

Chatbot for UMBC International Students using Dialogflow

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Abstract—International students face a unique set of challenges when adjusting to life in a new country and pursuing their academic goals. Navigating unfamiliar cultural norms, academic systems, and campus resources can be overwhelming. To address these challenges, we developed an intelligent chatbot using Dialogflow, a natural language processing (NLP) platform, to provide comprehensive support to international students at the University of Maryland, Baltimore County (UMBC). The chatbot leverages the power of OpenAI’s search algorithms to accurately answer user queries related to UMBC, ranging from admissions procedures to student life. A webhook seamlessly integrates Dialogflow with a backend Python script, enabling the chatbot to access and provide real-time information to the students. Additionally, we integrated the chatbot with Slack, a popular messaging platform, allowing students to interact with the chatbot directly within their preferred communication channel.

Index Terms—Chatbot Development, Dialogflow Integration, Natural Language Understanding, Webhook Integration, Ngrok Implementation, Educational Chatbots

I. INTRODUCTION

The University of Maryland, Baltimore County (UMBC) boasts a vibrant international student community, representing a wide array of cultures and backgrounds. This diversity enriches the campus life, bringing a global perspective to the educational experience. International student enrollment at UMBC has steadily increased over the past decade. While this growth is a testament to the university’s global reputation, it also presents challenges in providing adequate support to this growing population. International students often face unique challenges, particularly in navigating the complexities of university admissions, understanding the nuances of living in a new country, and accessing specialized international services. Traditional methods of providing support, such as email and phone calls, are often inefficient and time-consuming, making it difficult to meet the demands of a diverse student body. Given these challenges, there is a pressing need for an easily accessible and reliable source of information tailored to their specific needs. Chatbots offer a promising solution to address these limitations by providing 24/7 access to personalized support in a convenient and user-friendly manner. In response to this need, the project aims to develop an advanced chatbot using Dialogflow and OpenAI’s algorithms. The primary objective is to provide instant, accurate, and personalized responses to a range of queries from international students. These queries can range from detailed admission procedures and job eligibility criteria

to practical information about living accommodations and campus life at UMBC. Furthermore, the chatbot seeks to offer guidance on utilizing international services and provide essential contact information. The integration with Slack is a strategic decision, aimed at leveraging a platform familiar to many students, thereby enhancing the accessibility and user-friendliness of the chatbot. The overarching goal is to streamline the information dissemination process, making it more efficient and less daunting for international students at UMBC.

II. LITERATURE REVIEW

The literature review below delineates the utilization of chatbots within diverse educational contexts, elucidating their functionalities, applications, and implications.

[1] Isnafirlah et al, 2023, focuses on the implementation of Dialogflow to devise an Information Center Chatbot tailored for dispensing information in educational realms.

[2] Qasem et al, 2023, The research investigates the efficacy of chatbots as interactive tools for augmenting English for Specific Purposes (ESP) vocabulary learning within an online learning environment.

[3] Shahroze Ali et al, 2022, This study delves into the integration of the NLP-based chatbot NEDBOT as an intelligent agent for furnishing administrative support in educational institutions through Dialogflow.

[4] Misra et al, 2021, While not directly focused on education, this research explores the application of Dialogflow CX in bolstering customer response efficiency, elucidating its potential adaptability in educational settings.

Collectively, these papers underscore the potential of chatbots within educational institutions. They illustrate how chatbots, constructed on platforms like Dialogflow, serve diverse purposes such as dispensing information, aiding language learning, providing administrative support, and facilitating efficient communication, aligning with the prospect of employing chatbots for UMBC international students utilizing Dialogflow.

III. METHODOLOGY

The official International Student Arrival Guide, sourced from UMBC, served as our primary text corpus for this study. This dataset comprises diverse information about international students enrolled at UMBC, encompassing admission and arrival details, Orientation and Classes schedules, information on International Student Services, as well as Contact Information. Leveraging this dataset, our study addresses student queries encompassing the aforementioned topics.

A. Intent Recognition

We have systematically classified a comprehensive set of intents, encompassing the spectrum of inquiries and concerns commonly posed by international students. This method involves the categorization and definition of a diverse range of intentions or objectives underlying the questions and challenges frequently encountered by international students. It entails the comprehension and classification of a myriad of queries, concerns, and subjects typically sought after or inquired about by international students.

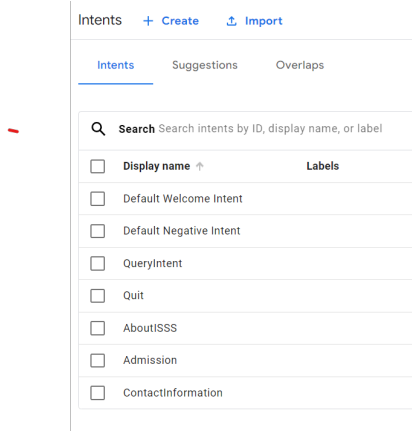


Fig. 1. Intents for UMBC Chatbot.

B. Entity Recognition

Entity recognition is a key component of the chatbot for UMBC international students using Dialogflow. We trained the chatbot to recognize and extract relevant entities from user queries, such as student concern department, query terms, and department names. The entity types are divided into two categories: custom and system. The custom entity types are specific to the chatbot, while the system entity types are provided by Dialogflow.

Entity types listed in the image are relevant to the chatbot for UMBC international students because they cover a wide range of topics that international students have questions about, such as admissions, billing, contact information, COVID-19, getting settled, orientation classes, student life, UMBC, and work. Entity recognition allows the chatbot to understand the specific context of user queries and provide more accurate and relevant responses.

C. Knowledge Base Construction

A structured repository was meticulously curated to compile comprehensive details concerning UMBC's academic curriculum, student-centric services, and diverse campus resources. The assembly of this knowledge base was sourced from UMBC's international student Arrival Guide, serving as a foundational resource for the development of the chatbot tailored specifically for UMBC International Students using Dialogflow.

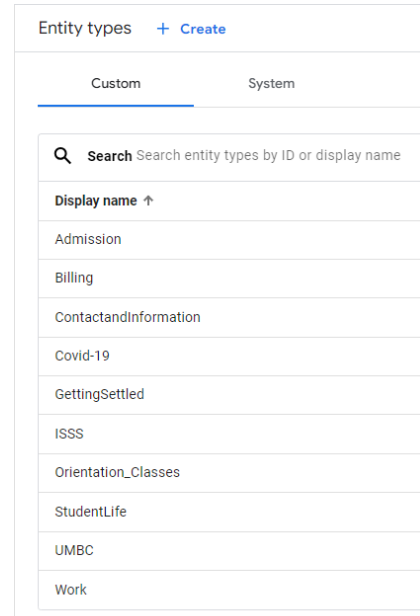


Fig. 2. Entities for UMBC Chatbot.

D. Dialogflow

Dialogflow, a prominent natural language understanding (NLU) platform offered by Google Cloud, serves as a robust foundation empowering developers to construct sophisticated conversational interfaces tailored for diverse applications such as chatbots, virtual assistants, and interactive voice response (IVR) systems. This platform encapsulates a comprehensive suite of tools and functionalities conducive to crafting natural, engaging, and efficient conversational interactions.

In our endeavor to develop a chatbot specifically designed for UMBC international students, we leveraged Dialogflow as our primary NLU platform. Utilizing its capabilities, we meticulously structured the conversational flow, defining pivotal components like Entities and Intents. Essential elements such as Welcome Intents and Exit Intents were thoughtfully crafted to enrich the user experience. Employing Dialogflow, we orchestrated the flow of the chatbot, establishing a cohesive and intuitive conversational pathway.

Furthermore, our implementation involved the utilization of a Python script integrating the OpenAI algorithm in the backend. This facilitated the retrieval of information from the text corpus, enabling the chatbot to efficiently address and respond to user inquiries and requests.

E. OpenAI Integration

Leveraging OpenAI's advanced search algorithms significantly augmented the chatbot's capability to furnish precise and extensive responses, especially when addressing intricate inquiries. The integration of OpenAI's search mechanisms substantially enriched the chatbot's ability to process and deliver nuanced information, ensuring a more robust and com-

prehensive support system for UMBC international students utilizing the Dialogflow platform.

F. Ngrok

Ngrok stands as a versatile and robust facilitator, empowering developers to seamlessly expose their locally hosted development servers to the wider Internet. Serving as a secure tunnel, Ngrok adeptly bridges the divide between local systems and the internet, eliminating the need for intricate port forwarding or VPN setups. This tool furnishes a public URL, thereby enabling the availability of our locally developed codebase online.

In the context of our project focused on crafting a chatbot for UMBC international students using Dialogflow, Ngrok played a pivotal role. Leveraging Ngrok's capabilities, we generated a public URL for the backend Python code. This URL served as the linchpin, establishing a connection between the backend Python script and Dialogflow through Webhook integration. By harnessing Ngrok's functionality, we ensured seamless and secure communication between our locally hosted backend code and the Dialogflow platform.

G. Webhook

A webhook serves as a mechanism employed by applications to instantly transmit information to other applications. Typically, it dispatches an HTTP request, commonly in the form of a POST request, to a user-configured URL. In our project, we established a webhook from Dialogflow to the backend Python script, employing Ngrok to facilitate this connection. This setup enabled the seamless transmission of real-time data between Dialogflow and our backend Python script, ensuring efficient and timely communication.

The chatbot is connected to Dialogflow, which is an NLU platform. Dialogflow is connected to the backend Python script via a webhook. The webhook is implemented using Ngrok, which is a tool that allows applications to expose local servers to the public internet. The webhook allows the chatbot to access the Python script's capabilities, such as searching the text corpus and answering user questions. This makes the chatbot more informative and helpful.



Fig. 3. Connection Methodology.

H. CHATBOT FLOW

At the heart of the chatbot's functionality lies Dialogflow, a sophisticated natural language processing (NLP) platform. As users engage with the chatbot, Dialogflow seamlessly employs advanced NLP techniques to decipher the intent behind their

queries, extracting relevant entities along the way. This extracted information is then encapsulated and transmitted to the chatbot's webhook, serving as the bridge between Dialogflow and the backend Python script.

The webhook, empowered by Ngrok, establishes a secure communication channel between Dialogflow and the Python script. The user's query, structured in JSON format, is conveyed to the OpenAI algorithm, a powerful language model capable of processing and comprehending complex inquiries. The algorithm meticulously analyzes the query, generating a nuanced response specifically tailored to the user's needs. This well-crafted response is then relayed back to Dialogflow via the webhook, maintaining the JSON format.

Finally, the chatbot, seamlessly integrated into the Slack application, receives the refined response and promptly presents it to the user. This seamless interplay between Dialogflow, the webhook, and the OpenAI algorithm ensures that users receive comprehensive and informative responses, fostering a positive and engaging user experience.

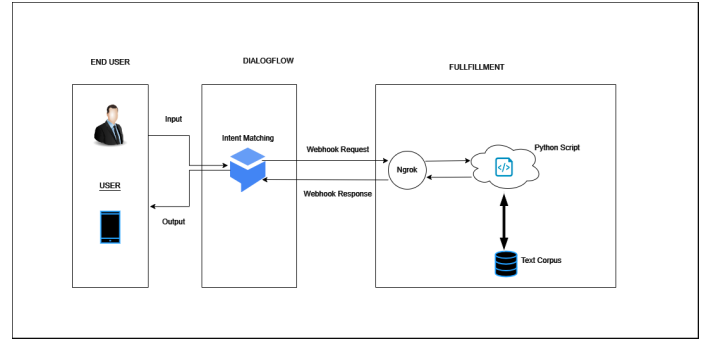


Fig. 4. Architecture Diagram.

I. INTEGRATION WITH SLACK

To extend the accessibility of our chatbot to a broader user base, we integrated it seamlessly with the Slack application using Webhook functionality. Users can conveniently access the chatbot by simply downloading the Slack application on their computers or mobile devices. This integration offers users the ability to interact with the chatbot effortlessly with just a single click.

When users input their queries within the Slack application, the system redirects these queries to Dialogflow through the Webhook integration. Subsequently, Dialogflow processes these queries and efficiently delivers the corresponding responses back to the users. This robust integration ensures a smooth and user-friendly experience, allowing individuals to interact with the chatbot seamlessly within the familiar Slack environment.

RESULTS

The chatbot underwent rigorous testing through simulated student inquiries on both Dialogflow and Slack platforms to assess its proficiency in addressing user requests.



Fig. 5. Chatbot Integration with Slack.

J. Testing on Dialogflow

1. Query regarding tuition fee: In this scenario, a student asks the chatbot about tuition billing and where to find the billing information. The chatbot provides a clear and concise answer, informing the student that they can access their e-bill by logging into their myUMBC account and providing a link to the SBS website for more information.

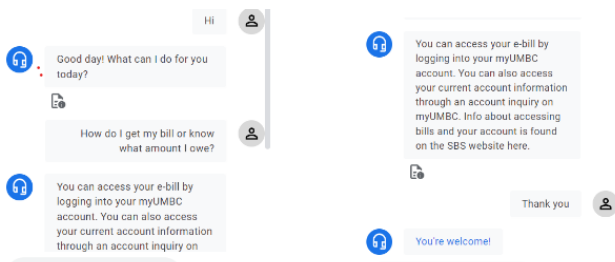


Fig. 6. Result for query regarding tuition billing.

2. Query regarding work authorization: In this scenario, a student asks the chatbot about CPT and on-campus work eligibility. The chatbot explains what CPT is and how students can apply for it. The chatbot also provides information about Handshake and career coaching.

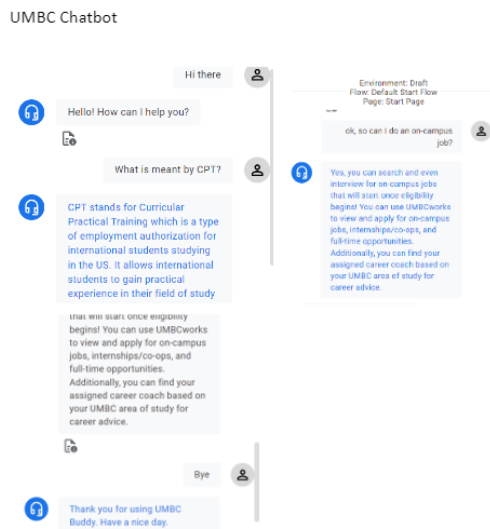


Fig. 7. Result for the query regarding work authorization.

3. Query regarding application status: In this scenario, the student asks the chatbot about the status of their I-20

application. The chatbot explains that it is not trained to track I-20 application status and that the student should email the International Admissions office for an accurate response.

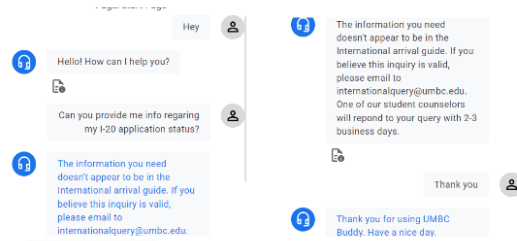


Fig. 8. Result for query regarding application status.

K. Testing on Slack

The image shows a screenshot of a Slack conversation between a student and the chatbot. A student asks the UMBC chatbot on Slack for information about international grocery stores near UMBC and transportation options to reach the stores. The chatbot provides a list of international grocery stores near UMBC and explains how to get to them using the UMBC transit shuttle.

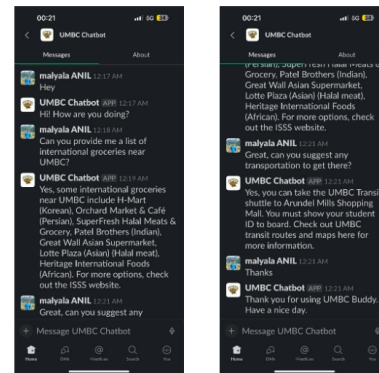


Fig. 9. Result for query regarding international grocery stores.

The ensuing outcomes suggest that the chatbot holds significant promise as a valuable resource for UMBC international students, furnishing swift access to information and aiding in resolving a spectrum of queries. The chatbot's adeptness in managing a wide array of requests underscores the robustness of Dialogflow as a natural language comprehension platform. Furthermore, the successful implementation of entities and intents underscores the efficacy of the chatbot's design, affirming its potential as a reliable aid for UMBC's international student community.

LIMITATIONS

The functionality of this chatbot relies on a comprehensive text corpus for interpreting and addressing user queries effectively. As a critical component, it is imperative to maintain a consistent update cycle for the text corpus, ensuring the

provision of the most current information to cater to users' queries. To adhere to the limitations of the OpenAI algorithm, it is necessary to have a minimum time interval of thirty seconds between successive queries.

While the design of this chatbot prioritizes the comprehension and response to queries posed in English, its effectiveness may present challenges for non-English-speaking students. This limitation potentially restricts accessibility and usability for such individuals, warranting consideration for future enhancements to support multiple languages.

Furthermore, this chatbot operates by interfacing with external services like Dialogflow, OpenAI, and Slack. Any potential downtime or operational issues encountered with these external services directly impact the functionality and reliability of the chatbot. Such dependencies highlight the necessity for robust contingency plans and measures to ensure consistent and uninterrupted service delivery.

FUTURE ENHANCEMENTS

This chatbot integration extends beyond its initial scope and can be synergized with the UMBC transit system, thereby offering students real-time updates regarding transit schedules and routes. Additionally, integration with the UMBC International Student and Scholar Services (ISSS) system can enable the tracking of crucial application statuses such as I-20 and Curricular Practical Training (CPT) applications.

Furthermore, this chatbot's functionality can be expanded to encompass the dissemination of emergency alerts across the campus. This enhanced capability ensures timely and crucial notifications reach students promptly, contributing to campus safety and security measures.

CONCLUSION

The integration of this Dialogflow-based chatbot marks a significant transformation in bolstering support for international students at UMBC. Through its provision of personalized assistance available around the clock, this chatbot is set to substantially enhance accessibility, operational efficiency, and the overall student journey. As we persist in refining and broadening its functionalities, we foresee this chatbot evolving into an indispensable asset, not only for international students at UMBC but also for all students. This strategic evolution positions the chatbot as an instrumental tool, promising continuous improvement in student support services and experiences.

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