International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 10, October-2015

Moving Object Acceleration/Deceleration Detection using Motion of Center of Gravity

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***Abstract*-The basic focus of research is to find the well defined and improved algorithm over the exiting algorithm. The algorithm in use involves the image subtraction and image dilation approach. Object movement characteristics are found by processing the sequence of images obtained from video in the region of interest (ROI). From newly developed program moving objects are indexed and unwanted noisy shadows are removed within the region of interest. In addition to this, it can characterize the moving direction and how it enter and exit from the region of interest. It also finds its characteristics such as count of number of objects, velocity acceleration and deceleration, also trace the objects path. Those features could also be derived from the analysis of the images.**

Index Terms- Image Processing, Video image analysis, Image morphology, image dilation, Image thresholding.

I INTRODUCTION

The main objective of the project is to find the moving object and determining the objects and its characteristics such as acceleration, deceleration, velocity and moving direction etc. The methods for determining the moving objects and its characteristics specified above are Frame difference, Image morphology, Template matching, Centroid determination for the object characteristics detection and tracking. Image subtraction or Frame differencing is defined as the obtaining the difference between two successful frames. The video which is red from a camera is stored and converted into the frames by sampling the continuous video at required sampling rate which is just significant for the object detection and tracking.

Video processing applications are rapidly increasing using video sources such as cameras. The sequence of images obtained from video is used to analyze and detect moving object characteristics such as acceleration and deceleration. Frame differencing is a technique where the computer checks the difference between two video frames. To find the change in the sequence of frames one should check if there is any apparent change in the pixels. This frame differencing helps us in case of finding the position of object as output.

This extracted position is used to determine the template in which the object is situated.

Image morphology is the technique which makes the content in images very clear i.e., the object's area inside image area becomes correctly detectable. This Image morphology techniques increases (stretch) and decreases (shrink) the objects area according to the requirement. Image morphology has two types, Image dilation and Image erosion. Image dilation is the process of dilating (expanding) the area of image by adding the similar extra pixels values. Whereas Image erosion is the process of eroding or (reducing) the area of image by subtracting the unwanted pixels. Image dilation is the process of expansion and Image erosion is the process of shrinking or reduction. To perform the Morphology operation we should convert the frame differenced image into binary image by using the threshold technique. Here we should consider the particular value of pixel as the threshold value, the pixels below which is considered as zero and the pixels above this threshold is considered as one. The threshold obtained such that without losing the required information in the image.

Template matching is very important technique in the object tracking; it is just extracting the objects as rectangular templates from the initial frames, and then this template is used to match with the following frames to track the object in the video. The generated template from each frame is passed on to the tracking module, which starts tracking the object with the input reference template. This module uses the template matching to search the input template in the scene grabbed by the camera. If the object is lost during the tracking due to its appearance, a new template is generated dynamically and used further. This dynamic generation of such templates helps us to track the object in robust manner. The main objective of this study provides a better and enhanced approach for the moving object detection the proposed method is effective in reducing the false alarms which are triggered by a number of reasons, such as bad weather or any natural calamity.

These processes help us to finish off the object detection and tracking but still we have to find the object's motion characteristics. For that we cannot use the template and template matching results directly instead we use the Centroid of the object detected. So now we have to find out the Centroid of the object and we can easily concentrate on

that Centroid to track object and find its motion characteristics. All moving objects in a scene can be detected at a time but no all detected objects can be possible to track at once. But we can concentrate only one object for efficient tracking.

The various problems or difficulties arise while detecting and tracking of objects. The difficulties in object detection and tracking are due to, loss of information caused by the 2d projection of 3d world, Noise in images, object shapes are complex, Illumination changes in scenes, Real time processing requirements, Shadows of moving objects etc.

The problems of object detection and tracking are made simple by imposing constraints on the object shape, size and its motion which is to be tracked. Video processing applications are increasing rapidly now days using camera as video sources. A video is a series of images which are arranged in the correct sequential order. This video is sampled to produce the sequence of frame samples. These frames are used for the further process of detection and tracking of objects. Here we use the stationary camera which is mounted in higher elevation angle. The high image description is required for detecting the moving object and to represent the accurate trajectory of the moving object. But we use the low quality video source to reduce the cost and speed up the computational process. We also described the approach to design the low cost and high efficient system for real time processing.

Some of the natural calamities which affect the processing are background changes due to sunlight heavy rains and irregular object movement. This causes an unexpected breakup in the trajectory of object. Also the light reflection from object surface and its surface characteristics also affect the process of detection by changing the object shape and the moving condition. I am also interested to automate the process of object tracking and detection which is led by advancement in computer technologies and availability of high quality video processing techniques and inexpensive video cameras. The implementation of object tracking system is based on following key concepts such as: Interested moving object Detection in a frame, tracking of object frame by frame, Track analysis is estimated, to recognize their behavior and trajectory of object.

II BACKGROUND AND RELATED WORK

In video surveillance moving object detection is very important step in moving frame flow. There are many several ways to occur the errors in the moving object detection such as, it depends on Dynamic background changes, light condition, illumination and reflection. So the high level techniques are needed for exact object detection from the given image sequence. The literature concerns on those types of application and it also depends on several factors.

In [1] the problem of object detection and tracking of moving object in a video processing is defined and the various several methods are suggested to overcome this problem. The system result from this relies on the graph representation of moving objects. This helps us to derive and maintain a dynamic template of each moving object from their temporal coherence. To characterize and to find the trajectories as optimal path in a graph this inferred template and graph representation is used. In very challenging situation the system tracker allows to dealing with partial occlusion, stopping and going motion. Advance blob detection technique is used on the dynamic template to detect the object. Here it is very difficult to detection of cluster of moving object in sequence. All these methods are basically bound with optical flow, continuity of space and time, template matching and background subtraction.

In [2] describes the fast and robust detection and tracking of moving object. It is based on the using the lines computed by the gradient based optical flow and an edge detector. Gradient based optical flow and edge detector is a very good method for accurate computation of velocity and much attention is not paid on creating systems for the detection and tracking objects through this feature. The edges extracted using optical flow and edge detector are restored as lines and background lines of previous frame are subtracted. Detected objects are tracked and each object has the state for handling occlusion and interference. Using the snakes to the clustered lines contours of object is obtained. It is computationally difficult and requires additionally storage of many frames in memory. Template matching process has to keep all shapes and compare with each. It needs more computational power for recognizing the exact shape in database. For real time image processing, segment and track closely interacting objects and deforming on video is very challenging task.

The popular for detection and tracking the object is optical flow [3] method. The motion flow vectors are used to extract the moving objects. Optical flow has very high computational difficulty and requires high level processing capabilities, so real a time implementation is difficult or expensive.

In [4] propose a detection free system to segment a multiple deforming and interacting people in a video. The performance of the detection based tracking methods is often limited by people detectors fail under close agent interaction. Motion information often fails to separate the similarly moving agents or group distinctly moving articulated body parts. So formulate the video segmentation as group partitioning in trajectory domain and group them into foreground and background based on trajectory saliencies and use foreground trajectories as graph nodes. Here objects connectedness is incorporated into our trajectory weight matrix based on topology of foreground: set repulsive weights between trajectories that belong to different connected components in any frame of their time intersection. Attractive weights are set between similar moving trajectories. Motion information is complemented by information from foreground topology and our

spatiotemporal segments are interpreted as connected moving entities rather than just trajectory groups of similar motion. All cues are computed on trajectories and naturally encode large temporal context, which is important for resolving local in time Disturbances. So for tracking moving object in video sequence this method uses dense point trajectories.

In moving object detection of images we widely use Gaussian mixture background model. In traditional Gaussian mixture model usually considers the time continuity of pixels and without considering the pixels spatial similarity, it establishes the background through statistical distribution of pixels. This will cause noise, imperfection and other problems. In [5], proposes a new Gaussian mixture modeling approach that encrypts both color and gradient data of spatial data, and integrates it to establish the Gaussian mixture background. This Gaussian mixture background model is able to easily detect the single separated object in static background.

In [6] we mainly concentrate to develop robust and reliable object tracking model, and is an efficient way to improve security services. This object tracking system uses the frame differencing and template matching. To detect the moving object in a video, frame differencing is used frame by frame in an efficient manner. By employing the efficient and robust template matching algorithm we generally track the detected moving object by frame differencing. The change in orientation and position of object are ensured by templates used for matching purpose and it is not difficult to tracking system. This system is cost effective and used in various applications as a surveillance tool. Also in [6] use this simple method for detect moving object and analyze the direction. Here time-space variation and acceleration characteristics of moving object are discussed.

III EXISTING SYSTEM AND PROBLEM STATEMENT

In existing system the single separated system can be detected in static background by using Gaussian background model. This is complex and time consuming but effective method. This also suits well when object's background is moving as well. The object will be modeled for the foreground initially and then it will be adopted into background after sometime. The fundamental approach for the tracking of object is by frame differencing, and it is widely use to bind the moving object. Problem statement is for developing the new system which is improved version of the existing system of moving object detection. This new system uses the background subtraction and time to space variation on specified region of interest to detect to moving object and its direction. The acceleration and deceleration of the object is also obtained.

IV THE PROPOSED MODEL

The system which is proposed here as shown in Fig.1, There are several steps in the object detection and tracking. They are,

Step1: Input the video and is sampled to give the series of frames. This sampled image sequence is applied to the next block.
Step2: Image Background Subtraction is made using the background model. The image background model is designed by considering the first frame of the sequence.
Step3: The Image obtained from the background model is then operated using image morphology to obtain the clear structure. Here we perform the Image dilation and erosion to obtain the correct structure of the object detected.
Step4: The object which is detected is counted using a counter.
Step5: The object is then tracked using the template matching technique. We have to find the template in which the object is present then after the object is tracked using the template matching technique.
Step6: The output of the Tacked results are now determined and plotted using the graph plot through the center of gravity.
Step7: Centroid is detected first and then using this we can detect the various motion characteristics and display those motion characteristics.

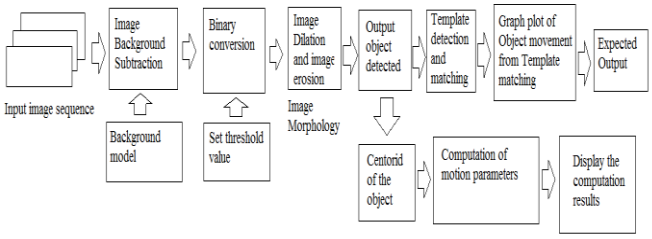

Fig.1.1 Block Diagram of Proposed System for moving object acceleration and deceleration detection.

V METHODOLOGY

Experimental image sequences are obtained from the Stationary Camera fixed in the region of interest. Input images are directly obtained from the video which is captured using the Camera by sampling it at particular sampling rate. The video recording is the done at 30 frames per second and with a frame size of 320x240.

The video which is captured is sampled at the specified sampled rate. After sampling image subtraction is performed. Then the results obtained is then converted into binary image sequences using the thresholding operations. The thresholding is mainly based on the intensity values of the object. By doing the thresholding operation on colored image we get the binary image. The binary image we obtained is morphologically operated to obtain the exact structure of the objects. Thus the objects are detected and structured. After detecting the objects using the initial image sequences we create the templates. Those templates created are using to track the trajectories of the objects by matching these templates with the following images sequences. By finding the Centroid of the object we can easily find the velocity and acceleration by finding the distance between the pixels of the Centroid of an object in the successive Image sequences. Then for finding the object moving direction image trajectory data is used. To find the object count the video sensors are used.

The following algorithm gives the better idea for the object detection and tracking.

Algorithm:

- Conversion of video into frames
- Preprocessing on each frames
- Initialization of the background frame
- Subtraction of the background frame and current frame
- Segmentation using thresholding (binary image conversion)
- Morphological filtering on the image
- Graph plotting and find the path of object
- Mathematical analysis and velocity of object detecting.

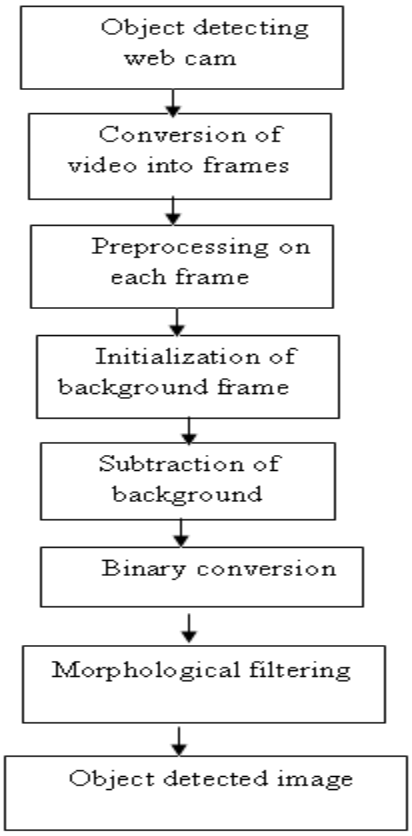

Fig.2 Detailed flow diagram of the Object detection and tracking part-1.

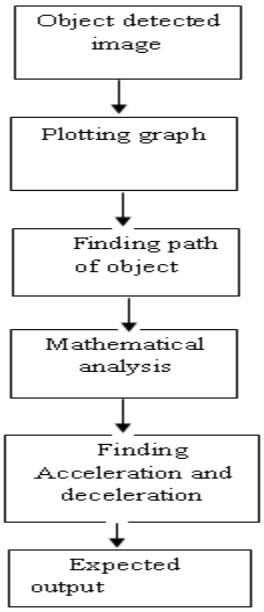

Fig.3 Detailed flow diagram of the Object detection and tracking part-2

VI EXPECTED RESULTS AND DISCUSSION

The results obtained from above methodology are shown below.

Fig.5 shows the video frame such frames of sequence are taken as the input for this Moving Object Tracking system. Using those we perform the following operation such as the image subtraction, Image morphology, Template matching etc.

Fig.6 shows the moving object detection in the frames of sequence. To detect an object we use frame differencing method. Frame differencing as shown in methodology take two successive frames as the input and output the difference between those frames in the form of binary image. In binary image White regions are considered as the object.

Fig.5 Input video frame

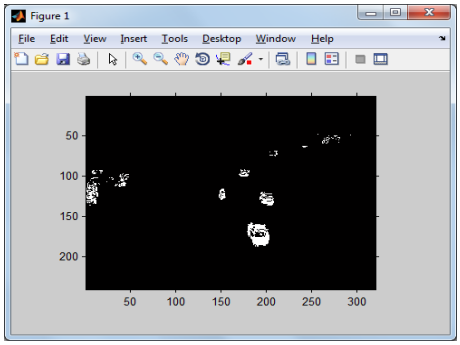

Fig.6 Object detection using Frame Differencing

The Fig.7 shows the bounding box surrounding the moving object detected and is used as the representation of the Object in the video which helpful to track the object.

In Fig.8 Motion vectors are represented this shows us the movement detection of object in the video sequence. Using this we find the path of the object and moving direction of the objects.

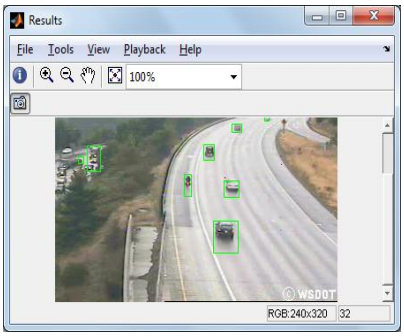

Fig.7 Representing Object detected using bounding box

Fig.8 Motion Vector Representation

Velocity found using the motion vectors detected. This is represented using the graph as shown in the Fig.9. Here Velocity is found by the distance between the Centroid points of the object in different frames with respect to time.

In Fig.10 the variation of velocity is represented in terms of acceleration. The graph in Fig.10 shows the plot of acceleration with y-axis as the velocity and x-axis as the time.

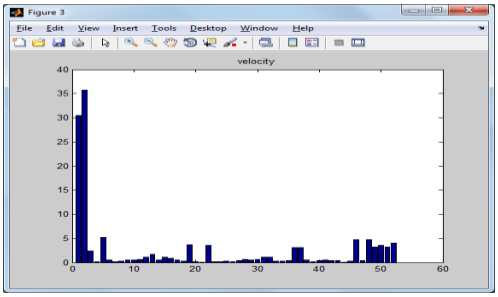

Fig.9 Velocity of the objects tracked

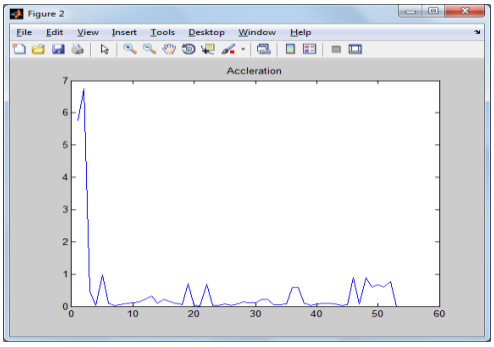

Fig.10 Acceleration

Fig.11 represents the path of the object obtained using the template matching technique and is represented using the graph with Y co-ordinates and the No. of frames as the co-ordinate axes. In the absence of object the path is represented only along the x axis co-ordinate.

Fig.12 is showing the object count. Figure consists of two boxes. Whenever the object enters that box increase the counter by one. Using these boxes we can also find the objects moving direction.

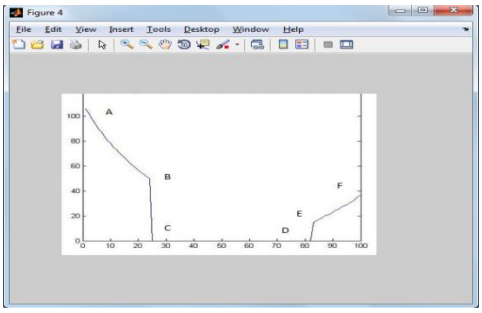

Fig.11 Path Representation of object

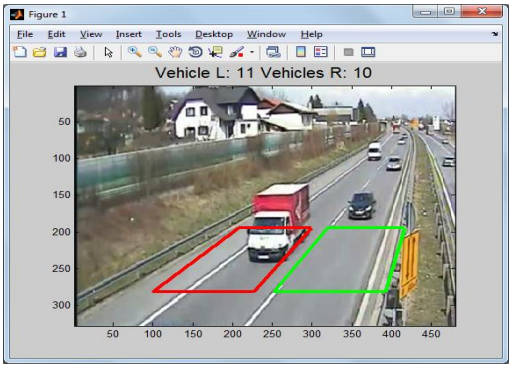

Fig.12 Object Counting

VII CONCLUSION

In the above system defined, object is detected and tracked using the video processing techniques which is very efficient compare to various analog techniques. The system designed is the embedded one which consists of various parameters related to the moving objects in the video. Various problems arise during this process of tracking in the video processing is addressed. In this process the movement is actually detected using the parameters such as velocity, direction and acceleration. The proposed work is based on the template matching and the center of gravity which are extracted from video.

It is possible to reduce the noise and moving trajectory of the object detected by further processing of video with the kalman filter

ACKNOWLEDGMENT

I should gratefully remember my guide Ms. Veena.R, Project coordinator, our beloved HOD of Electronics and Communication Dept. and finally Principal of SJCIT for their support by providing good platform to complete my project successfully.

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