AI Chatbot for Tourism Recommendations

A Case Study in the City of Jeddah, Saudi Arabia

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Abstract—Chatbots have gained increasing importance in today research with a lot of available applications. They are flexible and can be applied in many application domains. In tourism, Chatbots can recommend sights, hotels, activities, or even full travel plans. Usually, users are required to visit plenty of websites and install different Apps into their mobile phones in order to navigate the city and planning for the trip which is inconvenient and time-consuming. To address this issue, this paper proposes "Smart Guidance", an AI text-based chatbot that is developed as a mobile application. It simulates a chat with users in a natural language, it also provides a two-way interaction and it is a single point of contact for all user communications. We provide a use case in the city of Jeddah, Saudi Arabia. Jeddah is the second largest city in Saudi Arabia and tourists have various choices when it comes to moving around the city. The final evaluation of the chatbot showed that the bot could understand meanings and users' requests. Moreover, users found that the interaction is effective, and the responses are provided immediately. Users were satisfied and like the idea that they could express their needs in their natural language. Furthermore, users enjoyed the interaction and felt engaged.

Keywords—Tourism, Chatbot, Natural Language Processing, Machine learning, Jeddah

1 Introduction

Chatbots are form of Artificial Intelligence (AI) text and/or voice-based virtual assistants that aim at helping users to get what they ask for, more quickly and accurately and performing a conversation in natural language with human users on which this communication should be as human-like as possible [1][2]. They are important in areas where the quality and the speed of communication with customers matters, such as Booking services, Banks and Insurance companies, Educational, Media, Food ordering, Health and Medicine, E-Commerce, and Tourism which we are mainly going to be focused on [3][4].

The Saudi vision 20301 development plan aims to adopt the sectors of tourism and national heritage as one of the main essential elements of the vision of the kingdom and the national transition program 2020, and one of the most prominent alternatives to post-oil economies. Travelling has picked up exponentially over in these years, hotels and events are the primary parts of trip planning. People search for various sources for the best hotels and restaurants with the lowest prices.

However, many tourists are having problems and difficulties in finding hotels or entertainment sites suitable for them, including finding an incorrect destination and/or wasting time in searching for city events. Users are required to visit plenty of websites and install different Apps into their mobile phones in order to navigate the city and planning for the trip, which is a time-consuming process and causing memory congestion. With technological advancements, the way people now plan their trips has also changed. One of the latest technological implementations that have built a positive impact on tourism is chatbot.

This paper is aimed at developing "smart guidance" which is a text-based chatbot mobile application. The proposed chatbot s designed and evaluated to assist tourism and hospitality in Jeddah city as a case study. It is the first bot that combines all tourists need and offers 24/7 service availability in the Arabic language. It answers users' questions related to their desired destination, recommending offers and high-lighting real-time events to satisfy the needs and demands of the tourists and save a lot of time and effort.

The remainder of this paper is organized as follows. In Section 2, related work is reviewed. In Section 3, we present our work. In Section 4, Experimental results and evaluation are provided. Finally, we conclude our work in Section 5.

2 Related Work

Chatbots can be classified into two main types Rule-based and AI-powered bots chosen based on the business requirements. As shown below we will define the two approaches, their benefits, and limitations.

2.1 Rule-based chatbots

Rule-based chatbots work on a set of predefined simple or complex rules, these rules are the limited scope that the bot is familiar with, also this scope is where it can solve problems and deliver solutions. Since these bots cannot respond to any question outside this scope, so they cannot become more intelligent or learn from previous interactions.

However, these chatbots can be developed and trained faster, deployed through the easiest way, and require less cost to be built. For example, Artificial Intelligence

[1] https://mt.gov.sa/MediaCenter/Pages/vision2030.aspx

Markup Language (AIML) enables developers to write rules and scenarios for the chatbot to follow [5][6].

2.2 AI-powered chatbots

AI-powered chatbots use machine learning approaches to understand human language, create their own answers to complex questions. These bots become smarter with each newly held conversation, and in order to let them learn and operate better with the user, they need to be trained and used more and more. They have the ability to make recommendations, instant decisions, understand patterns of behaviour and be programmed to understand many languages Also, they can deal with a large amount of data which needs longer training time, however, they can save a lot of time in the long run [7].

High-level chatbots use complex underlying technologies for the sake of seamless interaction with humans. AI chatbots use Natural Language Processing (NLP) and Machine Learning (ML). NLP understands the user's written messages then predicts an appropriate answer via machine learning models [5]. NLP deals with handling unstructured data inputs in text or speech format that are controlled by poorly defined rules and transforming them into structured ontology or data in order to be understood by a machine then the machine can communicate back [6][8].

It can understand the meaning of human language regardless of what the language is spoken, who is talking, or the way he/she is grammatically talking. Then it interprets the human language into a machine representation format; performs some processing; reflects what is being desired of it and generating natural language talk back to the user like how humans do [8].

Machine Learning is also a subfield of Artificial Intelligence (AI) aims at developing software systems that can automatically enhance their performance and become more accurate in predicting results, identifying dangerous risks or profitable opportunities, through only observation and experience without being explicitly programmed [9].

Machine Learning algorithms are often categorized as supervised and unsupervised. Supervised machine learning algorithms apply everything learned in the past to new data by utilizing some labelled examples. Unsupervised machine learning algorithms can be used when the information used for training are not labelled [8][10].

The chatbot could be a stand-alone application or by adding a chatbot to a website like Booking.com2, TripAdvisor3, or even including it in any other application such as WhatsApp, Facebook, etc. In this paper, we are more focusing on stand-alone applications, we will discuss some of them and mention their advantages and disadvantage.

[2] https://www.booking.com/
[3] https://www.tripadvisor.com/

Mezi[4] is a personal assistant for travel, flights and hotels. It is powered by Artificial Intelligence and human experts. Mezi handles all booking, rescheduling, cancellation of flights, hotels and dining. The user simply asks the bot questions via text messages and the bot will engage in conversation just like a human agent would be. Mezi provides a good experience for busy and regular travellers by making planning for a trip much easier and time saving.

SNAPTRAVE[5] is an AI-powered bot that is accessible by text message, Facebook Messenger and WhatsApp. The user simply sends a message to bot with information about city, dates, and preferences then the bot will handle searching for the best deals for hotels. The primary goal of Snaptravel is to make booking hotels as easy as messaging a friend.

HELLO HIPMUNK[6] is a beneficial travel assistant AI-powered chatbot that enables users to communicate with the bot via existing messaging platforms such as Skype, Slack, or Facebook Messenger, the bot is part of the well-known travel-planning search engine "Hipmunk". It aims to make travel planning faster and easier by helping users to find real-time flights, booking hotels, or taking some travelling advice. The user can initiate the conversation with a question like "Could you find me a hotel in July?" The bot will reply with suggestions provided from different hotel sites when a user chooses a flight or a hotel the bot will redirect the user to the website where he/she can see prices, photos, and opinions from other users.

Kayak[7] chatbot is made for kayak website on which users can plan, search, book, and manage hotels, flights, rental cars, and things to do in the city by only typing messages in a natural language. It does not only provide information on these categories but also suggests different destinations based on the user's preferences. If the user needs more details regarding a flight, a hotel, or wants to perform booking, he/she will be directed to kayak website to find out further information. Users will be kept up to date if they have an account on kayak website and linked their account with the chatbot then they can receive real-time notifications regarding check-in status, flight delays, or even gate changes.

HelloGBye[8] is a standalone iOS chatbot application that allows users to type or vocally describe their travelling requirements then receive a response with detailed hotel and flight information. It aims to assist professional travellers who want to book their business trips quickly. It starts by asking the user several multiple-choice questions regarding the user travelling preferences, then the user can type or vocally record a message requesting flight times or hotel days, then the chatbot will search the web for flights and hotels based on the user's preferences and provides recommenda-

[4] https://www.crunchbase.com/organization/mezi
[5] https://www.snaptravel.com/
[6] https://www.topbots.com/project/hipmunk-bot-guide/
[7] https://www.kayak.com/messenger
[8] http://www.hellogbye.com/

tions via clickable links to other websites. Based on the features provided the chatbot application comes in two different versions either free or need subscription.

Recently, many chatbots have been deployed and adopted in many cities around the world to enhance the tourism section. AIRA is an AI tool that provides the best and latest services to customers in Malaysia [11]. In Ecuador, they proposed a mobile chatbot in Facebook Messenger using decision trees algorithm and will have a chatbot as user interface in Facebook Messenger. It allows access to tourist information about the city of Manta, Ecuador [12]. Table 1 shows the features for our application compared with other applications.

Table 1. Comparison of existing solutions

Features/applications	Our chatbot	Hello Hipmunk	Snaptravel	Mezi	Kayak	Hello GBye
Mobile Application	√			√	√	√
AI	√	√	√	√	√	√
Support Arabic Language	√					
Text based bot	√	√	√	√	√	√
Highlight real-time event	√					
Provide weather state	√					
Cover any city in Saudi Arabia	√					
Support map to locate the places	√					
Free Application	√	√	√	√	√	√

3 The Proposed Chatbot

The proposed chatbot is a mobile application as these apps are part of everyday houses and families [13]. Mobile apps have unique characteristics have positive impact in other domains such as education [14]. Figure 1 shows the architectural diagram of the proposed chatbot.

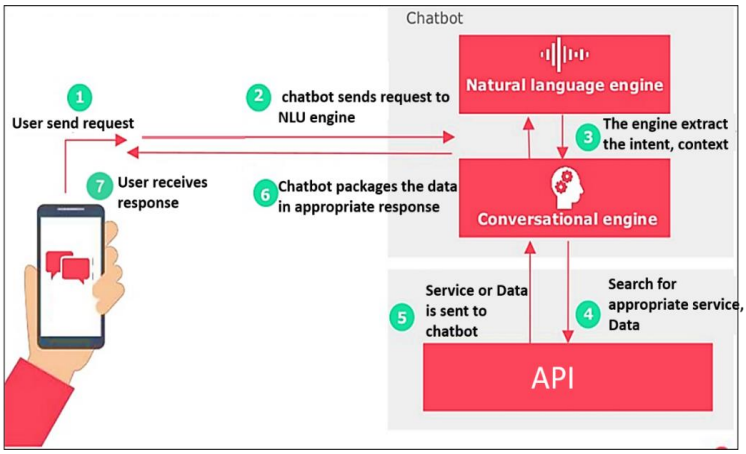

Fig. 1. Architectural diagram of the proposed chatbot

3.1 Data collection

Data was collected using online survey and distributed across Jeddah city through social networks and emails. It was designed to be completed in < 5min. The survey includes three parts as follows.

- Personal information such as age and gender.
- Tourism related questions such as How to get information about your destination? or Do you prefer to use tour guide services?
- Chatbot application related questions such as Do you support having a smart robot application to answer your queries?

We obtain beneficial information from the survey answers concerning the user's needs and challenges that they face regarding searching for their destination. We collected data from 148 participants, 80.4% of them were female, and 19.6% were male. Moreover, most participants were in the age of 20-29 years old. The question's answers reveal that 78.9% of participants are facing difficulty when they visit a city for the first time. The two difficulties with the highest percentage were: users do not know current city events and they do not know restaurants, hotels, and cafés recommendations and locations.

Moreover, 74.7% of responses show that users do not mind use tourism guide services. In addition, 63.7% of the total participants are getting wrong or not up to date information about their desired destination. Also, half of the participants are spending from 30 min to 1 hour searching for their destination which chatbots are able to minimize it to be only seconds. By observing responses, we got 90.5% of participants to support the idea of involving chatbot and AI in city tourism and hospitality.

3.2 Implementation

Here we represent the implementation part of the application. Initially, we describe the Graphical User interface (GUI) implementation after that we will discuss the authentication used and finally, we present anatomy of the rasa based chatbot coding and the integration with android studio.

Graphical User Interface (GUI): Android studio has a very powerful graphical user interface, it provides the ability to design user interface using layout editor and XML files, layout editor to create a layout that includes UI elements by dragging them into a visual design editor, also we can edit layout using Extensible Markup Language in XML files, while java file is used to manipulate XML file, listen and process user action, start-up other activity to the user when needed.

Authentication system: Firebase is a Backend-as-a-Service (Baas), it is a technology that allows you to create web applications without server-side programming, it provides a variety of tools and services to help developers create quality apps to making development faster and easier, one of it is feature is Firebase authentication which has a built-in email/password authentication system. It also supports OAuth2 for Google, Facebook, Twitter and GitHub. We use email/password authentication for the proposed application [15].

Chatbot development: Rasa.ai - an open-source framework for language understanding and dialogue management provided for the Python development environment. Although it is not easy to use, it is still considered as a powerful toolkit that is highly popular among conversational software developers. Rasa is divided into two modules which are Rasa Natural Language Understanding (NLU) and Rasa Core.

Rasa NLU is responsible for processing natural language by extracting all intents, entities, and any structured information from user's input messages. Intents are things that we expect users to say to the chatbot. Entities denote specific information the chatbot extracts from the conversation. Rasa Core is responsible for controlling the dialogue flow and executing the actions which are things that the chatbot can do or say based on the intents [15].

The interesting thing about rasa is that it allows us to train our model and give us nearly accurate results even with small dataset. So, we have created our own dataset that contains 160 example of users' messages such as greetings, saying goodbye, searching and asking for details regarding restaurants, malls, hotels, coffee shops, and asking for recommendation for places near the user's current location, also requesting weather states.

Rasa stories are represent used to train the Rasa core dialogue models. For the story is a conversation between the bot and user, first, start the story by double hashes ## to define the story name, then in new line start with * expressed the intent and (entities and slots if necessary), to represent the user input whereas, the response of the bot expressed the action name or utter name start by -.

Since our chatbot is built in Arabic language our NLU model will only understand messages written in Arabic. We performed some pre-processing for the text such as entity recognition, extraction, and tokenization because Arabic words are separated by spaces from user's messages. TensorFlow embedding classifier is used for embedding user messages and intent labels into the same space. Then, we proceeded with feature extraction into vectors. We used Long Short-Term Memory (LSTM) neural network implemented in Keras which will enable the chatbot to memorize the messages in our training data file and it is used to predict the next action.

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For instance, name of the story is ## Story searching_COFFEE2, then intent is *coffee which is user input and "location_C":" حي الجامعة " is the entity extracted from the input, after that, Slot is written as – slot{" location_C" :"حي الجامعة"} this slot set

inside custom action which is – action_coffee. We wrote about 85 stories like this example to train the model more for any question expected from a user.'

When the user asks about weather state, the bot calls API key to get data from weather stack website, the data that will get it is as JSON file. We selected some interesting data such as the name of a place, temperature, and humidity from JSON file that represents all data related weather state and wrote it by this way.

When the user asks for hotels, we built the custom action in class to return address and ratings of the hotels by get slot which is 'location' from the user input and set it in api_address variable with calling API key to get the data from JSON file. The user can check some details about the hotels such as phone number, rating, URL, and website if exist in the specific hotel.

4 Results and Discussion

Here we display some conversation pages between the smart guidance and the user as seen in Figure 2. First the smart guidance will welcome the user and then offer help through some options to determine the destination he/she wants to go, then complete the conversation with smart guidance and ask her more about the place, for example if he wants a location close to him or near to the sea, then will display details of the place and location through the map.

The user can send any text to NLP engine, the NLP will do context analysis breaking down the data inputted by a user to extract keywords include (noun phrases, themes, etc.) that help NLU to understand a user request. The chatbot decides which action should take using a probabilistic model (LSTM), there are two actions:

- Responds to a user by using simple messages such as greeting and asking general questions.
- Make external API call: The bot can obtain the information from external application to reconstruct the needed information to produce a meaningful response to the user in natural language.
- After the bot decided the action, it should build the response in format result.

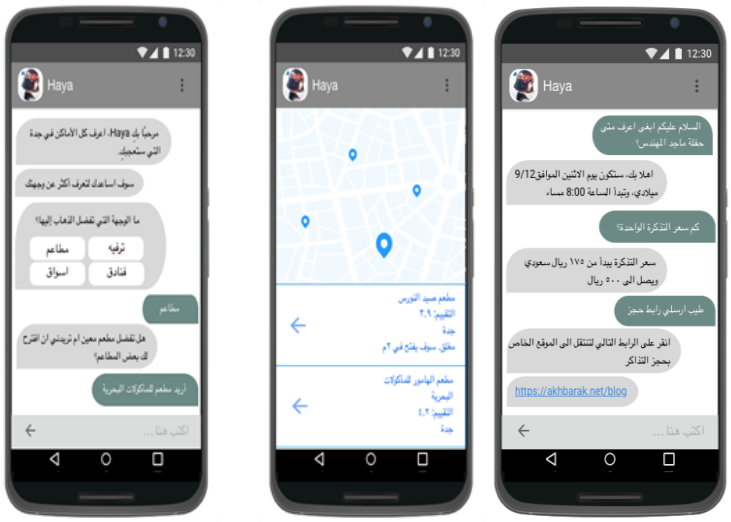

Fig. 2. Some snapchats of the application

We test the application to check if the speed and response time of a software program quickly or take more time. First, we checked the response time when the response bot is utterance action such as greeting, thanking and goodbye. Second, we checked the response time when the bot answers the custom action that request from external API, for instance, ask about the nearest places for the user, ask a specific place, ask details in some places, ask about current weather or anything else related to places in Jeddah city as displayed in Table 2.

The user can complete the conversation any time just by asking the smart guidance about any place or event and the smart guidance will answer all questions with more details.

Table 2. Performance testing

Test Case	Result	Response Time
The bot answers for nearest places to the use, it should return 5 places		The time to respond to the user's message by the bot is 14 seconds

The bot answers about specific information		The time to respond to the user's message by the bot is 3 seconds.
The bot answers about details in a specific place		The time to respond to the user's message by the bot is 3 seconds.
The bot answers for finding places in Jeddah, it should return 5 places		The time to respond to the user's message by the bot is 4 seconds.

The bot answers the weather state		The time to respond to the user's message by the bot is 4 seconds.
The bot answers for un-known or out of scope message		The time to respond to the user's message by the bot is 2 seconds.

5 Conclusion and Recommendation

In this paper, we proposed and developed the smart guidance chatbot which is a text-based application for the tourism sector in Jeddah city, having a chatbot always available to users, which can provide up to date information about places, events weather status and suggest where to visit. We gave a technical overview of materials needed to build chatbot which is Natural Language Processing (NLP), Machine Learning (ML), and Rasa.ai. The paper also discusses how the chatbot classifying, processing and making a prediction based on available data to find the best match by using the probabilistic model (LSTM). Results showed that the proposed chatbot can understand users' requests and respond very quickly. We can conclude that the use of chatbots, for the purposes of tourism, is perfectly applicable.

Finally, there are a number of features we would seek to it in the future. The bot will support booking of hotels and tickets, therefore no need to get out from the smart guidance application to complete the reservation process, the bot will send messages to confirm the booking. We will include more places such as hospitals, schools and airports. The bot will include other features such as supporting voice-based chatbot, English language and IOS platform.

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