Impact of AI and robotics in the tourism sector: a critical insight

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Abstract

Purpose – *The purpose of the present article is to highlight the role of Artificial Intelligence (AI) and Robotics in the tourism industry. The various technologies being integrated to improve the service and customer experience in tourism. The expected changes and challenges in tourism in the future are focused in this paper.*

Design/methodology/approach – *A systematic study on the emerging technologies of AI and Robotics applied in the tourism sector is presented in the form of a viewpoint.*

Findings – *AI certainly enhances tourism experiential services however cannot surpass the human touch which is an essential determinant of experiential tourism. AI acts as an effective complementary dimension to the future of tourism. With the emergence of artificial travel intelligence, it is simpler to make travel arrangements. AI offers travel services that are automated, customized and insightful. AI allows travelers to learn about their behaviors, interests to inclinations and provide a personalized experience. Gone are the days to consult a travel agent, meet him physically and indulge in an endless chain of troubling phone calls to inquire about travel arrangements.*

Practical implications – *Tourism marketing to see a positive and improved change that will enhance the tourists' overall experience due to the application of AI and Robotics. New emerging technologies like chatbots, virtual reality, language translators, etc. can be effectively applied in Travel, Tourism & Hospitality industry.*

Originality/value – *The present viewpoint discusses the application and role of AI and Robotics with the help of relevant industry examples and theory. The present paper highlights the different technologies being used and will be used in the future.*

Keywords *Chatbots, Robots, Human-Robot interaction, Technologies, Machine learning, Artificial intelligence*

Paper type *Viewpoint*

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1. Introduction

In the technology-driven times, Artificial Intelligence technology is one of the most innovative inventions that have revolutionized various industries all around the globe. Artificial Intelligence (AI) can be referred to as the development of computer systems that can perform tasks and activities which require human intelligence (Russell and Norvig, 2016, p. 4). Artificial Intelligence first made its appearance during the year 1956 in John McCarthy's Dartmouth Summer Research Project. Over the years, many successes of AI have followed in the form of heuristic searches, character recognition, facial recognition systems, the processing of natural language, and the concept of mobile robotics. By the year 1980s, considerable conceptual progress has been made in the technology-driven field, and its application has increased significantly (Issa *et al.*, 2016). During the 1990s, the technological setting made significant progress, especially in the field of Artificial Intelligence. The growth was mainly because advanced and new kinds of technologies allowed engineers to use large volumes of data, build robots in an efficient manner, and

work on improved computing powers. Since then, the AI concept has come a long way and transformed the power of technology. In the 21st century, Artificial Intelligence has reached a climax, and it has the potential to have a profound impact on individuals, organizations, and industries to a significant extent.

In the digitalized era, Artificial Intelligence technology is being used in various industries and not just the Information Technology industry (Nagaraj, 2019, 2020). For example, one can come in contact with AI in self-driving vehicles, robotic nurses, navigation systems, chatbots, human versus computer games and various other fields (Russell and Norvig, 2016, p. 5).

According to a prediction by McCormick *et al.*, due to the rise in the use of Artificial Intelligence by businesses across different industries, they will be able to steal almost $1.2 trillion in a single year from their less-informed rivals by 2020 (McCormick *et al.*, 2016). Some of the major industries where Artificial Intelligence has made its presence are the manufacturing industry, automotive industry, banking, and financial services, healthcare and life sciences, insurance, telecommunications, energy, travel tourism and hospitality and media and entertainment. Rapidly, AI's footprint is expanding in a greater number of industries all across the globe with each passing day (sites.tcs.com, 2019, p. 6). The popularity and application of AI technology are increasing in the industrial setting as it increases the level of innovation and minimizes the processes and activities that are carried out by human factors. In many industries, AI is being used in various functions of organizations such as sales and marketing, customer service, and finance (sites.tcs.com, 2019, p. 6).

In the 21st century, the tourism industry has seen incredible growth and prosperity at a global level. The international tourist arrivals have increased from 528 million in the year 2005 to 1.19 billion in the year 2015 (www.statista.com, 2019). Today several people are willing to spend money on tourism and traveling. This spending has boosted the demand and overall performance of the industry. Thanks to the growth of the travel and tourism industry, it is regarded to be one of the world's largest sectors that have the power to shape the economic health of a nation. Technology has entered the industrial setting and boosted its performance and quality of service delivery (www.statista.com, 2019). AI has invaded the tourism and hospitality setting, and it is being used to gain a competitive advantage in the dynamic market. The graph presented below shows that various kinds of AI strategies are being used in different industries including the tourism and hospitality industry.

Technology has gradually made way for itself in the tourism industry and reduced the processes that are carried out manually. As the tourism industry has always been an early technology adopter, it has welcomed AI with open arms (World AI Show, 2019). The Artificial Intelligence concept has entered the business context as it can enable marketers in the competitive industrial setting to automate the processes and streamline the business activities. Initially, it was used to simplify the marketing processes, but in the present times, AI technology is leaving a mark on every tourism aspect such as welcoming the guests, serving them and listening to their needs (World AI Show, 2019). AI is being used in the tourism industry for various purposes such as improving the level of personalization, tailoring the recommendations of the customers and guaranteeing fast response times even when the staff members are not present. The presence of artificial intelligence has become so crucial in the industrial setting that it is being used to assist and communicate with the customers and thus strengthen the quality of engagement (revfine.com, 2019).

The objective of this viewpoint is to capture how Artificial Intelligence technology has entered the tourism scene and brought about revolutionary changes in the industrial setting. This viewpoint attempts to give comprehensive knowledge about the various AI technologies being applied, its implications, challenges and future potential in the Travel, Tourism & Hospitality segment. In the technology-driven times, the topic can shed light on

the power of Artificial Intelligence and the implications that it has on the industrial environment. How AI has redesigned, the traveling and tourism process has been critically presented here. A holistic assessment has been carried out to comprehend how Artificial Intelligence is converting the regular tourism industry into a smart industrial hub.

2. Scope of AI in tourism as an industry

Although the Artificial Intelligence (AI) is a contemporary issue, there are few interesting findings that trigger the usage of AI in the Travel, Tourism & Hospitality Industry. There were few studies conducted in the recent past, on the usage of AI in Travel, Tourism & Hospitality Industry by companies like Tata Consultancy Services, Google Travel, Trip Advisor, etc. (Viglia *et al.*, 2014). These studies revealed some of the important findings that are advantageous to the Travel & Tourism companies. A survey done by Tata Consultancy Services (TCS) founded that 85 per cent of the travel & hospitality service providers use Artificial Intelligence in their business (Anurag, 2018). Studies report that this may be because of the rapid rise in digital travel sales, which are expected to cross $800 billion by the year 2020 (Chawla, 2019). Google Travel & Trip Advisor founded that 74 per cent of the customers plan their tourism trips using the Internet, in which more than 45 per cent of customers plan using smartphones (Peranzo, 2019). Other surveys indicate that 85 per cent of customers decide their travel activities, after reaching their destination (thinkwithgoogle. com, 2016). 36 per cent of customers prefer the Interactive booking process & 80 per cent of them choose self-service technologies over traditional services (Peranzo, 2019). 90 per cent of the customers expect relevant information about the trip while they travel to the destination spot (thinkwithgoogle.com, 2016).

Taken together, these results would seem to suggest the customers' tendency towards internet & self-service technologies. These findings would tempt the marketers to incorporate Artificial Intelligence in the form of interactive & self-service technologies to deliver enhanced customer experience. The finding of these surveys not only suggests the customers' tendency towards the technology but also infer the aspect of "Timeliness". The customers are so particular about the timeliness of the services, which they receive (Kim *et al.*, 2014). Majority of the customers are not ready to accept the services before the travel, rather they expect these services at the time of their travel. Findings also reveal that the majority of the customers prefer self-service technologies over traditional services. These self-service technologies are largely possible, by the usage of Artificial Intelligence (Ivanov and Webster, 2017; Ivanov *et al.*, 2017).

Besides, these factors, there are several other factors that influence the travel, tourism & hospitality industry. Important factors that influence the selection of the Tourism, Travel & Hospitality services include Natural Resources, General Infrastructure facilities, Tourist Infrastructure, Destination tourism infrastructure (Beerli and Martin, 2004). Natural Resources include scenic beauty, lakes, mountains, deserts, variety & uniqueness of flora & fauna, weather conditions (temperature of the region, rainfall, humidity, etc.). General Infrastructure facilities include road, public & private transport. Tourist Infrastructure includes hotel & accommodation facilities, restaurants, bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks, zoos, casinos, trekking, adventure activities, shopping malls, etc. Destination tourism infrastructure includes human resources, safety measures at that place (Beerli and Martin, 2004; Kaushik *et al.*, 2010; Seyidov and Adomaitienė, 2016).

Artificial Intelligence can provide a wide range of information on all the key factors such as Natural Resources, General Infrastructure facilities, Tourist infrastructure facilities, Destination tourism infrastructure facilities, etc. AI technology can surpass human performance by offering a wide range of information on all the key factors within no time. Given these circumstances, the Artificial Intelligence may outperform human services. Artificial Intelligence easily addresses the requirements of the customers by providing

timely information to customers on the key factors such as Natural Resources, General Infrastructure facilities, Tourist infrastructure facilities, Destination tourism infrastructure facilities, etc. This information can be in the form of interactive messages, self-service technologies, chatbots, audio tours, virtual tours, interactive booking process, facial recognition technologies, language translations, cross-selling & up-selling, competitive pricing, easy shopping, etc., which are discussed in the later sections in detail.

3. Artificial intelligence in tourism

There are several new technologies that evolved in the domain of Artificial Intelligence. These technologies were helpful in delivering a novel experience to the customers. These technologies include Facial Recognition technologies, Virtual Reality applications, Chatbots, Robots, Artificial Intelligence in Google Maps, Language Translators, Audio tours, Ease of Shopping, etc.

3.1 Facial recognition

Facial Recognition is an application of AI technology which is gaining greater importance and application across various industries for varied purposes. Facial Recognition is being adapted in the travel and tourism industry also at a large scale. For example, travelers have to undergo a repeated set of complex processes in the form of scrutinization of travel documents by various authorities like customs, immigration & airports. This complexity in the process consumes a lot of precious time, which further leads to a kind of frustration in the tourists (Patel, 2018). To mitigate these kinds of disturbances, Facial Recognition technologies have come into play. This technology recognizes the face of the tourists, verifies it with the face in the documents & provides hassle-free check-ins. By using this technology, tourists can comfortably pass through the airport check-ins & all other station check-ins, without the document verifications by various authorities such as immigration, customs, etc. (Chang and Yang, 2008). This technology is currently implemented by the ShoCard Organization for the airlines (Saulat, 2018).

3.2 Virtual reality

Virtual Reality (VR) technology generally uses the VR headset to create a simulated environment. This simulated environment gives an experience of virtual reality. The customer using the VR technology experiences the environment to a great extent in a 3 D, digital world (Guttentag, 2010). In recent days, this technology is used by the travel, tourism & hospitality companies. These companies demonstrate tourist spots & hotel locations by using 3 D videos. There is a major gap existing between customers & hoteliers. The customers at a far distance are typically unaware of the ambiance of the hotel, the quality of the rooms, etc. Hoteliers describe their hotel on the website; provide few images & videos that would not give a complete picture to the customers. Majority of the time, this kind of approach results in ambiguity to the customers. The customers, who are at a far distance, are unable to assess the ambiance & environment of the hotel, Quality of the hotel rooms, facilities in the hotel, etc. This problem is easily addressed by Virtual reality applications (Guttentag, 2010; Yung and Khoo-Lattimore, 2019).

There are various Virtual reality applications used in the Tourism & Hotel Industry. Few of them are Virtual hotel tours, Virtual travel experiences, Virtual Booking Interface. Virtual hotel tours include the demonstration of the hotel environment, its facilities in the form of 3 D-videos. This makes the customers encounter a real-time experience about the facilities in the hotel (Barnes, 2016). The customers would like to experience the travel & exploration of the tourist spots before they move to the tourist spots. This is done by searching relevant information on the Internet in the form of customer reviews etc. (Kim and Hardin, 2010). With the advent of Virtual reality technologies, there was a radical change in the availability of

information to customers. This information makes the customers decide about their travel beforehand.

Virtual reality technologies are perfect gateways to travel & explore the unseen locations beforehand. Marketers provide the virtual journey to the customers into the hotels & tourism spots by partnering themselves with the hotels, tourism spots (i.e. museums, zoo parks & all other recreational spots) (Jung *et al.*, 2016; Jung *et al.*, 2017). In the recent past, there are few hotels namely Marriott hotels, Atlantis Dubai Hotels who partner themselves with the marketers to provide the customers a virtual experience (Van Kerrebroeck *et al.*, 2017). Virtual Booking Interface allows the customers real-time, simulated experience of walking through a plane & selecting the seat in the aircraft. Customers also select other services like cab service & make the payment. This easy demonstration of booking the flight tickets & other services in the form of 3 D-videos allow the customers to book by themselves, without approaching any consultancies. This helps the airlines to become the next generation retailers. Few companies such as Navitaire airlines use the services of virtual booking interface (Wilde, 2017).

3.3 Chatbots

"Chatbot is a piece of software that conducts a conversation via auditory or textual methods." There are mainly two types of Chatbots, namely Text message-based chatbots & Voice based chatbots. Text message-based chatbots provide message services to the queries of customers in the form of text messages. Voice-based chatbots provide message services to the queries of the customers in the form of voice-based messages (Kumar *et al.*, 2018; Kumar *et al.*, 2016). Chatbots are typically computer software machines, which are pre-programmed to answer the simple questions raised by the customers (Oh *et al.*, 2017). Chatbots has inbuilt programs that identify the keywords within the questions that trigger the number of responses in response to a single question. This key feature of sending out multiple responses to a single question immediately has been a notable aspect of chatbots (Makar and Tindall, 2014). Moreover, chatbots can be accessed 24/7 for all the 365 days in a year. These key features made chatbots to replace the employees. Some companies offer a unique experience using travel chatbots. The travelers can ride the car on their own without any guide & the travel chatbot installed in the car keeps on describing each place. This technology is named as an Audio tour, which is preferred by the travelers who wish to have privacy & travel alone with their families (Boiano *et al.*, 2019).

Every hotel wants to have your guests a great experience. Inevitably, the guests need some or the other information about the hotel facilities. That's where the Chatbots come into play. Personalization is a key component that marketers need to integrate with their services. Especially, Voice-based chatbots provide a high-profile personalized service to its customers. It serves the customers by offering a wide range of services like ordering food services, cab services, reading out the messages, scheduling the tasks & appointments, setting up alarms, room services, house-keeping services, informing the hotel facilities, etc. (Gajdošík and Marciš, 2019). All in all, it acts as an assistant to the guest. Chatbots can even store the previous data of the guests by which they can suggest recommendations based on past purchases & activities. These voice-based chatbots are specially meant to improve hospitality, which further improves customer engagement & experience (Nagaraj and Singh, 2018, 2019). Delivering a great guest experience can be possible with chatbots for hospitality. Few hotels use the chatbots namely, Marriott hotels, Hyatt hotels, GRT hotels (Gajdošík and Marciš, 2019; Seal, 2019).

3.4 Robots

Robots are another type of AI technology that is strengthening their presence in the tourism industry. These technology-driven assistants are using the Internet of Things (IoT)

technology to do simple activities such as turning on the bedroom lights, turning off the television, handling systems to ensure the luggage is checked in automatically and receiving the guests in a hotel. Robot receptionists have become a trending thing in the tourism industry, which has a direct implication on the interaction and experience of the customers and guests. They are even taking care of the room service aspects so that the guests will not face any kind of issue while checking in to a new hotel room. In some of the reputed hotels of Marriott such as St. Regis, Westin and Aloft, the Alexa robot has been getting a lot of attention. Similarly, in airports, robots have started making their presence, and they are being used as guides and assistants. Some of the main advantages of robots in the tourism industry include enhanced customer experience, simplification of the work process, the ability of human factors to focus on other activities and improved efficiency of the tourism business.

The introduction of AI in the tourism industry is a reality of the current era. For instance, a reputed Japanese tourism and hospitality company Henn-a Hotel has introduced various kinds of robots in its workforce, including dinosaur robots. These robots are responsible for taking care of the front desk activities and receiving guests. Even though it might sound pretty weird, this is one of the examples that show the AI technology has come a long way in the tourism industry, and it has a long way to go as well. Thus, AI has introduced a silent revolution in the hospitality and tourism industry that cannot be ignored.

3.5 Google maps

Google Maps using GPS technology assisted the travelers by keeping them informed about the directions. Usage of Artificial Intelligence technology in Google Maps advanced the information by keeping the travelers informed about the accidents & traffic jams. Although Google Maps eases the travel journey by locating the right directions; travelers repeatedly encounter a common problem. The customers end up their travel by completely traveling in the wrong direction, which is realized after traveling a fair bit of distance (Marouane *et al.*, 2014). This experience brings a lot of confusion & irritation to travelers. To overcome this hurdle, Google Maps came up with a new solution of incorporating the Visual Positioning System (VPS) to ease the travel journey. This newer version makes use of the Visual Positioning System (VPS), which differs itself, from the Global Positioning System (GPS). Visual Positioning System uses Artificial Intelligence technology that gives the live view of the real world & visual landmarks in front of travelers (Anup *et al.*, 2017).

Google Maps with the help of Artificial Intelligence are now able to provide a live view of the real world. The new feature in Google Maps immediately starts the camera & starts scanning around, to find the visual landmarks like buildings, storefronts, etc. Travelers can switch on the Google Maps application to figure out their exact location & experience the live view of Google Maps. It would provide details about the shops, companies, hotels, malls, cinema theatres, restaurants, canteens, recreational zones, etc., thereby providing Location-based experiences (Xiao *et al.*, 2018). By making use of the live view, the travelers travel in a proper direction, without any confusion (Ruotsalainen *et al.*, 2011). In short, the newer version of Google Maps acts as a Local guide.

3.6 Language translators

There are few software applications that translate one language into others. These applications are helpful especially to travelers who visit foreign locations where they encounter unfamiliar languages. Traveling to foreign country can be tough, especially when there are language barriers. This problem can only be addressed if the travelers make use of any local guide, who can speak the local language. But the software applications can replace a local guide, by translating the unfamiliar language into the familiar languages. Few applications namely "Google Translate" would perform these tasks. These applications

would even allow travelers to converse with the local people in their language. Google Translate provides the audio speech services, when the traveler clicks on the option, "Conversation mode". This option allows the travelers to speak in their language, captures their voice message, translates this voice message into the target language (local language) & dictates the translation in the target language, thereby conveying the travelers' message to the local people (Azis *et al.*, 2011). This feature is especially useful for illiterate travelers, who cannot type their messages in Google Translate. The best part of this application is its ability to work in an offline mode. It can download languages into the application & work in an offline mode. Another feature, that is extremely useful is, "Camera Integration" option. Travelers prefer to understand the menus in the hotel, however, most of the time, they end up struggling with the menus, especially when they are at the places where they don't have any foundation in the local language.

Travelers are often out of luck when it comes to reading the signboards & menus in the hotel, in a foreign location with an unfamiliar language. "Camera Integration" option can be used to translate the signboards & menus in the hotels of foreign locations. The application scans the signboards & menus, by the phone camera & translates the information present on the signboards & menus into the preferred language (Ma *et al.*, 2000; Tatwany and Ouertani, 2017). This can help out the travelers who desire to read the menus in the hotel & understand the signboards. This application also can translate the words or messages present in the images captured by the camera (Tatwany and Ouertani, 2017). This particular feature can be helpful for the travelers who wish to capture some information for the current moment & want to have it translated later. This application helps out travelers to interact with the local people. Travelers can move to the local canteens, shopping malls & all other recreational zones where they can interact with local people in their language, which provides a novel experience to the travelers of visiting an unfamiliar place (Chavre and Ghotkar, 2016). In the marketers' perspective, this technology improves the customer experience (traveler experience) & customer engagement (travelers' engagement) (Bayern, 2018).

3.7 Optimization services

By the usage of Artificial Intelligence in combination with the Maximum Likelihood algorithm, the service providers can provide the optimization of the services. The Maximum Likelihood Algorithm makes use of the past data & suggests the likelihood values of the prices (Moraga-González and Wildenbeest, 2008). This algorithm would suggest the timings at which the prices rise & the timings at which the prices drop (Kumar *et al.*, 2018; Song and Jiang, 2019). Therefore, it suggests the best timings to the customers in terms of price. This technology is used in many areas of tourism, such as booking a hotel/flight/Cab services. Using this technology the customers can decide whether to book a hotel/flight/Cab or wait till the price drops (Ropero, 2011). Likewise, the Artificial Intelligence also helps in Cross-selling. Cross-selling is a sales strategy, where there is a sale of complementary products to the customers. For example, if a tourist is searching for a cab-service, the Artificial Intelligence would deliver a pool of suggestions, where there are suggestions about the cab services along with the hotel services, recreational zones nearby, etc. Few online companies such as "Hopper.com" optimize the travel experience by delivering information not only on the main service but also on the additional services that complement the main service (Bulanov, 2019).

4. Artificial intelligence affecting travel, tourism & hospitality related factors

Adoption of Artificial Intelligence technologies in delivering Tourism-related services:

4.1 Facial recognition regulating travel facilities

Facial Recognition technologies provide hassle-free check-ins at airports & all other stations, without any document verifications by the immigration department, customs department, etc. This facial recognition software, not only provides the hassle-free check-ins but also ensures data safety & security to the tourists by the usage of blockchain technologies (Chang and Yang, 2008; Patel, 2018). These technologies facilitate the travel process to the customers (Saulat, 2018).

4.2 Virtual reality regulating travel, tourism & hospitality related factors

There is a major gap existing between the customers' expectations of the service & actual service delivered by the service providers. The customers at a far distance are typically unaware of the tourist spots, the tourism experience of that destination. The customers would like to experience the travel & exploration of the tourist spots before they move to the tourist spots. This is done by searching relevant information on the Internet in the form of customer reviews etc. (Kim and Hardin, 2010). They consider numerous factors about travel & tourism before they select the destination spot. The factors include Natural Resources like Scenic beauty, lakes, mountains, deserts, variety & uniqueness of flora & fauna, weather conditions (temperature of the region, rainfall, humidity, etc.). General Infrastructure facilities like Road, Public & private transport. Tourist Infrastructure includes Hotel & accommodation facilities, restaurants, bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks, zoos, casinos, trekking, adventure activities, shopping malls, etc. Destination tourism infrastructure includes Human resources, safety measures at that place (Beerli and Martin, 2004; Kaushik *et al.*, 2010; Seyidov and Adomaitienė, 2016).

With the advent of Virtual reality technologies, the customers can get first-hand information on most of these factors unlike reading the customer reviews. Virtual Reality (VR) technology creates a simulated environment that gives an experience of virtual reality. The customer experiences the environment to a great extent in 3D, digital world. This technology addresses the major limitation that exists between the customer & service provider (Guttentag, 2010; Yung and Khoo-Lattimore, 2019). Looking at the virtual reality videos, the customers can experience the scenic beauty of the Natural resources like Scenic beauty, lakes, mountains, deserts, variety & uniqueness of flora & fauna, weather conditions, General Infrastructure facilities like Road, Public & private transport, Tourist infrastructure like Hotel & accommodation facilities, restaurants, bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks, zoos, casinos, trekking, adventure activities, shopping malls, Destination tourism infrastructure like Human resources, safety measures at that place etc. (Jung *et al.*, 2016; Jung *et al.*, 2017). The customers can have comprehensive first-hand information, which allows them to determine the selection of the tourist destination spot. In the recent past, many companies have started to use Virtual reality technology in promoting destinations & hotel experiences. These technologies not only provide the information on all these factors, rather provide the first-hand customer experience, which motivates them to travel & experience the service (Van Kerrebroeck *et al.*, 2017).

Thus, Virtual reality technologies help the tourists in accessing the Natural resources, General Infrastructure facilities, Tourist infrastructure facilities, Destination tourism infrastructure, which further influence their purchase behavior & decision-making process.

4.3 Chatbots regulating destination tourism infrastructure & tourist infrastructure facilities

Chatbots are typically computer software machines, which are pre-programmed to answer the simple questions raised by the customers (Oh *et al.*, 2017). Customers after stepping

into the hotel rooms are loaded with numerous questions ranging from the destination tourism infrastructure to tourist infrastructure. Customers ask numerous questions to the chatbots like facilities in the hotel, lunch & dinner timings, items served during lunch, dinner, gym facilities, services available in the hotel, safety measures, etc. (Gajdošík and Marciš, 2019). Hence, Chatbots provide all the information related to Destination Infrastructure. In addition to that, chatbots also provide the information related to Tourist Infrastructure which includes nearby bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks, zoos, casinos, trekking, adventure activities, shopping malls, etc. (Boiano et al., 2019; Gajdošík and Marciš, 2019). Thus, Chatbots provide all the information related to the Destination tourism infrastructure & Tourist Infrastructure.

4.4 Robots regulating hospitality related facilities

Recent surveys report that "Smart hospitality" is expected to grow over 25 per cent by 2021. Robots surprise the customers by providing unexpected services, keeping the customers continuously engaged, thereby, creating a novel & pleasant experience in the minds of the customers. Robots in the hotel assist the customers by directing them to their hotel rooms, carrying the luggage to their room, maintaining house-keeping services, serving the food & snacks (Ivanov and Webster, 2019). Thus, Robots continuously enhance Customer engagement & Customer experience by providing novel services providing assistance in the hospitality facilities (Sharma, 2016).

4.5 Google maps regulating general infrastructure & tourist infrastructure facilities

AI technology present in Google Maps uses GPS to provide information on the General Infrastructure facilities like Road, Public & private transport. AI technology used in vehicles these days uses GPS to provide information about road accidents, traffic jams & plans the shortest or alternate route that can escape the traffic jam. The newer version VPS would even provide the details about the nearby shops, companies, hotels, malls, cinema theatres, restaurants, canteens, recreational zones, etc., thereby providing the Location-based experiences (Anup et al., 2017; Xiao et al., 2018). Thus, the AI technology used in the Google Maps provides the information on the Tourist Infrastructure which includes nearby Hotel & accommodation facilities, restaurants, bars, discotheques etc. (Hallo et al., 2012; Walder, 2013). Thus, Google Maps helps tourists in accessing General Infrastructure & Tourist Infrastructure facilities.

4.6 Language translators regulating destination tourism infrastructure

Language Translators would help out the Tourists to communicate with the local residents in their local language (Azis et al., 2011). These language translators would replace a local guide, by translating the unfamiliar language into the familiar languages to the tourists & conveying the tourist messages to the local residents. Thereby, it acts as a key element in Destination tourism infrastructure replacing human resources (local guides) (Ma et al., 2000; Tatwany and Ouertani, 2017). Thus, Language Translators provide few facilities to the tourists that are included under the Destination tourism infrastructure.

4.7 Optimization services regulating tourist infrastructure

Optimization services that include cross-selling the products, optimizing the prices using the Maximum Likelihood algorithm, addresses the General Infrastructure facilities like Road, Public & private transport, by providing the optimum prices of the flights, cab services, etc. (Ropero, 2011). This optimization services provide numerous information on the optimum prices of the tourist infrastructure. It includes Hotel & accommodation facilities, restaurants, bars, discotheques, clubs, theme parks, entertainment & sports activities, water parks,

zoos, casinos, trekking, adventure activities, shopping malls, etc. (Kumar *et al.*, 2018; Song and Jiang, 2019). It provides the best available options to the customers by listing optimum prices. Thus, the Optimization Services provide few facilities that are included under tourist infrastructure.

5. Challenges for artificial intelligence in the tourism

Although the Artificial Intelligence is excelling rapidly, there is still a limitation of its usage by the illiterates (Reddy, 2006). These limitations have to be and will be surpassed as on when demanded with the innovative solutions coupled with the emerging technologies and updating policies. No matter what all areas AI replaces human efforts giving rise to the debate of AI replacing Human Intelligence, it is still to answer and resolve many unanswered questions in various segments of business. Despite the fact that "Artificial Intelligence" is providing monetary benefits by replacing employees & non-monetary benefits by providing a unique experience to the customers, it still cannot surpass human intelligence, as it is still an emerging area (Laurent *et al.*, 2015).

Another major challenge in the use of AI is the safety & security of data. This major concern in the application of AI in some of the crucial sectors like finance and military is a continuous challenge. For example, using the Blockchain technologies in Facial Recognition software ensures data safety & security; some countries are still reluctant to use the Facial recognition technology due to the privacy & data-security issues (Bowyer, 2004). Chatbots, hotels store the past purchase history, travel history which challenges the data privacy & security issues. It is a challenge to privacy & data security (Kannan and Bernoff, 2019).

A major problem with these software-controlled services is that a small malware attack can disrupt the software programs & the operations conducted by the service providers, which further leads to chaos. Though the AI technology is advanced & forward-looking, the small service providers cannot afford for these technologies, as it requires a huge investment (Murphy *et al.*, 2017).

Although Chatbots & Robots are able to replace the human workforce, the customers still rely on the human workforce, when it comes to queries that involve complexity. The machines like chatbots are only limited to answer simple questions. These technologies use the keywords in the questions to provide the answers. When there is an emergency & complex issue to be sorted out, the customers still rely on the human workforce (Lommatzsch, 2018).

6. Future applications of AI in travel & tourism

There are a lot of avenues and areas in the Travel & Tourism industry where there is a greater scope to apply AI for improved services. These may include unexpected and surprising ones. Artificial Intelligence technology can transform the entire hotel room into a desirable tourist spot. After entering the hotel room, the customers can select the option to transform their entire room into their favorite destination spot. By selecting such an option, the entire room is transformed into a virtual 3 D world that resembles their favorite destination spot. The customer can experience the 3 D view of their favorite destination spot inside the room (Wei, 2019).

Although there is a rejection of Facial Recognition technologies due to the issues of data privacy & Security, future AI technologies may solve such issues by incorporating more robust blockchain technologies that assure data privacy & security (Leong, 2019). In the future, we may see the Robots serving the hotel guests in directing them to their room, carrying their luggage, serving them food & snacks, housekeeping services, etc. This technology is currently used in a few hotels (Yang *et al.*, 2020).

In the future, the Visual Positioning System (VPS) may take over the Global Positioning System (GPS). VPS is an advanced technology that provides the live view of the real world & visual landmarks in front of the travelers in the form of shops, companies, hotels, malls, cinema theatres, restaurants, canteens, recreational zones, etc., thereby providing the Location-based experiences. There might be many more untouched and unexpected points related to service and customer touchpoints, where AI may be applied in the future.

7. Conclusion

With every passing day, the presence of Artificial intelligence in the tourism scene is increasing. Due to the widening application of innovative technology, it is expected that the tourism industry will reach unimaginable heights in the future. As per a recent research study, the global travel technology market, which encompasses Artificial Intelligence, is expected to grow by more than 9 per cent during the period 2010 and 2023. One of the main factors for the expected growth is the prosperous performance of the travel and tourism industry. But the application of innovative and novel technologies such as Artificial Intelligence, and Machine Learning will bring about significant changes at the industrial level. The technological factors can mold the industry landscape and the processes that are conducted by tourism businesses. According to an article by Forbes, due to the rise in the overall application of AI in the travel and tourism industry, many new jobs will be created. It is believed that between 2018 and 2022, the aviation industry and the tourism industry will see a high level of retraining so that human factors can adapt to the evolving technological infrastructure. It is expected that almost 58 million new jobs will be created by the year 2022. Such a scheduled change could help to deal with the existing unemployment problem.

In the technology-driven times, the rise in the AI footprint in the tourism industry is a good sign. This is because it indicates that the industry can make the optimum use of the latest technology to improve efficiency and productivity. The customers of the tourism industry will benefit due to the improved level of satisfaction. At the same time, the tourism business undertakings will be able to have better control over the processes. The business processes will be automated to a great extent, and the business operations and protocols will be streamlined in nature.

Even though the application of Artificial Intelligence technology will give rise to many benefits at the industry level, the organizational level as well as the customer level, it can also give rise to numerous challenges and complexities. For instance, introducing different types of AI in the business context of the tourism industry would not be an easy job. Business undertakings would need adequate financial resources to build a secure and robust technical infrastructure. The increase in the use of robots, chatbots, and other AI technologies would mean that the actual human interaction would be restricted in the tourism industry. This could have an adverse implication on the traveling and tourism experience of the end-users. The technology-driven approach could give rise to new, complex, and challenging technical issues that are not yet known. The marketers operating in the tourism industry would have to integrate technology seamlessly so that the technology would be easy to use, and at the same time, it would be beneficial for all the stakeholders. Such a process could be quite lengthy as the Artificial Intelligence technology is still in an early stage.

The Artificial Intelligence concept is quite new and very powerful. There is a need to carry out more research studies on the AI concept as well as its application in the industrial tourism setting. Additional studies will shed light on the complexities that might arise before business undertakings in the tourism industry due to the application of AI technology (Dirican, 2015). Many technical experts have been skeptical of AI such as Stephen Hawking. So it is necessary to carry out a holistic assessment if the new and unique form of technology as its implications would be severe. The concept of robotics and Artificial

Intelligence could have a direct impact on the human factors that are currently functioning in the industry. Thus there is a need to conduct comprehensive research studies on AI in tourism so that the overall implication of the technology can be critically assessed. It will help to capture the positive as well as the negative impact on the technology on the industry, the businesses, and the customers.

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