Moving Around in Virtual Space with Spider Silk

Ping-Hsuan Han,[*] Da-Yuan Huang,[*†] Hsin-Ruey Tsai,[*] Po-Chang Chen,[*] Chen-Hsin Hsieh,[*] Kuan-Ying Lu,[*]
De-Nian Yang,[†] Yi-Ping Hung[*]
[*]National Taiwan University, [†]Academia Sinica

Figure 1: We propose a method to allow the user to move around in a virtual space without walking. By combining several wearable devices and a wind-feedback system, we provide the user a new experience of exploring 3D space. More specifically, a user can (a) throw his wrist to shoot the spider silk, (b) grab and pull the silk to move forward, and then (c) release the silk for the next move. Here, (d) the IMU in the HMD is used to detect the jumping events, and (e) the wind-feedback system is adopted to enhance the feeling of moving.

1 Introduction

With the recent advances of wearable I/O devices, designers of immersive VR systems are able to provide users with many different ways to explore the virtual space. For example, Birdly [Rheiner 2014] is a flying simulator composed of visual, auditory, and smell feedback that can provide the user a compelling experience of flying in the sky. SpiderVision adopts a non-see-through head-mounted display (HMD) and two cameras with opposite directions to provide the user a front-and-back vision [Fan et al. 2014]. Although the use of HMD is quite popular recently, moving around in a virtual space is not as easy as looking around in a virtual space, mainly because position tracking is more complicated than orientation tracking with state-of-the-art technologies. Our goal is to provide the user the first-person perspective and experience of moving around in 3D space like a super human – jump high, glide off, fly with rope, teleport, etc., even without the position tracking technologies.

2 Implementation

Our VR system uses the Oculus Rift DK2 for visual display. Two Myo armbands, one on each hand, are used for gesture recognition. The signals acquired from the muscle sensors and the IMU of the Myo armbands can be used to recognize different types of hand gestures and to estimate the orientation of an arm, and hence, the throwing direction of the strand of silk. Therefore, users are able to perform grab-and-pull gestures for moving with spider silk. In regards to user feedback, besides using visual feedback, we have also used the vibration of Myo modules as the tactile feedback of performing certain hand gesture. In regards to falling in the air, we implemented a wind-feedback system composed of three electronic fans, for enhancing the feeling of moving through space (Figure 1(e)). To combine all of the aspects described above, Unity3D was used for system integration.

3 Application

To demonstrate our design of moving around in the 3D virtual space, we have built an immersive VR system containing a city scene. With this system, the user can experience the first-person perspective when moving among different buildings with spider silk. In the virtual scene, there are two kinds of objects. By throwing the spider silk to static or fixed objects, the user can moving around the 3D scene in an efficient way. On the other hand, by throwing the spider silk to a movable object, the user can easily acquire the object with the spider silk.

We have designed three actions for moving around in the 3D virtual space. These actions can be performed with either hand. First, the user can make a wave-out motion with the hand of his choice. At the same time, the corresponding hand seen in the HMD will shoot out a spider silk in the direction of the user's hand and stick to the object (Figure 1(a)). Within a limited distance, if no object is hit, the action will be canceled. Next, the user can perform a grab-and-pull motion with the same hand. If the object is static and fixed, the user will move forward in the direction of the silk until stopped in front of that static object (Figure 1(b)). Finally, the user can perform the motion of "releasing the silk" to release the current strand of silk and start the next shooting (Figure 1(c)). By combining the aforementioned actions, the user can easily move around in a virtual space with spider silk, such as swinging in a pendulum, swinging between buildings and hook on the traffic light.

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References

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