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Fire Detection by using Digital Image Processing Technique

Mahadev A. Bandi[1], Dr. Mrs. V. V. Patil[2]

[1]P.G Scholar, Department of Electronics Engineering, Shivaji University, Dr.J.J.M.C.O.E Jaysingpur, Kolhapur, India

[2]Professor, Department of Electronics Engineering, Shivaji University, Dr.J.J.M.C.O.E Jaysingpur, Kolhapur, India

Abstract: ***In this paper is to study the detection of flames in a video by using motion and edge detection technique. This is an improved method over all the existing ones. This method detects the edges of the flames properly by removing the noises in the flames. This paper focus is on identifying gray cycle pixels for the detection of flame. It's optimizing technique to detection of the flame, which generated because of smoke and of spreading of fire pixel and the area spread of flame. These systems can be used to reduce false detection fire. The novel system simulate the existing fire detection techniques with above given new techniques of fire detection and give optimized way to detect the fire in terms of less false detection of fire by give the accurate result of fire occurrence. The strength fire detection is the ability to monitor indoor and outdoor applications by using videos. The novel system also gives the opportunity to adjust the system by applying different combination of fire detecting techniques which will help in implementation of system according to different sensitive area requirement.***

Keywords: Canny, Color canny, Prewitt, Sobel edge detection and motion detection

1. Introduction

In previous fire detection system are base on sensors to make decision. Most of the available sensors used such as smoke detector, flame detector, heat detector are take time to response as well as they cannot analyze or visualize the damage. These sensors are to be carefully placed in various positions but these sensors are not suitable for exposed places. Due to speedy development in this technology and video processing techniques, the new conventional fire detection technique is going to be replaced by computer vision based systems. Conventional point smoke and fire detectors are widely used in buildings. Smoke and fire detectors are typically detect the presence of certain particles generated by smoke and fire by ionization or photometry. Unless particles reach the sensors to activate them alarm is not issued. Therefore, they cannot be used in open spaces and large covered areas. By using video in fire detection makes it possible to serve large and open place. In addition, closed circuit television (CCTV) surveillance systems are currently installed in various public places monitoring indoors and outdoors applications. Such systems may gain an early fire detection capability with the use of fire detection. This fire detection is done by using software processing the outputs of CCTV cameras in real time. Current vision systems are based on color clues, motion in fire and edge detection of flame. Fire detection scheme can be made more robust by identifying the gray cycle pixels nearby to the flame and measuring flame area dispersion.

2. Literature Review

This section covers the detail of the previous proposed fire detection techniques. The image capturing device produces output is in the form RGB. During an occurrence of fire, smoke and flame can be seen. In fire has include color, motion, shape, smoke and growth etc. For detection of fire these feature are used. If the fire increases its intensity, smoke and flame will be visible. In order to detect the occurrence of fire, both flame and smoke need to be analyzed. Han et. Al [1] divided the fire detection algorithm into two algorithms which are flame detection and smoke detection. Tareyinet.al [2] uses extracted features such as motion, flickering, edge blurring region from a video, using wavelet transformation and background subtraction for determination of smoke. Kandilet.al [3] and Liu et.al[4] use shape and color features to detect occurrence of fire. Many researchers used unusual properties of fire such as color, motion, edge, shape. Lai et al. [5] suggested that features of fire event can be utilized for fire detection in early stages. Han et. al. [1] used color and motion features while Kandil et al. [3] and M. Nixon, A. Aguando [6] utilized shape and color features to detect an occurrence of fire.

Lai introduced development of automatic video surveillance systems has been the core trend in the security and guard service industry. This paper presents a simple for detecting the fire calamity event automatically in the monitoring area via real time video contents analysis. A fast and exact detection process is developed for early fire warning purpose thus to reduce the loss caused by fire accidents by observing features of fire event. This paper show that the proposed algorithm is not only achieves real-time requirement and has better performance than the compared surveillance systems, but also attains the goal of alleviating the existing system cost efficiently [5].

Zhu cascade rejection approach with the Histograms of Oriented Gradients (HoG) features of an image to achieve a fast and accurate human detection system. In HoGs system used variable-size blocks that capture salient features of humans automatically. Using Ada Boost for feature selection for identify the appropriate set of blocks from a large set of possible blocks. In this system, integral image representation and a rejection cascade which significantly speed up the computation. For a 320 × 280 image, the system can process 5 to 30 frames per second depending on the density of scan image, while this approached maintaining an accuracy level

similar to existing methods [7].

Chen presented of a paper based on early fire-alarm raising method on video processing. The basic idea proposed in this paper of fire-detection is to adopt a RGB (red, green, blue) model based on chromatic and disorder measurement for extracting fire-pixels and smoke-pixels. The decision function of fire-pixels is mainly deduced by the intensity and saturation of R component of an image. The extracted fire-pixels will be verified if it is a real fire by dynamics of growth, disorder and further smoke. The growing ratio of flames with respective a fire-alarm is the based on iterative checking . This technique is very attractive for the important military, social security, commercial applications [8].

C. B. Liu introduced vision based fire detection. In this system the increased the number of surveillance cameras. Vision based fire detection techniques offers advantages over the traditional methods that were complementing the existing devices. In this paper presented spectral, spatial and temporal models of fire regions in visual image sequences. The spectral model was used for representing in terms of the color probability density of fire pixels. The shape of a fire region was represented in terms of the spatial frequency content of the region contour using its Fourier coefficients. The sequential changes in these coefficients are used as the temporal signatures of the fire region. Specifically, an auto regressive model of the Fourier coefficient series is used. Experiments with a large number of scenes show that the method was capable of detecting fire reliably but there were incorporated in existing surveillance systems at relatively low additional cost [4].

3. Methodology

The purpose of this is to develop an optimized system to detect an occurrence of fire based on video images. In this project use the previously proposed methods to conduct the fire detection and also propose new techniques to implement in parallel. It gives more optimized results in detection of flame. In developing the system the following stages are involved.

The facts that visual color images of fire have high absolute values in the red component of the RGB coordinates are based on algorithm [9]. This property permits simple threshold-based criteria on the red component of the color images to segment fire images in natural scenarios. The fire doesn't gives high values in the red component. An image is loaded into color detection system and mapped with the extracted edge detection image [5]. A color detection system applies the specific property of RGB pixels and gives the output result as an image with a selected area of color detection.

- **Edge detection**

Edge detection technique is used to detect the color variance in an video image. Block Diagram of Edge Detection System is as shown in Figure 1.

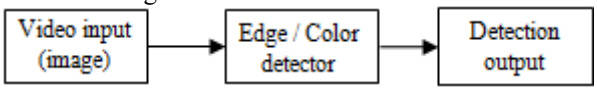

Figure 1: Block diagram of Edge Detection system

The edge detection system compares the intensity difference in the image and it provides an image with black and white color space where high intensity area is white color and low intensity area is black color [5].

The intensity difference is categorized using a global intensity threshold which is separately calculated for each image by MATLAB the output will provide a shape of the flame [4]. Thus, the edge detection can be used to analyze color detection of fire. After getting the output from the color detection we can apply different detection techniques by mapping these detected coordinate on its corresponding original image with different combinations.

In this paper use the canny color edge detection techniques because these techniques give the better performance as compared to other techniques. In this method first read the color image and divides it into its three separate color channels. Each color channel run through the Canny color edge detector separately to find a resulting colored edge map. Combine the resulting edge maps from each of the three color channels into one complete edge map. For this step it is found that a simple additive approach provided the best results. So if there was an edge in any of the three colored edge maps, we added it to the general edge map. We have three techniques to implements further.

- **Motion Detection**

Motion detection is used to detect any occurrences of movement in a sample video of sequential two frames. Block diagram of motion detection system is as shown in figure 2.

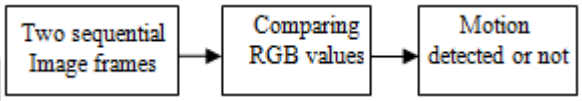

Figure 2: Block diagram of motion detection

Here we required two sequential images from video frames [6]. After applying basic two methods i.e. edge detection and color detection we get probable area of fire pixel then we compare the RGB value to of frame1 to the frame 2 for corresponding pixel and if pixel value differs then motion detector will show motion and will give resultant output to the combination of operator.

4. Experimental Results

In proposed work it has been done edge detection by using canny color edge detection method as compared with the other methods. In fig. 3 and 4 shows the original images and find the flame by using different technique such as color canny, sobel, Prewitt, canny. From this result conclude that as compared with the other methods color canny method gives better performance. In Fig. 5 shows the flame and by using canny color edge detection technique we get result of edge detection as shown in fig. 6. After edge detection next parameter is to find motion of fire. For the motion of fire we selected the sequential frames images from the video get the result of motion detection as shown in fig 3 & fig 4.

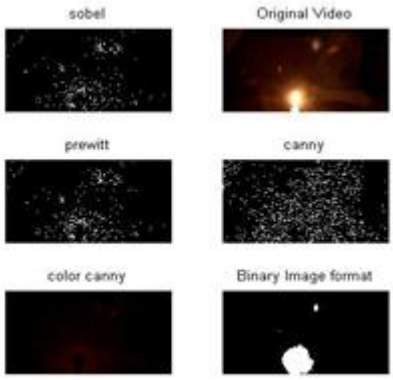

Figure 3: Motion detection for frame1

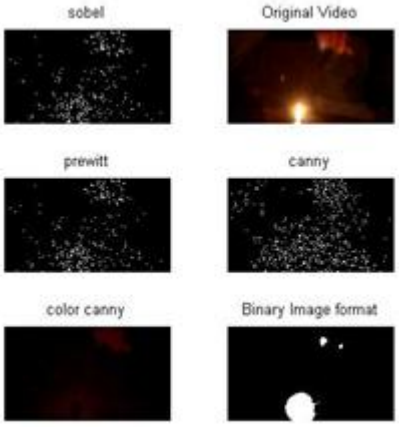

Figure 4: Motion detection for frame 2.

Figure 5: Original Flame

Figure 6: Edge detection

5. Conclusion

The proposed optimized flame detection system can be used more conveniently for the detection of flame in a live video stream sequences. It has shown that the proposed flame detection system performs well in both smaller and larger or open area flame regions in video sequences. With this advances the system can be used more conveniently in houses, school and colleges, industrial areas, and large open areas and even in the forest or farms fire detection. A novel combination of existing fire detection methods which are used together to obtain the optimized results is used for tracing and detecting the fire area in video sequence.

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