A SURVEY ON HAND GESTURE RECOGNITION THROUGH WEBCAM USING MATLAB

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Abstract- Gestures allow peoples to communicate a variety of thoughts and feelings A gesture is a form of non- verbal communication between human and computers in virtual system. Hand gesture is a method of non-verbal communication for human beings for its freer expressions much more other than body parts. The purpose of project is a moving object detection and tracking system with the help of a webcam has been developed to estimate velocity and distance parameters. The method used for object detection and tracking is implemented by using optical flow (Horn-Schunck) in MATLAB simulink . In this paper, a method is described for tracking moving objects from a sequence of video frame. It has various uses, such as augmented reality, traffic control human-computer interaction, security and surveillance, medical imaging and video editing, etc.

Key Words- optical flow, velocity threshold ,velocity estimation, Median filtering , Blob analysis.

I. Introduction-

Daily humans interactions easily use gestures and face expressions while human computer interactions requires understanding and analysing signals for interpretating the desired command that made the interaction unnatural. The objective of this project is to identify and track a moving object within a video sequence. In this tracking of the object is based on optical flows among video frames in contrast to image background-based detection. The proposed optical flow method is straightforward and easier to implement and has better performance. The project consist of software simulation on Simulink.

The Simulink model for this project mainly consists of three parts, which are "Velocity Estimation", "Velocity Threshold Calculation" and "Object Boundary Box Determination". For the velocity estimation, we use the optical flow block in the Simulink built in library. The optical flow block reads image intensity value . The velocity estimation can be either between two images or between current frame and N^{th} frame back. After we obtain the velocity from the Optical Flow block, then we need to calculate the velocity threshold in order to determine what is the minimum velocity magnitude corresponding to a moving object. To obtain this velocity threshold, we have to pass the velocity through couple mean blocks and get the mean velocity value across frame and across time. After that, we do a comparison of the input velocity with mean velocity value. If the input velocity is greater than the mean value, it will be mapped to one and zero otherwise. The output of this comparison becomes a threshold intensity matrix, and we pass this matrix to a median filter block and closing block to remove noise. After this segment the moving object from the background of the image, we pass it to the blob analysis block in order to obtain the boundary box for the object and the corresponding box area. The blob analysis block in Simulink is very similar to the "regionprops" function in MATLAB. They both measure a set of properties for each connected object in an image file. The properties include area, centroid, bounding box, major and minor axis, orientation and so on. In this project, we utilize the area and bound box measurement. In our model, we only display boundary box which is greater than a certain size, and the size is determined according to the object to be track.

II. OVERVIEW OF THE SYSTEM

In this Simulink model, there are couple of major parameters that we need to adjust depending on what the tracking object is. The presented system contain vision system that can capture videos and other is image difference algorithm that can processed for moving object detection and tracking.

Vision System

For many vision-based systems, it is important to detect a moving object automatically [11] .Image processing, analysis, and machine vision represent an exciting and dynamic part of cognitive and computer science. [8] Shown in Fig.1 .Vision System includes high resolution web-camera and hardware card (supported to camera) ,camera is interface to pc. The system overview shown in fig2. The video captured from image acquisition system. Read all images or frame in MATLAB platform the first image is called background or reference image. So all the no of images subtract to background then difference is greater than threshold the object is detected. For tracking side used region props command of MATLAB with properties of centroid , bounding box and area of white pixels. So the bounding box we tracked of moving object.

Fig.1 Vision System

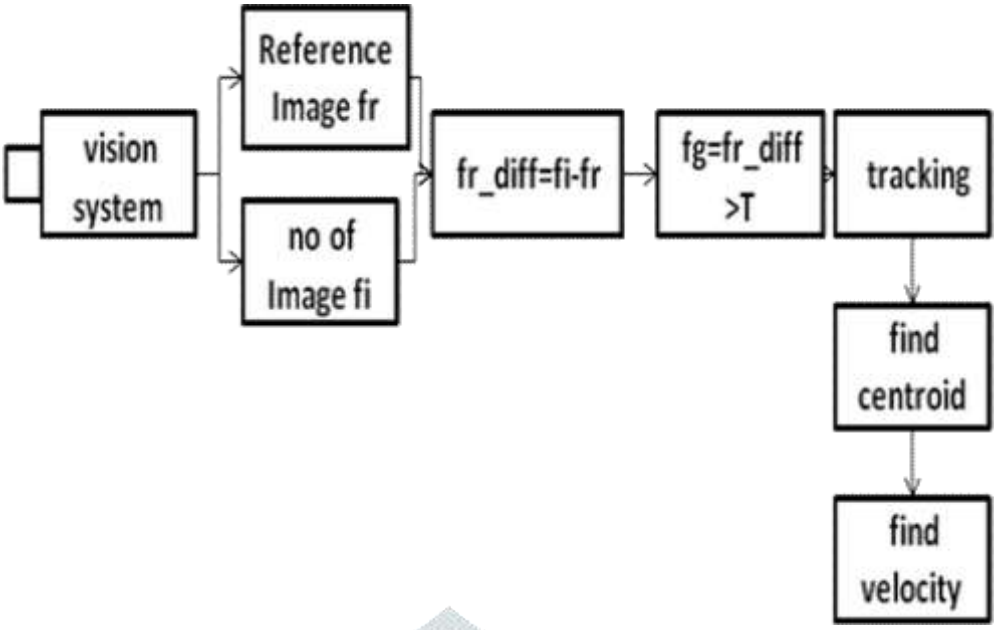

Fig.2 System Overview

There are various techniques for moving object detection and tracking like optical flow, low change of illumination, segmentation background subtraction ,frame difference etc. We formulated the problem in a sequential manner. . The last step will give the final output in the form of a video in a well-structured way

III. VARIOUS TECHNIQUES AND ALGORITHMS:-

The algorithm has following stages,

1) Feed a video file to be tracked as an input.
2) Convert color frames of video to grayscale video frames.
3) Compute optical flow between current frame and N^{th} frame back.
4) From above step we can calculate velocity of motion vectors.
5) Of all pixels of the frame only moving pixels are of moving object.
6) Compute magnitude of vector of velocity which can get through optical flow & take a mean.
7) Use median filter to get threshold image of moving object.
8) Perform blob analysis on thresholded.
9) After that box can be drawn around that image.
10) Moving object tracked in that box.

The main steps used are optical flow and thresholding, median filter and blob analysis.

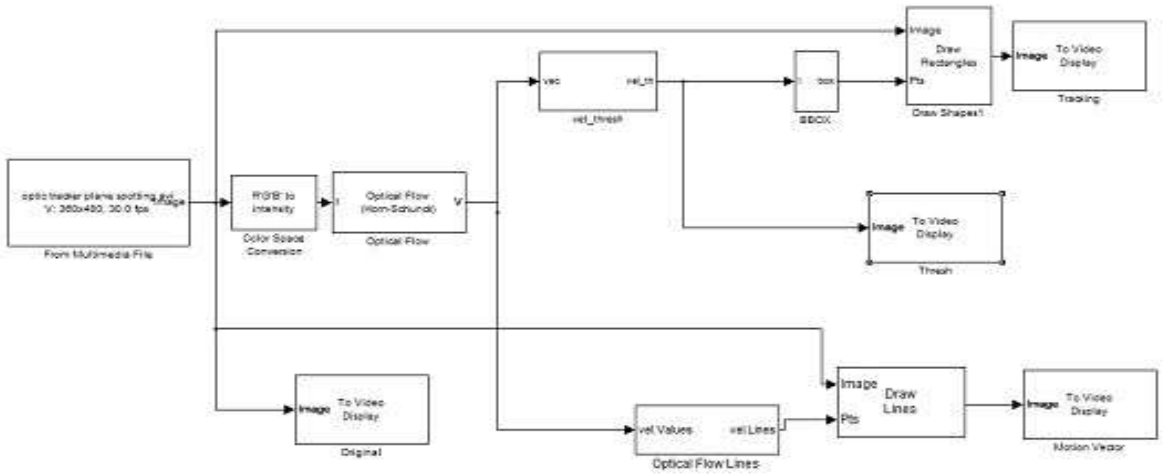

Fig.3 Simulink Block Diagram for Tracking Moving Objects Using Optical Flow.

A. Optical flow

Optical flow is the pattern of apparent motion of objects, surfaces, and edges in a visual scene caused by the relative motion between an observer (an eye or a camera) and the scene. . Optical flow techniques such as motion detection, object segmentation, time-to-collision and focus of expansion calculations, motion compensated encoding, and stereo disparity measurement utilize this motion of the objects' surfaces and edges.[5][6]

Velocity estimation as follows-

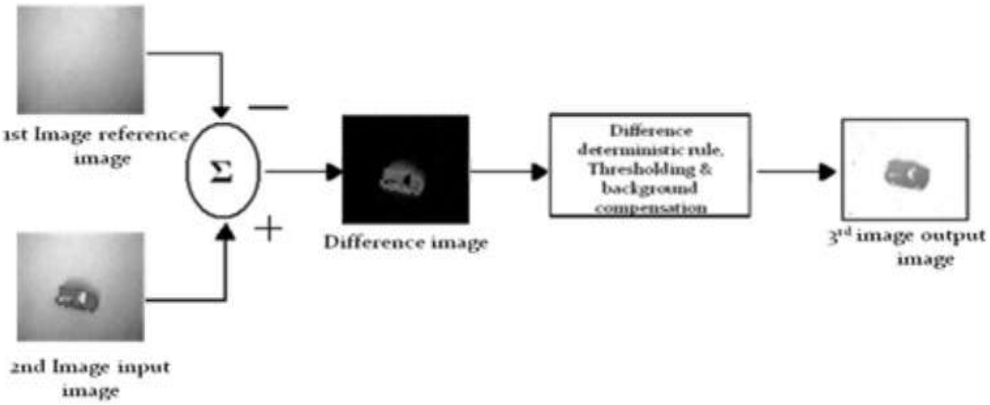

Fig.4. Object detection phase

B. Thresholding

Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images.

1) Method

During the thresholding process, individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value and as "background" pixels otherwise. This convention is known as threshold above. Variants include threshold below, which is opposite of threshold above; threshold inside, where a pixel is labeled "object" if its value is between two thresholds; and threshold outside, which is the opposite of threshold inside . Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." Finally, a binary image is created by coloring each pixel white or black, depending on a pixel's labels.

2) Threshold selection

The key parameter in the thresholding process is the choice of the threshold value (or values, as mentioned earlier). Several different methods for choosing a threshold exist; users can manually choose a threshold value, or a thresholding algorithm can compute a value automatically, which is known as automatic thresholding.They should also be brighter than the average. In a noiseless image with uniform background and object values, the mean or median will work well as the threshold. A more sophisticated approach might be to create a histogram of the image pixel intensities and use the valley point as the threshold.

3). Median Filtering

In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal. A nonlinear digital filtering technique called Median filter, often used to remove noise. Such noise reduction is a typical pre- processing step to improve the results of later processing. Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighbouring entries. The pattern of neighbours is called the "window", which slides, entry by entry, over the entire signal. For 1D signals, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible.

4) Blob Analysis

In the area of computer vision, blob detection refers to visual modules that are aimed at detecting points and/or regions in the input video.

IV. CONCLUSION

We have presented all the techniques and algorithm which we will use for getting results of moving object detection and tracking with the help of optical flow method in MATLAB. By the help of various noise removal filter we will get nice result compare to others [4]. Also in result we will be able to represent the movement of robotic hand in 0 to 180 degree form in a GUI interface. In this paper we have discussed median filtering and blob analysis which is important algorithm we will use to get final expected result.

V. FUTURE WORK

In future this methods , techniques and filters I will use to represent the movement of robotic hand in 0 to 180 degree form in a GUI interface in computer screen and by movement of Human hand , the GUI will direct show the hand movement from webcam or camera, and its gray-code converted image , and the human hand will be replaced by Robotic hand and Robotic hand will be displayed all these in single GUI window at same time. And the Robotic hand which will be shown will have two joints , in which one is elbow joint and another one is arm joint .

It also can be modified to differentiate different class objects in real time video, virtual reality and for video surveillance and also this can be used to perform obstacle avoidance for robots or cars and for medical imaging, video editing, augmented reality,etc.

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