

Development of a Smart Tourism Information Chatbot for Mauritius

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Abstract

Due to the current COVID-19 situation worldwide, the tourism industry has been heavily impacted worldwide. Chatbots help to minimise the spread of the virus, by limiting physical interaction, whilst help to promote the industry and make available tourism information in an accessible familiar manner. This paper aims to analyse the various aspects of the tourism industry and identify the gaps that need to be addressed in order to improve the customer experiences in Mauritius. The aim was deploy a tourism information chatbot that will provide the necessary information and recommendations to tourists coming to Mauritius and attract potential tourists plan their next trip in a few steps, using off-the-shelf technologies. The main advantage of the developed Chatbot is that is built on off the shelf technologies (Rasa, Telegram, etc), but with the ability to be further extended with APIs. Thus the chatbot developed exhibits a number of innovations for a Tourism chatbot, such as Google search, weather acquisition based on location and COVID-19 statistics.

Keywords: Tourism, Chatbot, Telegram, Rasa, COVID-19

1 Introduction

Tourists have been visiting Mauritius for its 3s which are the sun, sea, and sand. The tourism sector is a major employer that contributes significantly to Mauritius total gross domestic product (GDP), it is also considered to be one of the main sources of revenue for Mauritius. As one of the major drivers of economic activities, tourism has been identified as one of the fastest growing sectors in Mauritius. It has been linked to the development of the country's economy and employment opportunities which has contributed around 24% GDP (Gounder, 2021). Due to the COVID-19 pandemic the tourism sector has been highly

affected which has forced people to stay home, it has caused several negative impacts such as travel restriction and closed borders of many countries around the world, which it has led to a reduction of demand for leisure and work purpose travellers. In just a year Mauritius has lost around 10.8% of its GDP from the tourism industry (statista, 2022). Since January 2020, there has been a significant decrease in tourist arrival due to travel prohibitions, border restrictions, and quarantine measures. The suspension of economic activity drastically reduced government revenue, the tourism industry has taken a major hit, with border closures, mass flight cancellations, and hotel bookings as resorts and hotels closed, resulting in job losses and salary reduction. In October 2021, the Prime Minister of Mauritius has fully opened the border to international visitors, trying to rebuild its key tourism industry after long months of isolation from the rest of the world but COVID-19 still remains a risk in Mauritius, social distancing, wearing of face masks, using hand sanitiser are mandatory in public and mandatory temperature check done in businesses and mall. Due to the pandemic tourists want to avoid high risk and crowded tourism areas, they may decide not to go/visit their destination and would like to minimise human interaction (M. K. Rahman, Gazi, Bhuiyan, & Rahaman, 2021). In order to minimise human interaction tourists can use chatbot which are 24/7 available. A Tourism information chatbot can bring a new way of customer service agents, acting as a user's first point of contact and providing useful information or intelligent responses to questions asked. It can improve customer satisfaction in this area by providing quick, almost instantaneous responses, regardless of the time of day the customer contacts a tour operator service and can also improve in personalising marketing efforts to specific users by talking in the appropriate language and focusing on the appropriate

items or services (Calvaresi et al., 2021). That is to say an AI chatbot can analyse data and request from the user better than humans to more precise answers and can reduce human interaction due to the COVID-19 pandemic. This paper covers the development of one such chatbot, specifically for tourism during COVID-19 and the implementation of automated features that enhances the tourism experience. This paper is outlined as follows; Section 2 covers the background, Section 3 discusses the methodology. Section 4 elaborates on the results and Section 5 concludes the paper.

2 Background

Mauritius is often considered as a must-visit destination by tourists for its various attractions such as its tropical climate, beaches, and ethnic diversity. In the last decade, the tourism industry in Mauritius has grown dramatically, it is the third pillar of the Mauritius's economy, the travel and tourism sector has always been affected by various factors which are economic factors, political conflicts, and technological advances which it had contributed to the way it is now. Tourism is considered one of the fastest-growing sectors in Mauritius, it is creating jobs and boosting the local economy. However, the tourism industry has contributed significantly to the Mauritius's economic growth and development. In 2020, with the COVID-19 pandemic in Mauritius, it has caused various negative impacts such as restricted travel accommodations and closed borders and the arrival of tourist in Mauritius. As shown in chart the figure 1 below due to the pandemic caused by the COVID-19 diseases has severely affected the tourism industry in April 2020, this has led to a reduction in the demand for work and leisure travellers and Mauritius has lost around 10% of its gross domestic product in a year (statista, 2022). As travellers become more digital natives, they are also demanding more meaningful travel experiences. With the rapid emergence and evolution of technological advancements has greatly impacted the dynamics of the tourism and hospitality industry. The evolution of tourism has changed the way people book their vacations. Today, they do their research online before they go to a travel agent. With the rise of smartphones, travellers can now control all of their travel activities anywhere and can now access services like hotel reservations and airline tickets without having to go to a website.

They no longer have to wait for the events to happen for them to control their experience anytime and anywhere. Through the use of the internet, travels can experiment with the various features and functionalities of the new channels and develop their own personal travel plans (Dickinson et al., 2014). On the other hand, it has made these services very useful to many tourists since their smartphone is their daily life. Some travel apps are useful for tourists, but they can be considered as bloatware. Most of the time, these apps are focused on a specific topic like real-time weather updates, managing flights and hotel bookings and place to visit, most of the time, these apps are useless once a tourist has used them once. However, chatbots can operate 24 hours a day, seven days a week, which is far beyond the typical work week of human employees, and they can serve multiple users simultaneously. Instead of creating apps that are cluttered with useless features, travel chatbots deliver a cleaner alternative by using existing instant messaging platforms that people already use that do not create bloatware on their device. They make it possible for tourists to receive updates and promotional offers without having to download separate apps for each service they'll be using (Pillai & Sivathanu, 2020). The Tourism industry is benefiting immensely from technological advancements, like Artificial Intelligence (AI), robotics, and chatbots. The emergence of these technologies has changed the way the tourism industry operates and address some of the challenges that the new generation of travelers faces ((Pillai & Sivathanu, 2020). Chatbots have become an integral part of the tourism industry in the last couple of years, as this technology have the ability to automate procedures, replace people, and even provide new services (Calvaresi et al., 2021). Various sectors of the tourism industry benefit from the use of chatbot technology such as hotels, car rental services, and travel agencies (Ukpabi, Aslam, & Karjaluoto, 2019). With the increasing popularity of instant messaging apps, the tourism industry uses this platform to deploy their chatbot to help streamline their sales process and provide a better customer experience to travelers.

Due to the rise of instant messaging, people are demanding more information and better solutions for their travel needs. Chatbots are becoming more prevalent as they provide a more natural and user-friendly interface to interact with various websites

and smart devices (McTear, 2018). According to *traveldailynews* (2022), it was revealed that that 87 percent of users would be happy to interact with a travel chatbot to plan their trip or compare various options when it comes to booking a travel trip that could save them time and money. Despite the hype around chatbots, some travel chatbot are not as adept at guiding users through the various aspects of their trips. With so many choices when it comes to planning a vacation, many travellers are looking for an easier way to arrange their trips. According to McTear (2018), developers have created various chatbot-like apps with various functionalities for Facebook Messenger and Amazon Alexa. For the past few years, the use of chatbots in the hospitality and tourism industry has been increasing due to its popularity, it has started becoming an important part of the tourism industry. Many hotels and other tourism companies have their own bots on social media platforms (Doborjeh, Hemmington, Doborjeh, & Kasabov, 2021). In the tourism industry, AI chatbot technology is used for customer support, booking, tailored recommendations, marketing, and customer feedback which it provides personalised and relevant information to user's questions and requests. Using chatbots, it helps travel agencies to easily complete travel related tasks more accurate and efficiently than their human assistants (Pillai & Sivathanu, 2020). The technological advancements enabled travellers to make better decisions when it comes to their travel plans. Prior to the Internet era, people had to rely on the information provided by their travel agent for their travel plans. However, the information given by their travel agent can be inaccurate or outdated. Now with the help of internet, travellers can just go search on the web and plan their tips without the aid of a travel agent or to watch videos about their destination to obtain information regarding their trip. According to *appsolutions* (2022), the benefits of integrating a chatbot in the tourism industry are:

1. Increase engagement with tourist.
2. Reduce workload and operation costs.
3. Increase number of arrival and sales.
4. Build communities.
5. Attract all kind of tourists.

2.1 Existing Tourism Information chatbots

Chatbots on an instant messaging platform are more often just a different interface to an existing service like Expedia bot, Skyscanner chatbot, Cheapflights chat and Hello Hipmuk chatbot which use Facebook Messenger to plan your vacation. With the rapid growth of chatbot, instant messaging platform such as Facebook Messenger and Telegram are providing APIs to facilitate the deployment of chatbot (Grasselli & Zupancic, 2018). The tourism industry has gain interest of how a chatbot can be efficient. Moreover, users liked how the chatbot provided immediate feedback and their natural language was used to express their needs (Alotaibi, Ali, Alharthi, & Almehamdi, 2020). Some examples of tourism chatbots include :

1. The ski resort Zauchensee in Austria has created a chatbot on their website (<https://www.zauchensee.at>) named Zauchi that would allow guests to easily find the information they need to plan their trip and stay in the area. It has been noted that it eliminates the need for a customer representative to email or call them (*appsolutions*, 2022).
2. Saga, which was developed by Hopstay, is the most advanced chatbot that the Faroe Islands has launched. It is designed to answer the typical questions and provide dynamic information that tourists might have when they visit the islands. It will help visitors easily access all the information such as transport information, recommendations, and events, and available 24/7 on Facebook Messenger (*appsolutions*, 2022).
3. Sunny is the digital assistant of Serfaus-Fisss-Ladis region, with its various features, such as planning and organizing trips. Sunny is able to help people plan their vacations as smoothly as possible and also provide helpful information about their travel destinations and local weather conditions (*appsolutions*, 2022).
4. Claire a B2B travel bot and travel management solution. It is a virtual assistant that is powered by A.I., and it is designed to help small and medium sized businesses to

manage, control and automate their corporate travel through the various options when it comes to traveling. The bot's side will help them book a trip that's compliant with their policy in just a couple of minutes. Claire also has the ability to negotiate private rates and customize travel according to their preferences. Users can text Claire to resolve any issue they might have while traveling. It can also be reached through various platforms, such as Facebook Messenger, Slack, and SMS. On the travel management side, Claire can provide detailed analytics and send expenses directly to a company's expense management system (*There is a bot for that*, n.d.).

5. Pana is a virtual travel agent that allows you to interact with a human travel agent through a messaging app. Unlike other chatbots, it does not advertise itself as a bot. Instead, it uses AI to get to know the user better and has an interface that is similar to other messaging apps. It begins with a welcome call to the user by the travel agent that will learn about the user travel preferences. The user can submit any kind of request for a recent or upcoming trip using the mobile app, text message, or email while communicating with Pana, and according to their website, travel agent will respond within minutes. The user can easily book a trip that a travel agent suggests with just one tap. One of Pana's more intriguing capabilities is its ability to inform the users when they should get to the airport and what the weather will be like when they get there. When they finally arrive at the destination, Pana takes on the role of "concierge," provide "vetted recommendations for your meals and activities." However, it requires a paid subscription (*Pana*, 2016).
6. SnapTravel offers conversational commerce to provide affordable hotel rates via a chatbot. It attempts to use SMS, Facebook Messenger, or Slack to find you a hotel that fits your needs and price range. It claims to have "hidden offers" of its own and searches Expedia, Priceline, and more than 100 other websites for the best price using a combination of artificial and human intelligence. The bot will initially ask the user for their travel destination and dates, any hotel brand

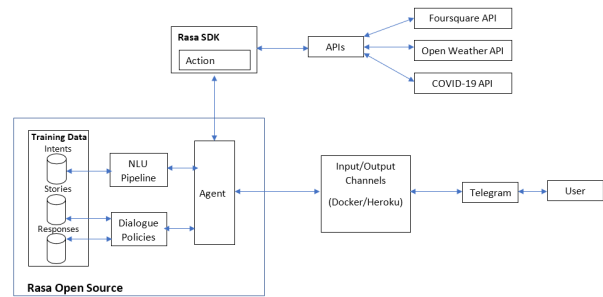


Figure 1: Chatbot Architecture

choices, budget, any preferred areas within the city and more. Based on the user request it will give a cost estimation for their request (<https://www.snaptravel.com/>, n.d.).

The main research gap being addressed is having a chatbot specific for Mauritius, with additional innovations that make use of off-the-shelf technologies with relevant APIs.

3 Methodology

The Rasa framework is used in order to build the backend of the chatbot, and Telegram is used for the front end of the chatbot. In order to use Rasa framework, the use of an IDE is needed to develop the chatbot. Visual studio code (VS code) is used to install Rasa and all its dependencies required. Python 3.8 is used to install Rasa and the dependencies. Figure 1 shows the complete architecture.

The TensorFlow software library is used for developing artificial intelligence and machine learning systems. It can be used across a variety of tasks, but it focuses on deep neural components. Python was used to create the scripts to interact with APIs such as Open Weather Map API and more. For the hosting and deployment of the chatbot, it is achieved by using a Docker container which contains all the necessary software components to run an application and Heroku to simplify cloud deployment.

The development of the chatbot is divided in three parts; the first part was to identify what question may a user ask a tour guide or tour operator; second part was to find the answers to the question, and lastly create stories/scenarios about the interaction of the user with the chatbot. A list of intents is very important for a bot to interact with end users efficiently and effectively. It should include many possible questions and statements, it

is done by providing examples what a user might ask for.

3.1 Design

This chatbot has been designed to answer all the users' questions about traveling to Mauritius and things to do in Mauritius, whilst considering COVID-19 scenarios (Example shown in Figure 2). Using this chatbot has some advantages over simply visiting the tourism website, one of these is that it gives a direct answer to a question, instead of requiring users to go/navigate through a large list of questions. The main features that the chatbot will provide are:

3.2 Creation of chatbot

In order to connect Rasa to Telegram, a Telegram API is needed to connect the back end to the interface of Telegram. Telegram offers a bot that generate bot API for developers which is BotFather API. It is a special account that does not require a phone number to be established. It serves as an interface for the code running on your server, in addition it handles all the encryption and communication, and allowed users to communicated with the bots in two ways by send messages and requests directly into the chat. This can be accessed through an HTTPS-based interface.

Rasa provides a number of files to create an AI based chatbot with programmable features:

3.2.1 actions.py

This file is used to create custom actions that can be called from an external service such as to query a database, or from an external API using Python. For example, the API used to retrieve the weather information is from Open Weather Map, in this custom action it is set that the Open Weather Map API only return the weather location the user requested, the API will return the condition, temperature, humidity and wind speed of the weather location in a JSON format.

3.2.2 stories.yml

This file contains sample conversations story between a user and a bot. The term story is used here to describe the interaction between a user and a chatbot that's actually happening. While the user inputs are being converted into actions, the responses are being treated as actions that the bot should perform when it's needed. They are used to train the dialogue management models of the

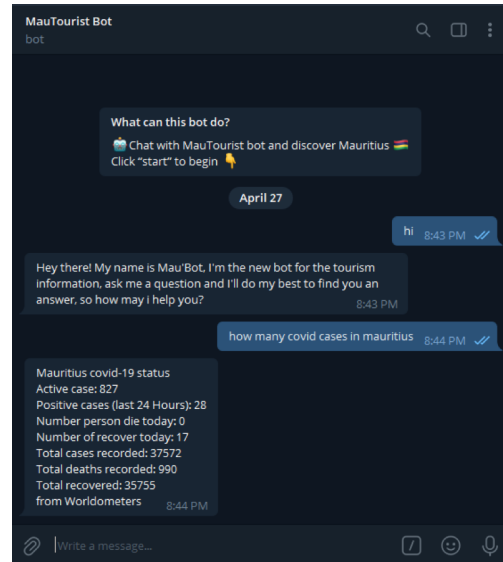


Figure 2: Live COVID-19 Statistics

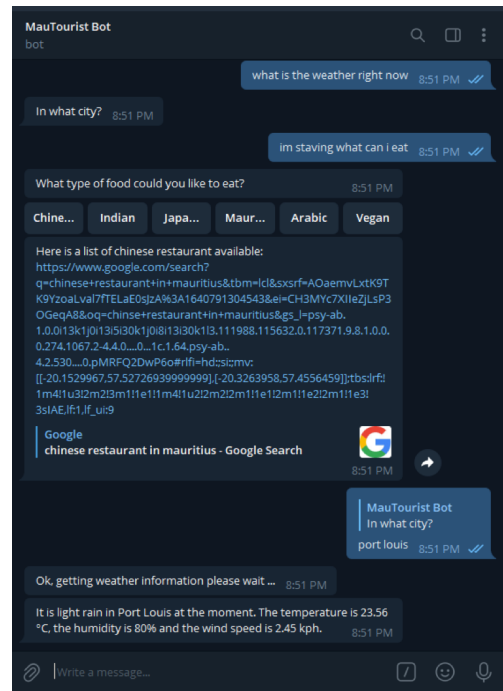


Figure 3: Chatbot restaurant selection

Rasa. There are two groups of interactions that need to be considered when developing stories, the happy and unhappy paths. The happy path is when the user is following the flow of the conversation and providing the necessary information. In the "stories.yml" file, several stories were added to cover a wide range of opening and closing conversations. By creating these stories, it will teach the chatbot how to respond to unexpected situations, such as when the user's input doesn't make sense, or the message is written in another language.

The main component of the framework is the dialog management, it handles the various aspects of a conversation, and it decides on the next steps based on the conversations' details. It generates a probability model that predicts the actions that will be performed based on the previous actions. In some aspects, upon certain keywords, a selection button (in the example in Figure 3 - the keyword for food/cuisine allows further selection of a restaurant).

4 Results

This evaluation tests the natural language understanding (NLU) model separately with a train set and test set. By doing these test stories help to make sure how the bot will respond in specific circumstances. It will provide a confusion matrix table that shows the summary of prediction result on a model, if the bot is replying according to the story created it will give a proper value otherwise it will give a wrong value. The matrix helps identify classes that are commonly mislabelled. For instance, one class might be mistakenly labelled as another. The confusion matrix shows which intents are mistaken for others (true versus predicted labels). A histogram intent prediction confidence distribution will also be generated to visualise the confidence for all the predictions, with the correct and incorrect predictions. The intent confusion matrix (Figure 4) shows that the chatbot is correctly identifying all the intents. As it can be seen there are no outliers. The matrix shows the intent name, the highlighted diagonal indicated how many answers are there in the intent name and how many are correctly predicted.

A further test evaluates the trained dialogue model on a set of test stories. A test file is created with a sample of possible user request to evaluate the stories in the model. This will generate a yml file to show the result of the evaluation. Figure 5 shows the result of the evaluation whereby the overall result is correct (with no wrong intent). As it can be seen that the model is well trained to respond to the test stories created.

5 Conclusion

According to the latest research, chatbots are becoming very useful and effective tools for people with limited or no technical expertise. They can be used to enhance the user experience and provide better service. The goal of this paper was to

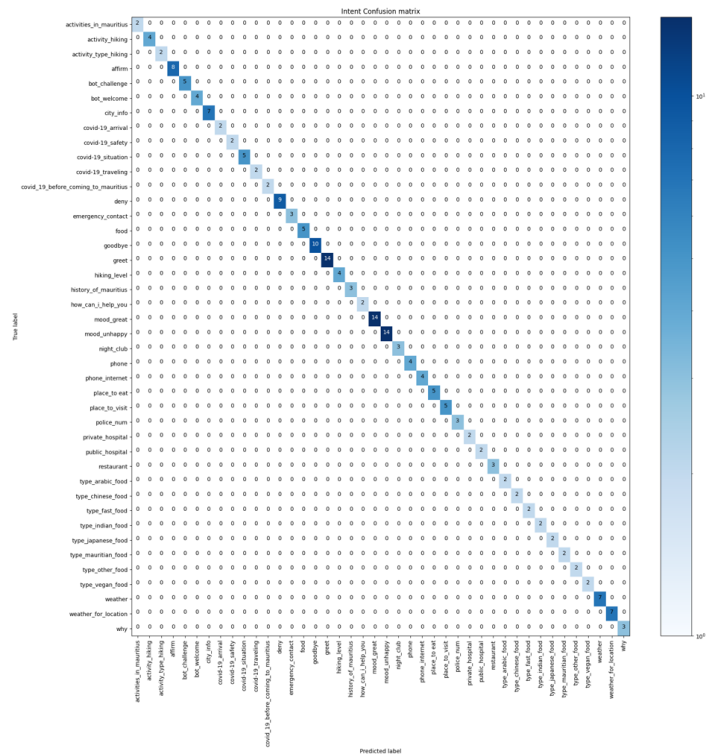


Figure 4: Intent confusion matrix

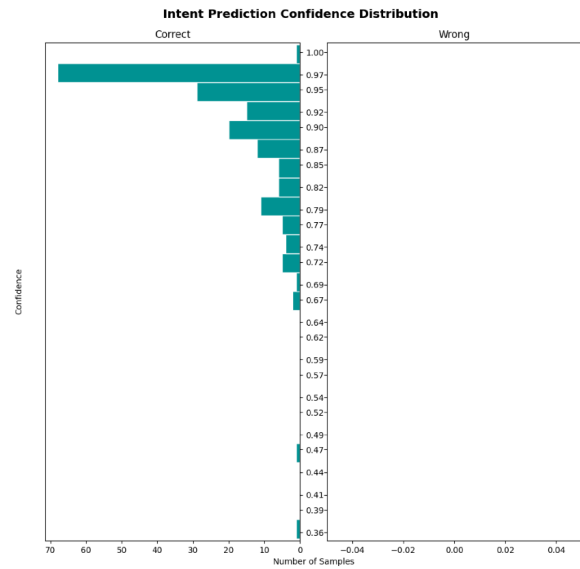


Figure 5: Evaluation

demonstrate the development of a chatbot that will provide useful information about Mauritius as a travel destination so that they can make their experience in Mauritius more pleasant and enjoyable in a unique way through a conversation, whilst being able to promote the tourism industry in Mauritius post COVID-19. In this work we have created a

chatbot using off-the-shelf technologies, and our results are encouraging. With these results, it can be seen that the Rasa open-source framework facilitates the creation of chatbot, and the evaluation that was conducted shows that the chatbot can have more features added to it as part of further work.

5.1 Further Work

This work can be extended by doing the following:

- More languages could be added and trained to support a wider range of users.
- Another feature that can be added to the chatbot is an action that can help the tourist to find the best deal for a hotel room of flight within their budget. For example, the chatbot will gather the data of the user either as from the input of the user or taken from the device of the user like GPS coordinates. In order to collect this information, the chatbot should comply with the General Data Protection Regulation and other laws which are applied, as there might be legal consequences for not following the laws. Users should have the freedom to allow this or not.
- Initially, the chatbot is currently on Telegram which is one of the popular instant messaging platforms. Research also shows that Facebook Messenger is also a popular app used by many people. Aside from being on only a messaging platform the chatbot can also be used in other platforms to get more users and to promote Mauritius.
- Another action that can be added is a feedback feature that will allow users to provide suggestions to improve the chatbot and keep up with the needs of its users. This will allow the developers to keep up with the needs of its users.
- With the advancement of natural-language processing, chatbots can now understand and respond to ambiguous queries like “Family trip vacation” or “romantic trip”. This can be used to analyse their questions/request and provide a relevant personalised response and detect the emotional state of the tourists when they are using the chatbot. For instance, a chatbot can help a user find a great deal on

hotel and flight. It can also provide a weather forecast during their visit and budget-friendly recommendations.

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