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Multifunctional Interactive Furniture for Smart Cities †

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Abstract: The adaptation of cities to a future in which connectivity is at the service of the citizens will be a reality by creating interaction spaces and augmented urban areas. The research on this field falls within the scope of Smart Cities (SC) with the advantages that the common public spaces provide as new points for information exchange between the city, the urban furniture and their citizens. Kiosk systems have been recognized as an appropriate mean for providing event-aware and localized information to the right audience at the right time. Hence, in this article, we provide a vision of an eco-system of multifunctional urban furniture, where kiosks are part of them, designed not only for digital interaction but for sustainable use and symbolic integration into the urban environment as well. The proposed approach is conceived to drive services through digital urban nodes that facilitate tailored citizen-city communication and interaction. The central element of the designed platform consists on an intelligent digital kiosk which features a series of hardware and software components for sensing different environmental conditions, multimodal interaction with users and for conveying the captured data to the Cloud. The custom-based contents visualized to the users are controlled remotely through a management tool that allows to set-up and configure the digital kiosk. This system is not presented as an ad-hoc solution for one specific purpose but instead, it becomes a platform that can accommodate and solve the needs of every kind of user that populates urban shared-use spaces.

Keywords: digital kiosks; smart cities; smart furniture; modularity; HCI

1. Introduction

Can we imagine a city that feels, understands, and cares about the environment together with its citizens? Can the city act as a digital background assistant that supports us with our everyday tasks? Can it even become a kind of "guardian angel" that understands our goals and fears, and actively actuates the built environment to optimize processes and make it safer? The concept of Smart Cities (SC) is broad and relatively new since it gained strength during the beginning of this century. Due to those factors, many of the current SC's problems relate to the lack of easy-to-use technologies, infrastructures and best practices [1]. The design of future SCs requires optimal combinations of automated systems, just-in-time delivery of relevant information for personal control and interfaces to interact with their citizens. Hence, through this article we want to contribute to the transformations that cities should undergo to succeed in creating useful solutions that bring closer people and city. For that, we present the implementation of a multifunctional digital system, in the form of smart furniture, to be deployed in future Smart Cities to weave urban spaces with a set of interactive nodes that facilitate citizen-city communication. The main axis of this platform is a device, which is actually a modular kiosk, that reacts

to its surroundings and people's interactions since it is equipped with built-in custom sensors. In terms of mechanical construction, this platform is provided by a set of assembled pieces or sections that are combined in a customizable construction. Each of these sections is in charge of a specific task and includes the hardware elements required to fulfill them.

The developed software solution, based on modular nodes, supports this hardware and enables data and information exchange to respond to users' needs. The system in a whole aims to be accessible and attractive, engaging visitors while maintaining its functionality and usefulness for supplying services. The types of interactive elements that are distributed throughout the structure can be grouped as input or output methods. An interactive tactile screen is the central element of the approach and a bidirectional communication method, being used both to show information and to gather users' interactions. Other elements such as speakers, display panels or projectors constitute the medium to offer contextualized services and to provide a better experience. In terms of input, environmental sensors and cameras enable to obtain real-time information and parameters. This bidirectional interactive eco-system is capable of collecting both objective and subjective information to allow the urban space to respond to the needs of society and the city itself in different time segments and localized points.

This work arises from the ideas and the urban design concept presented by Sádaba et al. [2] and aims to provide insights of the transformation that cities could undergo to become socially-engaging places where citizens will obtain personalized information to ease their daily living. In this sense, we present two contributions that will articulate the presented article:

(i) On the one side, an extensive review about smart kiosk systems, with a special focus on their role on Smart Cities, and an analysis of the key aspects to consider to improve the suitability of the approach through different factors that entail user acceptance.
(ii) On the other side, a case of study where we explain the concept of an eco-system of a multifunctional urban furniture, a smart and modular kiosk designed to connect with the community and end-users.

This paper has the following structure: Section 2 reviews previous work related to kiosk systems and smart cities. Section 3 introduces the system and its central element, a modular smart kiosk. Section 4 describes the design and implementation of this platform both in terms of hardware and software. Section 5 summarizes different factors related to increasing the usability and acceptance of the approach. Finally, Section 6 draws some conclusions and outlines the future work.

2. Related Work

Using interactive systems to provide ubiquitous access to useful contextual information or services is a well-known challenge. Within this section, the evolution of these interactive systems will be reviewed, starting from its roots and analyzing actual trends and its role in the development of Smart Cities. The first considered self-service kiosk was Plato Hotline System, based on Plato Computing System [3], developed by Murray Lappe in 1977 for the University of Illinois to provide information related to the university courses, activities or events. Since then, several approaches have been introduced both from a commercial and a research point of view, analyzing how public kiosks could change the way people, space and things interact [4]. Focusing on the research trend, the followed path covers a wide range of technologies and purposes. Back in 1987, Apple researchers designed and evaluated an electronic kiosk created for the CHI'89 conference [5], testing its advantages as a public information exchange point and collecting insights to understand how offered services could respond to users' needs [6]. The majority of these proposals focused on incrementing users' attraction to these devices leveraging the use of effective interfaces and making them tangible and actionable through a touchscreen. This interaction method, and the growing complexity and quantity of the available services and data, involved defining how easily information needed to be accessed and how clearly it

was presented [7]. Combining touch interactivity and easy-to-handle user interfaces, several platforms were defined and, in 1999, Maguire [8] reviewed the existing systems.

Lately, other works continued studying the interactive signage paradigm. Besides touch interaction, different approaches added multimodal input modes, increasing the means users could take through the content and personalizing the offered experience. Some approaches proposed voice interaction [9] while others designed human look-like interactive agents to give friendly feedback through audio output [10]. In some other alternatives, computer vision was added to allow navigation by gestures, as illustrates the Kiosk created by the MIT Media Lab to work as a wayfinding system [11]. A more recent proposal, from 2012, dealt with the idea of designing accessible platforms for blind people [12]. Computer vision was also employed for user detection [13] and even for a combination of all of these methods for gesture control and user detection [14].

Recent contributions continue evolving this kind of platforms to a new level. More than technical innovations, these new platforms aim to develop innovative means of communication with citizens, visitors and customers, creating a new class of services that affect users' lives [15]. Modern kiosk systems can be categorized depending on different dimensions; task, location, intended users or technology [16]. In terms of location, the nature itself of the concept involves its deployment in common share places such as urban environments, touristic places, hospitals or commerce where can be accessible to the general public. Closely related to the location is the user dimension, grouped as citizens, visitors or customers. Connected to them, the tasks any of these platforms fulfill are designed for a specific purpose, evaluating their suitability based on the place and the public for whom are designed. Based on this classification, a review of the existing literature differentiates some specific fields in which these systems deserve an important attention. Retail is one widespread example of kiosk platforms adoption as illustrates the banking ATM systems, completely integrated into the city landscape. The main aim of these solutions is to improve the shopping experience and customer satisfaction by offering them additional services [17]. Another domain increasingly popular is health care, where kiosk-based systems' advantages are well-known [18]. In this field, researchers focus on developing self-service solutions either for health-related information distribution [19], education [20] or health condition monitoring [21]. Combining this domain with the engagement searched in the kiosk platforms design, these systems are especially suitable for applications that involve user participation in a healthcare promotion environment [22].

2.1. Kiosk Systems as Enablers for Digital Smart Cities

All previous kiosks have a common objective: design systems to change the way people interact with the world around them and offer barrier-free information to support a broader community. This goal falls within the scope of the Smart Cities paradigm since kiosk systems constitute an appropriate mean of providing event-aware and localized information to the right audience. Outdoor public spaces play a paramount role performing such street-level interactions, where special design criteria are needed to connect with the community [23]. Different kiosk-based urban platforms have been proposed under this domain, covering a wide spectrum of services. One example of the suitability of this approach is transit kiosks, direct evolution of the tickets vending machines largely used in public transportation [24]. Beyond being only transaction points, these systems add interactive features enabling services as route finding, city guide or local events information [25,26]. Although this kind of public platforms is available for every user regardless of being visitors or citizens, sometimes are directly oriented for a specific audience. This is particularly the case for tourist information point, which aims to open the city to visitors and support travelers [27]. Bike sharing [28] and traffic data analysis kiosk [29] are examples of systems designed for the community, enhancing the experience by creating a participating scenario into urban development while contributing to its sustainability. Besides offering information services, data gathering is a parallel aspect which is attracting an increasing attention. The importance of data as a part of a smart city is a well-known concept [30] and providing an infrastructure for obtaining this data is an actual challenge. Taking advantage of its

public location, smart kiosk platforms can serve itself as an information source for further analysis that results in improved and contextual aware services for the cities [29].

Figure 1. Examples of different kiosk systems deployed on severals cities worldwide: (**a**) LinkNYC; (**b**) Points;and (**c**) UTS Wayfinding. Images property of their respective authors.

From the growth of a research trend directed to increase the Smart City potential, different projects are embracing the possibilities smart kiosks provide and deploying their proposals in real scenarios. Figure 1 illustrates the following examples.

The LinkNYC project (https://www.link.nyc/) constitutes an illustrative case of success of kiosk systems, probing the suitability of the approach for large audiences. The proposed solution consists of the deployment of digital kiosks with associated WiFi hotspots for the city of New York. By interacting with them, citizens and visitors can use digital kiosks as an access point to connect their devices to a free wireless network, enabling Internet access while providing city services or maps through a computer or mobile phone. Digital signage is another application related to smart kiosks, sharing the roots of the concept. In particular, Points (http://pointssign.com/) is an intelligent signaling system for the city. The form factor that Points present is similar to a conventional address signal with three modular arms. The main characteristic of this product is that the orientation of its "arms" and the information they show is dynamic and can be updated in real time according to users' interest. Related to making spaces more accessible, UTS-Digital Way-finding (https://www.meldstrategies.com/uts-digital-wayfinding) is an orientation system for students and visitors of the university campus of Sydney (Australia) based on different interactive kiosks. Its main objective is to help to find, as quickly as possible, the route to a specific place within the buildings of the university. The initial deployment consisted of seven kiosks with NFC connectivity to connect with the complimentary mobile application. Combining this app with the kiosk, users can mark where they want to go and the app shows a map of the campus and directs users to the selected location, while this piece of smart furniture can also serve as beacon devices to determine the route in indoor environments.

As reviewed in this section, there is a wide range of proposals that aim to make a quantitative and qualitative leap in the new design and deployment of interconnected nodes in the city. Contrary to the general trend, this platform aims to appear as an open solution, both in terms of its changing configuration and the customization of the available information. The following sections will explain in deep the concept and technical aspects of a system designed to suit every kind of user that populates urban shared-use spaces.

3. Re-connecting the City with its Citizens: A New System Proposal

Offering a suitable solution for the city and its citizens involves designing and creating a set of interactive and intelligent pieces of urban devices that can be easily deployed in the cities,

making citizens free to interact with the surrounding urban space for any purpose related to coexistence, mobility or accessibility. On the basis of the collected knowledge and the shortcomings encountered in the previous review, the proposed system seeks to revitalize the city by creating different spaces for the interaction with citizens, where selected urban areas are improved according to their specific needs. This platform is designed to fit in every environment by changing its configuration through a fully customizable structure to face the continuous changes and the growing opportunities that emerge within the development of smart cities. These advances include the increasing use of urban space as an element of information exchange, where it is necessary to develop more accessible and comprehensive systems to bring closer the relations between space, people and city. As a main innovation, the concept explained in this paper copes with a total modularity at the physical level of the device and at the network level of the interconnected devices. The main axis of the solution is an outdoor element consisting on a urban furniture, or digital kiosk, customizable and smart. In terms of physical shape, the kiosk can be considered as a totem formed by a series of modular sections in which every piece is in charge of a specific task, redefining the concept for every purpose or design requirements depending on which elements are included or what services are offered.

As a part of this citizen-city interaction system, the kiosk responds to users' needs by offering contextualized information and services through a series of integrated features and visualization elements; panels, tactile screens or speakers. This smart kiosk also incorporates hardware platforms and built-in sensors to be in charge of measuring external variables and process them to react to their surroundings. To deal with the need for providing updated information, these contents are managed remotely through a custom built management system that allows to control the system and change the displayed information. To illustrate this concept, Figure 2 shows one of the existing kiosk and the set of components included on one of its possible configurations where the different modules define a whole structure. This particular schema was specially formulated for open spaces such as gardens, parks or natural environments to serve as a contextual information point, prioritizing a natural integration with the environment, being completely sealed up and protected from outdoor climate conditions.

Figure 2. The final implementation of the smart kiosk according to one of the multiple possible configurations. Image property of Nerei-Emotional Intelligent (http://nerei.org/).

The previous idea allows weaving the city with a set of low cost and easy to deploy kiosks. In short, due to its modularity and versatility, this proposal has a wide range of sectors that fit its concept and where it can be applied. Some examples are the improvement of tourism services, citizen participation and e-governance through a leveraged interaction with the city, the promotion of local commerce and the improvement of physical spaces with a ubiquitous and universal provision of digital services. This enables public administration and private companies to explore and exploit the potential of applying this concept of digital urban ecosystems in those open areas and private environments where their services can help in different socioeconomic aspects. Therefore this solution fits to: (a) monitoring of users in public spaces; (b) complement physical spaces (stores, event centers, etc.) with nodes that inform and promote the interaction of users with the services provided; (c) generate guided routes thanks to the nodes deployed in strategic areas. Thanks to this customization capability, both in terms of physical construction and possible services and/or contents, the proposed kiosk-based platform itself is not presented as a custom-made solution. On the contrary, it is conceived with the idea of being a platform that can accommodate and solve the needs of every kind of stakeholder that populates urban shared-use spaces. This work should be understood as an enabling platform for services targeted to citizens, merchants and tourists through interactive nodes that facilitate citizen-city communication and interaction.

4. Design and Implementation

Once introduced the concept, in these sections the design of the software parts and all the aspects related to its functionality will be deeply explained.

4.1. System Hardware

To enable all the described capabilities, the proposed kiosk involves different hardware components. Because of its modularity, this equipment is located inside the kiosk's structure, which is divided into different Plug-and-Play sections that share some common elements to power and interconnect them. From top to bottom, these sections are the top of the system, the led panel, the display arms and the base connector. The different parts are joined through tubular connectors conforming to the structure.

The top of the construction is composed of two main parts. The first one includes an optional surveillance camera system, an independent element in terms of software that allows covering functionalities beyond the ones directly related to an information access point. This evidences the multiple possibilities offered by the ability to perform a customized composition of the solution. The second part of this top section is formed by a round piece which contains the environmental sensors for temperature, humidity and air quality in terms of CO_2 level, two stereo speakers and a globe projector. In particular, globe projector switching depends on a presence sensor, installed on the display arm, that actuates on the mechanism only once someone walks through near the kiosk and projects on the ground the desired logo or figure. This straightforward interaction draws people's attention and engages them to use the kiosk. The second modular section corresponds to the led panel arm. This arm represents another mechanism to display information, allowing to show warnings, remainders or specific messages through luminous letters that move horizontally with remotely managed texts. The middle part of the structure incorporates the central element around which the kiosk system is constituted: The interactive touchscreen. This screen is located in a medium height position where is easily accessible and comfortable for its usage and its interface provides a window to the contents and services that the platform integrate. Below the screen, on the bottom part of this arm, 3 USB ports provide a charging station for mobile phones. This service, once again and due to its location, promotes interaction with the screen while waiting for the phone to be charged, besides offering a particular service.

Lastly, the base foothold is the main container and point of union of the wiring that powers and communicates the different sections, corresponding to the core of the system. A built-in platform,

accessible through the incorporated door for maintenance operations, holds some of the gear that allows upper described components to work. This base contains the brain of the system, which is an industrial computer Central Processing Unit, or CPU, to whom touchscreen and speakers are connected. Additionally, a 4 g router works as a central access point and provide internet connection to the CPU and the two microcontroller boards, one to control the led panel and the one in charge of managing the environmental and USB current sensor.

4.2. Software and Architecture

The software solution developed for this proposal constitutes a bridge between the users and the city services accessible through the kiosk. This software encompasses diverse layers that correspond to the application interface shown in the main screen, the network architecture of the deployed kiosk systems and the communication to the cloud platform. The interface, that represents the principal mean of interaction with the system by a touch screen accessible for users/visitors, was specifically designed to fit on the requirements of usability. To maximize user experience expected on this kind of platforms, the contained visual elements must deal with the simplicity that involves a layout oriented to obtain the desired information at a gaze. The designed interfaces for the different sections are shown in Figure 3.

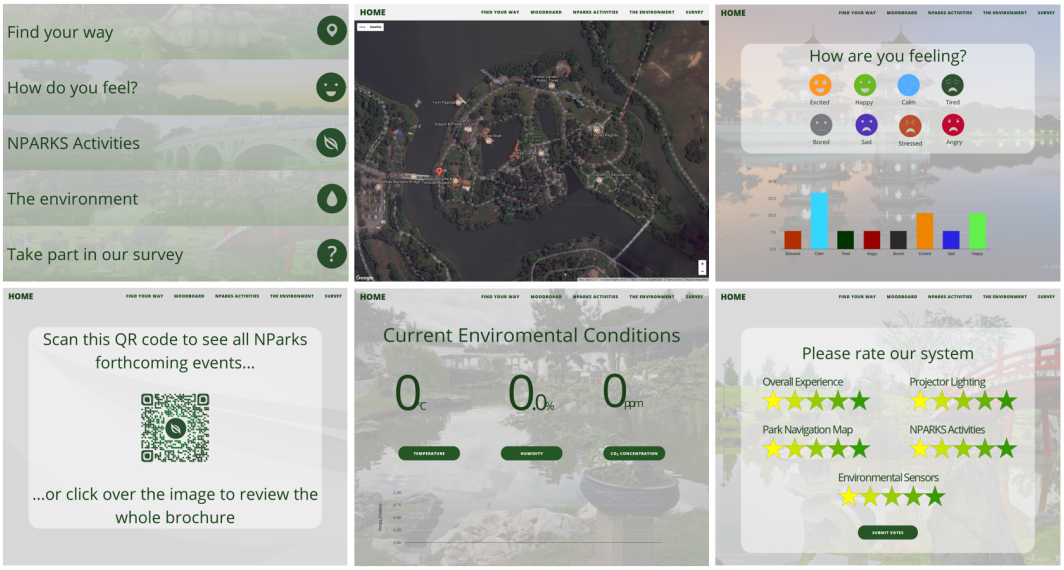

Figure 3. The designed interface including the following sections (from top-left to bottom-right): Main screen, Maps, MoodBoard, Events and Activities and Survey. The images and logos appearing in these frames are property of NParks (https://www.nparks.gov.sg/).

Following this principle, the main screen, set up as default, provides direct access to every included section of the application through horizontal tabs, making this tabs large tangible areas to facilitate the interaction. Once again, this configuration is modular and every section corresponds to a different application that configures a customized solution by being included or not on the main screen. In this particular work, the setup of integrated sections represents a sample of the wide range of possibilities available. The sections that encompass this solution are:

(i) A wayfinding solution where an interactive map shows the nearest points of interest and lets the user select any of them to calculate the best route to get to the desired destination.

(ii) A moodboard inquire to recover information about users' mood. The different items, from Happy to Angry covers a wide spectrum of options available to be chosen. The results of the voting are shown in a graph on the interface to let user compare themselves with peers.

(iii) The events and Activities functionality of the system has to do with covering the services offered by conventional information points, providing useful information about interesting events or activities carried out in a particular place. In this case, to enhance the adherence among visitors and the system, a QR-Code is shown on screen to motivate users to interact with the kiosk through their mobile phone. Nevertheless, if the user prefers to stick to the interface to go through the agenda of events, the same QR-code can be clicked since it points to a new screen in which the desired contains can be included.

(iv) Real-time measurements, obtained from the deployed environmental sensors; Temperature in Celsius degrees, Humidity percent and Air quality considering the CO_2 concentration level measured in particles per million. It also shows a graphical representation of the data.

(v) A Survey interface to evaluate the user experience that collects data about the visitors' opinion related to the system. In particular, it rates five aspects in regard to the general experience and the platform implementation: Overall experience, Projector lighting, Navigation Map, Activities and events and Environmental Sensors. Every item is rated at 1–5 points Likert scale, represented by stars that color when are selected.

The described interface is supported by the back-end of the application, which constitutes the core of the system for data management. Every kiosk device, whether in a network of multiple kiosk systems or not, includes its own local server. The internal server of each kiosk runs the application and contains a local non-relational database. This database receives and stores persistently the data obtained from the results of the participatory sections of the interface and the measurements from the attached sensors. Parallel to this local server, a central element provides common services to all of the kiosks while maintaining its individuality. This central element, or remote server, hosts the management website that allows interacting with the system from the outside and stores the data received from the deployed kiosk. Figure 4 shows a representative scheme of the explained architecture for a kiosk system network.

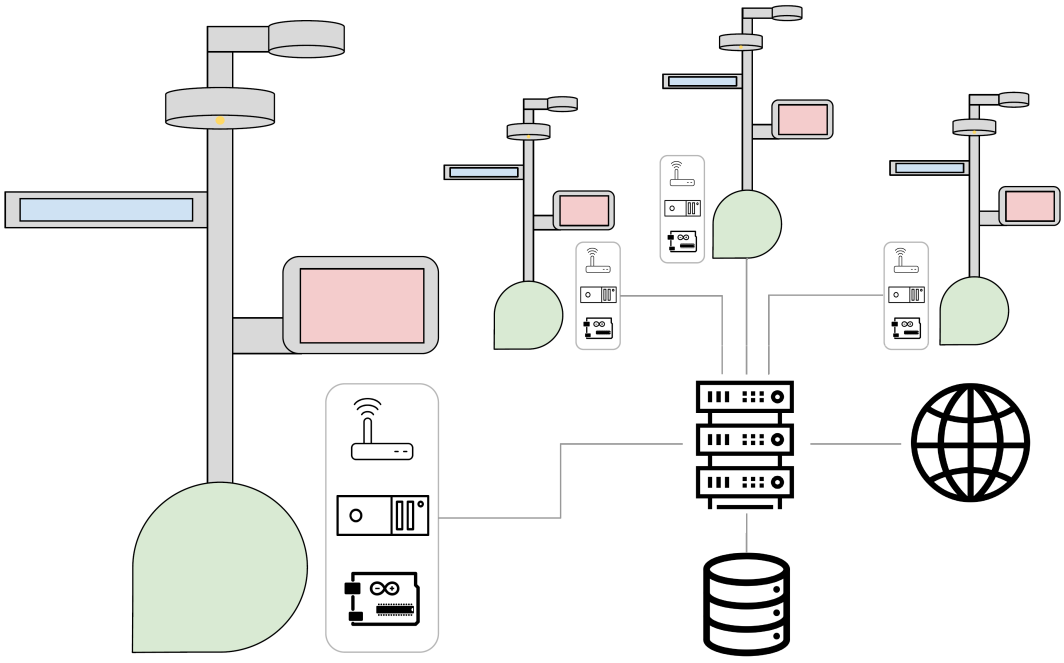

Figure 4. Schematic representation of the system architecture considering a network of multiple kiosks where every point of a network exchanges data with a remote server that hosts the management tools.

Each of the kiosks is identified with a unique ID and can be managed independently from the management web interface. In terms of the protocol, the kiosk works as a client for the remote server with whom communicates. The data sent from the client to the remote server backups the information

stored on the local server that corresponds to the environmental conditions, the results of the inquiries included on the application and the logged registry of the system usage. Therefore this data is stored both on the local database and the remote one. Thanks to this duality, the data is also accessible through the external website hosted on the remote server.

4.3. Management Website

The Management website is a specially designed web app to remotely manage the contents that are displayed and/or reproduced in each of the deployed kiosks. This web app provides an easy mean to interact with the system and enables several tools to visualize its state and to gather all the information obtained from the environmental sensors, the mobile phone chargers or the included interactive sections. This management website continues with the scalability and modularity factors pursued in all of the aspects the proposed overall solution. To cover the scalability, the number of kiosk systems this website provides services to is completely flexible, working as an expandable platform to accommodate a large network of kiosks. For the modularity, each of the services is implemented as an independent application, something that allows extending the functionalities of the solution. Additionally, the platform includes a complete users' authentication system to ensure privacy and security concerns. The main panel of the management site is the place where the applications are located, working as a repository of services. Since every platform involves a personalized selection of services, the layout of this main panel shows only the available ones that fit the customized solution. That means that the main panel for every user associated to a certain kiosk network may differ from the others. The particular software services that accompany the described hardware focuses on 4 main features: (i) Schedule an audio file to be played through the speakers or a video file to be shown as an animated wallpaper (ii) Manage the led panel text (iii) Download the whole information obtained from the kiosk system (iv) Observe and monitor real-time environmental measurements and graphical representations of the collected historical data.

Additionally, the different images, logos or texts that appear on the interface of every section can be remotely changed through a simple and easy form available in the management site. This option contributes to the idea of customization and modularity followed in the whole design process, configuring a changing and updatable solution thought to suit in every context. Figure 5 represents the different elements contained in this current configuration of the smart kiosk and the services that can be controlled from the management tool website.

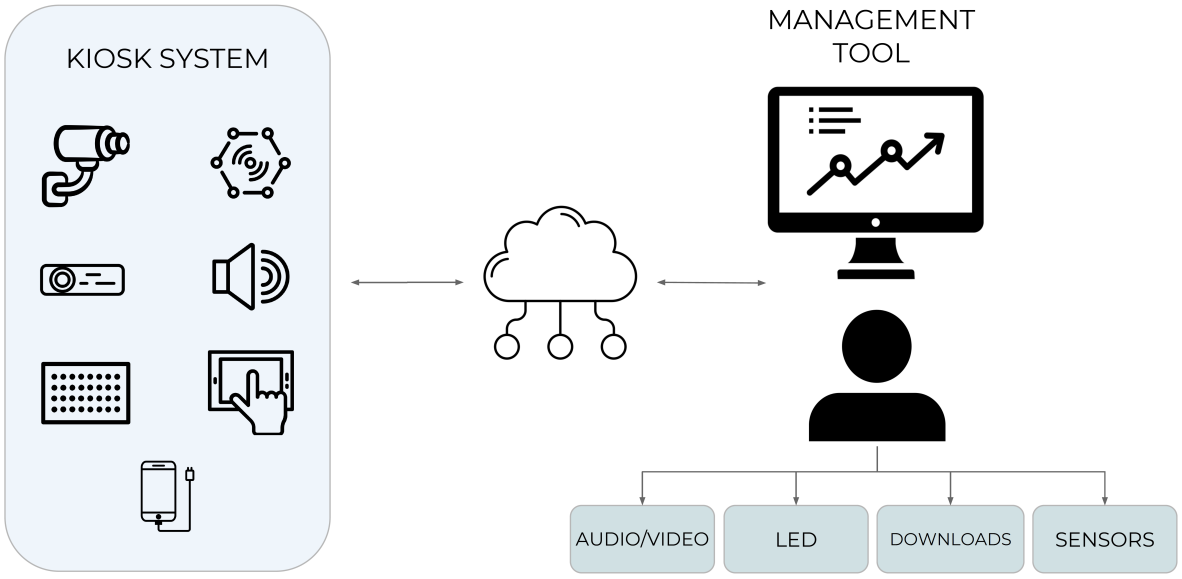

Figure 5. The included elements of this current configuration and the corresponding services provided remotely through the management tool website to control them or gather the obtained data.

5. Key Factors on the Smart Kiosk Acceptance

In 2015, more than 3 Billion people owned a smartphone. With the advent of a more technological and interconnected world, the expectations assume that we will reach 6 billion by 2020 (i.e., more than 70% of the population will own one). That means that designers, digital architects or urban planners for future Smart cities cannot overlook the potential of designing smart furniture, such as the example provided in this article, that can be connected and enriched directly with the new human extension, i.e., Smartphones. Providing to users the possibility to interact physically or digitally in a manner they are used to do with their mobile phones or other owned digital artifacts, gives a sense of security and confidence in the technology that is of high potential to get eventually acceptance of the technology. One idea in that direction is the application of physical web approach (https://google.github.io/physical-web/) for these objects or at least provide them with BLE ibeacon functionality.

As designers, what is important to provide in the future creation of assets such as the interactive kiosk, is that end-users may desire to invest time and some money in the product upkeep, instead of neglecting it when something goes wrong. Increasing the attachment to future smart furniture may depend on different factors. In the following, we provide three that we consider pivotal to guarantee some floor for acceptance and hence for usability: emotional bond, personalization, and technology appropriation. According to Chapman [31], to neglect or provide rapid replacement may be seen as a symptom of a failed subject/object relationship. People may feel deeply attached to their favorite possessions, whereas other possessions are less significant. When a person develops an emotional bond with a product, this product acquires meaning beyond the functional. The strategies suggested that can be applied for future smart furniture include new, alternative genres of objects or greater user experience, which engage users on deeper levels and over longer, more rewarding, periods of time. Existing literature on emotional bonding and digital product design suggests that this factor may result in an increase of the attachment to the product, which in turn is a predictor of the product's lifespan [32]. Emotional attachment can occur at multiple levels, usually from a combination of several ones, such as sentimental relevance, dependability, timelessness, usability, and graceful aging.

Another factor that may increase the preservation and usage is personalization. Product personalization is a process that defines or changes the appearance or functionality of a product to increase its personal relevance to an individual. Personalization can enhance the product's ease of use and reflect their personal or group identity. Furthermore, product customization helps consumers to recognize a product as one's own. According to Mugge et al. [33], by personalizing a product, a consumer directs time, energy, and attention to it. The authors conducted a study where they showed that product personalization by investing time and effort in the process can stimulate emotional bonding with the product, therefore extending the time the people interact with the product. The modularity concept presented in this model is directly linked to personalization. Not only because end-users may select custom pieces that make the smart kiosk to link closer to them, but because they can upgrade certain parts of the device in order to conserve a sense of continuous novelty which is appreciated in some segments of the population.

The final selected factor is the technology appropriation and the sense of technology ownership [34]. It stresses the importance of empowering and involving the user in the process of maintaining and taking care of the digital product in order to boost self-efficacy, satisfaction, and pride. In this regard, appropriation aims to develop feelings of psychological ownership with respect to the digital technology itself. Individual appropriation is experienced as a subjective and virtual form of customization or self-design that is usually studied as a formal, explicit process and involves the consumer applying their own individual resources, such as their need for control, aesthetic appreciation or self-efficacy, to resources provided by the manufacturer, including design toolkits and customizable interfaces.

6. Conclusions and Future Work

Throughout this paper we have presented a review of the state of the art related to interactive smart kiosks and an analysis of the key factors that are pivotal to increase its acceptation and hence, inclusion in future Smart Cities. Furthermore, we have explained a case of study for a multifunctional kiosk-based platform: A modular and customizable smart kiosk to contribute to the development of smart and friendly spaces by being naturally integrated into urban environments. From its scalable and section-divided mechanical construction to the modular hardware and software solution developed, the different sections of this work explain the characteristics of the designed platform.

The definition of this work draws from generating attractive and useful urban furniture designs not only through digital interaction but sustainable integration into the urban environment. The relationship between users and this platform is called to solve an identified problem in the city, the lack of humanity and interaction of urban elements, which end up becoming unnoticed anonymous objects that do not help in any way to improve the relationship between people and the city. Currently, the proposal included in this work has resulted in a system that has already been installed in public areas of different cities. With this first contact with a public environment, we envisage to evaluate the user experience and obtain the knowledge that allows us to continue developing and improving a system that, given its versatility and scalability, seeks to offer an interconnected technological infrastructure for a new class of services that affects users' lives.

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