

# eTourism: ICT and its role for tourism management

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## Abstract

**Purpose** – This paper aims to present innovative information and communication technology (ICT) infrastructure specifically designed and optimized for the tourism sector. The case presented, “La Valle del Pensare lungo il corso del Potenza”, has been conceived with the aim of providing a digital infrastructure to ten municipalities in the Marche Region (Italy), nestled among the valley of the Potenza River. This research project is aimed at developing an important communication system that facilitates the tourist routes of mining attractions and specific thematic routes across the territory, promoting historical centers, cultural heritage, green areas and interesting places.

**Design/methodology/approach** – “La Valle del Pensare” information system has the main feature of being scalable and multi-purpose, as the contents can be managed and conveyed through the website, app mobile, totem touch screen and standard tourist signage. It is integrated and modular and allows to manage multiple information, ensuring an interoperable and multi-channel approach. It is designed for small municipalities in the province of Macerata to connect the territory’s resources and activities through a network.

**Findings** – This work represents an important communication system, i.e. innovative ICT infrastructure that facilitates the tourist routes of mining attractions and specific thematic routes across the territory. Thanks to the collection of user-generated data, the platform allows monitoring of usage statistics and performances. In this way, the municipalities can infer useful information about user’s preferences and needs. The paper also discusses how “La Valle del Pensare” gives identity to the territory, which is not identified as a simple summation of the Common, but as a recognizable system that intends to implement the level of competitiveness through the creation of a real territorial logo able to identify vocations and specificity of the Valley of the Potenza.

**Originality/value** – The value of the project lies in the ICT system, able to convey information at different scales, providing the users with updated contents; at the same time, administrations can constantly monitor its performances, being able to infer useful information about tourists’ needs, habits and preferences. The main contributions are the creation of a single cloud-based architecture for the management of multiple multimedia contents, to be exploited in various platforms; the design of a unique content management system used by several small municipalities of a same territory; the monitoring user’s preferences and needs by collecting users’ generated data; and the analysis of meaningful statistics about the tourists, tested and verified in real scenario with real users.

**Keywords** Augmented reality, Mobile apps, ICT technology, Web portal

**Paper type** Research paper

## 摘要

**研究目的** – 本论文旨在介绍针对旅游行业而设计和优化的创新型ICT架构。本论文讨论案例题为“La Valle del Pensare lungo il corso del Potenza”，主要为马尔凯大区（意大利）的10个直辖市，位于Potenza河流域山谷中，提供数码基础架构。此研究项目主要是为了构建一条重要通信体系来帮助开发矿场景点的旅游线路和整个地区的特殊专题线路，以宣传历史中心、文化遗产、绿色区域、和各种景点。



研究设计/方法/途径 – “La Valle del Pensare”信息系统具有规模化和多样性的特点,其系统内容可以通过网站、移动app、图触控屏、和标准旅游标牌等方式进行管理和传播。此系统采用一体化设计、以模块为单位,这样使得多种信息方便管理,确保交互链接可操作性和多渠道性。此外,这个系统还专门为了马尔凯大区的小城市设计,使得该区域的资源通过网络得到整合链接。

研究结果 – 本论文介绍了重要通信系统,即创新型ICT架构,来帮助开发矿场景点的旅游线路和整个地区的特殊专题线路。得益于用户生成数据 (user-generated data),该平台还能监控使用情况和效果,从而使用该系统的城市可以推测出用户偏好和需求等有用数据。本论文还讨论了“La Valle del Pensare”如何标识地区身份代名词,这个代名词不等同于共和 (the Common) 的简单总和,而是一个醒目的系统,使得其通过树立真正的区域商标而具有竞争力,在Potenza谷中占有旅行度假的一席之地。

研究原创性/价值 – 本论文的重大价值在于其ICT系统,能够在不同领域传播信息,向用户提供更新信息:与此同时,管理当局能够实时监控其系统性能以及推测旅游需求、习惯、偏好等有用信息。本论文重要贡献在于:i) 搭建单个云平台基础的多媒体内容管理架构,能够在多个渠道上运行;ii) 设计特殊内容管理系统,服务于同一区域的多个小城市;iii) 通过搜集用户生成数据来监控用户偏好和需求;iv) 分析有关游客的数据,使用真实游客数据来实地测试和验证。

## 1. Introduction

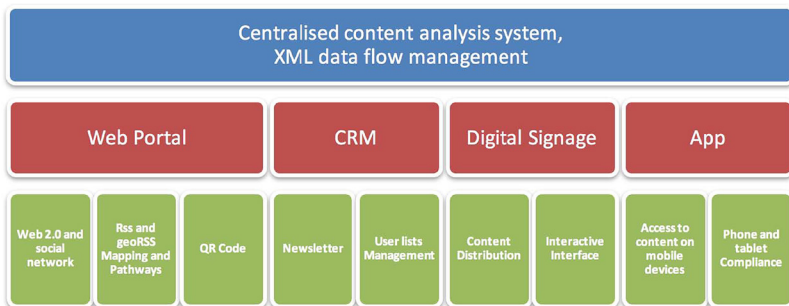
Information and communication technologies (ICTs) have been transforming tourism globally. The exponential growth of the technology-based service environment has increased the desire for consumer self-service from various customer segments, but also the industry-wide goal of reducing costs through automation, and has been a catalyst for the infusion of technology in today's service economy (Rivera *et al.*, 2015). The ICT-driven re-engineering has gradually generated a new paradigm-shift, altering the industry structure and developing a whole range of opportunities and threats. ICT empower consumers to identify, customize and purchase tourism products and support the globalization of the industry by providing tools for developing, managing and distributing offerings worldwide. Increasingly, ICT plays a pivotal role for the competitiveness of tourism organizations and destinations. Moreover, as proved by several studies, ICT is becoming a key determinant of organizational competitiveness (Buhalis and Jun, 2011). In this context, the exchange of information is very important at every stage. Information must be able to flow quickly and accurately and in this sense ICT has become an almost universal feature of the tourism industry. It allows the information management more effectively, and its worldwide transportation almost instantly. To serve the target markets, the tourism enterprises need to understand, incorporate and utilize ICT services strategically. In this way, they can improve their efficiency, maximize benefits, enhance services and maintain long-term profitability (Tahayori and Moharrer, 2006). Besides, the adoption of digital oriented policies allows the public administrations to achieve the wide public at different scales, thanks to the large variety of multimedia-platforms that nowadays are available (mainly composed by internet, mobile applications and single interfaces displaced among a territory). There is hence the necessity to re-orient the tourism industry toward an omni-channel approach (Wang *et al.*, 2012).

On the basis of the previous considerations, the main objective of the present article is to describe an innovative ICT architecture, specifically developed for the tourism sector, within the framework of the research project named “La Valle del Pensare lungo il corso del Potenza”. The idea of the project was born from the necessity of promoting the ten small municipalities in the Marche Region, Italy, nestled among the valley of the Potenza River with the use of digital infrastructure. The ICT infrastructure, modular and scalable, represents an important communication system that facilitates the tourists' routes, as well as mining attractions and specific thematic routes across the territory. The proposed system allows managing multiple information with an interoperable and multi-channel approach. Given its flexibility, contents can be

conveniently displayed in different ways: Web portals, fixed installations (totem), mobile devices (smartphones and tablets) etc. The following schema (Figure 1) shows the integrated platform designed for Web 2.0 and open data to be dynamic and intuitive.

Several benefits arise from the developed system; first of all, the attractiveness of the specific routes can be strongly increased, since the platform allows one to include and update photographs, videos, and interesting stories. Moreover, the end user is enabled to create thematic routes, representing potential starting point for formulation of new tourist products in connection with tourist agencies, health resorts, hotels and others. A territory can be conceived like a single large system, created by the many relationships between the main actors of a certain location, and these exchanges within a territory can contribute decisively to generate culture, which in turn gives shape to many business and cultural realities. These peculiarities must be related (ease of access, responsiveness, completeness of information, etc.) to the tourist's requests and/or resident. Another aspect of the developed system is noteworthy. Besides sharing the information on the Internet, it is designed to reach the tourists even in their mobile devices thanks to the use of an ad-hoc application. It is well known in fact, that the potential of mobile devices is growing with impressive speed, changing the way in which tourists gather and access information, especially in outdoor environment. The worldwide adoption of mobile devices by users can replace traditional orientation, guides and way-finding maps, moving toward the exploitation of built-in sensors of modern mobile devices. This is mainly because cameras, global positioning system (GPS) sensors and Internet connection open the way toward a new manner of experiencing public spaces, thanks to contextual information. With context-awareness services tourists have access to interactive experiences and, even if with little knowledge of a certain area, they can naturally experience unfamiliar places. All these features are included in the app, which exploits the same data of the infrastructure, which is in addition enriched with an Augmented Reality engine based on geolocalization services.

The key value of the whole project is that the ICT system is able to convey information at different scales, providing the users with updated contents; at the same time, administrators can constantly monitor its performances, being able to infer useful information about tourists' needs, habits and preferences. The main contribution of the project can be thus summarized into the following items:



**Figure 1.**  
Integrated platform

- creation of the single cloud-based architecture that allows the management of multiple multimedia contents, to be exploited in various platform;
- development of the unique content management system for several small municipalities of a same territory to share cultural and touristic information;
- monitoring user's preferences and needs by collecting users' generated data; and
- providing local administration with useful and meaningful statistics about the tourists, tested and verified in real scenario with real users.

The reminder of the paper is organized as follows: Section 2 is an overview of the state of art for the ICT application in tourism sector; Section 3 gives details on the proposed system; it is followed by the results description (Section 4); and finally Section 5 presents the conclusions and outlines future research directions.

## 2. State of art

For the sake of completeness, a brief overview over the latest achievements in the tourism sector is provided. Given the huge bulk of works, the study was restricted to ICT-oriented research, developed for monitoring and providing to the users the contextual information. Nowadays, the tourism experience is strictly related to the digital approach. In fact, the beginning of a trip starts from the Web which offers broad set of opportunity and makes the user's feedback the major criteria for decision. Then, it is generally followed by the visiting experience, when tourists collect pictures and share insights. Last, it finishes at home, when photographs and experience comments are made available to network of friends or other potential tourists (Rezaei *et al.*, 2016). In fact, it has been shown that the user-generated content is more trusted than official tourism websites, travel agents and mass media advertising (Law *et al.*, 2014).

Given the above, recent research trends show that the main direction is the development of the intelligent tourism recommender systems (Borras *et al.*, 2014; Emmanouilidis *et al.*, 2013; Gavalas *et al.*, 2014; Adomavicius and Tuzhilin, 2005). In such articles, there is a classification of systems by recommendation methods, interfaces, user preferences representation and so on. However, information sources are not taken into consideration, used to provide tourists with information on interesting places. Many systems use predefined databases, which include information about attractions. They carry out analysis of the systems that use predefined databases, which includes information about attraction, and can be divided into two main groups for information extraction:

- (1) applications that implement search for information around the tourist from Internet sources; and
- (2) applications that have own databases with information about attractions and provide this information to the tourist.

From a customer perspective, the literature on mobile technology examines technology adoption, and uses behavior and technological impacts on the trip experience (Lamsfus *et al.*, 2015; Wang *et al.*, 2016; Wang *et al.*, 2014; Tan *et al.*, 2017; Gupta *et al.*, 2018). The smartphone prevalence has had huge implications for travel planning activities during, before and after visiting a destination. In Wang and Fesenmaier (2013) for instance, the authors show that the planning process has become easier as a result of having ubiquitous access to the Internet using mobile devices. People can plan their holidays at any time, which has resulted in additional travel planning (Meehan *et al.*, 2016). Among several services that the mobile approach permits, one of the main technology that is nowadays

preferred for tourism related applications is Augmented Reality (AR). AR is a useful tool for exploring location-based information of real world objects, mainly because information can be superimposed onto the display, with the same point of view of the user. With an AR-enabled mobile device it is possible to easily access additional information about a Point of Interest (POI) in an urban environment (Fiore *et al.*, 2014; Jung *et al.*, 2015; Aluri, 2017).

Current issues and benefits regarding the use of AR for tourism purposes are widely discussed in Kounavis *et al.* (2012). Tourists in fact are exposed to unfamiliar environments where the fast retrieval of information is fundamental for our decision-making. Access to relevant contents through location-based services not only facilitates this process, but also changes the way we perceive destinations, creating more memorable and unique experiences. AR browsers deliver (geo)spatial and attribute information about physical objects through spatially registered virtual annotations. Such interfaces reduce the need to translate abstract information (for example, encoded in maps), or oblige switching gaze between information and physical space. This happens with guidebooks or list-based mobile interfaces. This scenario is particularly beneficial for time-pressured visitor at unfamiliar locations (Chou and ChanLin, 2012). In Garau and Ilardi (2014), a specific application was designed allowing people to download contents related to the Cultural Heritage (CH) area they were discovering. From the e-learning standing point, Mobile Augmented Reality (MAR) has proved to be a winning solution (Etxeberria *et al.*, 2012). In Yovcheva *et al.* (2014) interesting consideration has been made, with respect to the criteria that should be used when developing an AR service for tourism. Four features should be followed: readability, unambiguous association, aesthetics, frame-coherency. Among the others, the most interesting works that are worth to be mentioned are CorfuAR project presented in Kourouthanassis *et al.* (2015), PRISMA project in Fritz *et al.* (2005) and Lecce AR in Banterle *et al.* (2015). AR is also able to boost a participatory approach to the tourism industry (Reinwald *et al.*, 2014). In Chou and ChanLin (2012), a AR-based prototype to increase tourism has been developed and reviewed by two focus groups on the campus of Fu-Jen Catholic University. AR provides hidden information of the campus in the area, providing students with immediate assistance in case of a loss and also representing a mobile learning tool. Lecce AR in Banterle *et al.* (2015) is another interesting example of visualization of 3D models during a visit for city environment. It allows adding to a real-world scene, seen from a mobile devices camera, with 3D models of CH sites as they looked in the past. 3D models are displayed when the user points the devices camera toward a planar target which can be a photograph or an image. The experiences of using AR as POI finder now represent a state of the art approach (Fiore *et al.*, 2014; Jung *et al.*, 2015). However, a look forwards in the relation between the user, the devices and the space was given by Garau (2014).

In Reinwald *et al.* (2014), authors describe the possibilities of implementing AR in planning and participation processes by using the results of an applied research project “ways2gether”, a target group-specific use of AR and Web 2.0 in participative traffic planning processes. The article points out that the AR tools expand the repertoire of methods used in participation procedures and that they have the potential to support many phases of planning and participation process. Another important European project to be mentioned is CyberParks COAST action2. Future scenarios, for example through the use of wearable devices in open spaces have been outlined by Caggianese *et al.* (2014).

Enabling the user with contextual services, besides improving the user’s experience, allows one to collect the so called user-generated data (Simon, 2016). Monitoring and tracking these data represent the future pathway for analyzing, observing and recording the dynamics of our environment (i.e. urban open spaces, cities, rural areas etc.) and, more in general, the behavior of people who live in these spaces (Girardin *et al.*, 2008). The way



people interact with their surrounding is significantly changing as well thanks to mobile devices. In fact, the mobile devices are improving their capabilities and are able to sense the user's location and the environment. This combination is playing a pivotal role in the data collection mainstream. Currently, the digital footprints, left by individuals in their daily activities, can be used as data to make statistics and to extract metrics about our spaces, directly from the users (Zhang *et al.*, 2010). These information sources are geo-located and offer numerous opportunities, as well as the possibility to work with high spatial and temporal data, always available and always updated. The advantage of collecting digital footprints ranges among different domains, for example retail (Sturari *et al.*, 2016), cultural heritage (Pierdicca *et al.*, 2016b), security (Zhang *et al.*, 2010) and cities management (Garcia-Palomares *et al.*, 2015). In tourism, the collection and the analysis of digital footprints can be useful in understanding the tourist behavior in relation with a destination. On the other hand it can be a valuable source of information for both tourists and stakeholders. Tourists can take their decisions with more awareness on the place they are going to visit.

In particular, digitally active stakeholders, such as tourism and hospitality operators can easily obtain the user feedback to evaluate the performances of their offers, but also to reach a worldwide public. For improving the planning process, forecasting tourism demand, marketing, measuring economic impacts and benchmarking tourism data are important (Szopinski and Staniewski, 2016).

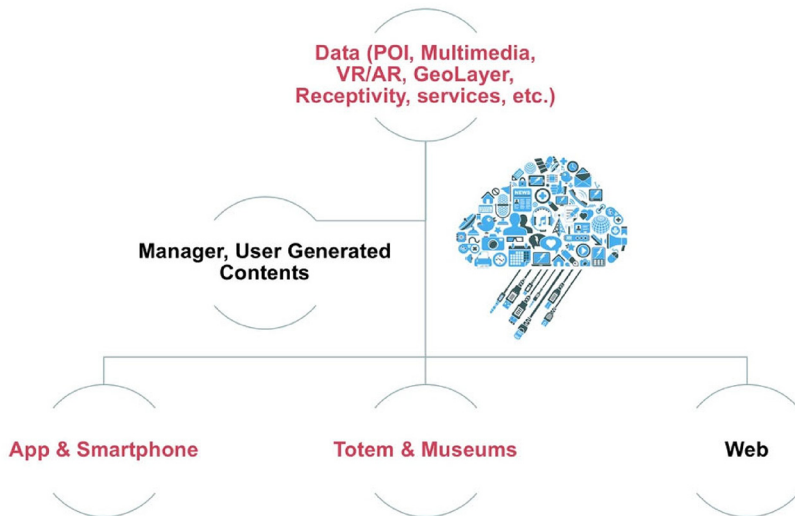
With reference to the above mentioned analysis, the need for the development of an integrated platform able to face with huge challenge of providing information to the user's and, at the same time, enabling the administrators to convey contents in the right way, monitoring the tourism performances has arose. The work presented attempts to solve this issue, as explained in the following.

### 3. Methodology

The case presented, "La Valle del Pensare lungo il corso del Potenza", has been conceived with the aim of providing a digital infrastructure to ten municipalities in the Marche Region (Italy), nestled among the valley of the Potenza River. This research project was developed due to the need of different municipalities to be joined by a communication system, where each of them could share its own contents, promoting historical centers, cultural heritage, green areas and interesting places and thus facilitating the touristic routes across the territory. In particular, several thematic itineraries are included: landscape/nature, churches, art, walls, palaces, history, etc. In this Section, the ICT services developed within "La Valle del Pensare" project will be detailed. Figure 2 summarizes the ICT tools which are part of our system, every of each implemented for promoting and orienting the tourism experience. The developed system consists of Web portal, digital signage, and mobile application with AR engine, all described here below in the following.

#### 3.1 Web portal

The Web platform is realized with Simplit, a Content Management System (CMS), according to Web 2.0. It allows managing and maintaining the portal contents of sites (Internet and intranet) in a simple, fast and secure way. In addition to the typical functions of a CMS, the modules have been developed with the aim of integrating the information systems with external data (Web services), allowing easy exposure of the information in Data Base. The programming objects integrated in the CMS allow to build Web-based applications without coding. Simplit CMS enables the production of automated indexes and the site structure is managed and displayed according to the tree logic. This portal is programmed using open source general-purpose scripting language Hypertext Preprocessor (PHP), the Google Maps



**Figure 2.**  
Platform

API and JQuery libraries and components. All graphics solutions are programmed by Cascading Style Sheets (CSS) 2.0 files according to modern Web standards (XHTML and HTML5). This choice allows a clear separation between look, constructive elements of the page (tag), and content. All recommendations of the W3C on the formal standards have been followed in the Web page construction and all pages have been submitted to HTML/CSS validation. The portal is compatible with all browsers that are currently used. The portal adopts a HTML5 standard page construction and allows viewing on all computers and mobile devices (smartphones, tablets). All contents are constantly available for integration into social networks through appropriate sharing buttons. With the respect to the Web 2.0 philosophy, all contents are evaluated and commented by users, contributing to their improvement. The content management software is Web available and accessible with personal credentials from any browser. The application is written in PHP and uses open source database. The multilingual Web portal is built using the latest technologies necessary to ensure immediacy in navigation, as well as dynamism and management autonomy, thanks to the presence of an editorial system for drawing widespread, modular development, accessibility of information.

### *3.2 Digital signage management*

Digital signage, also called dynamic signage, is a specialized form of sliver-casting in which video or multimedia content is displayed in public places for informational or advertising purposes. A digital sign usually consists of a computer or playback device connected to a large, bright digital screen such as an LCD or plasma display. Content typically includes advertisements, community information, entertainment and news (Dennis *et al.*, 2010).

Several players can be programmed in the same way or each one in a different way, both in relation to the content and to the form. This allows conveying different information in different places focusing on the chosen message.

An operator, from a connected computer, can access the administration environment, from where then is possible to manage the entire network of players (monitors), by

customizing content according to the different needs. The update is in real time and on the web. The operator through a few simple steps can:

- edit the contents of one or more players;
- insert new content; and
- modify the contents form of one or more players.

The advantages of this kind of solution are many and they can be summarized into the following points:

- strengthening the capacity impact of the message to convey contents;
- periodic content update and in real-time;
- focus of the message in the desired time and places;
- ability to create dynamic and interactive environments;
- customizing messages to individual displays, exhibition areas and geographical locations; and
- ability to obtain any economic return through the temporary insertion of advertising campaigns (Figure 3).

### 3.3 Mobile application

**3.3.1 Application design.** Mobile application designed for this project is a cross-platform mobile app available on Android and iOS devices. In particular, it provides information such as products news, companies list, contacts etc., also allowing the user participation by sending comments, ideas, suggestions, etc.

Furthermore, the application offers a possibility to generate a QR code with the appropriate software, which should be subsequently positioned in proximity to the territory points of interest, listed within the various solutions discussed above (site, itineraries, multimedia content). Through this code the tourist with a PC, smartphone or tablet can read the QR code on his device, which afterwards connects to the Web browser and opens the page containing the description of the selected item. The software which generates QR code



**Figure 3.**  
Digital signage  
architecture



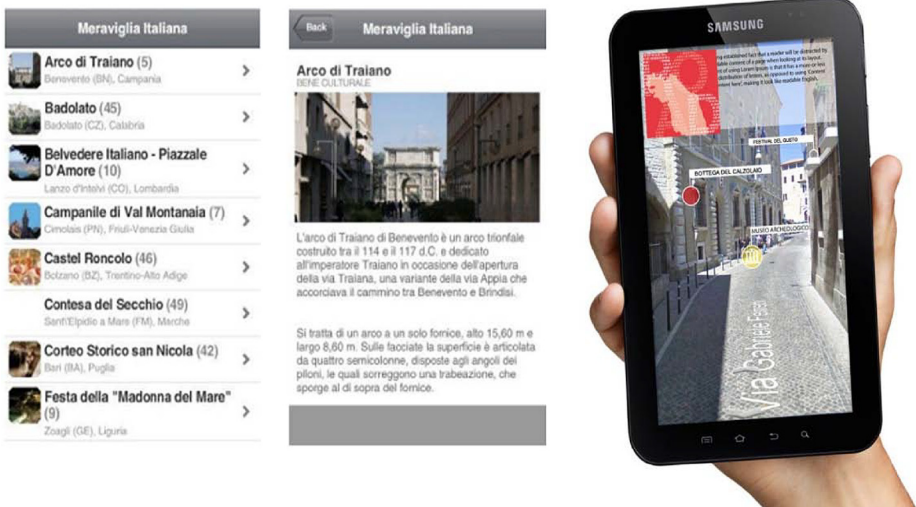
is integrated in Simplit CMS. Its use is very simple. The operator enters the text (or link, or other alphanumeric content) and the program returns the code image to be printed.

**3.3.2 Augmented reality.** Within the app, a specific AR engine has been developed. The tool is dealing with the registration of virtual objects in the camera scene, based on the user location and orientation. To determine these two, the device makes use of GPS receiver to retrieve the users' location in the real world and of gyroscope and compass to get the users orientation. In other words, the system relies on (geo)location services to determine the distance between the user and the Points of Interest (POIs) that are present in the surroundings. As discussed in [Pierdicca et al. \(2016a\)](#), urban open spaces (UOS) like parks or archaeological areas might have countless objects to be highlighted. And the closer the user is, the higher the error, caused by a deficiency of the receiver in terms of accuracy. The possibilities opened up by this system are enormous, especially for tourism and business purposes as mentioned in [Vasselai et al. \(2011\)](#) ([Figure 4](#)).

**4. Results and discussion**

The user services previously described in Section 3 have been implemented for “La Valle del Pensare” project; the main outcome of the project is a multichannel tourism information system with website, mobile app, touch screen interactive totem and standard tourist signage. The structure of the project has as main objective the coordination of the different channels with all necessary information to be included on content provider. In total, 150 way-finding standard totems describe every monument in the area, while 17 interactive screen totems are placed throughout the more interesting places across the territory ([Plate 1](#)).

All contents are managed from a cloud-based service that centralize and share all information and multimedia contents while collecting different user statistics about tourist behaviors. In particular in this section we focus on the result of one-year (2017) field tests with full user data collection and project evaluation based on user behaviors, shared among all contents providers (local municipalities and cultural heritage managers) on a participatory planning view of the whole project. Mutual interest and



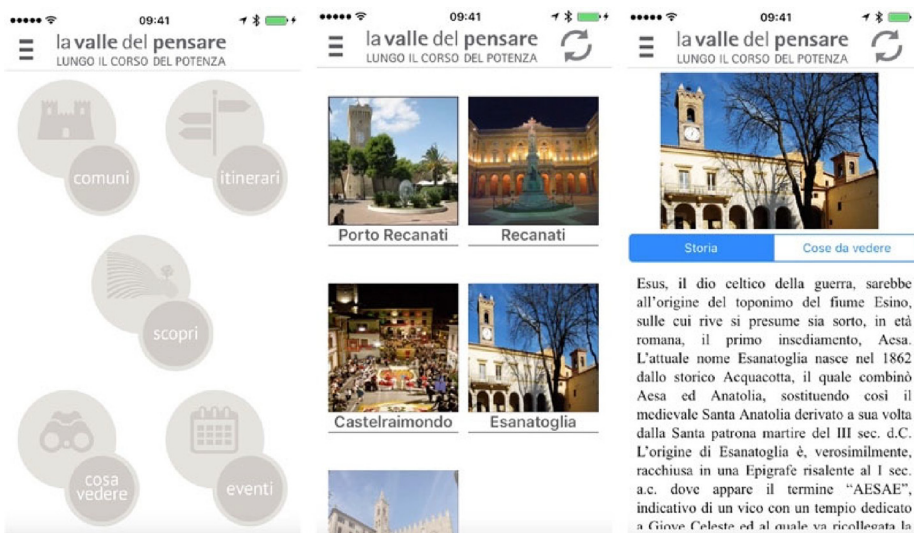
**Figure 4.**  
Augmented reality

participatory planning are the most effective way of involving content providers and local municipalities not only for the construction of the project but also for its management over time. The risk of overlapping with other elements of signs already existing in the territory is limited by the recognition, by the municipalities, graphic identity of the physical design, and the strong ability to report the media. The mobile application shows cultural heritages and points of interest of the territory, making it easy for tourists to learn about the history of monuments spread all over the municipalities related to the project. Generally, tourists have the possibility to educate themselves on places they are going to visit. They can read relevant books beforehand, they can hire a tour guide, or they can take the time to read every plaque and sign on the premises. The proposed app is also based on user localization to plot all nearby locations and show detailed way-finding instructions. Figure 5 shows some examples of the app interface.

Data collection and management provide a single, comprehensive view of the visitors that can be customized to meet the needs of the data analyst and can be shared across the municipalities. All measures and KPIs are based on the aggregation of the



**Plate 1.**  
Wayfinding totems that describe the monuments and touch screen totems



**Figure 5.**  
Mobile application interface

different omni-channel sources of information (websites, mobile apps, interactive totems) giving in real-time performance evaluation methods for all the project and for every municipality. Data can be used to evaluate the overall performance or to measure the interest on different cultural heritages or to define insights about different type of events or different tourist targets. User behavior analytics include unique sessions, average session lengths, bounce rates, and other aggregate information. This type of data is very useful for optimizing a website and understanding different contents performance. General statistics for the year 2017 shown in [Table I](#) proves that our tourist system has been supported by the users, in terms of site activity such as pages visited, single access pages, and number of different visitors. Furthermore, these kind of data allow one to learn more about the visitors and use those insights to better serve them. Here following a subset of different data evaluations are reported to show the effectiveness of the proposed architecture and use cases on content evaluation and cultural heritage metrics. These aspects, together with the omni-channel approach previously described, are the main contribution of this paper, supported by an extensive test of 1 year and hundred thousands of users. Given the total number of visits reported in the [Table III](#), the different channels (mobile, totem, web) demonstrate on a long term test that the highest number of users are coming from the mobile interface (about 80 per cent), with Web users (14 per cent) strongly decreasing with respect to year 2016 (-4 per cent). The number of visitor using totem and fixed installations is very limited, given also the limited number of totem (one for every village), with a total percentage of about 6 per cent.

Instead, [Table II](#) shows more details about the visitors, including views sorted by countries and insights about the website. Location data can be useful for targeting the market, advertising, and understanding to what extent it is spread. These specific details are of interest to the tourism management in answering the important questions: if the audience all across the world is involved or only in the specific countries, or only the audience in the cities similar to the ones that are being examined. It can also be utilized for the comparison on which channel is more likely to be used in different countries or different cities within the same country.

The Countries report gives the overview on countries producing the best search performance and user engagement for the website. In the case strong search performance but poor user engagement is noticed from a specific country, it could mean the need of developing a language-specific version of the site.

**Table I.**  
Statistics monthly  
report of 2017

Month	#Visitors	#Visit	Pages	Accesses
January	314	791	190,334	216,390
February	408	878	223,066	265,114
March	583	1,048	229,662	265,114
April	656	1,162	233,311	267,730
May	763	1,308	246,834	285,119
June	570	996	160,432	192,266
July	518	1,087	140,423	171,325
August	1,083	1,745	207,846	250,850
September	733	1,387	167,553	197,198
October	738	1,106	137,549	161,838
November	741	1,061	97,621	116,989
December	622	1,035	130,545	148,884
<i>Total</i>	<i>7,729</i>	<i>13,604</i>	<i>2,165,176</i>	<i>2,524,771</i>

**Table II.**  
Web-site activity of  
the first ten countries  
in 2017

Countries	Pages	Accesses
Italy	707,454	874,424
Great Britain	242,038	251,206
Belgium	177,248	179,752
USA	11,270	35,550
Republic of Serbia	10,013	10,088
Germany	1,106	5,986
Czech Republic	857	910
China	362	401
France	323	2,179
Others	1,600	11,784
Unknown	1,012,905	1,152,491

Table III shows the statistics on what type of browsers have been used by the visitors to view the website. This can reveal a possible reason why the information was not captured in some cases in Table II. Table II refers to a large set of data from a whole year with worldwide reach. It can be noted that a percentage of visits had a location that could not be determined. The reason is that the higher number of these locations came from mobile devices, which is not surprising, being most of them the ones using Opera Mini as browser. Opera Mini fetches Web pages to an Opera server and then sends a compressed version to the mobile device. In this way it ceases to directly connect the website and the device, making it impossible to determine its IP address.

Tables IV and V allow the discovering of the exact topic viewed in the different channels of keywords that people use while searching on Google before entering the Valle del Pensare website for the places they want to visit and the amount of page views generated by individual keywords or topics. In this way, it is possible to use this information for search engine optimization campaigns. By using the most important keywords that people search on the specific website, the page can be optimized and more targeted traffic can be obtained. Additionally, in those cases where some services or contents are not available, they can be easily added to the cloud and delivered on all channels. Also A/B testing to measure different performances of new topics or textual and multimedia optimization of already existing ones can be applied based on that data.

Browsers	Accesses	(%)
Android browser (PDA/Phone browser)	2,166,804	85.8
Google Chrome	169,506	6.7
Firefox	78,609	3.1
Safari	39,051	1.5
Mozilla	27,393	1
MS internet Explorer	15,976	0.6
iPhone (PDA/Phone browser)	2,290	0
Nokia Browser (PDA/Phone browser)	1,840	0
Opera	408	0
Others	1,182	0
Unknown	21,712	0.8

**Table III.**  
First ten browsers in  
2017

The average bandwidth consumption per session (with an average of six to seven page/topic views) is of 1.2 MB showing the dimensional optimization of contents for mobile users.

Finally, for technical reasons, bug over all channels were traced and the average system has currently on error rate by user visit of the 0.03 per cent, with main errors or crashes on the mobile app (i.e. 0.12 per cent). Thus proving the technical quality of the overall system.

Given the result already showed, it is possible to affirm that the project has been able to connect the territory's resources and activities through a network, and thereby connecting and promoting historical centers, cultural heritage, green areas and interesting places, even far from one another. Two types of results can be distinguished here, the intangible and tangible results. The intangible results show the added value in promoting the cultural heritage, both by visitors and municipalities/touristic sector. The visitors can use the powerful tool to make their experience more authentic, gaining more knowledge about the visited places, and finding their way around more easily. The system can easily be replicated and applied to different cultural or natural sites of interest. The tangible results can be seen in various insights provided, analysis of the number of visitors, website activities in different countries, channels that are being used, keywords visitors mostly use, etc. This information is beneficial for marketing analysis, for the touristic sector, Web page content optimization, future customer needs and developments, etc.

"La Valle del Pensare" represents an opportunity to supply the territory with digital instruments, developed to create a clear and uniform system that can be used by both

**Table IV.**  
Main topics in  
December 2017

Topic	Views	(%)
recanati	310	3.4
treia	294	3.2
porto	213	2.3
montelupone	203	2.2
esanatoglia	198	2.1
valle	194	2.1
chiesa	191	2.1
pensare	182	2
Other topics	661	73.6

**Table V.**  
Main topics in  
December 2017

KeySentences	Research	(%)
valle del pensare	13	5.2
recanati	10	4
esanatoglia cosa vedere	9	3.6
villa spade treia	4	1.6
oasi dei laghetti porto potenza	4	1.6
chiesa san Lorenzo treia	3	1.2
crispiero sagra della castagna	3	1.2
porto Potenza picena parco dei laghetti	3	1.2
ars	3	1.2
Other Phrases	194	77.9

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locals and tourists, providing a shared events calendar and thematic tours. The objectives of information, communication and promotion are naturally blended with the final goal of meeting the daily needs of users. The system developed is inspired by a vision of the project that exceeds the simple concept of indication or plate, tending to result in integrated, homogeneous, innovative system, able to exploit the full potential of the latest technologies. An added value of the project is undoubtedly the continuous interaction between the municipalities, called to participate in the project as deep connoisseurs of the territory, and its excellences. A major focus of the project is the contribution to the territorial identity, which is not identified as a simple summation of Commons but as recognizable system that intends to implement its level of competitiveness by creating a veritable territorial logo, able to identify vocations and specificity of the valley power. The project makes use of two systems, physical and digital, complementing their full potential.

### **5. Conclusions, implications and future works**

In this paper the project “La Valle del Pensare lungo il corso del Potenza” is described, a tourist system of information with website, app mobile, totem touch screen and standard tourist signage. The system is able to connect the territory’s resources and activities through a network, thereby promoting historical centers, cultural heritage, green areas and interesting places. The case presented in this paper gives the insight of how the territory can be supplied with digital instruments, developed to create a clear and uniform system that can be used by both locals and tourists, providing a shared events calendar and thematic tours.

The project, with the time duration of two years, was accomplished in 2016 but the architecture is still active and being exploited by all the stakeholders involved in it. The research team is constantly monitoring its impact on the territory, obtaining and analyzing the tangible and intangible results, as shown in the paper. The main contributions of the project can be seen in: creation of the single cloud-based architecture that allows the management of multiple multimedia contents, to be exploited in various platforms; development of the unique content management system for several small municipalities of a same territory to share cultural and touristic information; monitoring user’s preferences and needs by collecting users’ generated data; providing local administration with useful and meaningful statistics about the tourists, tested and verified in real scenario with real users. The developed system can easily be replicated and applied to different cultural or natural sites of interest.

Moreover, the cloud-based system, designed to manage different data type in different platform was shown to be successful. Contents can be easily managed even by non-expert users that up to now represent one of the main bottleneck for the durability of ICT-based systems. The cooperation among small municipalities is an added value of the project, since it opens up a new vision of tourism management, where the resources are placed in a unique system to wide up the application scale, which is too often limited to very small territorial areas. From the user’s perspective, digital services represent the sole instrument able to convey information in a quick and agile way. The system was designed with a user-centered approach, being able to manage a huge amount of data in a simple interface.

Future works will be devoted at offering more detailed journey planner information, including real-time departures and disruption alerts, as well as city routes, to give an alternative to the hotels and potentially unique experience of the chosen destination. The long term goal is to integrate the regional tourist databases also and to provide a multichannel system.



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