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Review on Vision Based Fire Flame Detection

Akshay Thokale¹, Poonam Sonar²

P.G. Student, Dept. of ETC, Rajiv Gandhi Institute of Technology, Andheri, Mumbai, India¹

Associate Professor, Dept. of ETC, Rajiv Gandhi Institute of Technology, Andheri, Mumbai, India²

ABSTRACT: A review has been described in the paper for development of video based fire detection. Video based fire detection technology has become the center point of research due to its capability of having higher intuitive, high detection time, accurate alarm time and also it is jamming free as well as robust. The review paper proposes the method to analyze the frame-to-frame changes to determine the region of fire by detecting the characteristics of fire. Characteristics such as color, random fire size area, boundary of fire. The characteristics make the system affirmative to detect fire in real time. The motive is to catch the fire in the frame at a very early point.

KEYWORDS: Colour Detection, Edge Detection, Morphological operations, Motion Detection, OpenCV

I. INTRODUCTION

Smoke, fire, and flames are one of the leading hazards affecting everyday life around the world. Fire and burns are the second most common cause of death to children under 10 in the USA, second only to automobile crashes. Smoke detectors have been widely used to an extent to raise alarms for saving people's life. However, faulty smoke detectors cause many of deaths resulting from smoke and fire. In addition, particle smoke detectors cannot be used reliably to detect fires in large spaces including auditoriums, warehouses, and outdoor spaces. Due to rapid development traditional fire detection system is replaced by vision based system. Researchers got attracted towards the detection method which is visually based. For identification of fire flames in video a new proposal and analysis methods have been approached by the authors. We propose that, changes in the features of the fire regions occurring differently at different frames can be used for the detection of fire flames in videos by combined algorithm. The average of RGB channel are the statistical features the coarseness and the skewness of the red channel distribution. CCTV's are placed in all areas and near all hazardous places to monitor real time activities. The advantages of fire detection technology based on the video image can be summarized as the following points: first, intuitive techniques. Second high transmission and induction which leads to no delay time in real time detection. Third, CCTV has a larger detection range and is confined to remote areas. Fourth, real time detection allows recording and saving the activity which helps us for future verification of fire occurrence.

Paper is organized as follows. Literature review is described in Section II. Methodology is described in Section III. Section IV presents Conclusion.

II. LITERATURE REVIEW

Large numbers of techniques have been developed for the fire detection from images of videos due to the number of vision based algorithms proposed in various literature surveys. Conventional methods of fire detection have been practically replaced with Video-based smoke detection methods due to various advantages over conventional methods like such as early fire detection, speedy response, non-presence of spatial limits, also information of the fire progress can be achieved due to live video and in fire investigation vision based is capable to provide forensic evidences.

Healey et al. [1] applied a model based on colour which is useful as a basic step for any different algorithms. By using this model any different algorithm can be generated in real time applications for fire detection. H.C. Muller and A. Fischer [2] suggested multi sensor based fire detection systems are important for automatic fire detection technology.

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But this system also takes time to response and cannot be used for open space. The two main motives of the progress are still not acceptable fake alarm and fire detection capabilities of the systems should be improved (i.e. timing of detection should be very quick). Multiple sensors when used in the detection system give a better quality image of the monitored environment which helps in making alarm decision safe. Enhanced detection systems of fire in desired direction is implied by multi sensor technology .An MSBFD algorithm with fire parameters like temperature parameter and smoke density parameter has been presented in the paper. Temperature and smoke sensors were chosen instead of ionization system. Due to imposed environmental regulations, difficulties in applying ionized systems have been increased. W. Phillips [3] used method is to detect fire by the temporial variations of pixels .The pixels of fire colored are obtained by creation of color histogram which is smoothed by Gaussian approach. But, as the method is based on color the complexity arises in temporal property of fire as it is not captured due to temporal variation in pixel color .Other pixels has more temporal variations than cored fire pixels. Blagojevice et.al [4] suggested the new function for approximation of front edge of the signal in early stage of fire development is presented. With this function, it is possible very fast, immediately after ignition, to predict the temperature development during the fire growth phase, its maximal value and the time interval needed to achieve this value. B. U. Toreyin [5] yield better results, as flame boundaries are represented in wavelet domain and fire regions having high frequency is used to generate spatial flame flicker model. But, the technique has two disadvantages: assumption of the stationary camera; and second, though real timed complexity in computation is more. Analytical method consumes more time as there are 25 frames per second in a video. D. Han and B. Lee [6] used tunnel environment to detect flame and smoke in real time by proposing image–processing technique. Existing algorithms for detection of fire in environment of tunnel are difficult to apply as environment somewhat differs and so author proposed a special algorithm for fire in a tunnel. An original algorithm that is applicable to environment of tunnel is proposed by the author. The particular position of event at an early stage can be detected by gaining the information from color and motion to lower false detections in tunnel. But, in real time applications the method is non-applicable due to large number of heuristic thresholds. T. Celik, H. Ozkaramanli, and H. Demirel [7] the authors replaced RGB space by YCbCr colour space. They PFM are generated by fuzzy logic to obtain the information of luminance and chrominance which act as a substitute for heuristic rules. The encodataion of certain drawbacks due to back to back experiments can be obtained by fuzzy representation. Author states fire coloured pixel can be determined by the single output decision quantity. Better rate of identifying exploitation of fluky changes of fire from one frame to another frame is prohibited. Kandil et.al and M. Salama [8] applied a hybrid algorithm depending on adapting the back propagation algorithm to detect fire in sequences of images by use of new adaptive terminal attractor algorithm, after canny edge detection to determine boundaries of smoke and fire. When the video is analysed in wavelet domain the other clue detection of fire flicker and smoke can be done. Computation of spatial wavelet transform of colored regions containing moving fire is done to detect variation of colors in flamed regions. An uncontrolled fire in a nuclear facility can be a very energetic event. The new hybrid is applied for real time fire recognition in the rooms of the second nuclear reactor of Egypt, which have high radiation levels. Shaik Raasool, Dr. P. Pandharinath [9] determines the edges of flame and fire is the process to identify a boundary between thermo chemically reacted area and those without thermo chemically reacted area. Use of temporal variations and color information of pixels generates regular false alarms due to the presence of lots of heuristic features. Thus, to overcome these limitations, this paper presented an algorithm for fire detection by using a model of adaptive background subtraction with Bayesian inference to verify real fire pixels.

III. METHODOLOGY

The aim of the paper is to generate a better system for the detection of fire flame in real time. By using previously proposed method and by proposing new techniques the better detection rate can be achieved by less consumption of time. The proposed algorithm is used to generate a robust system by using all the three algorithms. i.e. fire colour detection (HSV), motion and edge detection combined.

Motion Detection: Motion analysis acts an important role due to increase in demand vision based image interpretation. Movement in a video can be detected by motion detection. Analyzation of difference in images of video frames is done. An adaptive background subtraction method is used for detecting the sudden lightning conditions and to generate

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foreground mask. Adaptive background subtraction maintains background model and parameters of background model evolve over time.

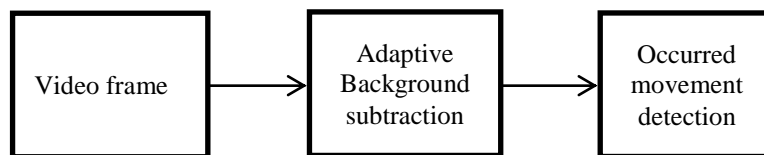


Fig.1. Block Diagram of Motion Detection System

In the above figure, frame of a video is input to the adaptive subtraction block. A subtraction between the present frame and background model is performed. After subtraction the image is segmented by threshold values. Then comparison is done between pixel and threshold value.
 Pixel value > Threshold value, then represent 1 i.e. white
 Pixel value < Threshold value, then represent 0 i.e. black
 Moving object is detected by white i.e. foreground and remaining black i.e. background. Advantages of adaptive background subtraction is that a different threshold can be selected for each pixel and thus the pixels can be adaptive with time, objects become part of background without the destruction of current background and speedy recovery.

Colour Detection: - Colour detection is used to detect any occurrences of fire in a video. Using OpenCV model, a Colour Detector model is built based on this block diagram.

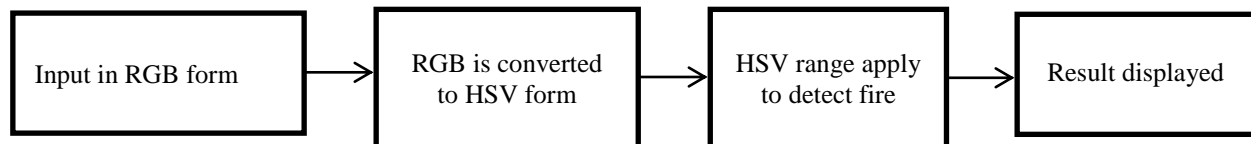


Fig.2 Block Diagram of Colour Detection System

Normally the input is in RGB form, and then RGB form is converted to HSV form. Then the range representing HSV form of fire is applied to detect only fire characteristics. Fire in HSV form is then displayed. HSV colour space is chosen purposely because it has ability to differ illumination information from chrominance more effectively than the other colour spaces. Threshold values for the fire are loaded in to the system, as per the threshold values colour detection system display result only if the fire is detected. In Colour Basics section hue is directly corresponded to the concept o hue. The advantages of using hue is the relation between tones around the colour circle can be identified easy way also Shades, tints, and tones can be generated easily without affecting the hue. Saturation corresponds directly to the concept of tint in the Colour Basics section, except that full saturation produces no tint, while zero saturation produces white, a shade of gray, or black. Value corresponds directly to the concept of intensity in the Colour Basics section. The advantage of HSV is that each of its attributes is directly corresponded to the basic colour concepts, which makes it conceptually simple.

Edge Detection: Edge is boundary between two zones i.e. thermo chemically reacted and non-thermo chemically reacted zone. Mathematical representation of first order and second purchase derivatives is utilized for analyzation of detection of edge. Gradient is found by first order and magnitude of sting is allowed by second order. Detection of the coarse and superfluous edge in the flame image is the main motive. Mostly and widely used edge detection methods like Sobel, Laplacian and Canny methods are applied with proper parameters for processing of genuine images of flame.

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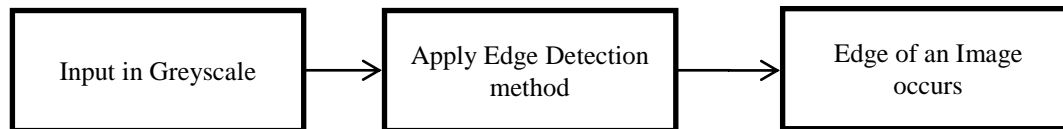


Fig.3 Block Diagram of Color Detection System

In the above diagram input image is in greyscale form, as grey form provides a good structure of an image, then an edge detection techniques are applied to give edges of images.

Morphological Operations: Morphological operations like smoothing, filtering, erosion, dilation, thresholding have been used in each above methods to make system robust and effective to vision based. Smoothing operation is used to make image look very clear by capturing certain pattern of data. Erosion operation is used to reduce the noise by deleting the spikes of data and reduces the size of data. Dilation operation is used to fill the empty void between pixels to make data look very clear.

IV. CONCLUSION

This project proposed the simplest fire detection algorithm which is free from ordinary fire detection systems which consists of number of sensors. The objectives of this project were to create a system which would be able to detect flame using images from a feed, such as a video feed. The system was made to detect flame while they are still small and have not grown too large. To Develop a System, we select Open CV library which are specially developed for image processing purpose and having high processing speed. So the system gives us promising results.

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