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CS 466/566 – Voice Assistants

Final Project - Winter 2024

Final Project: Designing, Building and Testing a Voice Application

For the final project, you will build a voice application using any of the technologies we learned about in class this quarter. You have a few different options for building this application:

- ❏ Alexa Skill using Amazon Developer Console
- ❏ Dialogflow agent in Dialogflow
- ❏ Google Action with the Google Actions console
- ❏ If you would like to work on something different than the options outlined above, please reach out to me with a proposal. I will need to approve your proposal before you can work on it.

- ❏ **Step 1 - Describe the Application**
  - ❏ What application do you plan to build? Please describe the application in detail and explain why you are planning to build it.

❏ Application Description:

The application ***CountryBot*** is designed to serve as a conversational interface, powered by Dialogflow, providing users with information related to various countries. It offers insights into currency details, population, COVID-19 statistics, tourism data and number of internet users for different countries based on user queries.

❑ Detailed Overview:

➢ ***Currency and Population Information:***

- Users can inquire about the currency used in a specific country and its population.
- The application retrieves real-time data from an external API and presents it in a conversational format.
- It provides randomized responses to keep the conversation engaging and informative.

➢ ***COVID-19 Statistics:***

- Users can obtain information about how COVID-19 has affected a particular country.
- The application calculates an estimated number of cases based on the country's population and presents the data for the year 2020.
- Responses are varied to maintain user interest and provide a personalized experience.

➢ ***Tourism Insights and Internet Users:***

- Users can explore tourism-related data such as the number of tourists and internet users in a specific country.
- The application offers insights into tourist trends and internet usage demographics.
- Responses are dynamically generated to offer diverse information tailored to user queries.

❑ Purpose:

The application aims to provide users with easy access to valuable information about different countries. Whether users are planning a trip, conducting research, or simply curious, the application offers a convenient platform for obtaining relevant insights. By leveraging natural language processing and external APIs, it delivers a seamless conversational experience, enhancing user

engagement and satisfaction.

- ❏ **Step 2 - Interaction Model**
  - ❏ This part should be a high-level description of the interaction model for the application. There should be descriptions of the three intents you will be implementing in the application.
  - ❏ Additionally, the interaction model should have:
    - ❏ 3 brand new intents
    - ❏ At least 15 sample utterances/training phrases per intent
    - ❏ 3 slots/parameters, including a custom slot type/entity type

The application utilizes a conversational interface powered by Dialogflow, offering users three primary intents to interact with: ***Country_currency***, ***Covid_Affected***, and ***Country_Tourists***.

❏ Intents:

- ➢ **Intent name: *Country_currency***

- **Description:** This intent allows users to inquire about the currency details and population of a specific country.
- **Functionality:** Upon receiving a user query, the application fetches real-time data from an external API to retrieve the currency information and population count for the specified country. It then presents the information in a conversational format, offering randomized responses to enhance user engagement.

- ➢ **Intent name: *Covid_Affected***

- **Description:** This intent enables users to obtain COVID-19 statistics for a specific country.
- **Functionality:** Upon receiving a user query, the application retrieves relevant data from an external API to calculate an estimated number of COVID-19 cases based on the country's population. It then presents the statistics for the year 2020 in a conversational manner, offering varied responses to maintain user interest.

- **Intent name: *Country_Tourists***

- **Description:** This intent allows users to explore tourism-related data for a specific country, including the number of tourists and internet users.
- **Functionality:** Upon receiving a user query, the application retrieves tourism statistics from an external API, presenting information about tourist trends and internet usage demographics in the specified country. It dynamically generates responses to offer diverse insights tailored to user queries.

❑ Training phrases:

- **Training phrases for *Country_currency* Intent:**

1. What is the currency of Iran?
2. What is the population and currency of Italy?
3. What is the population of France?
4. What currency does Japan use?
5. Can you give me information on the population and currency of the United Kingdom?
6. Tell me about the population and currency of Germany.
7. How many people live in Russia, and what currency do they use?
8. Can you tell me the population of Belgium?
9. Show me the currency and population of Argentina.
10. I'm curious about the population of Spain.
11. What money is used in Mexico?
12. What is the population of Brazil?
13. Can you show me the population and currency of Australia?
14. What is the currency used in South Africa?
15. Can you tell me how many people live in India?

- **Training phrases for *Covid_Affected* Intent:**

1. What was the impact of covid in Australia ?
2. How many got affected by covid in India ?
3. How many members in Italy got affected by covid?
4. How much did COVID-19 harm Iran in 2020?
5. Show COVID-19 statistics for the year 2020 in France.
6. How severe was the COVID-19 outbreak in Spain in 2020?
7. What was the COVID-19 infection rate in Bangladesh in 2020?

8. Inform me about the COVID-19 impact in China .
9. Can you tell me the number of COVID-19 cases in the United States in 2020?
10. Provide information on COVID-19 cases in Brazil
11. Can you give me details on COVID-19 cases in Mexico in 2020?
12. Tell me about the COVID-19 statistics in Canada during the year 2020.
13. How many people were affected by COVID-19 in the United Kingdom in 2020?
14. What was the extent of COVID-19 cases in Belgium during 2020?
15. Tell me about the coronavirus situation in Egypt in 2020.

- **Training phrases for *Country_Tourists* Intent:**

1. How many tourists does Japan attract each year?
2. What is Spain's current tourist numbers?
3. What are the tourist and internet usage statistics for the United States?
4. I'm curious about Belgium's tourism and internet usage statistics.
5. Can you give me information about tourism and internet usage in Portugal?
6. Tell me about internet usage in Canada.
7. What percentage of Germans use the internet?
8. Tell me about tourist statistics for Italy.
9. How many visitors go to Russia, and what percentage of individuals use the internet there?
10. Can you provide me the data on tourists and internet usage in Mexico?
11. What's the internet usage rate in the United Kingdom?
12. I'd like to know the percentage of internet users in India.
13. Please tell me about visitors and internet users in China.
14. In Brazil, how many individuals use the internet?
15. How many travelers go to France each year?

❑ Parameters and Entities:

➢ **Intent name: *Country_currency***

▪ **Parameters and their Entities:**

- **geo-country:** The ***geo-country*** parameter uses a build-in entity type called @sys.geo-country. This is a required parameter to fulfill the intent.
- **population:** The ***population*** parameter uses a custom entity of type called @population. It includes values like ***population***, ***people***. This is a required parameter to fulfill the intent.
- **currency:** The ***currency*** parameter uses a custom entity of type called @currency. It includes values like ***currency***, ***money***. This is a required parameter to fulfill the intent.

➢ **Intent name: *Covid_Affected***

▪ **Parameters and their Entities:**

- **geo-country:** The ***geo-country*** parameter uses a build-in entity type called @sys.geo-country. This is a required parameter to fulfill the intent.

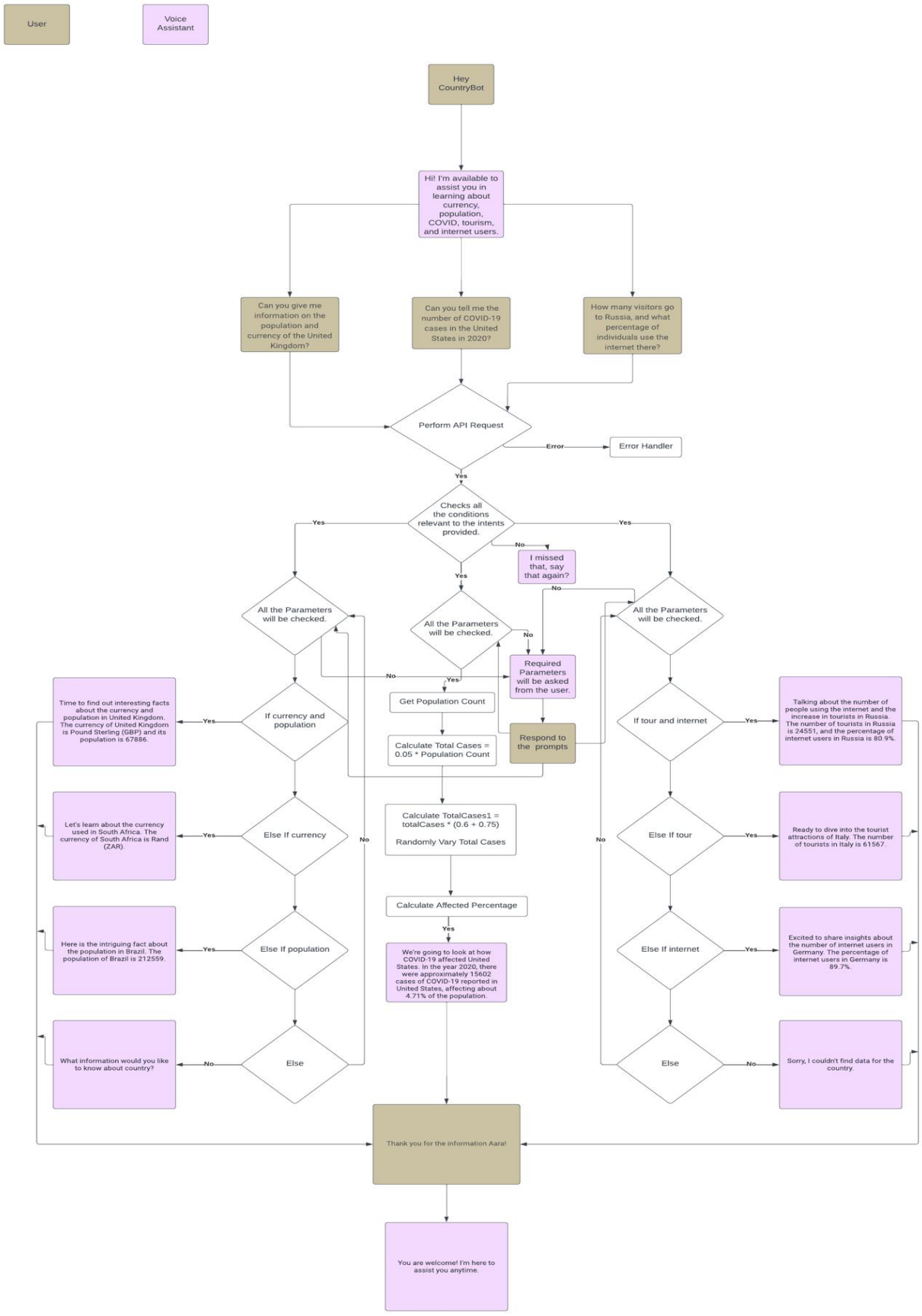
➢ **Intent name: *Country_Tourists***

▪ **Parameters and their Entities:**

- **geo-country:** The ***geo-country*** parameter uses a build-in entity type called @sys.geo-country. This is a required parameter to fulfill the intent.
- **internet:** The ***internet*** parameter uses a custom entity of type called @internet. It includes values like ***internet***. This is a required parameter to fulfill the intent.
- **tour:** The ***tour*** parameter uses a custom entity of type called @tour. It includes values like ***tourist, travelers***, ***visitors, tourism***. This is a required parameter to fulfill the intent.

❑ Step 3 - Conversational Flow Diagram

Conversational Flow Diagram will be submitted in a separate file.


User
Voice Assistant
Hey CountryBot
Hi! I'm available to assist you in learning about currency, population, COVID, tourism, and internet users.
Can you give me information on the population and currency of the United Kingdom?
Can you tell me the number of COVID-19 cases in the United States in 2020?
How many visitors go to Russia, and what percentage of individuals use the internet there?
Perform API Request
Error
Error Handler
Yes
Checks all the conditions relevant to the intents provided.
Yes
No
I missed that, say that again?
Yes
No
All the Parameters will be checked.
All the Parameters will be checked.
No
Yes
Required Parameters will be asked from the user.
Get Population Count
Calculate Total Cases = 0.05 * Population Count
Respond to the prompts
All the Parameters will be checked.
No
Yes
If currency and population
Time to find out interesting facts about the currency and population in United Kingdom. The currency of United Kingdom is Pound Sterling (GBP) and its population is 67886.
Else If currency
Let's learn about the currency used in South Africa. The currency of South Africa is Rand (ZAR).
Else If population
Here is the intriguing fact about the population in Brazil. The population of Brazil is 212559.
Else
What information would you like to know about country?
No
Calculate TotalCases1 = totalCases * (0.6 + 0.75)
Randomly Vary Total Cases
Calculate Affected Percentage
Yes
We're going to look at how COVID-19 affected United States. In the year 2020, there were approximately 15602 cases of COVID-19 reported in United States, affecting about 4.71% of the population.
If tour and internet
Talking about the number of people using the internet and the increase in tourists in Russia. The number of tourists in Russia is 24551, and the percentage of internet users in Russia is 80.9%.
Else If tour
Ready to dive into the tourist attractions of Italy. The number of tourists in Italy is 61567.
Else If internet
Excited to share insights about the number of internet users in Germany. The percentage of internet users in Germany is 89.7%.
Else
Sorry, I couldn't find data for the country.
No
Thank you for the information Aara!
You are welcome! I'm here to assist you anytime.

❑ **Step 4 - Fulfillment**

❑ Explain the logic that powers your application using pseudocode. Your logic should be based on the information received from the slots in this intent. Do not write any code in this section.

➢ **Intent name: *Country_currency***

1. Check if the intent name is ***Country_currency*.**
2. Retrieve the value of ***geo-country*** from the agent parameters and store it in ***country***.
3. Retrieve the value of ***population*** from the agent parameters and store it.
4. Retrieve the value of ***currency*** from the agent parameters and store it.
5. Check if both ***country*** and ***currency*** are provided:
    a. If true, select a random reply phrase from replyPhrases1.
    b. Construct a response indicating the ***currency*** of the ***country*** along with its ***population***.
6. Check if only ***currency*** is provided:
    a. If true, select a random reply phrase from replyPhrases2.
    b. Construct a response indicating only the ***currency*** of the ***country***.
7. Check if only ***population*** is provided:
    a. If true, select a random reply phrase from replyPhrases3.
    b. Construct a response indicating only the ***population*** of the ***country***.
8. If neither ***currency*** nor ***population*** is provided:
    a. Set a default response asking the user to provide the necessary information.
9. Add the constructed response to the agent's reply.

- **Intent name: *Covid_Affected***

1. Check if the intent name is ***Covid_Affected***.
2. Retrieve the value of ***geo-country*** from the agent parameters and store it in ***country***.
3. Check if the ***country*** parameter is provided:
4. If true:
    a. Retrieve the ***population*** count of the specified ***country*** using an API call.
    b. Calculate a reasonable estimate of total COVID-19 cases based on ***population*** (Assume 5% of the ***population*** affected).
    c. Randomly vary the number of cases to add variability (Random between 75% and 135% of total cases).
    d. Calculate the affected percentage.
    e. Select a random reply phrase from predefined options.
    f. Construct the response incorporating the retrieved data and the selected reply phrase.
5. If false:
    a. Add an apology message indicating the inability to fetch data for the specified ***country***.
6. Added the constructed response to the agent's reply.

- **Intent name: *Country_Tourists***

1. Check if the intent name is ***Country_Tourists***.
2. Retrieve the value of ***geo-country*** from the agent parameters and store it in the variable ***country***.
3. Retrieve the values of ***tour*** and ***internet*** from the agent parameters and store them in the respective variables.
4. Define reply phrases for dynamic responses based on the parameters received.
5. Three sets of reply phrases are defined:

    a. replyPhrases1 for responses related to both ***tourists*** and ***internet*** users.
    b. replyPhrases2 for responses related to ***tourists*** only.
    c. replyPhrases3 for responses related to ***internet*** users only.
6. Randomly select a reply phrase from each set (replyPhrases1, replyPhrases2, replyPhrases3) based on their lengths.
7. Construct the API URL using the provided ***country*** name.
8. Make an API call to fetch data about the ***country***'s ***tourists*** and ***internet*** users.
9. Upon receiving the API response:
    a. Extract the number of ***tourists*** and the percentage of ***internet*** users from the response.
    b. Based on the provided parameters, construct a response text:
        i. If both ***tour*** and ***internet*** parameters are provided, use a random reply phrase from replyPhrases1.
        ii. If only the ***tour*** parameter is provided, use a random reply phrase from replyPhrases2.
        iii. If only the ***internet*** parameter is provided, use a random reply phrase from replyPhrases3.
        iv. If neither ***tour*** nor ***internet*** parameters are provided, set an error message indicating incomplete data.
10. Add the constructed response text to the agent's response.
11. Implement error handling to catch any API call errors.
12. If an error occurs, log the error, and provide a default error message to the user.

❏ **Step 5 - User Testing**

❏ In this step, you will be testing the application with users. As such, you willneed to find **2 people** to test your application and you will have to put together three types of tests.

❏ **Part 1 - Usability Testing:** Create a list of **5 tasks** for a potential user to complete. Ask the person testing your application to complete each task. Keep track of whether they were able to complete the task, and if so, howlong it took.

Task	**Time to Complete**	**User 1 - Done?**	**User 1 - Time**	**User 2 - Done?**	**User 2 - TIme**
Task 1 - Population of India	50 sec	Yes	45 sec	Yes	38 sec
Task 2 - Currency of Germany	60 sec	Yes	45 sec	Yes	55 sec

Task 3 - COVID-19 cases in Brazil	55 sec	Yes	50 sec	Yes	52 sec
Task 4 - Internet users in United States	35 sec	Yes	30 sec	Yes	26 sec
Task 5 - Tourist numbers in Spain	45 sec	Yes	40 sec	Yes	34 sec

❏ **Part 2 - Likert Scale Testing:** Come up with **10 questions** to ask using the Likert Scale. See the sample questionnaire in the User Testing lectureslides.

Question	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Question1 - How satisfied were you with the accuracy of the currency information provided by ***CountryBot***?				Yes	
Question 2 - How helpful did you find ***CountryBot*** in providing COVID-19 statistics for specific countries?			Yes		
Question 3 - How informative did you find the tourism-related data provided by ***CountryBot***?				Yes	
Question 4 - To what extent did ***CountryBot*** meet your expectations regarding the population data accuracy?					Yes

Question 5 - How satisfied were you with the relevance of the COVID-19 information presented by ***CountryBot***?			Yes		
Question 6 - To what extent did ***CountryBot*** meet your expectations in terms of providing information about internet users in different countries?					Yes
Question 7 - How good was your experience with ***CountryBot***?					Yes
Question 8 - How likely are you to recommend ***CountryBot*** to others seeking country-related information?					Yes
Question 9 - How satisfied were you with the overall performance of ***CountryBot*** in fulfilling your information needs?				Yes	
Question 10 - How responsive was ***CountryBot*** in providing timely responses to your queries?				Yes	

❑ **Part 3 - Open-ended questions:** Come up with **3 open-ended questions** about the application. These types of questions will let the person testing the application tell you their thoughts on what works andwhat could be improved.

1. **As you explored the functionalities of *CountryBot*, did you find the responses provided by the application to be accurate and helpful in addressing your queries?**

Ans: Overall, ***CountryBot***'s responses were informative and relevant to my inquiries.

However, there were a few instances where I felt the data could be more up-to-date or specific, especially regarding COVID-19 statistics for certain countries.

2. **Did you encounter any aspects of the *CountryBot* agent that were unclear or challenging for you to navigate?"**

Ans: I sometimes found it challenging to navigate certain functions within the ***CountryBot*** agent, particularly when trying to obtain information about a country's currency, population, or COVID-19 cases. Occasionally, I wasn't sure whether I needed to close the conversation and open it again or if I could proceed seamlessly from my current point.

3. **Were you able to easily navigate through *CountryBot* to find the information you were looking for about tourism and internet usage in specific countries?**

Ans: While navigating through ***CountryBot***, I found it relatively easy to obtain information about tourism and internet usage in various countries. However, there were a few instances where I struggled to find specific details.

❏ **Step 6 - Review and Reflection**

❏ **General Impressions**:

The assignment gave a precise and thorough explanation of the application's features, goal, and interface design. The application's goals were in line with the well-defined intents, training phrases, parameters, and entities. The fulfillment logic's pseudocode covered all possible scenarios that might take place for each intent and was clearly designed.

There may have been more precise error-handling algorithms in the pseudocode, particularly for scenarios in which data retrieving from external APIs is failing. Giving instances of how the application tackles extreme situations or unexpected user inputs would have been interesting.

The changes that I would do will be improving the pseudocode's error-handling algorithm. Testing how the application behaves to unusual inputs or critical situations.

❏ **Time:**

I worked on this project for ten days. The interaction model's design and development of the intents, training phrases, parameters, and entities was the process that took the longest to finish. The requirement to take consideration of a wide range of instances and error-handling the methods made creating the pseudocode for the fulfillment logic time-consuming too. In the end, it was a learning curve for me even though it took a long time.

❏ **Testing:**

The most useful testing method was manual testing using sample queries and scenarios. This gave me the opportunity to copy user behaviors and find any problems or functional openings in the application. The tasks and questions relevant to processing incorrect or incomplete user input and error handling during API calls provided me with the most insight into application problems. It is crucial to have clear error messages and strong error handling operations, as I realized through user testing. If I had more time, I would keep testing the application by adding automated tests, such integration tests for API interactions and unit tests for the fulfillment logic.

❏ **Future Work**:

Improvement needs to be done on the intent, entity, fulfillment components of the program to properly handle a larger variety of user requests. To make sure the application executes properly in a wide range of scenarios and edge cases; more testing must be done. To improve the application, features like support for multi-turn talks, interaction with additional APIs to give greater depth to data. Use more APIs and data sources to give users even more detailed information about different countries. Data on the economy, climate, healthcare system, culture, and other topics may be included. Put in place precautions to guarantee that the data in the application is constantly current. To give users the most recent information possible, this could entail integrating real-time data sources or routinely refreshing data from other APIs. Include options that let consumers customize their experience and establish preferences according to their tastes and interests. This can involve bookmarking preferred nations, signing up for alerts or updates, and adjusting how the data is shown. To enable a larger global user base to access the application, expand support for multiple languages. inclinations. Implement methods for gathering user feedback and analytics to learn more about the preferences, behavior, and satisfaction levels of users. Based on user requirements and preferences, the information can be utilized to continuously enhance and develop the application over time.

❏ **Step 7 - Demo and Presentation**

Link to the Web Demo:

https://bot.dialogflow.com/1f35a168-0d7a-479e-ae62-3d9851236c32

Link to the Project Demo Video Presentation:

https://media.pdx.edu/media/t/1_17qa8mck/335477932