Certain Approaches of Real Time Object Tracking in Video Sequences on Embedded Linux Platform

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Abstract---Video tracking in real time is one of the most important topic in the field of computer Vision. Detection and tracking of moving objects in the video scenes is the first relevant step in the information extraction in many computer vision applications.This idea can be used for the surveillance purpose, video annotation, traffic monitoring and also in the field of medical In this paper, we are discussing about the different methods for the video trackingusing Python Opencv software and the implementation of the tracking system on the Beagleboard XM. Background Subtraction method, and color based contour tracking are the different methods using for the tracking.And finally, we concluded that the background subtraction method is most efficient method for tracking all the moving objects in the frames.

Keywords: Surveillance, python opencv, background Subtraction method, Contour tracking.

I. INTRODUCTION

Video tracking is the process of segmenting a particular area of interest from the different frames and tracking its movement.It can also be defined as the constantly moving dynamic entities under the influence of different factors. The factors can be illumination, change of the light, change of the appearance, scale, rapid movement of the object etc. The changes in the one of these factors can influence the results of the object tracking. The idea of video tracking can be used in the areas of vehicle navigation, video surveillance, automobile driver assistance, robotics, video games, biometrics and in the field of medical sciences.

During the last few years, various researches has been undergoing for the different algorithms used for the tracking the particular segment. Meanshift method, Camshift method[1], Kalman filter[3], Background Subtraction[2] methods are the different methods used for the tracking of the objects in the video scenes. Meanshift method is an iterative process, by computing the meanshift value of the current position of the object and then moves the point to its meanshift value as the new position. The camshift method used for tracking the object is the modification of the meanshift method.

The only difference is in the size of the search window. In the meanshift method, the size of the search window is fixed, but in the camshift method the size of the search window can be adjusted as per the movement of the object. Kalman filter can also be as the predictor- corrector method[4]. It will estimate the position of the object in each frame of the sequence. Kalman filter can reduce the noise in the tracking due to the illumination, the change of the light etc.Color based tracking is by taking the HSV value of the particular color tracking the value in the frames.And the background subtraction method [5] is also a efficient and easy method to find all the moving objects in the frame. In this paper we are discussing about the different techniques use for tracking the objects and the comparison with its results. The rest of the paper organized as follows: section (ii) presents the object tracking system using different methods, section (iii) presents the experimental analysis and its results, and section (iv) presents the conclusion and future scope of the paper.

II. OBJECT TRACKING SYSTEM

The goal of the object tracking is to track the exact position of the object in the next frame by frame. First, we tried to implemented the system using the MATLAB software, but its very slow to process the video. And the other drawback of MATLAB software is that it can work only with recorded video. Thus to ensure the progress of the work, we used the Python Opencv software in Ubuntu 12.04 OS. And the object tracking system implemented on the Beagleboard XM, which is a low cost embedded Linux based board that can be supported the Windows CE, Linux, Symbian OS. The Video camera used is a normal USB webcam which has a 4.0 MP video resolution at 15 fps.Beagle board xm is specifically designed for the open source community. We can access the memory of the hardware by using a μSD card. The experimental setup is shown in the fig 1.

Fig.1. Experimental setup with Beagleboard and web camera

A. Contour Based Color Tracking

The flow chart of the contour based color tracking system is shown in the fig 1.In this method, by finding the HSV value(Hue, Saturation, Value) of a particular color we can track the object. HSV is a color model that describes the colors (hue or tint) in terms of their shade(saturation or amount of shade) and the brightness(value or lamination). In openCV hue (H) ranges from 0-180, Saturation(S) ranges from 0-255 and the Brightness(V) ranges from 0-255.

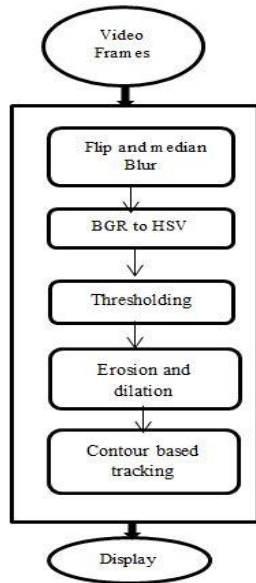Fig.2. Contour based color Tracking method

The Hue value can be calculated as :

$$H= \begin{cases} 60(green-blue)/[v-minimum(r,g,b); \text{ if } v=r \\ 120+60(blue-green))/[v-minimum(r,g,b); \text{if } v=g \\ 240+60(red-green))/[v-minimum(r,g,b); \text{if } v=b \end{cases}$$

The Saturation value can be calculated by :

$$S= \begin{cases} [v-minimum(r,g,b)]/v \; ; \text{if } v\neq 0 \\ 0 \qquad \text{otherwise} \end{cases}$$

And the brightness value can be calculated as:

$$V=maximum(r, g, b)$$

The HSV range of the yellow and the blue color is in between 20-30 and 100-120 respectively. The HSV value of the purple color is in between the 150-170. The video frames are getting in the rate of 15 frames per second.The incoming video frames should be blurred by using the median blur. The BGR image format that are getting using the web camera in real time should convert to HSV for finding the particular colored object. Then it is easier to separate the colored objects. The converted HSV image should be thresholded for getting the correct colored object. The After erosion and dilation of the thresholded image, we can find the contours by using the functions *cv2.findContours*and *cv2.boundingRect*in opencv.The main drawback of the contour based color tracking method is it

can only find one particular colored objects. It is not able to find all the moving objects in the video frames.

B. Background Subtraction Method

Background subtraction method is the efficient method for tracking the objects in real time. Because this method is able to track all the moving objects in the video frames. In this method, the background is kept as stable. The block diagram of the proposed method is given in fig 3. Adaptive thresholding is used to separate the foreground and background. Background subtraction method probabilistically models the background pixel color.
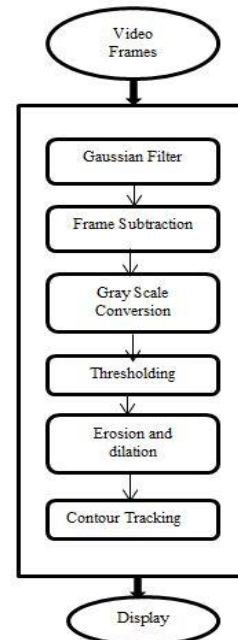

Fig.3. Background Subtraction method

This method will calculate the probability of an arbitrary pixel of the background based on the color. If the probability is greater than the threshold value then the pixel is considered as belongs to the background. Otherwise, it is considered as belongs to the moving object's pixels. If the background pixels are identified, then the next step is to subtract the current position of the image from the background.

From the incoming video frames, the pixels should be smoothening using the Gaussian filter. 'N' and 'N+1'Th frame should be subtracted and the difference frame converted to gray scale image. The resulting Gray scale frame should be thresholded. After the erosion and dilation operation, using the contour tracking we are able to track all the moving objects in the frame. Along with the tracking of the moving objects, it is able to detect the direction of the movement. Python software needs to download the 'numpy' module which supports the array. If the lens movement is greater than zero and the numpy array value is in between -30 and -1, then it will detect the 'LEFT' direction and display as LEFT. Comparing to the other algorithms, this is the most efficient and easiest way to track all the moving objects in the video frames.

III. EXPERIMENTAL RESULTS

We implemented the different algorithms for the tracking using Python opencv software in Ubuntu 12.04 platform. The whole object tracking system is implemented on the Beagle board xm. Our comparison procedures had been tested using the objects which have different shapes and size. The objects are detected and tracked successfully in real time and implemented the system on the Beagle board xm. Yellow, Blue, and purple colored objects are detected and tracked using the Contour based color tracking method. Tracking results are shown in the Fig.4.
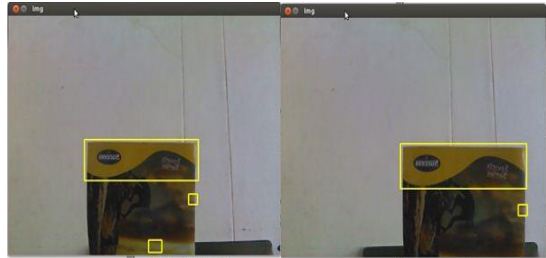
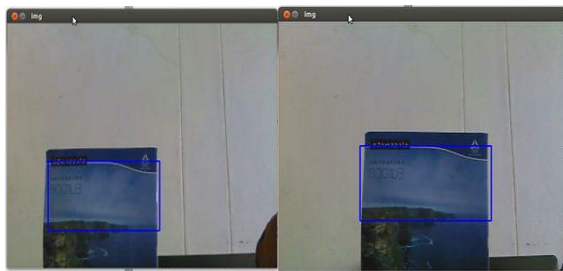Fig.4.1. Yellow color objects detected using contour based color tracking method.

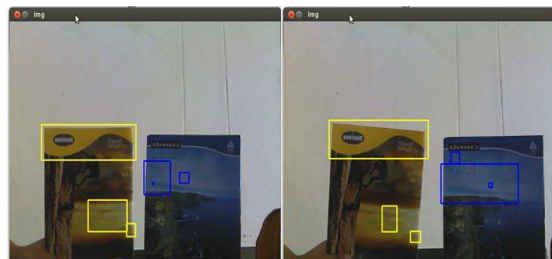Fig.4.2. Blue color objects detected using contour based color tracking

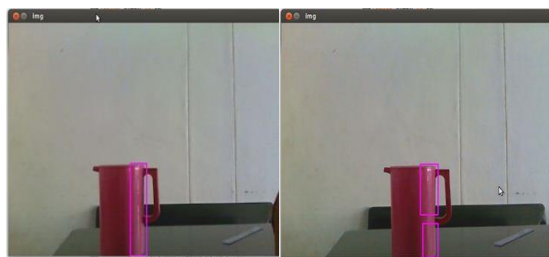Fig.4.3. Yellow and blue color objects detected together in different frames.

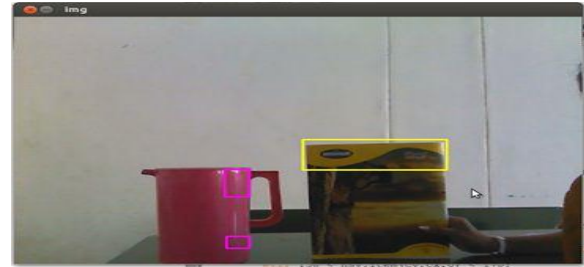Fig.4.4. Purple color objects tracked using contour based color tracking

Fig.4.5. Purple and yellow color objects are tracked together

Background Subtraction method is the method we implemented on the Beagle board xm. This is the easiest and simplest method to track all the moving objects in the frame. The camera used should be kept as stable. Otherwise, due to the movement of the camera, it may detect the objects without any movement. The tracking results by background subtraction method are shown in the figure 5.

Fig.5 Moving Objects are detected using the background Subtraction method in different frames.

IV. CONCLUSION AND FUTURE SCOPE

This paper focus on the simultaneous tracking of the multiple objects in real time. During the comparison test, the various pre-processing methods are applied to the frame pixels. The tracking of the various objects and colors are different from each other in different methods. From this discussion we can conclude that the Background subtraction method is superior to other algorithms. This method can detect all the moving objects by keeping the background stable. The contour based color tracking method and also the available camshift, Kalman filter methods are capable of tracking only single objects. The whole object tracking system is easily implemented on the Beagle board xm.

In the future, we will implement the object tracking system and its comparison work on the Panda board ES, which is the advanced version of the Beagle board xm.

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