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Interaction with Paintings by Augmented Reality and High Resolution Visualization. A Real Case Exhibition

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Abstract: *In this paper, an interactive software system for the enjoyment of the artworks in an art exhibition environment is presented. By using Augmented Reality technology, mobile application and High Resolution visualization we provide the users with a visual augmentation of the paintings and a touch interaction technique to display digital contents for art promotion, allowing exhibition visitors to interact with digital contents in an intuitive and exciting manner. The exhibition here presented is the result of previous research over the use of new technologies (e.g. Augmented Reality) for artwork promotion. Descriptions of the hardware system component and software development details are presented, with particular focus over the application implementation. Furthermore, we outline a possible Multi- media AR Installation connected with a semantic network..*

Keywords: Augmented Reality, Artwork, Mobile Application, Exhibition, Visualization

I. INTRODUCTION

Nowadays, art exhibitions are becoming ever more interactive. Artists undertake the strategy of offering technological services to its visitors; furthermore, insiders are increasing their awareness about the need to provide visitors innovative solution of experiencing art. The emerging technology with advanced digital tools (e.g. mobile applications, addictive interaction systems and multimedia contents) made possible a new paradigm for art installations. Despite some art curators still believe that the use of technology will place art in Background, new trends in the international panorama demonstrate how such Interaction with paintings by Augmented Reality and High Resolution visualization innovative tools are the best (and only) way to enhance the fruition of Exhibition.

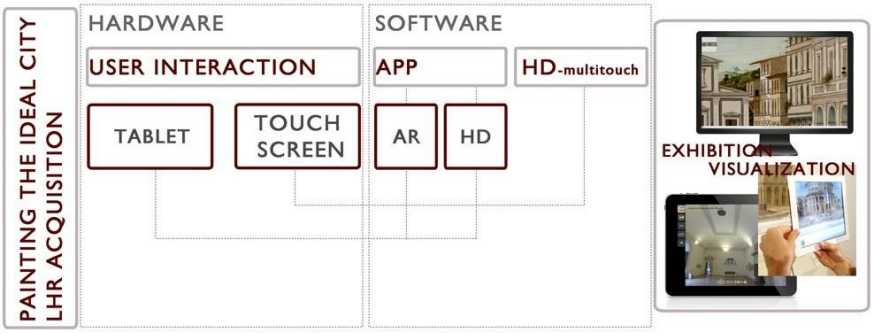

Figure 1: Phases and connections between elements: the production chain from the LHR acquisition to the exhibition.

With this aim, we present our work, experienced into a real implementation to prove how a personal own approach with the visual arts produces an increasing enjoyment for the users. The software described in this paper were installed in Artbook within the temporary app titled "Artbook the Platform" 3 ; more in deep, the Landscape painting was enhanced with two different contents: on a social networking app (Artbook the platform), the high definition (HD) picture of the painting with all its details, while the mobile app allows connecting several notes (textual or info graphics) also over the painting throughout augmented reality (AR) technologies. A schematic clarification about the developed workflow is described in Figure 1. The inspiration for the concept of such installation is twofold. On the one hand, a goal is to provide visitors with a mobile tool to deepen their knowledge of the painting in an interactive way, also thanks to the AR section, extending the

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visualization of the real painting with the superimposition of digital contents. On the other hand, A social networking app specially built for Artist to increase the reach and network. The
combination of the aforementioned contents are the result of a previous work [6], over the use of innovative techniques for the art promotion; indeed, previous research delivered meaningful results arising from a user test in the AR app usability. Improvements for image matching were made in terms of feature extraction as well as key point detection, both aspect that embrace many other computer vision fields [10], [9], [23]. Starting from this, we purse the aim to show strong enhancement in terms of usability and tracking system for AR, improvements that led to the real installation here presented. This paper is organized as follows: in the next section we debate over the importance of digitization for art promotion purposes; section 3 is dedicated to the presentation of the real scenario installation, with the description of digital contents implementation. Finally, in the last part of the paper, we discuss our approach and we also open some new opportunities of developments taking into account our experiences.

II. Mobile Application and Interaction Systems for Art Exhibitions

Toward the direction of enhancing exhibition fruition, researchers are conducting their efforts on the development of new digital tools; the main goal of this research field is to provide users-insiders as well as non-expert public - with new instruments for the knowledge and dissemination of artistic. The ICT approach also for exhibition domain is carrying successful influence, for example increasing the interest of young people by means of new tools. Generally, exhibition installations that do not introduce new technologies, are often boring and do not always have the reputation of being attractive. Furthermore, learning experiences in the exhibitions have been facilitated only by the use of labels and descriptions, to accompany the exhibits which are informative but not interactive. Nevertheless, during the last years, a great number of art galleries decided to offer social media services in order to replace - or better, improve - the existing standard solutions]. Moreover, the ICT approach enables new media and storytelling, which represents as a major interest in users experience. This is particularly true in terms of mobile development. Since the use of mobile devices is increasing also for cultural and museum sectors, the number of apps available on the main stores (e.g. Google Play, Apple Store) is daily growing; in particular, many Artist Visualization and Interaction. A real case Exhibition specific Apps are noteworthy. A good survey over this kind of application, as well as over impact of mobile devices in terms of app development can be found in. Also in the Italian National panorama this trend is strengthening, as demonstrated by the increasing number of mobile apps available in the stores. Many aspects have to be taken into account developing a mobile app; planning and production of cultural content for mobile usage should respect the synergy between digital contents and usability. Furthermore, proper planning of the steps development is mandatory. Helpful dissertation over mobile development for art can be found in. For the development of our solution, as described in section 1, all these issues have been considered.

Also Augmented Reality systems have demonstrated to be valuable solution for Cultural Heritage promotion. AR represents a stimulating solution in order to navigate, interact and discover within museum settings. It can provide a more intuitive interaction technique with the displayed objects, while for the AR scientific community, exhibitions provide contextually rich indoor environments for experimentation with AR applications. More in deep, there are many challenges to overcome and exhibition environments are particularly suitable to manage with different lighting conditions which are the main issue to face with for the development of image-based tracking system. The recent increase of computational capabilities, sensor equipment and the advancement of 3D accelerated graphics technologies for handheld devices, offer the potential to make the AR heritage systems more comfortable to carry and wear, facilitating the spread of this kind of AR systems to the mass market. Literature provides many relevant works about using AR mobile application for art purposes.

Another important aspect that is useful to be introduced is the visualization of art contents through advanced display techniques. Recent advances in visual display solutions are enabling users to experience digital content in new ways through social media. The key aspect that make such techniques particularly suitable for exhibition application, is the possibility to visualize paintings with a very high level of detail, with the possibility to dive into brushstroke-level detail. Conveying all the aforementioned considerations, in the following our solution is presented, with particular focus on the exhibition and the preliminary development phases.

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III. Overall Exhibition Design

The whole installation system is composed by a faithful (and real-scale) facsimile of the "River Side" painting. The artwork is flanked by tablets, which allow visitors to interact with social media contents thanks to the applications, Artbook the platform; inside the application the HR image of the painting is uploaded. The different "visions" of the same artwork, here accessible, form a new way to communicate paintings and to facilitate its disclosure with Edutainment practices. The "Artbook-the platform" app facilitates the link with the painting thanks to the technology, but the tool still need the real art work, in the physical dimensions for the same, in a close relationship between technology and art. Details about development and technological problems are discussed below.

3.1 Augmented Reality

The "Artbook" App is compatible with both iOS and Android devices. We utilized Flutter 2.0 for development, and we recommend an image-based tracking system (i.e. marker-less AR) that uses tracking pictures ('traceable') tiny areas of the art piece to provide the optimal user experience. The user experience will be more natural as a result, and the real-world and virtual worlds will be more seamless. When the built-in camera's video stream is activated, the device searches for key spots linked with the pictures using the pre-loaded 'trackables' The digital contents (i.e., the 3D object) are then projected on the screen from the user's camera view, which is determined by the device's orientation.

Interaction with paintings by Augmented Reality and High Resolution visualization We established six separate points of interest for AR recognition and user content overlap in this project. We focused on image-based material and movies (with translucent backgrounds) that are created dynamically and based on parameterized visualisation templates and database contents and shown in the user interface. Art curators carefully chose highlights, which were subsequently recorded on an external cloud-based database. The benefit of putting AR material on an external repository is that it allows you to edit or update the content without having to upgrade the app in the webstores. Starting with the aforementioned effort, the 'Artbook AR' app presents a novel method for painting experiences, allowing users to engage with all of the multimedia information created for this application.

Furthermore, the programme is totally portable due to the aforementioned. It is conceivable to standardize it, since the national cultural heritage landscape would benefit from a wider usage of such tools.

IV Discussion and Future Developments

We organically developed a conceptual model for social media engagement as a result of this project. There are artwork and equipment (such as a portable device) on the physical side, POIs on the virtual side, and Information Technologies in the centre acting as a facilitator.

An UUID (Universally Unique Identifier) identifies a POI, which is related to artwork, associated with one or more multimedia items, and has at least one 'marker/descriptor' and an optional sequence of potential interactions. The universe of DBMS (Database Management System) is promptly re-called by UUID: An information system keeps track of POIs and artworks. This framework underpins applications and installations, allowing for more consistent data structure and administration. This may appear to be a minor detail, yet it serves as the foundation for further improvements. For example, analysing visitors' interactions with exhibits or the entire site.

For the development of museum stands, exhibition collecting using a sensor network, similar to that used in retail. Relationships, linkages, and affiliations may be found in well-known databases and can be used to concepts such as sematic and ontology.

Artworks are semantically specified, and POIs are semantic nodes connected directly to an artwork allowing hot point interaction while also being linked to other artworks and POIs. These possibilities in an installation might lead to an enhancement in the exhibition's navigation path, as well as an association with other artwork in the same site or in other exhibitions and collections through visitors'; experiences. We don't ask tourists about their museum visits if their replies are suspicious.

The exhibition may reveal what visitors desire to see or learn, as well as how they traverse it. To serve as an ontology entry point to the mussel network, multimedia material, markers, and interactions should all be expressed in the same semantic way. From curious visitor to expert, a mussel experience may be developed along several paths for different user

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levels. All of the information is literally floating above the artwork, and visitors may select the items that interest them. As a result, the museum's hallways are covered in rules, and visitors can create their own enhanced journey.

V. CONCLUSION

We provided a novel scheme installation in this paper to enhance the visitor experience in a real-world exhibition setting. Our exhibit is made up of interactive instruments that are inextricably linked to one another. A brushstroke-level representation is provided via an interactive AR app for a thorough visualisation of Visualization and Interaction. A real case Exhibition the painting; some intended components of the artwork, such as concealed lines, author's afterthoughts, and oddities, can be apparent to visitors with simple motions. The mobile applications, which are accessible on app stores, provide a convenient way to learn more about the 'Ideal City' and to reach a broader audience. Visitors were given tablets for the museum exhibition, of course. Users can frame the artwork and interact with overlay contents that are a continuum between the painting and the user point of view thanks to the Augmented Reality area. The show opened on Friday, March 13th, 2015 at Magnani Palace in Reggio Emilia. Finally, as previously mentioned in section 4, Interaction with paintings by Augmented Reality and High Resolution visualization

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