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# Real-Time Fire Detection for Video Surveillance Using Digital Image Processing

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**ABSTRACT**: In this paper, a real time fire detection using video surveillance is proposed. This proposed system is a combination of both conventional based method and image processing technique. Conventional system use physical sensors like temperature, smoke and gas sensors. But, sometimes it can give false alarms. So in order to reduce the false alarms, conventional method is combined with image processing technique comprising of various algorithms to be applied on the frames of images. Thus both the techniques are used simultaneously which gives an optimised way to lesser the number of false alarms. The difference between the existing system and proposed system is that we intend to make the combination of both techniques to make the system more safe and efficient.

**KEYWORDS***:* Fire detection, image processing, video processing, microcontroller.

## I. INTRODUCTION

The purpose of this system is video surveillance based real time fire detection. In previously proposed method, only physical devices like temperature sensor, smoke sensor are used to detect fire. But sometimes it gives false alarms. Therefore the computer vision based fire detection algorithm is needed. This technique is used along with conventional fire detection method. In this proposed system, continuous frames of images are captured by camera. Thus it has faster response time. These images are monitored by software. After that, fire detection algorithms are applied on the video such as colour blurring, RGB to HSV conversion, HSV thresholding, grayscaling, motion estimation. After the algorithms are applied on the video and if the specific properties of fire pixels are detected by the image processing in an image, then the software will give command to the hardware and alarm is raised. The hardware system is also used simultaneously. Thus the temperature of the environment, smoke pixels and gases are monitored continuously. In case, if the temperature of the environment rises above the threshold value and the smoke, gas are detected by the sensor, then the buzzer will be turned on. This, in turn, will increase the efficiency of the system and provide safety to the environment. Thus, by combining both the image processing technique and conventional method, the real time fire detection system becomes more efficient as one method can overcome the drawback of the other if any. This system proves to be useful and safer for real time fire detection and thereby helps to reduce the danger.

## II. LITERATURE SURVEY

In [1], a method able to detect fires by analysing the videos acquired by surveillance cameras is proposed. The proposed method has been tested on a very large dataset of fire videos acquired both in real environments and from the web. A set of images have been used and a region of the colour space has been experimentally identified, so that if a pixel belongs to this particular region, then it can be classified as fire. This method evaluates the spatial colour variation in pixel values in order to distinguish non-fire moving objects from uncontrolled fires. In [2], Discrimination between fire and non-fire motion can be easily determined from the flow estimation. Video- based systems can detect uncontrolled fires at an early stage before they turned in to disaster. Detecting, segmenting, recognizing, and classifying dynamic textures can rely on visual aspects such as geometry or motion, or both. a algorithm uses HSV colour space to separate the luminance from the chrominance more effectively than RGB. In [3], a rule-based generic colour model for flame pixel classification is suggested. The performance tested on image contains fire, and image containing fire-like regions. This method has shown a higher detection rate and a lower false alarm rate. The arithmetic operation for the colour model is linear with image size and algorithm is very cheap in computational complexity. Colour model can be used in fire detection in video sequences. In [4], an optimized fire detection system using image processing is proposed.

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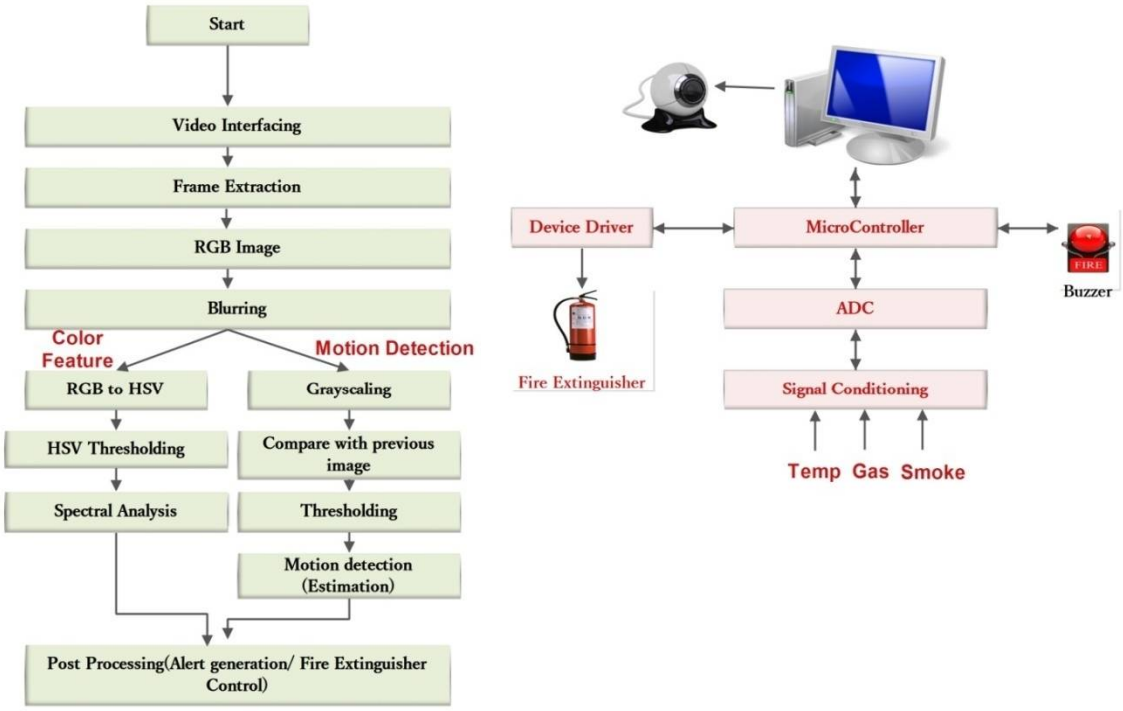
Proposed fire detection system consists of main parts: fire edge detection, colour detection, motion detection, gray-cycle pixel detection of smoke and area spread. Fire detection technology based on video image can extract much more information from smoke and flame which is helpful for the detection. Fire has number of visual features such as colour, motion, shape, smoke and growth etc. For detection of fire these feature are analyzed. The edge detection system compares the colour difference and provides an edge of the flame based on it. Motion detection method for fire is used to detect occurrence of any movement in a video. It is done by analysing the difference in images of video frames. By analysing these smoke pixels which are present near fire area in the video we can detect fire at earlier stages.

## III. PROPOSED WORK

The proposed system gives the schematic design of fire detection system. Here we have two architectures. One is image processing technique and the other is hardware based conventional method.




### A. Image Processing

Proposed system consists of input as frames of images from camera .These frames of images are processed for detection of fire. This is done using various image processing algorithms.

- Image Acquisition- Continuous frames of images are acquired using camera. It acts as a video surveillance.
- Pre-processing- Image pre-processing is used before any processing on the image for supervision. Various operations are performed on these frames. Operations for colour featuring of an image are Blurring, RGB to HSV, HSV Thresholding, Spectral analysis for blob detection and those for motion detection are grayscaling, comparison with previous image, thresholding, estimation.

1. **RGB Image**- Every image is described by its specific colour properties in terms of R, G and B elements.

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2. **Blurring**- This method is used to remove noise. This technique uses edge sharpness method. There are three types of blurring- Colour blurring, grayscale blurring, Gaussian blurring. In this proposed system, we use colour blurring.
3. **RGB to HSV**- This conversion is done to detect different shades of colour of fire pixels. HSV colour model gives equal weighting to the RGB components, when computing the intensity of an image. It is necessary to convert RGB to HSV as the fire pixels have different shades of colour which are not detected in RGB. This drawback is overcomed by converting RGB to HSV.
4. **Grayscaling**- The input image is colour image and the output image is gray image. This algorithm is used to analyse the smoke pixels which are created near the fire. This will help to detect the fire at an early stage. Smoke pixels possess specific colour properties in terms of R, G and B elements. The grayscale value for different colour combination is obtained as [gs=(r+g+b)/3].
5. **Thresholding**- It is used to produce regions of uniformity within the given image based on some thresholding criteria. It separates fire flame from background. Pixels that are alike are grouped together. The input image is gray image and the output image obtained is in binary form i.e. black and white image. The threshold value is set. If the grayscale value is less than the threshold value then the output image will have binary value of zero and if it is greater than the threshold value then the output image will have binary value of 255.

**B. Interfacing of microcontroller with sensors**

Microcontroller is interfaced with sensors using device driver. The sensors are controlled by microcontroller and when the values of the sensors cross the threshold value and the abnormality is detected then the microcontroller will turn on the buzzer. This hardware is connected to computer using serial communication.

## IV. RESULT

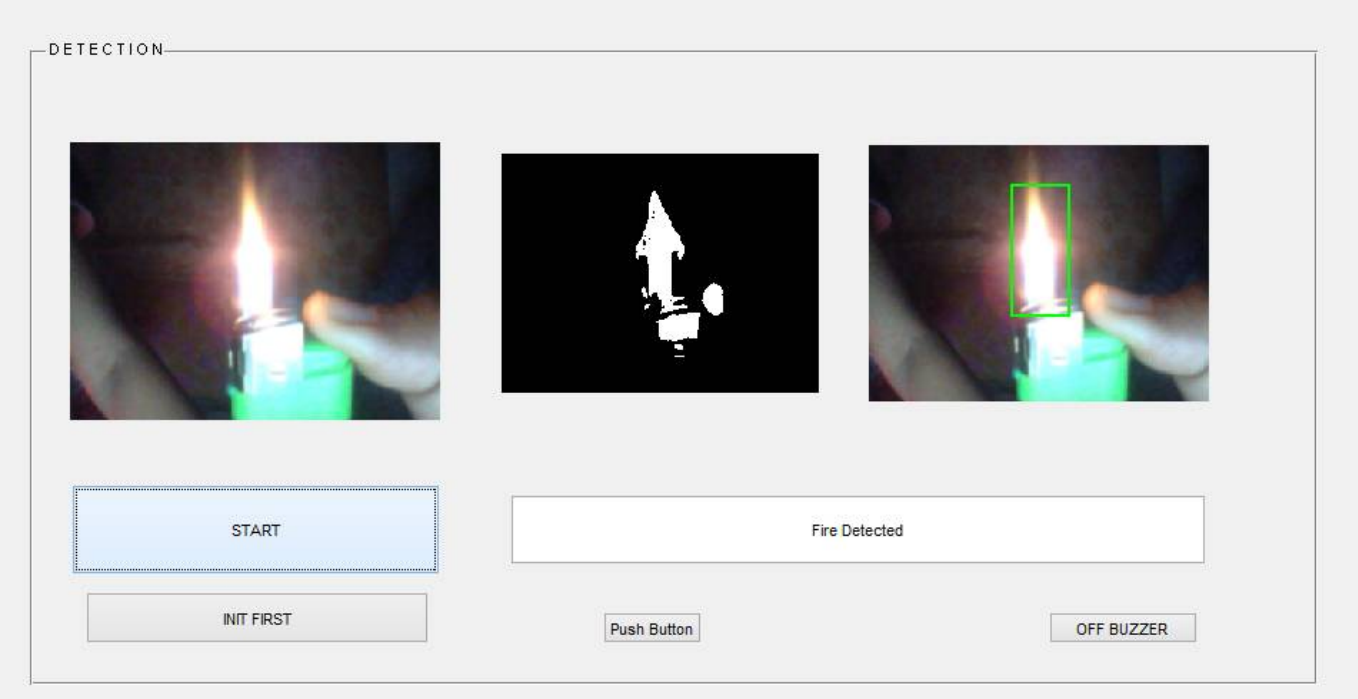


**Fig.2 Result**

First window shows the RGB image captured. On this image, grayscaling is applied. The output obtained is shown in second window.The white color in the window shows the fire pixels. After applying various algorithms on an image, the final output is shown in third window.

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## V.CONCLUSION

In this paper, real time fire detection using video surveillance is implemented. This proposed system is a combination of both image processing technique and conventional method thereby reducing the drawbacks of the false alarms. The entire system becomes much more effective and safe.

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