**Chatbot for Air Travel**

Mindy Wang, Viral Harishkumar Jani, and Sai Chand Kurre

Department of Data Science, University of Maryland Baltimore County

DATA 690: Natural Language Processing Final Project

Dr. Tony Diana

**Abstract**

The airline industry is being challenged to adopt new technological innovations to deliver products and services and skillfully manage digital innovation to improve direct channel functions. One example is the use of a chatbot to provide customer service. Chatbots, also known as conversational agents, are the next significant technological leap in casual services, allowing a device to communicate with a user in response to natural language requests. The device responds to the user with automated responses using artificial intelligence and machine learning. While this is a relatively new field of study, the application of this concept has grown significantly in recent years. The technology is no longer limited to simply simulating human conversation; it is also increasingly being used to answer questions, such as requiring assistants to investigate reasons for customer dissatisfaction or recommend products and services. With this chatbot, we intend to use Dialog Flow as a platform to build a chatbot that will answer travelers' questions about their air travel between Washington, DC, and New York. We created intents and entities and have simulated a dataset to mimic the flight schedules, cost, and stopover airports and provide a base for us to build the chatbot in Dialog Flow.  We intend to demo it in Slack.

**Related Literature on Chatbot and Air Travel Experience**

Chatbot was started by Eliza in 1966 and was created to answer questions as a psychotherapist. The next big breakthrough was in 2010 for iPhone Siri. Then the subsequent extensive development was Alexa of Amazon in 2015. The most recent significant development is Cortana by Microsoft. Recently, CHATGPT has changed the chatbot landscape and become the dominating giant. With the chatbot technology, air travelers’ experiences can be incorporated to build a chatbot that answers their questions. Research on travelers’ opinions about chatbots has found that “The air travelers’ first-hand experience with chatbots is essential to evaluate their effectiveness, particularly in functionality. In the same way, views from different stakeholders are needed to assess whether the chatbot performance is aligned to the airline’s goals of its implementation and the air travelers’ actual experiences”. (Trapero & Ilao, 2022)

Concerning air travel experiences, a survey of 10,000 travelers in 222 countries found “Proximity to the airport was passengers’ main priority when choosing where to fly from (75 percent). This was more important than the ticket price (39 percent).  “Travelers were satisfied with being able to pay with their preferred payment method.”,” Passengers are interested in more options for baggage handling”, and” Passengers see technology as key to improving the convenience of airport processes” are among the things that travelers care about the most (Thomas, 2022).

According to Airlines of America (2023), a survey by J.D Power found the following six factors (in order of importance) are essential for air travelers.

• Terminal Facilities

• Airport Arrival/Departure

• Baggage Claim

• Security Check

• Check-In / Baggage Check

• Food / Beverage / Retail

According to Airlines of America (2023), Airline Customer Satisfaction Index (ACSI, 2023) hit an all-time high, and ease of check-in, mobile apps, and websites ranked highest. Figue1 is a chart of their finding:

**Figure 1**

*Airline Customer Satisfaction Index*

*A picture containing chart

Description automatically generated*

**Introduction to Chatbots**

The era of complex automation is still in its early stages. This epoch will be technologically transformative, ushering in revolutionary changes in communication, transportation, health care, education, industry, and even fundamental research. Smartphones, apps, virtual face-to-face conversations, and the rise of Facebook, Amazon, Apple, Netflix, and Google have accelerated this development. Automated secretaries, salespeople, customer support personnel, and others will carry out work and tasks, resulting in cost savings, increased efficiency, and better customer experiences. Machine translation is also expected to break down the language barrier finally. Adapting to a new business model and technological phenomenon has made it difficult for the aviation industry to deliver products and services. Another challenge is to improve one's skills in managing technological innovation and improving direct channel duties, such as sales, marketing, cross-selling, and others to meet the needs of the new generation of travelers, that is, automation.

Furthermore, the pandemic's shift to the digital domain forces people and organizations to plan and present interventions and innovations that may benefit all of us. Some of these interventions, such as information dissemination, may be delivered via chatbots. Chatbots, or conversational agents (CA), are Artificial Intelligence (AI) systems that recognize voice prompts, text messages, or both to provide intelligent and human-like conversations. Regarding information dissemination, chatbots have been identified as critical conversation agents to keep us updated on the most recent travel advisories and procedures. Charlie (Cebu Pacific) and AVA (AirAsia) oversee disseminating the airline's most recent advisories, such as new contactless flight guidelines.

These trends have encouraged more customer interactions and participation through social networking platforms, resulting in high demand for customer support services. Chatbots are undoubtedly an essential tool for the Aviation Industry in the realm of Artificial Intelligence (AI) for accommodating customer offers. Its application is critical in said industry, where customer services, such as bookings, canceled flights, baggage fees, delays, package offers, and many other concerns are crucial. Chatbots can thus assist travelers in managing their experiences as efficiently as possible. However, many opportunities have yet to be gained due to modern chatbot technology during business-to-customer interactions. Customers have complained about the chatbots' inability to handle complex requests, deliver personalized offers, and lack human characteristics. These generated feelings of frustration, anxiety, and chaos, result in customer dissatisfaction, which lead to various coping strategies, such as avoidance.

This research proposes using conversational agents or chatbots as virtual assistant front liners to suggest the cheapest flights, to know flight status and baggage information, and to assist airline companies in providing quality service by capitalizing on technological advancement.

**Goals and Purpose of the Chatbot**

We want to create a chatbot that will the following functionalities for travelers traveling between Washington DC to New York: Flight Search, Flight Cancellation, Flight Status, Baggage Information/Details, Food Preference, Loyalty Program Details, Car or Hotel Booking, Customer Service (Live Agent), and Airport Information.

**Methodology**

For our chatbot, we utilized Dialogflow, a natural language understanding platform, for creating the conversational flow, and leveraged fulfillments and webhooks using Flask to deliver customized and appropriate response to customers’ inquiries.

**Architecture:**

**Figure 2**

*Architecture of the Chabot for Air Travel*

Graphical user interface, application

Description automatically generated

The architecture of our chatbot consists of three main components: the chatbot interface, the webhook, and the app logic. The chatbot interface serves as the front-end for users to interact with the chatbot. The webhook, which is a web service, contains the app logic that processes user inquiries and generates responses. These components work together to provide a seamless user experience.

When a user sends a question to the chatbot, the chatbot first utilizes natural language processing techniques to identify the intent and entities in the question. Once the intent and entities are identified, the chatbot forwards them to the webhook.

The webhook contains the app logic that identifies the intent and recognizes the entities, and then generates a customized response for that intent. For example, the chatbot may provide information on flight status or food preferences during the flight. Once the webhook generates the response, it sends it back to the chatbot.

Finally, the chatbot displays the response as the answer to the user's question. This process happens seamlessly in the background, providing the user with quick and accurate responses to their inquiries. Overall, our chatbot architecture enables the chatbot to understand and respond to user inquiries in a personalized and relevant way.

**Workflow:**

**Figure 3**

*Workflow of the Chabot for Air Travel*

The creation and design of our chatbot involved several steps to ensure that it was tailored to our users' needs. The following is a flow of the chatbot creation and design process:

1. Define Purpose and Scope: The first step in designing the chatbot was to define the purpose and scope of the chatbot. This involved identifying the specific user needs and requirements that the chatbot was intended to address. These were gathered through user research and analysis of existing customer service data in the aviation industry.
2. Create an Agent: The next step was to create an agent using Dialogflow, a natural language understanding platform. The agent serves as the brain of the chatbot and is responsible for understanding and processing user inquiries.
3. Define Intents: After creating the agent, we defined the intents that the chatbot would be able to handle. Intents represent the different types of questions or requests that users could make. For example, a user might ask about flight status or baggage information. Figure 4 shows the intents that we created in the Dialogflow.

**Figure 4**

*Intents of the Chabot for Air Travel*

Graphical user interface, text, application, email

Description automatically generated

1. Create Entities: In addition to intents, we also created entities that the chatbot would be able to recognize. Entities represent specific pieces of information within user inquiries, such as dates, times, or locations. Figure 5 portrays the entities that we created to identify and extract data spoken by the user.

**Figure 5**

*Entities of the Chabot for Air Travel*

Graphical user interface, text, application, email

Description automatically generated

1. Fulfillments and Webhooks: We created a webhook that would be called when the intent was triggered. The webhook was designed to retrieve flight data from our data set and provide flight recommendations to the user based on their requirements. Fulfillments enable the chatbot to respond to user inquiries directly, while webhooks allow the chatbot to interact with external services, such as a flight status API. Figure 6 shows the fulfilment in the Dialogflow and the Heroku web app linked to it which contains the app logic.

**Figure 6**

*Fullfillment of the Chabot for Air Travel*Graphical user interface, text, application, email

Description automatically generated

1. Test the Chatbot: Once the chatbot was built, we tested it thoroughly to ensure that it was able to handle a variety of user inquiries and provide accurate responses. This involved both manual testing and automated testing using tools like Dialogflow's simulator. Figure 7 displays the training phase of the chatbot, where we can see that it is quite successful in the majority of the conversations.

**Figure 7**

*Training phase of the Chabot for Air Travel*

A screenshot of a computer

Description automatically generated with medium confidence

1. Optimize and Improve the Chatbot: Based on the results of our testing, we optimized and improved the chatbot to make it more effective and efficient. This involved refining our intent and entity definitions, improving our fulfillment and webhook configurations, and updating our training data to make the chatbot more accurate. The web demo is located on the integration menu in the Dialogflow console. This web demo will be used as a simulator or platform to be tested on users so they can interact with chatbots that have been made. Figure 8 shows the demo of the user asking to book a flight from NY to DC on 1st June 2023 and the bot’s response in the Dialogflow Web Demo.

**Figure 8**

*Dialogflow Web Demo*

A screenshot of a chat

Description automatically generated A screenshot of a chat

Description automatically generated

A screenshot of a chat

Description automatically generated with medium confidence

1. Deploy and Integrate with the Telegram platform: Finally, we deployed the chatbot and integrated it with the Telegram platform, allowing users to access the chatbot through their mobile devices. This involved configuring the chatbot to work seamlessly with Telegram's messaging platform and ensuring that the chatbot was able to handle user inquiries across multiple channels.

**Figure 9**

*Telegram Demo*

A screenshot of a chat

Description automatically generated with medium confidence A screenshot of a chat

Description automatically generated with medium confidence

A screenshot of a chat

Description automatically generated with medium confidence A screenshot of a chat

Description automatically generated with medium confidence

**Future Works**

One potential area for future development is the integration of the chatbot with voice assistants such as Amazon Alexa and Google Assistant. By leveraging voice input and output, users can interact with the chatbot in a more natural and intuitive way, without the need for a keyboard or touch screen. Voice-enabled chatbots can provide an even more convenient and hands-free customer service experience for air travelers, especially for those on-the-go. Additionally, voice assistants can leverage natural language processing (NLP) and machine learning techniques to better understand user intent and provide more accurate and relevant responses.

Another promising area for future development is the use of large language models (LLMs) in chatbots for air travel. LLMs, such as OpenAI's GPT-3, have shown remarkable progress in natural language understanding and generation and have the potential to significantly enhance the capabilities of chatbots for air travel. For example, LLMs can be trained on large volumes of airline and airport data to provide more accurate and personalized flight recommendations based on user preferences, historical flight data, and real-time information, such as weather and traffic conditions. LLMs can also be used to generate more human-like and engaging responses, enhancing the overall conversational experience for users. However, integrating LLMs into chatbots requires careful consideration of ethical and privacy concerns, such as bias and data privacy, which must be addressed to ensure the safe and responsible use of this technology.

Overall, the integration of chatbots in air travel has already shown great potential for enhancing customer service and improving the travel experience. By exploring the opportunities outlined above, airlines and other travel-related organizations can continue to innovate and offer more personalized and efficient services to their customers.

**Conclusion**

In conclusion, we have successfully designed and implemented a chatbot for air travel that can provide a range of services to travelers. By utilizing Dialogflow and webhooks, we were able to create a seamless conversational experience that enables users to obtain personalized and relevant information quickly and accurately. The chatbot is designed to handle a variety of user inquiries and can provide flight search, flight cancellation, flight status, baggage information/details, food preference, loyalty program details, car or hotel booking, customer service, and airport information. The implementation involves defining intents and entities, creating fulfillments and webhooks, testing, optimizing, and deploying the chatbot. By integrating the chatbot with the Telegram platform, we have made it accessible to users through their mobile devices, making the chatbot a valuable resource for air travelers.

**References**

Airlines for America (2023, April 18). *A4A Presentation: Industry Review and Outlook*.

[[https://www.airlines.org/dataset/a4a-presentation-industry-review-and-outloo](https://www.airlines.org/dataset/a4a-presentation-industry-review-and-outlook/)k/](https://www.airlines.org/dataset/a4a-presentation-industry-review-and-outlook/)

Gitto, S. & Mancuso, P. (2017, April). Improving airport services using sentiment analysis of the websites*. Tourism Management Perspectives*. *22.* 132-136

<https://www.sciencedirect.com/science/article/abs/pii/S2211973617300259?via%3Dihub>

Thomas, G. (2022, November 2). *New global survey-What passengers want.* Air ratings.

<https://www.airlineratings.com/news/new-global-survey-what-passengers-want/#:~:text=The%20survey%20of%2010%2C000%20travellers%20in%20222%20countries%20found%3A&text=Proximity%20to%20the%20airport%20was,price%20(39%20per%20cent).b>

Trapero, H. A. & Ilao, J. P. (2022, August). The air travelers’ experiences and attitudes toward chatbots: A qualitative analysis of a technological innovation. *International Journal of Innovative Science and Research Technology. 7*(8), 1657-1666.