# A Study on Moving Object Tracking Using PTZ Camera in Video Surveillance System

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***Abstract* - Tracking people or moving objects across a PTZ camera and maintaining a track within a camera is a challenging task in applications of video surveillance. The goal of object tracking is segmenting a region of interest from a video scene and keeping track of its motion, positioning and occlusion. The object detection and object classification are preceding steps for tracking an object in sequence of images. Object detection is performed to check existence of objects in video and to precisely locate that object. Then detected object can be classified in various categories such as humans, vehicles, birds, floating clouds, swaying tree and other moving objects. Object tracking is performed using monitoring objects' spatial and temporal changes during a video sequence, including its presence, position, size, shape, etc. Object tracking is used in several applications such as video surveillance, robot vision, traffic monitoring, Video in painting and Animation. This paper presents a study on moving object detection and tracking techniques using PTZ Camera.**

***Index Terms* - Video Surveillance System, Object Detection, Object Tracking, PTZ Camera , PTZ Camera Controller**

## I. INTRODUCTION

Video surveillance is an active area of research. Object detection and tracking in video surveillance systems are commonly based on background estimation a subtraction. The primary focus of today's video surveillance systems act is the application of video compression technology to efficiently multiplex or store images from a large number of cameras onto mass store devices (video tapes, discs).

Object detection is to locate objects in the every frame of a video streams. It is the first step in video surveillance and it detects the moving objects after that objects are classified and tracked. There are challenges in moving object detection such as noise, lighting changes, dynamic background, occlusions and shadows. Tracking is defined as, "Locating a moving object or multiple objects over a period of time" and it shows the trajectory or path of an object in image sequence over time by locating its position in every image". There are two major components of a tracking system target representation and localization. So, for tracking the objects in video the first step is to detect the objects.

Pan-tilt-zoom (PTZ) cameras are one of the advanced security cameras in the market. These cameras have the ability to cover a very far field and can acquire high resolution of images. These cameras are deployed mainly for perimeter surveillance applications where the security guards have to monitor the intruders from a long distance. Although there are intrinsic advantages of using pan-tilt-zoom cameras, their application in automatic surveillance systems is still scarce. The difficulty of creating background models for moving cameras and the difficulty of optical geometrical projection models are key reasons for the limited use of pan-tilt-zoom cameras.

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## II. LITERATURE SURVEY

In paper [1] , an object tracking method is proposed and applied to human upper body tracking by IP PTZ camera in online application. Human body tracking determines the location and size of each human body for each input image of a video sequence. It can be used to get images of the face of a human target in different poses. The proposed method detects in every frame, candidate targets by extracting moving objects using optical flow, and sampling around the image center. The target is detected among candidate target samples using a fuzzy classifier.

In paper [2] , they present an effective approach for active tracking with a PTZ camera. A new framework for active Tracking of non-rigid objects is presented. The background subtraction with Gaussian Mixture Model is adopted for object detection and the region covariance is adopted for the object descriptor. Then, while tracking the target, a local search method with motion compensation is proposed for active tracking and acceleration. A near real-time system is established combined with the tracking algorithm and PID controller mentioned above. The performance of the proposed method is evaluated by indoor and outdoor video sequences. Experimental results illustrate the proposed method feasible and validate the efficiency and accuracy of our system.

In paper [3] , a configuration of an automatic real-time face tracking system is proposed. The proposed system is considered as a cost-effective solution for online education platforms which performs competitively compared to costly conventional systems. The main contribution of this paper is the low-cost and flexibility in implementation, namely, mobility. Simulation results show that the proposed system minimizes the reaction time of the camera regarding movement to provide a smooth and natural motion regarding the transition between movements.

In paper [4] , they proposed a PTZ Camera based human positioning tracking system with several analyses, which is Called CPTS, is developed. The key components of a fully automated system can track and positioning the human in a real-time, indoor surveillance environment. The motion vector out of moving object can be found with dynamic background, it affords the change of camera parameters to control the camera movement. Experimental results have demonstrated that CPTS would be a feasible solution, and make tracking and positioning accurately. The performance and easily implement is merit of this algorithm. Through that we can provide scalability in the IP-surveillance system.

In paper [5] , they designs a PTZ tracking system which can track a moving target in large complex scenes. The features applied to track are three-dimensional background–weighted histogram of the target model and could be updated online which makes the system tolerate change of illumination. The PTZ module keeps the target in the center area of the camera's FOV by controlling pan and tilt speeds according to the target moving. Experimental results show that the proposed algorithm can realize stabile and real-time tracking in complex scenes. But the system is still affected by the complete occlusion or the interference which has the similar histogram with that of the target.

### *2.1 Object Detection*

The goal of object detection is to detect all instances of objects from a known class, such as people, cars or faces in an image. Typically only a small number of instances of the object are present in the image, but there is a very large number of possible locations and scales at which they can occur and that need to somehow be explored. Object detection systems construct a model for an object class from a set of training examples.

Object detection is to locate objects in the every frame of a video streams. It is the first step in video surveillance and it detects the moving objects after that objects are classified and tracked. There are challenges in moving object detection such as noise, lighting changes, dynamic background, occlusions and shadows.

Object detection has many applications in many areas of computer vision, including image retrieval; pose estimation, and video surveillance etc. For object detection processing time and accuracy rate are two very important factors.

**Steps for Object Detection:-**

1. Acquire Frames in bit stream
2. Image Preprocessing
3. Feature Extraction and Selection
4. Recognition
5. Output/ Tracking Object

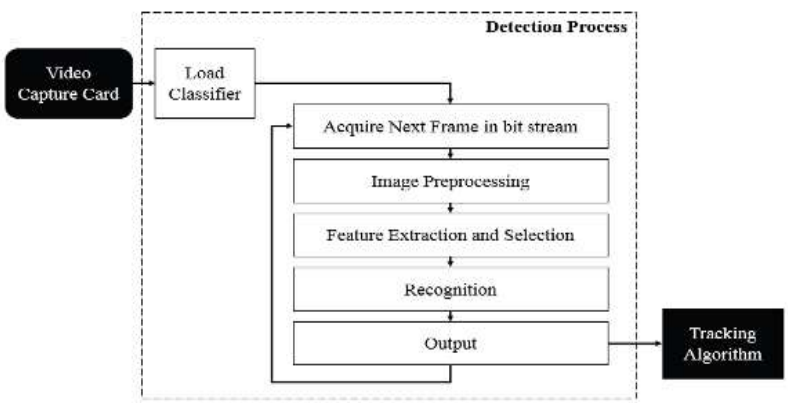


Figure 1.Object Detection Process[3]

### *2.2 Object Tracking*[6]

Tracking is defined as, "Locating a moving object or multiple objects over a period of time" and it shows the trajectory or path of an object in image sequence over time by locating its position in every image". There are two major components of a tracking system target representation and localization. So, for tracking the objects in video the first step is to detect the objects.

Object tracking can be applied in many areas like automated surveillance, traffic monitoring, human computer interaction etc. Challenges in the tracking include noise in frames, complex object motion and shape, occlusion, change in illumination etc**.** Tracking objects in video sequences of surveillance camera is nowadays a demanding application. Tracking objects is much more challenging in video sequences to improve recognition and tracking performances. There are many existing methods of object tracking but all has some drawbacks. Some of the existing models for object tracking are contour-based models, region-based models and feature point-based models.[6]

A. **Contour-based object tracking model** Active contour model is used for finding object outline from an image . In the contour-based tracking algorithm, the objects are tracked by considering their outlines as boundary contours. Thereafter these contours are updated dyna mically in successive frames.

The discrete version of this approach is represented in active contour model. The discrete version of this approach takes the advantage of the point distribution model to limit the shape. However, this algorithm is highly sensitive to the initialization of tracking, making it difficult to start tracking automatically.

B. **Region-based object tracking model** The region based object model bases it's tracking of objects on the color distribution of the tracked object . It represents the object based on the color. Hence, it is computationally efficient. However, its efficiency is degraded when several objects move together in the image sequences.

It is not possible to achieve accurate tracking when multiple objects move due to occlusion. Also, in the absence of any object shape information, the object tracking is largely International Journal on Information Theory (IJIT), Vol.3, No.3, July 2014 32 dependent on the background model used in the extraction of the object outlines.

C. **Feature point based tracking** algorithm In Feature point based model feature points is used to describe the objects. There are three basic steps in feature point based tracking algorithm. The first step is to recognize and track the object by extracting elements. The second step is to cluster them into higher level features. The last step is to match these extracted features between images in successive frames.

Feature extraction and feature correspondence are the important steps of feature based object tracking. The challenging problem in feature point based tracking is feature correspondence because a feature point in one image may have many similar points in another image, and hence results in feature correspondence ambiguity.

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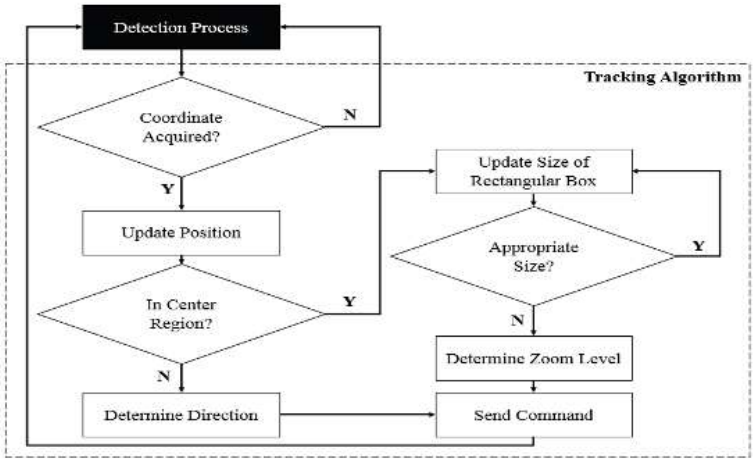


Figure 2. Object Tracking[3]

### *2.3 PTZ Camera Controller*

Each movement of the camera is controlled by a command in the form of a single packet consisting of 3 to 16 bytes. To ensure each command is properly transmitted and executed, an ACK (Acknowledgement) signal is transmitted back to the controller as shown in fig. In the case of executing more than two commands, the command queue is possible to overflow and eventually ignore later commands unless the ACK signal is transmitted back to the controller in a timely manner.

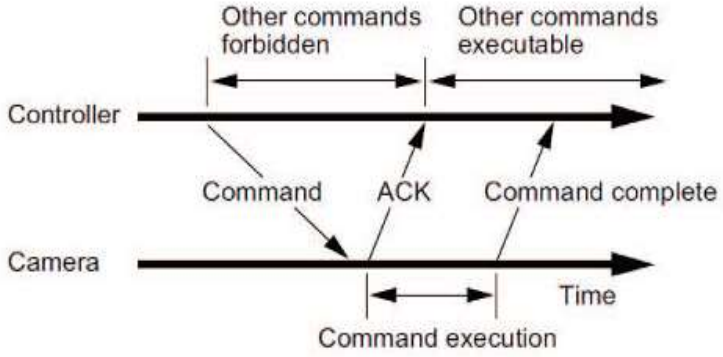


Figure 3. PTZ Camera Controller [3]

## III. CONCLUSION

Nowadays, real-time and automatic moving target tracking is a key technique in computer vision, target recognition and security surveillance. To enlarge the surveillance area, PTZ camera is employed in many surveillance systems, and the camera should be steered automatically to let the target in the center area of the camera's FOV.Moving Object Detection and Tracking is an important research field of Video Processing for Military and Civil application. For Moving object detection and tracking many algorithms are used for the Better Performance, Efficiency and Accuracy and also used the PTZ Control Camera for Pan , Tilt and Zooming Feature.

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