

Cultural hARitage: Augmented Reality applied on Cultural Heritage

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ABSTRACT

Cultural heritage contents are commonly offered by touristic mobile applications, but it is possible to explore deeper the subject and add AR elements to create an immersive approach. The adaptation of an art-oriented tool reveals some of the possibilities to display cultural heritage content in real case scenario without any large technical experience. It also presents the difficulties on dealing with historical content in a context-aware experience. The developed solutions from the cultural hARitage project, in two practical situations in distinct scenarios (Belgium and Greece) presents something more pragmatic, where it is empirically possible to validate some of the developed propositions and the opportunity to analyze the combination of AR and Cultural Heritage content.

Categories and Subject Descriptors: H.5.1 [Multimedia Information Systems]: Artificial, augmented, and virtual realities; H.5.2 [User Interfaces]: Graphical user interfaces (GUI)—Interaction styles.

1. Introduction

The present work describes practical experiences in adapting an augmented reality CMS tool, *WizARt* [00b], developed to display indoor information, into two outdoor real scale Augmented Reality (AR) scenarios. It reveals the usage and constrains of producing cultural content for an application originally designed to offer access mostly to art documentation. The idea was to adapt this tool in order to have a quick option to develop an open-air AR content in historical places. The main contribution was to test such deviation on the original function and offering an already available simple way to display cultural contents in real scenarios, turning such technology available even for non-programmers, opening new possibilities for this CMS Tool.

As the state of arts will reveals, there are several scholars aiming to combine AR and cultural and historical field, but the complexity and the amount of technical work necessary to turn the AR content viable in each scenario leave it distant of the average mobile phone users. The simple function deviation of the *WizARt* CMS tool shows another option, already applied in two different cities, turning AR a more feasible feature for a different range of enthusiast.

2. Contextualization

The spread and importance of mobile devices, as smartphones, on everyday activities is well known [CNP08]. It is possible to list several features that allows people to navigate and access context-aware information, such as GPS, QR Code scanners, AR, just to mention a few.

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The mobile devices have already supplanted the preference of the users as interface to check the latest news [Ind10] and social networking, but its use as an touristic tool or even as a personal cultural educational device are still incipient.

If in one hand, the technology can bring the world in a small scale of a mobile screen by enhancing the museums and galleries possibilities, on other hand the portable technology can add elements to the real world, changing the perception and turning the entire city into an open-air museum. There are no more limitations about space, neither about the opening hours to provide to the visitors a complete and empowered cultural experience.

There are already some advances regarding the application of these technologies for cultural heritage activities, such as historical apps, but some questions still remains about its use, especially regarding the results that those devices are introducing from the combination of historical and AR perspectives, and how they are affecting the experiences and notions of cultural heritage.

3. Similar works

The idea of using AR to explore historical and/or touristic places is not new. It is possible to trace it almost one decade ago [FSL05], by suggesting the use of augmented binoculars to enhance the experience during a landscape observation. The digital technologies, however, had turned possible to explore those premises in mobile versions. The topic was already being discuss in 2001 by Stricker [Stri01], who tried to create and intricate eye tracking sys-

tem to display 2D augmented reality information on a 3D environment of a museum.

In open spaces, Greece is almost an obvious scenario to place a cultural heritage project. As same as one of the implementation spaces described on the present work, another interesting experience took place on the ancient Greek ruins. The project ARCHEOGUIDE [VIK*01] offers the possibility to recreate the archeological scenarios in the past, rebuilding buildings, monuments and other artefacts using AR. The project, however, requires a specific hardware and a local database to retrieve the information. In the first stages of the implementation, before of the popularization of mobile devices, the software required a notebook with two batteries sets to run about two hours in the middle of the ancient ruins [DK02].

Another approach comes from Rome [EMF12], where the researches are offering a framework able to be adapted in different scenarios and accessible through iOS based gadgets. If in one hand the developed software allows the usage in different contexts, in the other, it centered on creating a 3D model of original buildings to be visualized in context aware experiences. The project has a large applicability, but requires a large previous 3D modeling work too.

The Framework Xmar [BCTB12] goes further. However, it was only tested in one place; it recreates the historic building in different periods and offers multimedia information accessible through the mobile screen when the camera is pointed to a specific building or position.

Even with the large amount of samples available revealing similarities to the list above, the possibilities of combination of augmented reality and cultural heritage content it is still an open research chapter, from the effectiveness perspective. Some apps are already displaying touristic information using AR, such as *Wikitude*, *Tripwolf*, *Junaio* and others.

There are some applications dealing with this possibility. If not exactly with AR, at least on using the mobile gadgets features to increase the location-aware experience.

4. An open chapter to augmented reality

This work deals with the adaptation of a tool originally developed for art purposes in two real scenarios: Brussels, in Belgium, and the historic city of Volos, in Greece. The WizArt Content Management System (CMS) Tool combines different media files (audio, video, 3D, text, links, etc.) elements with Junaio App [00a] turning possible the use AR to achieve cultural information.

The *cultural hARitage* project was developed both in Brussels and in Volos using the WizArt CMS Tool, developed by Luciano Pinna [Pin00]. WizArt consists of an intuitive web-based CMS applied in a Junaio channel where the AR can be experienced. With this CMS, users can upload images, 3D models, audio and even video to be displaced somewhere in augmented space. The tool can be used for several purposes, such as art education [00b], 3D art installations and from this research - also for cultural heritage orientation.

The WizArt was developed as a Junaio App Channel, through Metaio [00c]. Once the user has a login generated at WizArt CMS, it is possible to include Points of Interest (POI) based on GPS location with objects attached on it. Each POI can have several objects, by using cardinal references for each object around the POI's center. Each object can include a medium that can trigger another medium. The options of medium varies from static (text, photos, audio, videos, 3D objects) to dynamic (animations and slide show) possibilities.

Once created all the necessary POIs and Objects, the user can generate a main QR Code to be accessed in the designated local, or a QR Code for each POI (as test) which can be accessed in any place. The recommendation is to provide both types of QR Codes for the users, especially for those who cannot be physically present of the designated areas, but still interested in access the information. To access the WizArt Junaio Channel, the user needs to scan (through Junaio App) the generated QR Codes.

AR objects are placed in WizArt according to the bubble principle. A bubble is defined with a GPS location via the CMS. Once a viewer enters the bubble all objects that are attached to that bubble are displayed through the mobile device's camera. The objects are unloaded when the viewer leaves the bubble again. This principle provides a robust way of experiencing AR and enables almost endless content [00b].

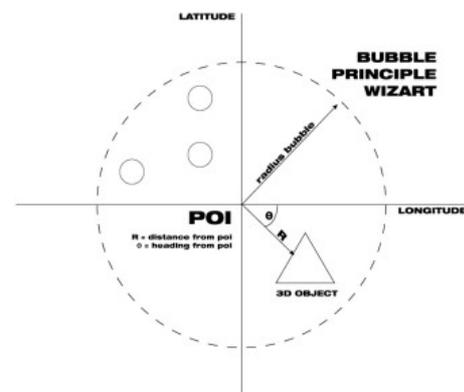


Figure 1: Bubble Principle of WizArt.

5. Multimedia on the small screens

On the cultural hARitage project, the main objective was to access cultural information regarding the place around the selected areas. For this purpose, a care was taken in provide a reliable information in an appealing way. In order to provide a variety of options for the users, the available information is divided in several media types, categorized as: audio, text, photos, video, and links (to external content).



Figure 2: Media Types applied in Volos/Greece.

For each medium type, there is an avatar to trigger the information. The avatar usually is performing an action related to the medium type, or related to the content. Each avatar is accompanied with a medium icon and file description, as Figure 3:

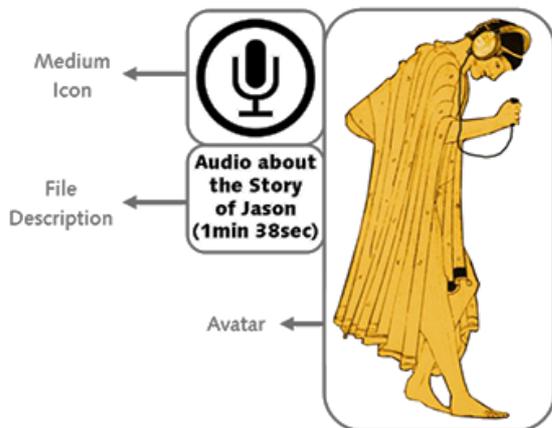


Figure 3: Avatar/Information Organization.

6. Two practical samples

The cultural hARitage project was implemented in two cities, with two different content as target. In Brussels, the chosen target content for this project is one of the official World Heritage Sites from UNESCO, placed in Brussels: the "La Grand-Place" [00d]. The Grand-Place is the main city hall / market square in Brussels.

The art concept for the avatars was created in a comics design, evoking a historical and contemporary relation to the target content. The contemporary element was a direct reference of the relation of the city and its comics creation, such as *TinTin*, *Spirou* and others [00e]. The historical element was a comics version of *Charles of Lorraine*, the founder of Brussels, as illustrated in Figure 4.

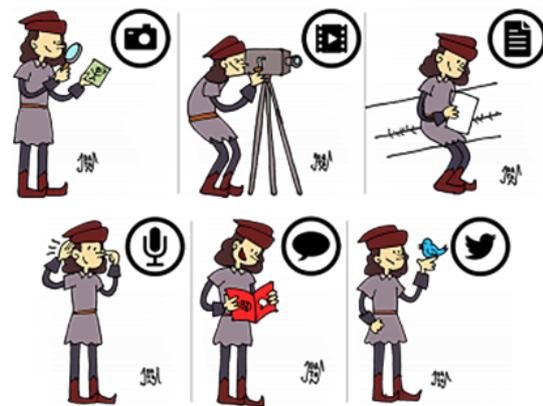


Figure 4: Developed avatars for Brussels.

In Volos, the chosen target content was the Greek mythology content regarding the region, such as Jason and the Argonauts, The Centaurs of Pelion, among others; but also contemporary touristic targets [00f], such as archeological sites, the artist Giorgio di Chirico, port of the city and Thessaly University. For each element, an avatar was created from using mythological images or art piece details, to facades and archeological findings.



Figure 5: Some developed avatars for Volos.

On each avatar was followed the concept of using/playing the related medium plus an icon of the medium (as mentioned and illustrated before) with a text label indicating the file purpose. In this way, the user can control of what will be triggered, according to their own choices.

Once the user enters the designated POI, several avatars will appear on the mobile screen. The user needs to click once on the avatar to trigger the information, based on the media types already mentioned. On the next Figures, it is possible to visualize how the synergy works with two examples: image (on example, a historical map) and text (with scrolling option, about the mythological information regarding the exposed object on background).

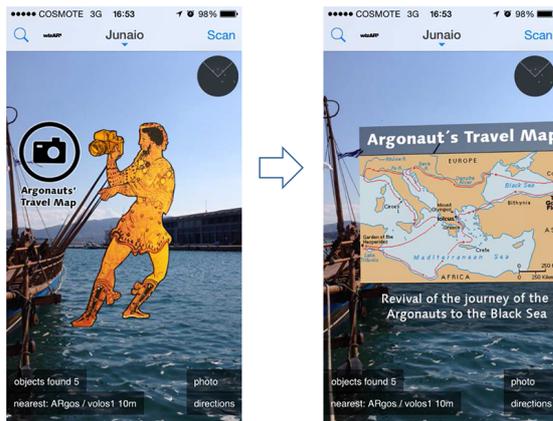


Figure 6: Example of Photo/Image medium triggered

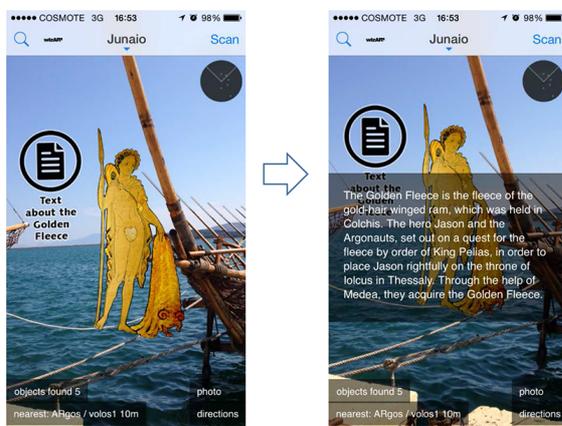


Figure 7: Example of Text medium triggered

7. Critical observations

The application is fundamentally working based in geolocation. The software does not permit to geolocate different layers of information in the same direction - one in front and another behind, for example. Once the POI is accessed, the information starts to float in specific cardinal points, always in the same angle in relation to the center of the bubble and not considering the chance on the center (the referential point is immutable). Once the media file is triggered, it should be played despite of the location, but the change of the angle stops the execution of the related file.

Another issue is the GPS accuracy [Car13]. As this technology is based on moving satellites, the accurate position may shift around 10 meters (sometimes more), as observed in the practical tests, which can allow misinterpretations in areas with several architectural points of interest, for example. With this in mind, it is suggested to avoid to place the objects (attached on the POI) to a very specific location, for instance to a detail on a facade.

The use of internet is mandatory for this application. It may be an issue when the user is abroad and does not want to use data roaming [00g]. Even with a 3G connection, the

accessibility is not a guarantee, once the networks around Europe (imagining just this scenario) does not have the same speed or capacity. Therefore, even if the WizART permits the usage of videos, photo galleries and audios, files that could use some megabytes of space, the technical issues are notorious sensitive. Thus, the possibility of adding videos of an important historical event that took place at a specific location exists and it is easy to implement. The discussion lays on how long the user will wait until the complete download of the information without changing the phone position, as mentioned before. A future suggestion is to offer a previous content download option, to be accessed offline later.

Another issue is the need to scan a QR Code in order to access the designed channel. It means that the information access should be triggered by a physical reference (the printed QR Code), visible in the specific location. It would be better if the user could download the channel as an installed app, or a direct link to be accessed without the need of scanning QR Codes.

In the end, the use of the Junaio App consumes a great amount of battery life, which is still an issue for the most part of the mobile devices [00h]. For that reason, it is recommended to make the POI-Tours short enough to avoid a drained battery, which could be a limitation on exploring the area using the AR possibilities.

8. Final Considerations

The cultural heritage is being contemplate by the mobile apps mostly in the rage of touristic aspects. There are several applications providing historical information and even some experiences regarding the use of the augmented reality. However, it is an open chapter on the technological application. Specific applications created to the cultural heritage field are in general 3D modeling displays of ancient buildings, demanding a high precision to be displayed properly and a significant amount of technical hours on the previous development.

The two practical approaches adapting an art-oriented tool to augmented reality based on geolocation, the WizART, was possible to collect important experiences. First, it is clear that AR can be used to improve a cultural experience, offering a most immersive experience by adding information layers. This context aware experience, however, demands some precision that the involved technologies are not customized to offer.

In comparison to other tools available or research on topic, what differentiates the WizART it the simplicity on create new content to different scenarios. It has an immediate applicability: a teacher can place AR content in different points of a city in a cultural trip and turn the constant presence of the mobiles among the students from a distraction factor into a learning tool. It is obvious that the educational capabilities should be deeply discussed and tested, but the local developments turned clear that with this tool the AR slips from the hand of highly skilled programmers into the normal user with an average knowledge in informatics.

Nevertheless, the use of the Augmented Reality tools in a cultural heritage approach is facing the same issues of any other AR application designed to mobiles: the lack of accuracy in the GPS systems, the battery quick draining of high-requiring programs, the speed of some 3G-internet connections. It is evident that every new generation of mobiles will introduce improvement on those technical issues.

The question that remains is to figure out how far the users will enjoy an AR experience to improve their interaction with cultural elements. The present work does not have the answer for this problem, but the questions generated by an in loco experience can provide some inputs.

There is already technical possibilities available, there are tools – such as the researched WizArt – who can provide a quick insertion of the augmented reality layers, but its usage is still requiring adjustments. As a closure, it is clear that the AR could be an effective tool to add a new significance to a cultural experience, rescuing the motion contents, sounds, pictures to recreate an atmosphere lost by the time.

The application of such technological resources could be still a bit clumsy, but it has chances of being improved as the mobile devices are being quickly refined every release. Based on the facility to place AR information in a scenario through automatized tools that are already available, it is possible to suggest that in a few years the content aware information could be so common for cultural heritage apps so are the mapped based information placed nowadays.

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