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Abandoned Object Detection with Security Alert Using Smart Phone

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Abstract*— Abandoned object detection is a technology that deals with detecting unattended, unknown objects of a certain class for a period of time. Detecting abandoned object is a very important task in places where there is high security threat e.g. terrorist attacks. In earlier methodologies there were certain drawbacks such as only security alarms used to be raised, accuracy rate of detection was low in case of static environment, and unwanted objects were misunderstood as abandoned. The proposed system consists of dynamic or real time environment and capturing of live streaming videos. In the proposed System, a new concept which is being introduced is the human detection using the RGB to HSV conversion algorithm. The major concern while detecting an abandoned object is when a human is misunderstood as abandoned object and false alarm is raised. To avoid such false alarms the proposed system uses skin colour thresholding on the focused blob and analyse if human or not. If the system displays human features then the detected object will be ignored and no alarm will be raised. Otherwise, the detected abandoned object is captured and an alert is sent to the security in-charge through SMS and Electronic Mail using wifi facility. For better security purpose the live video feed is provided on an Android Application.

Keywords*— Abandoned object detection, human detection, streaming videos, skin colour thresholding, RGB to HSV conversion algorithm, Android Application.

I. INTRODUCTION

An abandoned object is an object which is left at a particular place under surveillance and unattended over a period of time. Second, it should remain static in recent frames or for some time t. Detecting abandoned object is a very important in places like airports, railway stations, big shopping malls etc. where there is potentially high security threat. The biggest challenge is classifying an object as abandoned object, the object which was not present in the previous scene may be consider as an abandoned object, also the object becomes an abandoned object when it is carried by a person previously and it is unattended for a particular period of time which creates the potential threat. Human body motion analysis is an important technology which has been widely used in intelligent control, human computer interaction, motion analysis, and other fields. The motion detection is the most important part of the human body motion analysis, the purpose is to differentiate the human and abandoned object by analysing the mobile human body with its behaviour from the background image in video sequence and particular human characteristic i.e. skin colour observation. In this scenario the main challenge is to detect objects in convenient time interval without using any hardware specifications in image processing and consuming a lot of resources for development of this detection mechanism efficiently.

II. LITERATURE SURVEY

For Abandoned Object Detection various algorithms and methodologies have been proposed. 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 [3]. 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 colour space are constructed to obtain two binary foreground masks [2]. 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 [7].

In the frame difference, or Frame Subtraction method detect moving objects by calculating the differences between pixels in consecutive frames of a video sequence. Although frame Subtraction approaches are adaptive to environments with sudden illumination change, some relevant pixels cannot be extracted this results in holes inside moving entities. The advantages of this method are the insensitive to the change of light, fast background update, good adaptive performance, its calculation is simple and easy to implement .For a variety of dynamic environments, it has a strong adaptability.

III. PROPOSED SYSEM

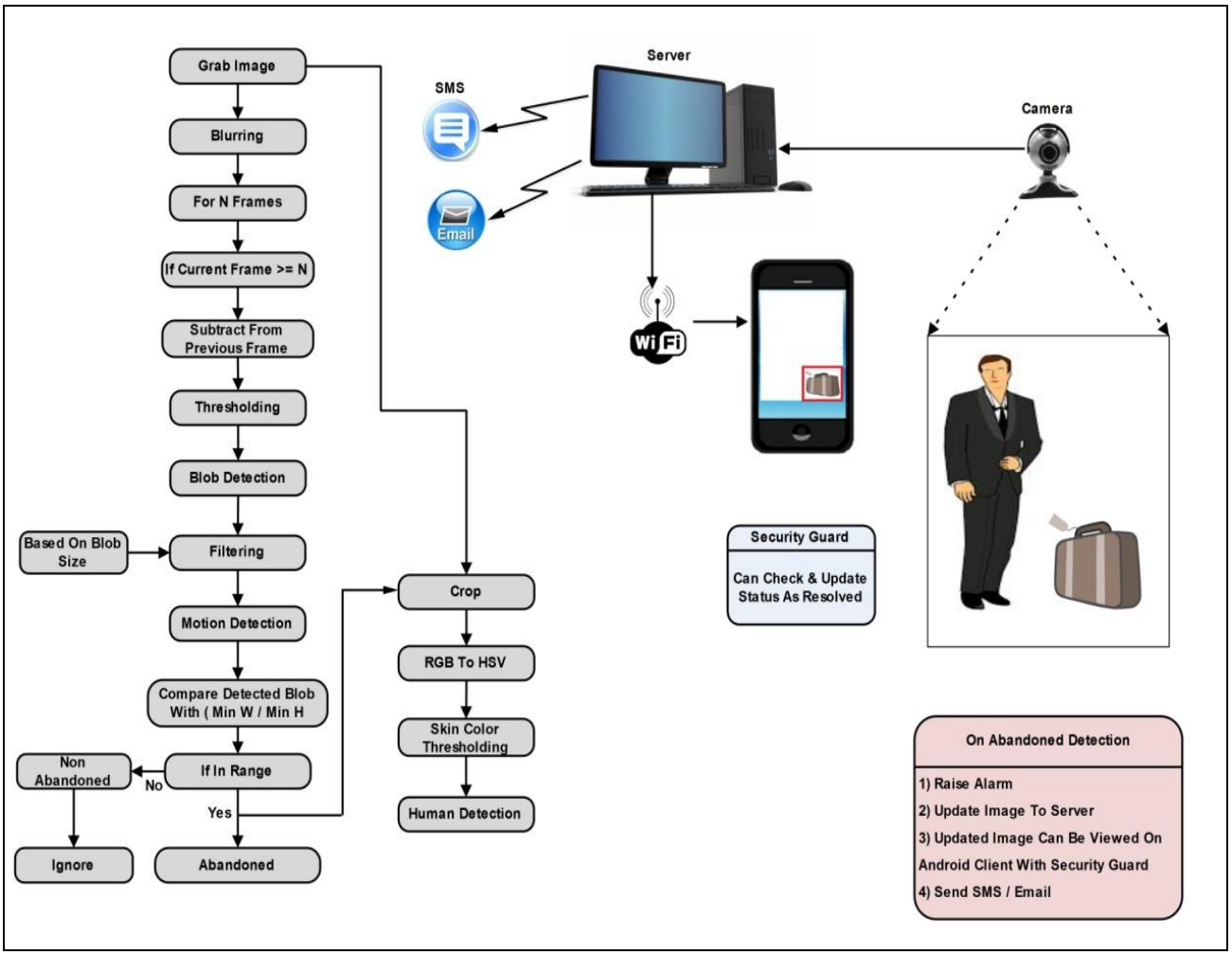

Fig 1: Block Diagram for proposed system

The aim of this proposed system is to detect abandoned object in fast and accurate manner in crowded places e.g. malls where it is difficult for the security to monitor number of cameras in surveillance. The proposed system consists of algorithms blurring, thresholding, blob detection, motion detection, RGB to HSV in human detection. Two main parameters are used namely Background count and Buffer Background Count which determines the frame interval and detection accuracy during buffering of video.

The Proposed method consists of three modules:

A. Abandoned object detection

1. Bluring

A Colour blur (also known as Colour smoothing) is the result of blurring an image by a Colour function. It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. Colour smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales like scale-space representation and scale-space implementation.

Fig 2: Example of Colour Blurring

2. Thresholding

Thresholding is an image processing technique for converting a grayscale or colour image to a binary image based upon a threshold value. If a pixel in the image has an intensity value less than the threshold value, the corresponding pixel in the resultant image is set to black. Otherwise, if the pixel intensity value is greater than or equal to the threshold intensity, the resulting pixel is set to white. Thus, creating a binary image, or an image with only 2 colours, black (0) and white (255). Image thresholding is very useful for keeping the significant part of an image and getting rid of the unimportant part or noise. This holds true under the assumption that a reasonable threshold value is chosen.

3. Blob detection

In the field of computer vision, blob detection refers to mathematical methods that are aimed at detecting regions in a digital image that differ in properties, such as brightness or colour, compared to areas surrounding those regions. Informally, a blob is a region of a digital image in which some properties are constant or vary within a prescribed range of values; all the points in a blob can be considered in some sense to be similar to each other. With the more recent terminology used in the field, blob detection can also be referred to as interest point operators, or alternatively interest region operators. One main reason is to provide complementary information about regions, which is not obtained from edge detectors or corner detectors. In the proposed work, blob detection is used to obtain regions of interest. After Thresholding of the video frames the regions of interests are gained. In the proposed system the size of the blobs are assumed and thus blobs are recognized by scanning the (x,y) coordinates of the pixels.

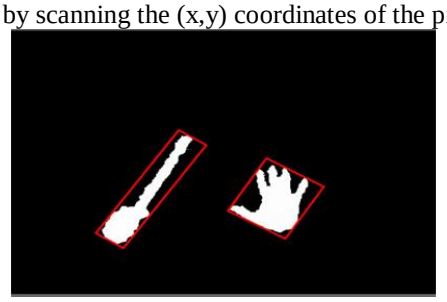

Fig 3: Example of Blob Detection

4 .Motion detection

Motion detection is the process of detecting a change in the position of an object relative to its surroundings or a change in the surroundings relative to an object. Motion detection can be achieved by either mechanical or electronic methods. The principal methods by which motion can be electronically identified are optical detection and acoustic detection. Infrared light or laser technology may be used for optical detection. Motion detection devices, such as PIR motion detectors, have a sensor that detects a disturbance in the infrared spectrum. Once detected, a signal can activate an alarm or a camera that can capture an image or video of the motioned. A simple algorithm for motion detection is used in the system by using a fixed camera that compares the current image with a reference image and simply counts the number of different pixels. Since images will naturally differ due to factors such as varying lighting, camera flicker, and CCD dark currents. More complex algorithms can be used to detect motion when the camera itself is moving, or when the motion of a specific object must be detected in a field containing other movement which can be ignored. An example might be a painting surrounded by visitors in an art gallery.

B. Human Detection

1. RGB to HSV

The RGB colour model is an additive colour model in which red, green, and blue light are added together in various ways to reproduce a broad array of colours. The main purpose of the RGB colour model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. RGB is a device-dependent colour model: different devices detect or reproduce a given RGB value differently. Thus an RGB value does not define the same colour across devices without some kind of colour management. Typical RGB input devices are colour TV and video cameras, image scanners, video games, and digital cameras. Typical RGB output devices are TV sets, computer and mobile phone displays, video projectors, multicolour LED displays. This System recognizes the human skin characteristic by using the RGB to HSV colour conversion model as RGB model is not well suited for practical implementation and in turn HSV model is an ideal tool for developing image processing algorithms. Hue, Saturation, Value or HSV is a colour model that describes colours (hue or tint) in terms of their shade (saturation or amount of gray) and their brightness (value or luminance). Hue is expressed as a number from 0 to 360 degrees representing hues of red (starts at 0), yellow (starts at 60), green (starts at 120), cyan (starts at 180), blue (starts at 240), and magenta (starts at 300). Saturation is the amount of gray (0 percent to 100 percent) in the colour. Value (or Brightness) works in conjunction with saturation and describes the brightness or intensity of the colour from 0 percent to 100 percent. The Human in the system will be marked separately but ignored as well as percentage of human features will be displayed if any presence of human is encountered.

C. Security Alert

In earlier existing methodologies an alarm used to be raised after detecting the abandoned object but the exact location of the object could not be determined, so the chances of false alarm where high. The proposed approach determines the exact position of the detected object as the captured image of the object will be sent to the security in

charge and also displayed on an Android Application which is connected to the main system by obtaining the machine IP address. The following are the steps that will be executed in the system.

- The system will raise alert after detection, simultaneously the video feed is updated on the Phone.
- Update Image to Server
- Send SMS or Email displaying the captured image of the abandoned object.
- Updated Image can be viewed on Android Client with security guard
- Security guard can check and update status as resolved

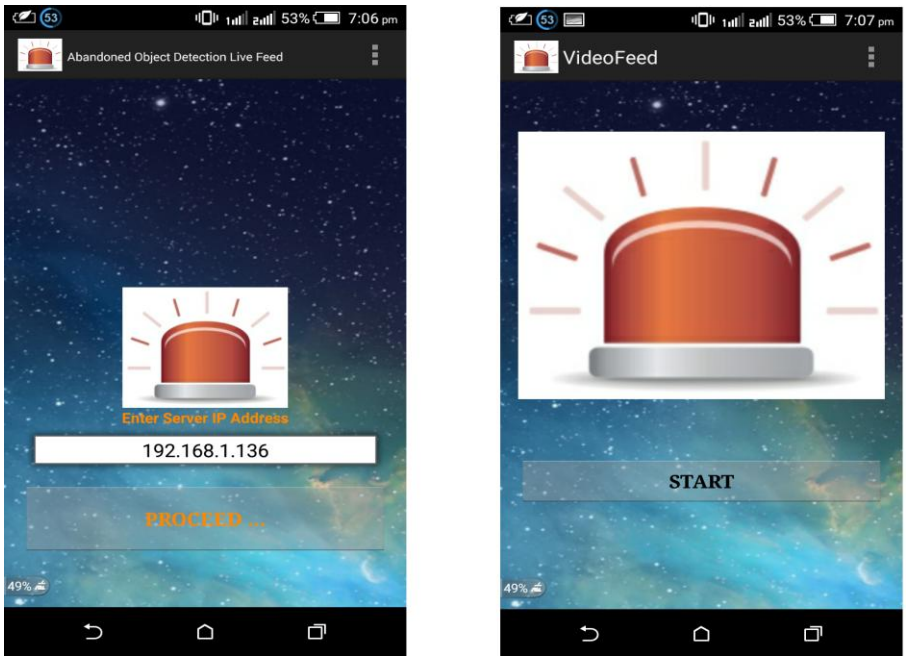

Fig 4: Android Application provided to security in-charge and guards

IV. ALGORITHMS

- ***Blurring***
  1. Grab the image from the live video
  2. Extract the colour value of each pixel by perform Right shifting and ANDING operation to separate the RGB components shown in the below formulas:

```
sumB += col & 0xff;
sumG += (col >> 8) & 0xff;
sumR += (col >> 16) & 0xff;
```

- ***Thresholding***
  1. Load the input image
  2. Perform Right shifting and ANDING operation on col to separate the RGB components
  3. check condition if (r,g,b values is lessthan and greater than threshold value)
  4. set r,g,b to black (i.e. 0xff)
  5. else set r,g,b to white (i.e. 0)
  6. Store and update the black and white pixel
- ***Blob Detection***
  1. Check the first line of the image and find groups of one or more white pixel.
  2. Repeat this for every line and store the collection of blobs
  3. Count the number of pixels in blob i.e. the area of the blob
  4. Calculate the bounding box with extreme values of x and y and calculate the center point.
- ***Motion Detection***
  1. Calculate C.O.G.
  2. Compute Cx=(Xmin+Xmax)/2, Cy=(Ymin+Ymax)/2
  3. Extract values of Cx and Cy from last frames
  4. Compare and analyze the values of x and y coordinates
- ***RGB to HSV***
  1. Perform Right shifting and ANDING operation to separate the RGB component on the required frame
  2. Find the Max and Min from r,g,b;
  3. set the Max as v;
  4. check condition if v=0 then set values h = s = 0;
  5. Similarly calculate the H and S value depending on the V value.
  6. Store and Update the r,g,b values to h,s,v for each pixel;

V. EXPERIMENTAL RESULTS

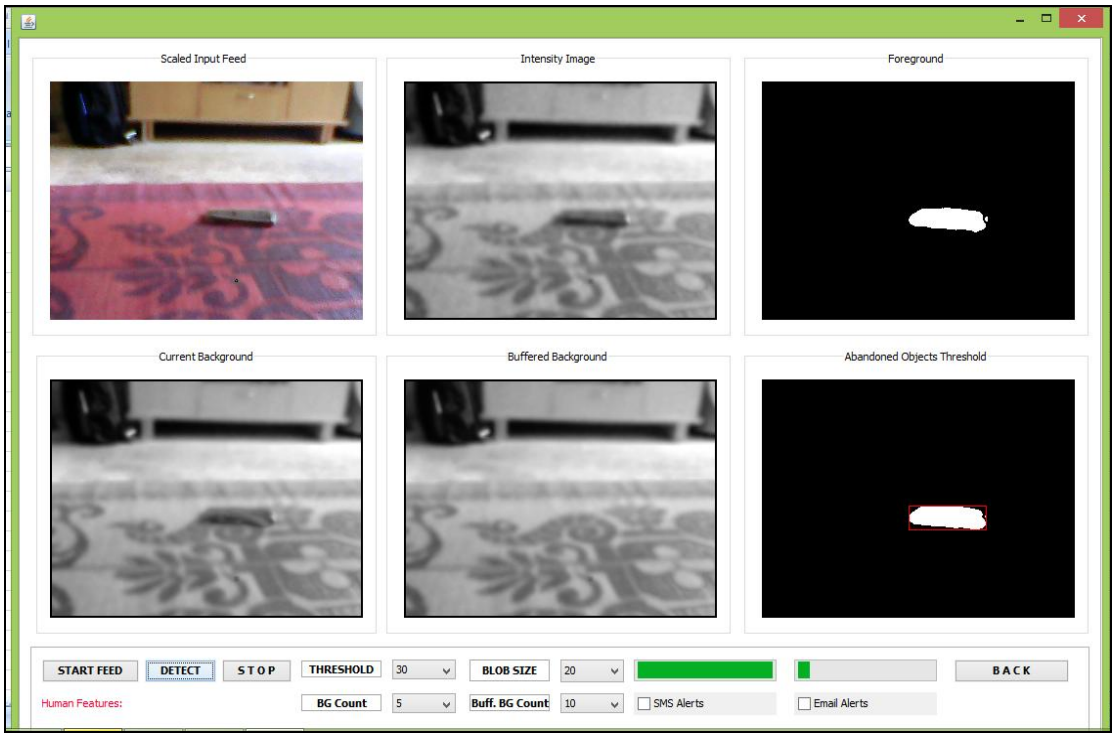

Fig 5: Abandoned Object Detection

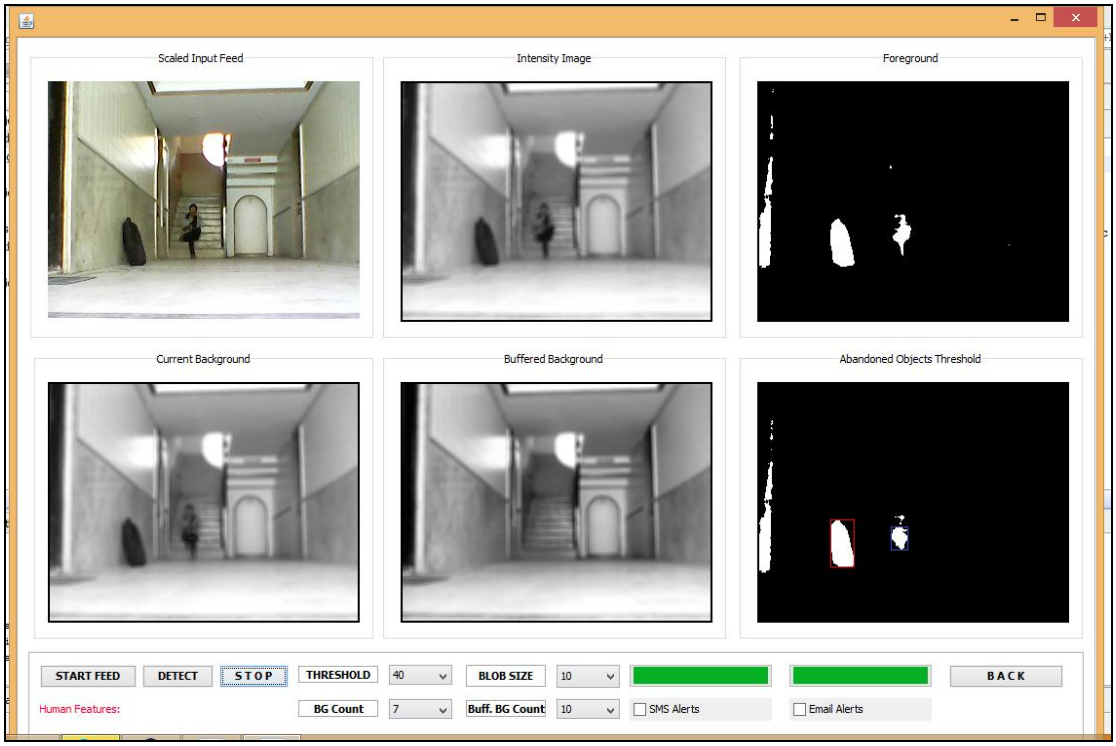

Fig 6: Abandoned Object Detection in the Presence of Human

VI. CONCLUSIONS

Systems detecting abandoned object using image processing algorithms have been proposed earlier but with large amount of constraints.The proposed system tries to overcome most of these constraints by adding new features i.e. using human detection, so even in the presence of humans abandoned object will be detected efficiently. The proposed system also enhances the security measures by providing an android application and email facility to determine the exact location of the abandoned object. Less time consuming and more efficient system that gives a better detection results. Parameters like blob size, background count and buffer background count makes it easier for analysis of abandoned object. In future scope the system can be made more efficient by using Cameras of higher resolution with high frame rate per second, which will help to overcome any environment constraints, analysing humans by other features like face detection.

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