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SURVEY

A Systematic Review of Chatbots: Classification, Development, and Their Impact on Tourism

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ABSTRACT Recently, we have observed a noticeable evolution and growing use and incorporation of chatbots on websites, mobile and social networking apps. A chatbot is a computer program that exhibits a capacity to converse quite naturally with users in a way that resembles a human dialogue. Examples of chatbots can be found in several areas, including education, commerce, and tourism. The use of Artificial Intelligence (AI) and its sub-fields, such as Machine Learning, Deep Learning, and Natural Language Processing (NLP), is increasing across all business sectors. One of the most advanced applications of this technology is the chatbot, which is particularly beneficial due to the quick response times and its simplicity. Nevertheless, although studies on chatbots exist in tourism, academic research covering their adoption, technological evolution, and impact on this sector is still relatively sparse. Therefore, this study aims to provide a comprehensive overview of chatbots and their effect on tourism. First, we provide a new classification of chatbots based on specific criteria. Second, we explore the conceptual architecture of chatbots and their key components. Third, this study aims to assess and contrast the main existing tools for developing chatbots, classifying them and highlighting their key advantages and disadvantages. Fourth, this study aims to examine the integration of chatbots in the tourism sector by identifying their key applications in the industry over the past decade. Additionally, it seeks to analyze the impact of chatbots on the various functionalities outlined in the 6A framework for tourism. To achieve this, a thorough search will be conducted using five prominent databases - Scopus, ACM, IEEE Xplore, Springer Link, and Web of Science - covering the period from 2013 to 2023. For this study, 1155 academic publications were reviewed after applying a systematic review protocol including purpose, research questions, keywords, digital libraries, search strings, and inclusion and exclusion criteria. Only 31 were identified to be primary studies.

INDEX TERMS Chatbot, conversational agent, tourism, history of chatbots, classification, architecture, artificial intelligence, NLP.

I. INTRODUCTION

A chatbot, designed to simulate conversations with human users in natural languages through voice or text [1], is considered one of the finest manifestations of Artificial Intelligence (AI) and its sub-fields like Machine Learning, Deep Learning, and Natural Language Processing (NLP). Its growing adoption across all business sectors can be attributed specifically to the advantages it provides, including quick response times and user-friendly simplicity.

Such typical conversational applications are frequently used in many areas [2], including commerce, transportation, and education. Recently, we have observed the evolution and growing use of chatbots through their integration into mobile applications, websites, and social networks to make all these traditional software applications easier to use and smarter. Additionally, these chatbots belong to the category of intelligent personal assistants, also known as virtual

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personal assistants or conversational agents. They can carry out specific tasks or provide services for a user via a dialogue in natural language. Indeed, the efforts of the leading information technology (IT) companies developing applications incorporating AI have enabled the extension of the capabilities and use of chatbots. In this regard, Gartner has predicted in these two reports in 2018 [3] and in 2023 [4] that all interactions of customer service will be completely handled by chatbots. So, it's no surprise that chatbots are increasingly entering the tourism industry. For instance, the city of Orlando, the most visited destination in the United States, offers a smart mobile application, Visit Orlando App [5], which offers functionalities in conformity with the requirements of the six As for tourism destinations. This app also provides some functionalities through a chatbot. In the same context of tourism, Hilton's Connie a chatbot concierge developed by IBM's Watson assists guests with information on hotel amenities and local attractions. Amtrak's virtual assistant Julie manages customer queries about schedules and bookings. Furthermore, OpenAI's ChatGPT showcases a broad application of chatbots in providing textual responses, answering questions, and engaging in detailed discussions across a wide range of topics and areas, including the tourism sector by providing information on tourist destinations.

Nevertheless, although studies on chatbots exist in tourism, academic research covering their adoption, technological evolution, and impact on this sector is still relatively sparse. Therefore, this study aims to provide a comprehensive overview of chatbots and their impact on Tourism. first, we provide a new classification of chatbots based on specific criteria. second, we explore the conceptual architecture of chatbots and their key components. Third, this study aims to assess and contrast the main existing tools for developing chatbots, classifying them and highlighting their key advantages and disadvantages. Fourth, this study aims to examine the integration of chatbots in the tourism sector by identifying their key applications in the industry over the past decade. Additionally, it seeks to analyze the impact of chatbots on the various functionalities outlined in the 6A framework for tourism. To accomplish this, a comprehensive search will be conducted using five prominent databases - Scopus, Web of Science, ACM, Springer Link, and IEEE Xplore - covering the period from 2013 to 2023.

The structure of this paper is as follows. Section II provides a retrospective analysis of the history of chatbots, tracing their origins to the present day, with a focus on the scientific community's involvement. Section III outlines the methodology employed in conducting the systematic review. In Section IV, the results of the review are presented and examined. Section V offers a detailed discussion of the findings. Finally, the conclusions of the study draw upon insights from the literature review and propose recommendations for future research endeavors.

II. BACKGROUND

A. HISTORICAL OF CHATBOTS

Back in 1950, Alan Turing posed a thought-provoking question that would become later pivotal in the evolution of chatbots [6]. He raised the question of whether a computer program could engage in communication with a group of individuals without them being aware that they were conversing with an artificial entity. This inquiry, known as the Turing test, served as a seminal idea that laid the foundation for the advancement of chatbot technology.

The first chatbot named ELIZA [7] appeared in 1966 and it simulated the role of a therapist, although its ability to interact with users was restricted. Irrespective of its limitations, the Turing test served as a great source of inspiration for the subsequent development of other agents. One notable example is ELIZA, which utilizes pattern matching and a pattern-based response selection scheme [2]. However, it is important to note that ELIZA has certain drawbacks. Firstly, its domain knowledge is limited, restricting its ability to engage in conversations on various subjects. Additionally, ELIZA is unable to sustain lengthy chats and lacks the capacity to learn or comprehend the context of the conversation.

PARRY, developed in 1972 by Kenneth Colby, emerged as a significant advancement in agent technology. It was designed to simulate a patient with paranoid schizophrenia [8] and showcased a more advanced approach in comparison with ELIZA. It is worth mentioning that PARRY incorporated a well-defined control structure and a distinct personality, resulting in improved response outcome.

In 1995, another milestone in the history of chatbots was accomplished with the development of ALICE, the first online agent inspired by ELIZA [9]. ALICE utilized pattern-matching and natural language processing techniques to engage in conversations. Notably, ALICE was developed by Richard Wallace and introduced a new language specifically designed for chatbot interactions called the Artificial Intelligence Markup Language (AIML). The adoption of AIML distinguished ALICE from ELIZA and marked a significant divergence between the two chatbot implementations.

The year 2006 marked an important milestone with the introduction of Watson by IBM. It showcased the power of natural language understanding and machine learning by triumphing over human contestants in the quiz show Jeopardy. One limitation of Watson, however, is its exclusive support for the English language. In 2010, Apple introduced Siri, a virtual assistant that revolutionized the way people interacted with their iOS devices. In fact, while Siri is an advanced virtual assistant that provides users with the possibility to make inquiries and have conversations through Messengers using voice commands, it does however have certain limitations. One such a limitation is that it requires an internet connection to function properly. Additionally, although Siri is multilingual, it is worth noting that there are

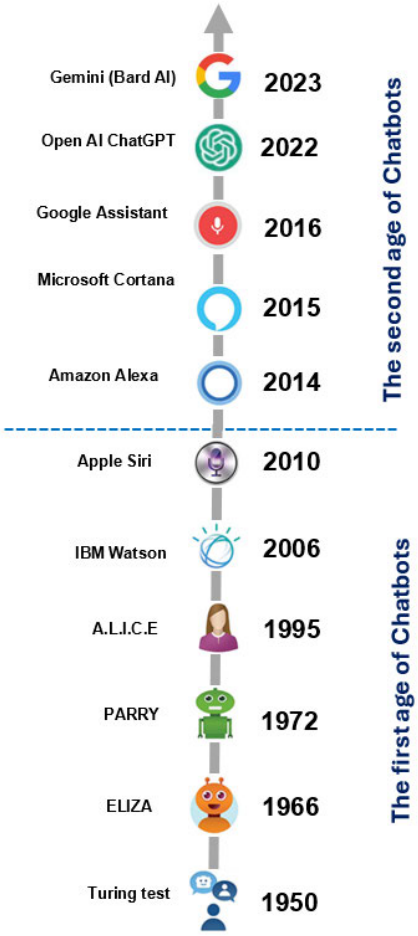

FIGURE 1. Brief Timeline of chatbots.

many languages it does not support. Siri uses a combination of natural language understanding, voice recognition, and machine learning to enable users to engage in conversational interactions. Google Assistant is a virtual assistant, that also made its debut in 2016, it is embedded in Android devices, providing personalized information and assistance based on user preferences.

Finally, in 2022, ChatGPT emerged as a significant milestone in chatbot technology based on the language model GPT [10]. It represents a highly advanced language model trained by OpenAI, designed to assist with various tasks such as generating human-like responses, answering questions, and providing information on a wide range of topics. A few months later, Gemini (previously known as Bard), a chatbot developed by Google based on the Large Language Model (LLM) emerged and is now gaining traction due to its speed and ability to respond to questions in a human-like manner by accessing up-to-date information from the Internet. It employs generative AI for natural conversations across various modalities, including text, voice, and images.

The Figure 1 shows a brief timeline of chatbots from their first appearance in the 1960s to today's language models used

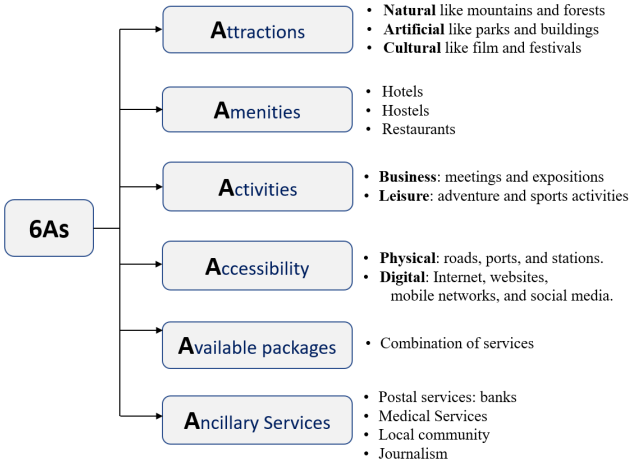

FIGURE 2. 6As of tourism destination analysis.

to develop the most sophisticated chatbots such as ChatGPT. In addition, the evolution of chatbots over time can be divided into two main periods, the first concerns primary rule-based agents, which generally represent the past of agents. The second period reflects the present and future of chatbots. It represents chatbots created using new advances in deep learning and NLP services. It also knows the appearance of a variety of tools that facilitate the creation of chatbots and is still evolving rapidly.

B. SMART TOURISM DESTINATIONS

The adoption of chatbots and other emerging smart technologies, such as recommender systems in destinations, gives rise to the appearance of the concept of Smart Tourist Destinations (STD). To discover this new concept, some tourist destinations in the world offer software applications such as websites, mobile applications, and social network apps with functionalities corresponding to the 6As of tourism destination analysis. Bahalis in [11] suggest that successful destinations can be structured in six components called 6As. Each component starts with the letter A as follows: Attractions, Accessibility, Amenities, Activities, Available Packages, Ancillary services. The Six As framework is illustrated in Figure 2.

- **Attractions:** these are points of interest that enhance the appeal of a destination to tourists. They encompass landmarks, natural parks, cultural institutions, and other noteworthy sites.
- **Accessibility:** this pertains to the various transportation options available, including air, land, and sea routes.
- **Amenities:** encompassing tourist infrastructures like hotels, restaurants, convention centers, and leisure facilities. These facilities contribute to the comfort of visitors.
- **Activities:** these are recreational opportunities and experiences for visitors, such as hiking, skiing, and cultural tours.

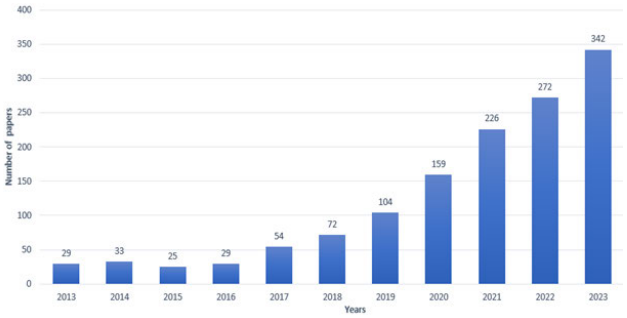

FIGURE 3. Search Results in the Scopus database (2013-2023) for the keywords AI, chatbot, and tourism.

- **Available packages:** comprising intermediary services aimed at capturing the interest of tourists, these packages may include accommodation, transportation, and activities bundled together.
- **Ancillary services:** encompassing essential daily services that enhance the accessibility of a tourist destination, such as banking facilities, postal offices, medical services, etc.

With the continued use of information technologies (IT), especially AI algorithms and techniques, it's inevitable that it has impacted tourism in different aspects of tourism, including the tourist experience before, during, and after their journey. Figure 3 illustrates the increasing number of papers published on 'chatbot' and 'tourism' from Scopus since 2013. It is worth mentioning that a substantial amount of all indexed papers corresponds to those published between 2013 and 2023. As the field of tourism continues to evolve, engineers and researchers are actively exploring the application of advanced AI techniques, such as deep learning, natural language processing, and machine learning. These sophisticated methods are being utilized to address complex activities and personalize tourist services to cater to the ever-changing demands of travelers.

Additionally, Buhalis and Amaranggana, in their studies [12], [13], have indicated that AI has impacted numerous tourist destinations and visitor experiences around the world. This can be observed from Figure 3, where we can see that the number of papers has increased remarkably since 2016, as this year is marked by the emergence of the first platforms for developing chatbots. In the next section, we present the methodology employed in this study to provide the answers to our research inquiries.

III. METHODOLOGY

The leading method for conducting systematic literature reviews (SLRs) in the last decade has been the systematic literature review (SLR) method, as proposed by the Kitchenham guideline [14]. The SLR procedure comprised three main stages: Planning, conducting, and reporting the review. In the initial stage, we formulate research inquiries and identify pertinent keywords for conducting literature searches on the subject. Next, we identify suitable databases

TABLE 1. Motivations and research questions.

IDs	RQs	Motivation
RQ1	What are the different types of chatbots?	Classifying chatbots can assist researchers in retrieving all the information they need on the different categories of chatbots
RQ2	What is the architecture used currently to design chatbots?	Identifying the different conceptual architecture of chatbots can assist and enable researchers in designing chatbots and understanding their key components
RQ3	What are the tools used to develop chatbots?	Discovering a range of tools for developing chatbots can provide developers with a better understanding of their main features.
RQ4	What are the categories of these tools, and their strengths and weaknesses?	Classifying a range of tools for developing chatbots can provide developers with a better understanding of their weaknesses and strengths.
RQ5	What are the main uses of chatbots in tourism?	Identifying the different chatbots used to enhance the tourism sector can assist and enable researchers and all stakeholders to understand the impact of each tool on tourism
RQ6	What is the impact of chatbots on the functionalities corresponding to the "six A" of tourism destination analysis?	Determining the impact of AI chatbots on the functionalities corresponding to the 6A of tourist destination analysis.

housing research papers. Subsequently, we establish criteria for inclusion and exclusion, these sub-steps are called the revision protocol (RP). In the second stage, we gather research articles pertinent to our research queries from the designated databases, applying a predefined RP. Concerning the third stage, we delve into the analysis of the retrieved articles, outlining the specifics of our analytical activities and presenting the findings. These activities were devoted to collecting information about the topic. Detailed elaboration of these activities is provided in subsequent subsections.

A. PLANNING THE REVIEW

1) GOALS AND RESEARCH QUESTIONS

Examining the most recent papers on chatbot design and implementation and their impact on the tourism sector is the prime purpose of this SLR. To accomplish these objectives, Table 1 synthesizes the six research questions (RQs) investigated in this study.

2) DIGITAL LIBRARIES AND ASSOCIATED QUERIES

As part of this stage, we initially chose digital databases where the search for papers would be carried out. We have selected Scopus, ACM, IEEE Xplore, springer link, and Web of Science due to the large range of studies they are indexing. The search was performed by using the keywords used to constitute the Queries listed in Table 2.

3) INCLUSION AND EXCLUSION CRITERIA

To choose the most relevant and pertinent papers to our research topic, we must define some criteria for performing

TABLE 2. Digital libraries and associated queries.

Digital library	Query (Q)
• IEEE Xplore • ACM • Scopus • Web of Science • Springer link	• Q1: TITLE-ABS-KEY(("chatbot*" OR "conversational agent*") AND ("classification of chatbot*" OR "chatbot classification" OR "chatbot architecture" OR "chatbot design" OR "development platform*" OR "development framework*")) • Q2: TITLE ABSKEY((impact OR effect OR adoption)AND(chatbot* OR "conversational agent*") AND ("tourism industry" OR tourism OR hospitality OR "smart tourism" OR "tourist destination"))

a suitable choose of articles. They are the restrictions, or conditions that we must have included/ or excluded in the study. In our study, we have defined a set of inclusion and exclusion criteria which are:

- **Language:** articles published in the English language.
- **Time Frame:** papers published from 2013 to 2023.
- **Source Type:** Journal and Conference proceeding.
- **Document Type:** Journal articles or conference papers.
- Document that addressed the proposed research questions.

B. CONDUCTING THE REVIEW

To choose the most relevant scientific publications that address the questions raised in this work, we followed the procedure for selecting and extracting data illustrated in Figure 4. This procedure consists of filtering the various scientific articles as described below:

- **Initial search**: in this step, we performed the first search in the five databases using two queries and we identified 1155 papers.
- **Selection using criteria**: in this step, we selected the relevant papers using inclusion and exclusion criteria such as language, period, and paper type. we excluded 548 papers, and we obtained 607 publications.
- **Eliminating duplication**: in this step, we manually eliminate duplicate papers. we obtained 301 papers.
- **Select by reading**: this step is based on the reading: title, abstract, introduction and conclusion, and the full text. We obtained 31 publications.

C. PRESENTING THE REVIEW

After conducting a thorough critical examination, the final stage of the systematic review process involves reporting and evaluating the answers to the research questions that were posed. The detailed answers obtained from each primary study are discussed and presented in the next section.

IV. RESULTS

The results section of the study is organized to present data to respond to the research questions. Firstly, we present the studies focused on the classification of chatbots and their conceptual architecture, as well as their development tools as illustrated in Table 3, then we provide the main applications of chatbots in the tourism sector. Finally, we identify the publications dealing with the impact of chatbots on tourism functionalities corresponding to the "six A" framework for tourism as indicated in table 4.

The number of publications involved in the studies is illustrated in Figure 5. it also clearly highlights the widespread use of chatbots in tourism. Especially in Attractions, Amenities, Accessibility, and Ancillary services (figure 6).

V. DISCUSSION

In this section, we discuss and interpret the results obtained, providing answers to the questions addressed in this SLR.

A. RQ1: WHAT ARE THE DIFFERENT TYPES OF CHATBOTS?

This first research question focuses on chatbot classification, firstly, to identify the various existing classifications in the literature, and secondly, to provide a new classification of chatbots.

Based on studies [15], [16], [17], [18], [19], [20], [21], chatbots can be divided into different types based on criteria such as the mode of interaction (text-based or voice-based), knowledge domain (domain-specific or open-domain), goals (non/task-oriented), and design (rule-based chatbots or AI-based chatbots). Hussain et al. [15] suggest a classification of chatbots into two main categories. On one hand, there are task-oriented chatbots specifically designed to assist users in accomplishing specific tasks, such as booking a hotel or a flight, or planning an event. Examples of task-oriented, voice-based chatbots can include Cortana, Alexa, and Siri. On the contrary, non-task-oriented chatbots are devised to engage in extended conversations.

In that respect, Braun and Matthes [16] distinguish between two types of chatbots when it comes to the knowledge domain. On one hand, there are open domain chatbots that can engage in conversations about general topics and respond accordingly. On the other hand, there are closed domain chatbots whose conversations are limited to a specific knowledge domain.

Sarikaya [17], [24] distinguishes between two main categories, proactive Chatbots that provide proactive assistance and those that provide reactive assistance Proactive assistance, as defined by [17], [46], aims to automate tasks or promote the user's interests within the context, without requiring an explicit user request. For example, notifying users by alerting them. Reactive Chatbots, also known as conversational understanding systems [17], can initiate a conversation with users on tasks such as hotel booking, flight booking, etc.

This category covers a wide range of domains, for instance, goal/task dialogues [47], [48]. Different input modalities are possible, such as speech, typing, or touch, and some domains involve peripherals like alarms, SMS, or calls. Even though proactive and reactive parts of the current chatbots are built

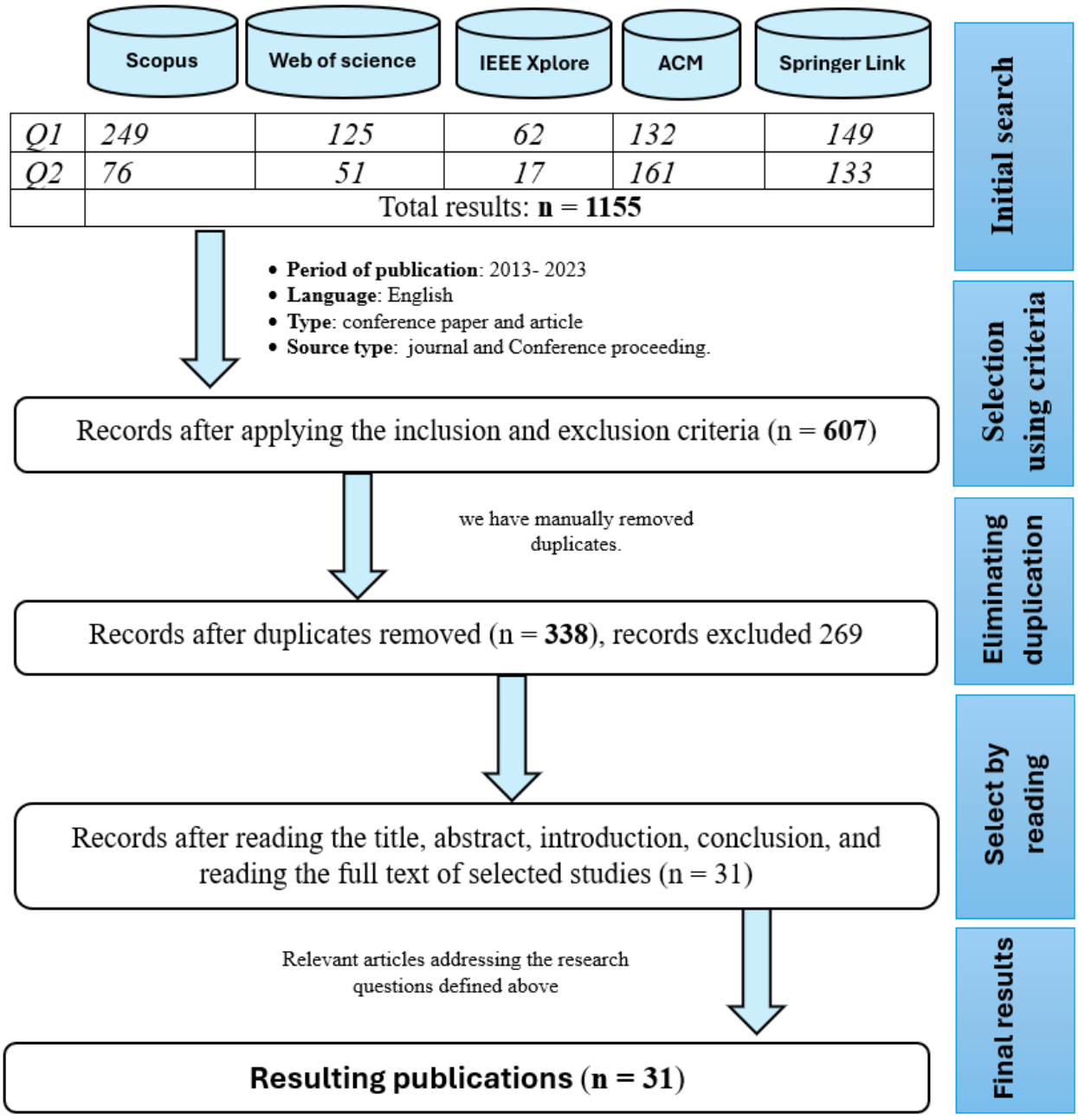

FIGURE 4. Publication extraction steps.

in isolation, they can mainly use one chatbot to enable both types of assistance. In fact, most proactive scenarios have reactive extensions, and vice versa. For example, if the user makes a restaurant reservation reactively, the chatbot may proactively suggest a movie after dinner. Similarly, if the user is on a trip, the chatbot can proactively notify them by sending an alert about weather conditions. Data and context are shared between the two assistance modes.

In the paper [18], Caldarini et al. makes a distinction between rule-based chatbots like Eliza and AI-based chatbots such as ChatGPT. While Rule-based chatbots are generally simpler to create and implement, their capabilities to understand user messages are limited because of their difficulty to respond to complex queries. These chatbots use pattern matching to respond to user requests. Contrary to rule-based chatbots, AI-based chatbots depend on the techniques of deep learning and natural language processing (NLP). These enable them to gain knowledge from already existing datasets of human conversations.

Based on the review of the literature conducted in section IV, it seems that all types of Chatbots are generally classified into two categories: reactive Chatbots and proactive Chatbots. additionally, the criteria (goals, knowledge, input, designing) defined in figure 7, make it possible to obtain

TABLE 3. A summary of contributions through analyzed studies relating from RQ 1 to RQ4.

Study	Year	Contribution and Significant Improvements	RQs raised
[15]	2019	The study discusses a classification of chatbots and design techniques, including rule-based, retrieval-based, and generative approaches.	RQ1
[16]	2019	This study proposes a framework for classifying chatbots based on relevant features that are relevant for developers	RQ1
[17]	2017	The paper explores the architecture, its key components, and the various technologies behind chatbots.	RQ1, 2
[18]	2022	This study examines recent advances in chatbots, discussing their adoption, challenges, and limitations, as well as the evolution of chatbot technology.	RQ1
[19]	2020	This work presents the general architecture of modern chatbots and provides a classification of chatbots based on various criteria, such as the area of knowledge.	RQ1, 2
[20]	2020	the paper presents a complete categorization of chatbots, and analyzes the essential implementation technologies, and details a general architectural design.	RQ1, 2,3
[21]	2021	This paper provides a classification of chatbots based on various factors and highlights their benefits and limitations in different contexts.	RQ1
[22]	2021	This article analyses various chatbot development tools, focusing on technical and managerial aspects, to help developers choose the right tool.	RQ3,4
[23]	2019	This document explores the components and architectures of chatbots, focusing on the dialogue manager as a central component.	RQ2
[24]	2017	This paper focuses on chatbot architecture, essential components, and provides experimental results demonstrating the system's performance across various scenarios and tasks.	RQ2
[25]	2019	This research presents a reference architecture for constructing chatbots and provides two concrete architectures based on commercial platforms.	RQ2,3
[26]	2023	The study explores the main components of chatbot architecture and classifies the tools used to develop them.	RQ2,3,4

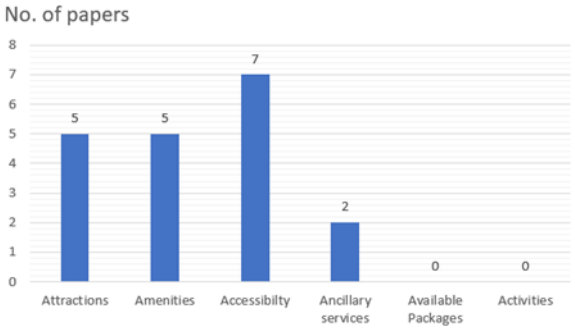

FIGURE 5. Number of papers per six As framework.

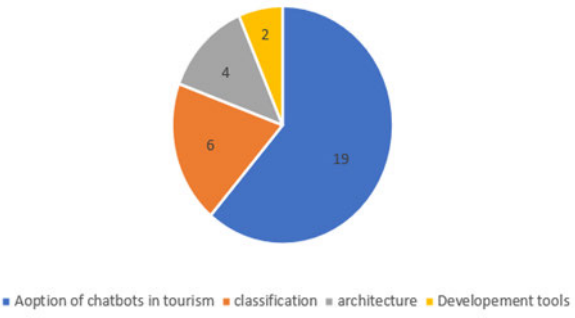

FIGURE 6. Number of papers per RQs.

sub-categories belonging to reactive assistance. The proactive chatbots differ depending on the mechanisms of proactivity (inference, suggestions, notifications, alerts).

B. RQ 2: WHAT IS THE ARCHITECTURE CURRENTLY USED TO DESIGN CHATBOTS?

The second research question focuses on two main aspects: firstly, to identify recent architectural designs used in the development of chatbots, and secondly, to determine the key components that constitute this architecture. The main aim is to better understand the different elements associated with this architecture by presenting a detail of these components.

According to the studies [17], [19], [20], [24], [26], conceptual architecture of chatbots relies on several key components to understand, manage, and generate conversational interactions (Figure 8). Firstly, the Natural Language Understanding (NLU) component plays a crucial role. It analyzes user inputs to grasp their intent and extract relevant information. For example, if a user asks about the weather, the NLU identifies this intent and extracts details such as date and location. Next, the Dialogue Management (DM) component comes into play. It handles the flow of the conversation by maintaining coherent context and making decisions on actions to take based on the user's intent. For instance, it may determine whether an automatic response should be generated or if further questioning is needed to clarify the user's request.

The Automatic Speech Recognition (ASR) component is used in voice-based chatbots to convert user speech into text. This enables the chatbot to process vocal requests in a similar manner to textual inputs. Similarly, the Text-To-Speech Synthesis (TTS) component is crucial for voice-based chatbots. It takes the text generated by the chatbot in response to the user and converts it into synthesized speech. This allows the chatbot to provide natural vocal responses to the user. Finally, the Natural Language Generation (NLG) component comes into play to create natural language responses based on the information processed by the chatbot. It utilizes linguistic models to generate coherent and appropriate responses based on the context of the conversation.

By combining these components, a chatbot can perform interactive conversations with users, whether through text

TABLE 4. A summary of contributions through analyzed studies relating to RQ 5 and RQ6.

Study	Year	Contribution and Significant Improvements	The use of AI chatbots	6As components
[27]	2019	The study investigates the effect of performance expectancy on the intent to employ chatbots in tourism and found a significant link.	destination	Attractions
[28]	2021	This work explores the use of virtual intimacy to improve the user experience with chatbots in the context of tourism by providing tourist information.	Transportation	Accessibility
[29]	2023	The study explores the impact of ChatGPT and large language models, on the tourism sector. It aims to outline their applications, benefits, and risks.	Customer services	Ancillary services
[30]	2028	This project examines the impact of ChatGPT on travelers' behavior and their trust in the recommendations provided by the technology.	trip planning	Accessibility
[31]	2022	This paper makes use of an integrated model to account for the determinants behind customers' continuity intention to use AI-based chatbots for tourism.	tourism service providers	Ancillary services
[32]	2021	The search develops a framework, drawing from self-determination theory and other literature, to analyze motivational customer experiences with chatbots.	Flight	Accessibility
[33]	2023	This study examines how chatbots are employed in tourism to assist with finding destinations and accommodations.	travel	Accessibility
[34]	2019	this research focuses on the development of an intelligent personalized chatbot for hotel services.	Hotels	Amenities
[35]	2020	The study examines how technology, including chatbots, is transforming the travel and tourism industry. It mentions the increasing use of chatbots in airlines and airports.	Hotels and transportation	Amenities and accessibility
[36]	2021	This article sets the objectives of using chatbots in the travel and tourism industry by putting emphasis on anticipating the intentions of individuals' use.	travel	Accessibility
[37]	2019	The study discusses the implementation and benefits of chatbots in the tourism industry.	tourism companies	Amenities
[38]	2020	This work presents the development of a text-based AI chatbot called "Smart Guidance" for tourism recommendations in the city of Jeddah, Saudi Arabia.	travel and hotels	Amenities and accessibility
[39]	2023	The work suggests developing a chatbot to enhance the tourism experience by providing information, assisting with bookings, and offering personalized recommendations.	bookings	Amenities
[40]	2023	The study treats the adoption of chatbots in travel and tourism services.	bookings	Amenities and attractions
[41]	2022	This search presents the development of a voice-based chatbot in the hospitality industry, focusing on the interactions between hotels and guests.	hotels	Amenities
[42]	2023	The study treats the use of a recommender chatbot as a tool to help tourists compare information and make informed decisions, incorporating conversational abilities.	providing information	Attractions and amenities
[43]	2019	The study presents a Context-Aware System-based chatbot that makes use of tourists' profiles and context to provide customised recommendations for content and services.	visiting cultural sites	Attractions
[44]	2021	The work presents a cultural heritage framework utilizing a deep learning-based chatbot to support tourist's journeys.	supporting tourist journey	Amenities and attractions
[45]	2020	This study presents the development of an intelligent agent designed to enhance accessibility to information in a history museum, improve cultural engagement, and provide a personalized experience.	enhancing accessibility to information in museums	Attractions

or voice, facilitating a range of applications from customer support to online consultation services.

The details of each component that constitute the architecture in Figure 6 are shown in Table 5.

C. RQS 3-4: WHAT ARE THE TOOLS USED TO DEVELOP CHATBOTS? AND WHAT ARE THE CATEGORIES OF THESE TOOLS, AND THEIR STRENGTHS AND WEAKNESSES?

The second and the third research questions refer to the identification of tools for developing chatbots, and to discover their strengths and weaknesses.

According to the studies [22], [26] shows that all tools offer the possibility of developing a chatbot according to one of the following approaches, the first approach uses interactive tools to facilitate mainly the development of simple agents. It includes commercial platforms. The second approach uses low-level APIs for the development of more complex chatbots. These tools offer more flexibility, allowing developers to create more advanced chatbots. While the interactive tools of the first approach are easy to use and suitable for simpler use cases, the low-level APIs cater to the needs of developers looking to create highly personalized and sophisticated chatbots.

In Gartner's two reports [3], [4], as well as in our previous research in [24], [47], several tools are used to build these applications, which are described below:

- **Frameworks**:To build, train, and deploy NLP and machine learning models for chatbots, developers use a group of pre-defined collections. These frameworks allow the development of more advanced chatbots

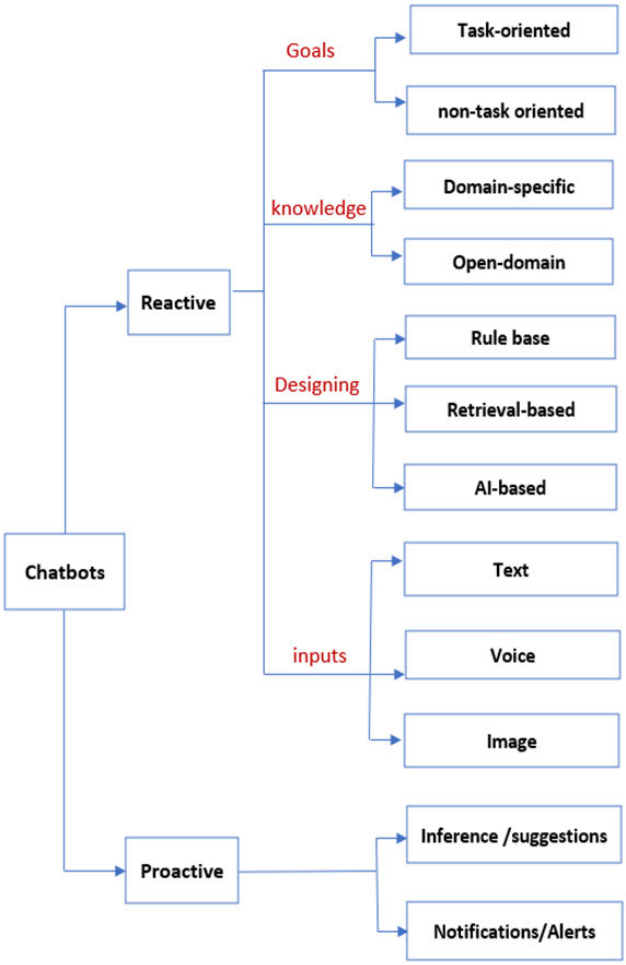

FIGURE 7. Classification of chatbots.

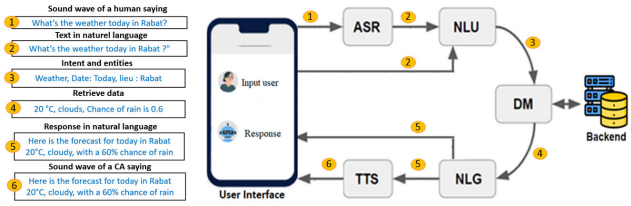

FIGURE 8. A standard architecture of chatbots (adopted from [26]).

using low-level APIs for the objective of building more sophisticated chatbots, and they are generally open source. For instance, Bot Framework and Rasa framework.

- **Platforms**: are the most widely used tools on the market, they are cloud-based and can be used to create the simplest chatbots using graphical forms. For instance, Amazon Lex Watson and Dialogflow.
- **Services**: Cloud-hosted solutions which include LUIS do provide AI services for NLP service delivery needs. They provide user interfaces to build chatbots and build natural language understanding (NLU) models based on machine learning.

TABLE 5. Key components of chatbots architecture.

Architecture and key components	Details of each main Component
The studies [19, 20, 23, 24] present a high-level diagram of a chatbot system, including components: • User interface (UI) • Natural language understanding (NLU) • Dialogue manager (DM) • Natural language generator (NLG) • Backend The proposed scheme in [17], [26] for reactive and proactive chatbots includes components for reactive assistance (such as ASR, NL processing, DM, NLG, TTS), proactive assistance (inferences, user modeling, suggestions), and device/service end points (phones, PCs, web browsers, messaging applications).	• NLU or LU uses intent classification and entity extraction. • The DM contains State Tracking enabling a chatbot to maintain a record of turns in order to provide a context of conversation, and a Dialogue Policy to assisting a chatbot to decide the next action to take. • The NLG or LG uses Rule-based, Retrieval based, and Generative-based models to provide to respond to the user. • The ASR and TTS can use APIs for handling the two main tasks in speech processing. • Backend can call external APIs or access databases.

- **Libraries**: provide the facility to reuse blocks of code to automate conversations, for instance, Chatterbot, which uses the Python programming language.
- **Language models**: developers leverage pre-trained language models like Bidirectional Encoder Representations from Transformers (BERT) and Generative Pre-trained Transformer (GPT) to enhance the NLU component of chatbots. These models are designed to understand and generate human language, having been pre-trained on large datasets and demonstrating strong NLU capabilities. By utilizing these language models, developers can improve the component used to generate responses within chatbot applications.

Another way to develop a chatbot from scratch is to use deep learning techniques such as LSTM cells [58] and Language models such as Bert and GPT for natural language understanding and generation [59]. These models leverage the power of neural networks to process sequential data and understand the context of user queries, enabling the chatbot to provide more intelligent and contextually relevant responses. Additionally, these models can be fine-tuned on domain-specific data to improve performance in specific applications or industries.

D. RQS 5-6: WHAT ARE THE MAIN USES OF CHATBOTS IN TOURISM? AND WHAT ARE THEIR EFFECTS ON TOURISM?

Since 2016, the adoption and utilization of chatbots in the tourism sector have experienced substantial transformation, revolutionizing the process by which travelers plan, book, and indulge in their journeys. Chatbots in tourism encompass

TABLE 6. Strengths and weaknesses of chatbot development tools.

Category	Tools	Strengths	Weaknesses
Frameworks	Rasa [50], Bot framework [51], and Botkit [52]	• Open source • Reusability • Any API by coding	• Technical Expertise • Programming skills required
Platforms	Dialogflow [53], Watson assistant [54], and Amazon lex [55]	• Easy to use • Run on cloud • Well documented	• NLP services can be locked • Requires high costs • Required subscription • Static Dialog
libraries	Chatterbot [56]	• Reusability • Integration	• Limited Scope • Technical Expertise
services	LUIS [57]	• Accurate intent recognition. • Effective entity extraction. • Multilingual support	• NLP services can be locked. • Requires high costs. • Required subscription
Language models	BERT GPT	• NLP Capabilities • fine-tuning on specific tasks	• Required subscription

nearly all aspects of destination analysis, as elaborated in the subsequent sections:

The integration of chatbots into the tourism sector is reshaping the exploration of attractions. These intelligent agents furnish immediate information regarding natural wonders like mountains, lakes, and forests, assisting visitors in trip planning. For artificial attractions such as parks, chatbots streamline accessibility by promptly addressing common inquiries. Additionally, chatbots enrich cultural exploration by providing insights into festivals, music, and folklore, thereby enhancing travelers' cultural experiences.

Chatbots wield substantial influence on tourism amenities, including accommodations like hotels, hostels, and restaurants, profoundly altering travelers' experiences. These virtual assistants simplify the booking process, offer tailored suggestions, and efficiently handle service requests. By playing a pivotal role in enhancing overall satisfaction, chatbots elevate the quality of travelers' experiences. The integration of chatbots into the tourism industry is revolutionizing accessibility, particularly in transportation services. Chatbots facilitate seamless travel by furnishing real-time updates on various transportation options such as taxis, buses, rideshares, and bicycles. Travelers can effortlessly plan itineraries, check schedules, and even make bookings, thereby enhancing the efficiency of transportation experiences. With their immediate support, chatbots play a crucial role in enhancing accessibility and catering to the needs of modern travelers. Moreover, chatbots in the tourism industry significantly impact a diverse range of activities, encompassing both business and leisure pursuits. In the corporate realm, chatbots streamline processes associated with meetings, conferences, and exhibitions, facilitating efficient scheduling and information dissemination. In the leisure sector, they enhance the sports and adventure experience by offering real-time updates, personalized recommendations, and instant assistance.

In addition to these Six A framework-centric advantages, chatbots contribute significantly to operational efficiency, allowing businesses to reallocate resources and focus on enhancing guest services and experiences. This efficiency translates into notable cost reductions, from reduced labor expenses to minimized response times, which can significantly boost profit margins. Furthermore, chatbots enhance customer service capabilities by providing instantaneous, 24/7 support and responses to guest inquiries, thus elevating overall customer satisfaction. The benefits of chatbots extend to their ability to collect and analyze vast amounts of data from interactions with customers. This data is invaluable for developing targeted marketing strategies and understanding consumer behavior, enabling businesses to tailor their offerings more precisely to meet market demands. Additionally, chatbots foster heightened customer engagement through personalized communications and recommendations based on previous interactions, thus deepening the relationship between the business and the customer.

E. LIMITATIONS AND FUTURE DIRECTIONS

The adoption of chatbots in the tourism industry is not without its challenges. One significant limitation is the current inability of chatbots to understand and process the nuances of human language, which can lead to misunderstandings and a less satisfactory user experience. Additionally, the diversity in tourist cultures poses a challenge in terms of designing chatbots that can communicate and respond to a wide range of cultural origins and language skills. Moreover, data privacy remains a crucial concern, as chatbots often collect personal information to provide tailored recommendations and services. Ensuring this data is handled securely and in compliance with global data protection regulations is essential but challenging, as these regulations can vary significantly from one region to another.

An important challenge in chatbot development is that most conversational platforms offer only basic tools, which are essentially modified open-source software components designed to deliver simple question-answer assistants. While these tools can support use cases across various domains,

none, to our knowledge, are designed specifically for the tourism industry.

To overcome these limitations and explore the potential of chatbots in enhancing the tourism experience, several future directions can be considered:

- Advancements in natural language processing and deep learning will focus on enhancing chatbots' understanding of context and informal language to provide more accurate and human-like responses.
- Future chatbots should be developed to support multiple languages and understand cultural nuances, making them accessible and effective for a global audience.
- Implementing advanced security measures, such as blockchain technology, will ensure the privacy and protection of user data.
- Developing a chatbot development platform specifically for the tourism industry. This tool would include features tailored to the unique needs of tourism.

VI. CONCLUSION

In this paper, an SLR is carried out to examine the most recent advances in research on chatbots and their impact on the tourism sector. This review is performed after a critical analysis of the most pertinent research articles published in five well-known online digital libraries: Scopus, ACM, IEEE Xplore, Springer Link, and Web of Science. Six research questions regarding the different aspects of chatbot progress (classification, architecture, development tools) and their main use and impact on the tourism sector. It is concluded that chatbots are rapidly evolving and proliferating across all fields of tourism.

In future studies, we aim to address challenges associated with development tools, such as NLP service locking, through the investigation of chatbots. However, this goal can be achieved by creating a domain-specific language that allows for the development of these agents independently of existing tools.

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