3D optical scanning of building interiors for game development - a case study

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Abstract—This paper presents results of preparing a 3D model of a building interior for the purpose of making a map in a computer game. The scanned building was the Bożków mansion. 16279 photos were made during the scanning session. Images were used to acquire a 3D model of scanned parts of the mansion. In order to adapt the model to a game it was necessary to performed further processing on the model aimed mainly on reducing the number of vertices in the obtained mesh. The paper describes a scanning process and the process of creating a game map on the basis of a scan.

Index Terms—computer games, computer graphics, 3D scanning

1 INTRODUCTION

There is a growing interest in creating game assets on the basis of 3D scans of real objects. In particular, such a technology is used in first person perspective games (FPP). A precursor of making games with this kind of assets was The Astronauts studio [1]. The studio successfully applied 3D scans to a game called The Vanishing of Ethan Carter released in 2014. Another groundbreaking game with assets based on 3D scans was Star Wars Battlefront. Currently, the technology of making assets from 3D scans is commonly used world wide. Scans are foremost used for making items used in the game.

This paper presents results of acquiring a 3D scan of interiors of a historical site of the Bożków mansion. The site was scanned with the purpose of preparing a game map resembling scanned chambers. The game will be quest bringing a player to an imaginary mysterious world. The paper describes the scanning process and and its results.

2 RELATED WORK

3D scanning is usually performed on a separate single objects that have complex shape. However, there are also projects in which entire building are scanned. Jung et al. created models of building the the purpose of improving their efficiency and maintenance operations [2]. Gomes et al. focussed on applications in the field of preserving cultural heritage [3]. One of the most spectacular project related to cultural heritage was performed by Google (https: //artsandculture.google.com/project/openheritage) [5]. It considered 3D scanning of dozens of historical sites from around the world. The results of scanning were released to the public domain and they can be downloaded for free as a part of supporting the Open Heritage Alliance which aims at preserving the structure of cultural objects [6].



Fig. 1. An image of a chamber with a fireplace in the Bożków mansion



Fig. 2. An image of a chamber with a mirror in the Bożków mansion

A variety of equipment can be used for 3D scanning including structured light 3D scanners, time of flight cameras, devices based on Light Detection and Ranging (LIDAR), and cameras [4]. Different scanning technologies are the most suitable in different circumstances. As far as making 3D scans of large objects such as building are concerned, LIDARs and cameras are usually applied [5]. In low cost projects it is advisable to use cameras as using laser based technologies is much more expensive.

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Fig. 3. The reconstruction of 3D model of building interior (a) A 3D scan, (b) A resulting model prepared for a computer game (c) A resulting model without textures

3 THE STERIO PROJECT

This paper presents results acquired in the Sterio project [7], [8]. The aim of the project is to develop a low-cost technology for making 3D scans on the basis of images from cameras. The technology is intended for use in smallsized and medium-sized game development studios. Such studios may want to prepare a game with original assets based on 3D scans however they cannot effort using laser based technology, structure light 3D scanners or expensive software for obtaining 3D models from a set of images. Using cameras and methods provided as a result of the Sterio project is the solution in these circumstances. Apart from methods for preparing game assets the result of the project is the development of a game which is based on 3D scans of real building interiors. A building scanned and adapted for the purposed of making a game was the Bożków mansion.

4 THE SCANNING PROCESS

It is a time-consuming process to take photos from which a 3D model is obtained. There are also procedures according to which photos needs to be taken [8]. In particular, it is necessary to take images from different spots located around a scanned chamber instead of redirecting a camera while remaining in the same location. If this recommendation is not fulfilled it is possible that a 3D model cannot be resolved on the basis of a set of acquired images. More information concerning suggested procedures for taking images are described in [8].

The scanning sesstion which was organized in Bożków castle lasted 5 days. Three participants took part in the session. The session resulted in acquiring 16279 photos. These are images of 22 indoor chambers and 2 outdoor locations. Outdoor locations included external walls of a palace and a fountain located in palace's garden. The part of a castle which was scanned covered approximately 20% of the entire area of a palace. Images were made both using a stereo camera which consisted of two cameras mounted on a rig and a single camera. Images from stereo cameras were always made with a support of a tripod unlike shots from a single camera. Sony Alpha 7R and Sony RX100 II were types of cameras used during the session. Sample images taken during the scanning session are presented in figure 1 and 2. Figure 1 shows a chamber with a fireplace and 1 is a chamber with a mirror.

5 RESULTS

The result of image processing is a model of a map which will be used in the Mansion game. The model precisely resembles real spaces of a mansion. The process of creating a final map which will be used in a computer game consisted of three step. The first step was taking images of the mansion in Bożków, the second step was generating a 3D model of the mansion on the basis of taken images and in the third step the graphic designer adapted the automatically generated 3D model to a model which will serve as a map in the game. Figure 3 present an image taken during a scanning session with a corresponding part of a map resembling this part of a building interior.

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ADAM KACZMAREK et al.: 3D OPTICAL SCANNING OF BUILDING



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