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ESQUINA MULTIMEDIA – MUSEUM EXHIBITION FOR THE VISUALIZATION OF CHAN CHAN ARCHAEOLOGICAL SITE

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Abstract:

Chan Chan, an archaeological site located at Trujillo, Peru, is a huge historical settlement very large and difficult to visit and some well-conserved architecture, like Huaca Arco Iris, is very far from the core centre of the site. Furthermore many other heavy factors, as illegal excavations, marine salt transported by the wind and the sometime devastating phenomenon of the *Niño*, are the reasons of the lost of many decorative elements, which are covered due to conservation issues. To overcome the aforesaid problems, we designed, developed and realized the museum exhibition called "*Esquina Multimedia*", providing the tourists with interactive and enjoyable applications. An Augmented Reality application has been developed in order to discover ancient artefacts that are invisible because covered by the earth (or by protection structures). A web-browser has been specifically designed to show bas-relieves, with HD visualization and with anaglyph stereoscopic view. Herewith, a wall-mounted panel representing a metric 3D reconstruction by an accurate survey of the building helps the user to find the artefact position.

Key words: virtual exhibition, cultural heritage, documentation, 3D model reconstruction, digital photogrammetry, orthophoto, stereoscopic view, augmented reality

1. Introduction

One of the major challenges in the archaeological domain is nowadays represented by the communication of ancient artefacts to the visitors. The work reported in this paper is aimed at describing the realization of a real exhibition, installed in an archaeological museum. The framework in which we operated is the Italian Mission in Peru (MIPE), which is working on the Chan Chan site since 2002 (Colosi *et. al.* 2009), enhancing Chan Chan and its territory through the realization of an Archaeological Park; providing an international dissemination of the information regarding the site; collecting and organising data into a Geographical Information System (Colosi *et. al.* 2013); and finally producing some virtual 3D exhibitions of ancient ruins, in order to show them into the Museum.

In archaeology, the complexity and some limitations make the use of new media (and technologies) unavoidable. Visitors, who can exploit the potentials of new ways of communication to improve their knowledge and an immersive and multimedia solutions enhances their experience. Users "interacts" and "reacts", (Malinverni *et. al.* 2015; Pescarin 2014). The installation described took place in Trujillo, Perù, within the permanent installation of "Museo de Sitio Chan Chan" and it was named "Esquina Multimedia". The exhibition is composed of three sections where different technologies are used depending on the problem it is attempting to solve:

- A virtual tour of Chan Chan site to overcome the archaeological area wideness;
- The use of Augmented Reality (AR) to display on mobile device of some archaeological rests of the main entrance of the largest square of Palacio Rivero. In (Pierdicca *et. al.* 2015), AR was tested in outdoor scenario.
- A web-browser to discover and explore the bas-relieves of Huaca Arco Iris to enhance the perception of the architecture and its decorations. Furthermore, it permits to discover ancient findings with different levels of details (LODs).

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The contents used to create the exhibition were obtained from different acquisition techniques:

- Spherical panoramas for the creation of 360° virtual tour;
- Digital photogrammetry for dense points cloud 3D reconstruction of the remains of Palacio Rivero;
- A complete 3D model of Huaca Arco Iris with a new operation of data fusion from the two abovementioned techniques.

2. Museum Exhibition

The exhibition was opened to the public the 27 November 2015, and the users when interacting with the three areas of the "Esquina Multimedia" (Fig. 1).

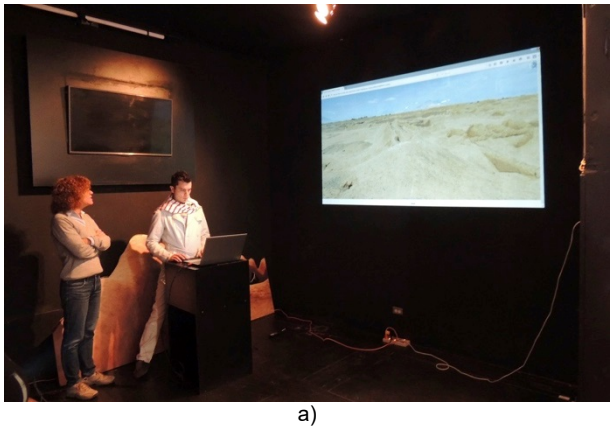
A portion of the exhibition regarding the virtual tour, acquired and produced with the consents described in (Colosi *et. al.* 2013) (Fig. 1a).

The Augmented Realty application has been designed using a wall-mounted poster, which reports some information of Palacio Rivero, the HD image of the main entrance door ruins and a QR code to retrieve the 3D model channel, stored in a remote repository. We adopted image-based tracking system (i.e. markerless), using as tracking images ("trackables") a small portions of the picture. Once the video stream of the built in camera is on, the device implements a matching with the pre-loaded "trackables", searching for the key points associated to the images. Then, the digital contents are projected on the screen from the perspective of the camera's view, based on the orientation of the device (Fig. 1b).

The third section of the installation was reached with a wall-mounted poster containing the 3D reconstruction of Huaca Arco Iris, with the correct position of the decoration. The latter were labelled with the same code of the web browser, so that the user can interact between the artwork and the digital tool. A dataset of hundreds pictures has been processed after the acquisition campaign on field, using Structure from Motion approaches, with specific tools like Photoscan®. Once the 3D meshes of the artefacts were ready, it was possible to manage them into specific tools for orthoimages with high resolution and 3D models stereoscopic visualization by anaglyph, (Fig. 1c).

In the Figure 2 is shown the web browser in detail. To allow the use of huge imagery for users visualization purposes, we used a virtual texturing technique, a combination of classical MIP-mapping and virtual memory usage. The approach consists in storing tiled images composing a multi-resolution pyramid, loading only the tiles needed to perform the texture at user request. For each level of zoom, the set of tiles corresponding to the observed texture lookup (2D+level-of-detail/scale coordinates), (Petrovic *et.al.* 2014).

Finally, to augment the three dimensional perception of the images, we realized the anaglyph view, composed of two monochrome stereoscopic images, each composed with a dominant of a different colour superimposed and printed on the same support. To obtain the 3D perception of course, the users need special optical filters, provided during the exhibition.



a)

b)

c)

Figure 1: Some pictures of the "Esquina Multimedia" during the exhibition: a) the Virtual Tour running and user discovering Chan Chan whole archaeological site; b) user discovering 3D models with AR function; c) users using the web-browser with 3D glasses for anaglyph view.

3. Conclusions

In this work, we presented a novel and interactive way to show the priceless heritage of Chan Chan site. The adoption of state of the art technologies, designed to overcame commons problems of archaeological settlement, is the demonstration of how cultural objects are protagonist, only with the help of a bi-directional interaction by the visitors. By arranging the Virtual Tour into the museum, tourist who cannot visit the entire site (due to time constrains, the wideness of the site and security issues) can reach far areas, having the overview of the whole settlement. The Augmented Reality

application allows visitors to discover hidden artefacts. The web-browser, containing the HD images of the decorations, gives a completely novel way of experiencing objects with a resolution that cannot be reached with the naked eye. Further, the design of a 3D visualization augments the reality of the experience. The mediation between classical exposition techniques (like posters) to enhance the interaction with digital contents has proved to be a winning choice.

Figure 2: In the last picture the browser to explore the HD switching between 2D and 3D model.

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