

# Indoor Surveillance System in Dynamic Environment

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**Abstract:** In the past few years, it has wide applications like video surveillance in highly secure areas. This paper aims to detect any intrusion with a high accuracy and reduce false alarms. This paper proposes a method that uses moving object detection and extraction algorithm to detect the anomaly. It has always been difficult to monitor an indoor area like a bank locker or a room containing confidential documents which requires 24-hr surveillance. The most difficult operation is to monitor these areas even under dynamic environment to prevent any intruder to steal information. The background adjustment includes intensity, brightness and motion due to fan etc. to get a clear view of subject. The paper is currently proposed to integrate with single external camera only. The resolution of the images that will be processed are limited with respect to the camera capability. Efficient video surveillance system which is cost-effective as well as highly accurate, with a user-friendly GUI.

**Keywords:** Human Detection, Object Detection, Static camera, Reference Background, video surveillance, Blob.

## I. INTRODUCTION

Insecurity and crimes constitute some major problems facing the immediate society today. People live with a fear of being attacked by burglars, vandals and thieves. Today in the society security is one of the major issues and having a 24\*7 human eye is just impossible. In order to be secured of safety, it has become a necessity to realize and manage smart surveillance system. Despite all the efforts, resources and time that has been devoted to the development of tools that will reduce crime rates and make the world safer place to live, these problems are still increasing substantially. These give rise to the need for an increasing development in the technology of motion sensors. Even with the introduction of the alarm system which has greatly reduced the level of insecurity, there is still a problem of false alarm which need to be minimized. Also, changes in illumination, noise and compression artifacts make motion detection a challenging problem. In order to achieve robust detection, there is a need of a new technique i.e. Using various image processing algorithms which will detect motion. This system will provide security and ensure alarms are activated only when an unauthorized person try to gain access to the protected area.

## II. LITERATURE SURVEY

### A. Existing System

Surveillance in dynamic environment has been an important component in video surveillance system. For example, like [4] too uses background subtraction method and also saliency detection with no supervision as such. The only disadvantage is that these system are perfect for static background whereas for dynamic background results are poor. [3] Uses the concept of multiple agent system where static cameras & mobile robots are used which learn the environment first and learn and start surveillance based on the learnt environment, detects abnormalities and alerts. This concept is still to be implemented and is purely theoretical. [2] Uses modelling of background and various filters. This system was successful in implementing for dynamic environment but the number of false alarms was too high. The novel idea of this paper was to overcome these shortcomings and to propose such a system is purely based on image processing that does not use any expensive materials but only one external camera and otherwise pure algorithm. The algorithm consists of usage of two frames one which is a reference frame & the other being a current frame. The frames are adjusted w.r.t brightness and then compared. The output gives the value in the form of a Histogram which indicates if an intruder is detected or not. The system comes with a G.U.I with an authentication feature to check for genuine users only.

### B. Loopholes in Existing System

The existing system [1] was successful in implementing a system for dynamic environment but had some flaws such as high number of false alarms which resulted in low accuracy. The system [2] was still a theoretical concept and was yet to be implemented which means results were not fixed, as well the cost of building the system was way too high since it uses 3 separate robots which needed learning process at first and then supervision and a human presence to monitor it. Although [3] requires no supervision and no training period but the results are still inconclusive and may lead into false alarms or may even fail to detect an intruder.

### C. Need of Proposed System

This paper proposes such an idea which will overcome all the above loopholes by improvising existing system [4], by modifying its algorithm in such a way that it will reduce false alarm, being a low cost idea which may require human supervision to avoid unnecessary errors leading to dis-functioning of the system.

### III. PROPOSED SYSTEM

This paper mainly deals with the constraint of dynamic environment. Dynamic Environment means an environment which is not fixed i.e. it is always in motion due to some or the other external factors. These external factors may include motion produced by fan which sets curtains in motion OR light i.e. variations in brightness or contrast. Currently, the two constraints/parameters decided for this paper is Intensity of light & motion produced by fan. Let us take an example of these two parameters :- 1) Consider a room for surveillance. The room may contain windows let's assume. There are seasonal changes (weather conditions) i.e. change in light intensity. Let's assume there is a tree outside the window whose image developed under light may be of a human. If that image is seen inside our room the surveillance may pick it up and may view it as an intruder. This will lead to a false alarm. 2) Consider the same room with curtains near the windows. There may be an electric fan being switched on which will produce some wind which will set the curtains on motion. Surveillance may pick it up as a motion of an intruder and may raise a false alarm. This paper aims to reduce these irregularities by using an existing algorithm which will be able to differentiate between an actual intruder and a pseudo intruder. Upon detecting an intruder it will raise an alarm which will notify the person in-charge. As soon as notifying is done video is saved for evidence purpose thus fulfilling the purpose of surveillance system.

The following approaches are used:

- A) Background Subtraction and Object Detection
- B) Optimization to get rid of Background Interference
- C) Human Detection

#### A. Background Subtraction and Object Detection

The surveillance is done for the monitor an indoor area like a bank locker or a room containing confidential documents which requires 24-hr surveillance. The first step is to detect is there any motion in the area. Initially, the software switches on the webcam in video mode. The first step is to extract the frames from the video. Motion Detection is done in the following way

- 1) *Temporal Differencing Detection:* Temporal differencing is based on frame difference which attempts to detect moving regions by making use of the difference of consecutive frames (two or three) in a video sequence. This method is highly adaptive to static environment. So temporal differencing is good at providing initial coarse motion areas. In this

method, the two subsequent 256 level grey images at time  $t$  and  $t+1$ ,  $I(x, y, t)$  and  $I(x, y, t+1)$  are selected and the difference between images is calculated by setting the adaptive threshold to get the region of changes. The adaptive threshold  $T_d$  can be derived from image statistics. In order to detect cases of slow motion or temporally stopped objects, a weighted coefficient with a fixed weight for the new observation is used to compute the temporal difference image  $I_d(x, y, t)$ . Temporal difference is a simple method for detecting moving objects in a static environment and the adaptive threshold  $T_d$  can restrain the noise very well. But if the background is not static, the temporal difference method will be very sensitive to any movement and is difficult to differentiate the true and false movement. So the temporal difference method can only be used to detect the possible object moving area which is for the optical flow calculation to detect real object movement.

- 2) *Optical Flow Detection:* Optical flow is a concept which is close to the motion of objects within a visual representation. The term optical flow denotes a vector field defined across the image plane. Optical flow calculation is a two-frame differential method for motion estimation. Such methods try to calculate the motion between two image frames which are taken at interval  $t$  at every pixel position. Estimating the optical flow is useful in pattern recognition, computer vision, and other image processing applications.

#### B. Optimization to get rid of Background Interference

After detecting the motion, it needs to classify the motion as the motion is due to intruder or it's a background motion such as curtains. In order to avoid the false alarm it needs to perform optimization to get rid of moving object. For that the following processing is required.

- 1) *Double Background Filtering with Morphological Processing:* By using the optical flow method, two types of optical flow information are obtained, which are the interference information of image background and the information of image pixel with any possibility of real object movement. In the real situation, because of the environment such as light, vibration and so on, the interference information of the background still can be detected. Sometimes, it is difficult for the real object movement to be differentiated from the background interference. The method of DBF with morphological processing is used to get rid of the background interference and separate the moving object from it. Firstly, the DBF method is used to stabilize the optical flow information of background interference but the background interference cannot be eliminated completely and for the background with moving object, although the moving object area can be detected, the background interference still exists. So to get rid of the background interference and preserve the

information of moving object at the same time morphological processing method is used.

### C. Human Detection

After detecting the motion is due to object, it needs to classify the object. For identifying the object as human the target persons' height has to appear completely in the scene as the ultimate measurement is the height. It is necessary to have the complete shape of the person in the image. It is not necessary to have person in movement because the detection is based on frame differencing, comparing every frame with the background scenario, which is previously computed, then a square box around the region of interest in order to work with surface or with the width/length ratio of the box. The system draws the rectangle which, allegedly, fits a human body silhouette i.e. blob. According to Vitruvius' proportions the ratio between the range 1.6 to 1.8 then object is human.

## IV. DESIGN:

### A. Flow Diagram

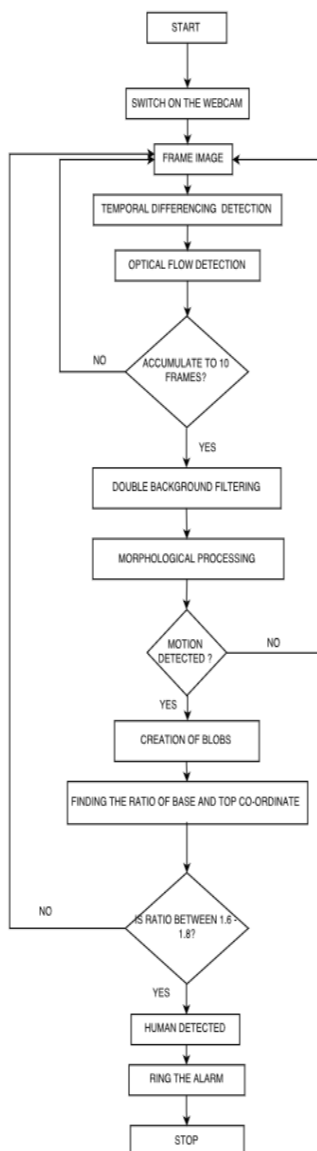


Fig.1 Flow diagram of Human Detection

### B. Block Diagram

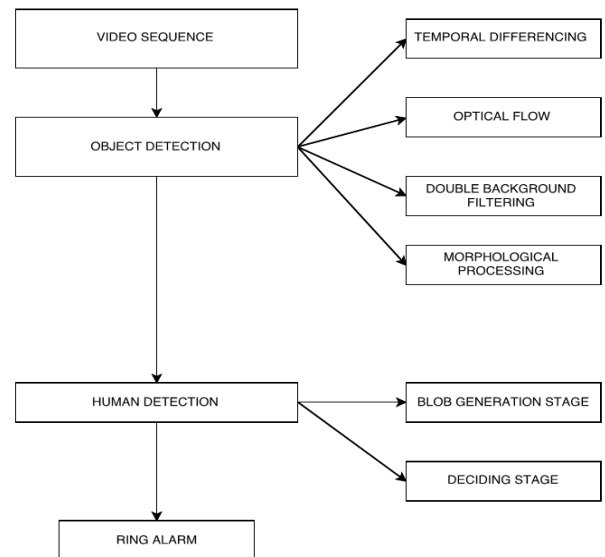


Fig.2 Block Diagram of Human Detection

Fig.2 shows that detection process generally occurs in 2 steps: object detection and human detection. Object Detection has to go through following steps: Temporal Differencing, Optical flow Detection, Double Background Filtering & Morphological Processing. At the end of this step, it completely get rid of background interference. Now in the next step i.e. Human detection it check whether the object detected is human or not. It has 2 stages: Blob generation stage & Deciding stage. At the end of 2<sup>nd</sup> step in deciding stage, it decides whether object detected is human or not. And if human is detected then the system will raise an alarm.

## V. CONCLUSION

The existing systems have some or the other cons such as inaccurate or high cost or have algorithmic errors which needs to be overcome so as to get an efficient surveillance system. The main aim of this paper is to design such a system which will work mainly in dynamic environment in indoor areas such as bank lockers or a room containing fans curtains where false alarms needs to be reduced which may be induced due to motion of curtains by motion of fans or change in light intensity due to external factors like seasonal changes.

## REFERENCES

- [1]. Antoine Monnet, Anurag Mittal, Nikos Paragios, Visvanathan Ramesh, "Background Modelling and Subtraction of Dynamic Scenes"
- [2]. Annalisa Milella, Donato Di Paola, Pier Luigi Mazzeo, Paolo Spagnolo, Marco Leo, GraziaCicarelli, TizianaD'Orazio, "Active Surveillance of Dynamic Environment using a Multi-Agent paper"
- [3]. Ijay Mahadevan&NunoVasconcelos, "Background Subtraction in highly dynamic scenes"
- [4]. [4]Nan Lu, Jihong Wang, Q.H. Wu and Li Yang, "An Improved Motion Detection Method for Real-Time Surveillance"