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Robust Part Based Hand Gesture Recognition Using Kinect Sensor: A Review

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Abstract: ***Hand gesture based Human Computer Interaction (HCI) is one of the most natural and intuitive ways to communicate between people and machines, since it closely mimics how human interact with each other. In this, we present a hand gesture recognition system with Kinect sensor, which operates robustly in uncontrolled environments and is insensitive to hand variations and distortions. Our system uses both the depth and color information from Kinect sensor to detect the hand shape, we demonstrate the performance of our system in real life application which is controlling various devices using kinect sensor.***

Keywords: Human Computer Interaction, Hand Gesture Recognition, Kinect sensor, Software development kit.

1. Introduction

To enable a more robust hand gesture recognition, one effective way is to use other sensors to capture the hand gesture and motion, e.g., through the data glove . Unlike optical sensors, such sensors are usually more reliable and are not affected by lighting conditions or cluttered backgrounds. However, as it requires the user to wear a data glove and sometimes requires calibration, it is inconvenient to use and may hinder the natural articulation of hand gesture. Also, such data gloves are usually more expensive than optical sensors, e.g., cameras. There is always a need to communicate using sign languages, such as chatting with speech and hearing challenged people. Additionally, there are situations when silent communication is preferred: for example, during an operation, a surgeon may gesture to the nurse for assistance.

It is hard for most people who are not familiar with a sign language to communicate without an interpreter. Thus, software that transcribes symbols in sign languages into plain text can help with real time communication, and it also provide interactive training for people to learn a sign language. Gesture recognition has become an important research field with the current focus on interactive emotion recognition. Instead of wearing a data glove, using the Kinect sensor can also detect and segment the hands Due to the low-resolution of the Kinect depth map, typically, of only 640*480, although it works well to track a large object, e.g., the human body, it is difficult to detect and segment a small object from an image with this resolution, Microsoft Kinect provides an inexpensive and easy way for real time user interaction. Kinect, originally designed for gaming on the Microsoft Xbox platform.

This system has several key features:

- Capable of capturing images in the dark.
- Identifying up to two hands, under all reasonable rotations of the hands.
- Translating and displaying gestures in real time.
- Allowing user to choose different scenarios.

The main contributions of this paper are as follows: We demonstrate our hand gesture recognition algorithm in one HCI applications. The proposed system operates accurately and efficiently in uncontrolled environments. It is applicable to other HCI applications.

Figure 1: kinect sensor

Furthermore, the high computational cost forbids its widespread adoption. Fortunately, recent development of depth sensors (e.g., Kinect sensor) provides a robust solution to hand segmentation. However, due to the low resolution and inaccuracy of the depth map, the obtained hand contour can be quite noisy. Classic shape recognition methods are not robust to severe.

For instance, contour based recognition approaches, such as moments, are not robust when the contour is polluted by local distortions. Skeleton based recognition methods also suffer from contour distortions, because even little noise or slight variations in the contour often severely perturb the topology of its skeletal representation. And its proposed a skeleton pruning method in, which makes skeleton robust to contour noise. However, skeleton based methods still cannot deal with the ambiguity problem. As the second and the third shape have more similar skeletons than that of the first and the second shape. As for the correspondence based shape recognition methods such as shape contexts and inner distance, they are not effective in solving the ambiguity either, because the correspondences of the second and the last hands have more similar contexts than the first and the second one do Several of the aforementioned applications employ various well studied principles from 2D image based computer vision in novel human computer interaction

applications. It has been shown that many traditional computer vision problems can be solved more efficiently and or accurately using RGB-D cameras. For example, there are several popular computer vision approaches for reconstructing the 3D shape of a human face, namely shape-from-shading shape from stereo shape from video However, a more efficient solution is offered in the framework presented in by fitting a morphable face model to RGB-D data.

2. Related Work

A. Concept for hand recognition

Kinect provides you with the position X, Y and Z of the users‟ joints 30 times (or frames) per second. If some specific points move to specific relative positions for a given amount of time, then you have a gesture. So, in terms of Kinect, a gesture is the relative position of some joints for a given number of frames. People wave by raising their left or right hand and moving it from side to side. Throughout the gesture, the hand usually remains above the elbow and moves periodically from left to right.

B. Coding concept

Written the condition to match with properties of kinect sensor using software development kit for java.

```
public class Global Data
public static int ww Feed = 640;
public static int hhFeed = 480;
public static int ww = 1280;
public static int hh = 720;
serial Port = (Serial Port) port Id. open("WSS1.0", 2000);
 input Stream = serialPort.getInputStream();
output Stream = serialPort.getOutputStream();
 Thread. sleep(1000);
```

For selecting the panel for interfacing with hardware and it‟s condition we will written the following code for selecting port. Also for the button status condition we are shows some code which check the condition of buttons for both hands.

```
Color draw Color[] = new Color[]{Color. DARK_GRAY, Color. GREEN};
double headz, lhz, rhz, diffL, diffR;
 int scaled Head[] = new int[3];
 int scaled Left[] = new int[3];
 int scaled Right[] = new int[3];
 public My Timer Task
double prevDiffL[], prevDiffR[];
int selected Button; //0 --- 7
int selection Status; //0 inactive,
public My Form(String comm. Port)
biButtons = new Buffered Image[2][2];
for(int i=0;i<8;i++){
buttonStatus[i][0] = 0;
```

3. Requirements and Set Up

A. Hardware Requirement

- A Intel Core™ 5 Processor
- Minimum Quad 2.66 GHz CPU
- Minimum3 GB of RAM.
- Windows 8 operating system.
- Need high speed port of 3.0
- Kinect sensor.

Express PCB 7.0: Express PCB is a CAD (computer aided design) software designed to help you create layouts for printed circuit boards. The program can be really useful for engineers but also students that need to create PCB's for personal projects.

Hand gesture based Human Computer Interaction (HCI) is one of the most natural and intuitive ways to communicate between people and machines, since it closely mimics how human interact with each other. In this application, we present a hand gesture recognition system with Kinect sensor.

In another case from the movies, many users have hacked their Kinect to allow users to control robots and devices via body movement**.** where hacked Kinects can be used to copy the movement of limbs with surprising accuracy. Combining an Xbox One Kinect to control a robotic arm and an Oculus Rift to provide first-person view. NASA hopes to install the system aboard the International Space Station if testing proves successful.

A great emphasis on Human Computer Interaction (HCI) research to create easy to use interfaces by facilitating natural communication and manipulation skills of humans. Among different human body parts, the hand is the most effective interaction tool because of its dexterity. Devices controlling by kinect sensor.

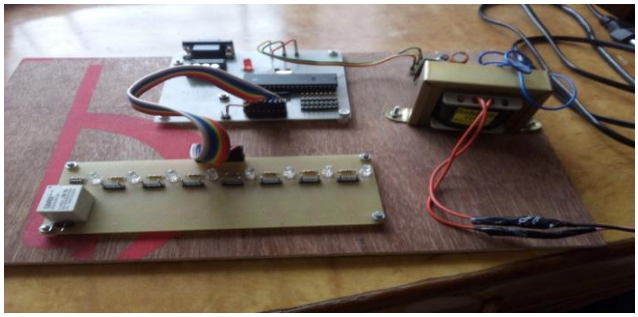

Figure 2: Hardware setup

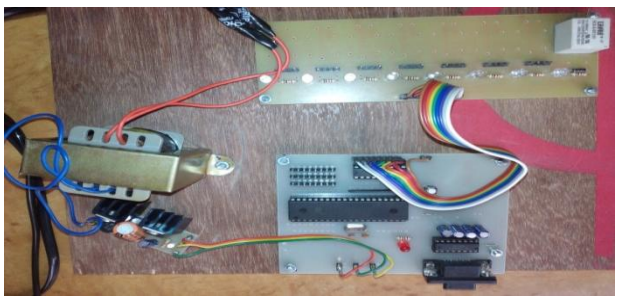

Figure 3: hardware setup (top view)

Netbeans 7.1: NetBeans is a software development platform written in Java. The NetBeans Platform allows applications to be developed from a set of modular software components called modules. Applications based on the NetBeans Platform, including the NetBeans integrated development environment (IDE), can be extended by third party developers.

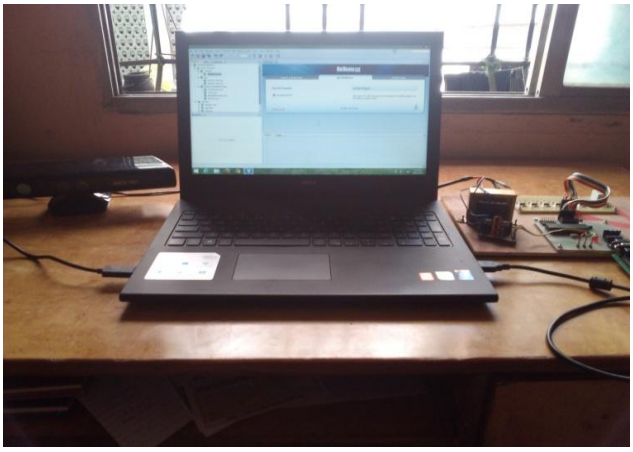

Figure 4: Setup for experiment.

Figure 5: When the project is running at that time shows the initial status of system.

4. Results

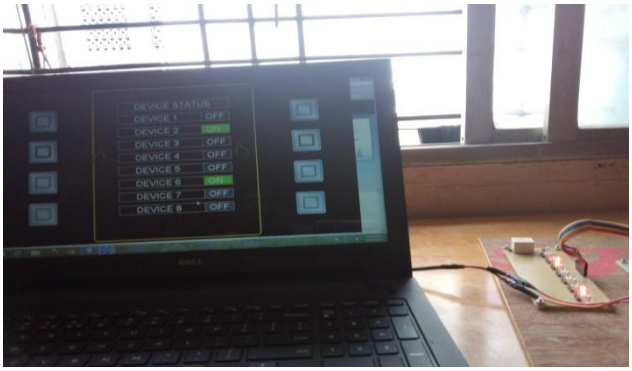

Figure 6: when device 2 and 6 will selected that time on hardware LED no 2 and 6 will gets ON. (from front view).

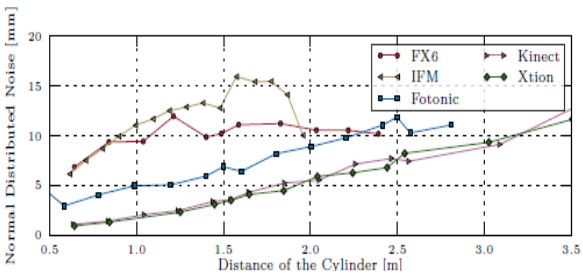

Figure 7: The three indicators normally distributed noise depending on the distance.

This reveals the strength and weaknesses of the sensors under different conditions and enables an appropriate choice of a sensor for a certain application. For all sensors the normally distributed noise, the absolute radius error and the rate of detected points is evaluated under different conditions in (fig.7). The tested conditions are distance of the sensor to the object, environmental illumination and the surface of the object. It is found that for the most sensors, distance has the biggest influence.

5. Conclusion and Future Work

Hand gesture recognition for real life applications is very challenging because of it‟s requirements on the robustness, accuracy and efficiency. A Time of Flight camera with a low resolution (176 x 144 pixels) was used to get depth image for segmentation, and it was paired with an RGB camera with a high resolution (640 x 480 pixels) for hand detection.

In this project, we presented a part based hand gesture recognition system using the Kinect sensor. Hand gesture recognition system based on Microsoft Kinect for Xbox is introduced. It achieves better accuracy of more than 90% when using a more accurate hand detection method. Taking both accuracy and efficiency into consideration, hand gesture detection in our real time demo system. Such a hand gesture recognition system provides a robust solution in real life HCI applications, which can also be applied to many other hand gesture based HCIs.

References

[1] A. Erol, G. Bebis, M. Nicolescu, R. D. Boyle, and X. Twombly, “Vision based hand pose estimation: A review,” Computer. Vision Image Understand., vol. 108, pp. 52–73, 2007.
[2] Ren, Z., Meng, J., Yuan, J., Zhang, Z.: „‟Robust hand gesture recognition with kinect sensor‟‟. In: Proceedings of the 19th ACM international conference on Multimedia. pp. 759{760. ACM (2011)
[3] Dix, A.: Human computer interaction. Pearson Education (2004) 16. Myers, B.A.: “A brief history of human-computer interaction technology interactions” 5(2), 44{54 (1998)
[4] Antonis A Argyros and Manolis I A Lourakis. „‟Binocular hand tracking and reconstruction‟‟ based on 2d shape matching. pages 207~21O, 2006.

[5] P. Buehler, M. Everingham, D. P. Huttenlocher, and A. Zisserman. „‟Long term and hand tracking‟‟ for continuous sign language TV broadcasts. In British Machine Vision ConjcTence, 2008.
[6] Philippe Dreuw, Jens Forster, and Hermann Ney. "Tracking benchmark databases for video based sign language recognition‟‟. In ECCV International Workshop on Sign Gesture and Activity SGA Crete Greece September 2010.
[7] Jos L. Hernndez-rebollar, Robert \V. Lindeman, and Nicholas Kyriakopoulos. „‟A multi-class pattern recognition system for practical finger spelling translation‟‟. In Proceedings of the 4th IEEE International Conference on Multimodal Interfaces, pages 185-190, 2002.
[8] M. Van den Bergh and L. Van Gool. „‟Combining RGB and cameras for real time 3D hand gesture interaction‟‟. In Applications of Computer Vision (WACV), 2011 IEEE Workshop on, pages 66-72, 2011.
[9] J. P. Wachs, M. Kolsch, H. Stern, and Y. Edan, "Vision-based hand gesture applications," Common ACM, vol. 54, pp. 60–71, 2011.