



Deliverable D.1.2

Use cases and data requirements

APPENDIX

WP1 - Definition of use cases, requirements and system architecture
T.1.2 - Definition of use cases and system requirements (functional and non-functional)

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INTRODUCTION

The deliverable titled *D1.2 Use cases and data requirements* has defined the use cases and functionalities of the **c-Space** environment. The content of this document extends the *D1.2 Use cases and data requirements* with a more exhaustive and technical description of the use cases processes. On the one hand, it describes in detail how stakeholders currently execute the tasks described in the proposed use cases, and, on the other hand, it provides further information on the specifications of the products that will be advertised.

Use Case - Architectural design process

This use case describes how a creative design consultancy firm “ACME Agency” (having a team of architects and designers) uses the **c-Space** infrastructure (client and server applications) to design and present a project for the renewal and further exploitation of an abandoned military construction.

This SME makes use of different **c-Space** technologies to enrich the company communication strategy and offer a comprehensive and appealing vision of the project. The presentation is devoted to the officers and decision makers of the municipality. Additionally, it should be instrumental in the public tender process, which is required for the realization of works of reform.



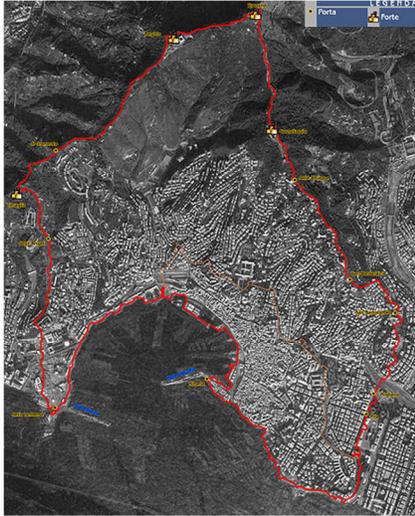
This use case addresses an experience of actual use of the SW products that will be developed in the project and the location context is completely real. In any case, it is important to clarify that the motivation of the use case is fictional and therefore the final step of restoration process will not be carried out. What will be carried out is a real experimentation with the **c-Space** toolkit and an exhaustive documentation of the process. The results will be used as a clear example and best practice of the potentialities of the **c-Space** technology in the context of architectural design process.

Geographical and historical context

In the mid-nineties, the City of Genova started to cope with the issues of recovery and regeneration processes for the city 18th century fortresses and walls. Some specific operations were launched in combination with integrated projects and a set of policies aiming to reinforce the social use of these infrastructures, attract projects and investors.

One of these infrastructures is Forte Begato ([44°26'18.15"N 8°55'16.16"E](#)). This construction stands over the city at 475 meters above sea level. Built between 1819 and 1823, the Begato fort could hold 840 soldiers and 41,000 kg. of munitions in the powder store. The Begato fortification is included in the Genova "New Walls" to defend the city, it has rectangular barracks and robust buttresses on the corners.

During the nineties, the Begato fort was involved in restoration works. The restoration, carried out by the municipality and other Public Administrations, had as objective the use of this public infrastructure for cultural activities and to host a museum, restaurant and other facilities. The initial conditions of the building were bad, especially due to the damage caused by World War II bombings. After completing the first phase of restoration, the work never received the certification due to failed quality assurance tests. Today, the fort shows up again a major state of decay. In short, a story of deterioration, wasted money and missed opportunities.



Genova with the "New Walls".



Fort Begato is a large quadrangular fortification



View of Genova from Google Earth (Forte Begato in the foreground)

Involved Stakeholders

The creative design firm "ACME" is a local SME that has signed a pre-contract with the Municipality of Genova (the owner of the Fort) in the context of a public call for projects for the Begato Fort recovery and exploitation. The objective is to present to the Mayor and the local urban planning department an advanced concept and design of the foreseen intervention and to get green light on the procurement process.

The involved actors are:

- **Designers:** They are in charge of interacting with the **c-Space** tools and for all 3D modelling works. They are also involved on the initial phase of analysis and search of the needed data sources and they are responsible for the management of all data interacting with the **c-Space** system.
- **Architects:** They are in charge of the plan and design of the project and also for its presentation.

- Public officers: They are technicians with different backgrounds (such as planners or social scientists)
- Decision makers: They are managers in the public sector, in a wide variety of fields including land use planning, environmental resource management, land development, heritage conservation, social planning, transportation planning and economic development.
- Drone operators: They fly drones by remote control following the requirements of **c-Space** for later use in the three-dimensional reconstruction of the scene.

Description of the workflow

Overview

The goal of our main actor, the “Acme” SME, is to use its design and technological skills and an experienced team of experts in various fields to come up with an amazing concept and presentation of the envisaged project.

The main objective of is to present a 3D model of the current state of the fort and then add various elements of restructuring on top of this model (a new roof, an area intended for parking vehicles, the restoration of various walls and bastions, and even new structural elements). The representation of these new elements in an AR experience will provide the Fort owners a comprehensive and realistic view of the foreseen operations.

Data Sources

After an exhausting search, for the “Acme” architects has not been possible to get the mapping and planimetry created during the previous reconstruction process, since many documents were lost in a fire.

Besides some digitalized floor map of the fort and several paper drawings from the municipal archives, does not exist any material that can be considered a good basis for 3D modelling/CAD suited to architectural work.

Anyway, the research work has led to the "Acme" designers to contact an architect involved with the process of restoration of the fort held during the first nineties. This architect has submitted several photographs of the renewal process of the Fort and a movie shoot from a helicopter right after the reconstruction. The existence of this footage is very important to compare the previous to the current restoration project and certainly bring added value to the presentation of the new project.

Initial conditions

In their daily work, the “Acme” studio uses 3D modelling, physical models, mock-ups and even interactive installations to explore and understand the space and context where their projects will be implemented, and to find innovative solutions.

A 3D presentation of a project requires a lot of efforts mainly due to the time devoted to the implementation of a model detailed and realistic enough to give to the viewer-client an understandable and realistic representation of the object or the scene. The 3D modeling process usually goes through

different phases, from the data acquisition to the data preparation and manipulation, requiring resources, time. Therefore, it costs most of the time available and is possible only in large-scale or big budgets projects.

For the “Acme” team, the creation of three-dimensional models is often an extremely difficult and time consuming work, especially when there is no information (such as CAD files) about the existing constructions. This is especially important in the case of projects based on archaeological or historical sites.

In the case of architects, hyper realistic computer-generated renders are well-established tools in the architectural design process, but augmented reality hasn’t been tightly integrated into their design work yet.

Augmented reality activity is currently heavily used for marketing purposes. Most augmented reality usages are often limited to the use of a two-dimensional flat marker patterns that interface with digital models on devices like iPads to render augmented reality views.

But augmented reality models can be of great help for several professionals such as Architects, Engineers, and Land Surveyors to help promote and develop their projects.

Main technology requirements

The main precondition of this use-case is the availability of a 3D model of the Begato Fort. For this, the **c-Space** technology for 3D reconstructions of real scenes through high resolution video streams will be used.



3D model of American Civil War fort featured in Google Earth (created with the Sketchup software)

A radio controlled quadcopter drone with the ability to take photos and videos will be used to capture 360 degree video views of the Begato Fort. The drone features GPS tracking and navigation so it could survey and pinpoint all the site conditions. Eventually, the pilot should be also able to define a flight path by selecting a series of waypoints.

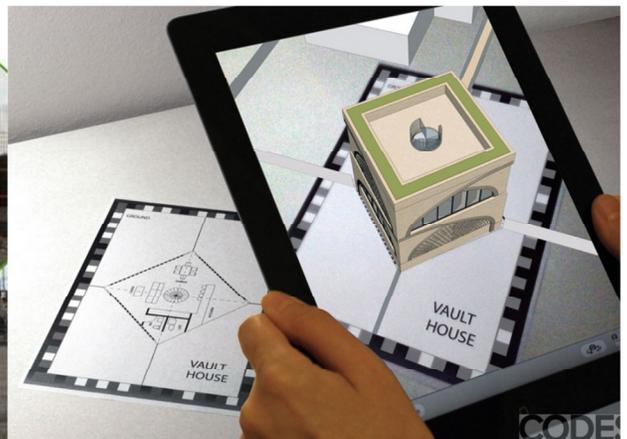


Example of a multirotor drone platform consisting of a frame with a mixed Carbon and Alu structure. designed to mount an FPV camera or HD camera in the front.

Another condition will be the availability of an Augmented Reality (AR) software for tablets and-or smartphone and-or augmented reality glasses, able to represent the fort 3D model (and eventually other content) on-location and also augmented over 2D markers.



A 3D model augmented on top of the current state of advancement of the project in a construction site



A 3D model augmented over a QR code or pattern

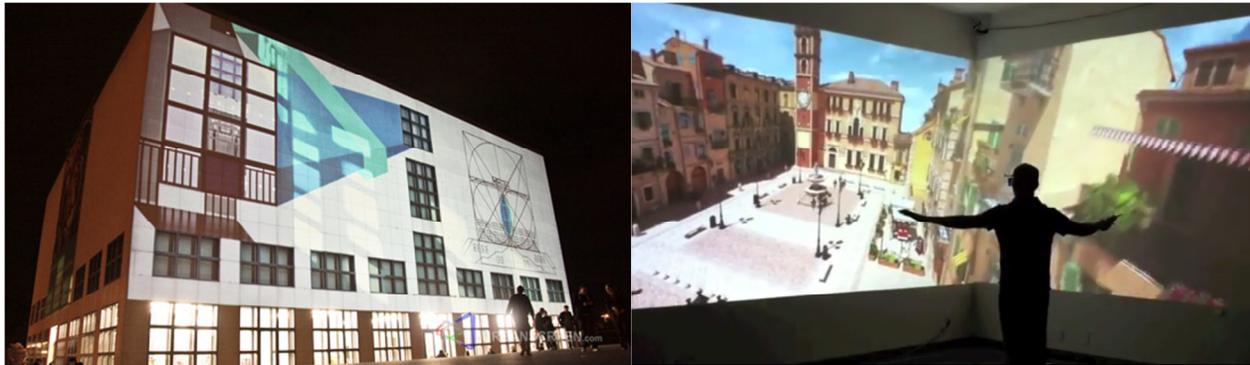
Finally, it will be necessary the use pico-projection technology for the presentation of the “augmented” 3D model on top of a table or the pavement. Pico projection will overcome the limitation of using small displays (e.g., tablet displays) during presentations to larger audiences, by enabling the in-site augmented content projection.



pico-projecting on the desk

Other possible situations related to this use-case but with less priority are the following:

1. The “augmented” 3D model can be also projected on top of the surrounding scene or Fort in the context of a public presentation of festival in the site.
2. The “augmented” 3D model can be also used in a virtual environment in the context of a public presentation in a tech fair or similar event.



Augmented Reality projection onto a building

3D model in an immersive virtual environment.

Use-case main user/functional requirements

- The **c-Space** system should handle the reconstruction of a 3D scene from a high-quality video (HD video sources like MPEG-4 at 720p or 1080i)
- The **c-Space** system should handle the reconstruction of a 3D scene (or at least parts of it) from old analog non HD footage (VHS tapes)
- The time for processing the source video cannot exceed three days.
- The resulting surface 3D model should have the most high level of detail and precision (e.g. without blind spots and missing data)
- The model surface should have the highest level of texture quality.
- From the 3D model obtained, it should be possible to derive a precise 2D floor plan of the construction.
- File formats and 3D modelling tools compatibility: The derived 3D model should be used and compatible in the most common 2D/3D architectural design software. It should be possible to edit and work on the output 3D model (the model is the basis for further design work)
- The **c-Space** mobile client should be able to represent the position and orientation information for the 3D model. The position of augmented 3D objects should be the most accurate possible reaching up a sub-meter level of accuracy.
- The client’s Projective Augmented Reality interface should be available from an Android-based tablet. The interface should also be available (even if with less priority) from portable augmented reality glasses (Google Glass).
- The AR client should be able to manage the visibility of different layers of information such as the original 3D model, other structural elements or added objects. The client should also support transparency of the 3D augmented objects.

- The **c-Space** content server online platform shall have an authentication service and a user directory defining different profiles of users and providing secure access to services and resources.
- The designer should have access to his own work-space, as well as to a public repository that also collects data from services like YouTube. The designer should have possibility to save all the reconstruction steps, as it might require several sessions to finish the project.
- The **c-Space** content server should permit upload of various contents (videos, images, 3D data, GPS tracks, etc.)
- The **c-Space** content server should provide pre-visualisation of the 3D models.
- A video should show the created 3D model on top (overlayed) of the recorded content using motion/camera tracking or motion control (the camera moves in the real life scene and it matches the movement done in the 3D scene)

NOTE: A strict quality assessment procedure will be performed to the obtained models in order to ensure its best quality.

Main Process (timeline)

1. The technicians at “Acme” and the outsourced company responsible for the management of drone flight decide to schedule a day for the flight based on the weather forecast.
2. The flight is performed following strict recommendations from the **c-Space** online support and published guidelines to ensure a perfect 360 degree coverage of the Begato Fort.
3. Once the flight is over, the “Acme” DESIGNER logs to the **c-Space** content server web interface and uploads the resulting video in the company profile space.
4. The **c-Space** SYSTEM starts the creation of a 3D model of the corresponding real scene.
5. The SYSTEM notifies visually (progress bar) the time needed for the model rendering. In case the user logs out, an email is received informing the process completion.
6. After completing the process, the SYSTEM provides the DESIGNER with a link to download the 3D model. This model is accessible from the user profile resources catalog.
7. The DESIGNER downloads and visualize the resulting model in a 3D modeling software or previews the model using the **c-Space** application or the **c-Space** content server.
8. In case the model does not meet the quality expected, the SYSTEM allows the upload of additional videos or 2D images, eventually captured with **c-Space** mobile application, to fill in the gaps of the 3D model.
9. When satisfied with the result, the DESIGNER uses a 3D modeling software to add additional structural and scenic elements to the original 3D representation based on the designs and mockups from the “Acme” architects.
10. Eventually, the DESIGNER creates from the 3D model an accurate 2D floor plan for further presentation material and early interior design study.
11. The DESIGNER repeats all the steps from 3 to 7 to create a 3D model from the digital version of the VHS video of the Fort.
12. The DESIGNER follows the **c-Space** guidelines to upload the updated version of the model, and to integrate the created 3D models in the AR client in a tablet. The designer loads all the 3D work into different tablets to be used in indoors and outdoors presentations.

13. The DESIGNER collects all the presentation material and organizes a meeting with the municipal officers and decision makers to show the “Acme” architects project and vision for the Begato fort.
14. The presentation makes use of different **c-Space** technologies, and is based on different locations, materials, and audience.
 - Presentation at the city council premises: For this presentation, the “Acme” designers and architects make use of the AR client in a tablet to augment the fort 3D model and the envisaged interventions on top of a desk. The 3D model is also pico-projected to support the architects on a more detailed explanation of the intervention.
 - Presentation on-site: The municipal officers and the “Acme” architects meet at the Begato fort. There, the officers are invited to check the 3D model and, more important, the planned architectural interventions, through a tablet with an AR client (or eventually Google glasses).
15. The Municipality officers remain very impressed by the presentation of the project and by the ability to transmit the vision of the project through the **c-Space** tools. Thereafter, they ask the “Acme” design team to create a high quality video showing the drone flight and an overlay of the 3D model and foreseen interventions synchronized and on top of the recorded content. The video should feature also some ground panoramic shots showing the before-and after situation. The result can be obtained manually or by attaching a smartphone to the drone.
16. The video is published in the **c-Space** platform, YouTube and other video-sharing and social platforms websites in the context of a participation process initiative/campaign from the municipality to inform, communicate and collect feedback from the citizens on the foreseen project.

Expected Beneficiaries and Impact

The main purpose of this use case is to demonstrate how the creation of 3D content through the **c-Space** platform can be easy, inexpensive and quick, giving to an architectural project, especially in the case of reform, a whole new perspective.

Using and adopting the **c-Space** toolkit, the “Acme” SME clearly benefits by shortening the 3D model creation work, having a clear effect on reducing the cost of their services production.

Another benefit of **c-Space** is that it supports the communication and presentation processes of this company. The effectiveness of the **c-Space** tools regarding communication is significant not just from the architectural point of view but as well for social and relational aspects.

The study of the social function and use of the architectural space is an increasingly important aspect in architectural projects but often very difficult to effectively communicate. The presentation of these aspects is obviously of great difficulty for a freelancer or even for a small company. Using low cost 3D model creation mechanism and AR applications can be helpful and significantly reduce the cost of these services.

Other direct benefits of using the 3D model creation and AR features provided by **c-Space** in the architectural project design and presentation process:

- The design review team (in our case the municipal officers) can interact with the data
- Designers can immerse themselves in their concepts for new perspectives
- Increases team collaboration
- Reduces risk, reduces the cost of operation, and enhances understanding.
- Adds the ability to view/simulate the activities and interactions that can be performed in the place
- Adds the possibility to easily produce instances of the model in different times.
- The technology can be also very effective in the context of the study and creation of 3D models of damaged and unsafe buildings in which it would be too risky to go into for the risk of collapse (using of remote control vehicles or drones).

Therefore the impact of **c-Space** in the context of this specific use-case can be of interest for the following beneficiaries:

- Provide SMES with the technology capable of undertaking significant projects for very competitive price.
- Provide to startups & SMEs the possibility to sell competitive services for investors, homeowners, hotel operators, architects, real state operators, contractors, etc.
- Foster the adoption of augmented reality as a real design tool for architects and other professionals.

Use Case - Begato Fort - Augmented history

The objective of this use-case is to exploit **c-Space** as a support toolkit for architectural and landscape heritage experts and tourism operators to tell stories and to explore innovative solutions for guide citizens and tourists.

The creative design consultancy firm “ACME Agency”, has been commissioned by the City of Genoa to create a free mobile tablet/smartphone application for tourism promotion and education of local communities based on the Genoa forts and walls system, and most specific on the Begato Fort.

Again, like in the use case 1, the main aim is also to use the **c-Space** platform to produce virtual models and representations of existing architectural elements. However, this time, the focus is pointed on the creation of a final product combining AR, routing, gaming and immersion on the landscape, providing a complete educational-touristic experience.

Among other potential uses, the app is planned to be used for:

- Promotion of territory and a cultural heritage site.
- A diachronic representation of a heritage site.
- The description of the landscape itself and of its cultural/morphological characteristics.
- The description and suggestion of touristic paths.
- The reconstruction of historical events and situations.
- As a support tool for the development of “urban games” based on sites of cultural interest.

Geographical and historical context

This use-case is focused on the creation of a historical-educational tablet app for the Begato Fort and its surroundings. See the *Use Case 1: Using C-Space as a support toolkit for the architectural design process* for more information.

Involved Stakeholders

The application will be designed as a travel-educational platform having in mind that the main users are not just individuals (citizens, travellers of tourist) but also (and more important) schools and organized groups of tourists that will interact with the application in groups of 2-3 individuals.

The plan is that the application, in a first phase, will be used by local schools (also in a context of testing) and, in a second phase, will be marketed to travel agencies or made available on mobile marketplaces.

The owner of the application (the Comune of Genova) will study very carefully the business models and possible exploitation of the app in other contexts than the Begato Fort (e.g. other cities, historic trails, urban parks, etc ...).

Actors

In this use case, the actors of the use case 1 play again an important role, but besides the actors already mentioned we should also include:

- **Game developer:** He/she has experience developing “serious games” for educational or training purposes, as well as with the organisation of urban games linked to urban regeneration, urban planning, city management initiatives, crowd sourced initiatives and other forms of urban digital innovation.
- **App developer:** He/she has experience integrating AR content in Android/iOS app environments. He/she has also experience creating game interfaces and tourism guide apps.
- **Student-Tourist:** The final user has a fundamental role as main beneficiary of the app to be developed. The application is focused on provide the user a rich experience in terms a guided tour with a high educational value.

Description of the workflow

Data Sources

The main sources of information for this use case are a selection of POI's with related information (sheets of historical information and associated multimedia resources):

- 3D models created from video footage
- 3D models created from old archive photography or designs (trenches, weapons, architectural elements, etc.)
- Base cartography
 - Rectified old and historical maps
 - GIS data, digital terrain models
- CAD recent files when available, from digitization of paper drawings.
- Imagery (photos, videos), recent or not, enriched with accompanying texts, describing the present situation but also the original state at the construction time and its following evolutions along the centuries.

Main technology requirements

The use of Augmented Reality in educational-touristic apps has great potential to offer more interactivity to students and the general public visiting historic sites. This is especially relevant in the case of isolated architectural elements or in the context of historical heritage sites.

One of the most characteristic features of this use case will be the creation of a client allowing the user to switch at any time a "map-like" view, where all the elements are positioned on a 2D/3D navigation display to an “Augmented” view offering an Augmented Reality browsing experience.



A New York Public Library Hi-Res Map digitally aligned over OSM



The 3D map interface of an application from the Smart-islands project

Being mainly based on AR, the foreseen app will make an extensive use of the potential of the **c-Space** AR client. For this the following features are expected:

- Click on various points of interest and access key facts about the location. Connect documents and photographs to local historic points of interest.
- 3D models and archive images projected on the landscape
- Another possible feature to be implemented in the tablet-smartphone AR application could be the appearance, in the most significant points during the guided tour of the site, of "avatars" of historical figures in the shape of dynamic tree-dimensional characters or a "virtual touristic guide" describing the story or relevant facts.



This interface features points with associated information (text and photos) in the augmented canvas



This interface features augmented archive images with associated information



An example of vision of associated information from Google glasses during a guided visit



The inclusion of archival footage in real contexts adds a huge storytelling potential on understanding historical places

As in the Use case 1, a precondition of this use-case is the availability of a 3D model of the Begato Fort. The 3D model will be reconstructed from high resolution video captured by a drone. Other 3D elements should be created, specially related to missing structures. Some of these elements could be created from old 2D photographs or using smartphones.

The use case will also take advantage of a “cultural routing” or “smart routing” system in order to create a path depending on the sequence chosen by the user during the visit experience. The use-case will attempt to maximize the adoption of this technology also during the potential organization of an “urban game”.

Other aspects of **c-Space** that could be accommodated in the context of this use case but have a lower relevance are:

- Augmentation of scenes in indoor environment
- Adaptive and affective content access: analysis of tourist/student interaction patterns and their reaction to different events measured by facial expressions and gestures
- Integration of social interaction mechanisms.
- Integrate in the app the ability to offer the “contest” or “scavenger hunt” activities to users (for example, a user completes a task and is rewarded with the ability to view a 3D model)
- Use of the foreseen application in Google glass

Use-case main user/functional requirements

- The client should be able to switch from a 2D/3D geobrowser mode to an AR mode at any time
- The client should be able to include georeferenced images in an AR environment.
- The client should be able to include 3D objects in an AR environment
- The client should be able to support the visualization of pdf, videos and links to Wikipedia articles.
- The client should be able to graphically inform the user about the nearest objects with associated information or POI's (a radar-like interface)
- The client should be able to feature a layer switcher were the user can activate-deactivate several information layers such as

- tiles (OSM, Google maps satellite, other satellite imagery)
- georeferenced old maps on top of the base layers.
- 3D objects
- The client should be able to visualize WMS layers
- The client should be able to show the current position of the user
- The client should be able to visualize routes and POI's
- In AR mode, the client should be able to show POI's with related info, directions and paths, augmented images, and 3D objects.
- The client should be able to represent routes and show them on the "map" mode (using a 2D or 3D geobrowser) and also in AR, to offer a clear idea of the development of the path.
- The client should be able to manage transparency of georeferenced/rectified maps on top of base layers.
- The client should be able to create and suggest a route for visiting elements and landmarks of the historical site.
- The client and app interface should be optimized for tablet devices (from 7 to 10 inches)

Main Process (timeline)

A group of tourists/students are about to start a historical field trip of the duration of 2 hours based on the Genova Forts and located in the Begato fort and surrounding area. The group arrives at the location by bus and then groups of 3 persons are created. Each group have a tablet with the **c-Space** application preloaded.

- Once turned on, the SYSTEM centres the map view to the user's GPS location and a "Tasks and goals to be completed" modal window (as a guide and wizard) is displayed.
- The SYSTEM suggests to the USER a path to follow.
- The USER explore the area both in the "map" and "augmented" views and chooses a point where to stay and interact with the model (3D avatar)
- The USER explores the whole landscape and sees both its overall evolution and the specific information about a point of the model (what is there; what was there in the past; which are the information associated to the point, what happened there). All of this can be done in both 2D/3D map representations or in AR.
- The designed path comprises 10 points (tasks) to be visited. The user chooses randomly where to start and the "smart routing" system works as the field guide the user through all points.
- During the historical path, the user visits points with "hidden" 3D objects (like trenches), sees photos of the fort on top of the real image, sees a 3D model of the fort with the inclusion of missing elements (a collapsed tower during a battle) and an evolution of the fort during different times through a dynamic 3D model.

Expected Beneficiaries and Impact

- From a historical and educational prospective, one of the main benefits of this kind of apps is to show the elements and structure of military architecture (rather difficult to distinguish with ordinary perspective vision).

- Another benefit is to offer a vision of the link between the military complex and the below town, to understand the urban structure and its development
- Understand the creation of paths within the fortresses and along the walls
- Evidence of old trenches, very difficult to single out for non-expert people, but as well of the position of opposing troops in the occasions of battles and combats.
- Show of the old snow reservoirs (neviere), some of which still remain.
- lastly and linked to the option for an urban game in the final steps of the project, the possibility of setting an historical event (starting from the XVIII century and arriving to the 2nd World War)

Use Case – Bologna - Cultural Heritage

The use case describes the cultural tourism services made available to a group of visitors staying in Bologna during their tour in Italy within the Expo 2015 in Milan. At the beginning of our case, they have been informed about the opportunities offered by the c-Space App for tablet and smartphone, create to help them in optimising the time they are going to spend in Bologna. According to the preferences, the time available, the mood of each participant, every visitor will receive a personalised programme for optimising his/her city tour. The tourist is presented with the main information about the city, its history and tourism opportunities, as well as a video presenting the main places of interest of Bologna.

At the end of the show, he/she is informed that a list of several places of interest have been selected according to the emotional reactions identified during the interaction with the application. The feedback received through the c-Space tool is personalised to the specific interest: if the top of interests and emotional feeling was e.g. when the exhibits of Museum of Modern Art (MAMbo), and the Museum of Ancient Musical Instruments were shown, a personalised tour is created on these elements. Furthermore, going to the Museum of Ancient Musical Instruments, the visitor discovers that the ticket is also valid to access all the other museums of the Genus Bononiae network, and can merge the visit to the proposed cultural institutions with the attractive experience of getting lost in the medieval narrow streets of the Bologna city centre, combining the cultural visit with a free walk downtown, also looking for some tasting of the famous Bolognese cuisine.

Institutions and locations: Genus Bononiae

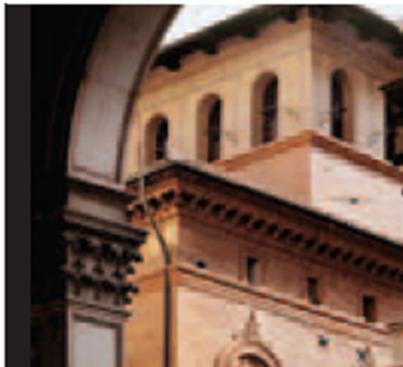
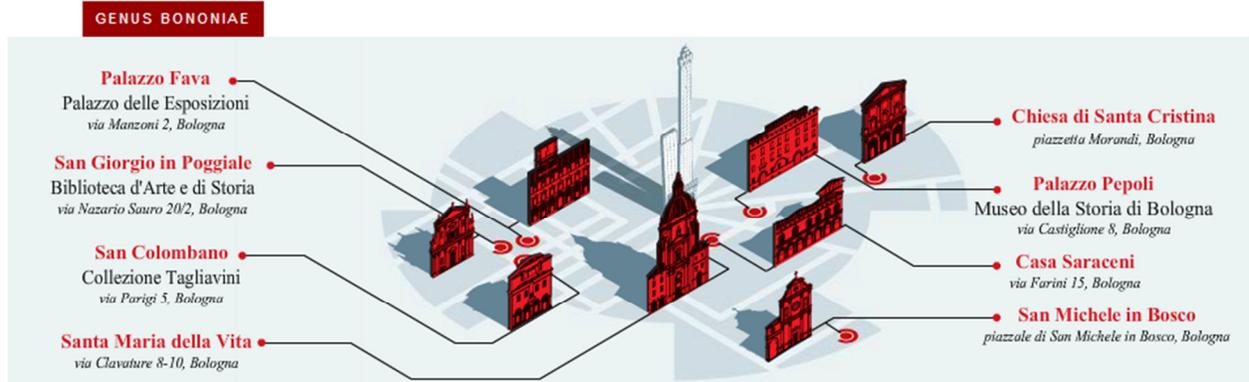
Genus Bononiae. Museums in the City is a cultural, artistic and museum itinerary running through buildings in the historical centre of Bologna that have been renovated and rehabilitated for public use (contact: info@genusbononiae.it, more information at: www.genusbononiae.it).

Genus Bononiae, Museums in the City, follows a path through the city and narrates its history, life and arts useful to describe and understand the genus of the Bolognese people. It uses the streets of Bologna as corridors and the buildings and churches as rooms, blending into the existing institutional structure, and ensuring a full link with other museums, art galleries, as well as the other cultural, economic and social initiatives which animate the local community.

Genus Bononiae has considerable dimensions even at a European level in terms of surface area occupied, collections exhibited and services provided to the public: The entire Genus Bononiae itinerary covers a surface area of approx. 20.000 m², 15.000 of which are dedicated to activities related to exhibitions, culture and museums. The collections contain 15.000 works of art, sculptures, drawings and engravings: 60.000 items as regards photograph collections, 115.000 antique and modern volumes (of the antique volumes 1.904 date to the sixteenth century and 3.435 date to the seventeenth century); 563 musical instruments, dating from the sixteenth century right up to the end of the twentieth century (Bologna has been a UNESCO “Creative City of Music” since 2006).



Genus Bononiae manages eight different buildings:



Palazzo Fava, frescoed by the Carracci's: a dedicated events and exhibition centre;

Casa Saraceni: home to the Foundation who created Genus Bononiae;

San Michele in Bosco: a magnificent belvedere looking out over Bologna, with a rich collection of art works.

Art and History Library at San Giorgio in Poggiale: with a rich collection of books dating from the 1500s onwards;

San Colombano: with the collection of ancient instruments belonging to Maestro Luigi Ferdinando Tagliavini;

Chiesa di Santa Cristina: where concerts are held;

Santa Maria della Vita: which houses the terracotta sculptures *Compianto sul Cristo Morto* by Niccolò dell'Arca;

Palazzo Pepoli: an innovative museum dedicated to the history of the city;

In particular our attention focuses of two locations: the Exhibition Centre of Palazzo Fava and Museum of the History of Bologna at Palazzo Pepoli.



Frescoed on the first floor by Annibale, Agostino and Ludovico Carracci in their early days, Palazzo Fava was described by Roberto Longhi as "a historical romanza, based on the great paintings of previous eras" without being marooned in mannerism and being able to "communicate directly through the opening not of a book but of a window". Covering more than 2600 square metres, Palazzo Fava is regularly used as an exhibition centre. Its rooms house collections from the Fondazione Cassa di Risparmio in Bologna, as well as exhibitions of works from other important public and private collections. It is currently hosting a special exhibition focusing on the Johannes Vermeer's *Girl with a Pearl Hearing*, from Mauritshuis in The Hague.

Palazzo Pepoli is a museum and cultural itinerary dedicated to the history, culture and transformations of Bologna, from the Etruscan “Felsina” to our times. The various ups and downs of the local community are narrated here in an innovative fashion using striking interactive display techniques that are still poorly used in Italy. The splendid backdrop of the medieval building makes a visit to the museum a unique experience. Palazzo Pepoli - Museo della Storia di Bologna has a total surface area of 6.103 m², the permanent exhibition space (including reception areas, courtyard, Tower of Time) is 3.405 m², the temporary exhibition space (gallery on mezzanine floor) is 270 m² (with room to expand); for educational activities (laboratories and other work spaces) 212 m² have been allocated, while the area reserved for public services is 420 m², and for offices and utility rooms 1.800 m². Palazzo Pepoli is fully accessible to the disabled; the lettering of its signs guarantees easy reading even to the partially sighted; the seats appear more and more frequent as the itinerary winds its way through the 34 exhibition rooms; reception, rest and transit areas are provided for; the video devices have sound diffusion equipment incorporated in order to facilitate individual listening without interfering with the surrounding environment.



Key professional figures involved and description of their tasks

Three key actors have been identified within the Genus Bononiae organisation, namely:

- Irene Tognazzi, responsible for transnational projects
- Alessandra Lauria, responsible for communication and social media
- Elena Faella, responsible for marketing and promotion.

These areas are the key ones most strictly concerned with the developments of the c-Space project and represent the contacts for the development of the use case. Genus Bononiae is investing in the development of Apps to be made available to the visitors, as well as they manage a user service in five different social networks for providing additional services and information before, during and after the visit. Digitisation of all the pieces of arts of its collection is at an advanced state.

The tasks concerned with marketing and promotion unit are mainly focused on the objective to make Genus Bononiae more known, increasing the information channels for the permanent collections, the temporary exhibitions and the events organised. The key issue is make the visitor understand the integration concept staying at the basis of the Genus Bononiae model, not centred on a single museum or building, but aiming to provide the visitors with a general vision of the city, enriching the value of each single unit. In this perspective, the challenge consists of developing Genus Bononiae as one of the pivots for local development plans, increasing strategic partnerships with other local and regional stakeholders, such as the City and the Regional governments, the cultural organisations, the tourism, accommodation, restoration and transport associations.

Following this strategy, the workflow of activities run by Genus Bononiae must be able to generate new tourist products and services, integrating and improving the existing information offer to better respond to the needs of the cultural visitor (e.g. supporting the tourist visiting Bologna in understanding how to

move across the town, using public and private transport systems). An additional task is the development of new models for organising guided tours, where the great variety of cultural offer proposed by the Genus Bononiae can be re-organised for preparing customised package for specific community of visitors moved by different interests and passions.

Institutions and locations: MAMbo – Museo d'Arte Moderna di Bologna

MAMbo – (Museo d'Arte Moderna di Bologna – Museum of Modern Art of Bologna) is the venue of Istituzione Bologna Musei. The museum travels through the history of Italian art from the second post-war period until today; it explores the present thanks to an exhibition centred on research and it contributes to outline the routes of contemporary art following the most innovative experimental practices. Located in the heart of the Manifattura delle Arti cultural district, the museum is the focus of various research- and innovation-based activities, such as the Cineteca di Bologna, the Department of Music and Spectacle workshop spaces, the Communication Sciences Faculty and many associations and art galleries. The exhibition spaces are concentrated at the MAMbo, however this museum also encompasses the Museo Morandi, the Villa delle Rose, the Museo per la Memoria di Ustica, and Casa Morandi where the famous Bolognese artist lived. The recently acquired Sandra Natali Residence for Artists provides logistics support to young artists who are in Bologna temporarily for cultural pursuits.

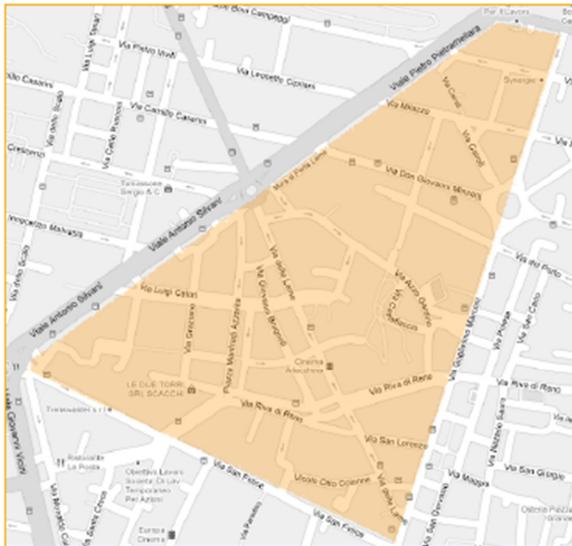


The Education Department of the MAMbo addresses its activities to the whole public of the museum: children, young people and adults, schools and organised groups. It acts as a facilitator between the artwork and the visitor: it promotes a more aware use of the art, it suggests a possibility of new elaboration, it responds to the different receptive and communicative skills of the public of every age and social and cultural origin. The proposals are various: simple guided visits, animated visits, workshops, preparatory meetings to approach contemporary art. Special paths for the professional development are then addressed to teachers and cultural professionals.

The Education Department proposes a wide range of paths conceived for every type of school. It helps teachers having difficulties to organise trips to the museum due to a lack of people accompanying the groups, thanks to a direct collaboration during the visits to the museum and the return to school. It also offers the opportunity for a workshop dedicated to artists' lives to be carried out directly in the schools. Furthermore the Education Department proposes to families different activities, according to the age of the participants. Meetings in the exhibition halls of the Permanent Collection or of the temporary

exhibitions can turn into aesthetic experiences and moments of creativity thanks to the workshops proposed.

The Education Department organises artistic tours along the streets of Bologna, inspired to the life of Giorgio Morandi. Starting from the house where he lived and worked, participants visit some of the most interesting areas of the city centres, and are shown how Bologna was at the times of Morandi.



A second tour organised by the Education Department of MAMbo crosses the district of Manifattura delle Arti, one of the most important destinations in Bologna, as a matter of arts and culture. Manifattura delle Arti (Art Manufacture) is a cultural district in the centre of Bologna, in a former industrial area where also the ancient river harbour was present. It includes several cultural, artistic and educational buildings as well as the Giardino del Cavaticcio. This park, just behind the MAMbo, is an open air art gallery, hosting sculptures of famous modern artists, and it is a perfect location for events and exhibitions.

The Educational Department organises tours where the participants receive an iPod supporting the explanations provided by the guide accompanying the visitors. A simple and effective multimedia tour presents the different pieces of art and locations, enhancing the information with additional reading, pictures, audios and videos.

The staff of the Educational Department of MAMbo include:

- Veronica Ceruti (department coordinator)
- Cristina Francucci (scientific supervisor)
- Anna Caratini, Ilaria Del Gaudio, Silvia Spadoni.

Use Case – Mobile advertising

The objective of this section is to identify and describe products and services to be advertised in the c-space use cases. The products, services, and message to be transmitted that were identified are:

- Agilis Engineering

Product advertised	Unique industrial material: extruded and ISO molded graphite , enhanced by innovative engineering processes
Functionality advertised	Enhanced technical properties: resistance to high temperatures, chemical resistance and electrical conductivity
Advertising message	The gateway to engineering excellence

- Airboxlab

Product advertised	Smart indoor air monitoring device delivering customised advice to consumers to improve the quality of air at their home
Functionality advertised	Benefits of the product for the customer: impact of air monitoring on health and well being
Advertising message	Monitor your home to improve your health

- All Square

Product / service advertised	Social network for golfers
Functionality advertised	Beauty and user friendliness of the platform + added value for golfers (e.g. new way to connect on and off the course)
Advertising message	Welcome to a new golf experience

- City Mov'

Service advertised	Car sharing service for companies based on a fleet of connected electric vehicles
Functionality advertised	Ease of use and flexibility of the service + cost effectiveness
Advertising message	Be free, be green, be mobile

- Cubelux

Product advertised	Video system that allows counting and classifying retail customers into gender and age groups.
Functionality advertised	Benefit of the technology for retailers: smart and powerful marketing decisions
Advertising	The Golden Eye for retail

message	
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- Cybercultus

Product advertised	Innovative online travel platform allowing tourists to organize their own visits and plans with the support of ICT technologies
Functionality advertised	Trips “à la carte”
Advertising message	Travel in a brand new way

- ECRES

Product advertised	Innovative industrial lighting systems based on LED technologies
Functionality advertised	Difference versus traditional industrial lighting in terms of design and comfort
Advertising message	You will see the difference

- Galimeo

Product advertised	Digitizing device called Trimeo, which allows non-IT people to create virtual tours of a shop or building in a few minutes
Functionality advertised	User-friendliness and ease of use
Advertising message	Virtual tours for all

- Geopowair

Product advertised	Innovative heating pumps
Functionality advertised	Enhanced robustness and efficiency versus competition
Advertising message	The winning choice for heating

- iNUI Studio

Product advertised	Educational video game for kids with fun animations and interactive features
Functionality advertised	Design, mix of fun and educational content
Advertising message	Connect your imagination

- Sportunity

Service advertised	Social support programme for underprivileged kids with the potential to develop
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	a professional sports career. The scope is to raise awareness among potential partners or donators.
Functionality advertised	Social impact
Advertising message	Little is needed to change someone's life

- Jamendo

Service advertised	Music from independent groups and artists
Functionality advertised	Diversity and quality of their music offer
Advertising message	Discover thousands of artists

- Jilbee

Product advertised	Video-based e-learning technologies
Functionality advertised	Benefit for the customer: enhanced skills and productivity
Advertising message	Disseminate the right knowledge to the right people at the right place and time

- Oneall

Product advertised	Social network API to simplify the integration of 25+ social networks into websites
Functionality advertised	Benefits for the customer: increased sales and enhanced user experience
Advertising message	Make your web business smarter

- Open Assessment Technologies (OAT)

Product advertised	Computer-based testing technology
Functionality advertised	Ease of deployment and enhanced user engagement
Advertising message	Empowered and creative testing

- Every 1

Service advertised	Website where people can publish their cooking recipes and be rewarded by food brands
Functionality advertised	Monetization features of the platform
Advertising	Cook, Post & Get paid

message	
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- Neotechpro

Product advertised	Self-balancing robotic mobility device for physical fitness purposes
Functionality advertised	Exercising while having fun
Advertising message	Ride and train with fun

- Vibrationmaster

Product advertised	Vibration testing devices
Functionality advertised	Enhanced technical features (improved test accuracy, shorter test programme times) + cheaper
Advertising message	Good Vibrations

Actors involved

The following provides further information on the targets for the mobile advertising scenario. All actors involved will be business professionals. Some of them will have a background in ICT, while others will not be experts in the field. None of them are expected to be experts in 3D/4D content and technologies. The target audience is expected to be specialised/interested in the following market segments:

Company	Target: visitors with an interest in
Agilis Engineering	Industrial technologies
Airboxlab	Green technologies or Health
All Square	Leisure or Sports or Social networks
City Mov'	Green technologies
Cubelux	Retail technologies
Cybercultus	Leisure
ECRES	Industrial technologies
Galimeo	Retail technologies
Geopowair	Green technologies
iNUI Studio	Education or Entertainment
Sportunity	Sports
Jamendo	Leisure or Entertainment
Jilbee	Human resources
Oneall	Social networks
Open Assessment technologies	Education or Human resources
Every 1	Leisure
Neotechpro	Sports or Health
Vibrationmaster	Industrial technologies