementation can support the Digital Single Market Strategy pillars by providing users with fast and easy access to information and services, as well as facilitating the exchange of ideas and opinions. They can reduce the cost of building new platforms by allowing organizations to work together more efficiently (Join Up, 2019a).

6. Conclusion

The potential benefits of chatbots are not limited to the European level; they could also be useful in supporting member states. Some member states already use chatbots, but there is room for improvement. Chatbots could be particularly useful on a European level and in supporting member states. To achieve this, a chatbot network could be developed, and a chatbot cooperation platform could be set up to exchange ideas, information and best practices, build a community, create public administration design principles, and create chatbot governance.

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