360 High Resolution Panoramic Screening of Malaysian Culture and Heritage Sites; A Collaborative Project Between Two Media Research Centers

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Abstract. Panoramic photography has become a popular genre with the technological advancements of cameras, from professional gear to the common smartphone. It has become a phenomenon because of its capacity to represent reality in 360 degrees form that provides for an interesting viewing experience. The process for panoramic photography involves the photographic capture of a scene, construction by computational stitching, and the final communication output. Levels of quality of the output vary as factors such as high-resolution accurate capture, software precision in scene construction, and device-referred screenings are included. The Centre for Creative Content and Digital Innovation, University of Malaya does, among other research projects, documentation of Malaysian Culture and Heritage sites in high-resolution spherical panoramic photography. These panoramas were captured in High Dynamic Range images (HDRI) and constructed using professional equipment and software. They are then viewed and interactively navigated through an LCD screen or a projector. Through a collaborative effort between the Centre and the ALiVE Lab, School of Creative Media, City University of Hong Kong, the panoramas are screened in a 360 degrees theatre, which is not available in Malaysia. The theatre is an enclosed 360-degree space of 14’ high walls with a circular viewing area, with a diameter of 10 meters across. Using 5 projectors, the panorama is projected onto the walls that give viewers a deep sense of immersion through a virtual excursion to the sites. The output of the screening consists of a video documentation and survey results from viewers’ experience.

Keywords: 360 Panorama, 360 Theater, Culture and Heritage sites, Collaborative Research

1 INTRODUCTION

This paper documents and elaborates on the collaborative research of two media research centers, namely; the Centre for Creative Content and Digital Innovation, University of Malaya and the ALiVE Lab, School of Creative Media, City University of Hong Kong. It describes the technology behind the creation of the 360 Panoramas, its working processes, the workflow between the two centers, and the screening and viewing experience. The screening took place in a 360 degree theater at the 20th International Conference on Virtual System and Multimedia on 9 to 12 December 2014 at the Run Run Shaw Creative Media Centre, Hong Kong. A brief output of a survey done at the screening is also included at the end of this paper. The 3-minute video of the screening can be viewed at;

https://www.youtube.com/watch?v=rwQ9_FoBfAk&feature=youtu.be
2 Background

2.1 High Resolution Panorama

The nature and technical specification of a High Resolution Panorama are the intended output’s file size, which determines clarity of details, and the usage of High Dynamic Range Imaging (HDRI) technique, respectively. In HDRI, multiple images of a scene are captured in varying exposures to improve the dynamic range that provides for details and extra luminance of shadow and highlight areas (Reinhard et. al. 2010, Fairchild 2007, Ward 2001, Nightingale 2012, Debevec and Malik 1997). This sequence of images is then processed through a software to produce a High Dynamic Range image. As stated by Reinhard (2010), the full range of what the human eye can see of the details in the darkest and the brightest parts of a scene is still an unanswered research question. However, HDRI has reached the capability of matching almost the human eye in capturing and creating an image as how it was seen (Larson et. al. 1997). This technique shares the same fundamental concept of sandwiching negatives, and the dodging and burning processes of exposures during printing in the film days (Fairchild and Johnson 2002).

High Resolution Panorama depends on what the image is intended for and how it is to be viewed. Studies for scientific observations and use such as in architectural or virtual heritage preservation works call for HDRI deployment for details and accuracy (Andres and Pozuelo 2005). Lately with availability of bigger bandwidth and higher computer processing capability, detailed panoramas can be viewed through the Internet using laptops, iPads, and even on a Smartphone. With that part solved, the other is the accuracy and aesthetics of capturing and stitching the scene to ensure a good quality panorama of a scene. Subject movement such as humans, traffic, clouds, and trees in the wind creates ghostly effects. Mistakes in the photographing process such as camera movement, axis change, and aperture inconsistency will lead to parallax errors and blurred images which cannot be rectified in the stitching process. Finally, the stitching process too may be flawed with the software’s inability to detect edge definitions of elements in the captured scene. These stated common flaws could be seen on Google street views, as they were not captured and stitched accurately, or for aesthetic value.

2.2 Panorama Capture and Stitching Process

The capture process in this project involved the using of a professional level DSLR camera for high-resolution image files. Mounted on a tripod, the aperture was set to the smallest possible opening; minimum of f8 for greater depth of field and sharper image. In better light outdoors, the f-number was increased. Lower ISOs were preferred for details, color, and contrast but not to the point of compromising medium to fast shutter speeds as low shutter speed may result in blurring of subject; as well as longer time required to complete the process. Time may affect the final output as the light of the scene may change before all the angles are captured (360 degrees). Bracketing at 2EV intervals for 5 exposures, the angle of view was kept to less than 20 degrees with allowance of 30% overlap to ensure accurate stitching. The batches of images were HDRI processed before stitching took place. Stitching was done with PTGui software by means of aligning the images in its correct position in the scene, much like a jigsaw assembly. The final outputs were exported as HTML5, Flash and QuickTime VR files and were able to be viewed through the Internet by Web Browsers.

2.3 Malaysian Culture and Heritage Sites’ Panoramas

The Centre for Creative Content and Digital Innovation has a special focus on Virtual Heritage documentation and preservation as its research-creation activity. Over the years a number of panoramas were done that include the Royal Belum Rainforest, Cheong Fatt Tze
mansion, Traditional Boatbuilder of Pangkor, the National Mosque, Sarawak’s Iban Longhouse, and many others. These panoramas were of high quality in terms of details and aesthetics and were viewed in an interactive manner (mouse and touchpads) but limited to a single or three monitor screens, and projected in a 180 degree curved screen. Below are some examples.

Fig. 1. Royal Belum Rainforest

Fig. 2. Cheong Fatt Tze mansion

Fig. 3. Sarawak Iban’s longhouse
2.4 Collaborative Work and Technology

The screening project was thought of during the initial stages as a part of the 20th International Virtual System and Multimedia Conference (VSMM2014). The ALiVE Lab in the School of Creative Media, City University of Hong Kong has a 360-degree theater in their building. Configured to screen videos and still images, it also provides for interaction control through a center console panel, using a joystick, mouse or a touch pad. The all-round screen is 14 feet in height with a floor of 10 meters across. 5 ceiling mounted projectors are used to spread the projection onto the screens at 8000 x 8000 pixels with 6500 lumens each. A Video Matrix Processor centrally processes the edge blending and visual feeds. The panoramas were then edited with pan and tilt movements and captions about the sites were included. They were transferred back and forth through the Internet for testing and fine-tuning. All the panoramic scenes were converted into video image-sequenced files that provided slow impressions of elevations and rotations during their screening in the theater. Below are a diagrammatic drawing of a similar system and the actual one photographed with a Ricoh 360 Theta camera.

Fig. 4. 360-Degree Theater

Fig. 5. A 360 Photo of a 360 Panorama in the 360 Theater
3. Survey Results in Brief

Out of all the visitors who viewed the panoramas in the 360 theater, 34 were respondents to the survey. They were a mixed group of males and females with an age range of between 17 and above 45. 50% of the respondents have never viewed a 360-degree panorama screening of which 13 of them find the screening extremely and very informative. This 38% of the whole group also thought the panoramas are extremely and very well produced both aesthetically and technically. They would also make it a point to attend other 360-degree screening of the same kind and extremely and very likely to recommend the experience to others. They also found the overall viewing experience as extremely and very enjoyable. Among the comments from an open ended question in the questionnaire of what do you like most about 360 screening are; ‘Feels like in the elevator or moving vehicle and it made me excited’. ‘Realistic feeling (spatial)’. ‘The environment is real’. ‘The floor moved’.

4. Conclusion

The project has become a new benchmark for the Centre of Creative Content and Digital Innovation as it broadens research opportunities in high-resolution panoramic screening. Through international collaboration of technology and content delivery between the two media research centers, certain workflow processes and framework has been established. These would open up greater possibilities for virtual culture and heritage documentations and preservations vis-à-vis content exchange on a single platform, specifically in the area of panoramic photography.

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References


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