Pallavi S. Bangare, Nilesh J. Uke, Sunil L. Bangare / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp.2646-2649

An Approach for Detecting Abandoned Object from Real Time Video

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ABSTRACT

Research in abandoned object detection is a need now days due to increase in attack by terrorists or anti social elements at public places. The traditional way to observe the places or to track the places is the CCTV cameras. In the current research of detecting abandoned object, the results are not optimal and need more work in this area. This paper discusses the proposed system for detecting abandoned object from Real time video. This system consists of 8 modules as Module 1: Real time video feed, Module 2: Get frame from the video after fixed time interval, Module 3: Get Intensity image, Module 4: Gaussian blur to reducing noise and smoothing, Module 5: Background subtraction, Module 6: Blob detection, Module 7: Still object tracking, Module 8: Occlusion detection. [Finally detected abandoned object]

Keyword *-- Abandoned object, CCTV, Foreground mask, Gaussian blur, Surveillance systems.*

I. INTRODUCTION

Many video surveillance systems have been in operation for with the human controlled or monitored CCTV systems. Here the quality and the effectiveness of humans is not up to the mark. The number of algorithms have been suggested and implemented by researchers across the globe. But due to their complexity and probability issues, the implementation was not so fruitful using languages like Matlab, Java etc. The available work is done by implementing some algorithms to reduce noise but it was not as impressive as the noise was still creating hurdle in getting the output. In this research work the Gaussian Blur algorithm-method is used for the noise elimination. About terrorism and global security on the rise, it has become vital to have in place efficient threat detection systems that can detect and recognize potentially dangerous situations, and alert the authorities to take appropriate action by raising alarm on right time. When an unaccompanied bag is detected, the system analyzes its history to determine its most likely bag position(s), where the position is defined as the location where the bag into the scene is left unattended. Through successive frames, the system keeps a lookout for the bag positions, whose presence in or disappearance from the scene defines the status of the bag, and decides the appropriate course of action. Automatic threat detection systems can assist security personnel by providing better situational awareness, enabling them to respond to critical situations more efficiently [1].

II. LITERATURE SURVEY

Many algorithms and methodologies have been proposed for Abandoned Object Detection. A. Singh has propose the some method on dual background segmentation in which blob detection, tracking is done but main methodology is to find out the object through intensity and frame delay [1]. Another method has also been proposed based on double illumination invariant Foreground mask and also proposes an automatic and robust method to detect and recognize the abandoned objects for video surveillance systems. Two Gaussian Mixture Models (Long-term and Short-term models) in the RGB color space are constructed to obtain two binary foreground masks [3]. The comprehensive solution for managing abandoned objects is proposed by *Lin et.al* which means that the system can deal with the objects that are abandoned and removed. The system contains two adaptive abandoned object detection methods that are both based on the Gaussian mixture model for real environments. The first method is more efficient than the second one, but the latter is more robust than the former. The proposed methods are proved to be characterized with prominent efficiency and robustness according to the experimental results [2].

III. WHAT IS ABANDONED OBJECT?

The detection of abandoned objects is more or less the detection of idle/inactive (stationary or non-moving) objects that remain stationary over a certain period of time. The period of time may be adjustable. In several types of images or frames idle objects should be detected. For example in complex near Elevator bag is left by some person. An unknown object is any object that is not a person or a vehicle. In general, unknown objects cannot move they are considered as stationary.

1. *What should be detected?*

Whenever an unknown object appears in the scene and remains stationary for some amount of time person, an alarm needs to be generated.

IV. EXISTING METHODOLOGIES FOR OBJECT DETECTION

1. Double Illumination Invariant Foreground Masks

Li et. al. has also propose proposes an automatic and robust method to detect and identify the abandoned objects for video surveillance systems. Two Gaussian Mixture Models

(Long-term and Short-term models) in the RGB color space are constructed to obtain two binary foreground masks. By refining the foreground masks through Radial Reach Filter (RRF) method, the influence of illumination changes is greatly reduced. The height/width ratio and a linear SVM classifier based on HOG (Histogram of Oriented Gradient) descriptor are also used to recognize the left-baggage. Li et. al. tested the result on datasets of PETS2006, PETS2007 and videos show that the proposed method can detect very small abandoned objects within low quality surveillance videos, and it is also robust to the varying illuminations and dynamic background [2].

In this case, first thing in the task of abandoned objects detection is to localize abandoned object items, and the second is to classify the detected items. The approaches of locating the left objects can be grouped into two categories: one is based on the tracking approach [8, 9], and the other is based on the background-subtraction method [6]. Most tracking-based approaches are designed for multiple camera systems, and they need to detect all moving objects accurately. They usually encounter the problem of merging, splitting, occlusion, and identity correspondence. And it is difficult to track all the objects precisely in crowded situations.

Background-subtraction techniques can work well in these highly-cluttered scenarios. The existing methods can be divided into two categories according to their use of one or more background subtraction models.
And for each category, it can also been subdivided into two classes:
1) One based on frame-to-frame analysis and
2) The other based on a sub-sampled analysis [4].

The results show that the detection of abandoned objects in simple scenarios is achieved with high accuracy in all the approaches above. However, for the complex scenario, approaches based on sub-sampling schemes or accumulation of foreground masks assures the best results. Finally, a classifying formula is set up to sort the detected temporary static objects. There are three main categories: the shape-based [7], the motion-based [8], and the combined shape-motion method [9].

2. Gaussian Mixture Model

Stauffer and Grimson [3] proposed the Gaussian mixture model (GMM) to adapt the background in a real environment. The main idea is to use more than one Gaussian distribution to describe the statistics of each pixel, since a pixel may change its value over time due to lighting changes or camera vibration. Assume that a histogram of a pixel p in a sequence of video frames is defined as $\{x1, x2, \ldots, xt\}$, where xi is the intensity value of p at time instant i. The GMM utilizes multiple (usually 3-5) Gaussian distributions to model the histogram of a pixel for observing the current pixel value xt, which is defined as

$$P(x_t) = \sum_{i=1}^{k} w_{i,t} \times \eta(x_t, \mu_{i,t}, \Sigma_{i,t}),$$

where k is the number of distributions, wi,t is the weight of the ith Gaussian distribution to describe the portion of the data resolved by this distribution, $\mu i,t$ and $\Sigma i,t$ are the mean value and covariance matrix of the ith Gaussian distribution, respectively, and η is a Gaussian probability density function. When a new sequence of frames comes in, the parameters of the GMM should be updated.

V. PROPOSED SYSTEM

The proposed system which is modular in nature and consists of eight incongruent modules and each module acting as a careful processing unit and an important building block of the proposed system.
The modules of proposed system are as follows:

1. Real time video feed
2. Get frame from the video after fixed time interval
3. Get Intensity image
4. Gaussian blur to reducing noise and smoothing
5. Background subtraction
6. Blob detection
7. Still object tracking
8. Occlusion detection

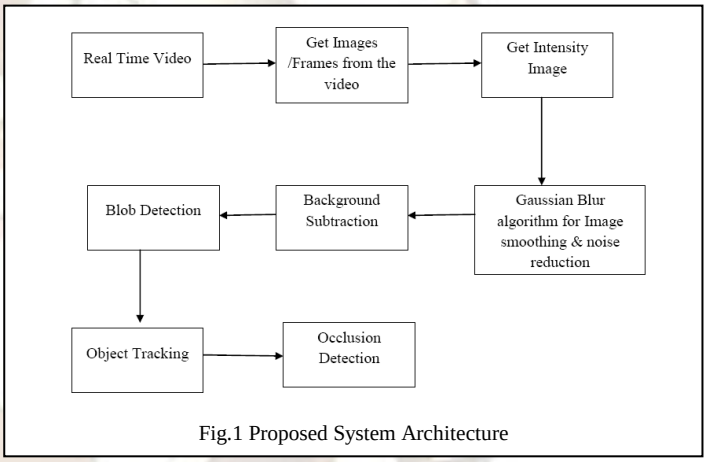

Fig.1 Proposed System Architecture

VI. OVERVIEW OF MODULES

Module 1: Real time video feed
In this module the real time video which is captured by the CCTV/Web camera is considered as an input to the proposed system.

Module 2: Get frame from the video after fixed time interval
Get the frames from the captured video after some time interval which is set as per the need.

Module 3: Get Intensity image
A live video stream is initially segmented into individual images from which a region of interest is extracted and through Max (RGB) gets the intensity image.

Module 4: Gaussian blur to reducing noise and smoothing
A **Gaussian blur** also known as Gaussian smoothing is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, typically to reduce

image noise and reduce detail. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen, distinctly different from the bokeh effect produced by an out-of-focus lens or the shadow of an object under usual illumination. Gaussian smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales. There are numbers of blur like box blur, motion blur, s pin and zoom blur but Gaussian blur is much faster than other types of blur. Gaussian blur can be used in order to obtain a smooth grayscale digital image of a halftone print [10].

The equation of a Gaussian function in one dimension is

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

in two dimensions, it is the product of two such Gaussians, one in each dimension

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Where

x is the distance from the origin in the horizontal axis,

y is the distance from the origin in the vertical axis, and

σ is the standard deviation of the Gaussian distribution

Module 5: Background subtraction

Background subtraction is a computational vision process of extracting foreground objects in a particular scene. A foreground object can be described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task under consideration.

Fig.2. Experimental results of Gausian blurred image

In some cases, distance of the moving object also forms a basis for it to be considered a background, e.g if in a scene one person is close to the camera while there is a person far away in background, in this case the nearby person is considered as foreground while the person far away is ignored due to its small size and the lack of information that it provides. Identifying moving objects from a video sequence is a fundamental and critical task in many computer-vision applications. A common approach is to perform background subtraction, which identifies moving objects from the portion of video frame that differs from the background model. Background subtraction is a class of techniques for segmenting out objects of interest in a scene for applications such as surveillance [12].

Module 6: Blob detection

The blob analysis takes an image is represented as a matrix with a certain number of pixels on a certain number of lines. When the image is grayscale, every one of those pixels has a value which indicates the brightness of the image at that point. When this grayscale image is converted to a black and white image, where every pixel above a certain threshold is white and under that threshold is black, then generated a black and white image with the white area's being the blobs. Following sequence of actions are involved [11].

- Check the first line of the image and find groups of one or more white pixels. These are the blobs on a certain line, called lineblobs. Number each of these groups.
- Repeat this sequence on the next line. While collecting the lineblobs, check the lineblobs on the line which are checked before this current line and see if these blobs overlap each other.
- If so merge these lineblobs as one blob i.e. Give the current lineblob the same number or id as the lineblob(s) on the other line.
- Repeat this for every line and have a collection of blobs.

Module 7: Still object tracking

The next process in object detection is tracking the different blobs so as to find which blobs correspond to abandoned objects. The first step in this process is to create a set, Track, whose elements have three variables: blob-Properties, hitCount and missCount. The next step is to analyze the incoming image for all the blobs. If the area change and the centroid position change, as compared to any of the elements of the set Track are below a threshold value then increment hitCount and reinitialize missCount with a zero; otherwise create a new element in the Track-set, initializing the blob-properties variable with the properties of incoming blob and hitCount and missCount are initialized to zero. Then run a loop through all the elements of the set. If the hitCount goes above a user defined threshold value, an alarm is triggered. If the missCount goes above a threshold, delete the element from the set. These two steps are repeated until there are no incoming images [1].

Module 8: Occlusion detection. [Finally detected abandoned object]

A tracked blob is considered to be occluded if its major region is covered by foreground and it should continue to be tracked if either it is occluded or its area and centroid is matched with any of the blobs.

VII. CONCLUSION

This paper incorporates a novel approach for detecting the abandoned object with multivariate quality output. This approach consists of identifying the captured live video and

uses Gaussian blur algorithm for noise reduction and smoothing. Still research is going on. More results will be presented in next paper.

VIII. ACKNOWLEDGEMENT

This work is partially supported by BCUD, University of Pune, Sinhgad College of Engineering & Sinhgad Academy of Engineering, Pune, India.

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