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# A Review on An Efficient Protocol to Capture UAV-image Frames and Detect the Fire and Smoke Using Image Features and Local Binary Pattern

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***Abstract:*** ***Lately fire outbreak is common issue happening in open space environments and the damage caused by these types of incidents is dangerous toward nature and human interest. Due to this the need of application for fire detection has increases in recent years. The accuracy of proposed algorithm is increased with decrease the non-smoke pixels of an image. Only true smoke pixels are analyzed and detected smoke on them. In this way the proposed algorithm is more accurate and computational time is decreased. The base algorithm's accuracy is decreased due to video frames and that consumes so much time to detect true smoke pixels. So the comparison between the proposed algorithm and the base algorithm is more.***
***Keywords: smoke detection, fire surveillance, video processing, early warning systems, environmental monitoring.***

## I. INTRODUCTION

Fire detection is very important for the protection of our environment as well as the safety of people and buildings also. The video-based system can detect uncontrolled flames at the starting stage. Fire detection technology based on video has the advantages are that the fire detection technologies are very instinctive. For researchers in the field of fire detection, video fire detection is a very interesting topic. Image information detection methods are more effective than other techniques which use a sensor or multisensory wireless network systems. To increase the accuracy of fire alarms, real-time, and robustness with the help of fire detection.Fire detection technology can be divided based on

*1)* the purpose of flame or smoke detection
*2)* the spectral range of the camera that is used
*3)* The range of the system.

In an open environment, Smoke and fire detection is challenging mainly such as power plants, chemical plants as they affect the surrounding area. If the optimal algorithms can be used for every part of the detecting area and extracting fire characteristics, the system performance can be improved.[1] In recent years, video surveillance has become a widely used tool for monitoring in many fields such as security, protection, etc. We are focus on monitoring the forest fires automatically via video processing. Conventional smoke sensors are not much suitable for fire detection in outdoor open spaces like in the forest. Smoke is a warning sign of forest fire.Sometimes flame may not be visible in monitoring cameras if the flames occur long-distance or are obscured by obstacles like mountains or buildings. Smoke is a good indicator of forest fire but it can be difficult to identify smoke in images because it does not have a specific shape or color pattern. Generally, methods for detecting fires using cameras can be categorized as smoke detection methods and flame detection methods. To detect smoke from digital images Smoke detection methods often use color and motion information. detect flames from video images and detect flames using IR images. [2]Both of the methods rely on ideal conditions. To classify regions as fire or non-fire by the use of color and motion. In the second method,videos are taken with high-speed cameras. to detect the fire using statistical methods that are applied to grayscale videos and algorithm is proposed to detect fire that is the combination of both color information of fire with temporal changes and background subtraction-assisted foreground object segmentation. A simple and effective color image-based background subtraction method is used to detect changes in the scene observed. The generic fire color model is embedded into the background subtraction output.[3]

## II. LITERATURE SURVEY

Surveillance systems are very important for monitoring wildfires which cause a bad impact on humans also. The fire detection technologies can be divided into two areas: the characteristics detection of smoke and flame. The result will be also the combination of whether smoke and fire are present or not. Kim and Wang choose a method for smoke detection.

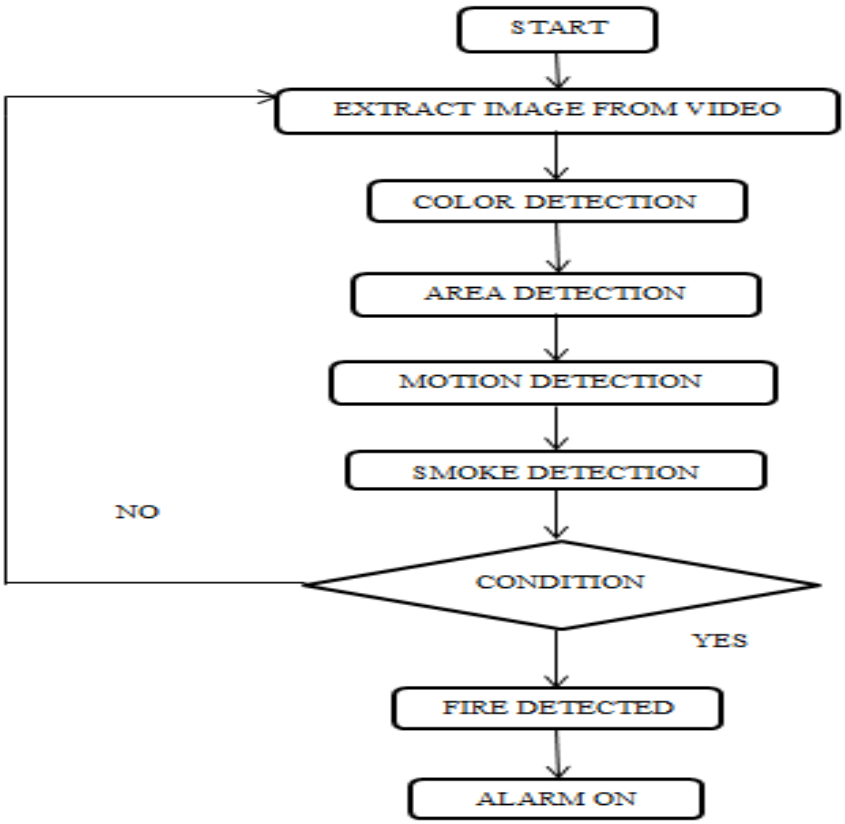
The method consists of three steps, first consider the camera is moving, the second step is to detect the area of change in the current input. The third step detects ROI (region of interest) in smoke. In future, the more improvement in algorithms will be needed in the tracking of blobs and the classification of smoke. In this paper, the authors proposed a fire detection that combines foreground object information with color pixel statistical of fire. A general fire color model is developed by statistical analysis of sample images that contain fire pixels. When the system started it detects the fire, except in explosive conditions. In addition image converts into HSV color model and also uses this model to analyzecolor and intensity smoke candidate features. The standard deviation was evaluated for each color component (RGB) of the colors of the resulting object. Then adopt the highest values and compare them with the characteristics of smoke to determine whether smoke is present. Finally, to evaluate the transparency of all objects during the smoke, Fourier transform is used, therefore the accuracy of the system increases. This process may increase the performance with the help of proposed detection algorithm and reduce false alarms. Smoke was detected by using two features, named as gray and transparency.

## III. OBJECTIVES

The primary objective is to improve a smoke detection approach based on frame movement by analyzing the characteristics of early smoke. Following are the main objective points which we aim to cover here:

*1)* To analyze the object tracking of moving objects using video analysis.
*2)* To represent the tracked smoke objects and draw boundaries to increase the true detection rate of the smoke.
*3)* Reduce the detection time with decrease the number of “non-smoke false detects”.
*4)* The proposed algorithm compares with the existing algorithms to increase the detection accuracy.

## IV. METHODOLOGY



*1)* Color Detection: This section covers the detail of the proposed fire pixel classification algorithm. Figure shows the flow chart of the proposed algorithm. Rule based color model approach has been followed due to its simplicity and effectiveness. For that, color space RGB and YCbCr is chosen. For classification of a pixel to be fire we have identified few rules. If a pixel satisfies these rules, we say that pixel belong to smoke class.

*2)* Area Detection: Area detection method is used to detect dispersion of smoke pixel area in the sequential frames. In this method, we took sequential images which comes out from color detector then we check dispersion in minimum and maximum coordinate of X and Y axis, acquired from color detector.

*3)* Motion Detection: Motion detection is used to detect any occurrences of movement in a sample video. We took sequential images from video frames. After applying basic two methods edge detection and color detection we get probable area of smoke pixel then we compare the RGB value to of frame1 to the frame 2 for corresponding pixel and if pixel value differs then motion detector will show motion and will give resultant output to the operator.

*4)* Smoke Detection: The smoke pixels do not show chrominance characteristics like fire pixels. At the beginning, when the temperature of the smoke is low, it is expected that the smoke will show color from the range of white-bluish to white. Toward the start of the fire, the smoke's temperature increases and it gets color from the range of black-grayish to black.

## V. PROPOSED FIRE DETECTION ALGORITHM

The proposed work consists of the following steps:

*1)* Take the input image from the database.
*2)* Database image acquisition in MATLAB environment.
*3)* RGB to Gray scale conversion.
*4)* Analysing pixel by pixel values and compares these values with smoke values.
*5)* If the pixels values are lies between specific ranges then it is detected smoke pixel.
*6)* The pixel values that are out of range are called as non-smoke pixels.
*7)* Repeat these above steps until all pixels are analyzed.
*8)* Detected output image.

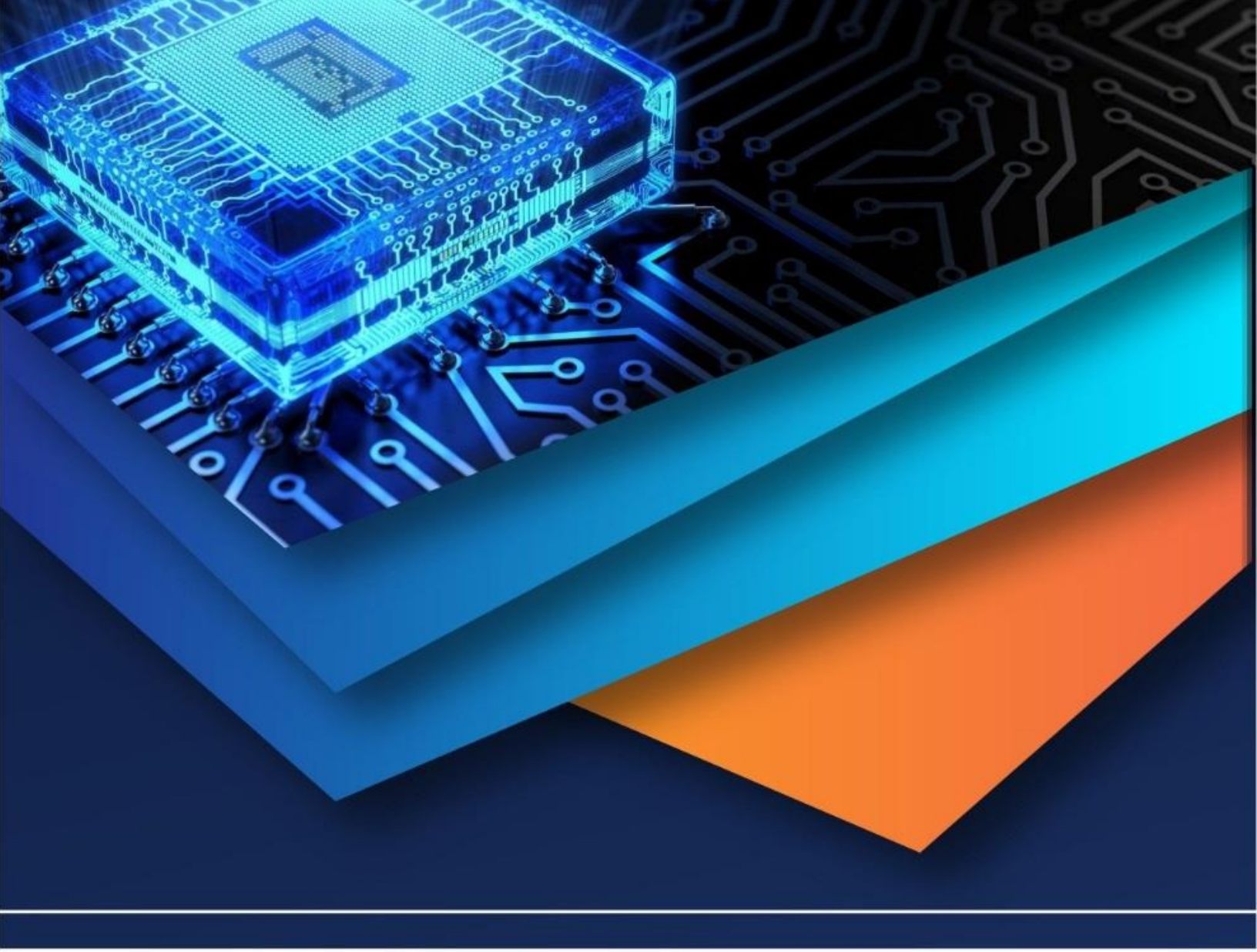
## VI. CONCLUSION

The image frames to detect fire and smoke system is proposed in this work. The fire and smoke detection methods are applied on real time different database images. Initially, the true smoke pixels are detected to increase the accuracy of the algorithm and decrease the non-smoke pixels. Due to this the detection rate is increased and this system will be more accurate. The more images are taken from the database according to the requirements. It has been observed that the average retrieval efficiency is increased as feature set increases. Also, it has been observed that the true smoke detection rate is increased with increase in non-smoke pixels of an image. The result tables show the accuracy of the algorithm increases with decrease in false smoke detection.

Furthermore, the main drawback of the proposed algorithm is that the completion time increases with decrease in non-smoke false pixels of an image.

## REFERENCES

[1] Ahmed Fakhir Mutar, dr. Hazim Gati dway "smoke detection based on image processing by using grey and transparency features" Journal of Theoretical and Applied Information Technology 15th November 2018. Vol.96.
[2] Ye, S., et al.(2017)." An effective algorithm to detect both smoke and flame using color and wavelet analysis". Pattern Recognition and Image Analysis. 27(1): p. 131-138.
[3] Kong, S.G., et al.(2016). "Fast fire flame detection in surveillance video using logistic regression and temporal smoothing". Fire Safety Journal,. 79: p. 37-43.
[4] Shantaiya, S., K. Verma, and K. Mehta.( 2015). "Multiple object tracking using kalman filter and optical flow". European Journal of Advances in Engineering and Technology,. 2(2): p. 34-39.
[5] Memane, S. and V. Kulkarni. (2015)." A review on flame and smoke detection techniques in video's". Int. J. of Advanced Research in Electrical, Electronics and Instrumentation Engineering. 4(2): p. 885889
[6] Bosch, A. Serrano, and L. Vergara, "Multisensor Network System for Wildfire Detection Using Infrared Image Processing", Hindawi Publishing Corporation, the Scientific World Journal, Volume 2013
[7] Avgerinakis, K., A. Briassouli, and I. Kompatsiaris.(2012.). "Smoke detection using temporal HOGHOF descriptors and energy color statistics from video". in International Workshop on Multi-Sensor Systems and Networks for Fire Detection and Management.
[8] S., P. Piccinini, and R. Cucchiara, Vision based smoke detection system using image energy and color information. Machine Vision and Applications, 2011. 22(4): p. 705-719.
[9] Kim, D. and Y.-F. Wang.(2009)."Smoke detection in video". in Computer Science and Information Engineering, WRI World Congress on. 2009. IEEE.
[10] Yuan, F., A(2008)."A fast accumulative motion orientation model based on integral image for video smoke detection".Pattern Recognition Letters. 29(7): p. 925-932



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