State-of-the-Art Survey

LNCS 11380

Carlos Smaniotto Costa · Ina Šuklje Erjavec
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CyberParks – The Interface Between People, Places and Technology

New Approaches and Perspectives

Springer Open

Lecture Notes in Computer Science **11380**

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-13416-7 ISBN 978-3-030-13417-4 (eBook)
https://doi.org/10.1007/978-3-030-13417-4

Library of Congress Control Number: 2019931991

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI

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Funded by the Horizon 2020 Framework Programme of the European Union

4.4

Using ICTs for the Improvement of Public Open Spaces: The Opportunity Offered by CyberParks Digital Tools

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Abstract. In the last decade, the potential of mobile devices for augmenting outdoor experience opened up new solutions, whose value is twofold. On one hand, users can experience new forms of interaction with space. On the other, stakeholders can have access to the so-called User Generated Data, that is different types of information related to public spaces that could be used to improve their conception of space. In line with this, several digital tools have been developed and tested within the framework of CyberParks COST Action TU-1306 with the intention of exploring how information and communication technologies (ICTs) can contribute to the improvement of Public Open Spaces (POS). In this way, this chapter aims to study the relationship between ICTs and POS, focused on the opportunities offered by three different digital tools: the WAY-CyberParks, the EthnoAlly, and the CyberCardeto. The main advantages of using these digital tools are: (1) the real-time data gathering, (2) maintaining an updated database, (3) collecting traces of different activities and users' groups "at the same time and space", and (4) recording their opinion and preferences, via text, video, sound or pictures. Furthermore, the chapter attempts to analyse distinct types of results produced by their use, based on different study cases where the digital tool has been tested. The data obtained in these places serve to demonstrate the features and type of data gathered. With these case studies, the chapter attempts to highlight the main potential of each platform as related to different stakeholders and users.

Keywords: Digital tools · Interacting with users · WAY-CyberParks · Ethnoally · CyberCardeto

C. Smaniotto Costa et al. (Eds.): CyberParks, LNCS 11380, pp. 278–293, 2019.
https://doi.org/10.1007/978-3-030-13417-4_22

1 Introduction

This chapter analyses how information and digital technologies (ICTs) can be used to improve public open spaces of our cities, and how new forms of communication can support different disciplines, in order to better plan and develop urban areas. The analysis is based on the work developed within the COST Action TU 1306 CyberParks. The CyberParks Project established an interdisciplinary research platform, including different specific groups working together to understand the dynamic relationship between ICT and the production and use of public open spaces, and its relevance to sustainable urban development (Šuklje-Erjavec and Smaniotto Costa 2015; Smaniotto Costa et al. 2015). This chapter is focused on the opportunities offered by three different digital tools: the WAY CyberParks; the EthnoAlly; and the CyberCardeto.

These digital tools are being developed, besides providing users contextual and interaction information, to monitor how people use public open spaces, and as an exchange interface between users and practitioners, decision makers, authorities. They aim to increasing the understanding of the usability of space and the call to improve it to meet people's needs. Additionally, all the three platforms are being developed with the intention of enabling planners to obtain data from different users and on specific issues related to a public open space. In this sense, the advantages of using similar digital approaches for monitoring and planning processes can be focused around the real-time data gathering, the maintenance of an updated database, the collection of different activities and users' groups 'at the same time and in the same space", and, finally, to record their opinion and preferences, via text, video, sound or pictures. These digital tools open up also the possibility to perform specific surveys.

Through this chapter, we intend to demonstrate the critical features of the three platforms and describe the functionalities and opportunities that each one offered. Different types of results produced through their use will be analysed, based on each different study cases where the digital tool was tested. By describing the case studies, our main goal is to argue about the main potential of each platform, related to different stakeholders and users.

This chapter is organised in five sections. In sections two, three and four the WAY-Cyberparks digital tool, CyberCardeto smartphone application, and EthnoAlly, are correspondingly described and discussed. In the last section, the chapter concludes with a critical discussion and lessons learned.

2 WAY-Cyberparks

The WAY-Cyberparks digital tool is one of the main outcomes of the COST Action TU1306, and it is a result of strong international transdisciplinary cooperation between ICTs developers, urban planners/designers/landscape architects, social and behavioural scientists. The main objective of this digital tool is to provide support to fieldwork activities, related to the understanding of the interactions between people and physical space, taking advantages of the potentiality behind the given mobile technologies.

2.1 Overall Description and Potential of the Digital Tool

In a nutshell, the WAY-Cyberparks consists of a smartphone application (APP) and a web platform, and it is developed with the intention of increasing the data and enhancing the insights on how citizens appropriate and use open public spaces, namely by tracking outdoor activities. Additionally, when users reach specific geographical points, the tool allows administrators to pose specific contextualized questions. Furthermore, users can also proactively send their suggestions and inquiries to the administrators, attaching different kinds of multimedia material. This collective method allows for the gathering of contextual feedback and significant information about the eventual use of public spaces. Moreover, the digital tool enriches the individuals' experience by providing contextual information and tools to socialize with others. The objectives behind the creation of these interactive contents is to make the exploration of public spaces more attractive and engaging, while fostering outdoor inclusiveness. By this way, the tool becomes more attractive both for place administrators as well as for common users. Additionally, the WAY-Cyberparks provides an off-line mode, allowing users to use it even when internet connection is not available.

The central architecture of WAY-Cyberparks is not the app itself, but rather the web platform where the administrator of each space can access all the available multimedia material gathered through the app, such as the participant's profile, their answers to the posed questions, their moving patterns in the place, the speed of movement, the stops enacted, their length, or even the weather conditions during the activity to better understand the complex user - space relationship. The administrator is also able to visualize information from the gathered material like the uploaded images, videos, audios and textual notes taken by the participants.

More specifically, the data gathered by the app can be divided into two groups. The first relates to the *direct data*, which includes the audio-visual material produced by the users while directly interacting with their surroundings. The second handles the *indirect data* classified as descriptive metadata. This second group of data is inferred by the app while it is running, gathering relevant information such as user's position, the actual time and the user's speed. The role of the material is important in better understanding users' behaviour, and to respond to their needs.

2.2 Case Studies Around the World

Up to date, the WAY-Cyberparks is specifically developed to function for many different cities attracting, at the same time, the attention of a remarkable number of professionals around the globe. Amongst these profiles we find teachers, educators, cultural heritage workers, urban planners, architects and local governments. It is being used in more than 25 cities spread all over the world (as shown in Fig. 1(A)), in European cities such as Barcelona, Lisbon, Ljubljana or Sofia; in Asian cities such as New Delhi; or South American cities such as Curitiba or Popayan. All these deployments have generated different data coming from more than 430 users. It should be highlighted that enable the digital tool for a specific place is a rapid process, coordinated by the University of Deusto with the administrator of this space.

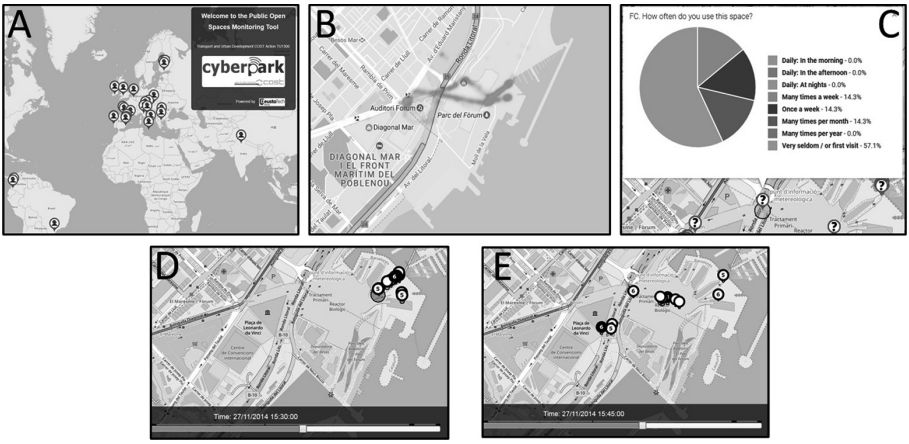

Fig. 1. (A) WAY-Cyberparks deployments all over the world. (B)–(E) Examples of some of the functionalities offered by WAY-CyberParks. Examples focused on the city of Barcelona.

The gathered data can be analysed in different ways by the administrators of each site. Among the various results obtained by the processed data we can highlight the development of behavioural heat map; the users' movement monitoring tool and the users' response analysis. The first one, the behavioural heat map, is a graphical representation of the activity carried out by the users. This graph is overlaid over the map of the study area, indicating the places with the most registered activity. One example of this functionality can be seen in Fig. 1(B), registered in the city of Barcelona.

The second functionality is the users' movement monitoring tool. The main motivation behind this monitoring tool is to trace how participants use an outdoor space - product of detailed planning and design - by recording their responses, behaviours and/or tracking their movement within the space. The aspects identified may help urban planners and decision-makers to investigate some crucial dimensions that can result to more responsive, stronger, safer and inclusive cities. An example of this functionality is demonstrated in Fig. 1(D) and (E), in which two different situations have been presented, showing the exact position of each user at two adjacent timestamps (with a difference of 15 min between them).

By the users' response analysis administrators can extract statistical data from the answers given to each question, and they can choose to receive graphical results from any of the questions posed, as showed in Fig. 1(C). At this point, it is important to highlight that all these functionalities can be filtered based on different criteria, such as the gender, occupation, education or age and that all this information can be taken from the user's profile.

2.3 Case Study Quinta das Conchas Park, Lisbon, Portugal

In this section, we explore the case study of the Quinta das Conchas Park in Lisbon. It was part of the activities associated with the European Researchers' Night which took place on September 25, 2015. The activity organised by the Portuguese team of

CyberParks (CeiED/ULHT and LNEC) set as main objective to test the digital tool WAY CyberParks. The results were processed, analysed and presented during the event.

The workshop was attended by 15 participants who, allocated in groups, used the mobile application WAY CyberParks. Beyond testing the tool, it was also an aim to open the opportunity to app users to propose improvements for its development and operation. During the event, administrators intended to collect information regarding specific functionalities of the WAY CyberParks. These can be categorised as follows: (1) the routes taken by each user (or group); (2) the information provided to the WAY CyberParks suggestion box; (3) the responses to the WAY CyberParks questions related to the visited space, and (4) a paper questionnaire on the usability and applicability of the tool WAY CyberParks. From these four functionalities, it was however not possible to collect the responses to the questions inserted in the application. The questions were uploaded and working online during the event. Due to technical issues related to a change of the hosting server of the tool, it was not possible to record the responses given by the users. Their routes allow to understand which parts of the spaces were more used. The Figs. 2 and 3 show an example of the route taken by a user and the behavioural map associated. This information, combined with possible suggestions and/or answers to questions, can show how the space is used, which areas have a greater or lesser occupation and the time space associated with journeys and stays.

Fig. 2. Print screen website CyberParks (http://services.cyberparks-project.eu/): User path and distance travelled.

The "suggestion box" was a functionality widely used by the participants, with 17 interactions in total. The sound submission feature was not used and only one video was uploaded. Sending of suggestions was done mostly through text and image, and the use of text with illustration (image) in the same suggestion was the most commonly used option. Most of records are related to observing of negative points, corresponding to 65% of interactions (11 records). This functionality allows to ease and speed checking users' opinions about the visited space.

Taking advantage of a workshop with a previously registered group of people, and in order to obtain more information about the usability of the tool WAY CyberParks a paper questionnaire was prepared and submitted to the participants. It was provided to participants at the end of the event. Although the objective was not to tackle the results obtained by the tool, the users' opinions regarding the questions launched by the mobile application highlighted some suggestions for improvement, for example to add the functionality to allow the discovery of something new in the park.

As for the questions that were automatically launched, the participants point out their preference for, among other things, direct opinions while encouraging a closer observation of the surrounding area. Some suggestions for improvement have also been made, such as to offer the mobile application in Portuguese; the improvement of the interface and a system of notifications of questions to be launched automatically. It should be noted that these two main aspects highlighted by the users allowed to significantly improve the tool soon after the workshop. Regarding the raised question in terms of the aid that the mobile application might have given in the discovery of something new in the Park, most users answered affirmatively, as indicated by the less visited areas of the Quinta dos Liláses, an adjacent park to Quinta das Conchas.

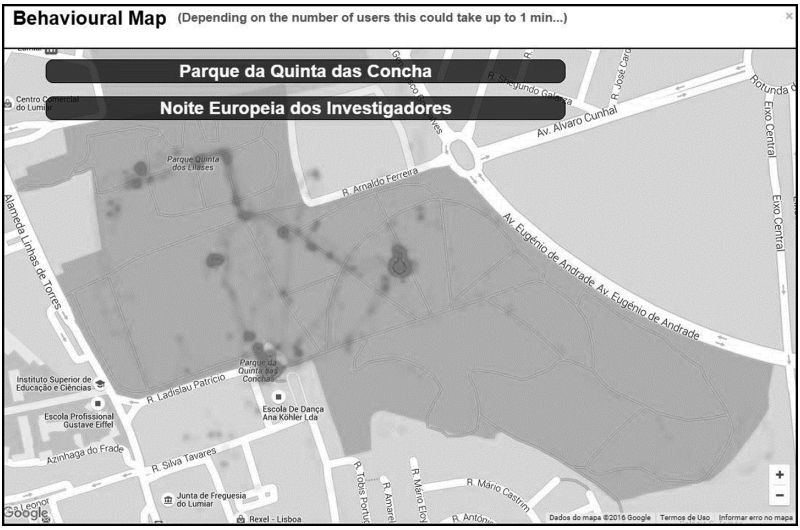

Fig. 3. Print screen website CyberParks (http://services.cyberparks-project.eu/): Behavioural map

3 CyberCardeto

The CyberCardeto application has been developed and tested in a real scenario to validate the feasibility of the mentioned paradigm of *Senseable Spaces* (Rati et al. 2006; Kostankos et al. 2010; Girardin et al. 2008), in terms both of giving and getting information to and from the users.

3.1 Overall Description and Potential of the Digital Tool

CyberCardeto is a mobile application developed with the specific aim of shaping the paradigm of a senseable space, defining this latter as this kind of space where there is a seamless exchange of information between the users and the technology installed on it. In fact, the application can be used once user gets into a public space, i.e. a park, since it provides contextual information about the environment with text and media hints. The user is geo-localised and can see her/himself located into the map of the park. The application is paired with sensors that have been installed in the park and that enable the activation of notification once the user gets into the radius of influence of each sensor. The sensors are also enabled to collect the information from the users' device, storing data in a remote repository for future statistical inferences. The architecture of the application in composed of three main elements. The first one is the mobile application, which provides contextual awareness services. The second consists of the active sensors installed within the park having the twofold purpose of providing the information and acquiring data. The data collection service is hence performed by a server, which deals with the task of storing the data coming from the activity of the users in the park. The overall architecture of the tool can be seen in Fig. 4.

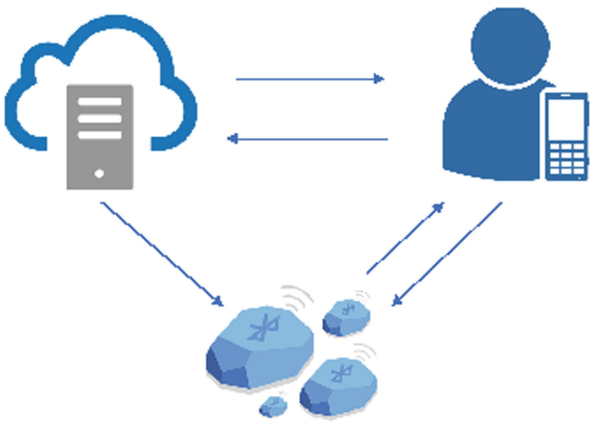

Fig. 4. Overall description of the main components of the system architecture. The Application can communicate with the sensors which provides.

The application was designed to run on both iOS and Android device and it is available for free[1,2] download. The structure of the application is very easy and user-friendly, and it is mainly composed of a toolbar which brings the user into the main functionalities:

[1] https://play.google.com/store/apps/details?id=it.univpm.dii.cardeto&hl=es.

[2] https://itunes.apple.com/us/app/cybercardeto/id1219952063?mt=8.

- The Points of Interest (POI) which allow the user to get in-depth information about the main attraction of the park and are divided into two main categories: *natural* and *historical*. Once the user clicks over a POI, she/he is enabled to discover more details in terms of the flora found in the park, as well as its background history. Moreover, the user can express her/his attitude/preferences towards a single POI, so that the manager of the area can understand the visitors' behaviour within the park. Some possible paths are also suggested, being accessible from the map function;
- The Map is designed as to be essential and simple and it is enabled for GPS geolocation. The user can see her/his position inside the map and can also pick the POIs to reach the associated information. The path is designed as to suggest the POIs that are closer to her/him.

Some screenshots of the application running are depicted in Fig. 5. Inside the park, and in order to monitor visitors' movements, we installed active beacons arranged in a limited area. Beacons are BLE (Bluetooth low energy) based sensor, enabling smart devices to perform actions when they are close to them. These transmitters are commonly used for distributing messages at specific POIs (as in this specific case) and as part of an indoor/outdoor positioning systems. More specifically, the beacons used for this case study are the well-known Estimote Locations Beacons[3] which are commercially available sensors with a built-in bidirectional low energy BLE radio. These are medium range location transmitters, designed to be used in both outdoor and indoor locations. Active beacons were placed near the main "attractions" of the study area, with the dual scope of providing notifications and collecting statistics about each attraction. Beacons' ping is caught by the smartphones and the application is enabled to send data to the cloud via 3G/4G connection. This solution is particularly suitable for such kind of services, since it allows the cross-platform development, it is of low cost and it assures a long-life due to low battery consumption.

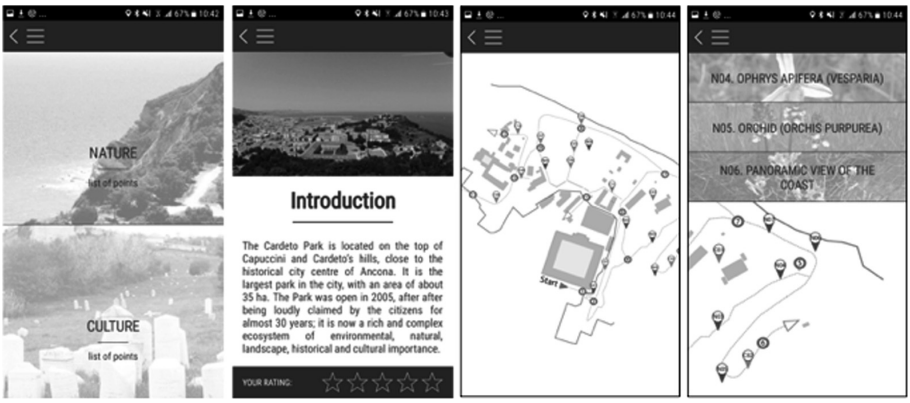

Fig. 5. Some screenshots of the application running. In particular on the right picture is depicted the interaction with the beacon, once the user gets within its area of influence. The nearest POIs are suggested.

[3] https://estimote.com/.

In the next section a more detailed description of the case study specifically designed to test the application and to validate the methodology for further investigations and uses is provided.

3.2 Case Study Cardeto Park, Ancona, Italy

The specific case study has been chosen to test the functionalities of the application within the premises of Cardeto Park in Ancona, an urban green space close to the city centre. It is one of the biggest city parks in Ancona with an area of 35 hectares. In its broad territory, the park includes numerous natural and historic places that attract a great number of users every year. Additionally, its proximity to the harbour, its natural landscape and the diverse views offered along the elevated coast makes it an attractive destination for local, as well as for tourists. The area of the Park can be ideally divided into three areas. The North-Western part of the Park located between the ruins of roman Amphitheatre and the Lighthouse including a small residential area close to the new lighthouse. The South-Eastern part of the park as a natural zone that includes places with panoramic views, jogging paths, lawn court for running and sports, ruins of the old Napoleonic fort, and rich botanic diversity. The middle part of the Park as an area of blended zones, from the historic-cultural cluster of the west part to the strong natural-botanic character of the south. This mixed-use area includes an English and a Hebrew cemeteries, old military buildings, to be restructured and assigned to further academic needs, and a play-ground. All these features make the Cardeto Park the proper scenario to validate the potential of the tools in terms both of behaviour analysis and efficiency for the visitors.

For testing the application, we chose the part located in the middle of the Park and, as it has been explained already, includes diverse elements identified by historic, cultural and botanic perspectives. The map of the area of interest is depicted in Fig. 4. The testing area is a territory of 9 hectares where nature and culture are inseparable, with two independent entrances from the city and the main road that connects the area with all the other parts of the Park.

The mobile application was designed to guide the user along the visit path, providing contextual information through the POIs and thus promoting a close synergy between visitors and the place. As said before, the main functionality of the application is the contextual notification of the attraction points. Moreover, to improve the capability of the park to “suggest a path” to the visitors, beacons have been also installed in bifurcation points leaving the user free to choose her/his own preferred path. Notwithstanding, other functions increase the user’s experience. The localization service allows finding attractions in a virtual map. The list of POIs proved useful for the visitor that attempts to reach a point of interest. Discussing the cloud service, the data have been collected in the following way: once the smartphone is permanently into the operational range of the beacon (recording five consequent pings) the application performs two operations. The first is to notify the users with a welcome message, while the second is the sending of the data to the cloud automatically done after the first step. The same criteria are adopted to discard the device once the smartphone exits

Fig. 6. The map of the park with highlighted the study area

from the area of influence of the beacon. In this way, it is possible to collect a series of information like the overall time spent by the users in each POI, the interaction among groups of users, the preferred path and response to an attraction point as well as other statistical data that can be of great value for the managing authorities and planners.

4 EthnoAlly

The EthnoAlly is a digital tool developed to facilitate the work of the ethnographic researchers, allowing them to strictly focus on their fieldwork, while letting the tool do the hard and necessary job of recomposing the gathered material once the experience has finished. A large part of the ethnographic fieldwork consists in bringing together the various materials collected during a day in the field. This is a daily activity, and it is important to make it in a coherent and productive way. Only by this way the researcher can generate intelligible archives or documents for further analysis and consultation. In fact, the ethnographer needs to be capable of finding a way throughout the amount of materials gathered in a later time, once the direct memory of the events portrayed may have faded. Specifically, the laboriousness of this activity is especially important for those researches performed in semiotically dense environments, or in scenarios in which little time is left during the day to collect thoughts or materials. To help out of this, digital technologies are rapidly entering the work of ethnographers, shaping new ways by which they can conduct their daily fieldwork.

4.1 Overall Description and Potential of the Digital Tool

EthnoAlly is a digital tool specifically designed for conducting participatory audio-visual ethnographic research. Succinctly explained, EthnoAlly consists of two different elements. The first one is a smartphone/tablet app, which permits the users the collection of audio-visual material. The second component is a web platform. Its aim is to drawn information from the gathered multimedia material and to transform it into an understandable structure for further use. These two components are connected by an additional third element, which is the server in the cloud. This server acts as a bridge between the web platform and the app. In this sense, the server synchronizes, archives, and organizes the raw data gathered by the app and provides the data to the web platform for proper visualization and analysis. The architecture of the complete digital tool is depicted in Fig. 7.

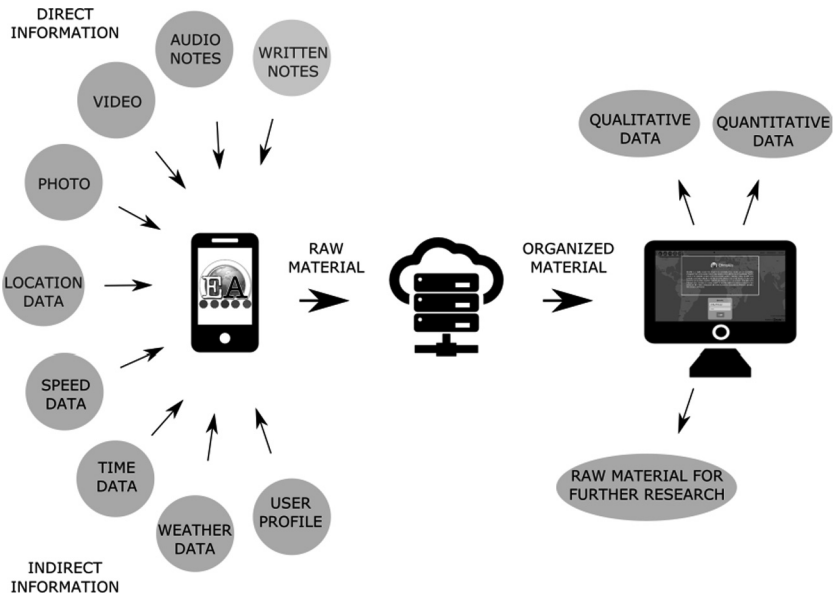

Fig. 7. Architecture of EthnoAlly digital tool with the three different elements depicted: The smartphone APP, the cloud and the Web Platform.

On one hand, the smartphone/tablet app, defined primarily as an audio-visual information gatherer, is able to collect different kinds of multimedia material such as photos, audios, videos, or text notes. All these data can be introduced by a user-friendly interface. In line with this, it is noteworthy to mention the full commitment of the digital tool with the user's privacy. In this regard, all the information gathered by a specific user cannot be seen by someone else apart from the material previously set as "public". Furthermore, EthnoAlly researchers have access to all the available data prior the consent confirmation of the users while all this information is completely untied

from any personal identification. This makes it impossible to associate the gathered data with any specific user. Besides that, as in the case of the tool WAY-Cyberparks, the data collected by the smartphone/tablet app can be classified into two different groups: *direct* and *indirect* data. Direct data are these audio-visual materials that are directly produced by the users through her/his interaction with the environment and the application. This information represents the principal data that any EthnoAlly user can access. Additionally, the indirect information represents the descriptive metadata. In this sense, this material is inferred by the application while being used, even in the background. Some examples of this indirect data are the time, the position, or even the weather conditions. All this information has a remarkable importance for the proper contextualization of the direct data, and it greatly helps the researcher to completely understand the users' behaviour and response.

On the other hand, the main component of the digital tool is the web platform[4]. This platform is fed by the direct and indirect data gathered by the app and is stored in the above-mentioned cloud server. In this sense, the server is responsible for the organization of all gathered data. Afterwards, all this material is provided to the web platform for its proper presentation, facilitating any posterior analysis and visualization. Besides that, the most interesting functionality of this platform, along with the possibility of visualizing and analysing all the collected material, is the content search engine further presented in the following subsection.

4.2 Case Study Antwerp, Belgium

In this subsection, an example of how EthnoAlly has been used in a real scenario is discussed. In this case, the activities performed by one user in a single field work session in Antwerp, Belgium, are described. More concretely, this case study is focused on an interesting functionality implemented on EthnoAlly, which helps the user to recompose all the materials collected during the fieldwork. This feature is represented by the track - a concept related to the activity conducted by the user in a single session. In this sense, once a user activates the track functionality, all the direct and indirect information acquired by the app during that session is automatically associated to this path. Additionally, the user can also attach any direct material taken in any other moment, or through any other method or application. The end results of this process result to a route composed by all the materials found and attached to the specific track. Figure 8 shows some screenshots related to the track concept.

Once the work of the ethnographer has been finished, and after collecting different information, she/he can easily view all the performed activity throughout the web platform. As previously explained, all the collected material is perfectly contextualized, meaning that all the information appears superimposed on the map in the exact places where they were taken (as shown in Fig. 6, in a created track in Antwerp). Furthermore, all the information has additional contextual data associated, such as the weather conditions or the exact time they were collected. Additionally, taking the track as an example, the route may acquire other associated digital materials such as written notes,

[4] http://cloud.mobility.deustotech.eu/ethnoally.

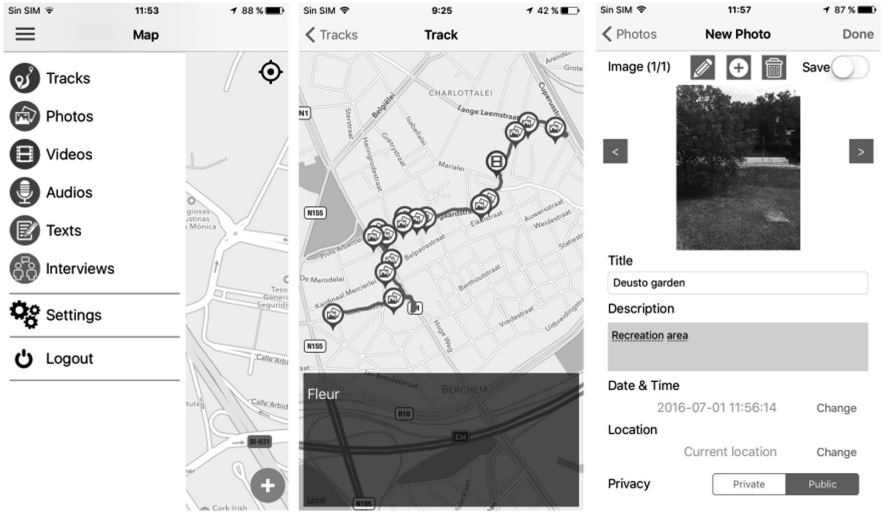

Fig. 8. Some screenshots of a field work session

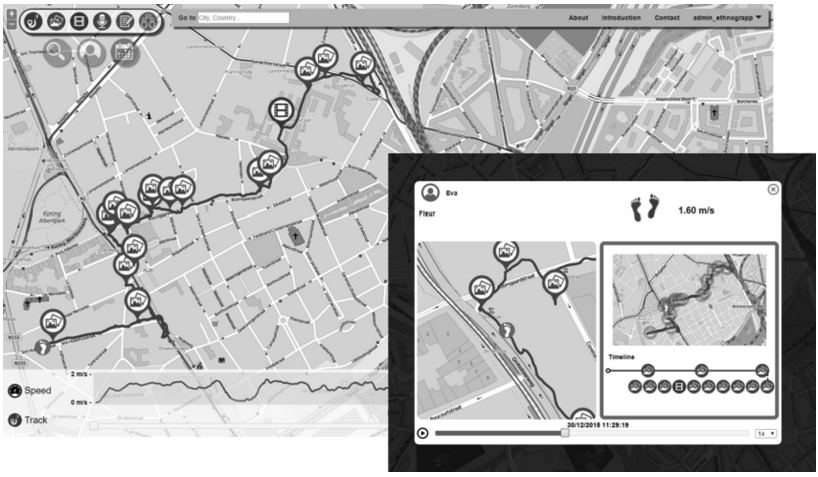

Fig. 9. Track functionality in the web platform

photos, videos or audios, which also appear in the exact places they were gathered. Besides that, as it is displayed in Fig. 9, all tracks can be visualized in an especially created video mode. In this mode, the user can reproduce step by step the followed routes. In addition, every time the route reaches a point in which a specific material has been gathered, it is automatically shown or reproduced.

Finally, to facilitate the retrieval of different content stored in the server, the web platform offers a user-friendly search engine. Using this engine, users can search any kind of content by keyword, user, or time-period. In Fig. 8, for example, a search by

keyword of any type of direct content has been made (photo, video, audio or written note) inside the track taken in Antwerp. In this specific example, the search term was 'street', and one video matched with the search conditions. Additionally, searches based on users can also be made. In this case, users can search any other participant by introducing her/his name. Once the search is made, all the public content associated to the quested user is displayed, as seen in Fig. 10.

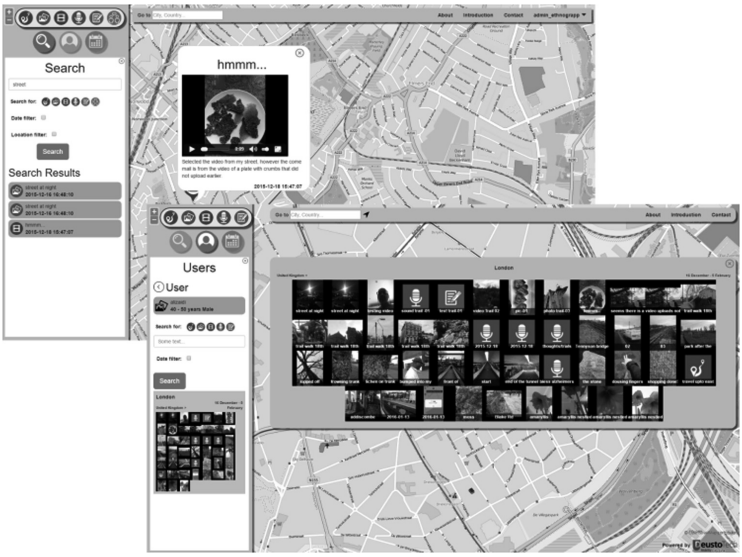

Fig. 10. Search function in the web platform

5 Conclusion and Lessons Learned

The use of ICTs allows for a new approach in the development of public open spaces in order to create more attractive and inclusive urban spaces. Throughout history, public spaces were reflecting the identity of the city, providing - from a social point of view - various functions. Increasingly, open spaces users have new needs, and planners have the responsibility to adapt and respond to these needs. Through the use of ICT, the main challenge is to promote interaction possibilities between users and decision makers, but above all promoting the coexistence of new groups (youngsters, adult, elderly people, tourists, researchers etc.). By enhancing public open spaces, we are encouraging healthier living behaviours, contributing to better living conditions in cities.

This chapter made possible a deeper understanding of the main functionalities and opportunities offered by the three different digital platforms: WAY CyberParks; EthnoAlly; and CyberCardeto. It allows the understanding of the main potential of each platform, related to different stakeholders and users. In brief, we can describe the WAY

CyberParks and CyberCardeto as tools that allow users to get dynamic contextual information related to space. Additionally, the first one allows different type of information to be transmitted using a suggestion box and a questionnaire available in each location. On the other hand, EthnoAlly is a digital tool born to facilitate the work of the ethnographic researchers, allowing them to focus strictly on their fieldwork, and letting the tool do the hard and necessary job of recomposing such material once the experience is finished. Being interactive tools, their use plays a relevant role not only in the development, but also in the maintenance and improvement of public spaces. They offer valuable resources to make a significant contribution to the study of public spaces. The type of results produced allows a quick and efficient collection of data that may prove essential in the development of new public spaces while improving existing ones. Basic advantages for different kind of users can be further highlighted. To refer some, in terms of planners and the public administration, we can foresee that a wider adoption of ICT tools might improve the tourism sector offering an economic boost by engaging higher numbers of visitors.

Moreover, the quality of the services can be improved, and new services can be tailored according to users' feedback and analysis. Finally, given the impervious layout of a park, the ICT can contribute to overcoming the physical barriers while restoring the vital connections and relationships between the park and the city. In addition, the visitors can benefit from such services. With pervasive, but not intrusive, services directly available for their own devices, users can achieve a better knowledge about their surroundings. Given the immense potential of the tools, it is also important to underline some possible drawbacks. Their systems are app based and are not so widespread. This is also because the app is based on BLE technology which is not popular so far. This presents a limitation, especially from the data collection viewpoint that is rather contradictory since by performing statistical inference about the behaviour of the user and the performances of the park, the bulk of data should in fact be increased.

Acknowledgements. This work has been supported by the Cost Action TU1306 CyberParks and the Spanish Ministry of Economy and Competitiveness under the ESPHIA project (TIN2014-56042-JIN). E. Osaba would like to thank the Basque Government for its funding support through the EMAITEK program. The authors would also like to thank the staff of UbiSive s.r.l. for the support in developing the CyberCardeto smartphone application.

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