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CHAPTER 16

Visiting an Urban Park in a Smart City: An Intelligent Systemic Approach Considering Visitors' Desires and Expectations

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Abstract. Public space is necessary to achieve wellbeing in cities. Urban parks in particular play a decisive role because they provide a connection between urban life and nature. Two case studies regarding the positive role of urban parks are presented in this chapter. The first case study regards a group of visitors driving under the influence looking for a safe port to avoid being the cause of an accident and stopping in a nearby park. The second case focuses on finding the best route for a visitor to avoid allergenic vegetation. In both cases, we adopted a technological approach using a mobile device, geo-referenced systems and biometric identification equipment to locate both the users and the best path to visit the park. We tested both systems at the "Hermanos Escobar" Central Park, located in Juarez, Mexico. The results show that a safe harbor for

intoxicated drivers is located near the west entrance. At this location, there is easy access to restrooms and it is a safe place to leave the car overnight. Furthermore, the park is an allergy-free space that is easily walkable, except for the east side of the park—where most of the allergenic species, such as *Morus nigra*, are concentrated. In this chapter, we present a general discussion of the advantages of both systems and the conclusions derived from this preliminary study.
Keywords: Urban green spaces, Smart Cities. Intelligent dispositive to decision support system.

Introduction and problem setting

Urban green spaces (UGS) play a crucial role in cities since they provide an extensive series of environmental, social and economic services. Urbanized areas are places where humanity has achieved economic, technologic and social progress; nonetheless, these areas lack natural environment. Moreover, persons who live in large cities face social disarticulation and farness. These phenomena are even more intense in cities experiencing urban sprawl (Rueda, 1997). The agglomeration of constructions and highways in cities promotes a monotone environment where mate colors predominate, mainly encompassed by grey and inert components. The heavy traffic intensifies stress at the time that incivilities and crime rapidly increase. The city script delineates in the mist of exposure to pollution and to a great variety of contaminants. No doubts cities lack of a naturalized profile that negatively affects the society as a whole.

Conversely, urban parks are perhaps the most refined form of public space, as they are not only common areas where many groups gather, either in harmony or in conflict, but also because they provide a wide variety of environmental, social, and economic services. Urban parks are essential elements of cities because they overcome the negative effect of urbanization. The literature repeatedly reports (see Córdova and Martínez-Soto, 2014) that when people gather in urban parks, social cohesion occurs and, at the same time, homogeneity is broken by the encounter of diverse groups coming from many backgrounds. In addition, urban parks aim to improve physical and mental health by promoting active and passive practices, such as exercise or contemplation. Although park services have no market value, i.e., their services are not for sale, these numerous social and environmental benefits enrich the economic value of urban parks in smart cities. Unveiling the value of these services is an excellent way to promote investment in maintenance and extra funding for the park.

Often, the design and planning of an urban park that aims to satisfy all user groups fails to do so. It is common that during the process—if there is any—the designer focuses

on the configuration of the park itself, and not on the multiple ways in which visitors can use the park, thus, creating a gap between the visitor and the technical requirements set by the designer. In addition, many studies on park-use patterns reveal that visitors do not always have a clear idea of their intentions when visiting the park. That is, once visitors arrive at the park, their intentions for use may vary, performing activities different from those originally planned. Moreover, these studies show that it is not common for users to have no clear intentions when visiting the park or for their plans to arise from circumstantial factors (such as passing by the park and deciding to visit it). In either case, users may experience uncertainty about what activities they can perform, what adverse conditions the park may have, or simply what to expect -safety conditions- during the visit.

Background on park visiting and use

Three pathways need to be considered to study patterns of urban park use. The first pathway addresses the active use of parks, which is directly related to fitness and health. This pathway concerns the set of facilities that a park should have for exercise and active use, such as stretching, walking, or jogging. Active use of parks helps prevent metabolic diseases like diabetes and obesity. The second approach involves passive activities, such as meditation, sightseeing, rest, relaxation, or contemplation. These activities are related to the prevention of mental illnesses like depression and anxiety. Lastly, the third pathway refers to community use for cultural or educational purposes. These forms of use are important because they encourage social encounters, interaction and the exchange of experiences among heterogeneous groups. In terms of active use, urban parks are excellent for exercise and sports. The most common activities are jogging, walking, stretching, personal routines, exercise in the gym and group programs. To perform these activities, the park must have adequate facilities, which in turn require periodic maintenance. The facilities most frequently mentioned in the research are tracks, walking trails, jogging tracks, gymnasium, tennis courts, playgrounds, sandy grounds and other similar amenities (Guevara et al., 2014; Espejel et al., 2014). Other publications refer to the importance of pet walks (Peñalosa, 2018; Iojă, Rozylowicz, Pătroescu, Niţă, & Vânau, 2011) and cycling routes (G. Brown, Rhodes, & Dade, 2018).

Research on active park use shows that weekday-weekend scenarios are determinants of active use patterns (Bertram et al., 2017; Baran et al., 2012; Flores-Xolocotzi, González-Guillén, and de los Santos-Posadas, 2010; Ries et al., 2009). Thus, studies should differentiate between these two scenarios. Moreover, active use is contingent on a park's actual facilities (He, Yi, and Liu 2016), this suggests that the supply of active amenities should be aligned with those in demand (B. B. Lin, Fuller, Bush, Gaston, and

Shanahan, 2014). Focusing on demand is the right strategy to satisfy visitor desires (Mak and Jim, 2019).

Studies emphasize the relationship between physical activity and physical health. H. Liu, Li, Li, and Zhang (2017) examined how people spend time exercising in a set of parks in China. They found an association between self-perceived levels of energy, relaxation, mood and confidence, and time spent. The elderly also take advantage of exercising in parks (Duan, Wagner, Zhang, Wulff, & Brehm, 2018). The distance between butler developments and parks is a factor associated with better health and fitness, as well as mental well-being (Ekkel and de Vries, 2017; Akpinar, 2016).

Passive activities are crucial for mental health and parks are spaces where people can appreciate nature and scenery. Here, people find relaxation and rest, they also find contexts for contemplation, reading spots, flirting options, or even the way to let the mind fly around a non-particular subject (Perelman and Marconi, 2016; Razak, Othman, and Nazir, 2016; Guevara et al., 2014; Baran et al., 2012). Quiet areas, benches, and tables are essential to meet the needs of visitors seeking passive activities (Bertram et al., 2017; Baran et al., 2012). Finally, interaction between different groups of people in cultural or educational events is among the most valuable social features in a park. This includes educational gatherings, plunges, workshops, or neighborhood meetings (Peñalosa, 2018). If the park can host groups in kiosks, amphitheaters, dance halls, or auditoriums, then its value is enhanced, thus increasing the positive impact of these activities (Dickinson and Hobbs, 2017; Peters, 2010). The celebration of civic events, such as Independence Day, Labor Day or local holidays, enhance the sense of belonging and cultural and historical values (Amin, 2008; Segovia and Neira, 2005).

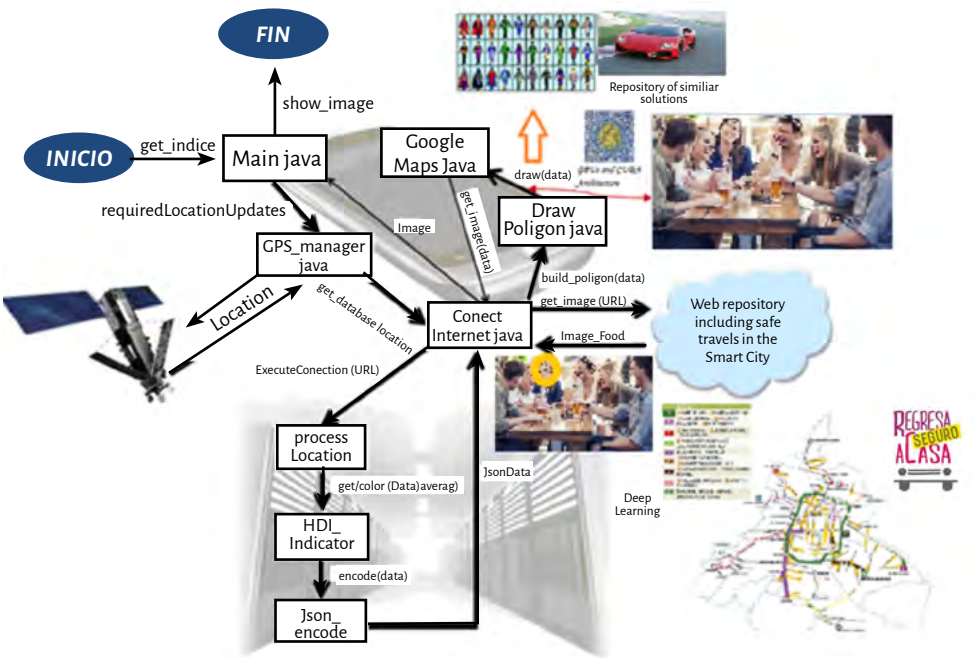
Method

Case 1: Safe Harbor for Intoxicated Drivers

To recommend activities to a specific user profile, we adopt the conceptual system depicted in Figure 1. In this case, we imagine a group of young or adult intoxicated drivers looking for a safe harbor in an urban park while waiting for a family member or friend to pick them up. As shown in Figure 1, the conceptual system initiates recognition of both the visitor's profile and the geo-referenced location and time at which the event occurs. A Java® interface manages this process through an interactive map that is easily accessible on a mobile device. Once in the park, visitors can enter their profile and their intention to visit. The system processes this input and provides an output with all the recommendations to find the best place to stay in the park.

The proposed system is a solution for a common problem in Smart Cities: drunk drivers. This interactive alternative, instead of endangering the integrity of the user and that of other drivers, scans the iris of each person in the group and determines who - if any - is capable of driving without being under the influence of alcohol. The configuration of the solution conveys an intricate network of interactions between various systems. A satellite locator determines where the group is at any given time. A database retrieves information from similar events and helps identify the patron to suggest a course of action. After determining the location and the patron, the system offers a solution, either by suggesting a safe route to the final destination or by providing a list of possible people to call for help. As a result, the system helps the smart city become a safer place, preventing deaths and losses from accidents due to intoxicated drivers. Although the setup needs further testing and probably more features, the current design, based on a high-resolution camera interacting with software adapted for various platforms, is an excellent starting point to scale up as the complexity of the phenomenon increases.

Figure 1. *Smart system configuration to find a safe harbor for an intoxicated DUI in an urban park in the Smart City.*



Source: *From Real-time video image processing through GPUs and CUDA and its future implementation in real problems in a Smart City, cited by Hernández et al., 2019, p. 47.*

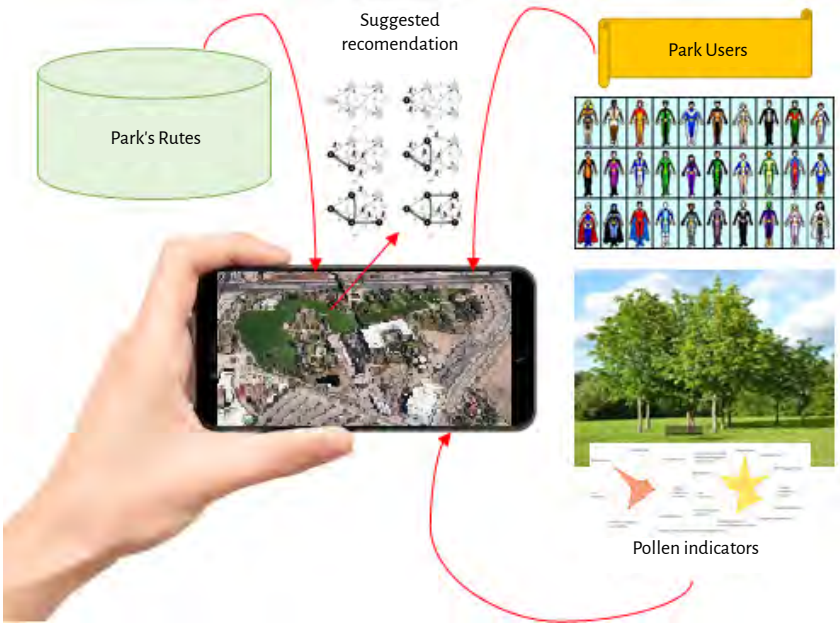
There are similar proposals to ours in other parts of Mexico. For example, in the region of Aguascalientes, known as "Altiplano Hidrocálido", the number of fatalities by drunk drivers is high and a program called "Safe Return Home" has already been implemented using similar technologies. Similar research proposes real-time image analysis is discussed in Hernandez, et al (2019).

Ciudad Juarez is one of the three cities in Mexico with the high rates of alcohol consumption among young people. Therefore, this research aims to present a proposal for continuous improvement to prevent traffic accidents associated with high speed and drunk driving in the city at night. This proposal includes an intelligent and safe alternative once the individual arrives at the urban park, so that he/she can alert his/her family and ask for help.

Case 2: Allergies caused by pollen propagation in urban parks

The Smart City ensures the health of society by anticipating adverse situations that bring danger to people. Allergies are one of the main concerns of park visitors. The system depicted in Figure 2 describes a configuration in which a mobile device displays an interactive map of an urban park showing the paths along which a visitor would encounter allergenic species. These species may affect visitors's health by triggering an allergic reaction.

Figure 2. *Configuration of the intelligent system to avoid allergenic species during a visit to an urban park*



Source: *Own elaboration.*

To do this, the system accesses a previously registered database that encompasses the different species of vegetation and the multiple routes that a visitor can follow. Then, an integrated and interactive geo-referencing-based application, which recognizes the visitor's location, advises him to take a recommended path where there are no allergenic trees. In addition, the application also describes allergenic species by their common and scientific name, as well as the period of the year when they pollinate. The touch resource on the screen zooms in and out as desired for additional useful information, such as average temperature and noise level in selected areas along the recommended route.

Results

In Figure 3 the line in blue shows the output generated by the system to find a safe harbor for intoxicated drivers who want to use the park as a place to leave the car while waiting to be picked up by someone else. Using this option would increase safety in the Smart City, reducing the incidence of accidents and fatalities. The exit area provided by the system is well lit and has 24-hour surveillance. In this way, the park acts not only as a public recreational space for environmental services, but also as an opportunity to allow intoxicated drivers to leave the car and avoid accidents. The area delimited by red lines represents the path to avoid if visitors do not want to encounter allergenic plant species. Allergy-related illnesses are aggravated during spring and autumn in Ciudad Juarez. Thus, by knowing which route to avoid, the intelligent system helps to improve the health of users. In this case, vegetation within the red lines is predominantly allergenic during spring (blackberry, whose pollen is highly allergenic).

Figure 3. *Output of both intelligent systems: a) safe port for intoxicated drivers (in blue) and avoiding allergenic species (in red) during a visit to Parque Central "Hermanos Escobar" in Juarez, México.*

Source: *Own elaboration.*

Preliminary conclusions

Urban parks promote health and social interaction, they are perhaps the most refined form of public spaces in urban settings (Campbell, McMillen, & Svendsen, 2019). The visitor experience should be the driving force in designing/planning the configuration of urban parks. That is, visitor desires and expectations should prompt the design and planning process of urban parks. In smart cities, technology greatly helps to improve the visitor experience of urban parks. This paper proposes a pair of system design structures to address two common problematic adversities in cities: drunk drivers and allergies. The first proposed system uses geo-referenced resources and biometric features to identify intoxicated people who cannot drive, thus preventing accidents and fatalities in smart cities. The second system aims to alert the visitor about allergenic plant species. This system anticipates allergy crises, which translates into improved health for park users. Although both systems are at a conceptual stage for now, they are fully feasible and applicable in a smart city. Moreover, the adoption of these approaches would improve the user experience in urban parks.

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