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IMPLEMENTATION OF AUTOMATIC VIDEO BASED ABNORMAL EVENT DETECTION AND ALERT SYSTEM FOR SECURITY

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ABSTRACT - The usage of surveillance camera system is increased nowadays because of increase in crime activities. To reduce such crime activities processing of videos involved in such activities is necessary. The proposed system is to detect the unusual event which occurs in the ATM centre. The video recorded in the surveillance camera is processed to identify the unusual event. In case of occurrence of unusual activity the beep sound will occur from the buzzer and the GSM modem will send the message to the authority. The entire processing of the recorded video sequence is done in Matlab software. The unusual output generated from the software is sent to the GSM modem to distribute the information to the concerned person or the concerned authority.The application of this proposed method is to enhance the ATM security.

***Keywords*—video surveillance, Target Modem ATM security.**

I. INTRODUCTION

In past few decades, the significant efforts in the field of tracking and moving object detection have been done to make the following applications robust, reliable and efficient. They are

- Video Surveillance,
- Robotics,
- Authentication System,
- Media Production and Biological Research etc.

But the challenges such as dynamic Camouflage and occlusion can produce hurdles in the improvement of these applications. In the conventional target tracking approaches the high resolution (HR) videos are used to extract the exact contour and shape features of target[4].

These approaches work on high resolution frames and require more computational cost. Some approaches use LR videos as an input but afterward with the help of super resolution techniques these videos are enhanced to high resolution(HR), which is not cost effective. For unusual event detection, most of the conventional methods uses high resolution video input and classifiers to recognize the events. These classifiers[7] need careful attention on training system and learning time .

This paper presents an algorithm which is able to detect abnormal event in low resolution video. The application of this

proposed approach is to enhance the ATM security without removing conventional LR camera.It does not need any training datasets and classifiers.It only uses rolling background subtraction technique, morphological operations and statistical property standard deviation of the centroids of the objects(blobs) to recognize the occurrence of the unusual events.

II. VIDEO SURVEILLANCE SYSTEM

In recent years, the video surveillance system has been an important research area in monitoring humans and their behaviors to analyze unauthorized activities[3]. This system can be applied in various areas such as security systems, banks, department stores, traffic monitoring on highway, air port terminal checkin,sports, medical field, and robotics etc. In general, the automated surveillance system has four main building blocks.They are

- Moving object detection
- Object tracking
- Event recognition
- Object identification

A. Moving Object Detection

Moving object detection has various applications.Video surveillance is one of the applications among them that is used to detect changes in the scene. There are several schemes available to detect such changes.They are Temporal differencing and Background modeling and subtraction.

1) *Temporal Differencing* - simple,low cost.

2) *Background modeling and subtraction*- most successful,used in both static and dynamic backgrounds.

Background subtraction is basically used to detect moving objects in videos using cameras. The basic idea in this approach is detecting the moving objects from the difference between the current frame and the reference frame, which is called "background modeling" or "background image".

B. Object Tracking

Obtaining correct tracking information of moving foreground object is a difficult task in events like activity recognition and modeling.For this purpose many different types of algorithm have been used.These algorithms are divided into four different groups .They are Contour based, Model based, Feature based,Region based.

C. Event Recognition

Event recognition is the ultimate purpose of a fully automated video surveillance system. In event recognition the objects are detected by using background subtraction.Motion activities of segmented blobs can be utilized in event recognition and detection such as fight or theft, walking or running, overcrowding etc.

D. Object Identification

In Object Identification the problem of "who is now entering the area under surveillance" is of increasing importance for video surveillance[2].Latest studies focus on personal identification and are based on biometrics such as Face and gait.Human gait and face are now regarded as the main biometric features that can be used for person identification in video surveillance systems. An example for human face and gait is shown in Fig. 1.

Fig. 1 Human Face and Gait

III. PROPOSED APPROACH

The proposed approach is used for detecting unusual events such as overcrowding and fight for the low resolution video particularly used in ATM.

For the better understanding of algorithm this section is segregated into the various sub-sections .They are

- Rolling Background Subtraction Technique
- Close Morphological Operation (o)
- Thresholding and Standard Deviation (σ)
- Pseudo Code of Proposed Approach

A. Rolling Background Subtraction Technique

The rolling background subtraction technique is used here.It dynamically update the background model and then does temporal differencing. It is very adaptive to dynamic environments but there may be holes left inside moving objects.

The background modeling and subtraction thechnique has various steps.They are Video Acquisition, Frame conversion, Preprocessing, Background modeling, Background subtraction, Post processing, Foreground extraction. Fig.2 shows an overview of the background modeling and subtraction system.

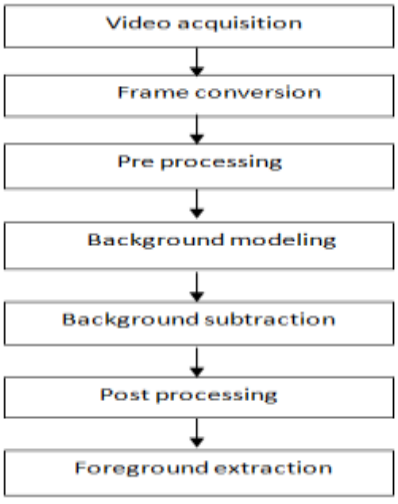

Fig.2 Overview of the Background Modeling and Subtraction System

B. Morphological Operation

Morphological Operations are generally used to fill small gaps inside the moving object, connecting disjoint objects and also helpful in reducing noise. Here the closing morphological operation is used which is composed of two sub-operations-dilation followed by erosion.

Dilation allows the objects to expand, thus potentially connecting disjoint objects and filling in small holes. Erosion shrinks the objects by (eroding) etching away their boundaries. .By the proper selection of the structuring element these operations can be customized for a specific application .

The closing morphological operation with disk shape structuring element on segmented areas are used here to remove pepper noise and other inaccuracies. The close morphological operation can be expressed as

$$Ft = Ft \; o \; D\rho$$

Here o→morphological closing operation.

Dρ→ disk like structuring element.

C. Thresholding

Thresholding is the simplest method of image segmentation .Thresholding[1] can be generally used to create binary images from a gray scale image. Segmentation involves separating an image into contours (or their regions) corresponding to objects.In each frame the every pixel is classified as either foreground (1) or background (0) using a simple thresholding functions.

$$Ft = \begin{cases} 1 & if\ |ut - Bt| > T \\ & . \\ 0 & otherwise \ldots\ldots \end{cases}$$

Here 'T'(threshold)→ difference between a pixel in current frame and background model.

'ut'→ pixel value in the current frame.

'Bt'→pixel value in the background model

In this proposed approach the clustering based thresholding is used. In Clustering-based methods, where the gray-level samples are clustered into two parts as foreground (object) and background or

alternately they are modeled as a mixture of two Gaussians.

D. Standard deviation

Standard deviation (σ) is a measure shows the amount of variation or dispersion exists from the average values. A low standard deviation (standard deviation close to 0) indicates that the data points tend to be very close to the mean and high standard deviation indicates that the data points are spread out over a large range of values. The standard deviation is calculated by the following formula

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

Where N →number of samples in population

μ →mean value

xi→sample value

σ→ standard deviation

In this proposed technique the standard deviation(σ) of the population of centroids of the bounding box of the blobs in 'n' consecutive frames are calculated. If the standard deviation is above than a threshold value continuously 'x' times then it signifies the presence of unususl event.Here the 'x' value is taken as 3.

E. GSM Module

GSM module is generally used to establish communication between a computer and a GSM-GPRS system[5].It requires a SIM card just like mobile phones to activate communication with the network. GSM networks generally operate in a number of different frequency ranges. Mostly 2G GSM network operates in the 900 MHz or 1800 MHz bands.

GSM-900 uses 890–915 MHz to send information from the mobile station to the base station and 935–960 MHz for the other direction, providing 125 RF channels spaced at 200 kHz. GSM was designed with a moderate level of security. Communications between the subscriber and the base station can be encrypted. The GSM Module needs AT commands for interacting with computer which are communicated through serial communication.

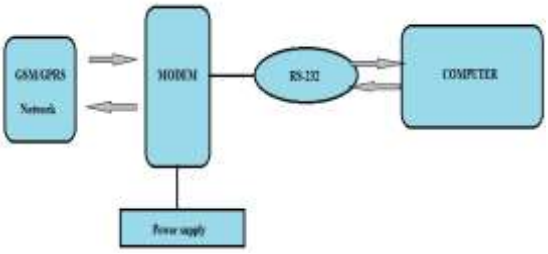

Fig.3 GSM Module

F. Pseudo Code of Proposed Approach

In this proposed approach, by using rolling background subtraction technique the moving object from the frame was first segmented.Then result was refined by using closing morphological operation followed by the connected component labelling(CCL) algorithm.CCL is generally used in computer vision to detect connected regions or it joins the different parts of the same blobs either by using 4-connectivity or 8-connectivity.

Blob extraction is usually performed on the resulting binary image from the thresholding step. Blobs may be filtered,counted, and tracked.After that the standard deviation (σ)of centroid in 'n' consecutive frames are calculated. The unusual output generated from the software is sent to the GSM modem to distribute the information to the concerned person or the concerned authority.

IV. SIMULATION AND RESULTS

The simulation results for background modeling, background subtraction,blob detection, centroids of the bounding box of the blobs and standard deviation are shown in figures below from Fig. 4 to Fig. 8 respectively.

Fig. 4 Background Modeling

Fig. 5 Background Subtraction

Fig. 6 Blob Detection

Fig. 7 Centroids.of the Bounding Box.of the Blobs

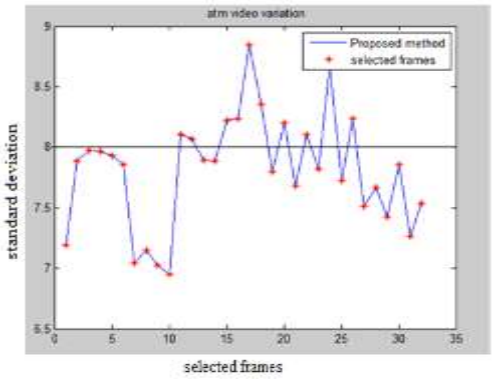

Fig. 8 Standard Deviation of Sample Video

Fig. 9 Prototype of GSM module

V. CONCLUSION

In this paper,from fig. 7 it is clear that the proposed new framework will be able to detect an unusual events such as overcrowding situation and fight within the different bank ATMs. In case of occurrence of unusual activity the beep sound will occur from the buzzer and the GSM modem will send the message to the concerned authority.The need of developing such security system is the increasing number of suspicious actions at the ATM booth. This proposed framework could be helpful to enhance the security of ATM. The results show that above algorithm efficiently applicable on (LR)low resolution video and there is no need of using any training datasets,classifiers and high computational schemes that enhance low resolution videos by super resolution techniques. In future the attackers face can be identified using appropriate techniques.

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