New Relations with the Architectural Heritage Education

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This work is part of an ongoing project, which focuses on the application of AR in Architecture and Urbanism and heritage studies seeking to develop interactive multimedia platform and contents about historic buildings known as "Quarteirão dos Trapiches" on Laranjeiras, city of Sergipe State on Brazil. This project explores the potential of mobile applications to disseminate the architectural heritage to researchers, citizens and tourists.

1. INTRODUCTION

The technologies related to virtual reality and augmented reality in combination with mobile technologies are being more consolidated and frequently used. The increasing technological availability along with the decrease of its acquisition and maintenance costs have favoured the expansion of its use in the field of historic heritage.

This work is part of an ongoing project at the Department of Architecture and Urbanism of the Federal University of Sergipe (in collaboration with scholars of the Museology Department of the Federal University of Bahia, which focuses on the application of AR in Architecture and Urbanism and heritage studies.

An application was developed for mobile devices on the Android platform. It combines geometric modelling with augmented reality (AR) and multimedia features. The idea is to allow access to interactive multimedia contents with cultural, social and historic information about a historic building taken as object of study.

We are focused on exploring vast possibilities offered by this resource for educational actions when dealing with heritage, conception of museums, and museum processes. Also, that kind of experiments can contribute to other social researches to elucidate how relationships between information and communication technologies and their various audiences might be a factor of social changes.

In this context it is focused, in this article, on the potential of mobile applications in the dissemination of the architectural heritage, using the technology of Augmented Reality.

From this perspective approach, it is discussed the process of producing an application for mobile devices on the Android platform, which combines the technologies of geometric modeling with augmented reality (AR) and access to interactive multimedia contents with cultural, social and historic information of the historic building that we take as the object of study: a block with a set of buildings built in the XVIII century, known as "Quarteirão dos Trapiches", which was modelled in 3D, coated with the original texture of its facades and displayed on AR.

This paper reports methodological aspects of the development of this application regarding to the process and the project development tools, and presents our considerations of developing an application for the Android system, focused on the dissemination of the architectural heritage, in order to encourage the tourist potential of the city in a sustainable way and to contribute to develop the digital documentation of the heritage of the city, meeting a demand of tourists visiting the city and the professionals who work in the preservation and restoration of it, consisting of architects, historians, archaeologists, museum specialists, among others.

Thus, the popularity of these devices associated with AR features favor the local population to...
establish a new relationship with its surroundings by interactivity and visualization of this patrimony.

Market researches point to a rapid growth of mobile devices in Brazil, currently one of the largest markets in the sale of tablets and smartphones worldwide. Moreover, the growing innovation of the technological market has increased the availability of mobile devices with lower cost, facilitating the use of technology in multiple areas of study. Augmented reality (AR) uses this feature combined with pattern recognition techniques to provide an innovative way to enrich reality with the use of interactive virtual objects that fit in the real world.

In addition to the facilities mentioned above, successful experiences using this technology, targeting the heritage, were a strong incentive for the development of this application.

Among these aforementioned experiments, which use technological resources in visualizing objects, it can be cited the projects developed in the area of museology, for instance, Archeoguide (http://www.instantreality.org/archeoguide/), Raptor Lifeplus (Silveira et al., 2011), in Europe and projects developed in Brazil such as Modela UFPeL and Alfa III Gaviota (https://www.facebook.com/alfagaviota.ufpel).

In this context, this work takes part by using AR on mobile devices in the historic heritage area.

Augmented Reality is an area that is experiencing a growing infrastructure improvement, and thus provides ease of registration, retrieval, modification, transmission and dissemination of information about the historic heritage.

The research was motivated by three factors:

- The ascertainment that there is a great demand for computational systems able to provide travelers with relevant information on visiting sites regarding social and cultural matters, or with reference to works of art exhibited in museums and squares, replacing traditional tourist paper guides for interactive digital guides.
- This will lead to the recognition of population references of its historical past and in consequence, an approach and engagement of local people in conservation, sharing and dissemination of these monuments and culture related to them.
- The urgent need to base a methodology with low-cost and appropriated to the documentation of architectural heritage in process of degradation, in order to preserve and manage this heritage.

In face of this scenario, the computing equipment able to play multimedia content with quality and meet the mobility requirements tend to be extremely suitable, filling a technology gap in the area of heritage and encompassing the work sustainably, proposing a multimedia-computing environment.

This application is directed both to tourists that visit a given location, as well as for professionals involved with the architectural heritage of the city, without losing focus of which will also be a resource accessed by the local population.

The development of an AR application brings a greater interactivity for the users in a practical and intuitive way, giving them an additional option over the use of paper tour guides. For professionals, viewing and accessing historiographical data from the heritage of the city of Laranjeiras, through this application, fills an important gap in digital documentation of its heritage.

For citizens, it would be a way to have access to the meaning of its monuments, this combined with the possibility to associate them with products and services that are offered by small businesses and local artisans. (Figure 8)

This virtual reconstruction not only divulges the heritage to the general public, but also provides technical information from the building about their formal and historiographical characteristics and interventional procedures, to a public of professionals who will develop projects in the region, which currently undergoes a process of revitalization and restoration of some of its heritage.

The development of this work solves at a low cost and dynamism the lack of information about the past and architectural value of the buildings. Also, this can solve some lack of information or inconsistency in technical documentation of the architectural heritage about the historic city buildings, some of which are registered on paper documents, fragile by their nature, sometimes in dispersed documentation or, in case of the majority of the buildings, nonexistent.

2. METHODOLOGICAL ASPECTS

It was taken as the object of study the architectural complex known as "Quarteirão dos Trapiches" (Figure 1), which was virtually reconstructed. The virtual reconstruction associated with historiographical contents of the building was made available in an application for the Android system.
Finally, it is presented considerations on methodological aspects of the development of this application, focused on the dissemination of the architectural heritage.

The development of this research involved the following steps:

- Elaboration of the historiographical contents of the building
- Technical Architectural Drawing of the buildings
- Tridimensional Modeling
- Photoshop Treatment of the images
- Application of these images as a texture in the buildings
- Application of Augmented Reality Visualization

3. REHABILITATION AND PRESERVATION OF THE ARCHITECTURAL HERITAGE OF LARANJEIRAS CITY

Laranjeiras, the second oldest city of Sergipe, was founded in 1605 and is the holder of an architectural heritage of inestimable historic value. The city is currently undergoing a process of rehabilitation and preservation of its architectural heritage, implemented by the Monumenta Program.

The urban and architectural ensemble of Laranjeiras gathers a historic past of the colonial period, and at certain moments of Brazilian neoclassicism and eclecticism. These narrate the story of a city that holds visible traces of the Brazilian cultural richness, which classify it as one of the most important architectural heritages in Brazil, listed by the Institute of National Artistic and Historic Heritage – IPHAN.

The city that experienced a period of glory, driven by economic progress, also experienced a long period of economic stagnation, and only recently has experienced a process of revitalization and restoration. Most of its buildings of historical interest in the city is relatively well preserved, but a significant number of these buildings is in an advanced state of deterioration caused by time.

Despite its importance, it was verified a lack of technical documentation for most of this heritage, particularly important at this time that the city of Laranjeiras undergoes a process of rehabilitation and conservation of the architectural heritage, coordinated by the Monumenta Program (http://www.monumenta.gov.br/site/), IPHAN and Municipal Government of Laranjeiras.

In addition to this, studies conducted by IPHAN and the observation of the city’s daily life makes clear the indifference of the majority of the population in relation to its historical past and the
preservation of its monuments. Its interests are focused only on meeting immediate needs in elements of social welfare, mainly public health and safety, the latter being the major concern.

Moreover, the city of Laranjeiras, traditionally described as an "open air museum", with a great tourism potential. That has been already consolidated by the constant presence of visitors coming to the city searching for knowledge about its architectural heritage, a legacy of the past when the city had the status the biggest market center of the State of Sergipe, due to the outflow from sugar production through its port.

In this context, one of the challenges of the rehabilitation policies of historic sites is making them once again producers of economic alternatives and in this sense, going against the policies of sustainable preservation of the architectural heritage and within the agreement established between the Municipal Government of Laranjeiras and the Federal University of Sergipe, this research is developed.

Despite all this effort for the restoration of monuments, local people, and especially young ones, are indifferent to this process and do not understand the meaning and value of this architectural legacy.

The central focus of the research is the technology of AR applied to virtual reconstruction of the city in its different developmental stages, in order to set up a technical collection that will be available through interactive multimedia resources with cultural, social and historic information accessible to mobile devices.

And our expectation with this action is precisely the potential use of augmented reality to associate it to the technical and historical knowledge cultural social elements that would integrate the interests and the common life of this population to their heritage, integrating residents, tourists and researchers.

4. "AUGMENTED LARANJEIRAS"

New techniques for visualization and interaction in computational environments have been increasingly used as academic and commercial tools, with highly satisfactory results. The technology of AR combines the real with the virtual environment in real time interaction via icons recognized by a webcam, which facilitates and enhances the user interactivity.

This technology has shown continuous and increasing applications in different areas of knowledge such as medicine, gaming and entertainment, education, simulation and aircraft training, teleconference (virtual human presence) and architecture and urbanism, with interaction and immersion in architectural spaces and thousands of other applications.

The use of digital technologies in the field of conservation and restoration of the architectural heritage has been presenting successful experiences in several countries efficiently and with low cost of implementation. These technologies generate new ways to build and share the produced knowledge and open new possibilities that point to new ways of relating to material culture.

Based on the premise that the technological mediation suits well to the organization needs of technical documentation of the architectural heritage, it was decided for its use to expand the technical basis related to this heritage, as well as for the dissemination of this heritage. In this way, it was used the technical resources of 3D modeling and applications of augmented reality technology, organized within an application to be released for free which should fill a gap that today presents a consistent base of technical information on such architectural heritage, with the organs responsible for the preservation and rehabilitation of it.

Virtual prototypes can be easily handled by potential users with the use of Augmented Reality in the area of the architectural heritage, since it uses interfaces to display information related to the building and encouraging interaction with the user in real time.

*Figure 5: 3D Model, with textures applied on SketchUp, visualized with Armmedia plugin in Augmented Reality (Source: Personal authorship)*

The technology of AR reveals itself fully adequate as a way to broaden the technical base for interventions in architectural heritages and sites in order to disseminate the architectural heritage, organized within a virtual environment. It provides
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an experience for users with the space and helps to raise awareness of them so they can recognize the importance of the existing heritage, learn to respect it and help to preserve it, to the extent that they realize their responsibility for the valuation and preservation of the heritage.

In the same way the AR allows the virtual world be mixed to the real world, which, by the ludic aspect, has a great impact cognitive and Youth user interest. and enables greater interactivity What, no doubt, a way of spreading knowledge in a fun way, it opens a new dimension in the manner how we perform tasks and in this regard such technology reveals a wide range of applications in different areas of knowledge and among these, the Architecture and Urbanism.

This technology proves to be potentially suitable for applications targeting the architectural heritage for the featured ability of combining virtual elements to the real environment, allowing interactivity with real-time processing in the manipulation of images and representations of the building in its different phases throughout history.

In Figure 5 it can be seen the one of the buildings of Quarteirão dos Trapiches, visualized with Augmented Reality. The building was modeled, received textured of the photograph of its facades previously treated with Photoshop and through a fiducial marker was visualized in Augmented Reality. In a real-time interaction, the image of the building is identified by the software Armedia via a webcam, which develops the virtual object that can be seen on the computer screen.

The AR makes possible to visualize the building, and understand the uses and functions over time and understand their interaction with the urban environment in which it is inserted.

In this sense, the 3D virtual model can thus stimulate further discussion and research on the history and urban culture as well as to complement the existing document collections and the new tools for processing, managing and delivery of information to both researchers and the general public.

Augmented Reality technologies are already being used in several areas of knowledge, but in Architecture and Urbanism its use is still superficial despite its enormous potential applications.

5. MOBILE AUGMENTED REALITY

In the context of the architectural heritage, it can be said that AR technology opens possibilities for applications throughout the urban space. The AR can be aggregated to the mobile computing technology in mobile devices equipped with online connection and when its camera is directed to a marker of AR, such elements are replaced with 3D graphics.

The idea is that the users, that are residents or tourists who live or visit the city of Laranjeiras find "markers" in the main historical or service buildings of the city, such as restaurants, and via their cell phone, or other mobile device, positioned on a marker, have access to information from cultural heritage of the city. The same applies to city museums. The tourists, who visit the city of Laranjeiras and townspeople with his cell phone, or other mobile device, can easily capture the image of the marker, see on the screen of their device, or by voice, receive additional information about the historic building or on objects exposed in the museum.

Therefore, this tourist visiting would be enhanced with information on places visited with access to a vast amount of information, which may include items such as age of the work, author, relationship between other historical contexts, on the native language of the user and making use of computer graphics resources to emphasize or illustrate concepts, reproduce works that are incomplete or whose original object can not be displayed inside the city museums.

Figure 6: QR Code on the facades of historical buildings of the city of Laranjeiras to provide information on heritage (Source: Personal authorship)

Another offshoot of the possibilities of application of AR would be the development of digital markers, available on the Internet (Figure 9).

In this way of relating to the heritage, it is worthy to investigate and categorize the types and levels of possible interaction that computer technologies cause.
With the evolution of technology and electronic devices, augmented reality is becoming more present, requiring only a cell phone with camera and Internet access. These facilities enable the construction of spaces and even entire spaces in augmented environments, where virtual information can be associated with tourist spots or landmarks directly at the source.

The emergence of mobile devices with more processing power, multimedia features and a large amount of sensors (such as a compass, accelerometer and cameras) enabled the widespread diffusion of mobile augmented reality applications.

AR is constituted as an important tool in understanding the meanings of spaces associated with historic, social and cultural information but nonetheless the use of AR technology is still modest, with most of the applications in the area of Architecture and Urbanism with an advertising character.

It was noticed an increased access to AR in several areas, pointing to the increasing use of AR through iPhones and smartphones with Internet access.

The rapid evolution of mobile computing and increased processing of these devices made it possible for augmented reality to come to mobile phones and smartphones, and additionally, there is a considerable increase in the number of enabled mobile devices in Brazil, which have evolved and acquired characteristics of small computers, both in hardware and software, with increasingly powerful operating systems.

The mobile devices with AR assume the role of transmitting agents of culture and mediators of expositive experiences and therefore, within the context of cultural tourism and heritage education, broaden the knowledge in a practical and intuitive way (Figure 7).

AR technology, brings up the story and spread the meaning of monuments, can be at the same time, cultural enhancement element, education and marketing, as well as research tool.

6. CONCLUDING REMARKS

The AR visualization uniquely contributes on the architectural heritage area, because it allows important real-time interaction to dynamically show different alterations of historic buildings over time, as well as their interaction in the urban context, and moreover, contributes dynamically and cost effectively with the storage and management of information relating to this heritage. The model in

7. REFERENCES


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