

A Mobile Application for the Enhancement of POIs in Calabria

Anna Berlino
berlinoanna93@gmail.com

Luciano Caroprese¹
l.caroprese@dimes.unical.it

Eugenio Vocaturo¹
e.vocaturo@dimes.unical.it

Ester Zumpano¹
e.zumpano@dimes.unical.it

Università della Calabria, Ponte P. Bucci, 87036 Arcavacata di Rende (CS), Italy

Abstract

Cultural heritage is a collection of works, monuments, buildings, and traditions belonging to the territory that generated it: this represents the wealth of a country both from a cultural and an economic point of view. Preserving and understanding the cultural heritage is of prior importance to discover and analyse findings of historical interest worldwide. Information and Communications Technology (ICT) is largely used for the enhancement of archaeological heritage, to provide the visitor with specific and complete information about tangible culture. This work is a contribution in this direction: it aims at disseminating information about a territory, Calabria, famous for being one of the regions belonging to Magna Graecia and rich in archaeological heritage. Specifically, it presents a project proposal that uses ICT technologies and augmented reality in the domain of cultural heritage, to promote new keys of reading and knowledge of the territory so that providing the visitor with specific and complete information about tangible culture. It describes a mobile application for the enhancement of points of interest (POIs) in Calabria. More specifically, the project at the present involves the archaeological park of Castiglione di Paludi and the Archaeological Park of Sibari. Castiglione di Paludi, located in the municipality of Paludi in the province of Cosenza, is one of the most important archaeological sites for extension and finds belonging to the Brettia era. Sibari, established about in 720 BC, is the first colony founded by the colonizing movement of the Achaeans. It is located in Cassano allo Ionio, is one of the richest and most important Greek cities of Magna Graecia and shows the overlap of three urban plants dating back to different historical periods.

Copyright © 2020 for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

In: A. Amelio, G. Borgefors, A. Hast (eds.): Proceedings of the 2nd International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, Bari, Italy, 29-Jan-2020, published at <http://ceur-ws.org>

1 Introduction

Cultural heritage is nowadays a powerful tool of communication and a valid means to disseminate knowledge and promote an asset. In this respect, technology plays an important role as it offers different channels to disseminate culture and information about the history of a given place [Man07].

There are several formal definitions of cultural heritage, collected by the ICOMOS ¹ organization in the document “Definition of Cultural Heritage - References to documents in history [Icom]. Therefore, cultural heritage represents a useful way to define a social and territorial identity, preserved, protected and handed down by past generations and which will be preserved for future ones.

Cultural heritage can be divided into three categories:

- *Movable tangible heritage*: these are all works of art such as paintings, sculptures, etc. which are transferable and can be collected;
- *Tangible real estate heritage*: it is all that has been built by man over time, such as buildings, palaces, etc. This type of heritage cannot be transferred and anyone who wants to visit it must go to the place where it is located;
- *Intangible heritage*: it is both the knowledge that has developed in the members of a community (traditions, religious beliefs and habits), and the relationships that have been established over time among the members of the society. In some communities this kind of patrimony turns out to be more relevant with respect to written assets, movable assets and tangible estate assets.

The activity of enhancing and protecting cultural heritage must strengthen and improve the identity of the community so that it is transmitted to future generations and create wealth through entrepreneurial initiatives that revolve around it. The combination of valorisation and protection is therefore important to ensure the dissemination of culture and the construction of a collective identity.

There are various activities that can be carried out for promotion, one of these is the development of cultural tourism, which could represent a valuable opportunity to promote cultural heritage, attracting a large number of individuals. Many different experiences have been developed to promote cultural heritage tourism by improving the level and quality of interaction between the visitor and the goods. Among these, we recall immersive technologies such as virtual environments and augmented reality that have a great potential to improve the experiencing of cultural heritage by allowing suggestive virtual and interactive tours. Technology in cultural heritage boosts the development of creative learning and educational tools as well as tourism applications and documentaries. In addition, some of its tools (e.g. 3D scanning) plays a major role in the task of preserving and restoring physical cultural assets.

There are several cases in Italy in which technological devices have been used in order to enhance and represent images of cultural elements.

An exhaustive list of them is not feasible, for their really huge number. We recall here some of them:

- *MAV of Herculaneum*. The virtual archaeological museum that is located a few steps away from the archaeological excavations of the ancient Herculaneum. It is among the most interesting, relevant and advanced center of culture and technology applied to cultural heritage and communication in Italy. The museum is unique and extraordinary and offers an impressive virtual and interactive tour.
- *Naples: Enjoy Palazzo Reale*. In 2012, an interesting project based on the creation of a tour path with additional information supports accessed through the QR Code has been developed for Palazzo Reale in Naples.
- *Milan: You are Leo*. Milan, on the occasion of the 500th anniversary of Leonardo’s death, has proposed an innovative audiovisual virtual reality experience in the artist’s places. The initiative, called “You are Leo”, has the final aim of narrating Leonardos experience in Milan. The tour consists of an hour and 40 minutes walk that, through advanced virtual reality viewers, allows the visitor to immerse in the Milan of five centuries ago. It starts from Piazza Duomo and has as final destination the Cenacle.

¹ICOMOS International Council on Monuments and Sites - is a non-governmental international organization dedicated to the conservation and protection of the world’s monuments and sites.



Figure 1: The Archeological Park of Sibari



Figure 2: The Archeological Park of Castiglione di Paludi

The objective of this paper is to disseminate information about a territory, Calabria, famous for being one of the regions belonging to Magna Graecia and rich in archaeological heritage. Specifically, it presents a project proposal that uses ICT technologies and augmented reality in the domain of cultural heritage, to promote new keys of reading and knowledge of the territory so that providing the visitor (also the disinterested one) with

specific and complete information about tangible culture. It describes a mobile application for the enhancement of points of interest (POIs) in the Archaeological Park of Sibari (Fig. 1), located in Cassano allo Ionio, and the Archaeological Park of Castiglione di Paludi (Fig. 2), located in the municipality of Paludi in the province of Cosenza.

2 Archaeological Heritage: Parks and Archaeological Sites in Calabria

Over the years, and often even today, many believed that Magna Grecia included, as well as southern Italy, also Sicily. In reality it is not so, since the name of Megale Hellas refers to a limited context (Calabria, Basilicata, Puglia and Campania). Initially, Magna Graecia indicated only the part of Calabria and a piece of Puglia up to Taranto [BR08]. Magna Graecia becomes important thanks to the flowering of the Greek cities from an economic, cultural, social point of view and due to the famous philosopher and mathematician Pitagora [Lat11], that, as known, settled in the city of Crotona a school of thought that was not open only to scholars, but also to indigenous peoples. The historical events of Calabria began from the era of prehistory, precisely from the Paleolithic period, which dates back to graffiti still existing at the cave of Romito, located in Pappasidero, the famous *Bos Primigenius*: for this reason it is considered one of the most ancient of Italy [Lat94]. Its importance is given primarily by its geographical position, by the climate and by the abundance of fertile lands. The region acquired several names over time: among these we recall the name of Enotria, whose meaning in Greek is “land of wine (in fact it derives from *oinos* which means wine and from *oinotron* that recalls the stick that holds the vine). Finally, before being defined with the current name, the region took the name of Italy, attributed to the son of Enotrio, Italo, who succeeded him to the throne at his death. Calabria is famous mainly due to the “bronzes of Riace, but besides this it offers a wide range of archaeological sites and parks dating back to different eras, but mainly belonging to the Greek era. The most important among these are:

- Sibari, established about in 720 BC, is the first colony founded by the colonizing movement of the Achaeans. In just two centuries Sibari acquired a great power, witnessed by the incorporation of twenty-five cities and for this reason it is often referred as the most powerful among the cities of Magna Graecia. The site of Sibari shows the overlap of three urban plants dating back to different historical periods: the first city was founded in 720 b.C. by the Sybarites and then destroyed in 510 BC; the second city, having the name of Thurii, was founded in 444-443 BC by Pericle; finally, the third city, having the name of Copiae, was founded in 193 BC by the Romans. The excavations conducted over the years have brought to light many remains and several areas have been identified, each characterized by various ruins of buildings and dwellings dating back to different eras of the three cities that have followed over the centuries. Each area is named after the excavation campaign carried out. In the area called the “park of the horse” two of the main roads (*plateiai*) of the city of Thurii, mentioned by the historian Diodoro Siculo and reused in Roman times, were highlighted. Also visible in the same area is a gateway to the town of Copiae called *Porta Nord*, probably of an imposing nature and consisting of a round arch *fornix*. There are several inhabited buildings found in the excavations, for example a series of typical Roman *domus* with quadrangular gardens and various living quarters, some of which are richly decorated with wall paintings and floor mosaics. The theater is well preserved, it has a semicircular layout and is the main visible public building in the area. Another important building visible in the same area is a small rectangular temple dating back around the 1st century AD. In the area called *Strada Prolongazione* the main findings brought to light are two buildings called *Plateia B*, better preserved and visible, and *Plateia C*. (the *plateiai* were the main roads) : The *Casabianca* sector, on the other hand, preserves the traces of various structures, including those of a wall called *Lungo Muro*, which characterized the walls belonging to the Roman colony. A necropolis, datable back to the end of the 3rd century AD, been excavated just outside the city and many interesting objects belonging to the funeral furnishings have been found in the same place. In the area of *Stombi*, however, today still not open to visitors, the remains of the most ancient city of Sibari have been found. The Archaeological Park of Sibari, also equipped with an interesting museum represents one of the most important and extensive sites of the archaic and classical era in the Mediterranean, but unfortunately it is poorly protected and enhanced.
- Castiglione di Paludi, located in the municipality of Paludi in the province of Cosenza, is one of the most important archaeological sites for extension and finds belonging the *Brettia* era. The first news concerning the site was dated between 1870 and 1880 and was provided by the Calabrian scholar Vincenzo Padula

[Mai04]. The entrance to the city took place from the so-called East Gate, with a monumental entrance and a rectangular plan; the northern part of the entrance presents two towers called respectively Alfa and Beta, constructed perhaps to increase and strengthen the protection of the urban center [NT08]. The site is endowed with a fortified settlement dating back to the IV century BC, and therefore of Brettia foundation, which followed the typical trend of the Hellenistic cities. A theater of type ekklesiasterion, was discovered between the 50s and the 80s along with other monumental buildings. In a flat area near the theater, the public area was identified, the agora and of a wall, called “Lungo Muro”, 42 meters long and 4 meters high, that divides it into two distinct parts and also served as a settlement for the main street of the city, since the territory presented irregular morphological characteristics [LP11].

- Two important archaeological evidences are present in the historic center of Cosenza ²: Corso Telesio and Piazzetta Toscano [Bro15]. The latter is the most important site in the city by extension and presents several archaeological ruins dated back to the Brettia era [Guz89] (IV century b.C) and the domus belonging to the Roman period (II century b.C. - III century).
- Timpone Motta located in Francavilla Marittima (CS), is a very important area also mentioned in the Homeric poem the Odyssey. It is said that tools, consecrated to Athena, and then used to construct the Trojan horse are buried in the site. The site is due to the population of Enotri: here it is possible to see remains of an enotouric village. The Sybarites drove out the indigenous population and marked the boundaries they conquered by building a sanctuary dedicated to Athena, which testifies to the presence of the Greeks on the territory, of which almost nothing remains today except for the stones. The archaeological park of Scolacium, a Roman colony, in which there is the presence of artifacts from different eras (prehistoric, Greek, medieval) [9].
- The archaeological park of Capo Colonna, so called because of the presence of a column of a Doric temple dedicated to the Goddess Hera Lacinia and dating back to the fifth century b.C. Near the theater it is present a building today called B, a Roman villa and the ruins of a thermal building dating back to the III century.
- In the province of Crotone there is an archaeological site of a sanctuary dating back to the pre-colonial era (IX-VIII century BC). In the site there are the ruins of a Doric temple dedicated to Apollo Aleo in which Filottete consecrated his arrows to Heracles after the victory of the Trojan war [Par98].

In this paper we use augmented reality to improve the experiencing of cultural heritage by allowing suggestive virtual and interactive tours in two different sites:

- the archaeological park of Castiglione di Paludi
- the archaeological park of Sibari.

Figure 3 shows a map of the archaeological park of Castiglione di Paludi and Figure 4 shows a map of the archaeological park of Sibari.

²Cosenza is one of the few Italian cities crossed by two rivers, the Crati and the Busento. According to the legend the Visigothic King Alaric and his faithful horse were buried in the rivers. Cosenza was founded by the Pelasgians, preHellenic peoples, or by the Enotri, an ancient population of Italic origin who lived part of the Calabrian territory. Since the IV century BC Cosenza is known as the metropolis of the Brettii, a very important population of strong warriors that occupied the hinterland of Calabria.



Figure 3: The map of the Archeological Park of Castiglione di Paludi

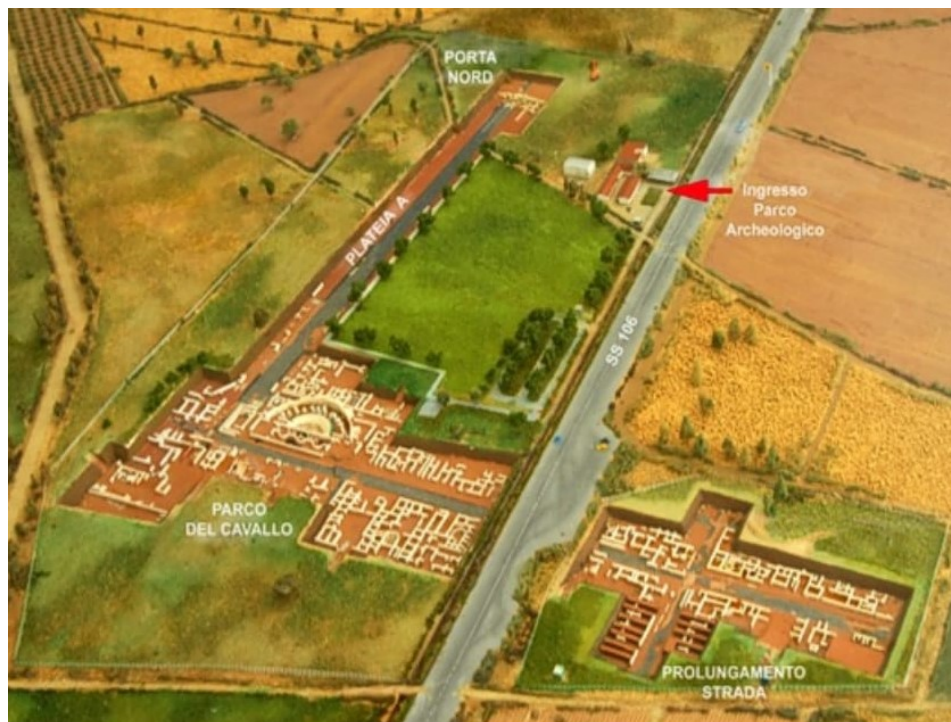


Figure 4: The map of the Archeological Park of Sibari

3 ICT: new ways to enhance cultural heritage

The word heritage, can be closely connected to the practice of a form of tourism linked to values closely related to the territory. Ruins are a symbol of people who made history, keep alive the memory and the value of civilizations and evident is the necessity of enhancing each cultural asset by highlighting its potential, improving its knowledge and making it accessible to the community [Man07].

In this respect, ICT is largely used for the enhancement of archaeological heritage, to provide the visitor with specific and complete information about tangible culture and often to give an image of the good taken into

consideration: this is because there are many cases in which a particular asset, for example a temple or a church are in a rather degraded state. There are several ICT technologies that are used by cultural organizations:

- *Website:* in order to be effective, it must represent the identity of the cultural heritage, be it an archaeological site, a monument, etc., guaranteeing access to all types of information and making the activities proposed by it constantly visible. The website must also be constantly updated in order to guarantee the user to receive real information and must be equipped with a virtual counter that guarantees the reservation of access tickets.
- *Audio guide:* This informatic device is nothing but a tool that allows the transmission of information about any cultural asset. The audio guide consists of a sort of radio and earphones that are usually provided to the visitor before starting a tourist visit on their own. The contents that are recorded inside tell the story, the details and all the information that must be provided to the user: moreover the information of the audio guide are usually translated into different foreign languages so that the contents are usable by tourists of each Nationality.
- *Virtual reconstructions:* This is a virtual reconstruction of buildings, neighborhoods, objects, etc., which today are in a state of slight or intense deterioration. The goal of these reconstructions is certainly to offer the visitor a complete and complete vision of the cultural asset that he decided to visit, but also that of offering an opportunity to discuss scientific hypotheses regarding buildings or environments destroyed.
- *Augmented reality:* Augmented reality applications, today are loaded on mobile devices and represent one of the fastest ways to find information in real time. This kind of technology contributes to increase the tourist promotion and the usability of the places. To take advantage of augmented reality technology it is necessary to have a smartphone or a tablet: these devices allow the user to find information in an alternative way, through the use of sounds, videos, voices, etc. Videos, voices and images that appear quite real in terms of size and detail. The goal of augmented reality is to create a kind of confusion between the perception of the reality that surrounds the user and the objects (audio and video) that are shown by the computer device. The application needs to 'hook' the IT content to the context framed by the camera of the device. The engagement operation can take place through the use of particular images that the application is trained to recognize, the so-called markers, or through the use of the sensors of which the device is equipped (GPS, accelerometer, etc.). The result is that the scene framed by the device is enriched, and therefore increased, of objects that increase its informative value. The effect is convincing: it is possible to study the details of the virtual objects dropped in the scene simply by approaching the object with the device. With this technique it is possible to enrich the scene with 3D objects, 2D, informational schedules, sounds, music, movies, etc.
- *Virtual reality:* This kind of ICT technology differs from augmented reality because to take advantage of the information made available by the system it is important to use appropriate technological tools, such as viewers, suits, gloves, glasses, etc. In this case, through the viewers are shown totally fictitious (virtual) contents. Thanks to virtual reality applications it is possible to reconstruct historical contexts that no longer exist and it is possible to compare what exists today with what existed long ago. The context within which virtual images are transmitted can be real or multimedia. It must be said that if the user makes use of devices such as gloves, suits, earphones or similar, he finds himself in an immersive reality, where almost all his senses are fully involved, and is made part of the scene reconstructed by the system.

4 A Mobile Application for the enhancement of POIs in the Archaeological Parks in Calabria

In this work we present an application for the enhancement of points of interest of the archaeological parks of Castiglione di Paludi and Sibari. Each of these points of interests is associated with a 3D model that shows the original structure. The 3D model has the final aim of reproducing all the details that have been detailed by the historians and therefore has to be extremely detailed. In particular, it is equipped with textures that reproduce

the materials that made up the object. The 3D model is semi-transparent so that it can be superimposed on the real object it represents: in this way it is possible to admire the remains of the ancient structure and understand how it looked when it was in perfect condition. The positioning of the 3D model on the point of interest is realized through particular images, defined markers, that the application uses to recognize the geometry of the place: the effect is of great visual impact. Specifically, when observing the point of interest through the mobile device, the user, reviews the structure and the materials of the POI as if time had never affected them. In this way, he/she is able to get closer to the valued object by observing the details more closely and will be able to analyze it from different angles. The markers is positioned near the points of interest that are intended to be enhanced. The markers are suitably protected by transparent plastics to prevent deteriorating caused by bad weather. It is important to note that the construction of the 3D model of an object requires the involvement of experts in graphic modeling as well as the advice of domain experts (historians, archaeologists, architects, etc.) who have to guide the modeling itself and validate the final results. Realizing a good 3D model can take several days of work and is normally quite expensive. Therefore, the number of points of interest valued through 3D models in augmented reality cannot be too high. The mobile application is available for Android and iOS devices and once installed, its use will not require any internet connection as the models are previously downloaded on the device. The size of the AR application is significantly high due to the 3D content. In addition, the 3D scenes can be enriched by audio and film; for example, a virtual guide that describes the point of interest or actors who reproduce scenes of everyday life in the place of interest. Different points of interest of greater importance have been identified to be enhanced through the application of augmented reality for the archaeological parks of Castiglione di Paludi and Sibari.

Example of the application of augmented reality for a POI in the archaeological park of Castiglione di Paludi.
We report an example of a point of interest to be enhanced through the use of a 3D model in augmented reality: it is the south-east gate, the main entrance to the city. Figure 5 shows the south-east gate and its tower.



Figure 5: The south-east gate.

Figure 6 shows the marker installed near the point of interest.



Figure 6: The marker.

Figure 7 shows how the point of interest viewed by means of a mobile device appears and is re-elaborated by the application of augmented reality.



Figure 7: The 3D model.

First of all note the presence of the marker, that is the image that allows the mobile application to identify the point of interest in which the user is located and to position the 3D model. In the figure it is also evident the presence of the 3D model correctly placed on the remains of one of the two towers. The model reproduces the tower itself and part of the wall showing its probable original appearance: observe that the model is semi-transparent. This artifice allows to observe both the revised model and the remains on which it is arranged. Observe that, the texture of the model reproduces the bricks used for the construction of the tower.

Figure 8 shows what an user would see using the app.

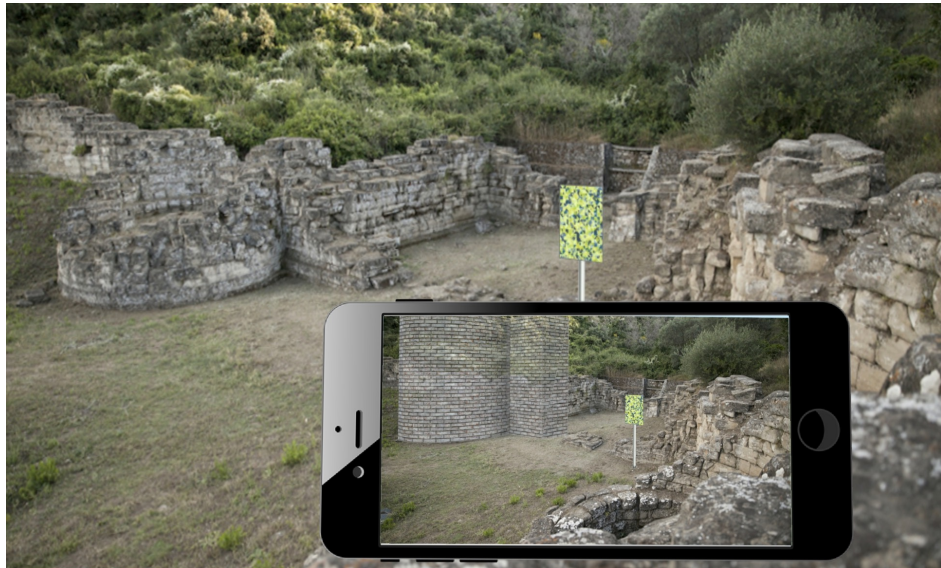


Figure 8: The mobile app.

Example of the application of augmented reality for a POI in the archaeological park of Sibari.

We report an example of a point of interest to be enhanced through the use of a 3D model in the archaeological park of Sibari (Figure 9).



Figure 9: The theater in the archeological park of Sibari.

Figure 10 shows the marker that will be installed near the point of interest.



Figure 10: The marker.

Figure 11 shows how the point of interest viewed by means of a mobile device appears and is re-elaborated by the application of augmented reality.



Figure 11: The 3D model.

Figure 12 shows what an user would see using the app.



Figure 12: The mobile app.

5 Conclusions and Future Works

Preserving and understanding the cultural heritage is of prior importance to discover and analyze findings of historical interest worldwide. This is especially true because the cultural heritage is spread everywhere, and it is part of multiple aspects of everyday life. Many different experiences have been developed to promote cultural heritage tourism by improving the level and quality of interaction between the visitor and the goods. Among these, we recall immersive technologies such as virtual environments and augmented reality that have a great potential to improve the experiencing of cultural heritage by allowing suggestive virtual and interactive tours.

This work is a contribution in the domain of cultural heritage. Its specific objective is to disseminate information about Calabria, famous for being one of the regions belonging to Magna Graecia, the important and well-known complex of colonies founded in Southern Italy between the 8th and 6th centuries BC and rich in archaeological heritage. Specifically, a project proposal is presented that uses ICT technologies in the domain of cultural heritage, to promote new reading keys and knowledge of this territory in order to provide to the visitor a specific and complete information about tangible culture. The project proposal describes a mobile application based on technologies of augmented reality and QR code which is useful for the enhancement of points of interest in Calabria, specifically in the archaeological park of Castiglione di Paludi and in the archeological park of Sibari. For each of the selected POIs, a 3D model shows its original structure.

As for future work, we plan to extend the project to additional areas of interest in Calabria, firstly involving sites in Cosenza such for example Piazzetta Toscano, and to enrich the 3D scenes by audio and videos. In more details, we plan to introduce a virtual guide describing the points of interests and actors reproducing scenes of everyday life.

The project has found the favor of some local administration that will promote and support it, in different forms, in order to enhance cultural heritage in Calabria.

References

- [BR08] BRACCESI L. - RAVIOLA F., *La Magna Grecia*, Il Mulino editore, Bologna 2008.
- [Bro15] BROCATO P., *Note di archeologia calabrese*, Pellegrini editore, Cosenza, 2015.
- [Guz89] GUZZO P.G., *I Brettii- Storia e archeologia della Calabria Preromana*, Longanesi & Co. Editore, Milano, 1989.
- [Lat11] LA TORRE G. F., *Sicilia e Magna Grecia. Archeologia della colonizzazione dOccidente*, Laterza editore, Roma-Bari 2011.
- [Lat94] LATTANZI E., *Storia della Calabria antica. Et italica e romana II*, Gangemi editore, Roma-Reggio Calabria 1994.
- [LP11] LUPPINO S., PAOLETTI M. (A CURA DI), *Il centro fortificato di Castiglione di Paludi*, AGM, Castrovillari (CS) 2011.
- [Mai04] MAIERU P., *Castiglione di Paludi viaggio nella memoria*, Ferrari editore, Rossano, 2004
- [Man07] MANACORDA D., *Il sito archeologico: fra ricerca e valorizzazione*, Carocci editore, Roma 2007.
- [Mol18] MOLLO F., *Guida archeologica della Calabria Antica*, Rubbettino editore, Soveria Mannelli (CZ) 2018.
- [NT08] NOVELLIS D., TOSTI A., *Castiglione di Paludi- un centro fortificato Brettio nella Sibaritide meridionale*, Rossano 2008.
- [Par98] PARRA M.C., *Guida archeologica della Calabria: un itinerario tra memoria e realt*, Edipuglia editore, 1998.
- [Andr] <https://developer.android.com/studio/>
- [AndP] <https://developer.android.com/studio/releases/platforms>
- [AugR] <https://developers.google.com/ar/develop/java/augmented-images/>
- [BAC19] BERLINO A., AMELIO A., CAROPRESE L., ZUMPARNO E., *Enhancing the Cultural Heritage Using ICT: Background and Perspective*. Lambert Academic Publishing 2019, ISBN 978-620-0-29650-4.
- [BCL19] BERLINO A., CAROPRESE L., LA MARCA A., VOCATURO E., ZUMPARNO E., *Augmented Reality for the Enhancement of Archaeological Heritage: a Calabrian Experience*. VIPERC@IRCDL 2019: 86-94.
- [Icom] <http://cif.icomos.org/>