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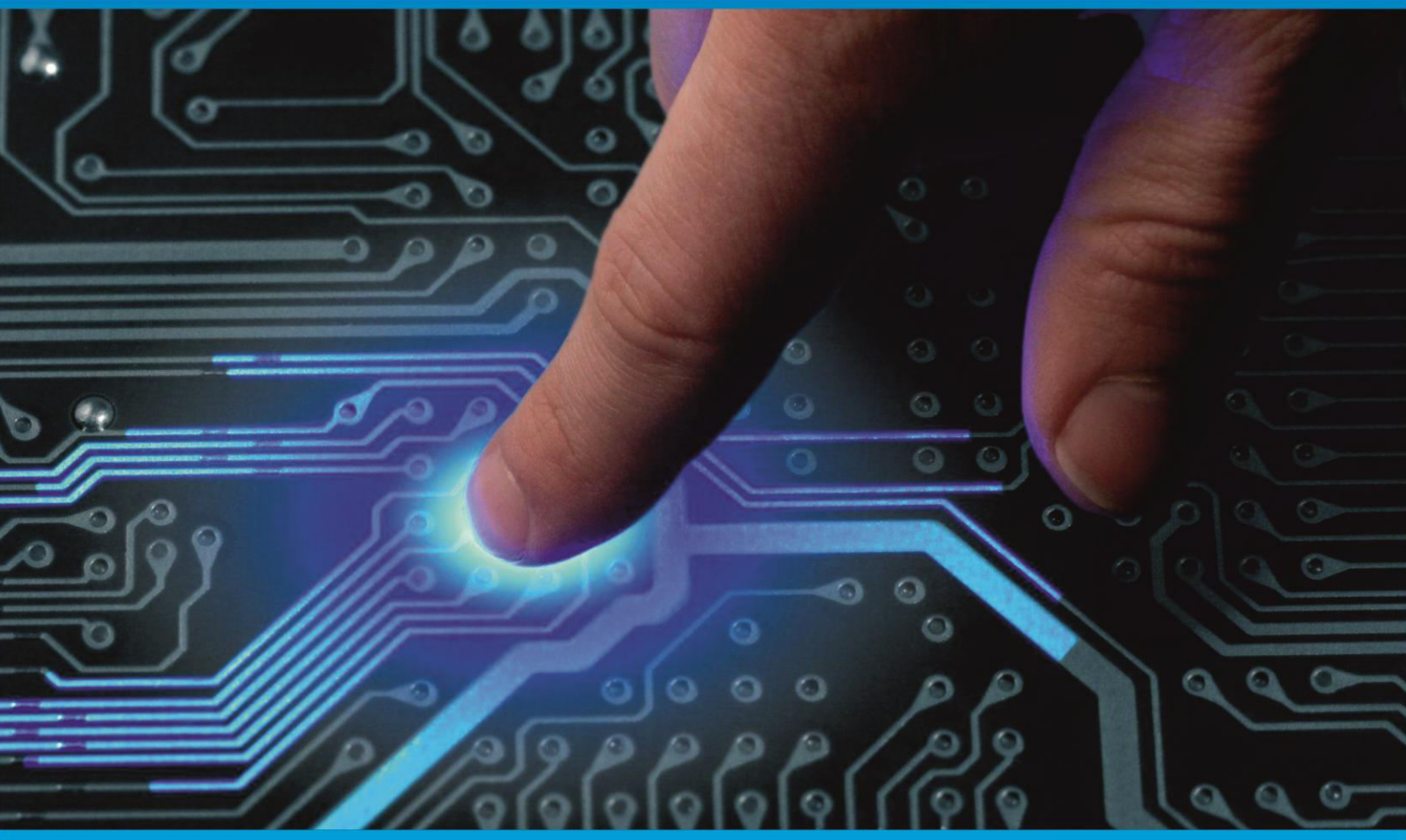

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Abandoned Object Detection System

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ABSTRACT: - Video surveillance systems used in places such as airports, train stations or different public spaces, can bring security to an upper level. The video surveillance systems that are used for security reasons require more intellectual and more robust technical directives. The proposed work compares different methods to detect abandoned baggage in a public area as well as introduces an abandoned luggage detection system for places like railway stations in India. With worries about worldwide security on the ascent, it has turned out to be crucial to have set up proficient risk recognition frameworks that can identify and perceive possibly risky circumstances, and alert the authorities to make a suitable move. This work depicts a framework that perceives the event of somebody leaving baggage unattended in railway stations either intentionally or mistakenly. As tracking of intentionally left baggage is a major problem as it imposes serious security risks in countries like India which has world's largest railway system. Also, proper tracking of mistakenly left baggage is another issue to resolve. The proposed system invokes an alarm whenever it encounters a left baggage as well as generates information about the baggage: its picture, date and time could be access when the baggage was left.

KEYWORDSForeground Segmentation, background modelling, Stationary Foreground Detection, Candidate Validation, Candidate Generation

I. INTRODUCTION

Intelligent and automatic security surveillance systems have recently become a point of focus because of the constantly developing need for such frameworks. In a crowded environment like railway platforms, it gets really tough for the human operator to detect left baggage manually. The intentionally left baggage can lead to severe security threats especially in countries where a large railway system exists as e.g., India has the largest railway system worldwide. Second aspect is keeping track of baggage which are left by mistake. To manually keep track of left baggage is therefore a very time consuming and tiresome task and requires huge manpower to handle. Typically, there is a small team that keeps an eye on a set of displays that cycles different views of various places simultaneously and it decreases the efficiency and creates a threat. To achieve early detection of these threats with the help of automated security frameworks, the capacity to dependably recognize suspicious things and distinguish their owners is desperately essential in public places like railway stations.

This work proposes a framework that perceives the event of somebody leaving baggage unattended in railway stations either intentionally or mistakenly and invokes an alarm whenever it encounters a left baggage. The system generates information about the baggage: date and time it was left unattended.so that the authorities can detect the object without any time waste and provide it to the people who have lost it, also it helps the authorities to detect abandoned object which may cause a security issue.

The project mainly consists of two stages, the first stage is the detection stage in which the abandoned objects are detected. We used mainly different type of image processing tools to detect and classify the abandoned object. The next stage is the alarm stage in which we need to generate an alarm when the object falls in the category of abandoned object. Atlast, we provide an interface through which the administrator will get the details of abandoned object at ease which shows date, time and picture of the abandoned object. Also, the user who comes in search of their missing objects can be easily obtained through it. So there is no lose of time and other process to obtain the objects of the user.

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II. RELATED WORK

A.*Comparative evaluation of stationary foreground object detection algorithms based on background subtraction techniques.*

This work was done by Bayona, Á.; SanMiguel, J.C.; Martínez, J.M In Proceedings of the IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), Genova, Italy, 2–4 September 2009. This work mainly focus on the stationary foreground detection based on background subtraction. Background subtraction is the main tool used in the video surveillance to detect the objects. It also compares various stationary object detection approaches comparing them in typical surveillance scenarios. Then at last a comparative evaluation using objective and subjective criteria is performed on video surveillance sequences selected from datasets, analyzing the advantages and drawbacks of each selected approach. Moving foreground segmentation and people detection is not performed.

B. *Traditional and recent approaches in background modelling for foreground detection*

This work was done by Boumas T compares the traditional and recent approaches to the background modelling for the foreground detection. The recent approaches has shown a significant increase in the detection of the moving objects using the MoGie is mixture of gaussian approach to perform foreground detection. Apart from MoG it also make use of subspace learning models, fuzzy models, robust PCA model. But this work lacks the people detection part at a threshold rate

C. *People detection in surveillance: classification and evaluation*

García-Martín, Á.; Martínez J.M proposed this work. People detection in video surveillance environments is a task that has been generating great interest. There are many approaches trying to solve this problem either in controlled scenarios or very specific surveillance applications. This paper mainly deals with different methods to detect the people in a most efficient manner. The methods mainly included are traditional handcraft methods such as histogram of oriented gradients(HOG), the haar-like feature classifier for full(HAAf) and upper body parts(DPM). It also consider as well two neural network-based object/pedestrian detectors faster R-CNN and YOLOv2.

D. *Detection of Abandoned object in crowded environments*

This work was proposed by Medha Bhargava, chia-chih, M. S Ryoo and j.k Aggarwal. this work mainly deals with detection of abandoned object in the crowded area here the system emulates the behavior of an human . if it sees a abandoned object the system traces the owner of the object who brought the object. It also considers spatio-temporal context ie its owner has left a predefined detection area for longer than a certain amount of time. It also performs image processing techniques techniques in appropriate way to finalize the object detected. Although the work mainly focus on detection of objects in crowded areas..

III. PROPOSED SYSTEM

The proposed system will take video as input and it is converted to frames and each frame is processed with image processing tools to get abandoned object. A trained Data base is created to classify detected objects. If the object detected meets the requirements of abandoned object criteria, then the object is considered as an abandoned object as shown in Fig-1.

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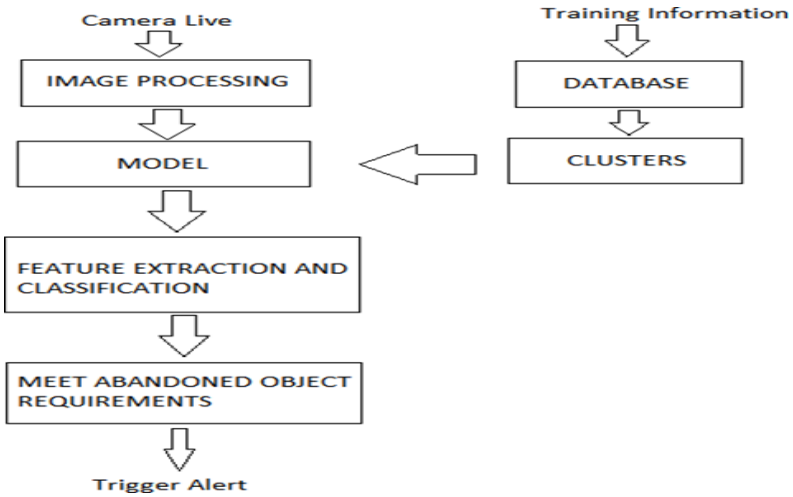

Fig-1: System Overview

IV. METHODOLOGY

Abandoned objects can be determined by two rules: the candidate object is stationary and unattended. The former defines a temporal rule where an object is considered asstationary if it has remained without moving for a certain period of time, which depends on the application, being usually 30 or 60 s. The latter corresponds to a spatial rule where an object is considered as unattended if the object owner (i.e., the person that left the object) is not spatially close to the object. Such closeness is often defined by considering an ellipse or circle whose radius is proportional to the object size (e.g., often set to three-times the object width or a fixed value of 3m. Both rules have to be fulfilled in order to consider an abandoned object event.

A. *Frameworks*

The canonical framework for abandoned object detection includes foreground segmentation, stationary foreground detection, candidate generation, candidate validation and detection of abandoned object as shown in Fig-2.

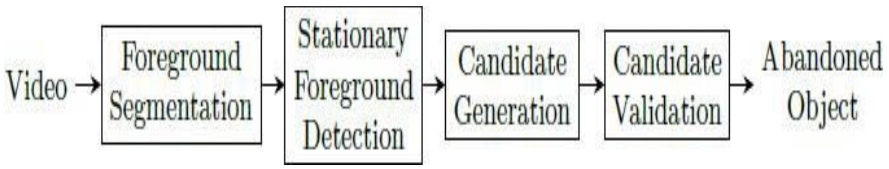

Fig-2: Framework for Abandoned object Detection

STEP 1: FOREGROUND SEGMENTATION

Foreground segmentation is key in many applications, such as video surveillance, aiming to classify each image pixel into foreground or background, thus producing a foreground mask containing the regions of interest (i.e., blobs), which represent the foreground. For example, such a foreground can be related to every object in the scene or only to the salient objects. In videos, the foreground may correspond to all moving objects, to specific temporal salient objects, to some relevant spatio-temporal patterns, or to pre-defined image labels. Background Subtraction (BS) is often used for AOD due to the relative control of camera motion. Traditional BS algorithms usually consist of four stages: modeling, to statistically represent the background of the scene;initialization, to acquire the first model; maintenance, to adapt the model to scene variations over time; and detection, to segment foreground objects by comparing each frame and the model. Segmenting the foreground addresses several challenges affecting segmentation performance. False positives may be caused by illumination changes (non-accurate model adaptation), camera jitter (pixel misalignment

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between current and background images due to camera motion), ghosts (objects wrongly included in the background model), dynamic backgrounds (background motion difficult to handle by the model), camouflages (foreground and background sharing similar appearance), and cast shadows (shadows from objects are sometimes detected). A high variety of approaches is proposed to overcome these challenges, which can be classified by the type of model employed: Gaussian and support vector models, non-parametric models, subspace learning models, neural networks, and RPCA (Robust Principal Component Analysis) and sparse models. These models can also use different features (or combinations thereof) such as color, gradient, texture, and motion. Moreover, deep learning models have recently emerged as promising frameworks to unify modeling and feature selection. However, these models are limited to employing training and test data from the same video sequence.

STEP 2:STATIONARY FOREGROUND DETECTION

When an object or a body shows no change for a specific period of time it is said to be Static region. There are many algorithms to detect these static regions. Gradient based technique uses static foreground technique for the detection of static regions by investigating the adjustment in edge vitality connected with edges of static frontal area district of current frame and background frame. According to this technique the object is abandoned if there are comparatively more edges but this technique fails in the frame with multiple objects. In the proposed system static region detection is based on background subtraction, where every frame is compared with the background frame and static regions are detected. In other words, an abandoned object can be considered as temporary static object which was not in the frame before. Hence, we use two frames to compare with background image to assure the motion of the object. The time duration for considering an object to be static, changes from environment to environment. With current data set, the static time window for every abandoned object was found to be 85- 100 frames. Any object which was fixed at a location for 85-100 frames was considered to be a static one.

STEP 3:CANDIDATE GENERATION

Depending on the final application, static objects of interest, i.e., candidates of interest, may vary. There are works only focused on detecting abandoned luggage. Since detecting abandoned objects, in general, is the goal of interest, one can make the assumption that whatever is not a person can be considered as an object. Following this strategy, this distinction problem between people and objects can be solved simply by applying a people detector. People detection surveys providing an exhaustive study of the existing conventional techniques based on hand- crafted feature-based models are available. Motion-based approaches only use information with respect to the person movements thus they are not able to deal with partial occlusions. periodic motion analysis including tracking to increase robustness or a detection system based on detecting people motion patterns could help. Appearance-based approaches exploit people appearance information such as color information, silhouettes, or edges. They can be divided into holistic and part-based models. Holistic models, such as are simple models representing the human body as a whole. They cannot deal with partial occlusions, nor people pose variations. In contrast, part-based models are more complex models defining the body as a combination of multiple regions, and they can detect partially-occluded people and people with different poses. However, the last few years have shown huge progress in pedestrian detection due to deep learning methods' emergence. Both objects and people detector approaches based on Convolutional Neural Networks (CNN) are able to learn features from raw pixels, outperforming models based on hand-crafted features.

STEP 4:CANDIDATE VALIDATION

Once the static foreground has been classified, object candidates can be known. The last stage in abandoned object detection systems consists of validating the candidates. This stage is necessary to discard false detections due to illumination changes or removed objects, for instance. This validation stage includes two differentiated sub-stages: left-object validation and unattended validation. Left-object validation checks candidate's nature in order to remove false positives due to illumination changes or removed objects. Once it is verified that the candidate is an abandoned object, it is important to check its surroundings, looking for potential owners in order to verify that the object is, indeed, unattended.

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V. RESULT AND DISCUSSION

After setting up abandoned object detection with required image processing tools and software the results were analysed and generated are as follows. Fig. 3 shows the basic frame or background frame used for background subtraction to detect objects. This base frame is passed on to the algorithm to detect the foreground images thus classifying it as abandoned objects.

Fig-3: Basic Frame

As the program runs it detects every object passing through its region of interest as you can see in the Fig 4. An object is considered as the abandoned object only if it satisfies the spacio-temporal rule that is the object should be left unattended for a particular time and no people should be in the objects radius when these two rules are satisfied, we can say it as a abandoned object (Fig. 5).

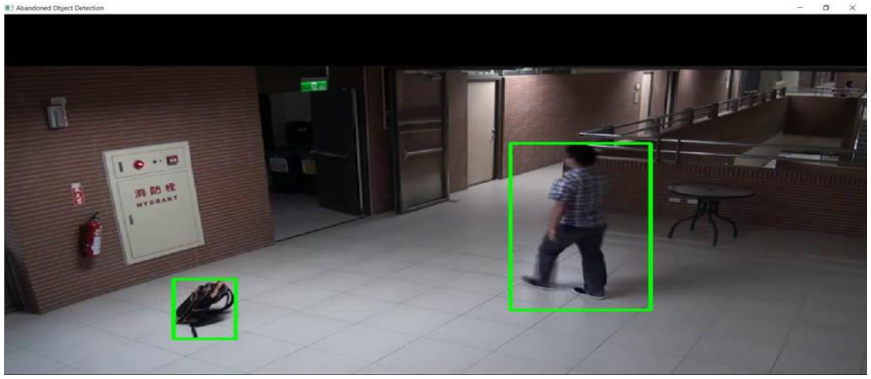

Fig-4: Before Detection

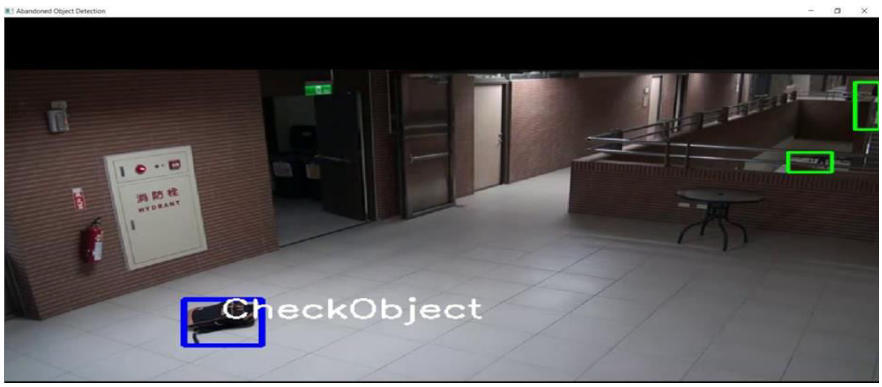

Fig-5: After Detection

The algorithm detects all events within an error of 9 frames (0.36seconds).The involved persons include anyone who is close enough to the involved luggage when and after the abandoned object event takes place. The correct number of

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involved people are detected and if the object kept unattended for a particular amount of time it is said to be abandonedobject and alarm is raised. The clear definition of the alarm event helps to contribute to the good performance of our detection system. We tested the method on different selected Dataset and following results were observed as presented in Table given below. The method was tested on seven different conditions with different types of baggage like Trunks, bags, suitcases and multiple owners. The scenarios contain different difficulties based on close proximity to the item of luggage. The method successfully detected abandoned objects in most of the conditions. The static time window for every abandoned object was taken to be 85-100 frames. Any object which was fixed at a location for 85-100 frames was considered to be a static one and further. The system can accommodate a maximum of 100 object profiles for simultaneous decision making and further processing. The system also considers only a single cameraview for detecting left objects. The system was tested on different shots taken from data set.

Shots	Alarm Count	Abandoned Object Detected	No. of Objects Detected
Dataset S1	85	Yes	1
Dataset S2	85	Yes	1
Dataset S3	85	Yes	1
Dataset S4	95	Yes	1
Dataset S6	85	Yes	1
Dataset S7	85	No	-

VI. CONCLUSION

The work proposes a framework that performs object identification and feature extraction of the unattended objects which are left purposely or mistakenly in a crowded environment. The proposed system is engaging in its straightforwardness and reasonably stable. The proposed system utilizes a static frame as a base frame to extract object information from frames which is a simple and easy approach yet may act as a limiting factor under similar but different scenarios. It is one of the modern era technologies which helps us to detect fraudulent activities in public places such as a railway station ie abandoning bags with bombs and drugs which cause threat to the human life. It is nothing a step towards effective, efficient monitoring of objects in challenging public environment.

There is tremendous scope of experimentation and refinement of the current system. A future expansion of this work will be to incorporate background estimation and extraction of relationship of the objects with the owner and picking up the details and identity of the owner. Implementation of this system using x-ray cameras will also make a great deal in future also getting the immediate id of the user which could resolve future security issues. with development in technology there will enough room for improvement until our system can be considered as operational. Besides restricting ourselves to one particular aspect-abandoned objects we could implement more detection in the future. so abandoned object detection system in public places like railway stations is going to one of basic security instalment in the future

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