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Motion Activated Camera For Video Monitoring System

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Abstract : *In today's modern world, there is a need of an efficient and automated surveillance system for security in homes and offices .We realized that in existing systems, a lot of energy, bandwidth as well as memory is being wasted as video is captured and uploaded or stored continuously. So we have developed a video monitoring system where the cameras start recording only when the motion is detected, thereby saving both bandwidth as well as energy. The system also sends an alert SMS, followed by a missed call as soon as motion is detected and uploads the recorded video on cloud storage, which enables remote monitoring and saves manpower.*

Keywords: *Absolute Difference, CCTV, Dilation, Dropbox,PIR Sensor, SMS, Thresholding.*

I. Introduction

Security systems used nowadays use CCTVs for 24 X 7 monitoring[1]. Eventhough it is necessary in public places and other areas where every detail needs to be accounted for, and be stored for future reference, the system becomes redundant when it comes to monitoring restricted areas where no unauthorized activity is expected and occurrence of an activity is very rare. In such cases memory is wasted in storing the entire video or network bandwidth is wasted in uploading it, and all together energy too gets wasted.The stored information is only useful in such cases when it has captured some unauthorized event. An event can be directly linked to presence of motion, so this paper proposes a solution by using motion to activate the video monitoring system and only capture information of importance. This system also sends an alert SMS followed by a missed call to the concerned person the very instant motion is detected, thereby eliminating the need for constant human monitoring of the CCTV feed to detect any unwanted event . Apart from this the recorded video is uploaded on a predefined Dropbox account known to the authorized person allowing it to be viewed immediately from anywhere and take necessary steps.

Systems exist which use motion based recording using PIR sensors, but these fail if the intruder is not human, say a robot or any nonliving thing. Our system on the other hand is capable of detecting any kind of motion. This system proves to be most useful for security in homes in absence of owner, where cost and maintenance of CCTVs become a barrier to be used .

II. Motion Detection Algorithm

The system uses image processing for detecting motion. OpenCV is used to perform various image processing tasks[2]. It takes difference between successive frames to detect any kind of motion. Frame size used is 640X480 to provide sufficient details and even after detection of motion, frames are taken from the video port to detect stop of motion without any loss of frames in the recorded video. Camera captures frames at intervals of 300ms and first converts the two successive frames to grayscale(8- bit image).

Algorithm functioning is explained with the help of figures. Fig.1 and Fig.2 are the two grayscale converted successive frames. The pixel values of these two frames are arranged in the form of an array of size equal to the frame size. We use 'absdiff' function in OpenCV which provides per element absolute difference between the two arrays or between an array and scalar and this is the first step which provides major information about any presence of motion.Fig.3 shows the result of absolute difference. For ease of motion detection, we perform some more processing on the obtained result in Fig.3.

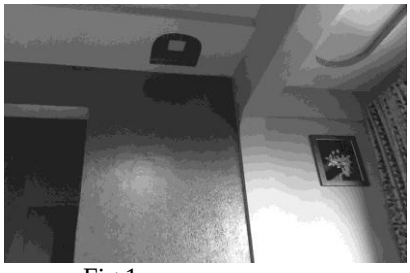

Fig.1

Fig 2

Thresholding is applied to the result in Fig.3 wherein all pixel values above a certain value are assigned the maximum value of 255 and rest are assigned 0 value. Thus we obtain a two valued image. Now two iterations of dilation is performed on the obtained image which increases the region of pixels valued 255 to compensate for the loss of motion detail due to thresholding to some extent. Fig.4 shows the resultant of thresholding and dilation[3,4,5]. And this image is finally used to detect if there is any motion.

Fig.3

Fig.4

The number of white pixels are counted in the resultant image such as Fig.4. If the number of white pixels is above a predefined value, which can be set as per the required definition of motion, the system assumes there is motion. After trying different values and testing the system under different conditions we have set the white pixel count parameter to 3000, which is also enough for detecting fast as well as small changes in successive frames.

III. Alert System

As soon as motion is detected the alert system which uses a GSM module sends an alert SMS followed by a missed call to the concerned person informing about the security breach[6]. The video containing motion which was recorded, is stored in the SD card and is then uploaded on Dropbox as soon as motion stops. The video is recorded at a low resolution of 288 X 144 and only 10 frames per second are used and the video is encoded using h.264 compression technique,which makes maximum use of previous encoded frames to reduce the size of video. This ensures faster uploading of video. App key and Secret is obtained from the Dropbox developers website for the particular account to which the video is to be uploaded[7]. This helps direct uploading of video to the account without the need to login everytime.

IV. Processing Details

Raspberry pi 2 is the brain of the system[8]. It uses Broadcom BCM2836 SOC and ARMv7 processor architecture and is a Quad Core 32bit Processor with 1GB RAM, running at 900MHz. Picamera is used as it is capable of using the processors resources to the full extent[9]. The total image processing steps used in the motion detection algorithm account for close to 400ms of processor time. This along with the 300ms time between acquiring of two successive frames, which is deliberately added to suit the algorithm used, to get sufficient difference between frames for motion detection, total time for running the loop for motion detection requires 700-800ms. The processor is consistent and has maintained its processing time even when tested for longer durations, and efficiently detected motion within the time frame.

V. Conclusion

This system is efficient in terms of saving energy, storage memory, network bandwidth and manpower. It is cost efficient also and does not need regular maintenance as it will be activated very few times owing to the restrictive nature of the area of installation. Although it has a simple and efficient motion detection algorithm, it is sensitive to quick changes in illumination in the monitored area. Also some parameters need to be changed in the algorithm depending on the nature of area being monitored as well as the size of area to get accurate results. But the benefits seem to outweigh the drawbacks, which are manageable to some extent.

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