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FOREST FIRE IDENTIFICATION METHOD FOR UNMANNED AERIAL VEHICLE MONITORING VIDEO IMAGES

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ABSTRACT:

An automatic forest fire monitoring system based on UAV(unmanned aerial vehicle)-acquired video images was studied in this paper. This novel method was proposed to address current problems in forest fire information monitoring practices such as poor real-time performance and low efficiency. Besides, it aims to realize the dynamic monitoring of forest fires in wild environment. In this paper, a forest fire monitoring method based on active analysis of UAV-acquired video image features is proposed to automatically detect and identify the occurrence of forest fires. The motion detection method based on dense optical flow and background modeling method were used to extract the motion regions for eliminating the influence of image background. By using wavelet energy feature and texture feature, 9 video images acquired by multi-rotor UAV on forest fire monitoring were selected as sample images(8 images for experiment and 1 image for contrast purpose). The mean values and standard deviations of the gray level co-occurrence matrix eigenvalues(angular second moment, entropy moment and reciprocal differential moment) were calculated as the discriminant basis for identifying forest fires. The experimental results showed that the proposed algorithm can effectively identify the forest fire,which provides a theoretical guarantee for the forest resources protection.

Keywords: NPA, PPA, XGBoost, RF, SMOTE.

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1. INTRODUCTION:

This Forest, as an important part of the terrestrial ecosystem, is indispensable resource for human survival and social development [1]. However, forest fire poses a extremely serious threat to forest resources which is one of three major forest disasters[2]. According to the survey results, the annually average times of forest fire in China is more than 10000, burning up the forest area of 1 million hectares about 8% the national forest area[3]. Therefore, scientific and effective detection of forest fire is an important prerequisite for solving this problem. This Forest, as an important part of the terrestrial ecosystem, is indispensable resource for human survival and social development[1]. However, forest fire poses a extrenely serious threat to forest resources which is one of three major forest disasters[2]. According to the survey results, the annually average times of forest fire in China is more than 10000, burning up the forest area of 1 million hectares about 8% the national forest area[3]. Therefore, scientific and effective detection of forest fire is an important prerequisite for solving this problem.

At present, existing forest fire monitoring methods mainly include satellite monitoring[4], sensor network monitoring[5-6] and video-based forest fire monitoring[7]. Nevertheless, satellite monitoring technique fail to meet the real-time requirements due to its low refreshing rate. Sensor network needs a large number of equipment units deployed which poses various challenges to installation and maintenance work. Video-based monitoring devices are only applied in fixed practices due to its high installation costs. In order to avoid those problems, miniaturized UAV (unmanned aerial vehicle)[8-9] monitoring platforms are gradually winning attentions from worldwide scholars. Multi-rotor UAV has various advantages such as simple structure, low manufacturing and maintenance costs, convenient deployment and operation merits, which can achieve real-time and efficient forest fire information collecting goals.

How to effectively identify forest fires from video information is the key point of the research. Video-based forest fire detection technique can be used to determine whether there is forest fire via smoke detection[10-11].Several domestic and foreign scholars have studied the smoke detection methods to be applied in forest fire monitoring practices such as histograms of equivalent pattern[12], static and dynamic characteristic analysis[13], video image segmentation[14] as well as Spatial temporal and Dynamic Texture Features[15].However, above methods can only

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process video materials under static underground with fixed monitoring range and distance. These methods are not dynamic, and the recognition results can hardly meet the practical monitoring requirement of forest fire. Yuan et al. presented the application to UAV for automatic detection of forest fires in infrared images[16] but this method can not achieve continuous monitoring of forest fires among frames.

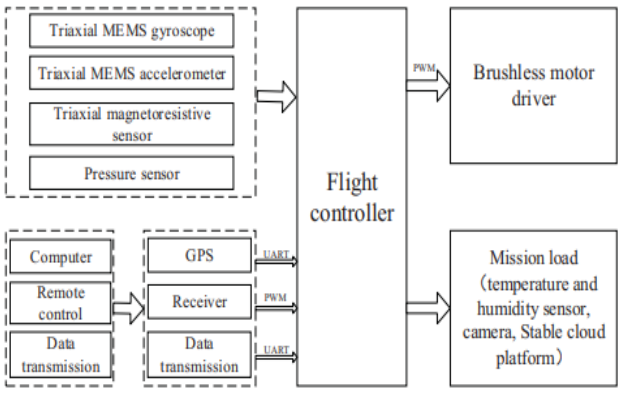
On the basis of above analysis, a novel forest fire monitoring method based on active image analysis for UAV video is presented in this paper to automatically identify forest fire. The contribution of the present study included: addressing the problem of image background discontinuity and improving the accuracy of forest fire recognition.

2. EXICITING SYSTEM:

Traditional monitoring methods can not collect forest fire video information in real time and effectively. At present, due to the characteristics of heavy load, long duration and strong wind resistance, eight-rotor unmanned aerial vehicle is widely used in forest fire monitoring field. The eight-rotor aircraft is driven by eight independent motors in which the adjacent motors rotate in the opposite direction to eliminate torque caused by motor rotation. The aircraft can control six freedom degrees of aircraft by controlling the rotational speed of eight rotors.

PROPOSED SYSTEM:

Traditional video-based forest fire monitoring equipments are usually fixed cameras that are deployed on the top of a mountain, and the background of captured video usually remains static, which is only applicable to long-distance and large-field forest fire monitoring. In addition, there are influential factors such as foggy in videos captured during morning. Traditional methods lack the ability to deal with this situation. This paper proposed a novel forest fire detection method based on image active analysis to address these limitations.



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3. METHODOLOGY

MODULES:

1) Image Processing which will read video frame by frame and then convert BGR image format to RGB format

2) Motion Detection: using python OPENCV we will detect movement from video and if moving object 0-90 degree then we will extract moving area

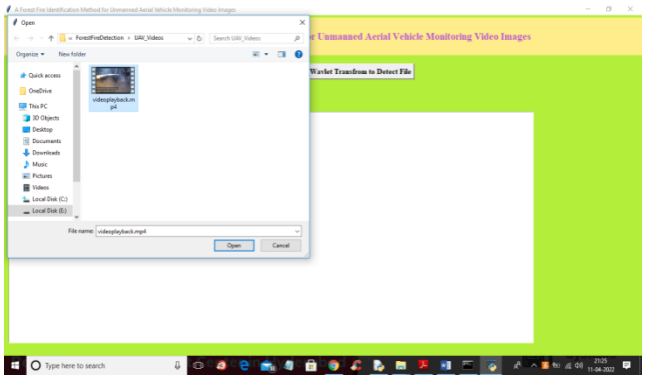
3) Colour Features Extraction: using this we will extract colour related to fire which will help in detecting fire or smoke

4) Wavelet and Texture Extraction: Wavelet and texture features will be extracted to identify weather colour features is fire or not and if fire then it will output as fire detected

OPERATION:

Double click on run.bat file to get below screen

In above screen click on 'Upload UAV Forest Fire Video' button to upload video and get below output



In above screen selecting and uploading video and then click on 'Open' button to upload video and then click on 'Run Motion Detection, Colour Features and WavletTransfrom to Detect File' button to get below output

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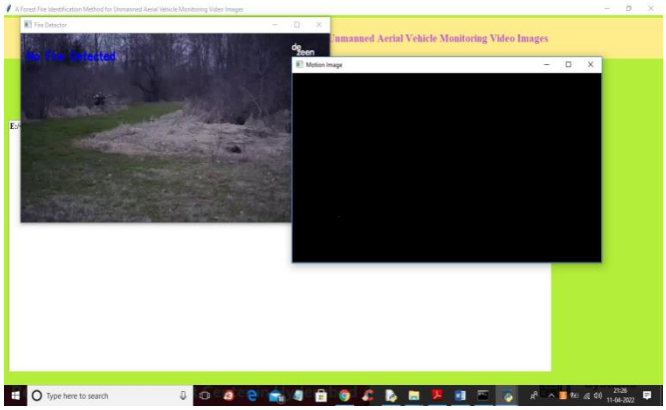
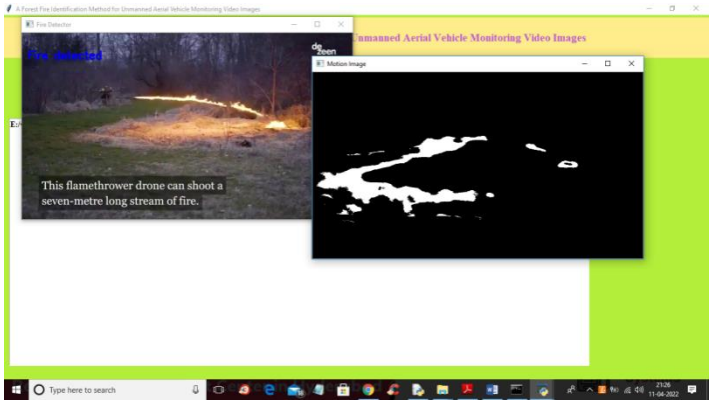
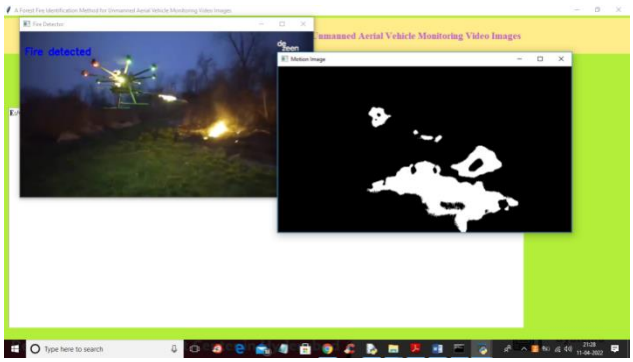
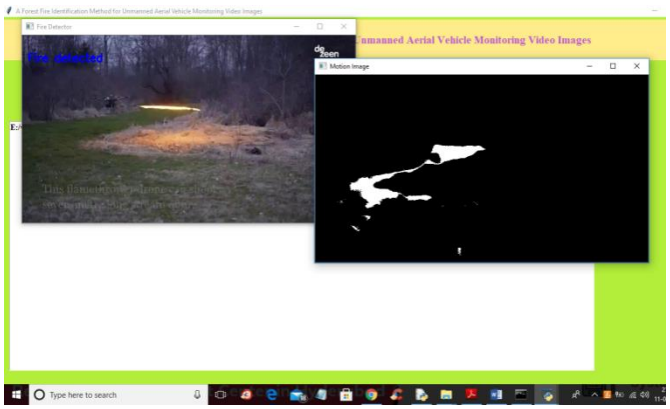


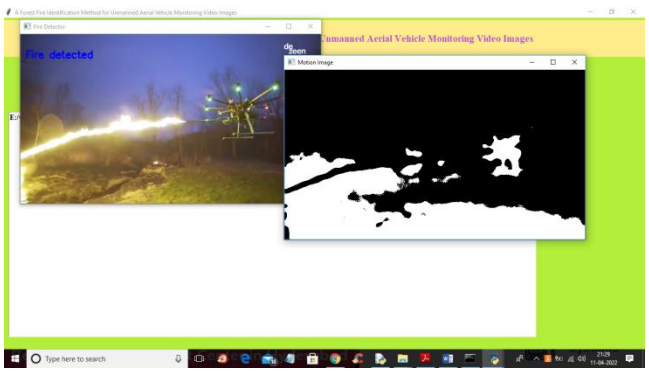


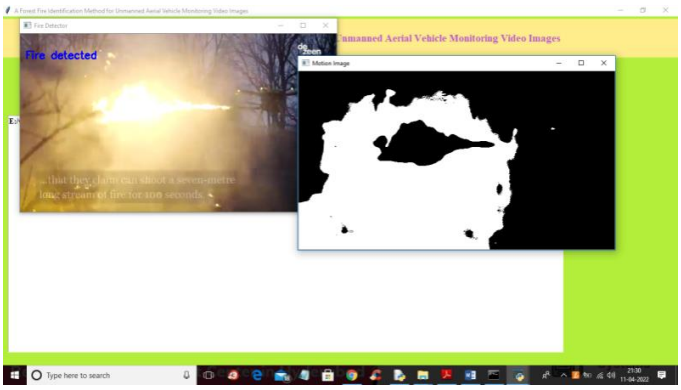
In above screen you can see no fire detected and in black screen also no fire movement detected and in below screen we can see fire detected with movement in black window.





In above screen fire detected and movement we can see in black screen





CONCLUSION

In this paper, the monitoring information of forest fire is obtained by multi-rotor unmanned aerial vehicle (UAV) which carried video acquisition equipment. The experimental sample image is extracted by frame. This paper proposed a forest fire monitoring method for UAV video image based on active analysis. The real time monitoring and automatic recognition of forest fires are realized by static characteristics of forest fires such as angular second moment, entropy and reciprocal differential moment. The experimental results show that the proposed algorithm can effectively identify forest fires, achieving real-time monitoring of forest fire goals based on multi-rotor UAV.

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