Fire Detection Using Image Processing Using Raspberry PI

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ABSTRACT:

The fire can be recognised effectively through video image processing. Traditional fire recognition system based on video image analysis do not analyse the color, texture and low level visual feature information of specific fire image. The validation performance is not good, the fire image scene recognition method is proposed on image processing. A contour is a curve joining all the continuous points along the boundary with the same color value. The detecting of contours in an image is very useful if you want to detect the boundaries in images. Gray processing and binaryzation process are taken into consideration for fire image. The normalization process is taken for filtering background interface. The refined video digital image is analyzed. Fire Sensor is used to collect the visual feature of fire video monitoring images. Simulation shows algorithm has good efficiency it can recognize campus fire accurately and gives real time alarming.

Keywords: Pi, Diode, Resistor, Image Processing, Binaryzation.

[1] INTRODUCTION

The school is a personnel intensive place, and it is easy to cause a fire. According to statistics, from 2007 to 2012 year, the total number of fire happened in campus was about 8666, and 80 people died, 121 people injured. The direct economic loss was nearly 36,331,800 rupees. The fire happened in campus greatly influence the normal work, and life and property safety is threatened. Especially in the colleges, the students have more freedom to spend their time and space, because of frequent use of electrical appliances and smoking, there are big fire hazards. Fire safety, not only related to the personal and property safety of teachers and students, but also related to the education reform, development and stability.

From past accidents we should be able to recognize that it is very difficult to completely prevent the campus fire, how the event of a fire is very important, however, because of the diversification of campus buildings, and the person distribution is dispersed. The campus fire safety management is difficult to implement[1]. There are many fire detection methods, the temperature, light, and smoke can be sensed for detecting the fire, but the factors such as temperature, light, smoke etc. are susceptible to interference.
from the environment, the fire recognition effect is not good, and the fuzzy and information deletion problem is occurred, leading to the image recognition efficiency decrease. The campus fire monitoring and rescue is lagged[2]. Due to the characteristics of campus video surveillance images have the real-time and dynamic property, and it is suitable for detection and recognition of the fire. By using the method of video image processing for campus fire recognition, it is attracting wide attention[3].

The key step of analysis and processing of campus fire recognition system and algorithm design is campus fire image data mining, the effective target acquisition model and correlation and rules are obtained from the massive image data of campus fire. The fire state analysis is taken, and it provides a reliable basis for fire detection[4].

[2] PRE-PROCESSING FOR FIRE DETECTION AND MODEL CONSTRUCTION

A. Kernel

Kernels are square matrices used in some image processing operations. We can apply a kernel to an image to get different results, such as blurring, smoothing, edge detection, and sharpening of an image. One of the main uses of kernels is to apply a low-pass filter to an image. Low-pass filters average out the rapid changes in the intensity of image pixels. This basically smoothens or blurs the image. A simple averaging kernel can be mathematically represented as follows:

\[ R = \frac{\text{All ONES MATRIX}}{\text{ROWS} \times \text{COLUMNS}} \]

B. Gray transformation and binaryzation

Because the fire monitoring images on the campus are 24-bit true color image data, different points include red (R), green (G) and blue (B) three components. In order to ensure the effectiveness of the follow-up operation, the three components of different fire image points converted into gray information. Because the gray image being affected by the interference of light, moisture and other factors, the automatic threshold method is used to a reasonable threshold. Then the image of campus fire processing is done with binary image analysis (0 for describing the background, 1 for digital description). In to resolve light imbalance and noise interference problem on campus original gray image fire, Gauss a filtering algorithm is proposed.

C. Erosion

The basic idea of erosion is just like soil erosion. It erodes away the boundaries of foreground object. The kernel slides through the image. A pixel
in the original image (either 1 or 0) will be considered 1 only if all the pixels under the kernel is 1, otherwise it is eroded (made to zero). What happens is that, all the pixels near boundary will be discarded depending upon the size of kernel. So the thickness or size of the foreground object decreases or simply white region decreases in the image. It is useful for removing small white noise.

![Fig. 1. Before Erosion And After Erosion](image1)

**D. Dilation**

It is just opposite of erosion. Here, a pixel element is ‘1’ if at least one pixel under the kernel is ‘1’. So it increases the white region in the image or size of foreground object increases. Normally, in cases like noise removal, erosion is followed by dilation. Because, erosion removes white noises, but it also shrinks our object. So we dilate it. Since noise is gone, they won’t come back, but our object area increases. It is also useful in joining broken parts of an object.

![Fig. 2. Before Erosion And After Erosion](image2)

**[3] BLOCK DIAGRAM**

A. Camera:

A camera is an optical instrument for recording or capturing images, which may be stored locally, transmitted to another location, or both.

B. Raspberry Pi

The Raspberry Pi is a series of credit card-sized single-board.

C. Buzzer

A buzzer or beeper is an audio signalling device, [1] which may be
mechanical, electromechanical, or piezoelectric.

D. LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals.

E. LEDs

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated.

![Block Diagram]

3. Block Diagram

[4] ALGORITHM

A. Video Capturing and Frame Grabbing

The first phase of fire detection using image processing is to grab the video via camera and divide the video into frames so the operations can be performed on the frame.

B. Resizing the frame, Converting it to HSV Model and Blur- ring it

The second phase of algorithm is to preprocess a frame, resize its width according to need. Resizing the frame allows us to process the frame faster leading to increase in FPS. We blur the image and convert it into HSV model. HSV represents colors in Hue, Saturation, and Value format. Hue, Saturation, Value, or HSV is a color model that describes colors in terms of their shade and their brightness. Hue is expressed as a number representing hues of red, yellow, green, cyan, blue, and magenta. Saturation is the amount of gray in the color. Value works in conjunction with saturation and describes the brightness or intensity of the color. In HSV Format, it's much easier to recognize the color range. If we need to track a specific color object, we will have to define a color range in HSV, then convert the captured image in the
HSV format, and then check whether the part of that image falls within the HSV color range of our interest. This function takes an image, the upper and lower bounds of the colors, and then checks the range criteria for each pixel. If the pixel value falls in the given color range, the corresponding pixel in the output image is 0; otherwise it is 255, thus creating a binary mask.

C. Erosion and Dilation

Erosion removes the boundaries in an image and slims it. In a binary image, white is the foreground and black is the background. All the pixels at the boundary of the white foreground image are made zero, thus slimming the image and eroding away the boundary. Dilation is exactly the opposite of erosion. It expands the foreground image boundary and flattens it. The extent of erosion and dilation depends on the kernel and the number of iterations.

D. Contour

A contour is a curve joining all the continuous points along the boundary with the same color value. The detecting of contours in an image is very useful if you want to detect the boundaries in images. In an image, the edges are computed as points that are the extremes of the image gradient in the
direction of the gradient. Contours are often obtained from edges, but they are aimed to be object contours. Thus, they need to be closed curves and are different from edges. It is helpful to threshold an image before extracting contours to increase the accuracy of the image and we find the max contour and map it in rectangle and we calculate absolute difference between the images if the frame is occupied and the delta is calculated which is used to compute the difference. If the delta time is greater than 5 seconds and the frame is occupied fire is detected.

[5]FUTURE SCOPE

The proposed system can be realized in future and can evaluate the performance of the system in real time fire monitoring system. Also, instead of using camera images if we go for videos, then we can calculate the spread of fire with time. We can develop a automatic fire extinguishing system with additional support.

[6]CONCLUSION

This proposed optimized flame detection system can be used more conveniently for detection of flames in live video stream sequence. It has shown that the proposed flame detection system performs well for smaller and larger or open area flame regions in video sequence. In advance system can be used more conveniently in houses, schools and colleges and in large areas like forest or farms for fire detection.

REFERENCES