MOTION DETECTION AND EVENT TRIGGERING

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***Abstract*—In present scenario, the security concerns have grown tremendously.Motion detection surveillance technology came about as a relief for the generally time-consuming reviewing process that a normal video surveillance system offers. The purpose of this project is to design a surveillance system which would detect motion in a live video feed and record the video feed only at the moment where the motion was detected also to track moving object based on background subtraction using video surveillance. The moving object is identified using the image subtraction method. This paper also focuses on face recognition using KLT algorithm. The proposed system is efficient and convenient for both office and home uses.**

***Index Terms*—Webcam, motion detection, face recognition, surveillance system**

I. INTRODUCTION

The task of a motion detection surveillance system is to detect a "region of interest" present in a "region of awareness", where the region of awareness, or the field of view, is defined as the "portion of environment being monitored". The region of interest in this case refers to bank locker. The system captures images only when the motions exceed a certain threshold that is preset in the system. Later the system detects the face and face recognition is done by calculating percentage of matching features point of both the images. It thus reduces the volume of data that needs to be reviewed and is therefore a more convenient way of monitoring the environment. Also, it helps to save data space by not capturing static images which usually do not contain the object of interest.

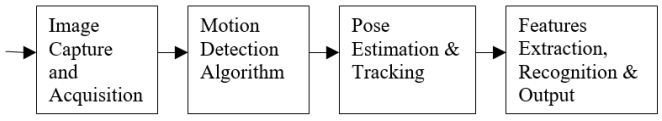

Fig. 1. Block Diagram of Motion Detection And Event Triggering

II. PROBLEM STATEMENT

Applications designed to detect movements work with a huge volume of image data that may disproportionately increase the demands on the hardware configuration. Hence the need to continuously improve their methods of reducing the volume of image data is necessary for processing video recording. Any saving, though small, may appear in one image as insignificant item, but for the sum of thousands of images that make up the video footage, it has very positive effects. Problems in motion are not only caused by a huge amount of data, but also by the enemy of image quality, which is noise. As people become more and more security savvy, they will demand real protection for their property. The new digital video systems will have to raise that security to a new level. They should make the customers feel good and those who do try to beat the system should face a far greater risk of getting caught. Hence, the new digital video surveillance systems should be able to provide a high sense of security. The peace of mind can only be achieved when the person is assured that he will be informed of any thefts of his property while they are in progress. He would also feel more secure if he can be guaranteed that the surveillance system that he uses will not only give him evidence against the perpetrators but also try to stop the thefts from taking place in the first place.

III. PROPOSED SYSTEM

In this System, there are two main components that concern basic 'Motion Detection" and 'Face Recognition'. Methods for motion detection can be categorized into two main classes, i.e. pixel-based and region-based algorithms. There are four popular motion detection algorithms available but this paper focuses on Background Modeling algorithm which uses pixel-based background subtraction method for this system. The user first of all initialize the camera then specify frame size. The frame size and frequency will be changeable. It will then start to capture the video, it will set the first image as a background, the next image will be taken compare and then store or delete the frame. It will store the image if it detects any motion and it will delete the image if there is no motion in image. If motion is detected it will recognise that object is human, animal, bird, other etc. If that object is human then face will be detected automatically from that frame. Face Detection is the first and essential step for face recognition, and it detect faces in the images. It is a part of object detection and can use in many areas such as security, bio-metrics, law enforcement, entertainment, personal safety, etc. It is used to detect faces in real time for surveillance and tracking of person or objects.

A. Motion Detection

Motion detection is one of the most important subjects in modern information acquisition systems for dynamic scenes. Detecting moving objects in an image sequence is a basic, and fundamental task for many computer vision applications such as video surveillance, traffic monitoring, human gesture recognition. At present method used in moving object detection are mainly the frame subtraction method, background subtraction

method, background estimation method and the optical flow method.

1) Threshold: In motion detection threshold does image binarization using specified threshold value. All pixels with intensities equal or higher than threshold value are converted to white pixels. All other pixels with intensities below threshold value are converted to black pixels.

For each pixel (x) in Image Z:
If X.getPixel(x).Intensity ¿ threshold
Z.setPixel(x) = White
Else
Z.setPixel(x) = Black

B. Face Detection

Face detection can consider a substantial part of face recognition operations. Firstly the image is imported by providing the location of the image. Then the picture is transformed from RGB to Grayscale because it is easy to detect faces in the grayscale. Next image segmentation is used for contour detection or segments the multiple objects in a single image so that the classifier can quickly detect the objects and faces in the picture. Face detection is a part of object detection and can use in many areas such as security, bio-metrics, law enforcement, entertainment, personal safety, etc. It is used to detect faces in real time for surveillance and tracking of person or objects. It is widely used in cameras to identify multiple appearances in the frame. The methods of face detection divided into four categories. These categories are as follows:

- Feature Based
- Knowledge Based
- Template Matching
- Appearance Based

Feature Based

The feature-based method is to locate faces by extracting structural features of the face. It is first trained as a classifier and then used to differentiate between facial and non-facial regions. The idea is to overcome the limits of our instinctive knowledge of faces. This approach divided into several steps and even photos with many faces they report a success rate of 94.

C. Face Extraction

This system uses Haar-Like features algorithm, which is proposed by Voila and Jones for face detection. This algorithm used for finding the location of the human faces in a frame or image. All human faces shares some universal properties of the human face like the eyes region is darker than its neighbour pixels and nose region is brighter than eye region. The haar-like algorithm is also used for feature selection or feature extraction for an object in an image, with the help of edge detection, line detection, centre detection for detecting eyes, nose, mouth, etc. in the picture. It is used to select the essential features in an image and extract these features for face detection. The next step is to give the coordinates of x, y, w, h which makes a rectangle box in the picture to show the location of the face or we can say that to show the region of interest in the image. After this, it can make a rectangle box in the area of interest where it detects the face.

D. Face Recognition

Face recognition is the process of identifying one or more people in images or videos by analyzing and comparing patterns. Algorithms for face recognition typically extract facial features and compare them to a database to find the best match. Face recognition is an important part of many bio-metric, security, and surveillance systems, as well as image and video indexing systems.Face recognition leverages computer vision to extract discriminate information from facial images, and pattern recognition or machine learning techniques to model the appearance of faces and to classify them.

1) KLT algorithm: Kanade–Lucas–Tomasi (KLT) is an approach to feature extraction in Computer vision. This approach is faster than traditional techniques for comparing best matches between two images. The algorithm is based on three main steps:

- Detect a real time face from webcam to track.
- Identify various features of the face.
- Finally track the face.

Face is detected using vision.CascadeObjectDetector object to detect face location in real time video frame.Cascade object detection uses viola-jones detection algorithm. To track the face continiously over the video frame KLT algorithm is used. After detecting face the algorithm tracks a set of features points from the video frames. Vision.pointTrackerSystem is used for initialize a face tracker to find corresponding points in the current frame.

IV. IMPLEMENTATION

A. Motion detection and basic principle

Idea of motion detection: Motion detection is identifying the image changes in some areas, detecting the presence of object motion, avoiding the interference by the light changes. One of the main applications of motion detection in the surveillance system is alarm linkage, which reminds a user to find motion targets and make further processing. Video sequence is composed of a series of video images, which contains the features of containing geometry information of the target. Through analyzing images, we can classify the target, extract relevant information to analyze the motion of targets, then get detection results. The target detection, which has high authenticity, is also an ideal intrusion detection alarm.

Several general methods: Motion detection analyzes the encoded data frame and produces a comparative analysis of the video frame by comparing the image change.

- Background Modelling
- Temporal Difference
- Optical Flow
- Spatio-Temporal Entropy

1.Background Subtraction:

The principle of this method is to build a model of the static scene (i.e. without moving objects) called background, and then compare every frame of the sequence to this background in order to discriminate the regions of motion, called foreground (the moving objects).This approach requires image manipulation to differentiate the foreground from the background. In general, the following manipulations are required. Assuming we have 2 images X and Y, we are manipulating these images to obtain image Z.

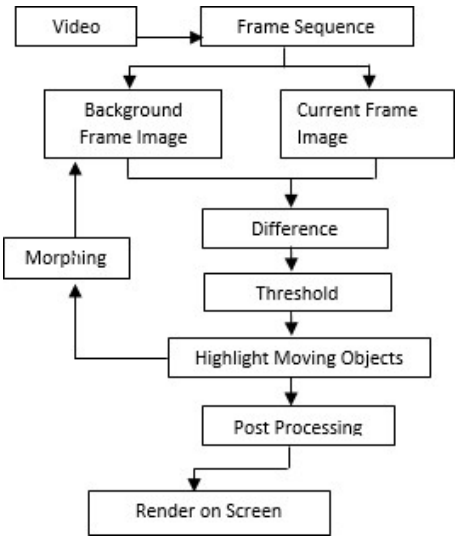

Fig. 2. Background subtraction process

B. Face Recognition

1.Training Process

1.1 Real time Image capturing: Image capturing is done by the use of webcam where user have to stand in front of camera .captured images are send to Matlab for detecting and tracking image .

1.2 Detect faces: Faces which are captured from webcam are detected using viola jones algorithm using cascade object detector class. Here faces are croped along with thier bounding boxes and pass to features extraction process.

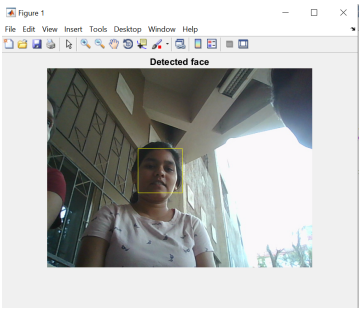

Fig. 3. Detected Face

1.3 Extract good features: After detecting faces KLT algorithm tracks a set of feature point across the video frames.

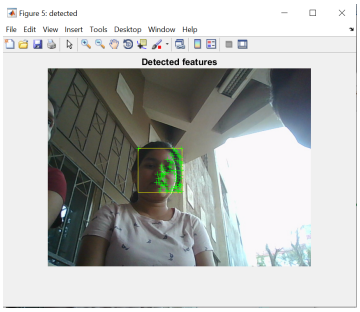

Fig. 4. Feature Extraction

1.4 Track Features: Matlab uses vision.PointTracker System object to track various feature points. The point tracker find the corresponding point in the current frame. Then the estimateGeometricTransform function is used to estimate the translation, rotation, and scale between the old points and the new points. This transformation is applied to the bounding box around the face.

1.5 Track faces: After detecting feature points matlab code tracks all points from frame to frame. estimateGeometricTransform function is used to calculate the motion of the face.

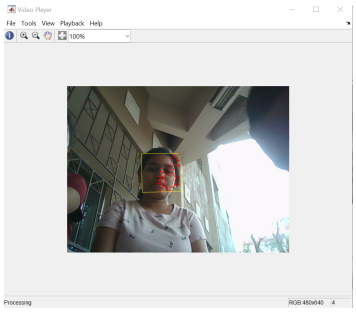

Fig. 5. Video Player

1.6 Store the tracked faces to database: After tracking faces different faces are stored in to the database for further recognition process. In our project we store 10 various faces of a single person in to the database. imwrite function is used for storing faces to a image database.

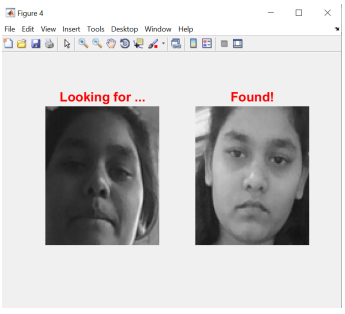

Fig. 6. Face Recognition

CONCLUSION

Our aim is to implement a face detection and recognition system using KLT algorithm . We used these algorithm because it finds the best alignment for each possible location in the search space and minimize the overall mean square error in the process of inverse filtering and noise smoothing Frequency domain respectively. These are very powerful techniques and can be used in modern day security systems. This project can be extended in future for the fields like e-banking sector, Criminal investigation system, social networking site, national security system, etc.

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