

Chatbot Enabled Smart Tourism Service for Indian Cities: An AI Approach

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Abstract—Tourism is one of the significant factors that determines the growth of any city. Tourism-based growth is possible only if the requirements and challenges of tourists are well addressed. A boost in the tourism sector is witnessed in the last decade due to the proliferation of Information communication technologies and smart devices in society. Tourists frequently encounter many challenges when they visit new cities such as the language barriers, food, affordability, transportation, guide and security concerns. Technology enabled information services are highly necessary for smart tourism. To address this, the tourism sector has to focus on Information Dissemination services for tourists and other visitors, especially in cities. In this work, we propose an Artificial Intelligence-based chatbot as an information dissemination system specific to Indian cities that are diverse in their culture and language. This work presents the design of a dynamic chatbot that gives real-time information to tourists and various city stakeholders. We also examine how Natural Language Processing can help to provide customized output to the users based on their queries. The proposed AI-based chatbot gives the user an optimum response and enhances the user experience.

Index Terms—Chatbots, Smart City, Information Service, Neural Network, Tourism.

I. INTRODUCTION

Tourism is the root of cultural exchange and development. More than a billion people travel from one place to another, making the tourism sector one of the fastest-growing economic sectors in the world [1]. India is a nation that is renowned for its tourist spots and pilgrim centers. In 2019, domestic tourist visits exceeded 2321.98 million, while international tourist visits exceeded 31.4 million. The economy of India depends largely on tourism, which is expanding rapidly. As per world The World Travel and Tourism Council, the tourism sector provided 8.1 percent of all employment in India as of 2018, and this sector contributed to 9.2 percent, of India's GDP [2]. It is projected that by 2028, the tourism sector is expected to reach 32,05 lakh crore rupees with an annual average growth rate of 6.9 percent [3]. It can be further enhanced with various technological initiatives and can elevate tourism's overall experience in any part of the country.

Tourists can be any person who visits a new place for different purposes such as attending events, shopping, or for

learning, or for pilgrimage, and so on. In the case of an urban setting and cities, tourists from various parts of the world face many challenges in identifying the right resources such as stay, food, transportation, and guides, endure economic challenges, and may have security concerns. Many of these challenges can be solved if a good tourist information service ecosystem is available to provide the correct information to meet the needs of the tourist. The recent development of information and communication technologies (ICTs) resulted in some transformation of the tourism and hospitality industries [4]. It increased the service quality and improved customer experience.

The rapid growth of IoT, smart devices, internet access opportunities, artificial intelligence, and related services and their applicability in various areas provide us opportunities to apply those in the tourism sector. Technology-enabled information services are essential for smart tourism. Smart tourism is depicted as an information service and support system to individual tourists [5]. Tourism and hospitality industries have been significantly influenced by the rapid growth of technology offering real-time information services, which has altered customer expectations and behavior as well as industry and strategic management choices [6]. The need for an Information services system for smart tourism is discussed in [5]. To build a smart tourism ecosystem, the city administration must focus on various aspects such as the safety and comfort of the citizens and tourists visiting the city. They are responsible for creating this ecosystem by collaborating with multiple stakeholders. This smart tourism ecosystem includes the city's service providers, and the central focus is to bring comfort and information services to the various users. It can be achieved only by bringing real-time smart information services in association with the city governing bodies. This service should provide information on various activities, events, shopping malls, traffic patterns, security situations, etc. To increase users' comfort and support them in their everyday activities, city services and localized general information must be made available to them.

In this work, we propose an AI-based chatbot for smart cities that helps provide real-time information to the tourist visiting the city. Chatbots are intelligent conversational com-

puter programs that mimic human conversation in their natural form. Chatbots often employ natural language text as their input, and its output should be the most pertinent to the user's input. These chatbots can offer services regarding information, including hotel bookings, advice for nearby tourist places, and assistance for clients with disabilities. Similarly, chatbots can simultaneously provide services to multiple users. Compared to conventional methods of getting help from tourist service business providers, chatbots are more collaborative, less expensive, and provide multiple inputs to the users. Italy has begun carrying out the aforementioned actions for certain sites of interest and is experimenting with how chatbots interact with visitors [7]. However, such work is limited to Indian cities and needs a holistic approach for designing chatbots for Indian cities as there is enormous variability in cultural, language, and geographical aspects. Each city needs some uniqueness based on the local context.

The rest of the paper is organized as follows. Section II discuss the literature review. Section III discusses the user requirements for assistance. Section IV discusses the chatbot architecture and implementation challenges. V Discusses about the experimentation and Result and finally Section VI concludes the paper.

II. LITERATURE REVIEW

The chatbot is one of the simplest and most common forms of intelligent Human-Computer Interaction and a basic example of an AI system (HCI). Chatbots can provide a lot of services to city residents and tourists. A historical summary of how the interest in chatbots has changed worldwide, reasons for using chatbots, and their applicability in various situations are presented in [8]. A chatbot developed using Artificial Intelligence Markup Language (AIML) and Latent Semantic Analysis (LSA) for interactive FAQ for students is deployed by [9] to quickly and accurately respond to the student's query.

A summary of cloud-based chatbot technologies, the challenges that arise in the development of chatbots, and how to develop chatbots are presented in [10]. Strategies used to create chatbots, and a comparison of several design approaches are presented in [11]. The work discusses the substantial advancements made in chatbots during the past ten years. The study mainly looks at the Loebner Prize-winning Chatbots and compares and contrasts various techniques. The details of a chatbot prototype for assisting students with their academic work were presented in [12]. The system uses Natural Language Processing (NLP) techniques to identify students' demands automatically, and they apply the ontological description of the knowledge domain to determine the optimal answer. Another work [13], discussed the methods employed in chatbot development and various applications.

A brief overview of a few applications of chatbots for conversational services and their use to provide helpful services and interact with customers instead of humans are discussed in [14]. A chatbot built on a context-aware system was introduced by [15], which makes recommendations for products and services based on the context and visitor profiles.

The underlying techniques and technological aspects of a Chatbot for e-tourism that enables text-based communication for hotel booking, trip planning, and enquiring about interesting places was presented in [16]. A prototype was created to assist tourists visiting Paestum, Pompeii, and Herculaneum in Campania to assess the proposed design. Another work proposed a chatbot that uses Latent Semantic Analysis (LSA) to respond to questions about services and Artificial Intelligence Markup Language (AIML) to respond to template-based questions like greetings and general inquiries [17]. Some prior e-tourism work exists to help the tourist; they are addressing only some verticals of requirements. Our work envisions building a smart tourism ecosystem that allows the tourist, the local governing body, and all the stakeholders within the city who provide various services to the tourist.

III. USER REQUIREMENTS FOR ASSISTANCE

Many tourists depend on information about various tourist destinations on the Internet. However, more realistic real-time information is required in an urban city to plan itineraries, select hotels, and prepare for the stay. A city-centric service chatbot can satisfy this requirement effectively. The various requirements for this city-centric chatbot for tourism service are shown in Fig. 1, and the details are listed below:

1) **Hotels** - : Most people new to a city have little knowledge of the hotels and the menu—the availability of region-specific foods and the rating. Similarly, tourists would also be interested in knowing the rush hours and the current status of how long they have to wait, considering the time for a visitor is precious. A chatbot is envisioned to provide them with information about general rush, current rush details, and the likelihood of fewer rush hours so that the tourist can select their visit according to the information provided by the chatbot.

2) **Resorts** - : Any tourist who visits the city for more than a day would want to select resorts that match their needs, such as the facilities, affordability, rating by the users, cleanliness, availability of rooms, and other facilities. Apart from this, they would also need to know the other reachable nearby visiting spots such as tourist spots, pilgrim centers, and other attractive places nearby. Providing alternative options with this much detail will help them select better options.

3) **Hospitals** - : Few visitors travel to cities for good treatment since their hometown lacks adequate medical facilities. This chatbot can assist such visitors in locating suitable hospitals in specific locations. Suppose there is an emergency and a few hospitals do not have enough beds to treat the patient, as seen in the Covid pandemic crisis. In that case, this chatbot will assist them by providing bed and ICU availability information.

4) **Guide** - : People new to the city find it difficult to know where to go, and even if they need guides, they may need help finding them. This chatbot can assist in providing tourist guide phone numbers. It is possible if all the tourist guides are registered with the city-centric service authority with the help of the local government.

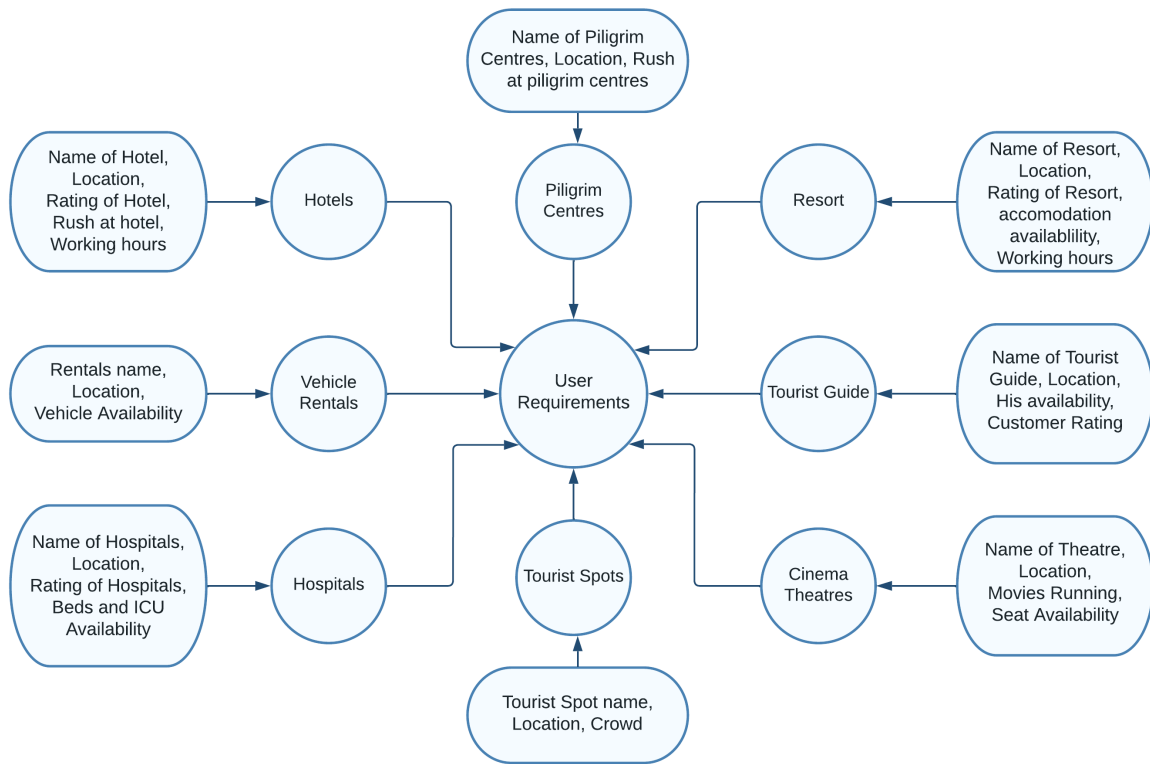


Fig. 1. User Requirements of Chatbot

5) **Pilgrim centers** - : People visiting the city may be aware of pilgrim centers such as notable temples, churches, or mosques. Still, they may need to know their exact location or details such as opening time, closing time, rush hours, and procedures, if any. A chatbot will be useful in providing tourists with the necessary information about the pilgrim centers.

6) **Vehicle Rentals** - : Most tourists take public transportation to the city and rent a bike or car to visit the attractions, as most now utilize Google Maps to find the routes. They prefer these as they can take their time to visit the places. A city-centric chatbot can assist by providing information on rental locations and the availability of bikes and cars.

7) **Tourist spot** - : Visitors to the city may be aware of a few locations based on their prior research, but not all. This chatbot will direct them to the local tourist attractions in the city based on their queries.

8) **Cinema Theatres** - : Tourists who visit the city might also be interested in watching the movie. This chatbot guides them to provide information on the film playing in their theatres and the available theatres' quality based on user feedback.

IV. TOURIST GUIDE CHATBOT ARCHITECTURE

The concept of a smart city has been mentioned as a technologically supervised future [18]. The chatbot as an information service can be a pillar of this concept. In this

work, we used deep learning over conventional chatbot designs such as Pattern Matching strategy and rule-based approach. The user input is extracted using Natural Language Processing (NLP) in a deep learning approach. This approach doesn't demand a predetermined answer for every potential user query. Instead, it uses the entire conversation context for text processing. We used the Convolutional Neural Network (CNN), and the chatbot system receives the user's query, then computes the vector representations of the user's query. These vector representations are used as features of the neural network to produce responses to the user. The proposed architecture of the city-centric chatbot is shown in Fig. 2. In the proposed chatbot, the users can be any tourist who wants real-time information about various information. The user can type the query in the chatbot. Then the AI chatbot engine computes the similarity score (SS) of the user query and identifies the suitable tag. Larger data sets are required for improved accuracy [19].

A. Chatbot Workflow

The chatbots are good for their conversational capability. The users of smart tourism chatbots are classified into two major categories. One category is the tourist coming to the city, and the other includes all the stakeholders in the city, including the city governing body and all the business sections which provide services to these users. Users who fall under the tourist category will always want to retrieve their favorable information through the chatbot; stakeholders give

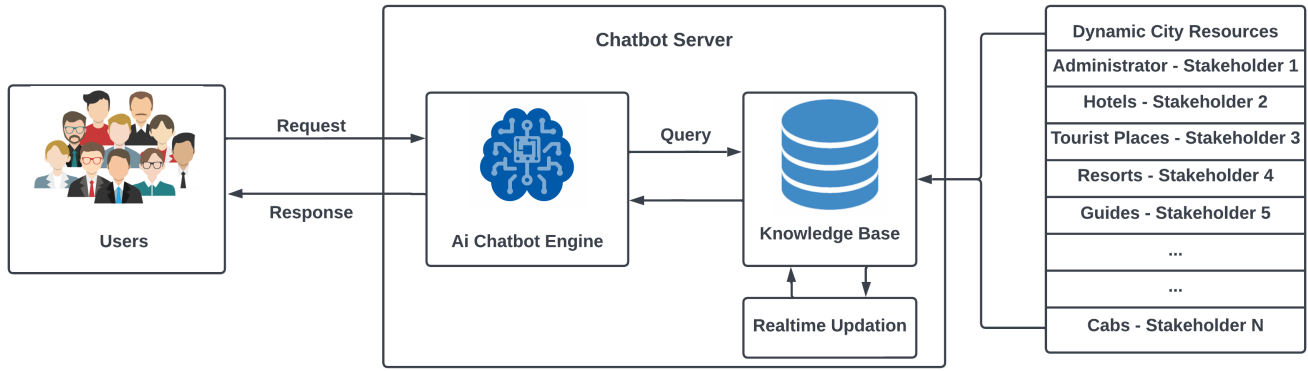


Fig. 2. Chatbot Proposed Architecture

information on the benefits and availability of various services. The stakeholder community of the city includes local tourist spot authorities, guides, local cabs, pilgrim centers, restaurants, other small and big shops, malls, and other transportation services. The details of the chatbot workflow are shown in Fig. 3. Once the user initiates a chatbot, the engine responds with a query to understand whether the user is. If the query response falls under tourist, the chatbot engine retrieves the latest information from the database and responds to the user query.

For the proper execution of this chatbot-enabled real-time information service, stakeholder participation is inevitable. The stakeholders from the various sectors have to update their status in dynamic intervals to attract tourists to their service availability. For instance, if the tourist wants to know about hotel accommodation and food availability, the different stakeholders must update their service availability regularly depending on the resource availability. It will help the users and the stakeholder equally. Only authorized stakeholders can provide authentic information that has to be entered by the stakeholders using their credentials. A web and mobile application for the service provided by the various sectors are required to ensure this dynamic real-time data availability.

B. Implementation challenges

The first and foremost implementation challenge of this kind of city-centric chatbot is the collaboration of various city businesses and service providers to give real-time data for their businesses. All the stakeholders must be registered to get the benefits of this system. Establishing collaboration is highly challenging, and this can be achieved one step at a time. It is possible only by adding one city sector, establishing cooperation in this small sector, and gradually expanding it to more sectors. The city administration has to implement some regulations and policies with the help of the residents and business community offering services to tourists/visitors. Creating responsibility among the stakeholders is another challenge we must address for this system's progressive adoption and maintenance. Technology adoption model also might be

required for the acceptance and adoption of any technology [20], [21].

Many chatbots use rule-based models to address user queries. In this work, we propose a neural network approach to address this problem, allowing a chatbot to recognize the user query and understand the context through a series of query responses to provide a more accurate response. This chatbot can handle multiple user queries and which can reduce the requirement of a manual command and control center for city-related services. An adequately designed chatbot can provide a valuable real-time response by understanding the user query and context.

V. DESIGN AND EXPERIMENTATION

In this section, we discuss our design and experimentation of the proposed chatbot and its UI design for the users and the stakeholders to update their real-time data. The chatbot experiment has been performed using Convolution Neural Network(CNN), and the chatbot module is trained using CNN. We implemented a static JSON file for our experiment. We created intents for every user requirement to address the user query. We made some groups of messages that the user might ask and the sample responses corresponding to each area. Similarly, we created different sample questions so that the chatbot could respond better to most user queries. But this requires a broader survey to finalize the type of questions to be fed in for training.

For the experimentation, we used the TensorFlow framework, which was developed by Google [22]. It has been used to build and train our neural network-based chatbot. Neural networks have interconnected nodes that resemble the function of brain neurons. They can classify and cluster raw data using algorithms, recognize hidden patterns and correlations in it, and over time, they continuously learn and get better. We use a sequential model for the chatbot, allowing us to add more layers to the deep learning model in a sequential manner. We used the TensorFlow inbuilt function `sequential()` for training the model. In the model, every unit is connected to every unit in the next layer.

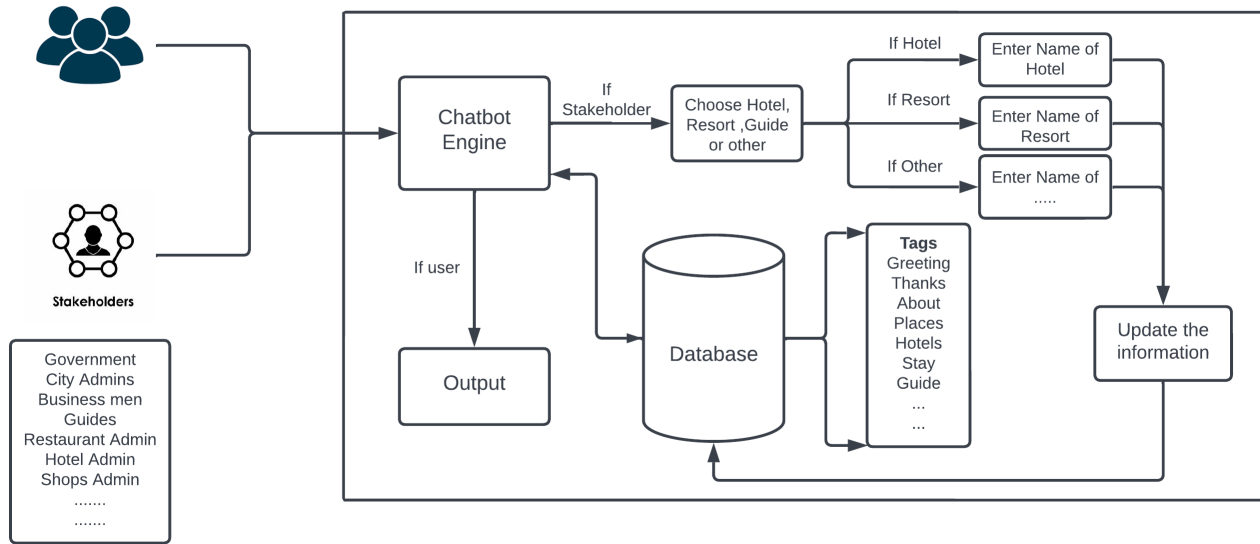


Fig. 3. Proposed Chatbot Workflow

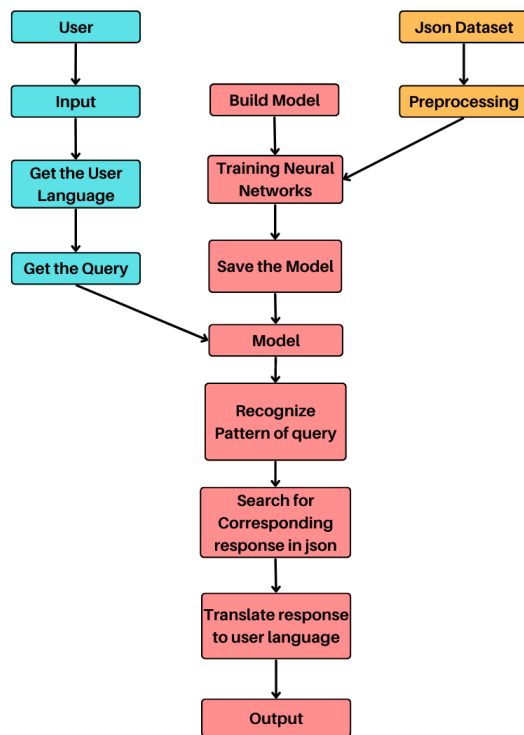


Fig. 4. Chatbot Deep Learning Model

The details of the chatbot model proposed are presented in Fig. 4. The model has been built using CNN, which works as our chatbot engine. When the user enters a query, the model recognizes the language entered by the user, gets the corresponding user query, and analyzes the pattern of the

question. Based on the pattern, it identifies the appropriate tag of the user query, then searches for the response in the databases. Once the most suitable response is identified, it translates the response into the user's language and sends back the output as a response to the user.

Our neural network is made up of multiple layers with an input layer for receiving the input, an output layer that finally produces the result, and there are hidden layers in between that carry out the majority of the computations of the neural network. We have used the CNN, and it generally has the convolutional layer, which computes the dot product of the input and the kernel. So it enables sliding window concepts for processing the text in multi batches, which is followed by the pooling layer and a fully connected layer.

The dense layer of the network uses an activation function, a dot product of input and kernel, and then adds a bias. This activation function is performed on each element in the network. This layer creates the bias vector and the kernel, a matrix of weights. The activation function used is rectified linear activation function (ReLU) because it is easier to train the neural networks. For any negative inputs, the function returns '0' and outputs the value if the input is positive. So it can be represented as $f(x) = \max(0, x)$ [23].

Once the model is built, whenever the user types a query, the model will compute the similarity between the sequence of the new text and the training data. The model responds to the user based on these similarity scores (SS) for each category. The sample output we received from the experimentation is shown in Fig. 5. The user asks different questions to get information, such as nearby hotels, enquires about each hotel, and gets a review. Inquiries about the resorts at specific locations to know the timings and accommodation details are also tested. The advantages and disadvantages of this chatbot are presented in

Start messaging with the bot (type quit to stop)!

User: Hello

ChatBot: Hi there

User: User: What is your name ?

ChatBot: Just call me as Hussain Sagar

User: Could you help me ?

ChatBot: Tell me your problem to assist you

User: what are the hotels available

ChatBot: some of the famous hotels are Radisson blu - 5 start hotel at banjara hills, red fox hotel in hightech city, Hotel sapthagiri in shivaji nagar

User: What are the timings of Radisson blu Hotel ?

ChatBot: The hotel is open and the working hours today is from 7:00 to 23:00 and currently there is no much rush at Radisson blu Hotel

User: Is the hotel sapthagiri open?

ChatBot: The hotel is open and the working hours today is from 6:00 to 23:00 and currently there is rush currently and the waiting time is approximately 20 minutes

User: what are best resort to stay ?

ChatBot: Few best places to stay are Kukatpally, Kondapur, Uppal, Banjara Hills

User: Which are famous resorts at Banjara Hills ?

ChatBot: The Famous Resorts at Banjara Hills are Taj Krishna Resorts, Taj Banjara Resorts, Park Hyatt Resort

User: Are rooms available at Taj Banjara Resort ?

ChatBot: The Taj Banjara Resort have 24*7 Services and have 4.75 stars rating. Currently there are very few accommodations Available so book it ASAP.

User: what are famous places to visit ?

ChatBot: The famous places are charminar, salar jung museum, Golconda Fort, Falaknama palace and nizam musuem

User: Thank you

ChatBot: My pleasure

User: Byee

ChatBot: Bye! Come back again

Fig. 5. Output of Chatbot Experimentation

TABLE I
ADVANTAGES AND DISADVANTAGES OF NEURAL NETWORK-BASED CHATBOT

Advantages of Neural Network Chatbot	Disadvantages of Neural Network Chatbot
We can train the chatbot to have conversations with individuals because it has been trained to identify the context through text processing.	This chatbot does not respond according to the user's users emotion.
Spelling mistakes will not affect the performance of the chatbot	Do not provide accurate answers for every query of the user
It gives more accuracy compared to other models when trained with large datasets.	If the chatbot is not trained for a particular question, it will not provide any answer.

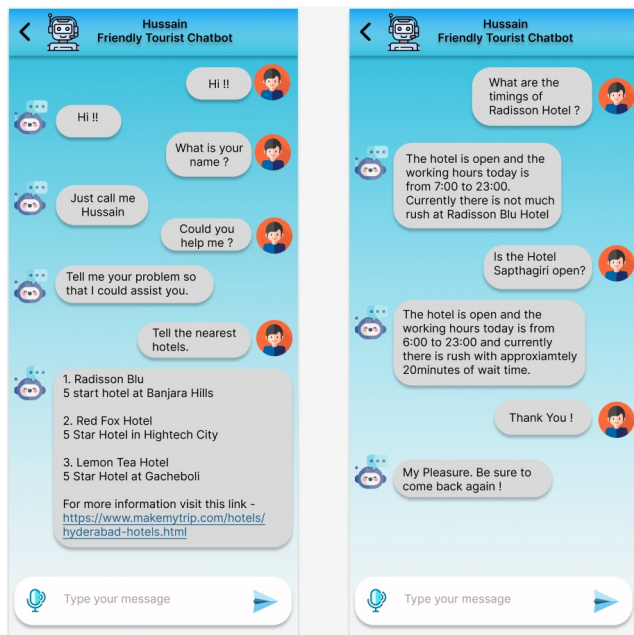


Fig. 6. UI design for User Chatbot

Table I.

VI. CONCLUSION

Chatbots are a widely accepted information service system for many applications, and it acts as an alternative to humans who respond to various queries intended for business. In this work, we propose the design of an AI chatbot for tourists in Indian cities as a city-centric information service system. We presented the various tourist requirements and the kind of information services the chatbot can enable for the tourist. This work is an attempt towards a smart tourism ecosystem that facilitates collaboration between various stakeholders to provide better services to visitors. We currently experimented with our chatbot using CNN as it gives better local context, but we intend to switch to RNN for improved text processing. We also presented a sample mobile user interface for the chatbot ad discussed the advantages and disadvantages of a neural network-based chatbot.

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