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CHARACTER INPUT SYSTEM BY HAND TAPPING GESTURE USING KINECT SENSOR

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ABSTRACT

Various studies are present in the text input system by using image based hand gesture recognition. However, hand gesture language like as finger alphabet, sign languages and aerial handwriting treated in some previous works have some problems to be commonly used. If aerial handwriting is concerned then much more time is required to recognition. Sign language and finger alphabets required more time to recognize the character. As a solution of this problem this paper purpose a new system which is based on hand tapping gesture for English Japanese hiragana and English character which can be use for better human computer interaction. The hand tapping gestures are the motions of tapping keys in aerial virtual keypad by only hands which can be effectively use by hand alphabet by anyone including people who has disabilities like as deaf and hard of hearing people. This technology input the character by flick keyboard. The users can interact computers using non-touch input system where kinect sensor used without any keyboard, mouse or any other body-worn devices.

Keywords: *Hand gesture, fingertip detection, non-touch character input, kinect sensor.*

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1. INTRODUCTION

Various studies are present in the text input system by using image based hand gesture recognition. Some studies aim at non-touch input methods of computer systems and other ones focus on support for the deaf and hard of hearing people the non-touch image-based input methods do not require mouse, keyboard devices, and body-worn devices, but image capture using devices such as cameras. The methods can be commonly applied because most of the mobile devices have an equipped camera. And they fulfilrequirements for hygiene and cleanliness. Although voice recognition supports non-touch input, it has some drawbacks such as privacy problems related to being overheard, and problems of mispronunciation and a speech disorder of users.

Basically hearing-impaired people use sign languages and finger alphabets. In each sign language has its own finger alphabet to express things such as proper nouns, objects that users do not know the signs for, and new concepts that there are no signs for.

There is some investigated result on the basis of image based hand gesture recognition and it found some problems in them, they are

1. Substantial practice is required for user to adopt the hand gesture communication.This restricts hand gesture languages and finger alphabets from being commonly used Andsign language requires long time for beginners to familiar with language and alphabet.
2. Considerable time required for character hand writing and hand gesture recognition in character handwriting in the air also problems related to writing speed of user and processing time for recognizing characters handwritten in the air by hands.

2 PROPOSED WORK

Various character input system by using hand tapping gestures for Japanese hiragana and English characters that can be used to for human-computer interaction. The hand tapping gestures are motions for tapping a key on aerial virtual keypads by hands, which any one can be used as a hand alphabet by anyone including hearing impaired individuals. The hand alphabet is an alphabet whose letters are represented by the hands. The key point of the hand tapping gestures is to tap an aerial virtual key by a hand with some fingers stretched. If the user raises hand around his/her shoulder, an aerial virtual keypad associated with the number of stretched fingers of hand is conceptually spread in front of him/her by the system. When the user taps a key on the keypad by P-hand, the system recognizes the input character according to the tap position. The layout of virtual keypad is similar to a flick keyboard of any smart phones. The system supports character input for Japanese hiragana and the English alphabet.

The flick keyboard has been adopted primarily in touch screens of smart phones. therefore, this input method is familiar in the world. The number of keys of a flick keyboard is much smaller than that of a regular keyboard because each key of a flick keyboard has a popup keypad spread when the key is touched. So it is possible to increase the size of each key in the keyboard and to reduce touches to incorrect keys. In addition, it is easy for users to adapt to the character input system without a proper knowledge and practice if the keys are well grouped into keypads according to relations among the corresponding

This system enables users to input characters in the air without any keyboard/mouse and wearing anybody-worn computer.

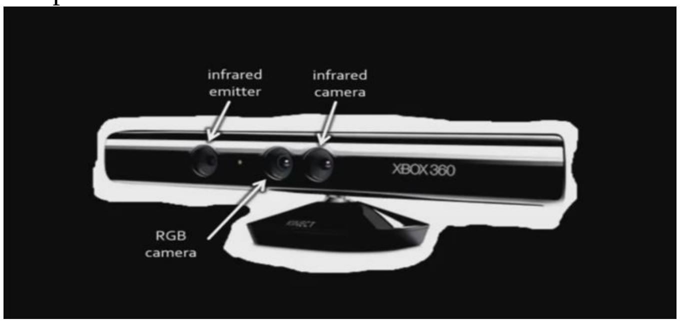

Fig.: 2.1 Kinect sensor

A Kinect sensor use for non-touch character input. The Kinect sensor for Windows is a controller for the home video game machine Xbox 360 from the Microsoft Corporation. Fig.2.1 shows the Kinect for Windows v1 used in the experiments. Fig 2.2 show the kinect pose estimation pipeline in which all camera works and find out skeleton image in real time system

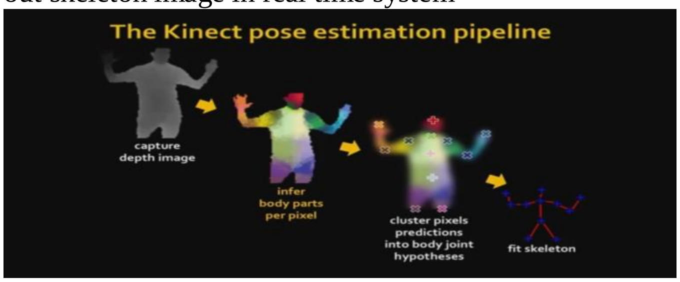

Fig 2.2 Kinect pose estimation pipeline

The most special part of the Kinect sensor is that it can measure the movements of the skeleton in real time by detecting each part of the human body. In the proposed character input system, the combinations of the number of stretched fingers of hand, the tap position of hand are mapped to characters.

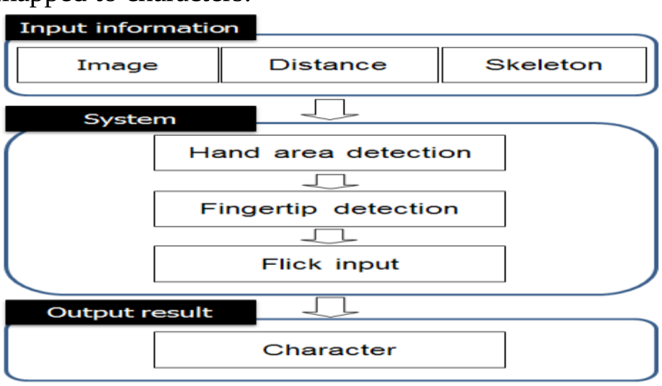

Fig 2.3 Overview of system

It shows an overview of the system. As input data, the Kinect sensor provides the system with user image obtained by the RGB camera of the Kinect sensor, distance from the Kinect sensor to the user, and skeleton data, i.e., the joint positions of the user. From the data, the system extracts the region of the user's hand raised around his/her shoulder and detects stretched fingers of hand. After the keypad associated with the number of stretched fingers of hand is virtually spread in the air, the key at the position where the hand tapping occurs determines the input character.

2.1 Fingertip Detection

A. Hand Area Detection

The Kinect sensor recognizes a user at 0.8m ~ 4.0m distance.The skeleton data find out the position of hand. The system cannot obtain the number of stretched fingers of hand directly from the data.It needed to count stretched fingers of P-hand, so they developed a method that recognizes effectively how many fingers are stretched by detecting fingertips from the user image. This is reasonable because each stretched finger has a distinguishable contour line from which fingertip can be easily detected.

To reduce the cost of fingertip detection, it reduces the actual detection area in the real time image of user. Hence they detects fingertips only in the region called hand area.They detect xy-plane centered at the three dimensional coordinates of the center position of hand in square region. Because of the average size of hands is less than 20cm, they set the length of the square side is 36cm. The system then extracts only pixels whose xy-coordinates are in the square region. Finally, the system detects the hand area by filtering out the pixels whose z-coordinate ismore than 10cm far from the z-coordinate of the center position of hand.Mask images of hand areas of the right and left hands are shown below.

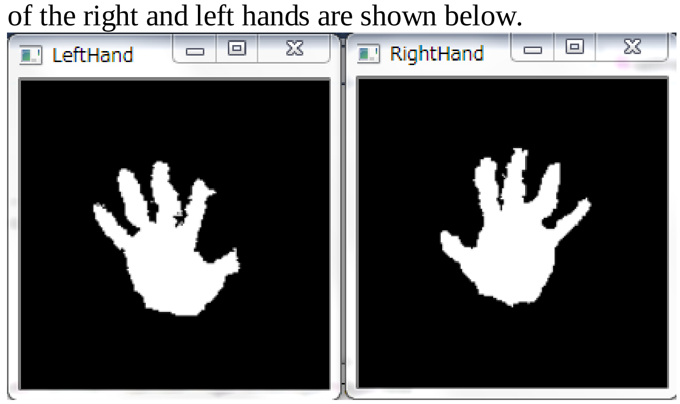

Fig.2.1.1Left and right hand.

B.Fingertip Detection Algorithm

The steps to detect fingertips from the mask image of hand area are as follows:

1. Detect the outline of hand. For doing this, the system uses the function Find Contours of Open CV that features the Suzuki85 algorithm. When the mask image of the hand area in Fig. 2.1.2 (a) is given, the detected outline of the hand is illustrated in Fig.2.1.2 (b). The point in the hand palm is the center of the hand.

2. Find all fingertip candidates. For the purpose, it calculates the distance from each point on the outline to the center of hand and compares it with than those of the 40 points is selected as a fingertip candidate. For the outline of the hand in Fig.2.1.2 (b), the fingertip candidates to be found are shown in Fig.2.1.2 (c).

3. Select real fingertips from the fingertip candidates. It can be done by filtering out the points near the wrist from the fingertip candidates. The fingertips to be finally selected are shown in Fig. 5.2 (f).

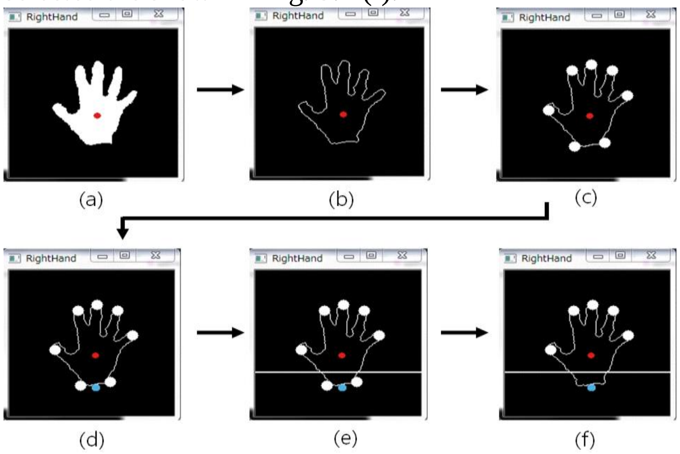

Fig 2.1.2 A process of fingertip detection.

Also in spite of the above efforts, the incorrect points around the wrist can be detected as the fingertip candidates as shown in Fig.2.1.2 (c). Then it removes the incorrect points according to the following steps. First, set a quasi wrist point based on the coordinates of the center of the hand as shown Fig.2.1.2 (d). Then, find the mid-point Z between the quasi wrist and the center of P-hand. It draw a straight line passing Z that is perpendicular to the line from the quasi wrist to the center of P-hand as shown in Fig.2.1.2 (e). Finally, the system selects the points in the opposite side of the quasi wrist as the real fingertips of P-hand. The finally detected fingertips are shown in Fig.2.1.2 (f). Fig.2.1.3 shows the detected fingertips in a real time image.

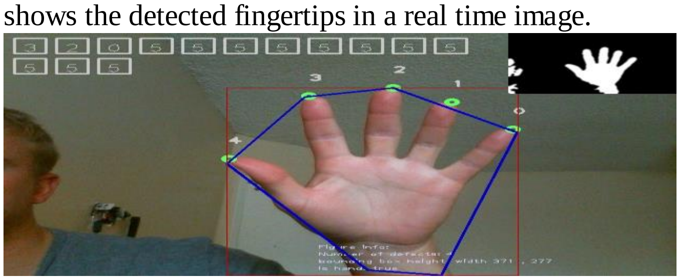

Fig 2.1.3 Detected fingertip in a real time image.

2.2 Character input system

1. Flick input system

Software keyboards are used to input characters on the touch screens. The user enters characters by manipulating the virtual keys that are drawn on the touch screen. Since the flick keyboards as software keyboards have a small number of keys, their key arrangement are similar to the numerical keypad that has been mounted on feature phones. If user enters a hiragana character in the flick keyboard, the consonant is selected by the tap position and the vowel by the flick direction. The flick keyboard is mostly used, because it reduces the possibility to tap on an incorrect key even though there are a lot of characters in the character set to be entered. Fig 3.4 shows typical examples of the flick keyboard layouts for Japanese and English on smart phones.

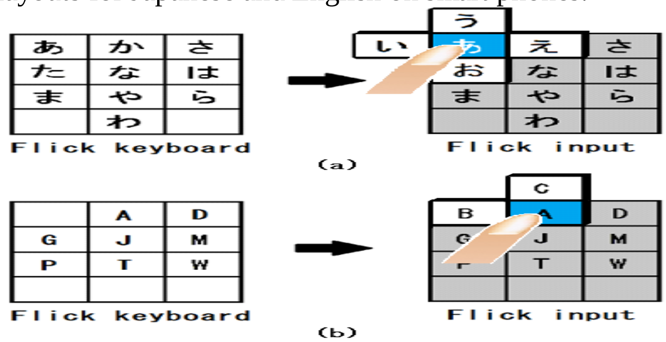

Fig 2.2.1 Fick keyboard layout for Japanese and English character

2.*Virtual Keypad Input in the Air*

Virtual keypad is similar to flick keyboard to enter character. When the user wishes to use a virtual keypad, then he/she has to raise hand around the shoulder with some fingers stretched. And then the system places a virtual keypad at the calculated position for character input as shown in Fig.5.3.

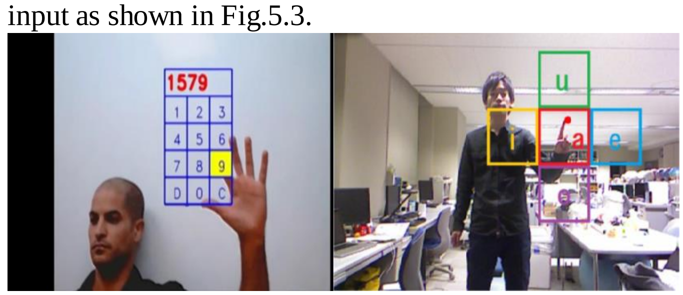

Fig-2.2.2An aerial virtual keypad for character input.

3. APPLICATION ADVANTAGE & DISADVANTAGE

3.1 Application

- Easy for human-computer interaction
- Useful for person who has disabilities.
- Automation and robotics purpose.

CONCLUSION

As we can see in the world various technologies and concepts are invented for better human computer interaction. This system helps the user to input character easily and helps a person who has some disabilities to handling the devices this is very easy to use and new

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