New Tendencies of Internet of Things in Smart Cities a Review

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Abstract

Humanity is heading towards a reality in which each device will end up being connected to the internet and, with it, to other objects with which it will be able to communicate, which affects the application in cities to make them smart. This communication will take place through various means such as WiFi, bluetooth or the famous 5G.

It can be said that this trend of the Internet of Things also implies machine to machine (M2M) communication. We can ensure that Internet connections will become more and more frequent between machines, making it possible for millions of chips to communicate the data they record. This paper aims to carry out a study on the new trends and applications of the Internet of Things in cities and smart tourism.

Keywords: Smart cities, Internet of Things, sustainable cities, smart destinations

1 Introduction

We are heading towards a reality in which each device will end up being connected to the internet and, with it, to other objects with which it can communicate. This communication will be carried out through various means such as Wi-Fi, Bluetooth or the famous 5G. This trend of the internet of things also implies machine to machine (M2M) communication. We can ensure that Internet connections will become more and more frequent between machines, making it possible for millions of chips to communicate the data they record.

The Internet of Things or IoT, refers to all the electronic objects or sensors that are used in everyday life and that are interconnected with each other in real time. The connection of these objects or sensors provides a large amount of data that can be evaluated in interpretation and analysis centers to subsequently carry out different actions. The actions that will be carried out with this data will depend on the specific needs of the environment or the people involved (Cerem, 2023).

The analysis of all the information offered by big data allows us from predicting actions to executing smart city models, building a sustainable and efficient population system. Here it is important to mention that the main source of information collection (data) comes from geolocation applications that study the social trends of everyone.

Smart City is the holistic vision of a city that applies ICT to improve the quality of life and accessibility of its inhabitants and ensures sustainable economic, social, and environmental development in permanent improvement.

A smart city allows citizens to interact with it in a multidisciplinary way and adapts in real time to their needs, efficiently in terms of quality and costs, offering open data, solutions and services aimed at citizens as people, to resolve the effects of growth of cities, in public and private spheres, through the innovative integration of infrastructures with intelligent management systems (CTN178, 2023). Due to the large amount of information generated in recent years in the tourism sector, several studies indicate that the opportunities that are opening are enormous. We can understand the advantages of Big Data in tourism with the figure from the Minerva Travel study carried out by Google Spain, where it indicates that "more than 75% of travel searches are made online, (Ostelea, 2022).

In other words, tourism will be one of the sectors that will have the greatest impact from Big Data, and in which it is important and fundamental to have the necessary strategies to face it and obtain benefits from it.

Today's traveler seeks a personalized, integrated, and continuous experience, supported by recommendations, values and motivations expressed spontaneously on the Internet.

Define, analyze, consult and leave your digital footprint on official and unofficial websites your personal preferences; Search social networks for the opinions of other travelers and acquaintances about your next destination; plan the itinerary of your visit from your computer; compare, book and pay for transportation and accommodation; and at the foot of the road, thanks to his mobile device, he builds a unique and unrepeatable story with photos and comments of what he sees, hears, feels and, in general, wants to share. Their experience thus becomes the reaffirmation of a unique identity and a vehicle for social recognition.

If we then know how to manage all this large volume of information, we will be able to understand what we do and what we are, and consequently identify almost exactly the tastes and preferences of consumers, and even more importantly, virtually anticipate their decisions to adapt in time Our services are real and personalized, that is, Big Data places us beyond facts and transforms our actions into predictions, (InvaTtur, 2022).

2 Metodology

We analyze big data as an actor within the general context and extrapolate this concept to the tourism sector and smart cities. Big Data is not exclusive to large organizations, due to the democratization of the use of technology, currently, even in medium-sized organizations, volumes and types of data are being collected and stored that require a processing speed that traditional systems do not offer.

According to (InvaTtur, 2022), There are nine ways to build confidence about Big Data, and they are: 1) *explore data*: that is, locate, visualize and understand the data for decision making, application; 2) *consolidation and retirement*: save old applications and rationalize the implementation start-up of new services through test digestion, integration and data quality models; 3) *360° approach:* improving customer service: where a true integrated approach is achieved from internal and external sources with structured and unstructured data; increased security and intelligence; 4) *increased security intelligence:* improves traditional security solutions by analyzing all types and sources of

data of interest; 5) *analysis of operations:* analyzes all kinds of automation to improve the evolution of the business; 6) *data warehouse augmentation:* integrates big data and data warehouse capabilities to increase operational efficiency, 7) *improved tool efficiencies:* manages information growth, improves performance and reduces the cost of dedicated tools to critical functions, 8) *efficient development and testing of applications:* creating and maintaining suitable growth and suitable test and learning environments, 9) *security and compliance:* protecting data, improving its integrity, mitigating risk and reducing costs compliance.

One of the main challenges of today's society is to solve the problems of the cities of the 21st century, which live immersed in different problems, according . But there are fundamentally two factors that have catalyzed the appearance of new urban management paradigms. On the one hand, the intensification of urbanization processes since the mid-20th century, which although they have the potential to make cities more prosperous, imply multidimensional changes for which they are not always prepared. Many of these cities follow unsustainable models, from different dimensions. Environmentally, the current model generates a low-density suburbanization that entails a higher energy expenditure and contributes to climate change.

In this context of socio-technological change, new urban planning and management approaches have emerged since the mid-1990s, among which the Intelligent City or Smart City approach stands out, (Caragliu & Pierce, 2017). This approach is characterized by a high degree of application of new technologies, which it considers key to obtaining an improvement in the quality of life, the social, economic, and environmental conditions of these urban areas, thanks to its implementation in the management of the infrastructures of the cities,(Guo, 2014).

On the other hand, (Celdrán-Bernabeu & Mazón, 2018), proposes an innovative data ecosystem in a tourist destination as shown in figure 1
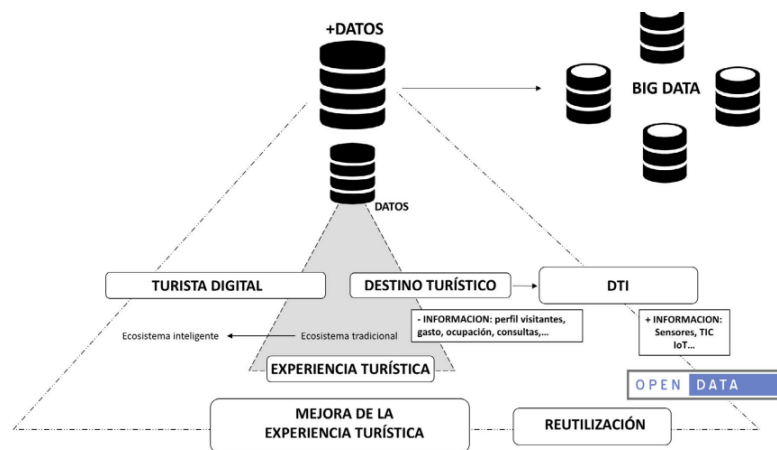

Fig: 1 Innovative data ecosystem in a destination (Celdrán-Bernabeu & Mazón, 2018)

The smart city approach has been transferred to the tourist environment by the hand of smart tourist destinations (DTI, hereinafter) or smart tourism destinations (Baggio, 2015), where it is especially interesting as it allows evolution towards planning based on the generation of knowledge and innovation, with a strong associated technological component (Huang, 2017).

Regarding this issue in particular, Spain is one of the countries that leads the development of DTI, which begins with the National and Comprehensive Tourism Plan (2012-2015), where a series of lines of work are designed for its formalization. , in collaboration with the Information Society to the

State Society for the Management of Innovation and Tourism Technologies, S.A. ,(SEGITTUR, 2023).

An interesting precedent about smart cities is found in California (USA). These are Smart Communities, defined as a geographical area of diverse size where its residents, organizations and government institutions use information technology to significantly transform their territories, through cooperation between government, business, educators, and the citizens; and technological improvements produce fundamental rather than incremental changes,(SanDiego City, 2023).

Although the European Union is fundamentally in favor of an approach based on ICTs applied to smart growth (Smart Growth), the concept of Smart City is not reduced to the availability and quality of infrastructures related to ICTs. How synthesize (Caragliu & Pierce, 2017), Other factors such as social capital, innovation or entrepreneurial capacity intervene in a concept that the mentioned authors still consider fuzzy, despite recognizing a series of basic characteristics attributable to the Smart City concept:

1. The use of a network of infrastructures to improve economic and political efficiency and allow social, cultural, and urban development. Therefore, connectivity is a key to the development model and a source of growth.

2. The premise based on development based on entrepreneurship and economics as the driving force of urban development.

3. An inclusive and socially inclusive type of development.

4. A crucial role for high-tech and creative industries (Florida, 2002), as well as for social and relational capital and the capacity to absorb innovation.

5. Sustainable development in all its dimensions (environmental, economic, and sociocultural)

There are various big data implementations in a sustainable smart city, thus there are several selected sectors illustrated in Figure 2, namely transportation, smart infrastructure, power grid, healthcare, and energy.
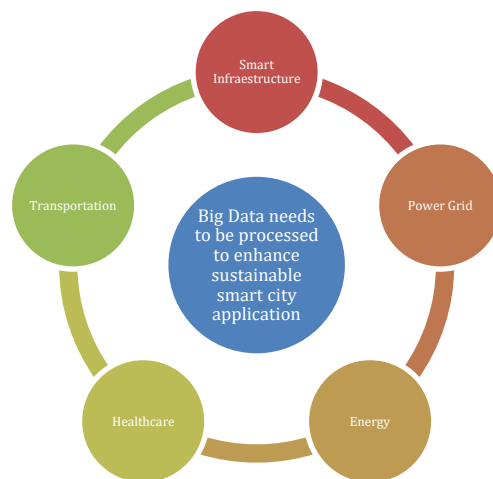

Fig: 2 Big Data and Smart cities sustainable -relationship

According to (Yuan, 2020), Nanjing, China, is an example of a city where sensors are installed in taxis, buses, and private cars. From these vehicles, data is sent in real time to the Nanjing Information Center to analyze traffic flow and routes. Elsewhere in Italy, the main rail operator, Trenitalia, used sensors on trains to provide real-time status alerts on mechanical conditions and maintenance forecasts for each train.

Meanwhile, in the Netherlands, it has always been at the forefront of being a bike-friendly country. Amsterdam (Amsterdamsmartcity, 2023), began its smart city initiatives when it used data analytics to improve urban life, using the information to develop more integrated services and a more sustainable community. One of the hundred pilot projects that Amsterdam has undertaken as improvements to its transport system is the distribution of garbage trucks. For example, different garbage trucks that used to separately collect waste and recyclables are now moving towards a single truck to collect both. This reduced the number of garbage trucks on the street.

In the Asian region, Malaysia, for example, aspires to integrate smart technology into public spaces. As an emerging nation, Malaysians face the problem of pollution, congestion and poor deployment of urban services. Addressing the issue of reliable digital communication, it seeks to improve digital communication by investing in 5G infrastructure. With the rise in the use of devices and the implementations of the Internet of Things, it is advisable to improve the digital communication infrastructure if a country wants to avoid bottlenecks in digital transactions., (Malasyan Government, 2023).

Among the applications of new technologies and their relationship with the common citizen are: *Smart Healthcare* or smart health technology combines smart technology and the latest mobile device with health. Smart devices act as the foundation of smart healthcare. It is smart in the sense that it not only monitors health but also deals with it at the right time. This is where the Internet of Things (IoT) such as sensors are used to collect patient data remotely.

In the area of Smart Energy, increasing urbanization, industrialization, and consumption comes with the addition of greater environmental challenges. Smart cities need to improve energy efficiency, not only to save money, but also to help the country achieve its net zero carbon emissions goals. To achieve the goals, holistic measures must be taken to master the transaction towards a low carbon economy to prevent the adverse effects of climate change at the global level. A smart energy system is the answer where the system integrates the flow of energy, the flow of information and the flow of business processes. Consequently, Big Data in smart energy systems is the combination of user description data, user behavior data, energy system data and data related to business systems.

(Giffinger, 2007), establish 6 fundamental characteristics of Smart Cities (Economy, Society, Governance, Mobility, Environment and Quality of Life), which are subdivided into 31 factors and 74 indicators, to establish a classification of a series of medium-sized European cities based on their relationship with the attributes of the Smart City.

Among the characteristics of smart cities that he mentions (Giffinger, 2007) are: a) Smart Economy (competitiveness), which includes: innovative spirit, entrepreneurship, economic image brands plus productivity, flexibility, international roots, ability to transform, b) Smart people (human and social capital), level of qualification affinity with lifelong learning, ethnic and social plurality, flexibility, creativity, open-mindedness, participation in public life), c) Smart Governance: implies participation in decision-making, public and social services, transparent governance, political perspectives and strategies, d) intelligent environment, Smart environment (natural resources), which considers, among other attractions, natural conditions, pollution, environmental protection, sustainable management of resources, e) Smart Mobility (transport and ICTs), considering local accessibility, international accessibility, availability of ICT infrastructure, innovative and safe sustainable transport system, f) Smart Living (Quality of life), cultural infrastructures, health conditions, individual security, quality of housing, educational infrastructures, tourist attraction, social cohesion.

Below we describe other Smart Cities projects that are being implemented around the world and that allow us to see the benefits of Smart cities:

1. The project to make Malaga a Smart City (Malaga Smart, 2023) is focused on energy management. The integration of renewable sources into the electricity grid has been chosen, with the aim of increasing efficiency and reducing carbon dioxide emissions. The intention is for this energy control system to also reach homes. State-of-the-art technologies in smart metering, communications and systems, grid automation, distributed generation and smart infrastructure are being deployed in the Malaga area of La Misericordia beach. vehicle loading. The objective is better energy management in the networks, efficient demand balances, and the involvement of all the agents of the electrical system, from generation to consumption. The installation of more than 17,000 smart meters has been carried out, and a sample of 50 of these users have energy efficiency solutions for the home. Emblematic buildings in the area have energy efficiency solutions installed at their headquarters, with which they can monitor their consumption and control some of their loads. Advanced automation systems have been installed in more than 20 transformation centers, and a total of 72 centers They are communicated thanks to a broadband PLC (PowerLine Communication) network, which connects any point of the electrical network to the network control center, where these assets will be monitored. The area has about 11 MW of renewable generation, which has been combined with two battery-based storage facilities to manage consumption more efficiently. Nearly 100 luminaires have been replaced by others with low-consumption technologies, such as LED and halide, and they are being managed thanks to a point-to-point control system. In addition, the project includes the installation of a small charging point infrastructure, where V2G (Vehicle to Grid) technology can be tested.

2. Barcelona (Info Barcelona, 2023) wants ICTs to become basic elements when it comes to executing various citizen services, such as mobility or administration. Endesa has already installed more than one million new telemeters in the city that allow customers to better understand and optimize consumption. The purpose of these systems is to facilitate and increase the ability to forecast and adapt consumption, leading to economic savings for the citizen and, in turn, a reduction in gas emissions. One of the city's improvement plans is the one that involves to the electric vehicle. In this sense, Barcelona has become a promoter of electric mobility through actions such as the creation of the first 'Endesa energy island'. This is the first fast charging point for electric vehicles in Spain, set up in a service station in the 22@ district of Barcelona. The Company also plans to start up new public lighting systems that are capable of uniting comfortable transit through urban roads, a significant reduction in light pollution and less use of energy resources. This will be achieved with the implementation of state-of-the-art LED technology such as that developed by the Enel Group.

3. According to Búzios (Brasil) Smart Cities, project (Ecointeligencia, 2023), The distribution network is being converted into a more intelligent network, with digital meters and automation capable of integrating all existing generation, new renewable energies, and electric vehicles. Among the benefits that the city will have are the possibility of applying differentiated rates according to the hours of consumption; the use of LED lamps in public lighting; a greater incentive to the energy efficiency of public building installations, allowing control of consumption by device in real time; a more efficient distribution network with automatic control systems, reducing the duration of supply interruption.

3 Conclusions

Smart infrastructure is a great opportunity for cities to improve the quality of life of residents, since the use of sensor data will improve city management, therefore, it helps cities in managing and monitoring the urban problems, such as transportation, waste disposal and saving resources.

To transform the infrastructure of a city into a smart city, three levels of process must be developed: a) the first level is to determine the technology-based devices, which implies a network of sensors and the connected devices that will be used to collect data quality. b) the use of intelligent applications, which includes the analysis of raw data and the determination of practical knowledge, c) Finally, the adequacy of the system by the residents of the community.

Smart traffic systems are essential in the ecosystem of a sustainable smart city, this includes smart street lighting systems and smart traffic lights that can help monitor, manage and respond to traffic conditions. These systems help reduce congestion and pollution levels by controlling traffic and improving incident response time through a real-time collaborative network.

A smart grid is a powerful 'manufactured' plant consisting of computer programming, digitization, automation, and control analysis, which realizes two-way communication between energy providers and consumers, enabling them to manage demand, protect the grid from distribution, save energy and reduce costs.

To establish an appropriate mechanism for the application of the Smart City approach, it is of vital importance to consider that this type of conception of Smart City is already a reality in large and medium-sized cities and, consequently, benefits tourism.

The adaptation of the Smart City principles to tourist destinations must be scalable, adapted to each context and the peculiarities of each tourist destination. However, a reference model is necessary to guide the application of these principles, duly adapted to the specificities of the destinations and the tourist activity.

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