Re-PITASu Concept: Touch-based Interaction Using Range Image Sensor with Image Projected onto Wall Surface

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Abstract

This paper proposes a concept of a system using a range image sensor for interacting with an image projected onto wall surface. A target surface and human hands are observed, and the finger motion is detected by the range image sensor. The user can interact with projected images by using the finger. The experimental results show that the prototype can detect the finger motion, and the contents shown by the projector can be interact with the user's finger.

Index Terms: H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems—Artificial, Augmented and Virtual Realities; H.5.2 [Information Interfaces and Presentation]: User Interfaces—Input Devices and Strategies

1 Introduction

Touch-based interaction is intuitive for interacting, and several methods have been proposed for interacting with the images projected on surfaces using a camera. PALMbit [3] has been proposed for projecting images onto the user's hand and operating the projected images by another hand using an Infrared camera and a projector. The method can detect the motions stably, however, the shape of the target surface is limited to hand shape. PiTaSu (Picture based Input Method Using Tapping on Wall Surface) [2] can detect the hand motion accurately. However, detectable motions are limited due to a property of the acceleration sensor.

We propose a system concept for interacting with surfaces called Re-PITASu (Rangeimage-Projector-based Interaction Tool for Arbitrary Surfaces). The proposed system consists of a range image sensor and a projector in use. The range image sensor is used to detect hands and a surface to interact with the images projected by the projector. The range image sensor is robust over colors of the scene. The scene of projection is generally dark and affected by the light from the projector. The Re-PITASu concept is aiming at calibrating between the range image sensor and the projector precisely compared to OmniTouch [1]. Experimental results show the calibration method of the Re-PITASu and the touch-based interaction by the Re-PITASu.

2 Overview of Proposed System

The Re-PITASu consists of a range image sensor and a projector. Figure 1 shows an overview of the Re-PITASu concept. To calibrate between the range sensor and the projector precisely, a camera is introduced to calibrate between the range image sensor and the projector indirectly. Firstly, a finger region to tap is extracted from an image taken by the range image sensor. Secondly, a distance between the finger and the surface is evaluated in the range image coordinate system. Lastly, the tapping action is detected by observing the distance between the finger and the surface.

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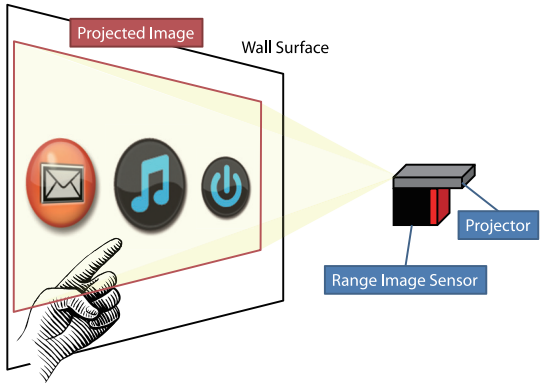

Figure 1: An overview of Re-PITASu.

(a) (b)

Figure 2: An example of the experimental results. (a) The finger is off the surface. (b) The finger is on the surface.

3 Experimental Results and Conclusions

Figures 2 (a) and (b) show an example of the experimental results. The prototype could detect the tapping and the label is displayed by the projector according to the position of the estimated finger position by the proposed calibration method.

Future work will aim at lifting restrictions on camera positions. We have used the background subtractions for the prototype. It is desirable that the position of the camera is estimated simultaneously without preliminary-taken images. In addition, the accuracy of the calibration should be improved. The indirect calibration in the prototype is so simple that the prototype has not been applicable for the practical use yet.

References

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