International Journal of Advanced Technology in Engineering and Science Vol. No. 09, Issue No. 06, June 2021 www.ijates.com



Terra – A contextual chatbot for tourists

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Abstract

Virtual assistants are the need of 20th century which are used for understanding human behaviour and customer-based services. These bots have been widely used in our day-to-day life such as social media, business, education, medical sector, farming sector etc. Tourism is one such industry where Artificial Intelligence can be of great use. An Interactive agent that uses the concept of Natural Language Processing to analyse and understand the human language and respond accordingly. A contextual bot is an intelligent AI which reciprocates in a personalized and effective way after analysing user's sentiments and behaviour. The proposed system- Terra a contextual chatbot for tourists, includes one such agent which acts as a local guide at user's finger tips. It focuses on a user-friendly interface that can communicate with the user at any given time of the day to provide all necessary assistance required by the user on their journey. It will guide the tourists in terms of traveling, shopping, accommodations, best time to visit, activities to do and translating local languages.

Keywords: Artificial Intelligence, Natural language processing, Contextual chatbot,

Flutter, Tourism

1. Introduction

With changing times, the demands and presuppositions also change for 'new' tourist, they are in a search for different adventures, different cultures and brand-new experiences. Today's Millennial travellersare driving it: knowledgeable, independent, open-minded, experienced, courteous and value proper utilization of expenses. Therefore, such tourists are moving away from traditional traveling systems and approach towards having a better experience in the planning of their journey. Digitalization has impacted all industries and sectors in the days of yore, and the tourism industry is no different when it comes to technology which has changed the old order of systems and completely renewed the ways to explore traveling. These days physical bookings are almost old-fashioned and will have a different point of view for going forward. In the modern era the tourists have huge possibilities for searching inquisitive information and organizing their activities via internet. Current developments in information and communication technologies have presented a variety fascinating information to tourists during their journey. Smartphones are mainstream in this area and offers advanced technologies with android devices and active iOS. Tourism has evinced as one of the most well-suited area for mobile technology and mobile applications. Improvement in information technology, becomes a facility that provides services to extract the data needed by the tourists to know descriptions of the monuments, get details regarding timings, translate local pamphlets and boards, etc. Mobile apps in tourism helps traveller in planning a trip, accommodation bookings, cab booking, ticket bookings, route mapping, and much more. Introducing internet to mobile phone has enabled its operations to operate just like a personal computer where customer can easily access information via smart applications on their phone. An application that extracts information on historical monuments in terms of location, distance, and their history which is needed to determine priority of monuments that can be visited by tourists. Based on the problems described above, we have proposed a system called the "TERRA". The key features of the "TERRA" are that it provides a convenient way for a

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tourist to get all the information for a given destination, collect photos or information about attractions attended by the tourist along with the local places, hotels, restaurants etc. all in one place instead of visiting various sites to collect information. The system also consists a contextual chatbot to answer the queries of tourists 24x7. Contextual chatbots are advanced type of chatbots. The aim is to figure out what user needs i.e., in which context the user is asking a question or doing some random stuff on the website. It reverts those sentiments and behaviour based on the intentions of the user. These chatbots remember all the past interactions with the user to give a more thoughtful answer. In addition, it will also help the tourists to read and understand the signs or boards in different languages when they visit places of foreign language.

This system can be used in place of the currently existing system like "MakeMyTrip.com" which helps in booking hotels, train tickets, bus, flight. They provide information on places of tourist's attraction but they do not provide local assistance. They also do not have the facility for guiding the tourists by havingstreamlined conversations of query-response interaction using a chatbot without the help of humans. The proposed system can solve all these problems.

2. Literature Review

Information plays an integral part in training a system, provided it is collected from the correct source. [1] proposed by Poonam Ghuli and Rajashree Shettar (2014), describes a web application which gives an amalgamated list of data which can be extracted when enquired by the user, containing information about all the retail products from various e-commerce sites by creating its own private database. The web application deals with huge amounts of data which consists of both relevant as well as irrelevant type of data. Bayan AbuShawar developed [2] using AIML, corpus, machine learning (2015) which is a conversational agent that interacts with users using natural language. It is a conversational agent which communicates with users using human language and it is primarily based on knowledge base and its pattern matching technique. ALICE lacks compared to other chatbots because it requires manual developing of its knowledge. In 2015, Gunjan H. Agre and Nikita V. Mahajan created a system called [3] which introduces the concept of extraction of URLs based on keyword or search criteria and uses ontology (tree structure) to create a knowledge path. It selects only those URLs which contain all the searched keywords in their content and marks such pages as resourceful and doesn't retain any irrelevant web pages. It may happen that the matched keywords correspond to unwanted and unreliable resources and it might not be useful to the user. [4] composed by Samiksha M. Nakashe and Dr. Kishor R. Kolhe (2018) overcomes this problem by involving a two-stage search. In first stage, the system performs a technique called as "Reverse searching" which works on the principle of matching queries with a URL from site's database. In second stage, crawler performs "Incremental prioritizing" which is implementing by searching the query content of web document, resulting in efficient ranking of the web pages and provides the correct resources to the user.

An intelligent system not only gathers information but also understands and responds in accordance to user's behavioural pattern. Tsaih & Hsu created an [5] in 2018 using cognitive engagement to provide smart tourism using artificial intelligent and apply various digital business strategies in a conceptual framework. They made an attempt to simplify AI's sophisticated technology into a cognitive function for smart tourism industry in a digital business environment. One of the shortcomings of the system included that it gave emphasis on global level only. [6] Aristotelis Gorgias created a Speech dialog, assistant agent (2019) aiming for a system that helps user find all the nearest and cheapest gas stations. Thus, introducing the idea of local search based on user's present location. [7] composed on 2019 by Dandison C. Ukpabi, Bilal Aslam and Heikki Karjaluoto, focuses on the role of chatbots in various areas of the tourism and hospitality industry and explores two prominent theories, institutional theory and organizational learning theory which has been an advancement in the study of resourceful factors affecting chatbot adoption. Venkatesh Subramanian, Nisha Ramachandra and Neville Dubash developed a system called [8] in 2019 which explores the idea of having a recommendation engine in the backend to match the learner's interest to the relevant content. It works on collaborative filtering and content-based analysis of other user's interests and keeps a record of the learner's progress and adapts itself based on the feedback given by the learners. Siddhi Pardeshi, Suyasha Ovhal, Pranali Shinde, Manasi Bansode & Anandkumar Birajdar studied deep learning techniques and algorithms like Natural Language Processing (NLP), Long Short-Term Memory (LSTM) and Hybrid Emotion Inference Model (HEIM) in 2020 [9]. It gives a

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gist of self-learning capabilities for user emotion analysis and to provide flexibility. It marks the importance of a system which is capable to give more personalized and accurate results.

Mobile applications help to increase user experience as well as it gives more credibility to businesses. It bridges the gap between customer and the services provided. [10] researched by Md. Palash Uddin (2013) created a Proximity Alert System using GPS. A major setback of this system is the range of the detection. Nazir Ahmad Dar invented [11] (2013) which acts as a tracking system for Android devices can cater to the requirements of marketing teams, transport companies and individuals. It needs the logs for tracking the location of the device which can be accessed through web application. Thus, expanding the scope of GPS-based system. [14], a project by Bahar Sateli (2016) worked on reducing the quantity of text to read and the number of screen tabs by applying Natural Language Processing (NLP) pipelines to develop an automatic summarization or information extraction for news feeds, emails, or attachments. This system can be further enhanced by translating the given information into various languages with the help of OCR. Saluja, R., Punjabi, M., Carman, M., Ramakrishnan, G., & Chaudhuri, P. explored OCR in [17] (2019). According to their study two different encodings were needed to capture frequently used words and feed the input to Long Short-Term Memory (LSTM). The first type of encoding uses a sub-word unit of frequency values, derived from the training data whereas in the second type of encoding fast text embeddings are used on the sub-word units to improve the word-level accuracy values.

Recent studies depict that tourism industry contribute about 5 to 6 percent to global GDP. It has become one of the top export earners in a lot of countries. Chatbots have added more features in this industry by giving personal assistance to all its users. Taehyee Um analysed on [18] in 2020 by finding a relation between service type and service situation to suggest various business strategies that are in accordance to the customer's traits with technology. Based on this study, Hosseini and Samane implemented a Conversational interface (2020) named [19] which gave a brief idea on the role of chatbots across the medical and tourism industry which has been examined to acknowledge the reliability of chatbots in today's digital world, particularly in the travel industry.

These systems can be studied thoroughly to create an interactive system that uses concepts of natural language processing and deep learning, built into a mobile application which can gather precise information from relevant sources and use OCR to translate various unknown languages to the user, to give a boost in the world of Tourism.

3. Problem Statement

Our aim is to create an end-to-end application which will assist users by providing the best experience throughout their journey. As younger generations are more engaged by products that provide "instant gratification," so we have created Terra- a contextual chatbot that uses the concept of Natural Language Processing to analyse and understand user's queries regarding their travels and correspond accordingly. In addition to the travel bot, two features of gallery and translating local languages are added to enhance user experience.

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4. Architecture



Fig. 1. This shows figure of the architecture of the system.

5. Methodology

The system proposed consist of components: a Contextual chatbot and flutter libraries. Contextual chatbots are self-learning chatbots that aims to find the intent of the user i.e., what exactly user wants to convey. These contextual chatbot remember the previous conversation and based on that it provides more thoughtful answer. For example, a chatbot that allows to order a pizza would store the data like recent orders, location and will not ask for these details again. The chatbot architecture consist of small modules: NLU(Natural language understanding) toolkit with an FAQ retrieval system.

5.1 Database Description

A set of intents and entities are defined in JSON (JavaScript Object Notation) file format which is a semistructured system for storing light weight storing and transporting data. Intents are pre-defined nested dictionaries that consists of sample queries and its corresponding response. Each query-response set is classified to a specific tag. The user given input is then mapped to a tag after training the system using neural networks. In addition to these keys, a pair of keys namely contextual_set and contextual_filter is used for

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ijates ISSN 2348 - 7550

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better understanding of user's sentiments and to engage tourists in a spontaneous conversation by keeping a track of previous interactions with the user.



Fig. 2. This shows figure of dataset.

5.2 Training the Chatbot

Terra is trained using deep neural network and uses libraries like TensorFlow and Tflearn. It should be capable to understand the intent of the user regardless of their choice or grammar of words. Hence, an FAQ system is established to recognize the main word in midst of many auxiliary words. Stemming is used to remove unwanted characters and punctuation marks which plays a crucial role in cleaning of the dataset. The classes are then converted to a bag of words but are represented numerically in terms of 0's and 1's with the current tag represented as 1, for training purposes. Initially, the first intent present in the json file is set as 1. These words are then presented to the system in a jumbled and arbitrary format. The bag of words representing patters or pre-defined queries forms the input layer whereas the bag of words representing the intents of the json file is the output layer. The user's query is then passed through hidden layers of neural networks. We have defined two functions – response and classify. Classify function calculates the question-question similarity and question-answer relevance by comparing the user's intents and returns a list of probabilities classified using tags as an output. The response function is responsible for returning the mapped response for the given input based on the highest probability score determined from the classify function. The pickle library is used to pack and unpack the pre-trained model so that it can stored without re-training the model every time the user wants to chat with the bot.

Total number of Documents: 112 Sample of Documents: [(['Hi', 'there'], 'greeting'), (['How', 'are', 'you'], 'greeting'), (['Is', 'anyone', 'there', '?'], 'greeting')] Total number of classes or tags: 25 Sample of Classes: ['Brindavan garden', 'Chamundeshwari Temple', 'Culture'] Total number of unique words 114 Sample Unique stemmed words: ['about', 'accomod', 'act', 'anyon']

Fig. 3. This shows figure of different categories of dataset.

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Training Step: 10999 | total loss: 0.02618 | time: 0.039s | Adam | epoch: 1000 | loss: 0.02618 - acc: 0.9799 -- iter: 80/85 Training Step: 11000 | total loss: 0.04217 | time: 0.043s | Adam | epoch: 1000 | loss: 0.04217 - acc: 0.9694 -- iter: 85/85

INFO:tensorflow:/content/model.tflearn is not in all_model_checkpoint_paths. Manually adding it.

Fig. 4. This shows figure of training the dataset.

```
[ ] response('See you later!',show_details=True)
tag: goodbye
Happy Journey!
[ ] classify('Where is it?')
```

[{'location', 0.7287691}, ('greeting', 0.2785931)]

Fig. 5. This shows figure of outputs of response and classify function.



Fig. 6. This shows figure of user and bot interactions.

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ISSN 2348 - 7550

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5.3 Flutter application

The system can be deployed using a framework called as Flutter. Flutter is a tool for various platforms to build applications. It was developed by the developer group of Google and first published in late 2018 as an opensource project. Flutter provides a range of libraries of Android and iOS standard UI components, but it can also be used to build conventional desktop web applications. The Flutter SDK is based on the Dart programming language from Google, which was originally intended as a JavaScript replacement. Dart also runs directly on a browser as a web app, much like the common web scripting language.



Fig. 7. This shows figure of user interface.

5.4 Tesseract OCR

Tesseract OCR is an Open-Source Text Recognition Engine, it is available under the Apache 2.0 license. It allows users to extract printed text from images directly or uses an API. It encourages a wide range of languages. Furthermore, it recognizes text inside a broad document with established layout analysis, or it can be used to identify text from an image in combination with an external text detector. A new OCR engine based on LSTM neural networks was introduced by Tesseract 4.0x+. It requires a new subsystem of the neural network designed as a recognizer of text lines and is equipped with 100+ languages and 35+ scripts. The word finding was achieved by grouping text lines into blobs, and for fixed pitch or proportional text, the lines, and regions are analyzed. According to character spacing, text lines are split into words differently. Then recognition proceeds as a two-pass process. An effort to acknowledge each word in turn is made in the first move. As training data, each word that is satisfactory is transferred to an adaptive classifier which recognizes more text lower down the page with accuracy. Modernizing the Tesseract tool was an attempt to clean the code and add a new model of LSTM. The input image is processed by feeding the lines and giving output to the LSTM model line by line.

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Translator	Translator	Translator
ಚಾಮುಂಡೇಶ್ವರಿ ದೇವಾಲಯ	ಮೈಸೂರು ಭವ್ಯ ಅರಮನೆ	ಉಪನಗರ ಬಸ್ ನಿಲ್ದಾಣ
Pics mage	Pick Image	Pick Image
Chamundeshwari Temple	Mysore Palace	Suburban Bus Station

Fig. 8. This shows figure of translating local languages.

5.5 Gallery Feature

The chatbot is capable of giving a gist of all the information needed by the user such as visiting hours, timings, entry fees, etc., but what about users wanting to knowabout their tourist spots with more data. Thus, the gallery feature is introduced. Instead of engaging the users in a very long one-sided conversation, the user can explore all the little intricate details about a particular place bybrowsing through the gallery feature. It contains interesting local stories and facts revolving around the destinations along with photos and suggestions regarding the activities they can enjoy can be utilized during user's free time to pre-plan their travel. Therefore, making the trip much more exciting and convenient byavailing all the information regarding famous spots from a single source.

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Fig. 9. This shows figure of images from gallery.

6. Conclusion

Tourism has tremendous contribution towards overall growth and development of a country such as bringing numerous economic values as well as helping to build country's brand value, image and identity. Traditional static websites have scattered information as well as they don't adapt to tourist's needs in real time but engaging users in a conversation with chatbot allows users to access information and details from a single source instead of relying on different websites. The proposed systems will not only help users in pre-travel preparations but also assist locally to know the more about their destination.

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