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Addressing New Challenges in Smart Urban Planning using Information and Communication Technologies

Short tittle: Addressing New Challenges in Smart Urban Planning using ICT

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Abstract

Cities today face the challenge of achieving more participatory and inclusive urban planning. Information and Communication Technologies make it possible to have access to information on the preferences and real uses that citizens make of urban public space; activities that are not always those foreseen in the original planning of cities. This knowledge provides a new understanding of urban capabilities and opportunities that enables planning closer to citizens' needs and designing cities more intelligently and effectively. Thus, a new, more social urbanism, where the citizen is a participant and not a mere observer, is possible with the help of technology. This work studies the potential of geolocated data generated by citizens and retrieved from social networks of sport, which analysis has been possible with the support of the measurement and visualization tools offered by Geographic Information Systems accessible online, open access cartography available on the Internet, among other resources.

Keywords: Smart Urban Planning, Smart City, Information and Communication Technologies, Social Networks of Sport.

1. INTRODUCTION AND OBJECTIVES

The different models of urban development that have served for the progress of cities in response to their problems and needs have always, throughout history, reflected the evolution of societies and the state of science and technology. There is no doubt that the rapid evolution of Information and Communication Technologies and the advance of knowledge are factors that determine and characterize today's society (Laurini, 2017). And it is in this context of today's knowledge society and its technological environment that the smart city paradigm arises, as a reflection, as a model of urban development capable of responding to the problems of the cities of the 21st century, which is none other than achieving a balance between social, economic and environmental sustainability (Pérez-delHoyo & Mora, 2019).

This research is based on the smart city paradigm and has a fundamentally social focus. It is developed in the political framework of the 2030 Agenda of the United Nations for Sustainable Development (UN, 2015), in particular to contribute to the achievement of Sustainable Development Goal 11 and, specifically, target 11.3: enhance inclusive and sustainable urbanization and the capacity for participatory, integrated and sustainable planning and management of cities.

It is clear that to achieve this target, Information and Communication Technologies have much to offer, enabling the development of people-centred methodologies to improve the planning and management of cities, so that it becomes more participatory and inclusive. But in this research, people - citizens - are not conceived as mere recipients of services that improve their quality of life through technologies, but as active participants and sources of information and data that enable, on the one hand, to generate new knowledge about the city, about the use they make of public space, different infrastructures, facilities and services; and on the other hand, to learn from those spaces that operate successfully, to detect urban problems and, in short, to improve the processes of urban planning and management from that knowledge.

The knowledge this way generated from the information obtained from the citizens' own experience, continuously updated, made available to the responsible governments, will enable a better planning and urban management, more participatory and inclusive, of the aspects related to the operation of urban spaces.

With this purpose, the present work is focused on the study of new unplanned uses of urban public space. Today's cities are the scene of new activities and uses for which they were not originally designed. The practice of sports in urban environments such as parkour, skating or running, are a good example of these new unplanned uses of urban public space. Actually, it is the citizens themselves who choose to use some spaces in the city instead of others to practice their sporting activity and not always these preferred spaces are those assigned by the urban development plans created by the city government (Marsal-Llacuna & Segal, 2016; Landry, 2016; Mueller et al., 2018). Consequently, cities face a double challenge: on the one hand, to adapt and improve their existing infrastructures and facilities so that these new uses can be developed; and on the other hand, to listen to citizens and enable their intervention in the urban planning processes that manage the distribution of the different uses in the city. With this purpose, the main objective of this research is the design of a methodology that allows, firstly, to identify the spaces chosen by citizens in their daily sports practice, so that they can be adapted and improved; and secondly, to characterize these urban environments, from the qualitative point of view, in order to understand the reasons, factors and elements that lead citizens to prefer them. In this way, this knowledge can be taken into account, as a priority, in the decision-making processes when intervening in the city.

This work focuses specifically on the study of the "running" phenomenon that, beyond a fashion, has become established as a social movement. In this sense, information and communication technologies have a lot to do with the boom experienced. The large number of wearable devices connected to the Internet, the numerous training-oriented applications, the emergence of a series of social networks increasingly specialized in the field of sport, the possibility of sharing routes and scores with millions of users, make practicing runnig in cities multiply its attractiveness. Running and technology have become an inseparable binomial. Within this context, the methodology that is proposed and developed in this work is based on taking advantage of the possibilities offered by information and communication technologies that have made it possible to have access to a large amount of information (Ferrari & Mamei, 2013; Uran et al., 2016; Balaban & Tunçer, 2017; Barfield, 2018; Mora et al., 2018; Pérez-delHoyo et al., 2018).

Thus, within the current context of smart cities (Visvizi & Lytras, 2019), this work studies fundamentally the potential of geolocated data generated by citizens and retrieved from social networks of sport, as well as from other web services, which it has been possible to analyze with the support of the measurement and visualization tools offered by Geographic Information Systems accessible online, open access cartography available on the Internet, among other resources. To carry out this purpose, the analysis of the urban area of San Vicente del Raspeig in Alicante (Spain) is proposed as a case study.

The rest of the article is structured as follows. First, a brief overview is given of previous work related to the use of citizen-generated information and its potential to improve urban planning in smart cities. Secondly, it proposes a methodology that incorporates this knowledge of citizen experience to support a more participatory and citizen-centred approach to urban planning. The proposed method is presented through a case study. Finally, the results are discussed, some conclusions are drawn and some suggestions are offered.

2. A BRIEF OVERVIEW OF PREVIOUS RELATED WORK

Since the late 1990s when the concept of the smart city was defined in relation to the use of Information and Communication Technologies (ICT), initiatives in this field to address the problems of the city in an efficient and sustainable manner have been many and diverse (Hollands, 2008; Harrison et al, 2010; Caragliu et al., 2011; Alawadhi et al., 2012; Chourabi et al., 2012; Gil-Garcia et al., 2013; Murgante & Borruso, 2015; Albino et al., 2015; Quijano-Sánchez et al, 2020). As a result, today the notion of the smart city is conceived in a holistic way as the model for achieving a more sustainable urban development in which, increasingly, the citizens who are at the centre of any smart initiative matter (Verdegem & Verleye, 2009; Salim & Haque, 2015; Cortés-Cediel et al., 2019). Thus, there have been developments in this regard from the most basic and traditional participatory digital platforms (De Filippi et al., 2020; Johnson et al., 2020), to more complex projects that seek to mobilize the collection of data from people by benefiting from the acceptance of user-friendly technology (Ricker et al., 2020).

In the field of urban planning, smart public participation and bottom-up smart cities are one of the main challenges today (Alverti et al., 2016; Kourtit et al., 2020). Thus, smart urban planning can be defined as one that, along with all other issues affecting the sustainable development of cities, is concerned with making urban decision-making processes more participatory between governments and civil society, thereby contributing to making smart cities more inclusive through the application of innovative technologies (Lee et al., 2020; Levenda, 2020). This field of research is not without controversy between those who advocate participatory democracy from the bottom up and those who warn against authoritarian control - especially through sensing technologies. Both political readings enrich the current discourse on the smart city, which is undoubtedly increasingly being postulated as an effective model of sustainable urban development (Zandbergen & Uitermark, 2020; Nesti & Graziano, 2020) in the face of the inability of traditional urban planning methodologies to solve the current planning challenges posed by cities (Marsal-Llacuna & Fabregat-Gesa, 2016).

The capabilities of many different technologies such as cloud computing, social media analysis, Big Data or the Internet of Things have been explored in order to include public participation in urban planning processes (Babar & Arif, 2017; Singh et al., 2020; Kopackova & Komarkova, 2020; Szarek-Iwaniuk & Senetra, 2020).

A wide range of studies has been developed to emphasize the great potential of information on the preferences and use that citizens make of urban public space, leading to the definition of what has been called a new citizen science (Mueller et al., 2018). Various data ecosystem models and participatory applications based on citizen science have been developed allowing collaborative mapping actions to help make cities safer (Jelokhani-Niaraki et al., 2019), healthier (Ottaviano et al., 2019), more accessible (Mora et al., 2017; Jelokhani-Niaraki et al., 2019), more creative (Mueller et al., 2020), more smart living friendly (Cristie & Berger, 2017) and where citizens can identify (Buš et al., 2017) thanks to this citizen design science from the bottom up.

Specifically, the study of citizen mobility has experienced significant growth due to the development of enabling technologies and the prevalence of mobile devices, particularly the space-capable smartphone, mapping applications and powerful support networks, including the Global Positioning System GPS (Rossiter et al., 2016; Chen et al., 2017; Lu et al., 2017; Korpilo et al., 2017). Some studies combine data generated by citizen users with the places of interest in a city, making it possible to know not only the movement patterns but also the purposes or preferences of citizens. Increasingly, citizen-generated data is accessible on a voluntary basis and, as a result, more projects are being developed that use this data to better understand and support urban mobility needs. Even beyond using data sources independently, projects have been developed to facilitate the holistic analysis of urban data on integrated heterogeneous data sources (Tempelmeier et al., 2019). Some studies also offer algorithms to identify possible paths from source-destination data (Bahbouh et al., 2017). Other recent studies make use of the potential of street-level imagery to uncover spatial-temporal urban mobility patterns (Zhang et al., 2019) and other studies have focused on assessing how new mobility initiatives affect the traveler experience even before they are deployed (de Berardinis et al., 2018). In addition, many other studies address, in a comprehensive manner, the development of comprehensive sustainable urban mobility plans as part of smart urban planning (Mazzarino & Rubini, 2019) and, specifically, Transit-Oriented Development (Motieyan & Mesgari, 2017).

In addition to these studies, there are others that currently represent a good part of recent research that introduce the study of social networks as open sources of geolocalized data to recognize which places in a city are preferred and used by citizens. Martí et al. (2019) analyse the challenges, opportunities and limitations of these studies in the urban environment. Some studies propose methodologies, for example, to research the attractiveness of green parks (Ullah et al., 2019); to study mobility patterns in cities (Osorio-Arjona, J. & García-Palomares, 2019); to explore the interaction between everyday human activities and traffic conditions (Huang et al., 2019); to identify successful public spaces in a city (Martí et al., 2017); to discover tourist attractions (Peng & Huang, 2017); or to represent urban boundaries (Yin et al., 2017). Other studies focus on the representation and visualization of geolocalized data from social networks (Wu et al., 2017) and how these visualizations allow researchers to explore various relationships between citizens' movement patterns, activity distribution and points of interest in a city (Zeng et al., 2017). In addition, some studies focus on the analysis of urban emotions (Ashkezari-Toussi et al., 2019; Resch et al., 2015; Resch et al., 2016). Thus, it can be seen how technology plays an important role in offering solutions that essentially promote citizen participation (Moreno-Ibarra & Torres-Ruiz, 2019).

In the specific case of social networks for sport, some recent research has started to study the possibilities offered by geolocated data shared by citizens using these networks (Cook et al., 2016; Merchant, 2017; Laguia Martinez, 2018; Pérez-delHoyo et al., 2018; Mora et al., 2018; Hochmair et al., 2019; Lin & Fan, 2020; Pérez-delHoyo et al., 2020).

3. A METHODOLOGY BASED ON INFORMATION AND COMMUNICATION TECHNOLOGIES TO FACE THE CHALLENGES OF URBAN PLANNING

The incorporation of the concepts of flexibility, uncertainty or open systems into the field of urban planning is currently a process with great potential for development. The traditional tools of urban planning need to be complemented by others that help to understand the increasing complexity of cities and their continuous evolution and transformation. In this context, smart cities supported by the intensive use of technologies and information-based methodologies are important allies.

The methodology proposed in this work recognizes the city as a reality in motion, in which citizens are not only beneficiaries of services but also sources of valuable information for better urban planning, that is, closer to the real preferences and needs of citizens (Landry, 2016; Mueller et al., 2018). Despite serious efforts by municipal governments to focus their policies on citizens, as the brief review of the literature presented suggests, municipal governments continue to view civic participation as a top-down tool in many cases (Goodman et al., 2020; Åström, 2020). This research seeks to contribute, as do the case studies referred to in the previous section, to transforming and improving this situation, but with a more focused approach to urban planning and urbanism of the city.

The method proposed in this study, based on the analysis of data generated voluntarily by citizens and shared through social media, is designed to meet the challenges of urban planning in the face of the new - unplanned - uses that citizens make of urban public space spontaneously, as it is the very popular case of the running phenomenon that has served in this research as a case study. In this way, it is possible to affirm that information and communication technologies have transformed the traditional meaning of citizen participation in urban planning processes (Fuchs, 2014).

The purpose of this study, according to the background presented, is therefore to advance the development of methods with a more specific focus on urban planning and urbanism of the city. For example, Cook et al. (2016) used the potential of information provided by the runners to study aspects of the movement, its meaning and personal experience, as well as other issues related to social interaction. Laguia Martinez (2018) assessed the socio-organizational potential that ICTs and their everyday use are bringing through bottom-up development strategies. Hochmair et al (2019) studied sports applications as a source of GPS tracking data to better understand user behavior, identifying characteristics of the built environment and sociodemographic factors associated with sport practice. Based on these previous experiences and other similar ones, this work proposes a more oriented approach to urban planning and urbanism of the city, in order to facilitate participatory decision-making. Thus, the objective of the study is to offer a methodology that enables the municipality to know the preferences and habits of the citizens, and to learn from the urban spaces that operate successfully, as a support for better urban planning and a more effective work of the urban architects.

The methodology proposed is presented below through a specific case study for its validation and better understanding.

3.1. How to study cities from the "running" movement: A proposal based on the smart city paradigm

The "running" movement has had a great impact on society in recent years. The increase in calls for events in relation to races, tournaments or competitions has positioned this phenomenon in a significant place on the Internet, and particularly on social networks. Sportspeople or amateurs using information and communication technologies constantly and voluntarily generate and share data on the routes they prefer to practice their daily sports activity, many of which are located in urban public spaces that have not been designed for that functional destination.

Not only social networks are acting in favor of the growth of this running movement, more and more specific applications have been developed for mobile devices based on GPS positioning and navigation technologies that offer very precise information on route location, distances, as well as user opinions, etc., for example, the communities of Strava, MyMapRun, Endomondo, Runtastic, Wikiloc, Sports Tracker, Runkeeper, among others. In this research applied to the study of San Vicente del Raspeig in Alicante (Spain) geolocated data from social networks MapMyRun and Wikiloc have been analysed and can be easily obtained in various formats such as GPX. The main objective of both networks is to enable users to create and share routes, as well as to give their opinion about their personal experience when they practice sports, differentiating between running, cycling and walking routes, etc.

MapMyRun [mapmyrun.com] —by Under Armour— has a greater use in the international scope and counts on more than 60 million users. Wikiloc https://es.wikiloc.com offers a service similar to MapMyRun, especially at the local level, and has more than 6 million users and more than 16 million shared routes. As can be seen, despite being used mainly at the local level, the activity of this platform is considerable and continues to grow.

For the analysis and visualization of the data, QGIS, a free and Open Source Geographic Information System, has been used, in addition to other online information systems such as Google Earth and Google Maps, which allow precise dimensional measurements of public spaces and road systems in a city, as well as the visualization of real 3D models of these urban spaces, in a simple and direct way.

3.2. The Case Study of San Vicente del Raspeig

The city of San Vicente del Raspeig is located in the northwest of the metropolitan area of Alicante (coordinates: 38.4342800, -0.5496300) and has a population of just over 57,000 inhabitants. The Campus of the University of Alicante is located in this city, so during the academic period this population increases considerably by the number of students who move to this city their residence.

3.2.1. Retrieval of geolocated data generated by citizens from social sports networks

To carry out the study, a total of 54 routes were obtained and analysed —41 retrieved from the MapMyRun social network and 13 from the Wikiloc social network—. Combining the data from various social networks allows access to the information generated by a greater number of users. Routes that are considered repetitive have been discarded, i.e. routes that are the same as those generated by the same user. However, similar routes generated by different users have been taken into account as they provide a measure of how often these routes are chosen by citizens in comparison to others.

Routes whose path belongs mostly to the neighbouring municipalities have also been discarded. The data was downloaded in June 2019 and a total of 54 routes considered valid for the study were obtained, as mentioned above. The data was downloaded directly from the social networks website in GPX format and the routes were imported and analysed in the QGIS system. OpenStreetMap was used as a base for the cartographic representation. Figure 1 shows the set of routes retrieved from the social networks integrated into QGIS —geolocated on the map—.

FIGURE 1 – Routes retrieved from sport social networks integrated into a GIS system

3.2.2. Analysis of citizens' preferred routes based on their location

When analysing the data, a first approximation shows that 95% of the routes are located in the urban road system, while only 5% are located in areas such as parks, facilities or other areas whose design could be thought of a priori as favouring the practice of the sport of running. Also, in a first approach it can be observed how a great amount of routes overlap in some areas. Thus, the segments of routes that are most frequented and preferred by the citizens when they practice the sport of running in the city can be visually identified. These segments are shown highlighted in Figure 2 with a greater thickness representing the addition of routes. As a result, five areas have been identified as preferred by athletes for running: the northern area outside the University Campus; the areas corresponding to the park and sports equipment of the city; and the north and south accesses to the municipality.

The area north of the University is where most students live. In addition, the sports centre on the University Campus is close to this area and many users start their sports activities here. On the other hand, the area corresponding to the park is one of the most visited places due to its great dimension —more than 8 hectares with vegetation— and the services it includes. This park is composed of several interior paths and allows a circular route. It is also close to the University and has bicycle path access within the urban environment. The area of the municipal sports centre is usually a place where sportspeople start and finish their sporting activities. Like the park, it is located inside the city but, at the same time, close to its perimeter. The rest of the areas preferred by users are the accesses to the municipality. The northern access has a bicycle lane and runs through a low-density residential area. It is a straight route without major obstacles towards the outside of the city —mountain routes—, well protected from traffic both by the arrangement of vegetation and by the speed limitation of vehicle traffic. As for the southern access, it also has a bicycle lane and offers a high degree of protection. This is one of the wide roads with a high volume of traffic that connects with large tertiary sports facilities and the city of Alicante.

FIGURE 2 – Athletes' preferred areas for running in the city

It is important to note that in some areas where a lot of activity was expected, the analysis has not confirmed this hypothesis (See Figure 3). Such is the case of the University Campus itself; a large Campus, with wide streets and green spaces, and the absence of traffic inside. However, the data analysed suggest that citizens prefer to surround the University rather than go through it or walk around it internally. Another open, undeveloped area that connects San Vicente with Alicante, offering a unique landscape as it contains several lakes, is also not used by runners; probably because it is currently being used spontaneously by motorcyclists and mountain bikers. Finally, the main communication route of the city, the avenue that runs from north to south, is not chosen by runners either. The presence of obstacles, the narrowness of the road and the large amount of traffic have led runners to choose other less direct communication routes around the city.

FIGURE 3 – Areas that are not unexpectedly chosen by runners

In a second approach to data analysis, different groups of routes are observed according to their location and the following classification can be established (See Figure 4): Routes inside the urban environment —not the most common, but it should be taken into account that most users start their sports activity from their place of residence—; routes outside the city but close to the urban environment —are the most common routes chosen by sportspeople—; within this group of routes we distinguish routes inside the University; routes around the city —are the least chosen by sportspeople—; and routes far from the city —mountain routes, natural areas not urbanized—.

FIGURE 4 – Route grouping according to location

3.2.3. Characterization of urban spaces chosen by citizens for running

In order to characterize the spaces preferred by citizens to carry out their sports activities, the existing urban elements on the different routes and the way these urban elements are organized along their path have been studied. To this end, a series of road cross sections of each route have been analysed, identifying the urban elements included in each cross section. Cross sections have been made each time there are changes in the route design, so that the cross sections represent each change in the route's path, so that a route with few cross sections corresponds to a homogeneous route in its path. The visualization and measurement tools of Google Earth and Google Maps have been essential to obtain the cross sections that are a true representation of reality.

Before obtaining these cross sections of the route layout, the essential urban elements have been defined for their identification and subsequent comparison between the different routes. Figure 5 shows these essential urban elements codified, from which the different cross sections for each of the routes have been represented, as can be seen in the example of a route shown in Figure 6.

FIGURE 5 – Essential urban elements for the study of routes

FIGURE 6 - Series of cross sections of a route

A total of 242 types of cross sections were obtained by analysing the 54 routes studied. For each of these types of cross sections a second level of analysis was also performed to identify the specific spaces where runners can perform their sports activity within these sections. These spaces were classified into two types: spaces that can be considered safe, such as pavements protected from traffic, parks, pedestrian streets, etc.; and spaces that could represent some type of risk due to the existence of unsafe pavements, unprotected roads, etc. The analysis showed quite positive results as more than 80% of the spaces used by citizens for running around the city could be considered safe areas. However, the remaining 20% represent a serious problem for the city government.

From the analysis it was deduced that the routes preferred by the athletes contained mainly 8 of the 242 types of cross sections identified. In all these cross sections, the specific spaces where citizens perform their sports activity can be considered safe. Figure 7 shows these 8 types of road cross sections that citizens prefer for running in the city, represented by the essential urban elements that make them up and indicating the safe lanes for runners. An overall graph is also included to identify the most common cross sections in the whole, highlighting by far one type of road section described below.

FIGURE 7 - Road sections preferred by citizens for running

The Road Section 1 (See Figure 7) preferred by the citizens consists of a building at one end, wide sidewalks with a bicycle lane, a double road with two lanes and parking areas, as well as vegetation. In fact, except for one of the 8 sections, all of them have a wide roadway where several urban elements are included, abundant vegetation, wide sidewalks and bicycle lanes, regardless of the existence of road traffic. In general, when there are buildings, they are usually located only at one end, leaving the other end free of barriers; users avoid running through central areas of the city and prefer to ride along the edge of the municipality.

4. DISCUSSION AND CONCLUSION

In this paper, the preferred routes used by runners in a city have been identified through the analysis of data retrieved from social networks. The routes identified have been classified according to their location inside or outside the city, using a geographic information system. The different routes have been characterised by studying the different cross sections of the path, identifying the types of road sections that are most repeated and the urban elements that make them up.

The study shows that the routes preferred by citizens for running in the city are located in the perimeter of the urban area, avoiding the high density of buildings and the narrow streets of the most central areas —historic city—. In this way, there is a greater tendency to go outside the city, although passing through the interior is almost always obligatory. Furthermore, as noted above, in a first approximation, the analysis of the data suggests that 95% of the routes are located in the urban road system, while only 5% are located in spaces such as parks or specific sports facilities.

It should be noted that the significant presence of vehicular traffic does not actually impede runners. However, the urban elements that ensure the protection of runners from road traffic are important. All the routes that citizens choose for running a greater number of times are safe areas with elements of protection against traffic and which do not pose a risk to runners. Citizens may even prefer more traffic-intensive routes to others because they perceive them to be safer. As regards pavements, those preferred are usually of a large dimension, generating more space for the coexistence of pedestrians and runners, they also tend to have abundant vegetation and include bicycle lanes in most cases. Wide sidewalks provide safety and also tend to contain vegetation that acts as a separating element from road traffic. It is also confirmed that facilities such as parks and sports centres have a great influence when choosing a route.

It is well known that cities have not been planned or prepared for running, but neither were many cities prepared to make cycling a safe activity until the bicycle lane was included in road design. This work does not claim the creation of a specific lane for running —although in some cities it already exists or is planned to be implanted— but it does claim the necessary creation of wider spaces in the interior of cities with a greater role of the pedestrian, a greater protection against traffic and a better environmental quality to make room for this new unplanned activity of practising sport while running in the city.

In summary, the study highlights three main conclusions: citizens who practice running in the city need to feel protected in order to be able to perform their exercise; as has been observed, traffic is not an inconvenience when choosing a route, as long as the runners feel truly protected; it is important to take into account that although runners tend to choose routes within the perimeter of the city —or, failing that, to use the facilities in the interior—, passing through the interior road layout of the city is almost always an obligatory route, so the safety of these urban roads must be considered in general.

As for the data that have been used to carry out the research, it is true that a greater volume of data could be obtained through applications that require prior payment, however the data used in this work have been sufficiently representative and have allowed some interesting conclusions to be drawn — this research has been developed exclusively with free open access data—. To this limitation, we should add the problem of the accuracy of the mobile devices with which users provide the information —

creation and sharing of routes—. The systems of coordinates of the applications or mobile devices used by runners are not exact, not even the same for some devices with respect to others. However, a simple analysis of the geographical area of study, for example through the Google Maps or Google Earth tools, has been sufficient to correct the cases of routes that were initially confusing.

Thus, despite these limitations, as a final conclusion it can be stated that the potential of geolocated data generated by citizens and retrieved from sports social networks, as well as other web services, the measurement and visualization tools offered by urban information systems accessible online, free access cartography available on the Internet, among other resources, are increasingly essential for urban planning and the decision-making process when it concerns action in the city.

The methodologies based on the ICT and focused on the citizens for a better and smart urban planning and its results are, without a doubt, essential and very useful in the phases of analysis and diagnosis of the urban development strategies enabling the generation of a real knowledge of the operation of the city. But they are not only essential for decision making in urban planning processes but also in urban management processes, that is, in order to obtain an updated knowledge that the operation of urban spaces continues to be successful over time or if, on the contrary, a transformation is necessary for their improvement.

The smart city paradigm has brought about significant social and economic changes. The new technologies enable connections that favour social, economic, cultural and idea exchange at all levels. However, for this smart urban model to be consolidated, an adequate political context is necessary and, therefore, it is very important to consider the role that governments play in this process. It is a fact that Information and Communication Technologies and the knowledge society have definitely changed the way citizens relate to the city and these new forms of relationship and development of activities in the city also imply a change and modernization not only of governance systems in general, but of urban planning and management models in particular.

In this context, it should be borne in mind that it is the role of the municipality, as a decision-maker affecting urban development, to provide the means to improve urban planning and management processes so that they are more participatory and inclusive. To this end, having a precise knowledge of the actual operation of urban spaces, of the way in which citizens use urban public space, of their preferences and habits, is fundamental. And in this sense, the Information and Communication Technologies are essential, enabling new current methods of citizen participation.

The municipality can and should, therefore, provide methodologies that allow, on the one hand, the administrations responsible for urban decision-making to know the habits and preferences of the citizens from the citizens' own experience -mainly from the routes that citizens take in the city through the analysis of location data-; and on the other hand, citizens a communication channel to communicate to these administrations their opinion and needs. In this way, the municipality will be able to have a constantly updated knowledge of the real operation of the city that will facilitate urban decision-making in a participatory and socially consensual manner.

The methodology proposed in this study provides a tool to facilitate the municipality's urban decision-making. A methodology based on a new and more current way of conceiving the citizen participation improving through new technologies the processes of planning and management of the city. However, the question is how to make academics and urban planners working in the different public administrations aware of the importance of these new tools and methods to help them create a truly smart urban living space. This awareness of academics and urban planners is therefore essential.

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FIGURE 1 – Routes retrieved from sport social networks integrated into a GIS system

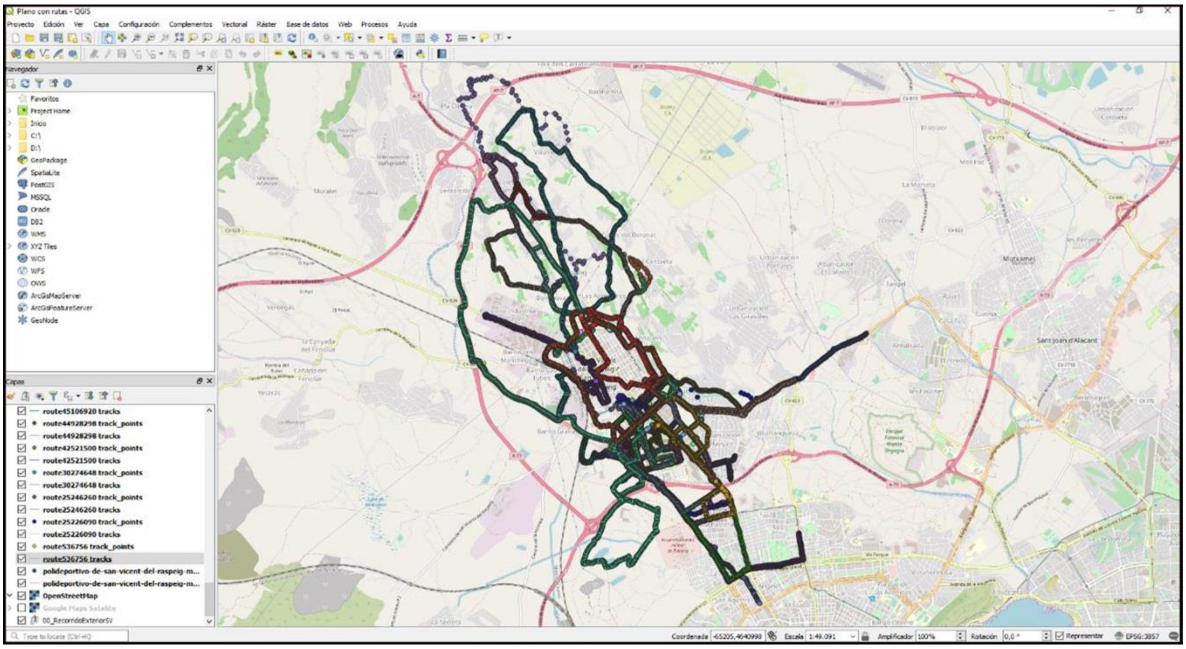

FIGURE 2 – Athletes' preferred areas for running in the city

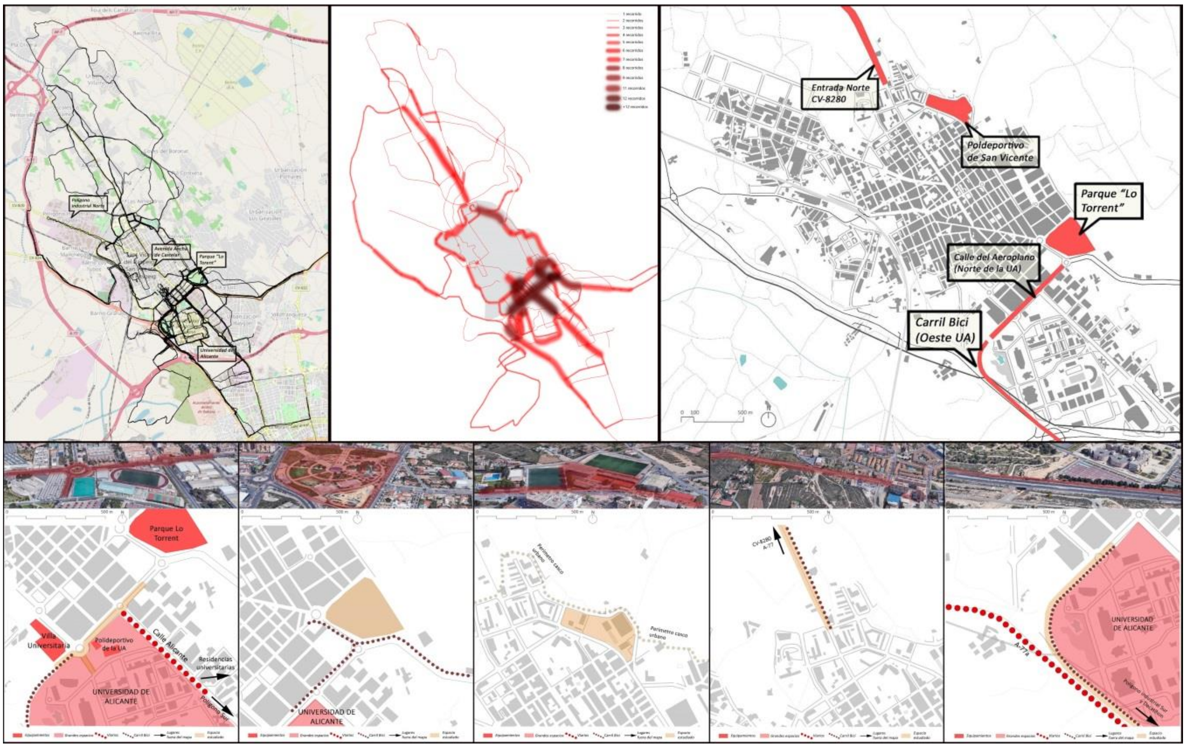

FIGURE 3 – Areas that are not unexpectedly chosen by runners

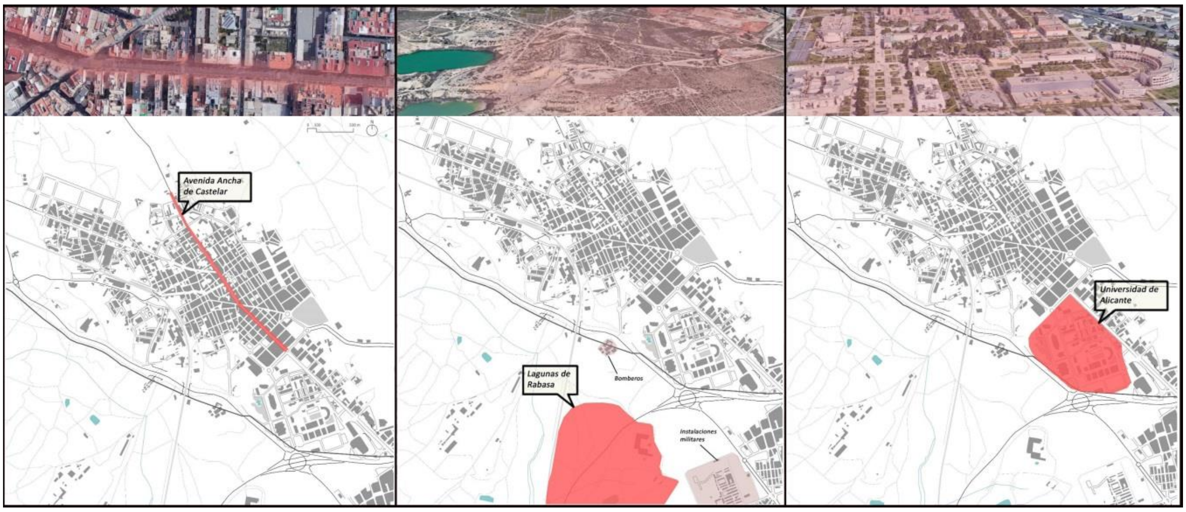

FIGURE 4 – Route grouping according to location

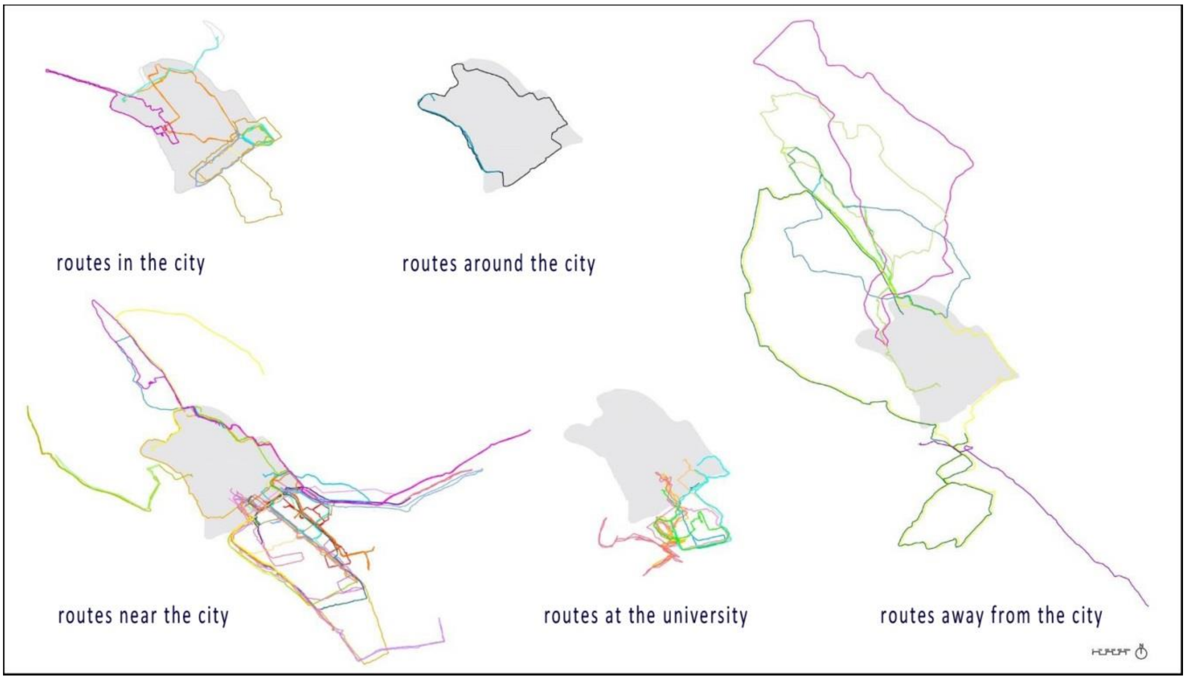

FIGURE 5 – Essential urban elements for the study of routes

FIGURE 6 - Series of cross sections of a route

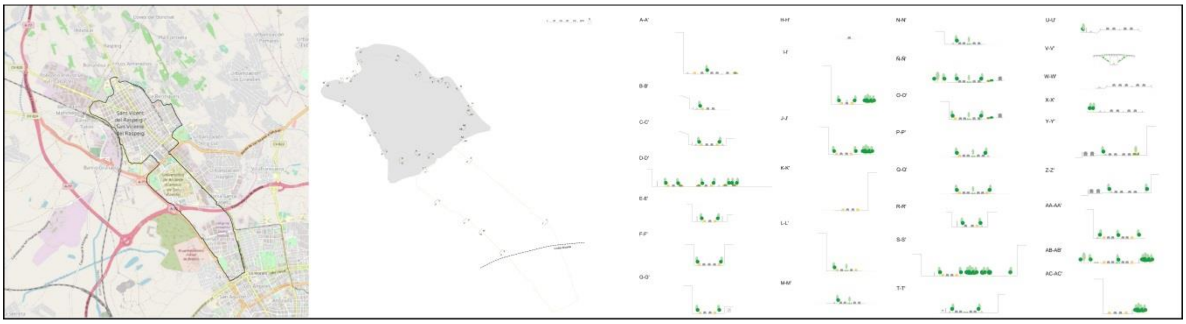

FIGURE 7 - Road sections preferred by citizens for running