AR Filming : Augmented Reality Guide for Compositing Footage in Filmmaking

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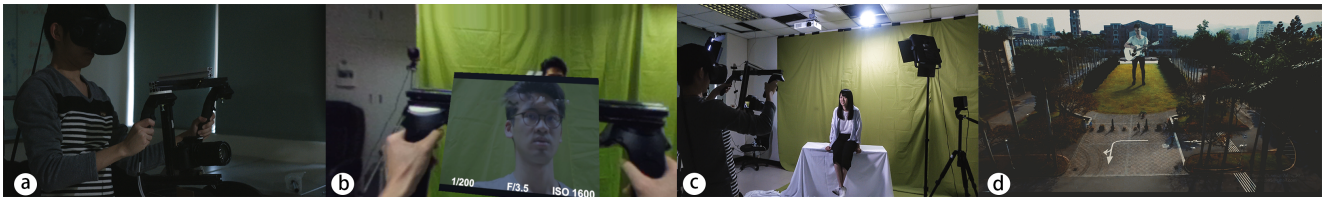

Figure 1: (a) We build a camera holder with Vive controllers. (b) Then, we make use of the tracking and augmented reality system for our guiding system. (c) The system will guide the user to capture a hand-held footage along the desired path. (d) We could achieve good quality result without a costly motion control system.

ABSTRACT

Creating videos from compositing multiple footage requires the support of the robotic arm due to the camera motion model needs to be precise. It is extremely difficult to shoot the footage with hand-held camera. However, the cost of the robotic arm is extremely high. Thus , we introduce an augmented reality guiding system to replace it. In our system, we utilized augmented reality to guide the user for the camera motion and implemented an algorithm of stabilization and camera motion alignment for a hand-held camera. The system reduces the cost but remaining good quality of the result at the same time.

CCS CONCEPTS

• **Computing methodologies → Mixed / augmented reality**;

KEYWORDS

Augmented Reality, Compositing, Viewpoint Shifting, 3D Warping, Cinematography

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1 INTRODUCTION

Filmmaker often applies their creative and imagination by compositing multiple footage together. It creates great visual impact in multiple ways, such as changing the scale, reorganizing the spatial and temporal relationship of the real world. For example, the music video of Up & Up by Coldplay [Coldplay 2016] successfully utilize this technique. Although it is entertaining while watching it, the filming process contains many rigorous conditions. Recent working process requires robotic arms and tracker to control the camera motion. The camera motion needs to be precise so the content can be merged naturally. Otherwise, it will contain different perspective and parallax. Thus, result in dislocation of the content. Moreover, without the robotic arm, it is extremely difficult to locate the camera motion in the real world. Shooting along the desired camera movement and orientation using hand-held camera is nearly impossible.

Although the motion control system plays an important role, its price is a critical condition. Only professional studios with sufficient budget can afford it. Therefore, we would like to replace the motion control system with an augmented reality guiding system using the hand-held camera. Through augmented reality support, we could visualize the camera motion and guide the cameraman while filming. Hence, reduce the hardware cost and make compositing easier.

Figure 2: Compositing from green screen

2 SYSTEM OVERVIEW

We introduce an augmented reality guiding system to replace the robotic arms during the process of compositing video. The flowchart is shown below in figure(3). First, we extract the camera motion model of the target footage using Voodoo camera tracker. Next, we stabilized the target footage and project the stabilized camera motion in our augmented reality guiding system. The user could interact with our user interface to determine the scale of the second footage, and capture it by following the path showing on the head-mounted display. The second footage is filmed in front of the green screen for later keying and compositing purpose. Then, we apply stabilization to the second footage from the handheld camera. At the same time, the system calculates the difference between the camera trajectories and warp them for camera motion alignment.

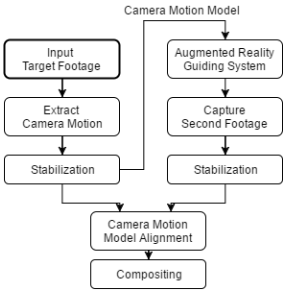

Figure 3: System Flowchat

2.1 Augmented Reality Guiding System

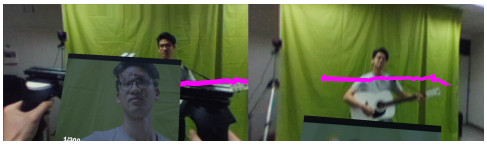

Figure 4: The pink camera path are rendered in our guiding system. Users could follow the path to capture the desired footage.

The system is implemented using HTC Vive. As shown in the figure(1a), we built a camera holder for users to operate with both hands. The controllers are attached to it as the handle. We make use of the tracking system from Vive to locate the camera position in real world. Therefore, we could provide feedback about the camera movement in real-time. Since the DSLR and Vive are both connected to the computer, as shown in figure(1b), the footage from the DSLR are streamed to the HMD.

For camera trajectory, we rendered a path of the movement, and locate the orientation guide between several keyframes. In figure(4), the user can follow it and move the camera along the path. Also, we implement a virtual guide, the ghost camera that simulates the movement for demonstration. The user can have a more clear look to the camera motion.

2.2 Stabilization and Camera Motion Alignment

A variety of methods of software stabilization and viewpoint shifting have been studied. We modified the method from [Liu et al. 2009], which is a 3D stabilization that satisfies both of our conditions. It smoothed the camera motion and warp it to the desired path while preserving the content from distortion. We divide the camera motion into position and orientation data and handle them separately. As shown in figure(5), applying low pass filter to them can smooth the path and generate a steady camera motion.

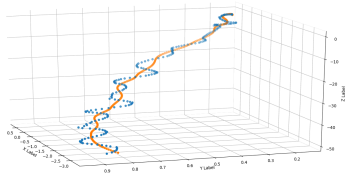

Figure 5: Motion data of the camera movement. Blue and orange are referred to original and smoothed position respectively.

3 CONCLUSION AND FUTURE WORK

We proposed an augmented reality guiding system to replace the robotic arm when filming compositing footage. Our system can provide visualization of the camera motion in the head-mounted display that makes it possible to move along the desired camera trajectory. The cameraman can directly follow the guidance and capture the footage. We also implement a set of algorithm to resolve the challenge from the handheld camera. By stabilizing and matching the camera motion model, we can mimic the professional camera movement and composite the footage together without artifacts. With our system, we can significantly reduce the hardware cost of compositing.

The system can also be modified for other tasks during the general filming process. The augmented reality guiding system can play the role of visualization of the camera motion when the director or cameraman are designing the shot. Also, we can create a cinematography tutorial for students in film school using it. Our algorithm can also be used to mimic a motorized cinematic hardware. We look forward to providing more application with the support of augmented reality.

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