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Abandoned Object Detection via Temporal Consistency Modelling and Back-Tracing Verification for Visual Surveillance

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ABSTRACT: Security of public places is a considerably burning issue. Day by day the issues of mass killing due to bomb explosions are increasing. These bombs are mostly disguised in bags, luggage, etc. The common strategy of sleeper cell is to leave bags or belongings in public area. The security in charge cannot be always vigilant over Camera's footage, hence if an automation is given to Camera itself; that will lessen the chances of such risk. For that the proposed system is processing the video with the image processing using OpenCV on .NET platform. If a person is dropping off some bag or any such suspicious thing and leaving it running away, the system will catch this activity and if such bag is immobile for certain time span decided by analyzer, then it will give notification to authority as abandon object using Image processing.

I. INTRODUCTION

Currently,the proposed system is designed in such a way that it accepts the video input given by the remote operator.It does not support the real time application i.e the real time video captured by the cctv camera footage.
In the future, the proposed system is planned to enhance this method for handling more challenging situations such as sudden changes in lighting and overly crowded scenes.In future,the proposed system is planned to work on the real time cctv footage captured by the camera.

Also this system will reduce the human interaction in the surveillance system which minimizes the possibility of human errors and increases the security.Due to this intelligent surveillance system, human efforts are also reduced.A sensor unit which is connected with system.

Our proposed system will let user perform following functionalities:

- User will start the video from file.
- User will be able to register mobile number to get notification.
- User can see all objects detected and abandoned object on GUI.
- User will get the notification through SMS when abandoned objected is detected.

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Our proposed system is based on following assumptions:

- It is assumed that the user have adequate skill with using computers and mobile phones.
- The system depends on the Microsoft .Net framework to operate. Accuracy of system may vary depending upon light intensity changes and distance between camera and object.
- The correctness of output depends on the quality of video given as input. The input video should be of high accuracy.
- The external factors like climatic conditions, crowdy places may alter the precision of output.

II. LITERATURE SURVEY

Visual surveillance in dynamic scenes, especially for humans and vehicles, is currently one of the most active research topics in computer vision. It has a wide spectrum of promising applications, including access control in special areas, human identification at a distance, crowd ux statistics and congestion analysis, detection of anomalous behaviors, and interactive surveillance using multiple cameras, etc. In general, the processing framework of visual surveillance in dynamic scenes includes the following stages: modeling of environments, detection of motion, classification of moving objects, tracking, understanding and description of behaviors, human identification, and fusion of data from multiple cameras.[1] This system review recent developments and general strategies of all these stages. Finally, we analyze possible research directions, e.g., occlusion handling, a combination of twoand threedimensional tracking, a combination of motion analysis and biometrics, anomaly detection and behavior prediction, content-based retrieval of surveillance videos, behavior understanding and natural language description, fusion of information from multiple sensors, and remote surveillance.

In some security-sensitive locations such as military bases and important governmental units, only people with a special identity are allowed to enter. A biometric feature database including legal visitors is built beforehand using biometric techniques. When somebody is about to enter, the system could automatically obtain the visitors features, such as height, facial appearance[2] and walking gait fromimages taken in real time, and then decide whether the visitor can be cleared for entry.

Increasingly, police and security staff rely on video surveillance systems to facilitate their work. This practice is most evident in mass transit areas such as metro stations and airports. However, these systems remain largely labor intensive and the personnel monitoring the video displays and it extremely difficult to be attentive to randomly occurring incidents. Although automated video surveillance does exist, they have been mainly used for offline video analysis after an event has occurred. At present, these surveillance systems are of marginal help for real-time alerts. The function of real-time surveillance system[3] is to draw the attention of monitoring personnel to the occurrence of a user defined suspicious behavior of abandoned objects, when it happens. Two challenges stand in the face of developing, real-time tracking down of abandoned objects in mass transit areas. First, objects of interest, such as luggage in the scene, must be found robustly, classified and tracked through time. Second, a stable means of describing events must be found.
As an active research topic in computer vision, visual surveillance in dynamic scenes attempts to detect, recognize and track certain objects from image sequences, and more generally to understand and describe object behaviors[4]. The aim is to develop intelligent visual surveillance to replace the traditional passive video surveillance that is proving inactive as the number of cameras exceeds the capability of human operators to monitor them. In short, the goal of visual surveillance is not only to put cameras in the place of human eyes, but also to accomplish the entire surveillance task as automatically as possible.

III. PROPOSED ARCHITECTURE

Based on the results and analysis, we can conclude that low to medium density crowd has no e effect on processing speed or accuracy of the model. In a high density scenario, there is a possibility that the object is prone to be hidden from camera

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view for most of the time or in other words it is camouflaged by the background leading to a failure in detection. Another achievement of this model was that difference in lighting conditions had almost negligible effect on the operating performance. This can be attributed to the use of Dynamic Background technique. The system will thus work perfectly in an open environment (under sunlight) too. Additionally, shadow effects and reflection of light from bright objects do not pose any problems. The model can detect any number of abandoned objects in a given video sequence. Although speed is compromised with an increase in the number of objects to be detected but such cases are rare to encounter. Some noticeable limitations of the model are that a completely immovable person gets mistaken for an abandoned object. Also, the object must be in clear view of the camera for at least five seconds, otherwise it gets merged into the background.

Currently, the proposed system is designed in such a way that it accepts the video input given by the remote operator. It does not support the real time application i.e the real time video captured by the cctv camera footage. In the future, the proposed system is planned to enhance this method for handling more challenging situations such as sudden changes in lighting and overly crowded scenes.In future, the proposed system is planned to work on the real time cctv footage captured by the camera.

This system developing perspective is to provide high level security to every user from terrorist attacks. So the proposed system develops a surveillance application for detection of abandoned objects from the input to the system as a video stream. Also this system will reduce the human interaction in the surveillance system which minimizes the possibility of human errors and increases the security.Due to this intelligent surveillance system, human e orts are also reduced.

To develop a surveillance application for real time detection of abandoned objects from the input to the system as a video stream; store the video in the system then the activity will be detected as suspicious. Further detecting abandoned object by the sys-tem on its GUI. And from this it can provide notification to user on his registered mobile number through an SMS. Initially the input video will be accepted by the system in the form of continuous images. These continuous images are called as frames. From these continuous frames, frames per seconds(fps) will be calculated.Background Subtraction and Foreground Detection Algorithms can be used to calculate frames per second. In the Background Subtraction Technique Background is subtracted from the stationary objects and the properties of the stationary objects can be identified using the Blob Detection Algorithm. When these stationary objects are detected by the system then it will be detected automatically on the GUI of the system and a notification in the form of an SMS can be send to the admin(user) on his registered mobile number.

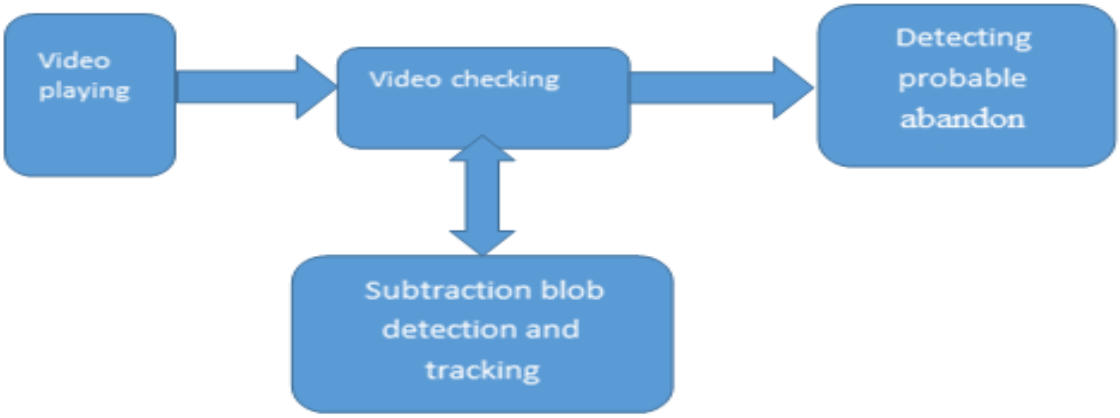

Fig 1: System Architecture

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IV. ALGORITHM

Blob Detection Algorithm:

- Filter the given image using CVBlur orCVS-mooth.For better results, use Gaussian Filter.
- Segmenting the image with the required color.
- From the segmented image, connect all 4/8con-nected image pixels. For every pixel, check the value of its pixel at its all directions. If it is also segmented include it in your blob. In this way, all disjointed patches can be detected as blobs.
- Use some filter like area/roundness/compact or the blob detected to get the blob you are looking for.
- If you are detecting blobs in video, try to track blobs from one frame to the next, this will ensure robustness. A simple way is to detect mean of the current blob and in the next image search for the mean near the current mean. This algorithm is used for detecting the abandoned object. And the output of this algorithm will giveto the further processing which is triggering the alarm.

V. MATHEMATICAL MODEL

S= {s, X, Y,T, P}
S (system):- Is our proposed system which includes following tuple.

s (initial state at time T) :-GUI of Abandoned Object Detection. .
X (input to system) :- Recorded Video.
Y (output of system) :- Detection of Abandoned Object on GUI and notification to user via SMS..
T (No. of steps to be performed) :- 5.
These are the total number of steps required to process a video and generates results.

P= {f_{friend}, DD, NDD, memory shared, CPU_{count} }

Where,

1. f_{friend} :- VC And OE. In this system, VC and OE are the friend functions of the main functions. Since we will be using both the functions, both are included in ffriend function. VC is Video Capture used for capturing video and OE is Object Extraction which is used for extracting Abandoned Object.

f_{friend} = f(VC, OE)

Where,
VC is Video Capture
OE is Object Extraction.
P is processes.

VC= {U, MAX, VF)

Where,
U=Video path name.
MAX = {1, 2, 3, . . . , n}
VF is output of Video Capture which is Video Frames.

OE= {CP, NLP Techniques, Info}

.

2. DD (deterministic data):- It contains Database data. Here we have considered Video i.e. Video which contains number of frames/objects. Such objects are used for showing results. Hence, Video is our DD.

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3. NDD (non-deterministic data):- Quality of Video. In our system, user can give input as a video that might be of any quality. Depending on that the frame might differ
4. Memory shared: - Database. Database willstore information like list of abandoned objectsdetected, registration details and numbers of receivers.
5. CPU_{count}: - In our system, we require 1 CPU.

VI. ADVANTAGES

- Safety and security have become critical in many public areas, and there is a specific need to enable human operators to remotely monitor activity across large environments .Hence it is a hectic job for human operators to continuously keep track of video and its hard to identify abandoned object by the operators.Hence for secu-rity at public places and remote areas this sys-tem comes into picture.This system detects the abandoned objects and an SMS is send to the registered mobile number of admin or user if any suspicious activity is detected.
- It belongs to an NP Complete problem as the abandoned object can be detected within the polynomial time.As it is an NP Complete problem, the system is feasible.
- The temporal consistency model is described by a very simple FSM. It exploits the temporal transition pattern generated by short- and long-term background models, which can accurately identify static foreground objects.
- The architecture of the system is easy to understand and hence any person having the basic knowledge about computer systems can operate and detect the abandoned objects.

VII. CONCLUSION

The proposed system is about abandoned object detection system which is based on a Background subtraction, Blob Detection and Tracking, Morpho-logical Processing. The Background subtraction, Blob Detection is adaptive in nature and based on the Approximate Median Model. Background subtraction, Blob Detection and Tracking, Morphological Processing algorithm is devised for tracking the blobs even under occlusion. Detection results show that the system is robust to variations in lighting conditions and the number of video in the scene. In addition, the system is simple and computationally less intensive as it avoids the use of expensive filters while achieving better detection results.

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