AN EFFICIENT SURVEY ON FIRE DETECTION SYSTEM USING SURVEILLANCE CAMERA

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Abstract—It is more circumspect to lead a disaster beforehand than to deal with it after it occurs. there are many systems present to detect fire but they produce wrong alarms ,they are expensive and installation of those systems is financial, those systems can't handle outdoor fire, so to avoid false alarms An efficient survey on fire detection using surveillance camera to be used. It has less financial burden , we can install this system in outdoor areas, it require less hardware. methodologies used are Frame Grabbing technique , Gray scale conversion , and Image Threshold ,Axial covariance algorithm, Frame intersection technique, Snaps mailing etc. Software used are JDK 1.6 , JRE, My SQL 5.0, JMF, JAVA Mail API, Text Speech API. Most of the methodologies in (project name) are having some performance issues regarding accuracy of the system to enhance this paper proposes novel idea of An efficient survey on fire detection using surveillance camera.

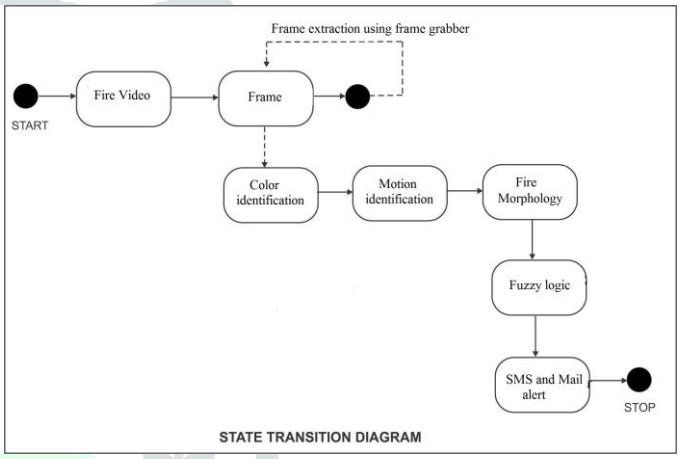
Index Terms—Video Surveillance , Fire detection ,Multiexpert system.

I. INTRODUCTION

An efficient survey on fire detection using video surveillance camera is designed to provide warning of the outbreak of fire and allow appropriate fire fighting action to taken before the situation get out of control . This system has advantages over all fire detection systems like this system detects outdoor fire too. It nullifies wrong alarms to right decision .It has a camera which collects live video frames and detects fire using three features: color, motion, and shape. In particular, the color and motion features are often combined to provide reliable fire detection results. Adopted an RGB (Red, Green and Blue) color model and dynamically analyzed the ruffled characteristic of flames to verify the occurrence of fire. An algorithm which combined motion and color features with fire flicker analysis in wavelet domain to detect fire in vide, designed a real-time fire detector that made use of an adaptive background subtraction algorithm to extract leading edge information and a statistical fire color model to check fire existence. Alert given in the form of voice ,SMS and email methods. Fire snaps send via mail using java mail api. This system captures video using JMF ,colors are identified using binary threshold , motion identification by temporal difference, shape verification by morphology fire. Fire confirmation has done using fuzzy logic , then it rises alert by SMS using AT commands .

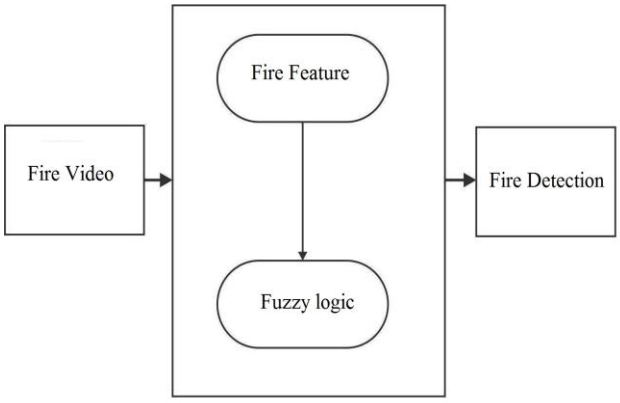
Fuzzy logic is an access to calculating based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean **logic** on which the modern computer is based. Type of reasoning based on the recognition that logical statements are not only true or false (white or black areas of probability) but can also range from 'almost certain' to 'very unlikely' (gray areas of probability). Software based on application of fuzzy-logic allows computers to mimic human reasoning more closely, so that decisions can be made with incomplete or uncertain data.

In this paper section 2 is dedicated for background work and section 3 elaborates proposed technique in depth. The evolution of the system is carried out in section 4 and finally this paper is concluded with feature enhancement traces in section 5.



STATE TRANSITION DIAGRAM

The basic concept of fire detection using video surveillance is come from the fact that other methods of fire detection like sensors and all always need high implementation and resource cost. And it is always having issues of producing wrong alerts, So Proposed system gives an idea of detecting fire using its color, Motion and shape which is powered with fuzzy logic for providing more accuracy. proposed systems normally detect fires according to three features: color, motion, and shape. In particular, the color and motion features are often combined to provide reliable fire detection results. Affiliated RGB (Red, Green and Blue) color model and dynamically analyzed the disordered characteristic of flames to verify the occurrence of fire.



Level 0 DFD

Even a strict classification of the methods is not simple, three main classes can be acclaimed, depending on the analyzed features: color based, motion based and shape . The methods

using the first kind of features are based on the flame, under the presumption that it is formed by common flammable as wood, cotton, paper or other, can be stably differentiated by its color, so that the interpretation of the color components (in RGB, YUV or any other color space) is sufficient to identify the existence of flames.

The video clips used in our experiments are real-world image sequences taken from a random selection of commercial / training video tapes. They include different types of fires such as residential fire, warehouse fire, in this proposed paper use images captured at day time, dusk or night time to examine system execution under many light effect.

In fire detection there is surveillance camera which detects fire by taking snapshots. These Snapshots are the input which stored in storage devices like hard disk and these inputs decide that how much amount of fire is there. The inputs are in the form of photos, snapshots are sends via messages or email to users or owner. For sending purposes there is a Wi-Fi network. In system there are already phone number of users and email - id and fire brigade number are have to save.

Literature survey:

This section of literature survey eventually reveals some facts of Survey on Fire detection using three factors methodology based on their analysis of many authors works as follows

1.In Online Detection of Fire in Video B. U˘gurT¨oreyin, A. Enis C¸ etinBilkent University 06800 Ankara Turkey paper it proposed a method which able to detect fires by analyzing the videos acquired by surveillance cameras. It based on color, shape and motion interpretation are combined by a advance system. The approach has been tested on a wide database with the aim of assessing its performance both in terms of sensitivity and specificity. Starting from this collection, composed by frames, it added several long videos acquired in both indoor and outdoor situations so resulting in a new dataset composed by 62:690 frames and more than one hour of recording. This simple idea suggest many recent methods: for instance, fire pixels from frame are recognized by a well-known attainment subtraction technique and a "statistical RGB color model" a set of images always used and a region of the color space has been analytically defined, so that if a pixel belongs to this particular frame, then it can be classified as fire. In this paper drawback is it consumes lot of memory on hard disk.

2. Human face detection propose a face detection algorithm for color images in complex actions, using fuzzy logic, Fast advance method and some image processing techniques. The algorithm is mainly based on skin colors. Sizes, shapes of faces and facial features are fuzzy agents for verifying face candidates. To reduce computation time, we deal only with border points of each object. Regardless of positions of true faces detected, we also get their comparatively correct confine for the results. Experimental results demonstrate successful face detection over a wide range of facial variations in color, position, scale, orientation, 3D pose, and expression in images from several photo collections. The computation time is also faster than many other face algorithms based on skin colors.

A human face has a wide range of variations in a color image. Therefore, to get high detection rate and low false positives, we need a flexible face detection algorithm. The fuzzy logic approach is appropriate. The verification process for face candidates is based on the structure of a fuzzy controller. The shape, the size of a face, and the presence of eyes, lips or noses become the fuzzy factors of the fuzzy reasoning.

A face usually has a general height/width rate, and it contains facial features such as eyes, a nose, and a mouth. Also, facial features have horizontal shapes and are darker than other skin areas. Based on these characteristics, we make a statistical survey to build fuzzy membership functions of mentioned fuzzy factors. The survey also gives some special cases such as a face connected with background or faces connected via the skin color, and a skin region containing no hole (inside border).

3.Flame object segmentation by an improved frame difference method Chen Ning, Ding FeiJiangsu University of Science and Technology, Zhenjiang, Jiangsu, 212003, China with fluctuation in demands, the Fire and Rescue Service must equip with the best techniques, training regime and equipment to meet public expectations. All the data taken from smoke sensor and camera will be send to data monitoring system and be display on monitoring system wirelessly. Wireless Fire Detection prototype will send all the sensor data to the monitoring system wirelessly by using the wireless module. Wireless Sensor Network can be the most useful way to assemble many specification and all the erudition needed by environments such as in industrial, shipboard, home, building, utilities and transportation system automation. Color probability density of fire pixels. Experiments show that our algorithm detects fire with high accuracy, both in single images as well as in image sequences. The objective of this work is in the general context of modeling and recognizing shape evolution in stochastic visual phenomena. In particular, this paper focuses on detection of fire in image sequences.

4. In Wireless Fire Detection Monitoring System for Fire and Rescue Application Muhammad Salihin Ahmad Azmil, NorsuzilaYa'acob, KhairulNizamTahar, SuziSerojaSarnin it consists of weak organizers based on secular and specific modeling of fire.HMM based secular fluctuate modeling of fire and wavelet based lineament modeling approaches are used as weak classifiers. A weighted-majority based method is utilized for online learning. It also issues false alarms for moving fire-colored objects exhibiting periodic motion such as rotating ambulance lights in a tunnel and their reflections from the walls. An important drawback of point detectors is that they are distance limited and disable in open or big spaces.

5. Rain, fog and haze are general aspect that evanished sites, limit the visibility range, and cause shifts in colors. These aspect also play a absolute role in determining the degree of reliability of many kinds of outdoor applications, such as up above and satellite imaging, surveillance, and driver reinforcement systems. Thus, removing their effects from images/videos is very absolute. Due to its mathematically ill posed nature, increase process of rain, fog, and haze plagued images/videos is highly challenging. it proposes a fast yet potent technique to enhance the visibility of video frames using the dark channel prior combined with fuzzy logic-based technique. The dark channel prior is a statistical regularity of outdoor haze-free images based on the observation that most local patches in the haze-free images contain pixels which are dark in at least one color channel, where the fuzzy logic-based technique is used to map an input space to an output space using a collection of fuzzy membership functions and rules to decide softly in case of uncertainties. The combination of the dark channel and the fuzzy logic-based technique will produce high quality haze-free images in real-time. Furthermore, it will be combined with rules derived from the stable atmospheric scattering model and will yield a fast yet high quality enhancement results.

II. PROPOSED SYSTEM

This area uncovers all the procedure and techniques which are being conveyed for the identification of flame from the live video. Beneath specify steps speaks to the fire identification method that our framework fuse as appeared in the figure 1.

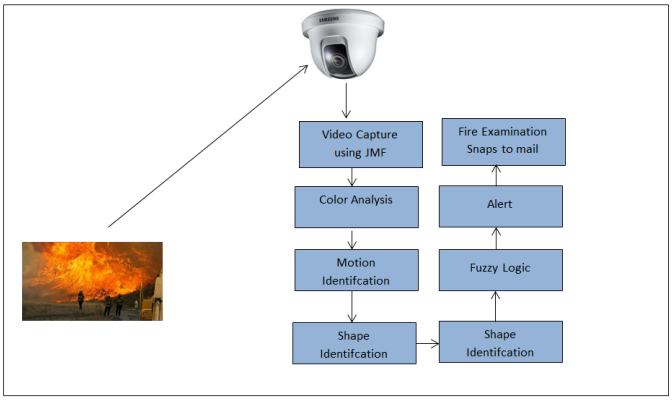


Fig. 1: System Overview

Step 1: This is the progression of arranging the equipment webcam with our program. This procedure is effectively completed by utilizing an outsider Programming interface called JMF(Java Media Records),which in the end gets the live recordings from the inside or outer webcam appended to the framework.

At that point by utilizing outline snatching system relative edge from the video is been caught consistently in JPEG organize for the set time in seconds. At long last these casings are then used to distinguish the fire with the underneath say steps:

Step 2: The effectively caught outline from the earlier stride is being utilized to recognize the fire utilizing shading as its essential parts. For this procedure our framework utilizes a heuristic approach of changing over the picture into dark scale by utilizing mean estimation of the RGB shading parts of the pixel. In the exact next stride this mean estimation of RGB is been confirmed for the edge estimation of the brilliance that in the end demonstrates the fire shading (The limit esteem is by and large set more than 180)

Whichever the pixels are crossed these edge are labeled as flame pixel and after that at last the number is been taken for these fire pixels. On the off chance that the fire pixel check is more noteworthy than the edge number set by our framework in view of the measure of the picture, then the picture casing is named as flame containing outline. This progression is been delineated by the beneath said calculation 1.

ALGORITHM 1: Fire detection Algorithm for color component

// Input: Video Frame **G**
// Output: Fire detected image

Step 0: Start
Step 1: Image path.
Step 2: Height and width of Image **G** (L*W).
Step 3: FOR **i**=0 to W.
Step 4: FOR **j**=0 to H.
Step 5: Get a Pixel at (i, j) as signed integer.
Step 6: Convert pixel integer value to Hexadecimal to get R, G, and B.
Step 7: **AVG**=(R+G+B) /3
Step 8: **IF AVG** >**T**
Step 9: Pixel at (i,j) is FIRE
Step 10: **ELSE**
Step 11: Pixel at (i, j) is NOT FIRE
Step 9: End of inner for
Step 10: End of outer for
Step 11: Stop

Step 3: This is the progression where our proposed framework recognizes the state of the fire by utilizing co pivotal difference procedure, Where our framework continues checking the proportion of the fire pixels which is been distinguished by the past stride. The proportion is recognized utilizing the accompanying two conditions (1) and (2) for each pixel. What's more, the surge of this proportion inevitably demonstrates the shape vector or the morphology vector of the fire.

$$N(x) = \sum_{i=1}^{N} P\,(i,j)/WIDTH \quad \text{(1)}$$

$$N(y) = \sum_{i=1}^{N} P\,(i,j)/HEIGHT \quad \text{(2)}$$

(1)

Where N(x) – Morphology vector related to X axis.
N(y) – Morphology vector related to Y axis.
P(i,j) – Pixel at position i and j
N – Number of pixels in the image

Step 4 Here in this progression for each given time T, got edge is been doled out to the past edge for the movement discovery of the fire. In this procedure for each time the distinction between the current and the past edge is been figured for the fire pixels which was recognized through the shading parameter in the earlier strides. On the off chance that the distinction is crossed the limit esteem then the casing is been marked for the fire picture. This procedure can be portrayed in the figure 2

The algorithm 2 clearly indicates the details of this step as follows.

Algorithm 2: motion Detection in Fire

// Input: Time **T**, Frame $\mathbf{F_c}$, Frame $\mathbf{F_p}$, Threshold Fire pixels $\mathbf{T_h}$
// Output: Fire Detection through motion
Step 0: **Start**
Step 1: **WHILE** (TRUE)
Step 2: for each time **T**
Step 3: $F_p \rightarrow F_c$
Step 4: calculate pixel positions of $\mathbf{F_p}$ in an vector $\mathbf{V_p}$
Step 5: calculate Pixel positions of $\mathbf{F_c}$ in an vector $\mathbf{V_c}$
Step 6: IF ABSOLUTE DIFF ($\mathbf{V_p} - V_c$) > $\mathbf{T_h}$
Step 7: Label Frame for Fire
Step 8: **END IF**
Step 9: **END WHILE**
Step 10: Stop

Step 5: This is the last stride of our framework where false positivisms can be decrease by utilizing fluffy rationale. This procedure gets the all the three parameters from the previous three stages. That are fire discovery by shading, movement and shape, the got parameters are been labeled between the esteem 0 and 1.

So by utilizing the Fluffy fresh values, which are partitioned in the middle of the extents as takes after

- ✓ VERY LOW (VL) – 0 TO 0.2
- ✓ LOW (L) -- 0.21 TO 0.4
- ✓ MEDIUM(M) -- 0.41 TO 0.6
- ✓ HIGH (H) _ 0.61 TO 0.8
- ✓ VERY HIGH(VH) --0.81 TO 1.0

So any casing whose mean parameter values falls in the middle of the HIGH and HIGH is considered as the fire edge and after that the significant caution will be raised by the framework. The parameters which are gone under the range LOW, LOW and MEDIUM will speak to the false fire distinguished casings.

III. RESULTS AND DISCUSSIONS

So any casing whose mean parameter values falls in the middle of the HIGH and HIGH is considered as the fire edge and after that the significant caution will be raised by the framework. The parameters which are gone under the range LOW, LOW and MEDIUM will speak to the false fire distinguished casings.

The system is evaluated using the fire images from the publicly available datasets from URL: http://mivia.unisa.it/datasets/video-analysis-datasets/fire-detection-dataset/ .

Different types of the images are been set to identify the fire by our system as shown below.

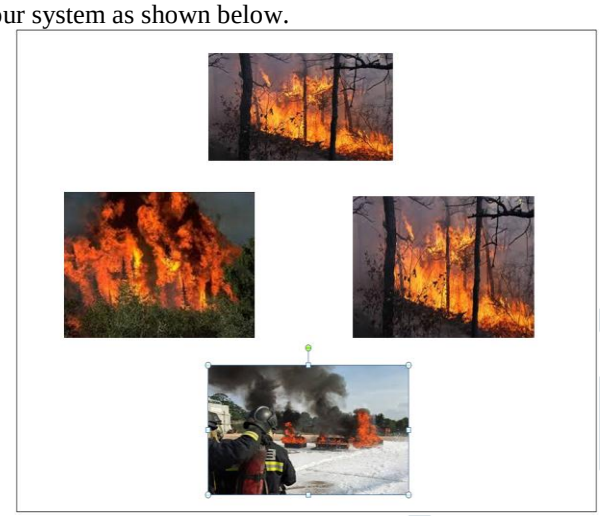


Figure 3: (a) and (b) images shown detection of fire and they are taken from the datasets. (c) and (d) images showing the detection of fire which are collected form the live streaming the videos from our camera.

Each time when fire is been recognized by our framework is set to be assess by the client for its legitimacy. MRR (Mean corresponding proportion) is one of the best assessment strategy by the human for the flawlessness of the framework.

In MRR a rank is been appointed to the yield picture which is extents from 1 to 6 in view of the flawlessness of the fire location in the given pictures. On the off chance that a rank 1 is given for the fire recognized picture then it demonstrates its rank as 1, for 2 it shows rank as ½, then 1/3, ¼ ,1/5 and after that at last 0.

So At long last the mean rank will be recognized for the arrangement of pictures utilizing MRR condition as demonstrated by condition 3 and 4. $S = \sum_{i=1}^{n} 1 / (Ranki)$ _____(3)

MRR=S/N _____*(4)*

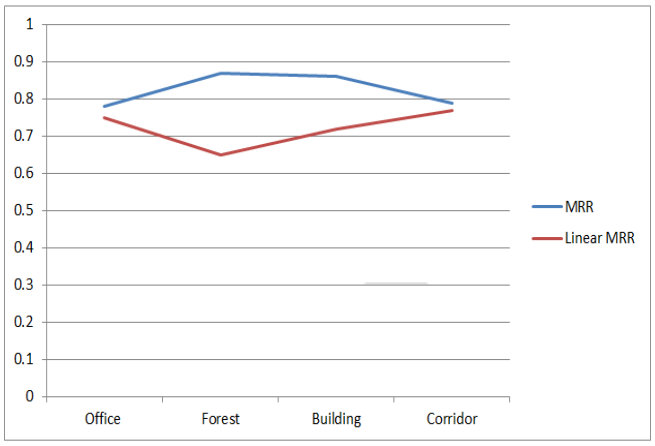
Where n – Number of sample images

MRR is computed for various sorts of picture for the arrangement of 25 numbers, Then got yield for MRR is been recorded in the underneath table 1.

Trial No	Fire images Type	MRR
1	Office	0.78
2	Forest	0.80
3	Building	0.75
4	Corridor	0.84

TABLE 1 : Recorded MRR

(1) Figure 4: MRR Comparison for different types of images The Above plot in the figure 4 shows that our proposed framework for flame recognition yields a normal MRR of 0.82, which we can guard for the one of the best fire location framework utilizing the video observation technique.



On putting our framework for further investigation of correlation with another strategy for flame location portrayed in [11] for parameters like Exactness and Effectiveness. We discovered a few outcomes that are tabled as beneath.

TABLE 2 : Comparison Table

Fifty Images	Multi-Expert	ROI
TP	57	55
TN	8	4
FP	2	2
FN	0	0
accuracy	91	94
efficiency	92	83

Where ,

- True positive = correctly identified
- False positive = incorrectly identified
- True negative = correctly rejected
- False negative = incorrectly rejected

Accuracy and Efficiency can be given by Following Equations

Accuracy = TP/ (TP+TN)*100%

Efficiency = (TN+TP/TN+TP+FN+FP)*100%.

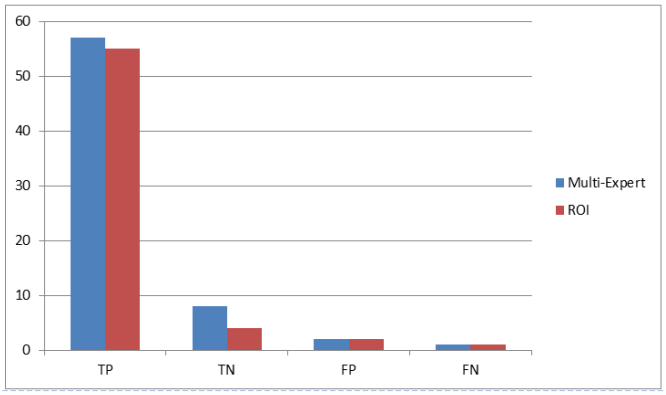


Figure 5: Comparison Graph

On plotting the graph for the parameters given in the table 2 which is represented in the figure 5. It clearly indicates that our system of multi expert system performs well compared to that of ROI method.

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