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FLAME DETECTION IN VIDEOS USING BINARIZATION

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ABSTRACT

Detection of flame based on computational vision has visible attention in the past years. Many selective features such as shape, colour, texture, etc., have been used to detect flames. The drawback to detect flames with these features are that they uses Lucas-Kanade method which is an optical flow method and it adopt flow constancy same for the adjacent pixels. This will reduce the reliability to detect flames from the videos. In this paper point-wise approach is used in which the conditions are applied to every pixel instead of continuous regions. And also this paper is not uses thermal heat fire detection method as used in classical approach. In this paper we have used binarization algorithm which provides accuracy of detecting fire flames as it very useful for detecting suspicious regions of flames in video files and also helps to eliminate background nosiness from the videos. With the first section, moving pixel's region is calculated and differentiated from the rigid object region. Then features are extracted as frame separation, flicker colour detection, source matching, radius of fire object region, gradient area and stream of frames are then stack into a video file. Then with the output of feature extraction, the flames are recognized whether they are present or not. If the flames are detected then fire alarm is raised to take fast action on fire and similarly send the result to the server for security purpose. The proposed procedure can be used on a huge video record. This paper allows a well-ordered atmosphere to inspect frame rate and provide robustness. The major advantage of the proposed algorithm is that it works well with CCTV cameras and low resolution video files that can detect the flames located at the far distance and can be used for commercial purposes.

Keywords: flame recognition, features extraction, point to point.

1. INTRODUCTION

The existing fire recognition systems detect the flames based on component, relative humidity, temperature and smoke recognition. These sensors are of very low cost and simple by functions that are why these devices are used very often and roughly. The disadvantage of these devices is that they have to be placed nearest to the fire otherwise they cannot intellect fire. This is the major drawback of ordinary process of fire recognition. Therefore, these fire devices cannot provide positive outcome in large or open spaces. There are some other drawbacks of these systems such as get in supportable by dust and non-fire component because there is direct interaction with them. Some devices which uses sensors can recognize fire but these devices are very costly so cannot use commonly. Many new techniques have been anticipated in order to reduce fire disaster and reduce the control of observation process and also improve the performance of recognition of fire. This novel method is vision based fire recognition. This technique can recognize fire which is placed at far away from the detecting devices and also provides graphical material on the fire.

Fire tragedies is the destruction of human properties and it carryout physical damage if fire accidents cannot be handled within time. In the traditional fire recognition system, uses fire alarms which does not operate automatically. Video detecting devices has the capability of automatically examining video to notice and recognize sequential procedures not depend on a distinct image. This technique is used in a wide-ranging area together with automotive, health-care, entertainment, home automation, transport, safety and security. The techniques can be used to develop software which can be used on all general purpose equipment or can be used as hardware in some particular techniques. The fire recognition devices captures the information over long distance and an extensive observing range and from this information additional data can be take out. This additional information can be the accurate position, range and rate of growth. Some cameras are mounted by government and industries for some specific purposes such as detection of license plate and robbery prevention. For such purposes these cameras have recently become noticeable. But these camera are costly so cannot use for general purpose. The proposed techniques can be significantly used for public purpose and provide security and safety with not costly expenditure.

Vision-based recognition uses the following three steps. In the first step pre-processing is essential for expenditure on devices such as strength of hardware of camera and lighting and brightness. Then features are extracted for recognition of fire at some particular location. Then the captured information is saved as records and uses these records to recognize flames. Classification process is used for taking input and analyze to make correct and reliable output that the presence or absence of flames. Neural network is the classification algorithm which is based on machine learning are thoroughly used

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on a number of large records. The proposed procedure emphases on extraction of feature, different physical parameters of fire and a set of different features are considered for recognition of fire from videos. There are two techniques basically designed for recognition of fire is as follows: First is optimal mass transport that is used for detecting the flames of dynamic textures, whereas a non-smooth modification is used for finding magnitude between pixels and also find saturated flames with no dynamic texture. On the other hand, a number of features are available for recognition of fire. Then the real data is analyzed and examine to detect flames. It eliminates the non-fire objects from the moving fire objects reliably and efficiently. These procedures also evaluate some features such as flame saturation, spatial resolution and frame rate. There is a need of reliable fire detector which can be used at open and large spaces for fire safety. Classical fire recognition system that is used for buildings are depends on infrared sensors, ion sensors or optical sensors. These sensors work on some features of fire for eg. fire heat, smoke and radiation. These devices have to be placed very close to the object so that they can sense fire. They are not able to detect flames properly in open and large spaces. The proposed algorithm added some different features for detecting flames that is point to point approach. In this approach, first frame segmentation is done then color transformation is proposed, the pixel value for each frame is calculated. Then it is distinguish that the fire is present or absent among many videos. Basically the records which are used in the traditional approaches use high quality video information whereas information which is used in the proposed algorithm has been taken from marketplace and low resolution cameras.

2. LITERATURE REVIEW

Chunyu Yu [1] describe two procedures in fire flame detection is as follows- First is foreground image gathering and second is optical flow method. In the first method foreground objects are differentiated using frame differential approach [1]. Chunyu Yu presents three cases in this algorithm through which the flame is detected- fire detection with flame without smoke, fire detection with smoke without flame detection and last is fire recognition using both flame and smoke detection. Fire recognition process involves four major stages- First method is frame differential method [1] in which dynamic objects and regions of the object is extracted from the input videos contains fire. It extract the foreground objects. In these foreground objects fire and disturbances are in existence [1] which have to be eliminated with the following stages: In the second stage of flame and smoke detection [1], flame colour is distinguished from smoke colour.

Flame color model- This model uses HIS colour model because it is more appropriate for describing the flame colours.

$0 \leq H \leq 60$
$0 \leq S \leq 0.2$
$127 \leq I \leq 255$ (1)

The pixels which are having values between above range are called as flame candidate region.

Smoke color model-

$$m = \max\{R(i,j), G(i,j), B(i,j)\}$$
$$n = \min\{R(i,j), G(i,j), B(i,j)\}$$
$$I = \frac{1}{3}(R(i,j), G(i,j), B(i,j)) \quad (2)$$

In the equation (2), i and j describes the pixel points. And a is the typical value of gray color that exist between 5 to 20.

FD (x, y, k) have to fulfil both the situations m – n < a and K1 ≤ I ≤ K2 with the same time, if FD satisfy both conditions then FD (x, y, k) is measured as a smoke pixel, or else FD (x, y, k) is not considered as a smoke pixel [1].

Next third phase [1] is foreground extraction of objects-

$$H_T(x,y,k) = \begin{cases} H_T(x,y,k-1) + b_1 & \text{if } FD(x,y,k) = 1 \\ \max(0, H_T(x,y,k-1) - b_2) & \text{otherwise} \end{cases} \quad (3)$$

In the equation (3), pixel's value represent no of times foreground image appear in the same pixel region in successive time window. Value b1 is the accumulation augmenter, while value b2 is the accumulation attenuation. Value b2 is generally set to 1. Every flame's pixel value changes with time, so the entire flame area have to be take out with the help of frame differential method [1]. In order to get the foreground object which is having smoke, the factors b1 and b2 should be define as b1 > b2.

Fourth phase [1] is flame region recognition- Flame region is recognize with the help block image processing technique. If the image is not affected by wind or airstream, then the continuous flame region and uneven flame region in the certain area will be detected at fixed intervals. Therefore the flame region's pixel value in the foreground object showed as bigger. [1]- In this technique each image taken from video is separated into chunks. These chunks are of resolution 8×8. Then all pixel's values of a block is added to satisfy the following circumstance:

$$H_T(x,y,t) \geq T \quad (4)$$

In above equation, T represents threshold value.

Fifth phase is determine the smoke region [1] - Block image processing and optical flow both techniques are used together to gather the moving pixel values of smoke. Each foreground object of image of videos which

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contain videos is separated into different chunks having resolution 8 × 8. Then the pixel values are added which lies in a same block and also sustaining the above equation, value of T is fixed to 50, and parameters b1 is assigned as 3 and b2 is assigned as 1 in the equation (3). And when majority of pixels satisfy the above equation then this block is measured as this block contains smoke. When this is applied to all the blocks then coordinates of the center is determine for all the blocks which are having smoke and its Lucas-Kanade features can be calculated as follows:

$$d_{OPT} = G^{-1}\bar{b} \quad (5)$$

Last phase [1] is Back-Propagation Neural Network-The function is used for analyzing the result of above equations for smoke detection:

$$f(x) = \frac{1}{1+e^{-ax}} \quad (6)$$

If the result is fire then f(x) will be 1 else 0.

Enis Cetin [2] defines video fire recognition. It helps to decreases the recognition time in comparison with already available devices that are used for indoors and outdoors. These cameras can be placed at the height such as hills for forest fire detection and it can cover 100 km2 of area with the help of zoom lenses. Other benefit of this approach is that it can gather records such as the intensity of fire, fire growth and size also. In the first step [2] video fire detection is done in visible/visual range. Next YUV color space is used to identify color. YUV color space conditions describes as follows:

Condition 1: Y > Ty
Condition 2: |U-128| <Tu and |V-128| <Tv
Here, Ty, Tu, Tv defines threshold values.

Now moving object detection is done using background subtraction method [2]. Then histogram based approach is used to analyze spatial wavelet color variation and it focuses on green color band can be calculated by standard deviation. Now dynamic texture and patterns are analyzed. The output of these steps are used as an input for recognize smoke from the videos.

[2] Can be used in buildings and indoor areas. Many smoke recognition system can be installed at height such as towers and poles for detecting smoke and fire. Although these system does not work automatically but provide safety tools. When this fire detection system raises an alarm, the maintainers have to check whether it is a false alarm or original one. Fire flame detection [3] in video for recognizes pattern is an effective procedure because it can be used automatically to detect fire without the need of a maintainer. This approach is efficient with the videos of high quality and works efficiently on them and also works for official purposes such as indoor areas hospitals, buildings etc. They can provide additional information about the fire and heating practices. In the first step [3] fire features are extracted. Then moving object's regions are extracted with the help of Gaussian mixture model [3]. In the third step colour separation of fire is done with the help of fuzzy c-means clustering. In the next step [3] fire factors is take out with the help of tempo- spatial features of region of fire object. In the last step [3] fire and non-fire objects are classified with the help of support vector machines. If fire is present in the videos then it raises fire alarm. Tung Xuan Truong [3] said that this algorithm provides fire detection correctness, reduces a high false alarm rate and provide high reliability to recognize fire. Smoke detection [4] for transportation hub complex provides a process for recognize smoke for transportation hub. It also raises early fire alarm for providing more security to the videos. Enhanced Gaussian mixture prototype [4] for extraction of background objects is accepted in this paper for video image pre-processing. In this a large number of video image classifications are gathered to create and maintain contextual prototypes. Firstly, the edges of flames are taken out with the help of background extraction [4]. Then suspicious edges are identified and features are extracted. Then discrete wavelet transform is used to eliminate frames of objects which are in the motion form and the proportion and speed is examined and judged for the whole movements.

Figure-1. Block processing technique for the flame detection.

In the above scene different features are selected such as smoke fuzzy features and entire movement features are extracted. It will detect the flames with block processing approach [4]. The pixels in the videos are recognized by detecting the same characteristic of the adjacent pixels.

Chen Juan said [5] flame colours and wave ring delivers consistency to recognize flames from videos

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where video contains in complex scenes. It mostly emphases on information of fire color and brightness. This is an effective method of detection of flame color.

In the first step [5], 2-dimensional color space is used and renovation is completed for the records which are manually gathered. [5] Now dimension of flames is calculated and gray value are then take out. This will build frame by sequence of time in the videos. [5] At last, the fluctuation regularity of the brightness of flame is extracted with the help of Fourier Transform for these frames which are sequenced in time.

This [5] technique can be used to recognize fluctuation of fire. Capturing devices can be placed at various places and at different viewpoints. The straight handling of such situation affects the consistency of the outcome.

Adaptive estimation [6] presents smoke detection system that detects fires with remote cameras placed at observation area. Images are captured from the cameras located on the remote positions are examined with ordinary techniques of computer vision. When the alarm raise then only human interference is necessary.

Spatial data and fire risk index [6] uses GIS and augmented reality so that the scenes can be observed and fire risk can be evaluated. In the input image, GIS is used to compute geographical coordinates and each pixel's real-world distances. Then [6] the information which is captured by geographic information system is computed into suitable Figures so that the sensitivity factors can be estimated for detection of smoke. Adaptive estimation [6] presents an enhancement in visual smoke detection based on the adaptive modification of smoke detection constraints. This enhancement can be accomplished with geographical information system. And it delivers additional consistent and strong smoke recognition.

B. UgurToreyin [7] that the fire and flames can also be detected with the basic features. These features can be motion, fire flame color and some particular fire patterns. The flames can be differentiated in the form of wavelet domain by analyzing the video features.

Computer vision based approach delivers the procedure which comprises the following stages:

The position of pixels in the selected area is first calculated and moving pixels regions [7] is computed from the videos in the first step. Then fire colors [7] are already defined so pixels which are in motion are tested to observe that whether they are matching with pre-specified colors of fire in the next step. Now wavelet [7] is evaluated. Spatial and temporal domains are calculated to define which moving regions are having high-frequency activity. This algorithm [7] helps to detect flames from color videos. Computer vision based technique recognizes flicker that are in fire and flames. It uses temporal and spatial wavelet transformation.

Fire detection [8] provides fire-detector which links to the foreground facts of objects using fire's color pixel information's. This method is done with the help of 3 distributions in Gaussian form [8]. The algorithm uses background subtraction to gather information from foreground and now it has to recognize that captured foreground images are fire or not.

In the first step [8], background detection technique is used. This technique works for the background and remove the background so that we can recognize fire pixels from the foreground. In the second step, generic statistical technique is used [8]. With the help of this technique fire-pixel classification are distinguished from the foreground with the help of fire parameters. In the third step, the above methods are combined to recognize fire system and this third circulation [8] is used to recognize frames for fire from videos. Detection of fire with statistical color [8] technique can be used to recognize smoke in the video sequences. It can also be used for faster detection of fire alarm as per the necessity.

Feiniu Yuan said [9] smoke detection method based on videos is viewed as an operative and reasonable way for recognize fire in large spaces. Smoke detection technique uses a sequence of histograms. It involves four steps. In the first step [9], image pyramid of 3 levels is created with the help of multi scale analysis process. In the second step [9], the features which are unresponsive to image spin and brightness situations are take out at all 3 levels of pyramid using some constant textures, spin invariance texture and spin invariance constant textures to create an local binary pattern pyramid. In the next step, LBP patterns depend on inconsistency [9] which is having same texture are also taken into consideration and produce local binary pattern variance pyramid. And at last, histograms of the both pyramids are taken as an input and calculated [9], and then the output of previous steps in the form of histograms are merged into one and generate an improved feature vector. Then neural network is used to distinguish between object contains smoke and objects which does not contain objects.

This smoke detection [9] can provide recognition over large databases and provide fast response to trigger alarm for safety and security purposes and also provide effective way to detect smoke through sensor devices.

Thorsten Schultze [10] uses a block based technique to trace the flame movements. The flame movements are of high velocity so this detection of motion is only effective in recordings with high speed. So analysis of basic flow have to be developed that can be used to trace the separate movement of flame pixels in blowy exposed flames. In the first step, a flame detection system [10] based only on the analysis of the wavering rate. So flame waves are recognized in this step. Then flow analysis is done with the help of height, width and in time in by motion estimation [10]. In third step, a simplified flow analysis has been developed where video sequences with only the upward signal is taken into account [10]. It reduces the number of false alarms from a flame detection system based on videos. The wavering rates are taken into

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consideration that reduces noise from the images such as echo of lights on water that gives the same wavering rate as given by original flames.

Fire detection and video sequence procedure [11] uses YCbCr model to differentiate the chrominance from the luminance in an efficient manner with compare to the other colour space model such as RGB. The algorithm presented in the paper verified two types of images first is having fire and the other is which do not have fire and fire edges.

The fire detection rests on [11] the pixels of flames that produce pits areas. And on this area the rest of the system operates. This technique can be taken into consideration in [11] first grayscale and second videos with colours. The method uses statistical features depends on gray scale frames which contains intensity of pixels and also depends on standard deviation. It also uses thermal heat geographical features for Example moisture and temperature to recognize fire. This is a Abasic color model [11] which works on YCbCr color space, YCbCr is better to distinguish the chrominance component from the luminance component. This makes algorithm more reliable with compare to RGB color model.

Dechuang Zhou derive [12] the algorithm for recognition of flame and said this algorithm is based on the color of fire, object in the motion form and recognize texture of fire. It can work efficiently on different scenes of fire in videos.

This method depends on [12] generic color model. Generic colour model works on large quantity of information such as flame pixels. So in the first step generic colour model is analysed. Then in the second step, a cumulative geometrical component model is developed with the help of geometric component model [12]. This model is used to recognize background object which are not in motion form. And in the third step, a back propagation neural network is developed to get final output. This fire detection process experiments on different fire scenes in videos and it shows the accuracy as well as fast reaction to detect flames.

Giuseppe Marbach said [13] this technique follows visual image devices which is used for high resolution of fire images. The fire is detected by recognize the regions of flames. The regions of frames are captured by parameters of fire and used to recognize whether collected features are non-fire or fire. When fire is recognized then fire alarm is activated.

In the first step, fire regions are recognized with the help of temporal accumulation [13]. The fire edges are calculated and the result is analysed and calculated in this step. In the second step [13], features of fire are calculated from the data which is calculated in previous step. In the fourth step, pre-specified features of fire is recognized and analysed that fire is present or absent in the video. In the last step, a fire alarm is triggered if the fire is present in the given video [13]. This techniques works well with proper brightness in flames and provide flexibility and reliability to the system. This image processing technique [13] delivers stability and fast response which will decrease false fire alarms.

3. METHODOLOGY

Traditional Optical flow techniques have a theory of intensity constancy means values of intensity is save from adjacent frames of the pixels in motion form. In the existing algorithm, Lucas-Kanade optical flow process is taken into consideration that adopts flow constancy for pixels depends on the adjacent pixels. This paper uses the point-wise approach. Point-wise approach applies conditions on every pixel rather than continue adjacent pixels.

(I, u, v) + α rreg(u, v) dt dx dy

Here, represents the error from the optical flow constraint and rregmeasures the smoothness of the flow field. The constant α controls regularization. This equation does not fulfill the consistency of intensity in adjacent pixels.

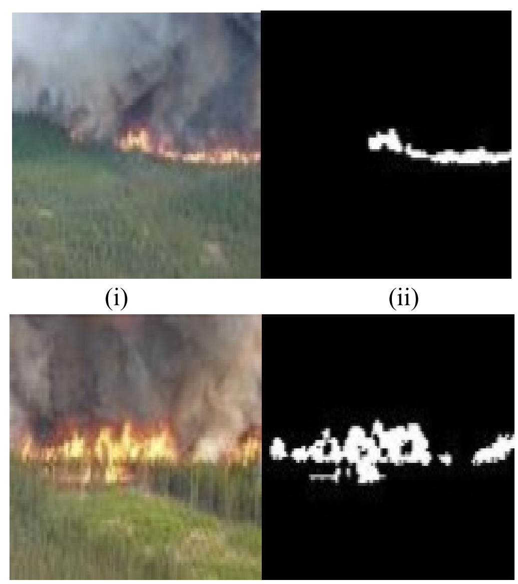

Figure-2. Pre-selection of essential pixels.

In the pre-selection process the moving pixels regions should be extracted. In the above Figure (i) and (iii) are the images which contains fire and (ii) and (iv) are the images which shows the moving pixels of the fire.

Image segmentation

In this step, the frames are separated for further calculations from the input data. The frames are separated by the following process:

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$FD(x,y,k) = \begin{cases} 1 & \text{if } |I(x,y,k) - I(x,y,k-1)| > L \\ 0 & \text{otherwise} \end{cases}$ In the above equation, (x, y) defines the coordinates of the pixels in x axis and y axis. I(x, y, k) defines values of pixel x and y in the existing frame. I(x, y, k-1) defines values of pixel x and y in the earlier frame. L defines threshold value. FD(x, y, k) defines result which provide extracted foreground objects.

Color detection

RGB color model is used to detect color for fire flames from videos. The flame frequency at the initial level appears as yellow or red color. R component of the RGB color model have the range of red yellow color. These ranges are described as follows:

(i) $R > RT$
(ii) $R \geq G \geq B$
(iii) $S \geq (255-R) \cdot ST/RT$

RT denotes threshold value, ST shows saturation value.

Source matching

Source matching differentiates pixels of the fire motion and pixels of the rigid motion.

$$f = \max_{\Omega}\left[\left[u_T \cdot \frac{u}{\|u\|_2}\right] + \left[v_T \cdot \frac{v}{\|v\|_2}\right]\right]$$

Where x and y denotes coordinates,u and v defines flow vector, uT andvT defines templates for flow vectors.

Radius of fire

The extracted red color region may contain colors other than red and yellow. And fire color always lies between the ranges of red to yellow.

$Red_{xy}(t) > Red_{Txy}(t)$ and $Red_{xy}(t) > Green_{xy}(t)$ and $Green_{xy}(t) > Blue_{xy}(t)$

Here, Red_T is the threshold value.The output of the above equation named as $S_{xy}(t)$ is then product with saturation value of frames. The product output named as $S2_{xy}(t)$ will contains the pixels lies between the ranges of red to yellow.

Gradient area

Now the extracted frames contain the high or low value of fire color range. So we need to extract peak value of gradient which will assure that it contains fire pixels. If gradient area contains very low value then $S2_{xy}(t) = 1\text{-}S2_{xy}(t)$. With this equation, the highest value of red color is then found. This gradient value defines the presence or absence of flames in the videos. Now all the frames are to be streamed in one video file for getting converted output. It will detect the fire and similarly raise the alarm when fire is recognized.

DFD is a graphical representation of the "flow" of data. They are a preliminary step used to create an overview of the system which can later be elaborated.

In the proposed system, the pre-selection of moving pixel's is calculated and differentiated. Then features are extracted as image segmentation, flame color detection, source matching, radius of fire object, gradient area, extract peak value of gradient, and draw rectangle over fire object location. Then will get output of feature extraction by stream all the frames in one video. Then the alarm is triggered to take fast action on fire and similarly send the result to the server for security purpose

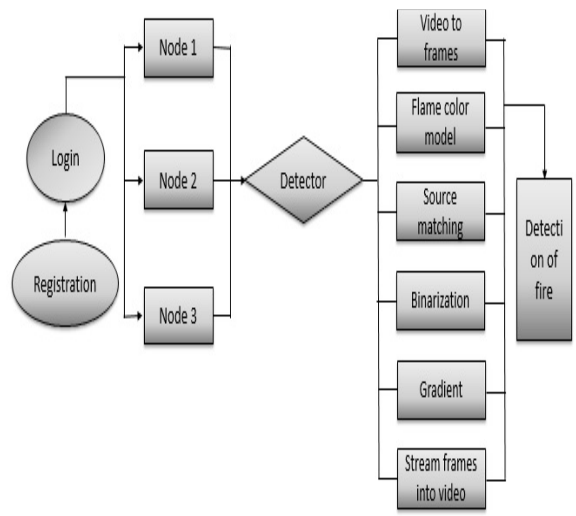

Figure-3. Data flow diagram.

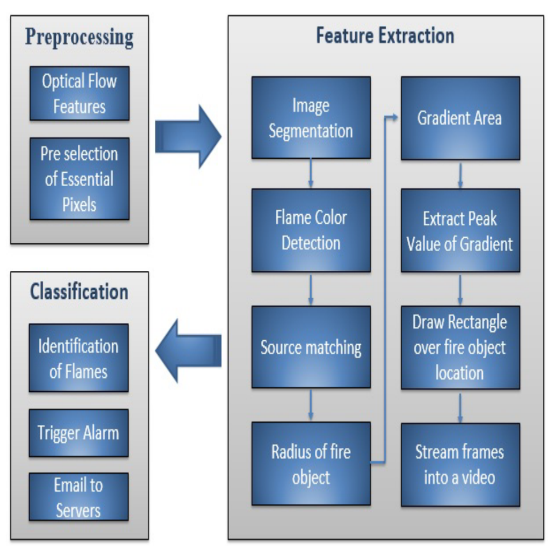

Figure-4. Architecture of proposed algorithm.

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Algorithm

A. Firstly, login to access videos for security purpose is done through database connectivity.
B. The video with flame or direct camera is an input for further processing.
C. Identified the region of moving objects from the videos or from the recording camera's data.
D. Now the video file is converted into frames. There are 25 frames per second. So if there is a video of 1 min, then 1000 frames will be save.
E. In the next step the color of fire is identified with the RGB color model.
F. Features are extracted by calculating source matching for finding the pattern for fire pixels.
G. RGB contains 3 binary values for R,G and B. So the radius is to be calculated for detecting the value of fire pixels for point to point approach.
H. Now the gradient area is to be extracted. This will contain the lowest and highest pixel values of the objects in the video.
I. In this step eliminate the gradient values of the pixels other than peak value or the highest value. Now the frames with the fire will be extracted only.
J. Now with the help of flame color, texture, radius and gradient result, the location of fire pixel is analyzed using the xy coordinates, size, and height and width parameters.
K. Now rectangle over the calculated location is drawn using blob counter.
L. In this step all the calculated frames have to be streamed in one video file to get the result of converted video.
M. The alarm is triggered when output indicates that the flame is being identified.
N. The result is then forwarded to the different server for added security for accidental area.

Advantages

a) The proposed algorithm eliminates noise from the frames in videos with the help of gradient area detection.
b) Existing algorithm only categorizes between occurrences of dynamic textures. It does not differentiate between the presences absences of fire among many videos. The proposed algorithms also differentiate the presence and absence of fire.
c) It has the ability to reliably detect fire and reject non-fire objects.
d) In the existing algorithm, the input information does have to be taken from high quality of videos. In the proposed algorithm input can be taken from the mass market and cctv cameras with low resolution.
e) In the existing algorithm, Lucas-Kanade process is used in which the constancy in adjacent pixels assumes as same but proposed algorithm follow point-wise approach, which applies conditions to every pixel instead of continues pixels.

RESULT

The implementation of the Flame detection in videos using binarization is capable to recognize flames with the help of various flame features and pattern recognition and it is robust against on purpose attacks or accidental ones such as forest fire, fire at building and commercial purposes.

Figure-5. The video file for selection.

In the Figure-5 when the video file is selected, click on the run uploaded video to run the selected video file. When the file is completely run then clicks on the convert button. The convert will split the video into separate frames. To save theses spilt frames 'save as' dialog box will open in the next window. Next window saves the frames at the user given location and detection of flames is now done using frames of the video.

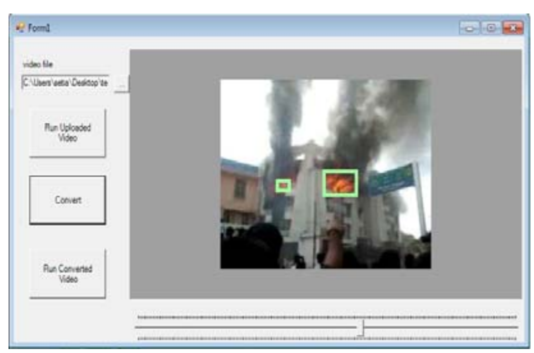

Figure-6. With flames in video.

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Figure-6 Shows the converted video which show the flames in the video by rectangle boxes. The frames are now combined using video stream to run the detected flames in a single video file.

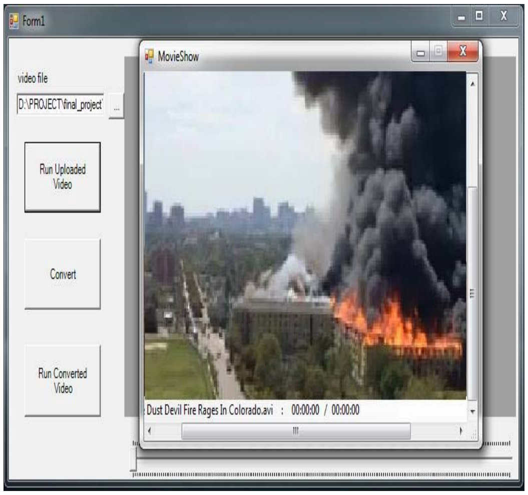

Figure-7. Very low resolution and distance.

In The above video is taken from a very low resolution camera which is also placed at the distance. This algorithm is also capable to detect fire efficiently with the low quality of videos.

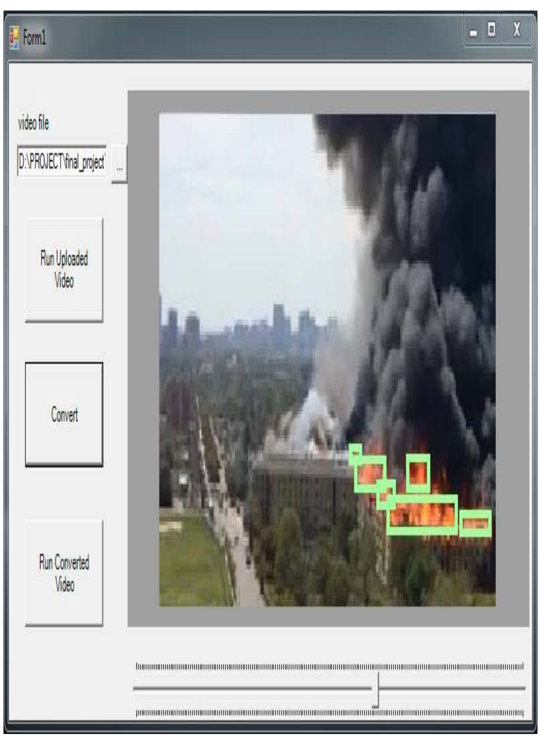

Figure-8. Detection of very low resolution and distance.

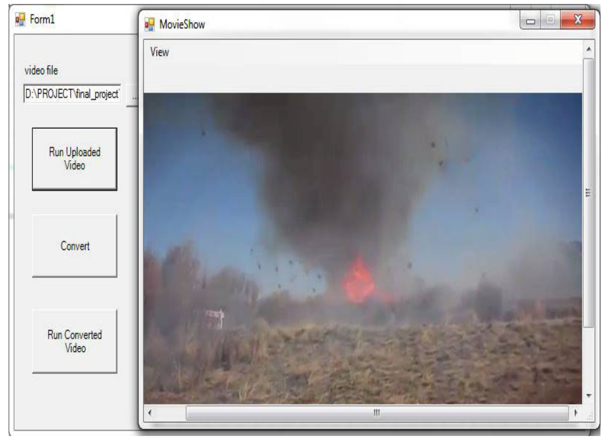

Figure-9. In the field with low resolution.

In the above figure, the fire is at the field and this video is also taken from a very low resolution camera.

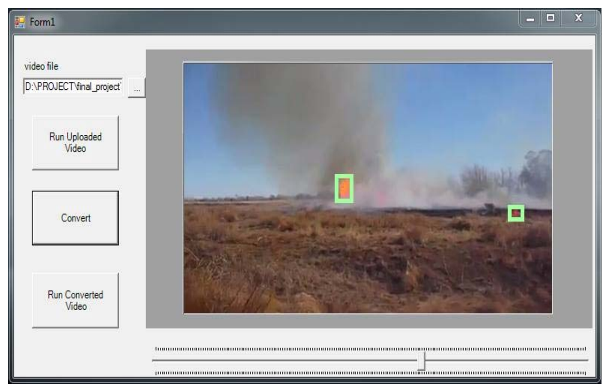

Figure-10. Fire at open and large spaces.

This algorithm is also capable to recognize fire at open and large spaces as it shows in above figure. The proposed approach uses point to point detection of pixels of fire flame and also uses gradient that makes this algorithm more robust and the fire alarm and sending the video of fire flame by email to different servers added more security and awareness to the proposed algorithm. This project can be used for the commercial purposes with the low resolution camera.

CONCLUSION AND FUTURE VISION

The flame detection algorithms with novel features have been presented that overcome drawbacks of traditional optical flow method when used on the video which contains fire. These features reliably sense fire and discard the non-fire objects. It can also be useful on large video records. The point to point detection provides robustness to recognize fire flames. The major advantage of this algorithm is that it efficiently works on the videos

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which are of low resolution and have been captured from far distance so that the cameras can be placed at hill or some height for detecting fire in forest, buildings, large and open fields. There is no need of very costly cameras so it can also be useful for commercial purposes such as at hospitals, railway stations, organizations and different public areas. The drawback of this algorithm is that it works on only avi and mpg files and also there are compatibility issues with operating system which are above than 32 bit. Future work take account of the improvement of flame detection with all extension of files and able to operate on any platform.

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5. APPENDIX

Table-1. Summary of Literature survey 2011-2013 [2].

Paper	Color detection	Moving object detection	Flicker/wavelet analysis	Spatial difference analysis	Dynamic texture/pattern analysis	Training (models, NN)	Flame detection	Smoke detection
Chunyu Yu [1], 2013	HSI	✓	×	×	✓	×	✓	✓
A. Enis Cetin [2], 2013	RGB/HSI	✓	✓	✓	✓	×	✓	×
Jie Li [4], 2013	×	✓	✓	×	✓	×	×	✓
Marin Bugaric [6], 2013	×	✓	×	×	✓	×	×	✓
Tung Xuan Truong [3], 2012	RGB/HSI	✓	×	✓	×	×	✓	×
Chen Juan [5], 2012	YC_bC_r/RGB	×	✓	✓	×	×	✓	×
JianzhongRong [12], 2012	RGB/HSI	✓	×	×	×	✓	✓	×
Feiniu Yuan [9], 2011	RGB	✓	×	×	✓	✓	×	✓

Table-2. Summary of Literature survey 2005-2010 [2].

Paper	Color detection	Moving object detection	Flicker/wavelet analysis	Spatial difference analysis	Dynamic texture/pattern analysis	Training (models, NN)	Flame detection	Smoke detection
Hasan Demirel [11], 2008	YCbCr/RGB	×	✓	✓	×	×	✓	×
TurgayCelik [8], 2008	YUV/RGB	×	✓	×	✓	×	✓	×
IngolfWillms [10], 2008	×	✓	✓	✓	×	×	✓	×
Markus Loepfe[13], 2008	YUV	✓	×	×	✓	×	✓	×
B. UgurToreyin [7], 2005	YUV	✓	✓	✓	×	×	✓	×

Table-2. Summary of proposed system.

Paper	Color detection	Moving object detection	Flicker/wavelet analysis	Source matching	Point to point detection of pixels	Gradient area detection	Thermal heat	Spatial difference analysis	Training (models, NN)	Flame detection	Smoke detection
Proposed algorithm	RGB	✓	✓	✓	✓	✓	×	✓	×	✓	×