Gesture Recognition: A Communication and Future to Tablets

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ABSTRACT

The term "Gesture" means non-verbal communication by means of visible body actions in order to communicate a particular message, similarly "gesture recognition" is a field of computer science technology which aims at recognizing human gestures in order to convey a particular instruction by means of mathematical algorithms. Gesture recognition is an initiative from the technology's end in order to understand human perspective through sign language. The algorithm basically aims to determine "what instruction is to be given by the human being at a particular instant". Human gesture is approximated with somewhat close to the actual instruction which is indeed in the person's mind at that point of time. That is "the gesture should resemble the instruction which is to be given by the human to the machine ". This reduces human complexity.

This paper elaborates on the discussion "gesture recognition and analysis" and also highlights the key-concepts. The technologies supporting the concept of gesture recognition is also discussed in the paper with the aim of inculcating this concept in the presently existing technologies and future to Tablets.

KEYWORDS: - Gesture Recognition, Free-digiter, single camera (HD Camera), future perspective, future to tablets, automobiles.

I. INTRODUCTION

These days Handy devices such as mobile phones, laptops, tablet etc. have turned into the basic necessities of the day. With the constant improvements in these fields, there is a tremendous

Use of mobile devices for various purposes like taking pictures, writing documents, showing presentations etc.

Gesture recognition is an area in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. It is a real tool in language generation process. Mobile devices are very common and majority of the people

Use smart phones in their daily lives. Their interactions with these devices can be made cooler by using such gesture recognition features. For example, if the user wants to lock the document in his tablet or a computer then he can use the gesture recognition using a single camera to unlock that file or to lock. Gesture Recognition can also be used in biometrics like we keeping our face near the camera and we are moving our face in a pattern to unlock the computer.

In May,2012 the Intel Corporation discussed about the gesture recognition that with the help of this recognition used in windows there will be a relief from using the 'middleman'(like keyboards and mouse) and to make computer act as a 'human' and this technique will be most powerful in ultabooks using the RBG lens(720p) , an HD webcam.

Gesture types

In computer interfaces, two types of gestures are distinguished which are online gestures and offline gestures which are described as follows:

Offline gestures: Those gestures that are processed after the user interaction with the object. An example is the gesture to activate a menu.

Online gestures: Direct manipulation gestures. They are used to scale or rotate a tangible object.

Gesture Input Devices

These days the input devices which are being used in the gesture recognition are the HD camera fitted in the smartphones or in the ultrabooks. Some of the input devices are:

Wired gloves: These can provide input to the computer about the position and rotation of the hands using magnetic or inertial tracking devices. In addition, some gloves can detect finger bending with a high degree of accuracy (5-10 degrees), or even provide feedback to the user, which is a simulation of the sense of touch. The first commercially available hand-tracking glove-type device was the DataGlove a glove-type device which could detect hand position, movement and finger bending.

Example:-This technology has been used recently in one of the smartphones provided by Sony Mobile Communications and the handset was *Xperia Sola* in which they use the same concept and gave the name as floating touch technology in which we can use the handset using wired or unwired gloves and the phone can sense the fingers.

Single Camera: A normal camera can be used for gesture recognition where the resources/environment would not be convenient for other forms of image-based recognition.

Hand Gesture Recognition

Hand gesture recognition is one obvious way to create a useful, highly adaptive interface between machines and their users. In the present scenario, hand gesture recognition technology would allow for the operation of complex machines using only a series of finger and hand movements, eliminating the need for physical contact between operator and machine.

In the near future this recognition will become a common thing in smartphones and tablets too because of increasing in the size of the devices and nobody would like to use their fingers on that devices alot.

Facial Gesture Recognition

Facial gesture recognition is another way of creating an effective non-contact interface between users and their machines. The goal of facial gesture recognition is for machines to effectively understand emotions and other communication cues within humans, regardless of the countless physical differences between individuals.

Example:-This recognition is the first which has been used in the recently launched smartphone provided by Samsung in Galaxy S4 in which it plays a vital role when playing a video

and if it's the user face in not in front of the phone then it stops the video automatically.

II.   Gesture Movements used in the Automobiles

Nowdays, the technology in the automobiles are going at a boom like we are using the speech recognition to control the music system and the Bluetooth technology for being connected with the phone and can call and talk through the speakers fitted in the car. The Gesture movements are also important in four wheel vehicles so that we can make the vehicle friendlier with the human and can make the car fully featured. The recognition can be done with the help of one-hand since the other must be on the steering wheel. The gesturing area is above the gear shift stick, where a single camera is placed above to record it. This setup is done due to two reasons which are:

1. The arm can lie comfortably on the arm rest,

2. This area is not observable for other road
user, which is necessary to avoid misunderstandings in public traffic and to avoid collisions.

This setup can be viewed in the following image:

Camera
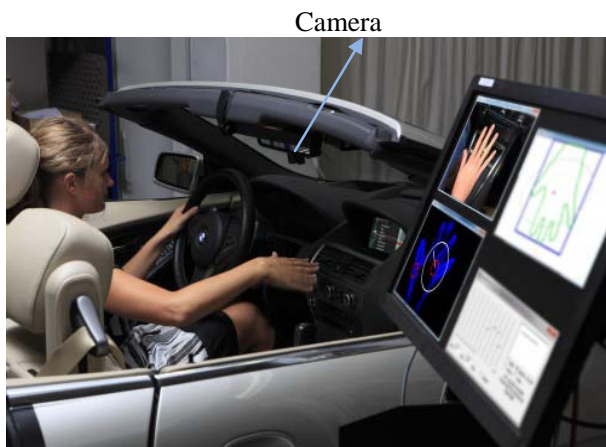
Gesture application can also be used in the incoming messages of different categories like traffic, email, answering machine etc. that are stored. The driver can control message playback by performing gestures and gets speech output via car speakers and textual information via a display. The control concept is derived from usual radios, because it is generally known and thus intuitively understandable. This can be done with some different gesture movements like backward, forward, pause, reset, pointing, and idle gestures. It is possible to skip messages by performing the 'forward' respectively the 'backward' gesture, whereby short execution skips one message and longer execution skips several messages. Alternatively the user may use the 'pointing' gesture (left or right). Playback mode can be interrupted by the 'pause' gesture and resumed by the 'forward' gesture, while the 'reset' gesture quits it. The 'idle' gesture represents the typical resting position of the hand. Therefore it is used as a garbage model, which means it is recognized but has no function.

HAND BASED SEGMENTATION

It is the process in which we group up the points which belongs to the same object into segments. Here are the set of points which describes the user's hand.

The different type of segmentation are:

1. range based segmentation

2. integrated time model

3. noise removal

4. connected component analysis

5. hand tracking

Fig: - Objective of the Segmentation process

- *Segmentation based on range*

The basic principle under this is there shouldn't be any object between the camera and the hand. Therefore the hand appears in the foreground of the image. If there is any point found between the hand and the camera it is consider as a noise. To find the hand information here we can use a simple range based threshold. The algorithm is designed as follows:

a) Find the closest point to the camera using the range

b) Select those points which are less than a threshold from that point;

c) If total number of points lower than a threshold, delete the closest point to the camera and re-start from a)

- *Integration time Model*

Here we can avoid saturated pixels, if we found the approximate distance of the hand from the camera which is used to determine the appropriate integration time for the image to be acquired and the result lie between 17 to 54 frames per second

- *Noise Removal*

The obtained result contains the appropriate information but it appears noisy due to the presence of hanging points or the points describing part of the image background depending on the closeness between the hand and the background. The point density of the hand is much higher than the one of the hanging points. The hanging points are appear to be isolated as we compare to the once that belongs to hand.

- *Connected Component Analysis*

This labeling is used in computer vision to detect unconnected regions. It is an iterative process that groups neighboring elements into classes based on a distance threshold. A point belongs to a class if and only if it is closer to the distance threshold to another point belongs to the same class. When the removal of noise take place than hand segmentation will appears one in the dataset.

- *Hand tracking*

Tracking the hand gesture is an appropriate alternative to avoid a time-consuming on every acquired frame. The tool which is design for this purpose is the KALMAN FILTER, which is used to find the position of the hand in the coming frame and after having measure the actual position of the hand. , this prediction is corrected and the adjusted value is used for the prediction in the following frame. We consider the centroid of the hand region to track the hand gesture. The state vector is represented as $x_t = (x(t), y(t), z(t), vx(t), vy(t), vz(t))T$ where $x(t), y(t), z(t)$ represent the locations of the centroid in the camera frame and $vx(t), vy(t), vz(t)$ represent the velocity of the hand in the tth image frame. It is assumed that between the (k-1) th and the kth frames.

$$\hat{x}_{k|k-1} = f_k \hat{x}_{k-1|k-1} + G_k a_k \qquad (1)$$

where f_k=dynamic matrix which is applied to previous state x_{k-1} and G is driving matrix.

$$G_k^t = \{\Delta t^2/2 \; \Delta t^2/2 \; \Delta t^2/2 \; \Delta t \; \Delta t \; \Delta t\} \qquad (2)$$

Fig- kalman filter using newton's law of motion.

All those first four steps are stands for the initialization of the tracking process. These are applied once at the beginning of the procedure.
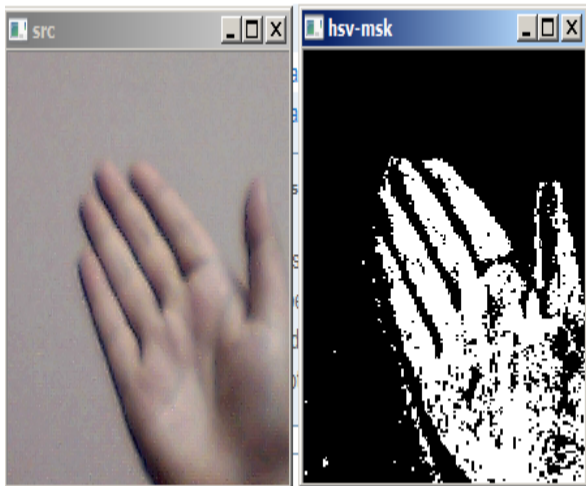
Fig: - Example of noise removal using the point density and connected component analysis
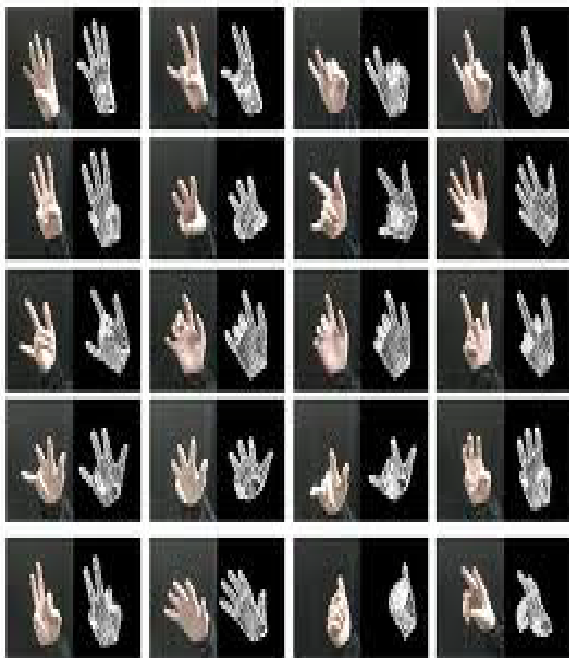

Fig: - Example of hand tracking

III.   Conclusion

With this paper we will conclude that the gesture recognition should be made available in every devices especially in Tablets because of their size and the usage so that people won't get irritated to use the fingers on the big screen and to decrease the time and to make the automobiles more eco friendlier with the human beings.

IV.   Future in Automobiles

- These days we have seen many changes in the music system fitted in an automobile like earlier we had cassette system in 1990's till the end of 2002 after which companies switched to CD system but that was not much success because of the memory of the CD.

- In 2007 the company again switched to new technique which consists of a USB port and that is a big success till now. But now as the new vehicles are introducing with new technique, one more technique we could provide to the users are the tablets of variable sizes, removing the use of music system.

- With the help of the tablets we can provide a large memory and screen which should be inbuilt and can be used easily using hand gestures. If a user wants to 'forward' any song or anything else then it can be easily done by waiving the hand to the right and 'backward' option can also be used.

- These tablets can also be fitted on the back of the headrest of the driver and co-passenger seats and we can do anything in it like playing games having gesture input or we can view videos or we can view the navigation system. These tablets can also be installed with the operating systems.

- These days the automotive companies have remove the noise of the red bell if we are not putting a seat belts and only a red bell is shown in the speedometer console blinking regularly. Our idea is that we can use the gesture recognition using a single camera installed with night

vision sensors too which should be fitted in the speedometer console and this camera should scan the human body till his/her middle and if there is no seat belt then it should sound an alarm and provides a message on the display screen about wearing your seat belt. This camera should be installed on the co-passenger side area too.

- Here we can also use gesture recognition in the case of accidents or for the beginners in driving. In this the camera spotted in the front of driver i.e. in the speedometer which will recognize the size of driver's eyeball and retina. If the eyeball and retina expands while an accident is taking place then the camera sensors will sends a signal to the breaking system in engine to stop the car or it can also done by applying sensors in the front headlight of the car so that its sends signals when it sense that an accident is about to occur so that the car will stop down.

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