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A Novel Approach for Video Surveillance using Frame Comparison Algorithm

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***Abstract*—This paper describes a method to extend the capabilities of surveillance system. As in traditional surveillance system, our method also makes use of CCTV camera. However traditional system simply records the environment which can be monitored once the theft or intrusion is notified. This requires tremendous video storage and cause incredible financial burden to the user. In our system, adjacent frames are compared using frame comparison algorithm and if difference exceeds a threshold value, security alarm will be generated automatically to notify the user.**

***Index Terms*— Motion detection; Frame comparison;Threshold; Frame rate; Surveillance camera.**

I. INTRODUCTION

Videos are sequences of images each of them called as a frame which are displayed in fast frequencies so that the human eyes can percepts the continuity of its content. Image processing techniques can be applied to individual frames since the contents of two consecutive frames are usually closely related. This process is classified into 3 sub categories. [1]Detection that Automatically identifies interesting features, interest points done robustly. The same features should always be detected regardless of viewpoint.[2] Description in which each interest point should have a unique description that does not depend on the features scale and rotation.[3]Matching that determine which all objects it contains through a given input image, and possibly a transformation of the object, based on predetermined interest points.[2]

Object detection in videos involves verifying the presence of an object in the sequence of images and locating it precisely for recognition. [3].Tracking of these objects is to monitor the spatial and temporal changes during a video sequence which includes their presence, position, size, shape, dimensions etc.

This can be achieved by solving the temporal correspondence problem - the problem of matching the target region in consecutive frames of a sequence of images taken at closely-spaced time intervals. These two processes object detection and object tracking are closely related because tracking of

objects usually starts with object detection, while detecting an object repeatedly in image sequence is necessary to verify tracking. Currently, a number of algorithms are available for object detection of these we selected SURF which expands Speeded up robust features [1].

One of the major problems around the world is maintaining security with minimum expense. It is impossible to have 24*7 security surveillance by human eye. This paper deal with an application which helps to achieve the goal by introducing a new technique of motion detection in images from CCTV cameras. This new technique will reduce human effort of constantly monitoring camera greatly by showing only the screens

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where significant changes had happened. This paper illustrates the advantages of using this technique by clipping photos which are outputs from actually implemented application.

II. EXISTING SECURITY CAMERA SYSTEM

Using CCTV to monitor an environment is one of the biggest innovations in the human history. Nowadays most offices as well as public places have CCTV cameras. As always it has advantages and disadvantages [4]. Even though the advantages are superior to disadvantages, it needs to be addressed.

Advantages

- Deter crime: Once a camera is installed at the home or office people feel a security. Since people know they are being monitored the tendency towards committing crime reduces.
- Monitor Scenarios and Activities: The cameras can be placed anywhere if a power source can be provided. Cameras are available different sizes and shapes. Tiny cameras can be placed anywhere. Cameras help to monitor suspicious people and activities.
- Gather Evidence: The cameras record the events happening. Whenever something wrong happens this can be used. Unlike humans it does not forget anything.
- Arrive at the Right Decisions: The output of security cameras cannot be easily fabricated. So whenever a dispute is being settled this can be used to take the correct decisions. Since fake claims can be understood.
- Maintain Records: The outputs are saved. So it can be viewed whenever it's needed. Using hard disks, the records can be stored for years or even decades. They may become useful in the future.

Disadvantages

- Privacy: There have been cases where employees have objected to being under constant surveillance without been permission and citing the 'invasion of privacy' to the reason. A few have also resorted to taking legal action against their employers in relation to this.
- Cost: The cost of cameras increases with the features. Camera size, shape, clarity etc. are that deciding the cost of camera.
- Vulnerability: Nowadays people know how to get by cameras. Also tech savvy criminals can cut the power to camera or even damage it externally.
- Cannot stop theft: Cameras can only record events. It cannot alert people like an alarm. To perform this sensors or hardware needs to be used. This increases the cost.

III. SYSTEM DESCRIPTION

The system must be started by the user. He must login into the system either by unique key code or by face identification. Once he/she has logged in the control panel is provided to set the parameters (frame rate and the threshold value of motion). The system can store the culprit frames in user specified storage location.

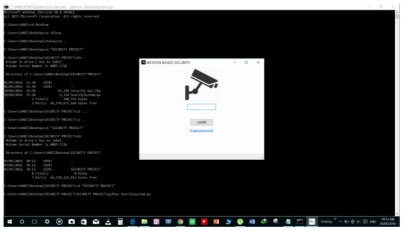

Fig 1. Login

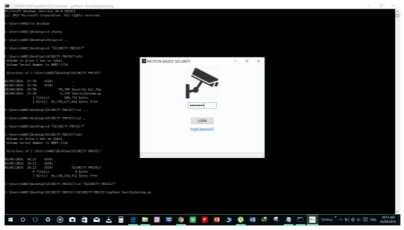

Fig 2. Security system password

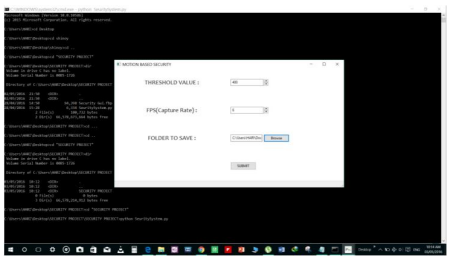

Fig 3. System security control

A. Working

Module 1: Framing of video

All operation performed by the software is based on the video from the surveillance camera. For motion detection the resolution of the camera is not a big deal. In order to get good clarity images, should need high resolution cameras. The video is the collection of large number of images called frames or in reverse video at an instant is called frames. From the video, frames are extracted in order to apply the image processing. Framing is done by sampling the videos at the following frame rates 30, 15, 7.5, 5, and 1. Video recording between 7.5 and 15 frames per second is very common. This is because very little quality is lost as you can see here. Once you start going below 7.5 frames, the choppiness is much more noticeable to the human eye. Something else to consider is that although the human eye does not pick up much difference between 15 and 30 frames per second, when an operator digitally plays back surveillance video footage on the monitor, user can capture and pause a much more specific frame in time with the higher frame rates.

An Image is represented as m x n matrix, where m is the width and n is the height of the image in pixels. The Frame comparison is done by the RMS value comparison of two consecutive frames [5].The RMS value is the amount of variation between two frames. If there is a motion the RMS value is huge. Else it is comparatively low. This determines the motion in the video.

Module 2: Frame comparison

Fig 4. No Motion

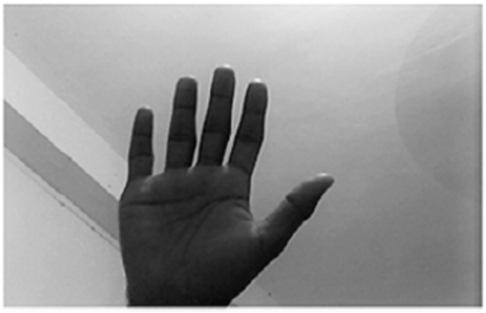

Fig 5. No Motion

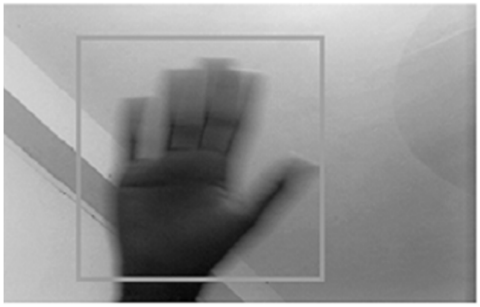

Fig 6. Motion

Root Mean Square (RMS)compares two structures by computing the root mean square deviation (RMSD), the size-independent 'ρ' similarity parameter (rho). The RMS value of the j^{th} column of an M-by-N input matrix u is given by

$$y_i = \sqrt{\frac{\sum_{i=1}^{M} |u_{ij}|^2}{M}}$$

Module 3:

This module basically depends on the motion threshold. User have an option to set the threshold level by analyzing the day and night vision of the surroundings, where he /she wants the camera to be installed. In the case of banks where high security is needed we should track the very minute changes. So we set the level of threshold from 160 to 200. If in the case of household where we bothered less about the motion changes, we set the value between 400 and 600.

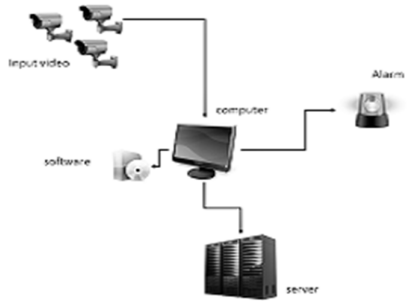

Fig 7. System Diagram

If the frame threshold is greater than the user set threshold, then that frame should be captured by the system and get stored in the systems database. The number of frames need to be captured per second can be set by the user depending upon his /her systems capacity. At the time when a motion is detected the system generates a warning alarm to notify the user.

B. System features

1. The system generates alarm when motion occurred.
2. When motion detected the motion frames are stored for further enquiries.
3. The system can have implemented in existing surveillance systems.
4. There is no additional hardware required.
5. Previously stored video can use for checking the motions.

IV. Conclusion

Through the output of security applications, we proved that our technique is much better than old security systems. In the old security camera monitoring system, the user needs to provide his/her attention to the screen all the time even if there were no significant changes happened. In our system, the user is

automatically alerted by an alarm sound. This happens only when significant changes had occurred in the image.

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