SonalShooter: A Spatial Augmented Reality System Using Handheld Directional Speaker with Camera

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Figure 1: SonalShooter

Figure 2: System Design

Figure 3: Application for Museum Guide

1 Introduction

Mainly in the field of Augmented Reality (AR), various systems that can overlap virtual information onto physical space in the real world have been developed. In such systems, wearing special equipment might obstruct users' natural interaction and communication. Contrarily, Spatial Augmented Reality, which project additional information directly on the targeted physical space, has attracted much attention. In our research, we aim to provide a novel auditory interaction with physical surfaces through the approach of Spatial Augmented Reality. Our system, named SonalShooter, can give auditory information to physical objects (Figure 1). When a user aims the device at a physical object, the device detects and identifies the target with a computer vision approach and he/she will be able to hear corresponding auditory information from the object itself as if it is speaking.

As related work, CoBIT [Nishimura et al. 2004] enables users to acquire auditory information related to real objects through an earphone by installing infrared LEDs on them. On the other hand, our system does not require any electronic device on the targeted objects and does not cover users' ears like headphones. Coco [Ishii et al. 2007] also enables users to hear auditory information in a particular space like our system by using a directional speaker. While the speaker in Coco is fixed, our system utilizes a handheld directional speaker and provides mobile interactions with the real world.

2 SonalShooter

In the SonalShooter, we offer technical innovations as follows:

First, we developed a system which enable users to receive auditory information selectively from a surface of physical objects. This device is composed of a compact directional speaker, a camera, a laser pointer, and a tact switch (see Figure 2). When a user aims the device at one of the objects with the help of the laser pointer, the device detects and identifies the target by the camera, and corresponding auditory information is emitted from the directional speaker. Since the sound of the directional speaker is reflected when it hits solid objects, the user can hear the sound not from the held device but from the surface of the object.

Second, we developed an intuitive interaction method for controlling embedded information. In this system, users can switch channels of additional information by rotating the device. We put 2D AR markers to the target object for the system to identify the object as well as detect the rotation of the device.

3 Applications and Future Works

As an application of the SonalShooter, we propose a system for museums: a system that makes caption panels speak explanations. Previously, we put AR markers to caption panels with written explanations of exhibits. When a user aims the device at one of the panels, the explanation of the corresponding exhibited object will be heard from the surface of the panel itself (see Figure 3). Since this system does not require visitors to wear headphones, users can easily recognize the connection between the object and the additive auditory information while converse with other audiences. Furthermore, this application provides multilingual information for users. As a channel-switching function, when the device is rotated, the language of the explanation will be switched in real time.

In the near future, we plan to apply this system for not only flat surfaces but also objects of complicated shapes. Moreover, by adopting a marker-less object recognition method, we hope to apply this system to more various situations.

References

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