

Tourist as a Smart Tourist: a review

Jorge Oliveira e Sá, Ana Margarida Rodrigues Cunha

(jos@dsi.uminho.pt, ORCID 0000-0003-4095-3431; a86067@alunos.uminho.pt)

Centro ALGORITMI, University of Minho, Guimarães, Portugal

Abstract

We are living in a digital age and people in their day-to-day use a huge number of technologies, implying a volume of information shared on the Internet, with social networks having an important role in this sharing. This technological growth comes along with the increase in the use of smartphones connected to the Internet. Therefore, people share and consume information on an ongoing basis.

One of the areas in which this sharing of information is relevant is Tourism. The comments/actions, conducted by the tourists, are useful for other tourists and for those who offer tourist services. Thus, the relevance that the sharing of information and communication between tourists has for Tourism is perceptible and that enables the growth of this industry. However, collecting data from tourists is still an arduous task, even though several platforms allow collecting data from tourists. However, most of this data is collected because the tourist decides to comment/share a tourist experience, allowing other tourists who take advantage of this knowledge to plan their next visit.

This chapter aims to see the tourist as a Smart Tourist, exploring concepts such as Human-as-a-Sensor, but going beyond collecting comments/actions. The concept of Human-as-a-Sensor allows humans to collect information, and from this concept, it is possible for the emergence of the concept Tourist-as-a-Sensor. The concept of Tourist-as-a-Sensor allows us to see tourists as information generators, thus turning them into Smart Tourists. *In this sense, it will be important to know a little more about the current tourism and the tourists themselves, thus it will be fundamental to explore concepts such as Tourists' Behaviors and Smart Tourism. To understand what motivates humans to share information and what already exists in this field, the concept of Gamification will be addressed. Then it will be explored what already exists in the concept of Smart Tourism and the initiatives created in this sector, some cities highlighted by their Smart Tourism initiatives will be exposed. Finally, a proposal will be presented based on the concept of the Smart Tourist as a human-as-a-sensor that integrates the technologies mentioned throughout the chapter and the knowledge acquired based on it.*

1. Introduction

We are living in a digital age and people in their day-to-day use a huge number of technologies, implying a volume of information shared on the Internet, with social networks having an important role in this sharing. This technological growth comes along with the increase in the use of smartphones connected to the Internet, in other terms, it comes in a context in which the sharing of information in society has progressed substantially.

One of the areas in which this sharing of information is relevant is Tourism. The comments/shares, conducted by peers, i.e., by other tourists, are also useful for those who offer tourist services. Especially in today's tourism industry which is made up of companies that are purposefully engaged in the joint coordination of their activities to serve tourists. The coordination of activities is the central issue, which points to the importance of an analysis of the stakeholders and their

interactions (Pencarelli, 2020). Thus, the relevance that the sharing of information and communication between tourists has for Tourism is perceptible and that enables the growth of this industry. However, collecting data from tourists is still an arduous task, even though several platforms allow collecting data from tourists, namely TripAdvisor, Trivago, Momondo, Kayak, Youtube, GoogleMaps, GooglePhotos, Facebook, Instagram, Twitter, and The Fork, among others. However, most of this data is collected because the tourist decides to comment/share an experience, for example when visiting a restaurant, hotel, local accommodation, or tourist activity, among others. This enables other tourists who take advantage of this knowledge to plan their next tourist visits and then consume these comments/shares. Currently, given the existence of several travel platforms, many tourists use them as an aid in their travel decisions and to define the places to visit, seeking the opinions of other tourists.

The approach in this chapter aims to see the tourist as an intelligent tourist, for this, throughout the chapter we will address issues such as the Human as a Sensor. This is one of the many concepts that allows the tourist to be seen as a Smart Tourist since this concept sees the human being as a source of data. Integrating tourism with this concept gives rise to the concept of the tourist as a sensor, i.e. the tourist as something capable of generating data that will be useful for the sectors related to tourism. Thus, throughout the chapter, we will address issues and technologies that will allow us to propose a solution to better manage the flow of tourists benefiting the entities that benefit from tourism. The goal of this chapter is to propose a solution that will be able to collect dynamic tourist information with a high spatial and temporal resolution, acquiring the necessary data from the human beings themselves and with their consent, allowing any tourist in a city to be considered an intelligent tourist through this solution.

To build the solution, it will be essential to know tourism and understand tourists and what they are looking for when they visit a city. At the same time, it will be necessary to understand what currently exists in the field of Smart Tourism and how tourists can be motivated to share data about their routes when they visit a given city. Thus, in addition to studying technologies such as Gamification, it will be important to understand how Smart Tourism is currently processed and what initiatives exist in this ambit, so that the suggested proposal fits what is expected of these initiatives.

2. Tourist Behavior

To understand tourism and how to act to provide a better service to tourists, it is important to understand the behavior of tourists. If we know tourists, we will understand what they are looking for when they visit a city and it will be possible to understand which mechanisms adapt to their needs, allowing better management of the tourists themselves.

However, there is no single, accepted model that explains the behavior of all tourists. There are several types of tourists with very different motivations and, therefore, it is practically impracticable to create a single paradigm capable of understanding the behavior of different tourists (Gražulis, 2015). However, some authors have tried to form models that could be useful in this sense, namely

that the decision process to purchase a tourist package has some special characteristics when compared to other types of purchases (Moutinho, 1987; Moutinho & Vargas-Sánchez, 2018). One of the characteristics of the tourism sector is that any investment made is to obtain tourist satisfaction as a return and, on the other hand, it is important to bear in mind that tourists are becoming increasingly experienced, flexible, and with more resources, making them more demanding consumers (Griffiths, 2012).

To study the behavior of tourists it is necessary to understand all the factors that affect their satisfaction, such as the motivation of each tourist, the tourists' state of mind, and factors generated by economic and social changes. These latter factors include, for example, the rising price of energy, new communication possibilities, education opportunities, and so on. In addition to these, there are also environmental or social effects, such as the role of the family, the role of other groups of people, the role of social status, and the role of culture.

Based on several existing studies related to tourist behavior, nine key concepts for tourist behavior were identified (Juvan, Omerzel & Maravić, 2017):

- Decision making: understanding how tourists make decisions when choosing what they want to do;
- Marketing: understand how tourists are influenced by product categories, brands, and attributes;
- Motivation: understand how tourists are attracted by marketing in terms of product segmentation, advertising, and positioning;
- Self-concept: understand how the tourist's personality influences the selection of destinations and travel intentions;
- Expectation: understand which tourists' expectations may not be met, be met, or even exceeded, this allows for assessing the tourist experience;
- Attitude: an understanding or measuring the tourist's attitude towards the services, destinations, and trademarks of tourism providers is a challenge, as it is also essential to consider the tourist's mood and emotions at the time of measurement;
- Perception: understand how the tourist perceives risk, and security, including the perception of crime, the perception of terrorism, or epidemics of certain diseases;
- Satisfaction: understand how the tourist evaluates the purchase as a whole or the individual elements of the purchase;
- Trust and loyalty: realize vertical loyalty, i.e. tourists can be loyal to suppliers of tourism products from several tourism sectors at the same time; horizontal loyalty, i.e. tourists can be loyal to several suppliers of the same tourism products; and experiential loyalty, i.e. tourists may be loyal to a particular form of travel.

The study of tourist behavior around the world is extensive, however inconclusive, in the sense that, as mentioned above, there is no consensus.

Understanding tourist behavior is a challenge, as there are numerous variants that condition tourists' behavior and, therefore, the design of a single model that allows knowing and classifying tourists based on their behavior becomes considerably arduous.

3. Smart Tourism

The emergence of smart devices connected to the Internet has brought a set of communication mechanisms and sensors capable of collecting positioning, movement, photos, sending messages, etc., and sharing them immediately with other devices. Consequently, it is possible to agree that the conditions exist for everything to be digitally connected, thus allowing, for example, opinions to be shared, to be read, and to be commented on almost immediately.

Smart Cities are a concept emerging with the evolution of technology where communication is centered on the Internet, mobile services, wireless sensory networks, smart technologies, and IoT. However, the key elements of a Smart City are the proactivity of citizens and the ability to generate new links between them and city administrations. This means that Smart City proposes the integration of advanced tools and technologies in solving social problems, providing solutions that generate a better opportunity to deal with some obstacles (Tripathy et al., 2018).

Smart Cities have at their core a highly capable ICT system connected to sensor networks and wireless broadband connectivity, and advanced data analytics that lay the foundation for the development of intelligent applications and services applications and services for citizens. However, there is a major obstacle in the use of IoT that is essentially due to the current lack of fully defined standards for IoT architectures. Thus, the key requirements for their use in a Smart Cities scenario become quite difficult to define (Nitti et al., 2017).

The concept of Smart Cities encompasses Smart Tourism, which integrates the sharing of information and communication between tourists, generated by the Internet, and which has a major impact on the tourism industry. Thus, from the combination of ICT and tourism comes Smart Tourism. In other words, Smart Tourism is any service that can be used by tourists to automate tourism-related tasks based on the Internet of Things (IoT).

The adoption of IoT-related technologies by the tourism sector will bring improvements in performance and the way business processes are currently designed. In this way, IoT could provide new ways of doing business for the tourism sector, making it possible for the industry to benefit from investing in this type of technology (Tripathy et al., 2018). Figure 1 illustrates some of the advantages that result from the introduction of the Internet of Things in a city, advantages capable of improving the mobility of tourists, and mobility refers to the activity of tourists within cities:

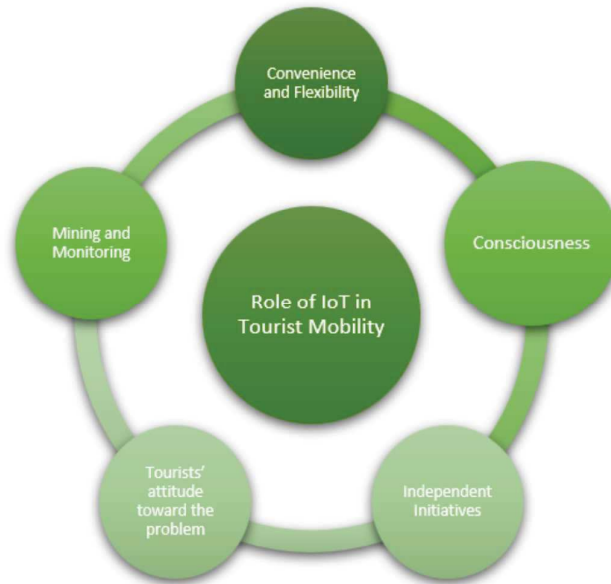


Figure 1- Role of IoT in Tourist Mobility

- **Convenience and Flexibility:** IoT can be used in a way that brings convenience and flexibility to the tourism domain. This technology can integrate and automate various tourism services making it easier and more convenient for tourists to use IoT-related services. In addition, any tourist will be able to communicate through IoT devices. Thus, IoT-based services and applications end up automating tasks and enabling communication sharing and, in this way, bringing new tourism features that facilitate tourism mobility and bring advantages to it.
- **Consciousness:** With the help of IoT, awareness of tourist mobility in Smart Cities and other tourist places can be improved. For example, information about hotels and tourist places can be integrated into a smart map. This smart map can be quite useful. This map will be able of assisting the various stakeholders with tourism and who may have real-time support capable of exploring all likely options as per their needs and thus making more related decisions.
- **Independent Initiatives:** IoT can help different stakeholders in collecting new ideas, it not only facilitates the investigation of initiatives and their adherence but also suggests initiatives to be evaluated.
- **Tourists' attitude towards the problem:** IoT solutions can help improve tourists' response to problems arising from tourism.
- **Mining and Monitoring:** government authorities and the entire tourism-related sector can use artificial intelligence and monitoring tools to make the system and their business processes more effective.

With the proliferation of devices such as smartphones and other smart devices, humans have come to be seen as sources of information, that is, the concept arises in which humans are seen and used as sensors – Human-as-a-Sensor (HaaS). This concept opens the door to new ways of solving recurring problems on the part of Smart Cities, allowing them to take advantage of the information

produced by these devices. On the other hand, humans can also benefit from the information shared by other humans. This phenomenon can also be seen when humans use social media since when this happens, they are acting as HaaS, providing real-time data and information about entities and events (Rahman et al., 2017).

The concept of HaaS assumes that it is humans who detect or report events. That is, instead of automated sensor systems we use humans to collect data (Rahman et al., 2017). The use of technology of this type has increased considerably in recent years (Rahman et al., 2017) and the concept of HaaS has been widely used and successful in detecting threats and adverse conditions in the physical space. Examples of this success include the diagnosis of noise pollution in a city and road traffic anomalies through social networks (Heartfield and Loukas, 2016).

The introduction of this idea of HaaS in tourism revolutionizes the entire industry since it is easily perceptible the importance that this real-time generated data has for this sector. Through them the tourism industry can make improvements in the market based on the collected data, adapting and improving their business processes according to the information obtained about tourists and their behavior. From this interconnection between the concept of Human as a Sensor and the Tourism sector a new concept emerges, the idea of a tourist being seen as a sensor, i.e., Tourist-as-a-Sensor (TaaS).

The large amount of data generated by TaaS when using social media, wired networks, and mobile devices has caused the tourism sector to start looking at collecting and analyzing this data. TaaS, allow generating more useful information for the tourism sector, information that allows the emergence of improvements in this sector. Thus, the tourist is now seen as a source of data.

This new vision allows Smart Tourism to collect data through TaaS and using ICT, bringing advantages to entities that provide tourist offers by changing, redesigning their business processes, improving their efficiency and effectiveness, providing increased profits, cost reduction, and improved functionality, greater productivity, and increased tourist satisfaction.

However, a question arises, how to convince tourists to be TaaS? A possible solution is the use of Gamification. This concept is analyzed in the next section.

4. Gamification

The concept of Gamification has become a common practice in several businesses (Kawanaka et al., 2020). Gamification comes from the word game and this technique consists in using game dynamics thinking to attract and retain audiences. Considering the power that games have over people and the way they can hold them and capture their attention, it is possible to realize the power that Gamification will have on human beings, and how can be useful in business (Alves, 2015).

Gamification can be seen as progressing through two primary developments (Mandujano et al, 2021):

- **Intentional Gamification:** Gamification is defined as an intentional process of transforming virtually any activity, system, service, product, or organizational structure into a process that provides positive experiences, skills, and practices similar to those found in games. This process is commonly but optionally done to facilitate changes in behavior or cognitive processes;
- **Emergent Gamification:** Gamification can be defined as a gradual and emergent, although unintended, cultural and social transformation arising from increased widespread engagement with games and playful interactions. The assumption is that through the increasingly pervasive role of games in human life, cultural and social practices will gradually become and transform into increasingly game-like practices, game communities, and gamer practices.

Associating Gamification with data collection, it is plausible to assume that it is fundamental, in the sense that classical forms of data collection on human behavior are time-consuming, expensive, and subject to a limited number of participants. This is how Gamification emerges, which is a technique capable of generating motivation to participate and provide information. Thus Gamification makes the whole process of data collection more attractive since it involves the existence of rewards and prizes for those who provide information. This technology provokes greater adherence by humans since they will feel more motivated to participate in the process (Dergousoff and Mandryk, 2015). Many well-known companies have already adopted this technique as a measure to increase customer engagement, gain customer loyalty improve employee performance, or gain competitive advantage. Despite the panoply of industries in which Gamification can be useful, the study will target the tourism industry (Negruşa et al., 2015).

According to United Nations World Tourism Organization, the mechanisms involved in Gamification are game mechanisms capable of creating positive experiences in tourism (Council, 2001) and providing tourists with both information and entertainment (Negruşa et al., 2015).

The Gamification market is evolving exponentially, this growth is due to companies becoming more aware of its benefits. This growth represents an important incentive for suppliers of Gamification solutions providers to increase the quality of their products and develop more efficient solutions. The best proof of this is the fact that, even if Gamification is less developed in tourism than in other sectors, there are already some producers and platforms in the market. The existence of a new generation of tourists eager to compete in the virtual environment for status recognition and incorporation rewards has generated a decline in the attractiveness of traditional loyalty programs based on the frequency of stay in the hotel chain or of serving dinners in a restaurant. Thus, international hotels and restaurant chains have introduced gaming mechanics in their loyalty programs.

The following examples are some of the most relevant in understanding this phenomenon: InterContinental Hotels and Starbucks (Negruşa et al., 2015):

- InterContinental Hotels Group added a daily online trivia game in 2011 to the group's loyalty program. The game enables participants to earn rewards (free miles) based on quick and correct answers related to travel destinations. Marketers noted that this Win It in a Minute program determined the attractiveness among younger consumers, a group that usually did not loyal to the brand.
- Starbucks recently began implementing quick response codes as part of its mobile Gamification strategy for new product promotions. By scanning a product's QR code, consumers are directed to the company's website where they can find information about its products, newsletters, coupons, customer service, and other similar benefits. To intensify interaction with consumers, the mobile website is linked to social media outlets. A connection to Facebook is used to create a social platform for consumers to interact and comment on likes and dislikes. From the company's perspective, the accessibility via QR code ensures an analytical database (e.g, time of day, gender, location) that can be taken into consideration in future marketing campaigns.

Through the previously described examples, it is possible to conclude that Gamification, when implemented properly, is effective in building customer loyalty. The fact that there are more loyal customers will generate a greater frequency of consumption by these customers. Consequently, there will be greater brand awareness or the development of new products (Negruşa et al., 2015). In this way, the adoption of Gamification by establishments that benefit from tourism could translate into numerous advantages for these entities. Considering this assumption, the city of Breda uses Gamification as a way for tourists to use the *Breda City App*. In the case of this city, we realize how Gamification can be useful not only in establishments but also in large cities to collect data from tourists visiting the city. Breda is a city in the Netherlands, notable for its accessibility, the city won an award for its accessibility especially because it cares about tourism and the tourists it receives, and for this reason, it creates initiatives that aim to satisfy the needs of any visitor. The platform created by the city *Breda City App* presents interesting upcoming events that the city will have, and it is possible to filter these events by considering the tastes and preferences of each tourist. This application provides hotels, restaurants, and venues to visit, city news, and shopping areas and allows you to easily find the best stores, tourist routes, museums, and theatres. All this in a fast and effective accessible app. The application also provides photos of the city's festivals so that the visitor can see what they look like and feel more intimate with the city. However, what stands out in this application is the use of Gamification to captivate the tourist to use it. The data provided by tourists provide the city with efficient management of tourist flows in certain areas of the city. With this data they will be able to understand which areas are the busiest and least busy, thus focusing on improving the areas with less demand and making better management of the territory. Thus, it is perceptible the importance that this data has for the city. To ensure that the tourists share this data, the city of Breda introduced Gamification in its application *Breda City App*. The application offers points that are accumulated and can be reversed in discounts on events, museum tickets, and tourist attractions in the city. These points are achieved by completing routes around the city that pass-through tourist points, shopping areas, and special places in Breda.

The use of Gamification in the city of Breda encourages tourists to use an application, i.e. to become a TaaS, where they share information about their routes, this data sharing allows them to know the flow of tourists. In this way, it will be possible to manage more efficiently tourism, the tourist points, and all the entities that benefit from tourism in the city.

Reinforcing this idea, Gamification was identified in tourism as one of the futures of this industry, since it is appealing to all ages. Currently, as it was possible to see in the previous example, there are already tourism applications that involve Gamification, and these can be divided essentially into two branches (Bartoli et al., 2018):

- Games that prepare the tourist for the visit.
- Location-based mobile games, where the user plays while visiting.

Regarding the first type of game, its main objective is to provide information to the tourist to promote the place of the visit. In turn, the second type of game aims to encourage greater involvement with the place so that the exploration is more immersive (Xu et al., 2016). The smartphone games based on location are essentially connected with the principles of the treasure hunt classic, where users must collect context information and at the same time simultaneously explore the location in search of points of interest. To increase engagement (Leorke, 2019) and the connection between the real and virtual environments (Yovcheva et al., 2014), location-based games quite often use augmented reality. Since it allows one to visualize through the screen virtual content in a real environment. There are five main patterns in the design of these applications involving Gamification (Subhash et al., 2018):

- Badges and levels;
- Game design patterns and mechanics such as time constraints, limited resources, and turns;
- Principles of game design and heuristics such as enduring play, well-defined goals, and diverse play styles;
- Game models such as challenge, fantasy, and curiosity;
- Game design methods such as play, test, a game-centered design, and a values-conscious game design.

5. Smart Tourism Cities

Since 2018, the European Commission, based on a preparatory action proposed by the European Parliament, has designed an initiative that rewards European capitals for Smart Tourism. A given city is only rewarded if it considers the various parts of the city, the tourists, and the common well-being between the two, that means, the harmony between the city and the tourists in such a way that both benefit. The city must also fulfill a series of requirements and therefore take into consideration four fundamental concepts that we can see in Figure 2.

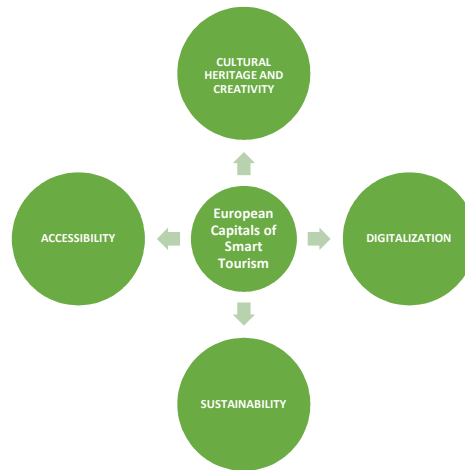


Figure 2 - Fundamental Concepts of European Capitals of Smart Tourism

Regarding accessibility, it is important to consider if the city is accessible for everyone, if the streets, the beach, the infrastructure, etc. are accessible. In this context, it is also important to understand if the information about the city is accessible.

Sustainability is important to consider the fight and adaptation to climate change, if the city preserves the environment and if they try to make good management of tourist flows.

Addressing digitalization, it is fundamental to understand if the information is available for the target groups, if there is a good collection of information for more effective management, and if there is physical and psychological accessibility through innovation.

Regarding cultural heritage and creativity, it is important to understand if the city is reviving traditions and cultural heritage sustainably and if they are using the cultural heritage of the city creatively.

Below it is possible to see some of the awarded cities and the reasons that lead to their recognition in Smart Tourism.

One of the awarded cities was Valencia, this city is the third largest city in Spain and was one of the winning cities in 2022. Valencia receives a certain 2.2 million visitors every year and holds three UNESCO World Heritage declarations. This Spanish city has developed innovative tourism practices and several platforms that involve tourism and require the participation of tourists, these platforms are presented below:

- AppValencia: This platform was developed by the City Council of Valencia and aims to be a communication channel between the citizens/tourists and the administration. AppValencia is dynamic, accessible, and easy to interact with, making it possible to analyze and obtain information about its users. The application has two distinct parts, one for tourists and the other for citizens of the city, so when the user starts using it, he/she is approached to understand if he/she is a tourist or a citizen of the city of Valencia, so that

can be redirected to the corresponding section of the application. In the section directed to the tourist, it is possible to obtain various information that can be useful to the tourist, such as how to get around the city. The application provides explanations regarding available bicycles along with the city, cut-through streets, availability of parking spaces, real-time traffic status, or extension of the bicycle network. In addition to issues related to tourist mobility, the application has other relevant features for tourists in Valencia, such as where to find the nearest libraries and museums or get information about a large monumental area. In this way, it is possible to understand that this application has varied functionalities and concentrates all the necessary and useful information in a single space for a tourist in the city.

- VLCTurism: A very intuitive application that gathers in a single space all the information for a tourist in the city. This application has several features and provides diversified information to tourists. Thus, its tourists can, for example, see the main sights of the city, view information about events and activities that will take place, or even have access to maps and guided tours. The application also has a recommendation system in which it suggests restaurants of the most varied tastes to tourists. In addition, it is also possible for the user to analyze various itineraries according to the interests that the user has in the city, i.e., the user has access to several itineraries with different purposes and characteristics, so the user can choose an itinerary that best suits the desired trip and the conditions of that trip. This application also offers an area where it is possible to explore the city, where the various museums, hotels, monuments, restaurants, and cabs, among others, are presented. Another feature of the application VLCTurism is the option that tourists have to buy economic cards to visit various establishments at a more affordable price, in other words, only with the cost of the card has the opportunity to visit several monuments of the city and may even be included in the transport.
- Touristphone Valencia: This application allows that only with the cell phone the tourist can take guided tours of the city in a personalized way. A Touristphone Valencia has a feature that allows tourists to receive a notification on their smartphone when they pass by a certain place with a brief description of the place and its history. Through this application, it is also possible to see the various establishments, monuments, and museums available.
- València Travel Guide: This application presents several features to improve the well-being of tourists. Valencia Travel Guide is completely free and supported in over 14 languages. Through the application, it is possible to plan a trip with the best activities and the most highly rated tours, offered for the user to book immediately. This application presents the main attractions of Valencia and provides street maps and public transport means such as metro and bus views.

In 2020 Malaga was the winner of the European Smart Tourism Capital award, as the city has been bringing together the concepts of sustainability, innovation, and culture to meet the needs of tourists. In addition to the investments made by the city in accessibility issues and the improvement of tourist attractions in recent years, the city offers an application called TurismoMalaga. This application has several pieces of news about the city, through which it is also possible to view the

events happening, monuments, hotels, and beaches, among others. The application in question is quite complete since it allows you to analyze all the information about the city, such as the weather. Besides that, it is also possible to see how to get to the city and all the information regarding the city's transport. In this application tourists have access to different guided tours that integrate the main points to visit in the city, it also has tips on what you can buy in each shopping center, the timetables of the establishments, the traditional foods of the city, and even the most visited restaurants.

Another of the winning cities of the European Smart Tourism Capitals 2020 was Gothenburg, the city tries to stay on top of digital trends in all digital initiatives, to achieve equal access for all, affordable technology, effective long-term planning, and promotion of public-private partnerships. The city stood out as it wanted to give access to innovation and technology, in this way the city paved the way for abundant 4G coverage, smart grids for traffic and electricity, accessible and open government data, future-oriented public transportation systems optimized for all citizens, and platforms dedicated to environmental protection. Gothenburg, not a major world tourism city, is committed to Smart Tourism to become an expert in building capacity from effective partnerships. The seaside city works together with a wide variety of stakeholders and sectors to implement a truly integrated approach to Smart Tourism. Gothenburg has an app where live news from the city is available, and a variety of tourist guides on what to see in the city, including restaurants, hotels, museums, outdoor spaces, stores to buy, tourist attractions, and events related to culture and entertainment. The application also provides a city map to help the tourist move around the city and important information for those visiting the city about transportation, lodging, Internet, and public bathrooms, among others.

Helsinki was the winner of the award in 2019 and is a modern city with a booming smart tourism industry. Helsinki is a destination that blends high-tech and sustainable design with art and culture. Helsinki Travel Guide is the app for tourists of the capital city of Finland, where to enter the application is necessary user authentication with Facebook, Google, or even registration where it is necessary to enter one's data. The application is very attractive with information about the city, about hotels, and through which users can be redirected to the hotel's page if they click on it to find out more information. It is possible to see beautiful images of the city, from the perspective of a tourist, the application offers several options of what to do in one day, two, or even three days in the city. Furthermore, the app provides all the information about the city, such as its history, information on the city's nightlife, what to eat, traditions, what to buy, how to get around the city, information about transportation, and several other points.

Finally, the city discussed will be Copenhagen, the capital of Denmark. This city did not receive the European Smart Tourism Capital Award, however, it was recognized for digitalization. This recognition is due to the Copenhagen Travel Guide application. The Copenhagen Travel Guide offers a complete travel guide for tourists with only your cell phone needed, the travel guide is designed to be used offline without the need for an Internet connection, it provides an augmented reality view where you can see on the screen in 360 degrees the best points of the city, such as bus stops, how to find the best attractions, restaurants, bars, theater, museums, hotels and several

other points of interest. The application also offers a GPS feature. The application can provide information on various sights and attractions in the city such as information on the history and culture of the city, safety tips in the city, tips and advice to travelers, information on how to get to the city, how to get around, where to shop, busiest nights out in the city, budget hotels and restaurants, popular places, and more.

Some of the examples described above show us how some cities have responded to this technological change in the tourism industry and how they have managed to introduce Smart Tourism in their cities. The study of these cities and their initiatives was fundamental to understanding what exists within the scope of Smart Tourism initiatives, which best practices are implemented, and the main gaps.

6. Discussion

The previously mentioned award-winning cities, referred to as European Smart Tourism Capitals, integrate applications that despite offering benefits to the tourist do not contain a bi-directional relationship between the tourist and the city. That is, the tourist receives information about the city in most of them, but there is no sharing of information with other tourists or provision of opinion from tourists in almost any of the examples provided. There is a lack of interaction between the tourist and the city.

Thus, the proposal that solves this problem would be an application that involves the technologies mentioned above and that involves and interconnects tourists with other tourists and with the city itself, sharing information among all. The solution is based on an application that tourists could install that contains information about the city and the possible touristic routes that could be taken in it. Tourists would select the route they wanted based on their preferences, and after selecting it they would be redirected to a live view map. This map would have integrated virtual reality tools and at each point of the routes the tourists would have to capture an object to signal that they were in that place, and if they wanted, they could also give information about that place. When they captured the virtual object, an explanation about the place where they were would appear and the tourists would receive points, in the same way, that if they gave their opinion about the place, they would also receive points. These points would translate into achievements that offered discounts in restaurants, hotels, and museums, among others. The opinion provided by the tourists not only provides points but also serves as information for future tourists. Once in the application, there will be a section where tourists can see other tourists' opinions about the places they visit.

In this way, we realize that the application contains information not only provided by the city but also information provided by other tourists, moreover, it will gather in a single space everything that tourists need to visit the city. Besides this issue, due to the introduction of gamification, tourists will feel motivated to use the application. However, this application will be beneficial not only for tourists. The city itself and the entities that are linked to tourism will benefit as well since they will have information regarding the flow of tourists and their opinions, and in this way, they will be able to make better decisions in that ambit.

7. Conclusions

Tourists can be seen as a source of Smart Tourism. IoT concepts such as HaaS as well as TaaS frame tourists as producers of data as well as consumers. In this way, tourists can be seen as Smart Tourists.

However, there is a difficulty in motivating tourists to share their data, a concept to consider is Gamification. The use of this concept makes it possible for the tourist to be motivated to provide information, in this way it is possible to introduce the idea of an Intelligent Tourist as a tourist who voluntarily provides data and benefits from the data that other tourists have shared. This idea revolutionizes the entire industry, as it is easy to see the importance of this real-time generated data for this industry.

Good use of this data by the tourism industry can make improvements in the market based on the data collected, adapting and improving its business processes according to the information obtained about tourists and their behavior.

It was concluded that it is important to integrate these concepts of HaaS and TaaS to reach a level of Smart Tourism, particularly in cities that intend to innovate and become Smart Cities.

References

- Alves, F. (2015). *Gamification: como criar experiências de aprendizagem engajadoras* [ISBN: 9788582890882]. DVS editora.
- Bartoli, E., Elmi, B., Pascuzzi, D. & Smorti, A. (2018). Gamification in tourism. *Psychology& Behavioral Science*, 8(3), 93–95. <https://doi.org/10.19080/PBSIJ.2018.08.555740>
- Council, W. T. O. B. (2001). *E-business for Tourism: Practical Guidelines for Tourism Destinations and Businesses*. <https://pub.unwto.org/WebRoot/Store/Shops/Infoshop/Products/1210/1210-1.pdf> (Last accessed on: 21.01.2022)
- Dergousoff, K. & Mandryk, R. L. (2015). Mobile gamification for crowdsourcing data collection: Leveraging the freemium model. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, 1065–1074. <https://doi.org/10.1145/2702123.2702296>
- Gražulis, V. (2015). A systematic approach to personal travel motives (theoretical construct). *Human Resources Management & Ergonomics*, 9(2).
- Griffiths, C. (2012). The Role of Motivation within Tourism Behaviour and its effect on the Consumer Decision Making Process. Accessed in 19 January 2022, URL: <https://cag2611.wordpress.com/2013/11/04/the-role-of-motivation-within-tourism-behaviour-and-its-effect-on-the-consumer-decision-making-process/>
- Heartfield, R. & Loukas, G. (2016). Evaluating the reliability of users as human sensors of social media security threats. *2016 International Conference On Cyber Situational Awareness, Data Analytics And Assessment (CyberSA)*, 1–7. <https://doi.org/10.1109/CyberSA.2016.7503282>
- Juvan, E., Omerzel, D. G., & Maravić, M. U. (2017). Tourist Behaviour: An overview of models to date. In *Management International Conference* (pp. 24-27).

- Kawanaka, S., Matsuda, Y., Suwa, H., Fujimoto, M., Arakawa, Y. & Yasumoto, K. (2020). Gamified participatory sensing in tourism: An experimental study of the effects on tourist behavior and satisfaction. *Smart Cities*, 3(3), 736–757. <https://doi.org/10.3390/smartcities3030037>
- Leorke, D. (2019). Location-Based Gaming's Second Phase (2008–Present). In *Location-Based Gaming* (pp. 85-126). Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-13-0683-9_4
- Mandujano, G. G., Quist, J., & Hamari, J. (2021). Gamification of backcasting for sustainability: The development of the gameful backcasting framework (GAMEBACK). *Journal of Cleaner Production*, 302, 126609. <https://doi.org/10.1016/j.jclepro.2021.126609>
- Moutinho, L.(1987). Consumer Behaviour in Tourism. *European Journal of Marketing*, Vol. 21 No. 10, pp. 5-44. <https://doi.org/10.1108/EUM00000000004718>
- Moutinho, L. & Vargas-Sánchez, A. (Ed.). (2018). *Strategic Management in Tourism*. 3rd Edition, Cabi Tourism Texts. ISBN: 9781786390257.
- Negrușă, A. L., Toader, V., Sofică, A., Tutunea, M. F., & Rus, R. V. (2015). Exploring Gamification Techniques and Applications for Sustainable Tourism. *Sustainability* 2015, 7(8), Pages 11160-11189, <https://doi.org/10.3390/SU70811160>
- Nitti, M., Pilloni, V., Giusto, D. & Popescu, V. (2017). IoT Architecture for a sustainable tourism application in a smart city environment. *Mobile Information Systems*, <https://doi.org/10.1155/2017/9201640>
- Pencarelli, T. (2020). The digital revolution in the travel and tourism industry. *Information Technology & Tourism*, 22(3), 455-476.
- Rahman, S. S., Heartfield, R., Oliff, W., Loukas, G. & Filippopolitis, A. (2017). Assessing the cyber-trustworthiness of human-as-a-sensor reports from mobile devices [ISBN: 9781509057566]. 2017 IEEE 15th International Conference on Software Engineering Research, Management and Applications (SERA), 387–394. <https://doi.org/10.1109/SERA.2017.7965756>
- Subhash, S., & Cudney, E. A. (2018). Gamified learning in higher education: A systematic review of the literature. *Computers in human behavior*, 87, 192-206. <https://doi.org/10.1016/j.chb.2018.05.028>
- Tripathy, A. K., Tripathy, P. K., Ray, N. K. & Mohanty, S. P. (2018). iTour: The future of smart tourism: An IoT framework for the independent mobility of tourists in smart cities. *IEEE consumer electronics magazine*, 7(3), 32–37. <https://doi.org/10.1109/CEM.2018.2654444>
- Yovcheva, Z., Buhalis, D., Gatzidis, C. & van Elzakker, C. P. (2014). Empirical evaluation of smartphone augmented reality browsers in an urban tourism destination context. *International Journal of Mobile Human Computer Interaction (IJMHCI)*, 6(2), 10–31. <https://doi.org/10.4018/ijmhci.2014040102>