Low-cost Creation of a 3D Interactive Museum Exhibition

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ABSTRACT

We present a demonstration of a multi-sensory virtual experience that accurately reflects the experience of a real visit to a museum. We have developed a 3D interactive digital museum exhibition corresponding to a photo-realistic 3D reconstruction of the Iconic Treasures exhibition at the National Museum of Ireland's archaeology building. Users can explore the 3D virtual environment and interact with the displays by accessing high resolution photographs and historical descriptions of the artefacts. This demo will showcase the experience on a 3D laptop with the use of active shutter LCD glasses to create an immersive experience. A key aspect of the demonstration is that it was developed using low-cost or freely available OTS tools wherever possible putting the creation of such digital exhibitions within reach of even modest budgets.

Categories and Subject Descriptors

I.4.5 [**Computing Methodologies**]: Image Processing and Computer Vision—*Reconstruction*

General Terms

Design, Measurement, Experimentation

Keywords

3D Reconstruction, Museum Exhibition, 3D Vision

1. INTRODUCTION

The archaeology building of the National Museum of Ireland[1] (NMI), originally designed by Thomas Newenham Deane in the late 19^{th} century, is a magnificent example of Victorian Palladian architecture and a stunningly beautiful building. The building spans two floors connected by a grand staircase and several compact spiral stair cases. It is a historically "listed building" and is protected against alterations under Irish law. An unfortunate side-effect of these protective measures is that the NMI is unable to have an elevator installed in the building and thus the upper floors of the archaeology museum are not accessible to visitors of limited mobility.

This provided our motivation to create a virtual museum exhibition that reflects as accurately as possible the experience of actually visiting the museum in person. An ancillary motivation is that if provided in-class, this virtual museum experience could also provide a platform to enthuse school children, to foster learning and to encourage visits to the museum. With the ever increasing popularity of 3D and augmented reality technology, many museums around the world have moved to provide a digital experience for visitors. The Louvre in Paris, for example, has an online interactive tour with photographs of the exhibits superimposed on a virtual recreation of the museum. To the best of our knowledge, however, our demo is the first time that a photo-realistic virtual museum exhibition has been demonstrated that utilises cheap laser scanning technology combined with interactive audio and visual content.

A key novelty of our demo is the cost to achieve the final results. Given the budget-constrained conditions under which most museums operate, it was imperative that our goals be achievable in a cost-effective manner. To this end, we used off the shelf (OTS) low-cost or free tools wherever possible, putting the creation of such digital exhibitions within reach of even modest budgets. Our demo was completed by a single graduate student with no prior experience of 3D tools over a period of 3 months.

2. SYSTEM DESCRIPTION

We decided to approach the 3D reconstruction of the exhibition from two perspectives. From the macro perspective, we performed 3D modeling of the entire room based on wire mesh drawing. To do this, we captured 50 photographs taken at random locations throughout the exhibition and utilised Autodesk's Imagemodeller[2] to enable us to draw the wire mesh. The wire mesh represents an accurate scale model of the entire room in which the exhibition is housed. Next, an open source game engine called Unity[3] was

[1] http://www.museum.ie/

[2] http://usa.autodesk.com/

[3] http://unity3d.com/

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ACM 978-1-4503-0616-4/11/11.

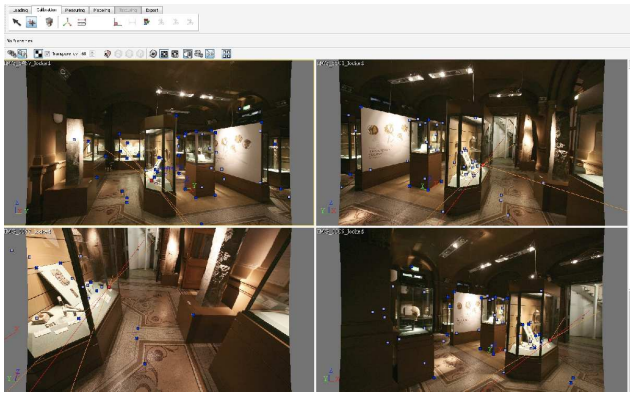


Figure 1: The Iconic Treasures Exhibition, National Museum of Ireland

employed to allow us to create the 3D interactive environment. Texturing of the mesh was performing using the same 50 photos, and then pre-existing museum content, such as audio and text descriptions of the artefacts, were integrated into the virtual exhibition. Finally, realistic lighting conditions were added.

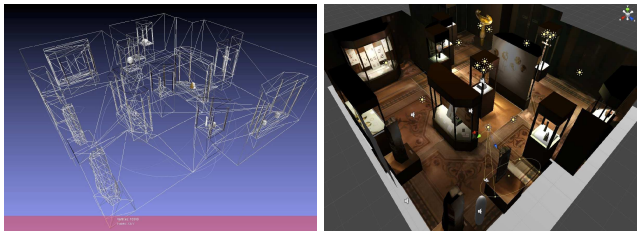
From the micro perspective we used a NextEngine[4] desktop 3D laser scanner to scan various artefacts, which produced high definition, textured, wire-mesh scans of selected exhibits. This allows a user to interact with a given artefact by rotating and moving the virtual artefact so it can be viewed from any angle providing a more comprehensive experience than simply viewing an artefact behind a glass display case. The laser scans of the artefacts were then imported into the virtual exhibition, resized and displayed in a virtual display case.

Finally, to complete the visual experience the Nvidia[5] 3D vision system was used to provide the stereoscopic images that produce the 3D effect. This creates images for both the left and right eye and displays them sequentially on the screen in an interlaced format. It works with LCD active shutter glasses that open and close 120 times a second and isolate the appropriate image for each eye resulting in a virtual 3D image. These glasses are currently expensive, however, the system can also be configured to produce content for ultra-cheap red/cyan passive 3D glasses with only a small reduction in terms of the quality of the immersive experience.

3. DEMONSTRATION

The demonstration will consist of a laptop with a special 3D screen coupled with active shutter glasses. The 3D digital museum exhibition with be show cased on the laptop and users can explore the virtual museum exhibition and interact with the displays. Users will need to wear the 3D glasses in order to experience the 3D effect produced by the laptop. A poster detailing the project and showing graphically the steps involved will also be displayed.

[4]https://www.nextengine.com/
[5]https://www.nvidia.com



(a) (b)

Figure 2: Wire mesh reconstruction of the exhibition space

(a) (b)

Figure 3: (a) The Aghaboe artefact and (b) the laser scan after texturing is applied

Figure 4: A 3D display showing the virtual exhibition

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