Hand Gesture Recognition

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Abstract:
To get more interactive with virtual reality systems, hand gesture recognition appears as a suitable mean. Gesture recognition are of different types making use of other types has been a research topic for many years. However, the use of cameras technology for automatic gesture recognition is in its infant stage. Cameras, with its potential of simultaneously capturing a full 3D point with a sensor in video rates, this provides us with a great potential for real-time measurement of dynamic scenes. With the help of camera the aim is to build a man - machine interface, this will be done using a range in camera for identifying hand gestures. In the near future, gesture recognition technology will routinely add yet another dimension to human interactions with consumer electronic devices such as PCs, media tablets and Smartphones. Gesture recognition is a very exciting prospect, particularly for Smartphones and tablets. Camera-based tracking for gesture recognition has actually been in use for some time. Leading video game consoles Microsoft's Xbox and Sony's PlayStation both have gesture recognition built-in.
There are certain limitations related to gesture recognition like adverse light conditions, variations in the background, and high power consumption. Gesture recognition will likely become a useful feature for all media tablets, portable media players, and portable game players. Over time, it is anticipated that a higher percentage of media tablets will have the technology, rather than Smartphones This research demonstrates the capability of a range camera for real-time gesture recognition applications.

1.Introduction

From earlier times till now interactions between man and computer are performed using keyboards, mouse or different haptic devices. These tools are being used mechanically which is different from our natural way of interacting, these tools do not provide enough flexibility and are rigid for a number of applications. In order to improve the man-machine interaction physical movements can be used i.e. An automatic hand gesture recognition system.

Research has been conducted on hand gesture recognition, making use of digital images and is still ongoing research as we are not able to get the remedy to the previously mentioned problems. Cameras can capture a full 3D point with an array sensor at video rates. They offer great potential. 3D range cameras for automatic gesture recognition is in its initial state. However, some research has been conducted in this area. The main goal of this research is to design and build a man-machine interface using the 3Dimensional information provided by a camera for real time identification of hand. Gesture is basically the sum resultant of all the actions done in front of the camera.

Hand Gesture is basically a process which is based on the hand movements being made and not on the hand shape, the trajectory of the hand movement is being fed in the gesture program when the replica of that movement is being performed in front of the camera the gesture application becomes active and performs the task which is allotted with that specific movement.
 Here the main goal applications are-
 The first one is used to recognize the number of raised fingers that appear in the hand gesture and the second is meant for moving an object in a virtual environment using only a hand gesture.

As hand gesture is a real-time application, the main aim is to obtain the best image of the hand gesture within the lowest possible time. This configuration relies on the relative position of the hand and the camera, the influence of the integration time of the camera, the amplitude threshold, the lighting background of the environment, the surrounding objects and the skin colour of the person. Column 1 is based on "The camera and some parameters for obtaining the best image of the user's hand. Column 2 consists the steps for extracting the hand information from the image from the camera. In Column 3, it's the process designed for analysing the number of raised fingers in a hand gesture being made. Column 4 descriptions about the process used for studying a moving object in a virtual environment using a hand gesture. Column 5 focuses on the applications and improvements that can be made.

1.1.The Camera And Other Parameters For Imaging Sensitivity To Integration Time, Sensitivity To Lighting Conditions, Sensitivity To Surrounding Objects

Integration time is the length of time that the pixels are allowed to collect light. Pixels receiving more light than expected are saturated and do not provide any information in the output image. More the light is collected without saturation, better the hand gesture will be imaged.

Saturation is due to excessive signal and light. Thus one should look for the highest possible integration when the integration time is inappropriate then we obtain just the outline of the hand and when the integration time is ideal, then we obtain the best quality image for hand gesture.

Any additional light directly placed in front of the camera is clearly advisable as it may degrade the quality of the image to be formed by the camera only normal lighting is best advised in the case of gesture operations as it can cause a blur effect leading to spoiling the image.

A Camera produces hand images which are highly dependent on surrounding objects. These objects may cause multiple reflections in different paths of some light rays and generate some blur pixels in the images which do not represent any physical object. In case some of these pixels appear between the hand and the camera, they should be discarded while gathering the hand information via hand gesture.

1.2.Clevage Between The Hand And The Camera Hand Tracking, Integration Time Model, Noise Removal, Range-Based Segmentation

The main basic principle is that there shouldn't be any object between the camera and the hand. Any point between the hand and the camera is considered as a noise. Hand tracking is used to predict the position of the hand in the frame and after calculating the actual position of the hand in the frame, this calculation is corrected and the adjusted value is used for the prediction of the correct position. In case of Integration time Model the approximate distance of the hand to the camera is calculated to avoid saturated pixels, this is used to determine the appropriate integration time for the following image to be acquired; which result of 18 to 52 frames per second. Noise should be removed as it is responsible for the blur image formation as it comes in contact between the camera and the hand so therefore is responsible for the illusion

1.3.Recognizing The Number Of Raised Fingers In A Gesture DTW, Exterior Point Mapping, Smoothing The Outline Points, U-Turn Recognition

Initially the palm is detected by computing. The points within a range are assumed to be a part of the palm. All points in the hand segment are then projected into that plane. The objective behind is to generate an approximation of the outline of the hand. This process starts with the determination of the lower left corner. The other corners are then determined successively. A moving window centred on the current corner is used to collect all other corners information

Smoothing outline points take input data in the form of outer points produced and generates line segments out of that data. With the help of this feature we get an outline better regularized with a noticeable reduction of the number of outline points. The finger detection is being done by a simple trick of U shape the number of U are used for detecting the number of fingers shown in the gesture.

Dynamic Time Warping is basically the DTW technique for measuring the distance between the two points in a trajectory of fingers.

1.4.Moving Object In A Virtual Environment Using A Hand Gesture Depends On Moving The Hand And The Environment

The hand and the virtual object are supposed to be moved in the same direction. Thus the 3D translation and rotation applied to the moving object are obtained from the hand segment. Regarding the translation, the coordinates of the centre of the moving object are the same as the ones of the centre of gravity of the hand. The rotation angles are taken from three orthogonal vector. The first vector joins the centre of the hand to the farthest point of the plane. The second vector is the normal to the plane and the third vector is the cross product of the one and two. After making them unite, the new coordinates are used to define a rotation matrix from which different angles are derived. These rotation angles are used to move the object.

1.5.Applications And Improvements

A gesture is a form of non-verbal communication or non-vocal communication in which visible bodily actions communicate particular messages, either in place of, or in conjunction with, speech. Gestures include movement of the hands, face, or other parts of the body. From home computers till mega factories and hospitals this technology of hand gesture is now in practice as it simplifies the work by just making physical move in front of the camera for example rotation of the hand in clockwise direction is used in laptops for increasing the volume n vice versa, waving left to right or right to left is used for navigating pages .

- Sign language recognition.
- For socially assistive robotics.
- Directional indication through pointing.
- Virtual controllers.
- Affective computing.
- Immersive game technology.

These are some professional applications of hand gestures.

Hand gesture basically depends on two things Hand detection/tracking and Trajectory matching. If these two are having error then the gesture will not be able to act properly. The recognition is basically done matching the trajectory being feed up in the database and if it doesn't match with the hand the hand points are not recognized the improvement scope is basically required in the field of hand detection and noise reduction.

Some improvement features are creating a gesture system which is compatible with all operating systems, it should recognize any kind of hand shape in a small instance of time, detecting hand at different angles and in different background light.

DTW (dynamic time warp) based cluster recognition are the most important as based pre-clustering technique to significantly improve hand gesture recognition accuracy of various graphical models used in the human computer interaction.

2.Refrences
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