Detection of Abandoned Objects in Control Environment

Shafik Pathan

Computer Engineering, Trinity Academy of Engineering, Pune, India

Suyog Pardeshi

Computer Engineering, Trinity Academy of Engineering, Pune, India

Akansha Satpute

Computer Engineering, Trinity Academy of Engineering, Pune, India

Ashutosh Jha

Computer Engineering, Trinity Academy of Engineering, Pune, India

Nilesh Uke

Computer Engineering, Trinity Academy of Engineering, Pune, India

Abstract

Today CCTVs only act as evidence it is ineffective while stopping illegal and suspicious activities. Detection of objects is to provide safety and security in real time. There are many tools and languages used for performing real time applications in computer vision. Detection and tracking of objects is performed nicely in OpenCV libraries.

Main aim of this paperwork is to detect abandoned objects in a real time controlled environment, Objects which are static and were previously moving. Once moving objects get static the system will track the object for a specific period of time then it will declare the static object as an Abandoned Object then the system will give an alert message to the security or system.

For this reason, we have proposed a system that is able to detect any Abandoned objects in real-time in a controlled environment by using CCTV cameras.

I.   INTRODUCTION

For many years, terrorist attacks and bomb blast are happening around the world. Cameras are available everywhere but still bomb blast happen. CCTVs only act as evidence and are not as effective in stopping such kinds of activities. Due to such activities security has become a major issue in public places such as e.g. Train stations, Airport terminals and crowded places, etc.

Intelligent Video Surveillance is useful in various places like Train stations, Airport Terminal, Metro stations, etc. Cameras are also called as a Second Eye of Human Being, It is Useful for monitoring the places and to improve security of our places. It captures Large Wide Areas and Recordings of every Object. Intelligent Video Surveillance systems have become popular because of its growing demand for such kinds

of systems. We will be implementing a system, which can be used for detecting and tracking the hazards objects which may cause a big threat towards public safety.

We have proposed a system that is able to detect any abandoned objects in real-time in a controlled environment by using video surveillance cameras. Video surveillance is very important in computer vision for detecting abandoned objects in OpenCv.

II. LITERATURE SURVEY/BACKGROUND

Most of the works done under Abandoned object detection use background subtraction as a low-level preliminary step for detecting foreground regions or objects, albeit Smith et al. start directly by tracking multiple objects in the scene utilizing trans-dimensional Markov Chain Monte Carlo (MCMC). After background subtraction, some works aim to abbreviate erroneous positive detections utilizing object tracking and relegation methods while other approaches employ edge detection frameworks or generative models. Some frameworks model the forsook objects detection quandary as finite state automata while others use temporal logic based inference as an alternative solution. Different from all other works, Kong et al. endeavor to detect forsook objects on the road utilizing a moving camera. Ferryman et al. present a threat assessment algorithm that cumulates the concept of ownership with automatic understanding of gregarious cognitions in order to infer abandonment of objects. Homogeneous to Porikli et al. Lin et al. accumulate short-term and long-term background models to extract foreground objects. Szwoch describes an algorithm for the detection of stable regions by comparing these regions with the contours of moving objects. Dahi et al. present a method predicated on static edge detection and relegation. Pham et al. propose a two-stage method for unattended object detection. The first stage endeavors to detect all possible forsook objects, obviating erroneous negatives. In the second stage, their method minimizes erroneous alarms by utilizing kindred attribute matching between first-stage candidates and the background model. Different from all antecedent methods, and utilize a CNN in second.

OPENCV

In computer vision there are various libraries like OpenCV, TensorFlow[1], PyTorch, Dlib, etc. OpenCV may be a python open-source library, which is employed to unravel computer vision problems. OpenCV stands for Open Source Computer Vision. OpenCV may be a library that wants to develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis of features like face detection and object detection. OpenCV features a bunch of pre-defined classifiers which will be able to identify objects like trees, number plates, faces, eyes, etc . Also, we can use opencv for moving vehicle detection to measure traffic counting[2].

OpenCV is more advanced image manipulation and processing software than others like PIL(Python Image Library). OpenCV module cv2 is 3 times faster than PIL. There are differing types of methods is employed to detect, locate and recognize the objects in images and videos like R-CNNs(Region Based Convolutional Neural Networks), SSD(Single Shot Detectors), HOG(Histogram of Oriented Gradients), YOLO(You Only Look Once), etc. OpenCV may be a very vast library which is employed to perform operations in image and video functions. By using OpenCV we will capture video from the camera, it is often done easily. There are some methods that are able to capture video in python using OpenCV.

Surveillance is a crucial technology in life. When there are any stationary objects like luggage, electronic devices like Mobile, Laptop,[3] etc.An impuissance of those methods is that the high mendacious alarm rate, which is usually caused by imperfect background subtraction resulting from a ghost effect,also stationary people,and crowded scenes.In additament,these methods involve utilizing only the foreground

information as compare to per single image to locate regions of interest of forsook-object candidates. Process of tracking begins and helps the safety of getting an abandoned object within 5 sec.

As all of us know that the Importance of Surveillance has been increased across countries which is beneficial for tracing, Detecting every moving object[4]. Also there are three categories that are Captured through Surveillance are Human, Vehicle and Background Clutter. We've studied all about Visual Surveillance from what proportion of distance it's frequency is employed for capturing every Image. It's constantly used for detecting stationary objects also as movements of citizenry . But in rare cases Background Clutters also are very useful for black and white images for capturing whole footage of any places.

Background Deduction, the process of abating the current image from a reference one, is a simple and fast way to gain the moving object in the focus region and has been employed by numerous surveillance systems[5] .In our multiple subcaste background conservation model, the pixel stir character is used to decide which pixel should be streamlined, and the deduction results between the input videotape and the two layers are used to make a decision which subcaste should be streamlined.

Image sequences non inheritable with a camera square measure processed by a microprocessor system that detects in real time the presence or the passing of a vehicle within the camera field of read. Another system for time period accident bar and traffic observance has been developed in Europe and is represented in . The system, known as TRISTAR, processes pictures setting out from cameras placed near main road lanes and produces alarm signals once a potentially dangerous state of affairs (e.g., accident risk) is detected. A further example of a video-based system for traffic observance and management is bestowed in . The represented system will be addressed to get a visible following modality (i.e., vehicle tracking and pedestrian following) for a traffic consultatory system. It's shown that the exploitation of advanced image-processing techniques for moving-object detection and following will be a sound support to extend the margin of safety in a very giant variety of common traffic things[6].

The k-nearest neighbor classifier classifies foreground images with the help of frames that belong to the bag or any certain object. Classification is based on the shape and size of objects located at a certain place. The representation of bags is established using typical shape and size characteristics gleaned from a set of positive and negative examples provided to the system. Positive moments done by nearest security places with the help of mobile,laptops,TV,etc.Negativity moments include leaving objects, position in certain places,etc.The classifier is trained off-line, using the following features they are compactness,solidity ratio, size,etc[7].

The main motive of the system is to give a comprehensive result, which can identify the status of an object, abandoned, removed, or incompletely clotted. We employ the combination of background modeling grounded on admixture of Gaussians (GMM) and Markov Random Field (MRF) . Likewise, we employ a cast- shadow approach on reviewing the shape of the abandoned object. By combining these two approaches the abandoned object discovery can perform well and gain accurate results[8].

Most analysis work[9] till date looks to be focusing over one challenge and resulting resolution causes another challenge, like whereas segregating background from object such assumptions were created that can't be feasible in planet situations. Background segregation needs to be finished on ghost image space, that has not been achieved effectively, while not compromising processing concerns.

PROPOSED WORK/SYSTEM

The basic representation overview on the system block diagram. Our system block diagram as shown in fig.6 in which the system captures the whole environment and we are taking this video as an input for

further process. The next step is to convert the given video into the frames then the system will read each and every frame. Now after reading each and every frame system will observe the frames and using the background modeling system will subtract every frame with its previous frames. In this process the system will subtract the background and system will be left only with the objects that are present in the frame.

Our next step is to detect the moving objects and now the system will detect the abandoned objects, in short the objects which were moving previously and now they are static. If the object is abandoned then the system will pass the alert message to the nearest security system.
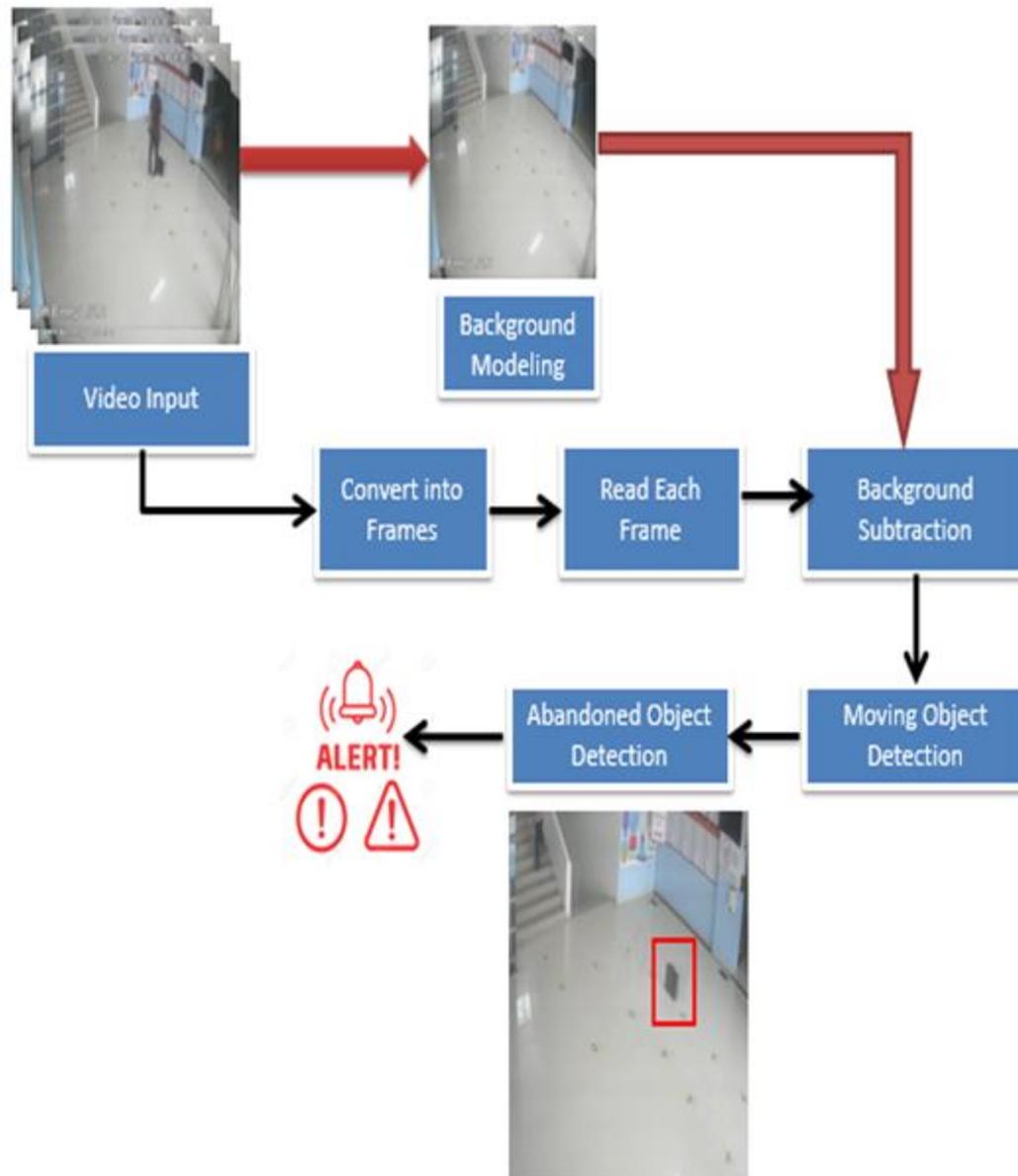
Fig.1.Block Diagram

i. Background Subtraction

Background subtraction is needed while detecting the objects from the frames. Now we see how it works, for background subtraction first we have to take the first frame or background modeling frame to compare with the upcoming frames. Then only we can find out the difference between these frames.

After this background subtraction will give us the difference which means it will give us a new object in the frames and we will track and detect the objects. There are different methods for background subtraction out of which we will see some methods.
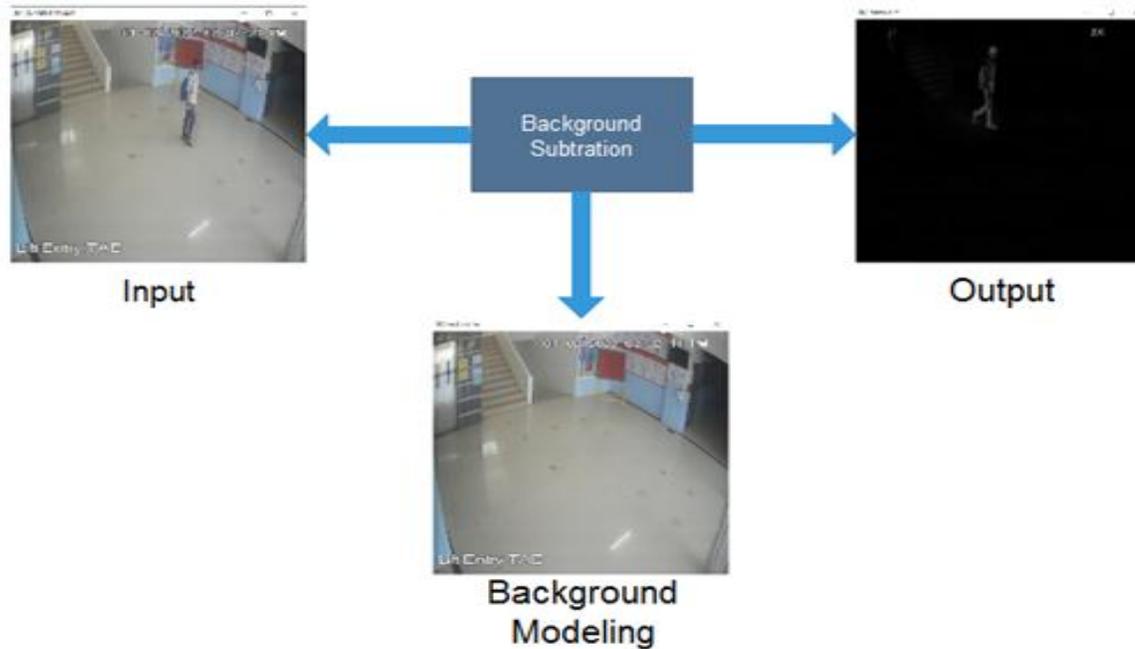
Fig.2.Background Subtraction

a) Gaussian-Mixture(MOG2)

Gaussian Mixture(MOG2) is a probability model which assumes that all the data points in the frames are generated from a mixture of a finite number of Gaussian distributions with unknown parameters. It is a mixture based background/foreground segmentation model that is also very effective and a good method for background subtraction.It provides better adaptability to varying the scenes due to illumination changes.But in some cases mog2 is not much effective in noise cancellation it not gives the propper results.

b) K-Nearest Neighbor(KNN)

K-Nearest Neighbor Algorithm is one of the machine learning algorithm.It is extensively used in algorithm classification in machine learning. It searches the nearest neighbor in test data. It is widely used for background subtraction. In which the foreground environment is categorized and compared with the background frame.It is one of the methods of cluster analysis. Euclidean distance is used in KNN to find the K number of neighbors. It stores all the data and performs classification based on similar data points.

Euclidean distance between two points = $\sqrt{[(x2 - x1)2 + (y2 - y1)2]}$

It is simple to implement and effective in noisy data training.

Fig.3.Background Subtraction using KNN

ii. Object Detection

There are different methods for object detection out of those will see some methods. As we already see the background subtraction method is also an object detection method it finds the difference between the frames and if any new object is visible in the frames it detects them now there is one more method that is used for the structural representation of an object that we will see next in this paper.

a) Canny edge detection

Canny edge detector is one of the edge detectors that detects a wide range of edges in an image. It gives structural information of objects from different visions. It uses a multistage algorithm to find structural data. It suppresses noise. The image is first converted to grayscale. Then we apply Gaussian blur to the image. This helps in removing noise for processing. The gradients are then determined by the Sobel filter. we get the non-maximum suppression but the result of it is not so perfect. thus applying double thresholding to get edges and remove noise. The weak edges are later determined by tracking. At last we do cleaning to get the final structural image data.

Fig.4.Canny Edge Detection

iii. Object Tracking

Now we will see how to continuously track the position and state of the objects.First we need to import the math library to do the mathematical operations. Now in center points will store all the tracked objects which are present in the frame. Abandoned_temp will be used to store temporarily detected abandoned objects for later verification.Id_count is a unique id for each detected object.

import math

```
self.center_points = {}
self.id_count = 0
```

After any new object detection will increase id_count by 1. Here are the center points for each newly detected object.

```
 for rect in objects_rect:
x, y, w, h = rect
cx = ( x + x + w) / 2
cy = ( y + y + h) / 2
```

Now will calculate the distance between each and every new object's center points and the previous object's center points. If the distance is less than the given threshold then the object will be considered as the same object and it will not concentrate on those objects. Now we add these objects to the objects list. We use Math hypot it calculates and gives us the distance between two points.

```
same_object_detected = False
    for id, pt in self.center_points.items():
        distance = math.hypot(cx - pt[1], cy - pt[2])
           if distance < 25:
               self.center_points[id] = (cx, cy)
          objects_bbs_ids.append([x, y, w, h, id, distance])
            same_object_detected = True
```

As we know that an abandoned object is a static object and doesn't move. So we again check if the distance is less than 1 then the object is added to the abandoned temp list.

In each loop, we check the object is still present in the abandoned temp list. If the object is present for a particular time then we consider the object as an abandoned object otherwise we increase the count by 1.

```
if id in self.abandoned_temp:
    if distance<1:
        if self.abandoned_temp[id] >100:
   abandoned_object.append([id, x, y, w, h, distance])
           else:
             self.abandoned_temp[id] += 1  # Increase count
```

III.   RESULT AND DISCUSSIONS

We tested this proposed system in the control environment. First we tested on a pre recorded video. The control environment was our college premises.
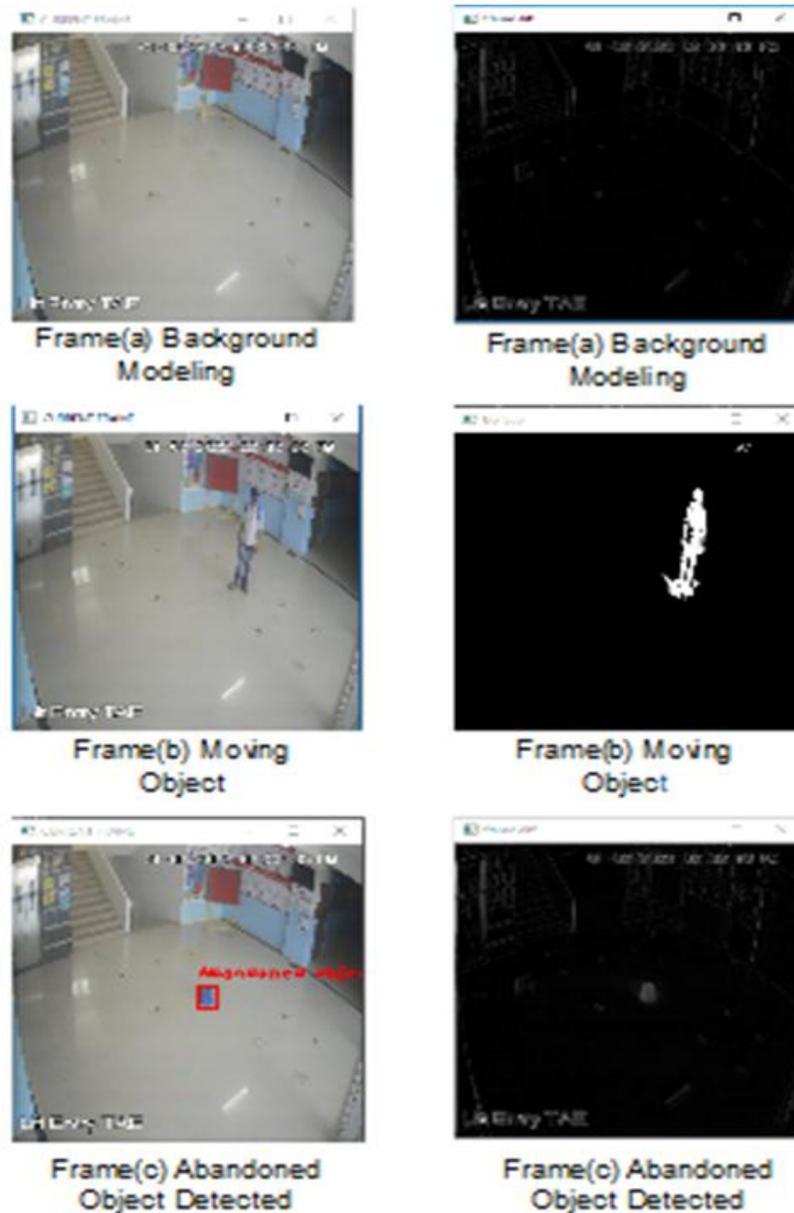
Fig.5 Results on Pre Recorded Video

As we see in the frame(a) is the First frame/Background modeling frame. In frame(b) a person came and he left his bag behind. After some particular time this object is considered an abandoned object. As shown in the figure in frame(c) the system detected the abandoned object.

IV.   CONCLUSION

In this project work we have studied Abandoned object detection and studied Various methods for detecting moving objects for monitoring our places. And detect the abandoned objects in real time surveillance. And in this paper we have studied opencv python library and different algorithms which are used for object detection. Also we have studied different applications of moving object detection and tracking.We also studied the different algorithms and methods of detecting and tracking the moving objects and we successfully detected the abandoned object.

VI.   REFERENCES

[1]   A. Talele, A. Patil, and B. Barse, "Detection of Real Time Objects Using TensorFlow and OpenCV," *Asian J. Converg. Technol.*, vol. V, no. I, pp. 1–4, 2019.

[2]   N. J. Uke and R. C. Thool, "Moving Vehicle Detection for Measuring Traffic Count Using OpenCV," *J. Autom. Control Eng.*, vol. 1, no. 4, pp. 349–352, 2013, doi: 10.12720/joace.1.4.349-352.

[3]   K. Lin, S. C. Chen, C. S. Chen, D. T. Lin, and Y. P. Hung, "Abandoned Object Detection via Temporal Consistency Modeling and Back-Tracing Verification for Visual Surveillance," *IEEE Trans. Inf. Forensics Secur.*, vol. 10, no. 7, pp. 1359–1370, 2015, doi: 10.1109/TIFS.2015.2408263.

[4]   N. J. Uke and P. R. Futane, "Efficient method for detecting and tracking moving objects in video," *2016 IEEE Int. Conf. Adv. Electron. Commun. Comput. Technol. ICAECCT 2016*, pp. 343–348, 2017, doi: 10.1109/ICAECCT.2016.7942610.

[5]   T. Yang, Q. Pan, S. Z. Li, and J. Li, "Multiple layer based background maintenance in complex environment," *Proc. - Third Int. Conf. Image Graph.*, pp. 112–115, 2004, doi: 10.1109/icig.2004.101.

[6]   C. Sacchi and C. S. Regazzoni, "A distributed surveillance system for detection of abandoned objects in unmanned railway environments," *IEEE Trans. Veh. Technol.*, vol. 49, no. 5, pp. 2013–2026, 2000, doi: 10.1109/25.892603.

[7]   M. Bhargava, C. C. Chen, M. S. Ryoo, and J. K. Aggarwal, "Detection of abandoned objects in crowded environments," *2007 IEEE Conf. Adv. Video Signal Based Surveillance, AVSS 2007 Proc.*, pp. 271–276, 2007, doi: 10.1109/AVSS.2007.4425322.

[8]   E. Engineering, "Abandoned Object Detection in Complicated En- vironments."

[9]   N. Gaba, N. Barak, and S. Aggarwal, "Motion detection, tracking and classification for automated Video Surveillance," *1st IEEE Int. Conf. Power Electron. Intell. Control Energy Syst. ICPEICES 2016*, pp. 1–5, 2017, doi: 10.1109/ICPEICES.2016.7853536.