DELIVERABLE 3.1.1

Common concept of cloud-based tool

for Virtual Museum

Work Package	3
Activity	3.1.1
Phase Leader	PP1-NASPA
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Aim of the paper

This **common concepts** for the development of a cloud based tool in the framework of the Virtual Museum of REMEMBER project (Deliverable 3.1.1) should provide all Project Partners with a **common baseline for setting up cultural and technological virtual museums**, for the preservation, enhancement and promotion of ports cultural elements during the project implementation.

It should outline a long-term strategy, jointly agreed upon and pursued by all Project Partners, highlighting the role of the involved ports as "cultural hubs" able to constantly generate connections, exchanges of cultures, traditions, jobs linked with their maritime relations and heritage.

In addition, the document provides concepts about the platform architecture that will allow VMs to be implemented.

Setting the scene: REMEMBER goals

The **REMEMBER Virtual Museum** (hereafter REMEMBER VM) aims at fully exploiting the potential of cultural, social and economic valorization of the ports' intangible and tangible heritage focusing on the Adriatic macro-region.

On the one side, the concept of **Tangible Cultural Heritage** refers to physical artefacts produced, maintained and transmitted into a society from one generation to another. It includes artistic creations, built heritage such as buildings and monuments, and any other physical or tangible creative products cultural the significant for a society. On the other side, the concept of **Intangible Cultural Heritage** indicates '*the practices, representations, expressions, knowledge,*

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skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their Cultural Heritage' (UNESCO, 2003). Examples of intangible heritage are oral traditions, performing arts, local knowledge, and traditional skills in fishing, ship building and other "blue economy" related domains.

Ancona, Venice, Trieste, Ravenna, Rijeka, Zadar, Dubrovnik, and Split, namely REMEMBER Project Partners, are port-cities definitely sharing a high value tangible and intangible cultural heritage based on their maritime history and evolution from a spatial, economic and mind-setting point of view.

REMEMBER VM overall objective is **promoting the shift of traditional tourism-based business models towards sustainable tourism and blue growth paths in the Programme area**.

The creation of a VM **should result** from the conjunction of the traditional museum concept experience with the advantages offered by multimedia and communication Internet technology. The REMEMBER VM aims at **offering a maritime and port based heritage "remote immersive experience", overcoming the lack of time or resources to travel, the lack of exhibition space, affording easy transfer of common knowledge to remote sites and circular exploitation of common heritage.**

REMEMBER VM should increase the attractiveness of local economies using ICT for the digitization of cultural contents, increasing the touristic offers to reduce tourism seasonality and create new and qualified jobs linking digital and cultural competences.

Using information and communication technologies, REMEMBER VM will leverage the generation of added value from the full exploitation of the eight Adriatic Italian and Croatian ports sites – namely Ancona, Venice, Trieste, Ravenna, Rijeka, Zadar, Dubrovnik and Split.

REMEMBER innovative approach supports sustainable tourism undertaking starting from the common need to ensure preservation and management of cultural heritage in the port areas. The cross-border cooperation enhances the efficacy of project activities allowing the exploitation of the multiple effects of institutional cooperation among partners.

The joint valorization of tangible and intangible port cultural heritage is expected to enhance the capacity of involved territories to generate added value from the full exploitation of the cultural asset and from its integration in the cultural, touristic and social policies.

Concept

The word *"museum"* comes from the Greek "Mouseion" (eg: the center of scientific studies in Alexandria), and means *"the temple of the Muses".* In the 19th century, the museum would fulfill the need to display objects (paintings, sculptures, art objects and archaeological artifacts) in order to create an encyclopedic knowledge and to gradually spread this knowledge to the largest number of people.

The project deals with **Virtual Museums**. Some of them will be developed in a physical space, some other will exist only on line.

If we consider physical Museums, they changed during the second half of the 20th century. Before they were considered like temples: self referenced places where competent visitors could only admire collections, develop inner thoughts and remain silent.

The museums were designed to enjoy trained and educated visitors. The immersive and "exciting" stories were not necessary. Today, **museums need to be for everyone**.

Museums are changing. To be part of this process proactive museums choose to evolve and make their offers more appealing and attractive to a wider variety of audiences. This shift in social roles of museums encourage new styles of communication and expression, new goals and missions, all to became places of human transformation.

The most recent evolution allows a wide public (that includes tourist, citizens, students, businesses, …) to **create their own stories about themselves, within museums, about their relations with the cultural landscape**. Digital technologies allow everybody to participate. They can post, take picture, interact with exhibitions and among each other, in a continuous stream of experiences, comments, memes, crowdsourcing.

REMEMBER VM will result from the conjunction of the traditional museum concept with the multimedia and communication Internet technology.

It is not merely a physical museum that has been digitized and uploaded to the web.

REMEMBER VM aims at providing a wide knowledge of the Adriatic common culture through an immersive experience inside the City Port heritage. With VM a "remote visit" became possible. It can **virtually connect** city ports that are very distant from one another, but linked by common cultural backgrounds.

In REMEBER VMs, educational techniques evolve the "traditional museum experience" and provide engagement ad entertainment for different target groups using new technologies.

www.italy-croatia.eu/acronym

Each REMEMBER VM should be an **Experience focused on** "**THE COMMON CULTURAL HERITAGE OF THE ITALIAN AND CROATIAN CITY-PORTS**".

REMEMBER VM will use the great power of modern media, and visual-interactive technologies, to spread the Adriatic cultural patrimony to the widest possible public.

According to the International Council of Museum (ICOM) (2011) *"**sustainability** is the dynamic process of the museum based on the recognition and preservation of tangible and intangible heritage with the museums responding to the needs of the community. To be sustainable, museums, through their mission, must be an active and attractive part of the community by adding value to the heritage and social memory"*.

REMEMBER VM should offer a cultural proposal available all year long and accessible by a large typology of visitors, an economic opportunity for the territories, not limited only to coastal/summer tourist activity.

The City-ports involved in REMEMBER project – spreading across shores of the Adriatic Sea - share a thousand-years old port-maritime cultural heritage, a common background and sense of belonging resulting from the intense commercial and social relations, that made the Adriatic Sea "**the sea of intimacy**" (quoting the Croatian writer Predrag Matvejević).

The digitalization of both tangible and intangible cultural heritage have to be considered as a means of preservation of the identity of the involved ports.

In addition, preservation means valorisation. **The port-maritime intangible cultural heritage is continuously recreated by the community.** Fixing this aspect means to recover and valorise the relation between ports and cities, by linking the present with the past. This parallel valorisation will show how the past is the origin of today's port-cities identity and its richness in terms of

culture, works, productions, investments and how the port system is still operating as an engine for the local community.

Referring to the port-maritime tangible heritage, it needs to be discovered and promoted, not simply as a valuable evidence of art crafting, but as extraordinary sign of an ancient society based on the relations with other cultures via the maritime connections.

The REMEMBER VM is conceived as unique framework to give access to the digital contents of the project. The eight VMs should be linked in a multidimensional network of contents, referrals, tours, stories.

The Adriatic Port Cultural Network (APCN)

The eight ports involved share a rich cultural tangible and intangible maritime heritage belonging to a common historical past where the economic, social and cultural life of the respective cities was strictly intertwined with the ports evolution. Indeed, the cities' identity was forged around the ports activities that fostered the economic and social expansions of the cities themselves.

The involved ports also share a common background and sense of belonging resulting from the intense commercial and social relations between the two Adriatic shores. Today, this maritime cultural heritage is facing several challenges that are endangering its integrity.

All these aspects shape the conceptual framework that gave birth to the new APCN, the new born network among Project partner, the common goal with the strongest long term impact of of REMEMBER.

Structure

REMEMBER VM will count on a common platform and a cloud-based tool providing common contents to be shared by all the users and able to allow the uploading of different kinds of digital contents.

It should be accessible:

a. **From everywhere in the world**: toward a basic set of contents and functionalities, with an Internet connection on personal devices as pc, smartphone and tablets

b. **By the eight port sites**: With a full and sophisticated set of contents and functions in Ancona, Trieste, Venice, Ravenna, Rijeka, Dubrovnik, Zadar and Split. Through tablets, smartphones, touchscreens and other digital devices and tools in permanent locations.

The content structure of REMEMBER VM will be as it follows:

- **an introductory/common section, hosted** by a shared platform provided by an website. The basic common contents will be: presentation of REMEMBER and APCN; Introduction to the 8 city ports; presentation of some new touristic routes involving city ports; introduction to the 8 VMs. Each partner will contribute to this part following a common structure and methodology;

- **eight local sections,** developed by each partner, according to a common storytelling methodology, conceived as a net of contents with a common taxonomy and logic.
  Local sections contribute to improve the accessibility to the eight cultural heritage ports sites (Ancona, Ravenna, Trieste, Venice, Rijeka, Dubrovnik, Zadar, Split). The Local sections will be realized with selection, editing and uploading by each Project Partner, in

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the framework of a common approach that includes links referring to each other's contents.

The introductory/common section goals

The introductory/common section should:

a. to describe the positive and long term influence that the relationship with the sea had in the past on the cultural, social and economic development of the eight ports involved in the project;

b. To describe the process that transformed also conflictual relations among city-ports in a contemporary win-win continuous relation targeted to a global economy.

c. to highlight some crucial parallelism between the eight port-cities maritime culture/life of the past and the one of today (i.e. economy, supply-chain, tourism, …); all reasons that drove the partnership to start up the APCN;

d. to remark the positive effects of port-maritime activities on the territories surrounding the eight ports involved in the project. Identifying ports as hubs, regions and municipalities will improve the attractiveness of their own territory by upgrading the cultural offer;

e. to identify and brand the maritime culture of the Adriatic macro-region into the APCN;

f. to enhance and rediscover the common cultural values shared by the Adriatic Italian and Croatian ports and their surrounding territories, starting from the role of „cultural hubs" traditionally played by the ports.

The common introduction should provide several **«fil rouges»** - based on the Adriatic strong identity - connecting the different storytelling made by the eight city-ports involved.

These related histories and experiences have to be presented throughout three main content categories:

1. **TRADITIONS & CULTURE - Intangible heritage,**
2. **SOCIO-ECONOMIC RELATIONS – Intangible heritage,**
3. **PHYSICAL HERITAGE – tangible heritage.**

The three main categories allow each partner to vertically decline its contents in subthemes. The sub-themes will be presented in the Storytelling paper (deliverable 3.1.4)

With the aim of valorizing and strengthening **the link between the cities and their communities**, paying specific attention to create **experiences** and fix **common meaning**s, we organize them around **uses and purposes that could be immediately understood by the different target groups**

The eight local sections

The eight VM local sections should make understandable the nature and the value of those categories which form the cultural, social and economic heritage of the eight ports.

Virtual experiences provided by the local VM will probably be different, **fitting local needs and contexts**. They all should explain the role of the ports as gateways for social and economic development in the past centuries, but also their current importance as a network, their dynamism and their ongoing adjustments to the changing environment.

The tangible elements of the interconnected maritime history presented by the local VM have to be easily recognized by the visitors as a sign of the Adriatic Maritime culture related to the single city-port.

Engagement

REMEMBER VM content should be developed **at least in English and National language**.

REMEMBER VM should share and broadcast its "strong" message to everyone, answering to educational and didactic purposes, but also to tourists and local visitors request of information and entertainment.

We need to provide layered interpretation, at a variety of levels, from a simple overview to a more "in-depth" content presentation. In this way we give people the option to find out more detail about the specific topic, both on-site and through publications and websites.

We must also be aware about different cultural backgrounds, and about multiple perspectives on history and politics.

The nature and the value of the shared cultural heritage of the Adriatic port cities should be propose in a **user-focused perspective**.

Contemporary visitors, especially the kind of person who approach digital contents nowadays, enjoy to be stimulated to interact with a virtual place.

In a storytelling paradigm, a VM engages considering he/her as an **Explorer**. In some application involving gaming techniques the visitor will be an **Hero**. Other stories will engage him/her as a Sage (providing answers) or a Warrior (engaging in some virtual conflict).

For this purpose, will be crucial the use of Social media to:

- reach and inform the touristic and cultural social communities all over the world in order to influence their destination choices
- create relations, empathy and fidelity with the city ports
- engage people (both visitors and citizens) in creating User Generated Content with digital activities that will enrich the VM
- develop a gamified approach to involve users in challenges, scavenger hunts, playable activities, etc

Each Project Partner VM should communicate the VMs in a simple way, that should, if possible, also motivate the users to discover the whole network of the Adriatic Ports. Different gamification approaches could be developed to engage all target groups.

Citizens of involved Project partners, local stakeholders, neighbouring municipalities, tourists of different typology and the virtual community will increase their knowledge on the richness and variety of the Adriatic maritime cultural heritage and contribute to its preservation through the raised awareness. **They could contribute to this wide intangible heritage with stories, videos, photos in a never ending discussion about the city ports of the Adriatic Sea.** According to each VM purpose, channels for this engagement will be social media, newsletter, challenges, crowdsourcing

Stakeholder Engagement

Regions and municipalities of involved partners and neighbouring municipalities should improve the attractiveness of own territory by upgrading the cultural offer; they are addressed through

the high-level conferences, local media and social accounts, workshops to be informed on REMEMBER strategy and its potentialities for the local development. They should be addressed through social media, local press, and during the culture and tourism fairs participations. They will contribute with original contents that could enlarge the point of view on the several relations developed by city ports

Target groups in each region are involved in the design and collection of REMEMBER VM high quality contents and for the future use and sustainability of the final output.

They want to be involved in an experience, and also to share it with their social media, which could be used as a second level promotion of the VM. We should use a multi-sensorial approach, maybe create an artistic experience with sound of the sea, traditional music, audio guide, lights, sea fragrances, touchable items, etc. It is important to introduce these elements to create an interactive experience, and to let the public participate in the exhibition.

Target Groups

Heart of the matter, most of our visitors can be divided into couple of categories:

a. tourists
b. locals
c. school children and students
d. senior visitors
e. family with children
f. disabled visitors

These sets of users are **not disjointed**. Each one has its peculiar characteristics, interests and expectations towards a VM. They visiting time are different and also the choice criterias.

In designing and developing VM, it's crucial to focus on them. For this reason, experience design and two-ways communication will be related.

The content design could differ according to the characteristics and ages of the audiences. The stories need to be widely accessible but some target groups may welcome more detailed explanations.

Tourists:

More and more Tourists choose a new destination surfing on the web, watching at their peers Instagram profiles, choosing experiences more than places. Their favourite channels could be portals, Tripadvisor, Instagram and other online resources.

For approaching and engaging tourists we should operate on the web and involve local tourist information centers and tourist offices in the process of promoting the VM.

The port itself is often the gateway to the city. Ferry and cruise/boat carry people. Here, also on board, could be possible to introduce the APCN and the local VM attraction. Than, the port is the environment where they can meet the VM.

If they arrive on site without already knowing about the VM, they must discover it through local resources, like: tourist information center, to get various information about the city; local guides; attendance at events and places; local people word-of-mouth. As VM will interpret tangible and

intangible cultural heritage of the Adriatic Sea and the port cities included, local Tourist Boards will definitely be interested in our Project and VM.

By redirecting tourist to visit VM, either in the ports or by smartphones, at a small scale, we will be an alternative to mass touristic flows into the city centers and usual tourist hotspots within the city. Visiting VM will enable to learn and experience something new about the cultural heritage of the Adriatic port cities, which will give tourist a unique experience of the port site and a better understanding of Italy-Croatia sea relations.

Tourists on a leisure visits are 'pleasure seekers' : they skip traditional presentations, they are looking for nice experiences based on challenges, gaming, scavenger hunt, pop approaches that will smoothly drive them into contents and informations in a easy way.

This will usually mean highlighting selected themes and storylines, and providing various narratives, leaving technical or more detailed informations to a second level that can be surfed only if desired.

They desire to '**share**' what they see/experiences to their contacts. To generate this useful behaviour we could include selfies opportunities, dedicated hashtag, contests, …

Locals

Museums are an important part of these audiences' cultural and community lives, attracting an extremely local audience to visit and participate in activities.

Locals must find themselves mirrored in the VM. They should recognise their families story, environment, panoramas. They must became the main ambassadors of VM and present it to tourist, relatives and other target group.

If along the VM's design and implementation local has been involved, all these processes will be natural and most sincere.

Locals are also the target audience that can attend the VM features more than once. Families and children love to repeat engaging experiences.

Definitely, on the local target must be designed a specific communication and engagement campaign that starts even before the VM 'opening'.

Seniors Visitors:

Today seniors community is more and more active. They represent a large part of the tourism (often in low season), they are curious and attracted by new representation.

Although some seniors are not so familiar with the usability of a VM and new digital technologies, they will probably know much about the cultural heritage of their cities and ports. In this perspective, we will involve seniors in content development with interviews, video, photo and so on. Promoting of VM to seniors should aim at the fact that we are trying to implement past, present, and future together with the help of digital technologies.

Often seniors have more time and content interests, so they like to explore topics in detail and appreciate being provided with appropriate information.

Involvement of the senior people into the VM should be done with the support of the local senior foster homes, various senior and pensioner associations and various organizations that work with the seniors. We should ask their advice on the most effective ways to promote these materials to visitors.

Disabled:

Disabled people are a project target.

According to the local context, we should plan different ways of delivering our contents. It will be made with a careful use of sounds, pictures, videos, and words. Main items and stories presented in VM should be a mix of different media languages. This way, we can shape digital experiences suitable, for example, to blind or deaf people.

For VM that is going to be situated in a physical location within the port site, we must ensure that the site is suitable for use by both disabled and senior people. We need to provide level access where possible, hand trails near steps, ramps, easily operated doors, textured surfaces, and easy to use taps and toilets. Toilets should be clearly signposted and easy to reach and use. We need to provide some easily accessible seating with armrests. If possible, provide wheelchairs for visitors with mobility impairments.

Children and students:

Ports are hugely attractive for kids and students. History, machines, boats, everything hits their imaginary and make the VM a preferred place for them. In groups, with schools, with families.

Educational institutions should be informed about the Project and its aims as soon as possible. That way, with their help, we will engage children and students to visit VM. We should present aims of our Project to the educational institutions to show them that it is possible to include some parts of the VM into the educational processes.

Young people are used to interactive and virtual technologies. They often consider usual 'static' exhibit as terribly boring. To catch this audience, we need to include games and activities that will be interesting and attract them.

Concept of the Platform Architecture

The main objective of this part of the document is to describe the innovative ICT architecture, specifically developed for the REMEMBER project. The services, depicted in the following paragraphs, will be customized by PP9-Univpm to guidelines of the VMs and the graphics and contents structure will be defined in the partnership, according the WP responsible roles. **The ICT infrastructure, modular and scalable, represents an important communication system that facilitates all the stakeholders involved in the project to exploit many kinds of information at different system levels of detail and fruition.** It allows to manage multiple information with an interoperable and multi-channel approach. Given its flexibility, contents can be conveniently displayed in different ways: Web portals, fixed installations (totems, digital signage), 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.
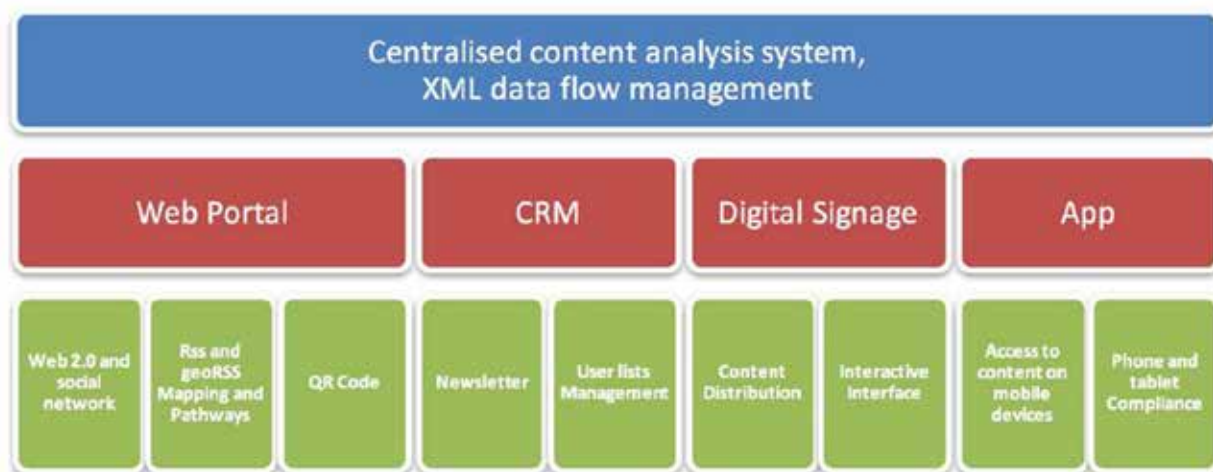
As stated by EU MEMO/11/745: "Through digital libraries people can visit the past in a virtual way to experience Europe's cultural wealth and history. Once digitized, cultural material is a valuable resource for creators and businesses, who can reuse it to develop innovative products and services, for example for education and tourism or games and animations." According to this assumption, the architecture is developed following the **cloud-based services paradigm**, with the aim of creating a long-term and linked open data platform, designed for CH-related repositories. This approach allows interoperability between **different platforms** (on site, online, mobile) and between **different users** (augmented usability of metadata for both experts/non-experts). Moreover, the architecture allows different kind of users to manage and maintain it in a simple, fast and secure way. Particular attention is paid to the integration of the information. In fact, while populating the database, different stakeholders, as well as heterogeneous data, can be involved. 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 features of the system can be summarized as follows:

- 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 all stakeholders to share cultural information;
- monitoring user's preferences and needs by collecting users' generated data

Cloud-Based services

As stated before, the main objective of this deliverable is the creation of an innovative ICT. The technological infrastructure will hold and manage data and services. The architecture assures efficiency in the management of context-aware services, analysing data arising from different experiences. The cloud platform will be able to offer a great number of IT services, however, services will be designed according to the needs of users and the needs of each participant to the project. The system will be centralized, the physical location is not up to the development team but depends on the hosting service. However, It will be compliant with the specifications provided by AGID (Agenzia per l'Italia Digitale) and developed according to the conditions imposed by the call for tender. The system provided will include, in the hosting cloud, all the required software services.

The Cloud infrastructure is be based on protocols (for the standardization of data flows) and multi-level aggregations; a joint control interface serves to merge information, using a Multisensor Information Fusion (MIF) approach.

The cloud service of REMEMBER is composed of **three levels of service** to warrant interactions, data exchange and more general aspect such as backup ad data protection:

- SaaS (Software as a Service) – It consists in the use of programs installed into a remote server to be managed via web server.

- DaaS (Data as a Service) – It allows to make available via Web to the users only data to which user can access through any application as data resides on a local disk.

- HaaS (Hardware as a Service) – It allows to send data to the server and to process them before and return them to the starting users.

In other words, the architecture has two mutual task: from the one hand, the managing of information about Heritage and, from the other, allows the single instruments to exchange data in a smart way, based on ontology and will use OWL language (if required).

The main advantage of cloud computing is that, such architecture, resources are always available for the user. A detailed description about the **back-end platform** (for both data loading and management) will be provided in the next deliverable 3.1.2. Notwithstanding, we can summarize the main tasks as follow:

- Integrated management of data and resources to ensure the integration and cooperation of the technologies used in the platform

- Management of levels of interoperability between applications and services present at different levels of the platform;

- Management of rules according to the context of application and user typology

Web Platform description

The Web platform is realized with 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 are developed with the aim of integrating the information systems with external data (Web services), allowing easy exposure of the information in Database. The programming objects integrated in the CMS allow to build Web-based applications without coding. The 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 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.

The web portal is developed to be **responsive** and accessible from any device within which to consult information and contents.

A system of content filtering and advanced research will be devised that allows simple navigation of the contents and the possibility of correlating the same so that one can pass from one content to another in a simple and effective way. All the contents will be localized in the languages that the client will decide to enable and **geo-referenced** so as to be easily identified on geographical maps. An example of an already system can be found in Figure 2. The web platform was deployed by the research group for the DCE project[1] [Clini et al. 2015].

FIGURE 2 – THE WEB PLATFORM DEVELOPED FOR THE DCE PROJECT

Mobile Application description

The mobile application permits to enjoy all the contents present within the web-portal as well as a series of additional contents of **Augmented Reality and Virtual Reality** (please refer to Section AR/VR editor for additional details). The application will be characterized by **high usability and**

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[1] http://www.flaminianextone.eu/it/

simplified usability of the contents, by interfaces specifically developed for the various operating systems and by intuitive navigation.

The connected mobile application is a cross-platform mobile app available on Android as well as on iOS devices. The **geo-localization service**, which retrieves the information from the Data Base, has the twofold advantage of suggesting a preferred itinerary to the users and enabling the Location-Based AR and image-based AR service, as explained below. Within the app, a specific AR engine is developed. This tool permits the registration of virtual objects in the camera scene, based on the user's location and orientation. For Location based AR, the device makes use of a GPS receiver to retrieve the user's location in the real world, and a gyroscope and compass to obtain the user's orientation. For Image based AR instead, the device exploits the built in camera In other words, for the first kind of experience, the system relies on (geo)localization services to determine the distance between the user and the Points of Interest (POIs) that are present in the surrounding area. For the second one, the system makes use of the video stream acquired when the user is turn-on the camera, and superimposes the virtual contents with the same point of view. Examples of existing applications developed for Marcheology[2] and SmartMarca[3] projects [Quattrini et. al. 2018, Frontoni et. al 2019] using geolocation services and all the features here described can be found in Figure 3.
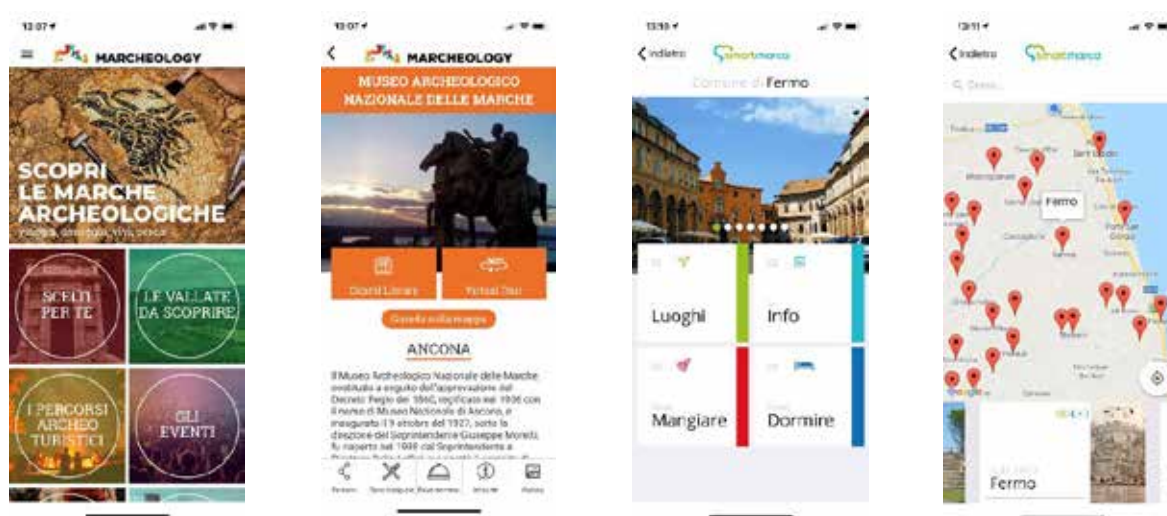
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[2] http://www.marcheology.it/en

[3] http://www.marcafermana.it/it/SmartMarca

Through the use of innovative technologies such as the Bluetooth Low Energy (BLE) it will be possible to make enhanced POIs, allowing them to "speak" with the visitors: when a user approaches one of these sensitive spaces, he will be automatically notified by the system through the use of notifications, bringing it to the attention of that particular monument / promotions etc. and going to do proximity marketing. Furthermore, **thanks to the BLE we will be able to measure, count and analyze user behavior** such as: the number of users within a given area, the time spent in a specific area and much more.

Using the new Virtual Reality technologies, we will create a **360 ° panoramic tour** that will allow the end user, through the use of latest generation viewers (Google Cardboard) an immersive experience (Figure 4). Within this experience it will be possible to interact with points of interest that will have the task of recalling tourist and cultural information.

FIGURE 4 – THE IMMERSIVE CONTENTS OF THE MARCHAEOLOGY APP. 360° VIDEOS AND PANORAMIC PICTURES ENABLE VIRTUAL REALITY (VR) WITHOUT INSTALLING TOOLS

Other innovative functionalities

Another important aspect that it is worth to describe about the platform is that, beside enabling the management of contents as described above, the back end is specifically designed for implementing two innovative functionalities. Here below these functionalities are just merely listed, referring the reader to the deliverable 3.1.2 for more accurate and detail descriptions.

AR/VR Editor

The first one it the possibility, for all the stakeholders and PPs, to implement by their self-AR and VR experiences. It is in fact well known that, nowadays, the development of such features is only

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entrusted on expert developers, given the complexity of the programming tools. With this service, users are enabled to implement by their own such features.

Analitycs

The second is the collection of lifetime usage statistics. This permits the managers to have analytics, hence, insights about the performances of the developed tools.

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Some examples of virtual museum

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