Design and Implementation of a Bluetooth Air Finger Mouse

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Abstract-- **With the trends of more and more new technology emerging, smart products, such as smart phones and tablet PCs, have become daily necessities. They bring a convenient life for people. The development of new technologies not only improves the performance of system hardware and software continuously, but also impacts the evolution of machine user interface. From keyboard control to touch operation, the users' operation habit is changed. However, in order to integrate into humans' life, this paper design and implement a bluetooth air finger mouse, that uses 3D image recognition and emulate a bluetooth mouse to any computer device. The issue of small body movement detection is improved. The bluetooth air finger mouse is approached by system software and hardware. It provides a convenient and intuitional operation interface. Users can use his finger to control any computer devices that are compatible with a normal bluetooth mouse. In the future, the air finger mouse technology should be extend to more novel and creative applications.**

I. INTRODUCTION

With the rapid development of technologies, intelligent and smart information products would be necessities of modern. How to improve the interaction between machine and human has become a key topic. Recalling human-machine interface technologies, from past simple keypad, joystick, mouse and gyro controller, the human-machine interface is evolved into somatosensory remote control. These instances reflect the evolution and development of the operating interface.

Currently, touch screen technology is mature. Touch screen with gesture is the major control method for smart phone and laptop nowadays, such as scaling photo size, unlock the screen, enter your messages, etc. However, not only operation on the touch screen, but also people would like to operate in a space freely and intuitively.

This paper designed and implemented a bluetooth air finger mouse system. Bluetooth is one of the typical interfaces in most computer devices. The technology of 3D image recognition and finger gesture recognition are used to detect user's operation. In the gesture recognition, the issue of small body movement detection was improved in this paper. The signal are emulated as a bluetooth mouse information to the computer devices. The user can move his finger to control the system cursor in the space as well as using touch screen. It provides a convenient and intuitional operation interface.

The remaining part of this paper is organized as follows. In Section 2, we introduce the system design. In Section 3, our system test are presented. Finally, Section 4 concludes this

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paper.

II. SYSTEM DESIGN

A. System architecture

The bluetooth air finger mouse system environment is illustrated in Fig. 1. The bluetooth air finger mouse system is a bluetooth mouse compatible device. The system cursor shown on projector screen or on-device screen can be controlled by our system.

The bluetooth air finger mouse system contains two parts. The first part is finger gesture recognition, and the second part is bluetooth mouse emulator. The finger gesture recognition connects with Microsoft Kinect[1]. The 3D information and Image for finger gesture would be received from Kinect. After detecting the user's finger gesture, the bluetooth mouse emulator will sent a mouse information to the computer device.

In the situation, the user can move his finger to control the system mouse cursor. When he make a fist, a mouse click signal will be triggered. Therefore,
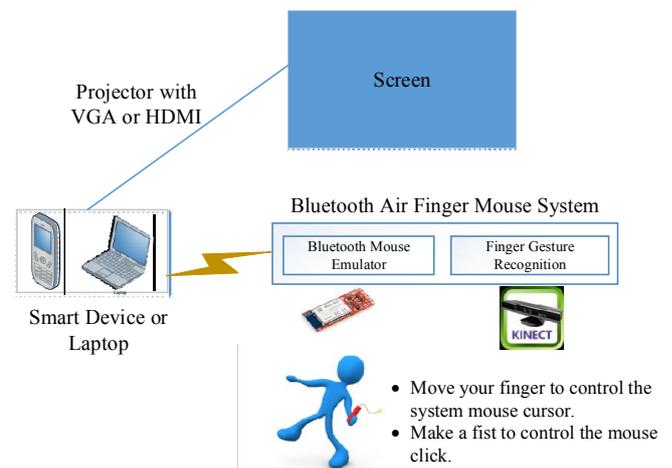

Fig. 1 The bluetooth air finger mouse system environment.

B. Finger Gesture Recognition

The bluetooth air finger mouse system was implemented on a Microsoft Windows-based computer platform. The functions of the finger gesture recognition was approached by using Microsoft C# programming language based on .Net Framework 4.0. The task procedure of the finger gesture recognition is shown below[2]-[6].

1) Read the depth of the image information from the Kinect,
2) Analysis using Kinect for windows SDK human skeleton,
3) Filter out specific depth image,
4) Filter out the area of user's hand,
5) Preprocess the image information of hand area, and
6) Recognize the finger gesture.

C. Bluetooth Mouse Emulator

The bluetooth mouse emulator is based on the RN-42 Bluetooth chip that is produced by Roving Networks[7]. RN-42 is class 2 for mobile devices, which means it is in the range of about 50-60 feet. The corresponding power consumption is reduced, and RN-42 uses only 26μA in sleep mode.

After recognizing user's finger gesture, the signals of mouse moving and mouse clicking will be emulated and sent to the connected computer device. Finally, the system mouse cursor will be controlled exactly regardless of using which operating system and which device type, if the computer device is compatible with a normal bluetooth mouse.

III. RESULTS

A tester made a fist to drag a folder icon is presented in Fig. 2. In the corresponding Fig. 3, the photo was captured from the projector screen. In the top-right side, the system cursor was dragging a folder icon on the windows desktop. More mouse information emulated by the bluetooth air finger mouse is shown in the bottom of Fig. 3.

Fig. 2 A tester made a fist to drag a folder icon.

IV. CONCLUSION

This paper designed and implemented a bluetooth air finger mouse system. Bluetooth is one of the typical interfaces in most computer devices. The technology of 3D image recognition and finger gesture recognition are used to detect user's operation. In the gesture recognition, the issue of small body movement detection was improved in this paper. The signal are emulated as a bluetooth mouse information to the computer devices. The user can move his finger to control the system cursor in the space as well as using touch screen. It provides a convenient and intuitional operation interface. Our system worked well with Android, iOS and Microsoft Windows OS via bluetooth interface. In the future, we are

going to improve the mouse sensitivity, degine more gesture and optimize the system performance. The air finger mouse technology should be extend to more novel and creative applications.
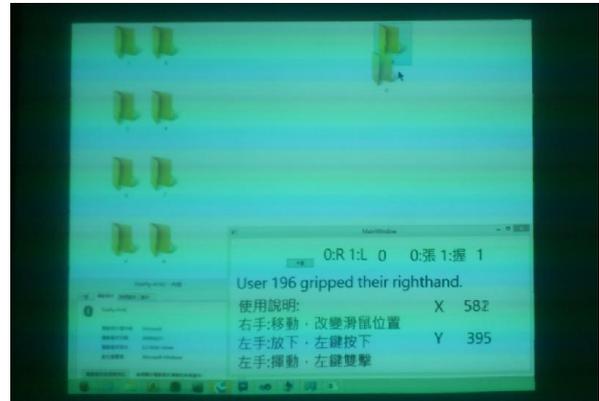

Fig. 3 The result of dragging a folder.

EXAMPLES OF REFERENCE STYLES

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