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IMAGEP ROCESSING BASED FIRE DETECTION ANDALERT SYSTEM

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ABSTRACT

*In this paper, fire detection system using image processing is proposed. It is a real time system. The input is taken from camera in the form of image frames. The original image of RGB format is converted into CIE L*a*b colour model for betterment. Also, parameters like motion and edge are used for detecting fire. Finally, combined result of parameters and smoke sensor will be indicated by alarm. With the help of GSM module, the message will be sent to fire brigade in case of severe fire incidents.*

Keywords- Colour and edge detection, GSM, Motion detection, Smoke sensor.

I. INTRODUCTION

It has been seen thatfatal fire incidents causes moderate or critical burnt cases of mankind and propertyevery now and then. Smoke is an early identifier of fire. But only smoke detection can cause frequent false alarming of fire. Therefore fire detection can be possible by using image processing techniques along with smoke sensing. Fire is detected by analysing the features and other characteristics present in the image. Now a day's cameras are already installed in many public places for survey purposes. The camera can cover a large area to create a higher possibility of fire identification faster as possible.

This system proposes use of cameras generally placed at various locationin the surroundings like malls, campus, buildings. Under the continuous surveillance of camera each frame acquired will be processed to perceive a close match of fire image by using image processing tools such as feature extraction, edge detection, colourspace improvement etc.

Firstly, the input image is converted into CIE L*a*b colour model for better performance of the system. Moreover in our project we would be also training the system in a way to identify the direction in which the fire growth occurs. This project specifies about edge detection technique. Detection of edge is one of the image processing operations which are most commonly used in pattern recognitions. An edge is the boundary of objects. The edges present in fire image can be identified effectively. Basic features such as shape, area and perimeter of various objects at the location are recognized and measured.

F furthermore, this system also includes ATMEGA 328P

Microcontroller, MQ2 smoke sensor and GSM module. Once,

T the system is subjected to identify fire it can easily detect the

Fi fireand will automatically turn on the alarm.

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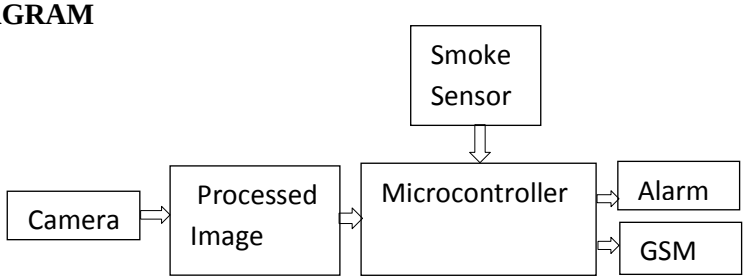
II. BLOCK DIAGRAM



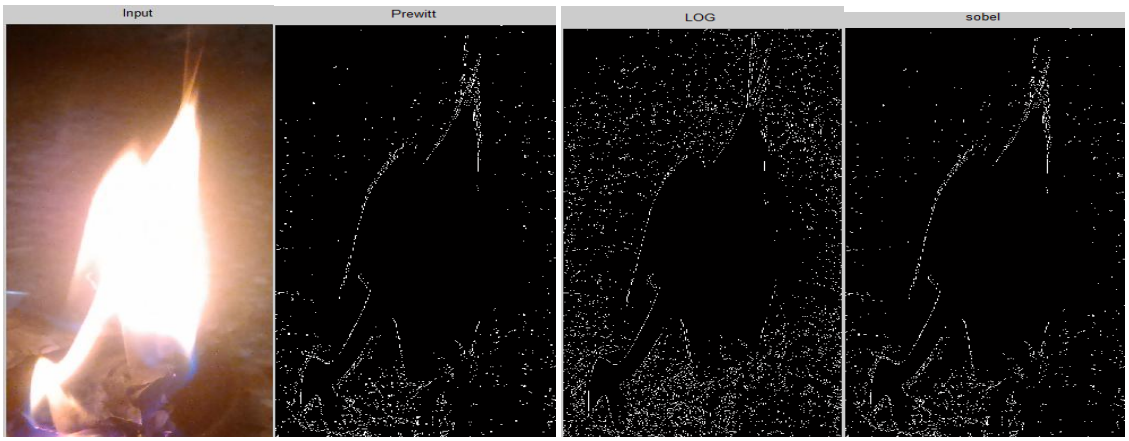
III. PROPOSED MFTHODS

a) CIE L*a*b* colour model

For the accurate detection of colour, the colour model of input is converted into CIE L*a*b* colour model. It has uniform colour space derived fromCIE XYZ model.The L component represents lightness of the colour(when L* =0 means black and when L* =100 referred to while), a* represents Chroma(for positive values indicate red and for negative values indicate green) b* represents Hue (positive values indicate yellow while negative values indicate blue) [5].CIE L*a*b* colour model contains more colour than human eye can perceive and also gives more information about colour. This colour model is device independent [5].

b) Edge Detection

Colour model is one of the parameters of fire detection but sometimes fire pixels can relatively match with pixels of other objects having much similar colour pigmentation as that of fire. For avoiding such disorientation in output, edges of objects in the input can be detected along with colour pixels which will lead to accurate outcome. An edge can be definedas asset of connected pixels that form a boundary between two disjoint region. Edges can be detected by the Robert operator, Sobel operator, Prewitt operator, Laplacian operator but they don't give sharp edges.In 1986, John F. Canny proposed a new edge detection algorithm; known by this name "Canny edge detection Algorithm" [2].Canny detector gives sharp edges of objects in the image. Comparison of different edge detector operators is given below:



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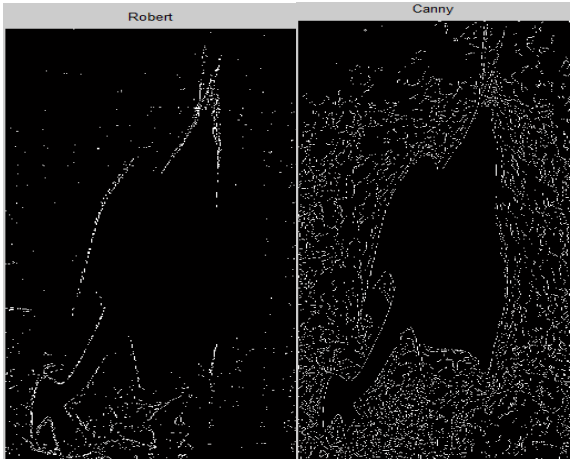


c) Motion Detection

Motion detection is used to find detect any movement in the video. This method is specially used to separate out moving object from the background. Fire flames are seen as constantly moving objects in a video. Due to this reason most of the objects in images of camera are static in observed scenes. This feature can be used to distinguish a true fire flame from other fire-like objects.

Motion detection is performed on an available real time video input. Motion based Background storage uses the first frames of the video stream to store the background image. It subtracts the background from each video frame to produce foreground images and only redraws the portion of the background that is revealed by the movingobjects. The background storage unit provides background for the entire processing. The background is the outcome of the background storage unit where there is no fire. Then, the threshold is the output ofbackground subtraction, where it shows the differencebetween original captured frames with estimated background. [1]

d) Smoke Detection

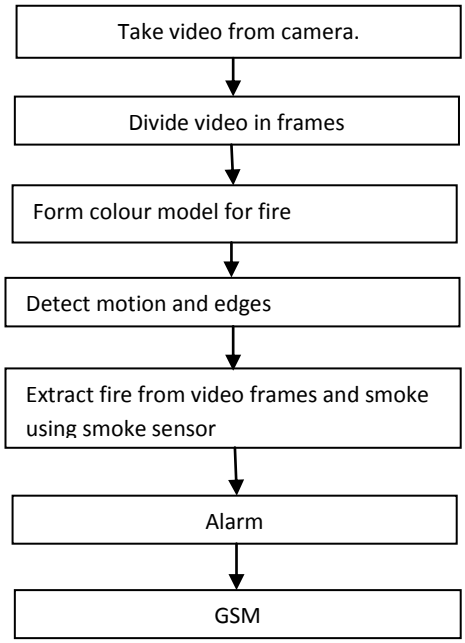
Smoke is an early sign of fire hence, it is necessary to detect smoke along with other parameters like colour, edge and motion.The smoke sensor can be exclusively used for detecting smokeas the pattern of smoke is not fixed.

The analog Smoke/LPG/CO Gas Sensor (MQ2) module utilizes an MQ-2 as the sensitive component and has a protection resistor and an adjustable resistor on board. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detection in household and industry. The resistance of the sensitive component changes as the concentration of the target gas changes [9]

IV. WORKING

First step consists of image acquisition by web camera. It analyzes each frame of real time data. These input frames are converted into CIE L*a*b* colour space for better performance. Also, motion and edges of each frame are detected using image processing. The motion of objects in the acquired frames is detected by background subtraction method. And edge of frame is detected by using Canny operator and smoke is detected using MQ2 smoke sensor. Output of smoke sensor and detected parameters are given to microcontroller. When fire is detected, indication will be given by alarm. If large fire growth is observed, message will be sent to fire brigade using GSM.

V. FLOWCHART OF ALGORITHM



VI. CONCLUSION

This method gives accurate result than conventional methods which are based only on parameters like temperature, smoke.

Using image processing occurrence of false alarms can be reduced and immediate help can be available in the worst case fire scenario. Message will be sent to fire brigade if the fire is on large scale.

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