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Review Article

Systematic Literature Review: Smart Drone for Early Smoke Detection in Forest Using IOT

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Abstract: Promt response via enent of unexpected hazards, early forest fire alarms are having crucial factors. Cameras which are cost effective, their memories, and ehancement in computiations in power manners are enabled real time applications and using detection algorithms which are using in light weight solution for survillance systems. Due to these factors, performance is unsatisfactory to monitoring and detecting scenarios. Various applications like Unmanned Aerial Vehicles (UAVs) are more complicated. The current observation-frameworks for fire-free forests need support for regular monitoring for each purpose. For preparing UAV (Unmanned Aerial Vehicle)'s arenautical picture indicates prerequisites of ranger services at UAV stage. It provides a continuous and remote watch on a flame in forests and mountains. UAV is flying and getting the elevated information, helping clients to maintain the no. of areas where flame focuses. Detection of programming spreads capacities, including Fire: source-identification, area, choice-estimation, and LCD module. This paper proposed (1) Code Coloring Identification, (2) Recognition of the Smoke-Motion, and (3) Algorithms of Fire Clasification. Moreover the use of a helicopters with visual cameras portrayed strinkingly.

Keywords: Unexpected hazards; Fire Classification Algorithms; Color Code Identification; Smoke Motion Recognition;

1. Introduction This SLR is composed of three papers which are related to our topic i.e. 1. Unmanned Ariel Vehicle based forest fire monitoring and detection using image processing technique(San-Miguel-Ayanz, Schulte, Schmuck, Camia, & Economics, 2013). 2. A review on forest fire detection technique: A decadal perspective(Schmuck et al., 2012) and 3. Unmanned Aerial Vehicle (UAV) based Forest Fire Detection and monitoring for reducing false alarms in forest-fires(Chen, Yin, Huang, & Ye, 2006)

The reason why we choose this topic is that the forest fire rate increase day by day and it badly affect the economy of every country facing this problem. Not only economy but it also affects our ecological system, damage our lands, wildlife, humans, vegetations as well(San-Miguel-Ayanz et al., 2013) (Schmuck et al., 2012)

To overcome this problem many of organizations and authorities are working on it, but in result they didn't find this way affective because when they come to know about fire, half of the forest was already captured by it, so for some efficient way there is need of some way more authentic techniques, for this purpose we go through some of the past work which has been done recently, every paper has its own flaws and its own advantages. At (San-Miguel-Ayanz et al., 2013)the researcher use the technique of "Image Processing" for detecting the forest fire, the method used in this technique is that they prepare a helicopter

type tool which was mounted with a camera on its end and drone on its upper side so the camera used to fly with the drone and then capture the whole area ,this tool detect the fire on the basics of its motion and it's color ,then send the pictures to the ground operator where the person is handling the computer ,that person detect the flow of motion and detect the color by the given picture ,but the issue in this technique is that the result is not that efficient and the camera didn't capture the perfect click so to improve this issue another research in 2020 works on the same issue but with (Unmanned Ariel Vehicle)UAV .

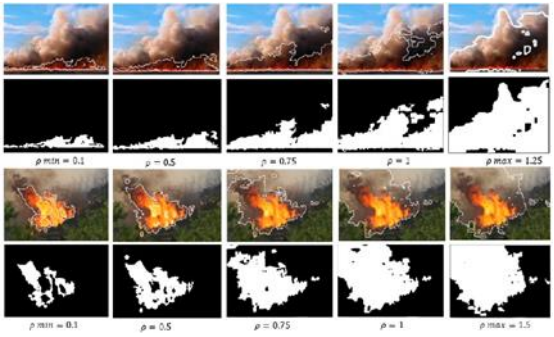


Figure 1: Image Processing Techniques

After that another researcher works on the same issue but with different techniques to make this method more effective(Chen et al., 2006), this researcher uses the (Unmanned Ariel Vehicle) UAV for fire detecting, in this method the drone which are used are programmed, and works on different strategies and techniques. The current reflection frameworks for FF absence want supporting in continuous checking of each purpose of the location at all time and prime location of the fire dangers.

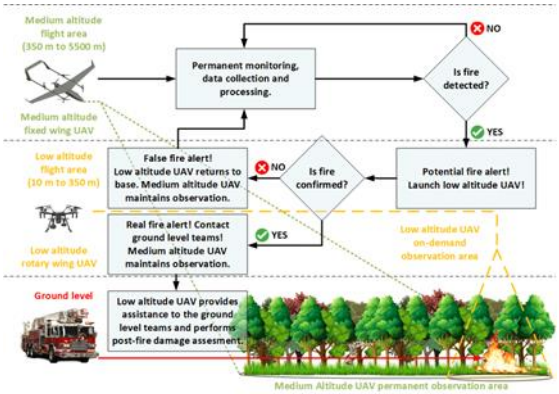


Figure 2: UAV based Forest Fire Detection and monitoring for reducing false alarms in forest-fires

For continuous and remote monitoring in forest areas, UAV is elevated all information from one point to another and helping clients to maintain the areas where fire can catch. This paper proposed includes;

1. Code-Coloring Identification
2. Recognition of the Smoke-Motion
3. Algorithms of fire classification

All of the above terms present methodologies that are used for fire division obscure cameras, as well as the systems that combine the information obtained: Correctly, given the forest's very complex and disorganized circumstances, smoke obstructing the flame, the movement of cameras placed on UAVs, and analogs of fire qualities, the present FF position remains testing. These negative effects might cause either a true or false alarm. This project aims to increase the accuracy and reliability of FF recognition algorithms for UAVs.

2. Materials and Methods

The method used at(San-Miguel-Ayanz et al., 2013) a general concept of vision-based fire-detection system is to deploy a group of UAVs with fire detecting sensors onboard to search an assigned area, while communicating with ground station. Once potential fires detected, other UAVs in the vicinity will come to make further confirmation. If a fire is confirmed, a fire alert along with fire images will be sent to the ground station and mobile devices, respectively. Meanwhile, firefighters are informed to fight the fire as shown in Fig.3.

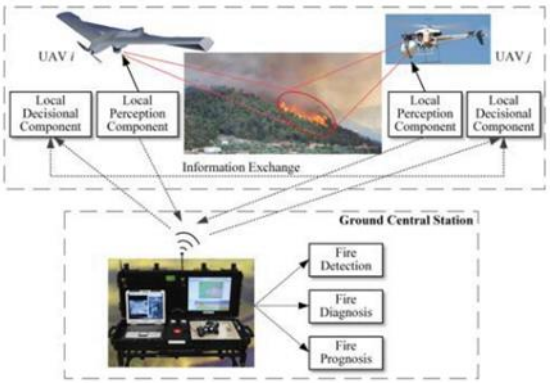
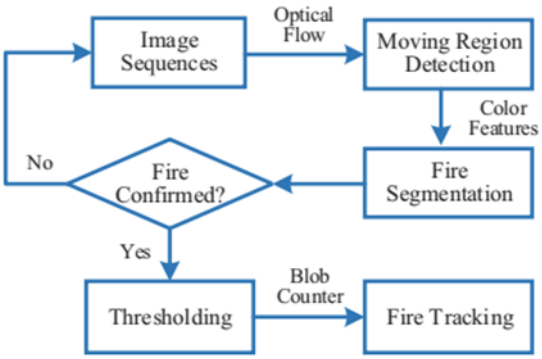


Figure 3: Schematic illustration of UAVs-based forest fire monitoring and detection system [1]



At (Chen et al., 2006) The main objective was to deal with a comprehensive framework for furthering existing flame recognition breakthroughs. To the degree as the UVA is concerned, there are two distinct sections that have an effect on flying: the assembly or undercarriage, and its accessories. The evaluation of these components leads to the conclusion that the improvements available assets are minor, if not non-existent, for the purposes of this work.

The proposed flame identification methodology as follows:

- To remove the non-fire foundation, burning chemicals were mostly recognized as promising flame zones using a histogram-based division technique.
- The old-style optical stream strategy is then connected to identify moving articles for disposing of stationary non-fire objects in the candidate flame areas.
- After that, the movement vectors identified by the optical stream are analyzed in order to reduce false alarm rates caused by fast moving objects.
- Visual and IR pictures are sectioned; these pixels in the convergence zones are required for a conclusive flame confirmation.
- Finally, when the flame areas affirmed, fire zones are followed by mass counter-strategy.

Figure 4: Flowchart of proposed fire detection andtracking methods

Fig. 5 represented the proposed FFD algorithm;

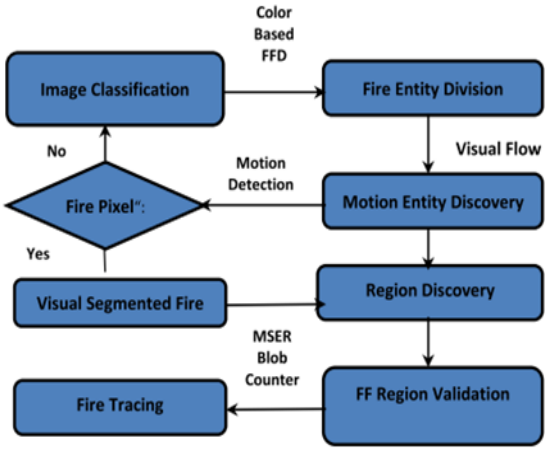


Figure 5 Proposed workflow for FFD algorithm

3. Planning

So, after keeping the recent work in view now the method and technique which we are going to work on is "Smart Drone for Early Smoke Detection in Forest Using IOT" in our system we use smoke sensors which are not used in any research before for this particular area, these sensors sense the smoke in the forest which clearly defines the indication of fire and quickly send the exact location of the area which is been affected and try to make fire out of the area quickly. Also, we use auto drive drones in our proposed work so that we just define the way point at once and after that drone follow that way points and cover the concerned area. They also recharge their self automatically by wireless charging concept.

4.Conduct Review

Conduct review is basically the combination of inclusion, exclusion, problem identification and quality assessment.

4.1. Inclusion

The three papers which we include in our work are the papers which perfectly goes with our topic and these are very helpful for us to find the research gap so we can easily find our area to work.

4.2. Exclusion

As we have read more than five papers but we consider only three of them the reason of neglecting others is that the work done in those papers is not that efficient and the paper is not related to our topic with all the aspects.

4.3. Problem Identification

In following research papers, we identify some issues like:

In (San-Miguel-Ayanz et al., 2013) the proposed fire detection technique is not that accurate so that sometimes generated results are true to help in better decisions and sometimes these results lead to wrong way.

In (Chen et al., 2006) system alerts false alarms so that concerned organization not sure to take action or not.

5.Quality Assessment

Comparison	Sensor Based Techniques (Wireless sensor Networks) [4-12]	Camera Based Techniques (Image and Video Processing) [13-27]	Neural Networks Based Techniques [28-33]	Satellite Based Techniques [34-37]	UAV/ Air borne Techniques [38-42]	Fuzzy Logic Based Techniques [43, 44]	Animals as mobile sensors [3, 45]	Radio-acoustic based techniques [46]
Cost	Low	High	Low	Very High	High	Low	High	Medium
Practicality	High	Medium	Low	Very High	High	Low	Very Low	Very Low
Frequency of use in literature	High	Medium	Rare	Very High	Medium	Rare	Very Rare	Very Rare
Detection device mobility	Fixed	Fixed	Fixed or mobile	Mobile	Mobile	Fixed or mobile	Mobile	Fixed
Battery power provided through	Rechargeable Devices	Rechargeable Devices	Rechargeable Devices	Solar	Rechargeable Devices	Rechargeable Devices	Rechargeable Devices	Rechargeable Devices
Information on fire behaviour	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Region of Interest	Can be extended	Limited	Limited	Complete Forest	Can be extended	Limited	Limited	Limited
Detection to notification delay	Small	Long	Small	Very Long	Long	Small	Long	Small
False Alarm	Low	Medium	Medium	Very Low	Medium	Medium	High	High
Fire localization error	Low	High	Low	Very High	High	Low	High	High

All of the techniques are mentioned here which are been used for forest fire detection so here we can easily judge the quality of each technique.

6. Research Questions

Q1) Why Forest fire cannot detect earlier?

Q2) How Forest fire effect the economy?

Q3) What are the major causes of forest fire why it is that difficult to detect perfectly?

Q4) How sensors/smart drones works more efficiently than present techniques?

Q5) Is there is any specific technique to protect the populated area from forest fire?

Q6) What are the benefits of using drones during fire?

Q7) Are drones good for firefighter?

7.Results

Q1) Why Forest fire cannot detect earlier?

Ans: Because the resources and the techniques we use are not that efficient.

Q2) How Forest fire effect the economy?

Ans: Because half of our economy depends on the resources comes from the forest, so when we lose those resources, it automatically effects our economy.

Q3) What are the major causes of forest fire?

Ans: The major causes of forest fire are climate conditions and some of the manmade reasons.

Q4) How sensors/smart drones works more efficiently than present techniques?

Ans: Sensors and drones are more efficient than the present technique so that's why.

Q5) Is there is any specific technique to protect the populated area from forest fire?

Ans: Yes, there is architecture of basic detection system which is used to protect specific area by using node to node method.

Q6) What are the benefits of using drones during fire?

Ans: Drones help us detecting the early smoke and they work more efficiently than humans.

Q7) Are drones good for firefighter?

Ans: Yes, because in all conditions humans cannot be present at the spot because it's risky so that's why in sensitive areas drones are placed.

8.Disscussion

Forest fires are one of society's most severe environmental challenges, especially in Southern European countries like Spain. Apart from the impact and damage to ecosystems, as well as the possibility for human mortality, massive direct and indirect costs connected with catastrophic disasters must be taken into account. According to the fires in Galicia cost the country 155.89 million euros in October 2017. According to sources from the Ministry of Agriculture, Food and Environment, Spain suffered an annual average of 14,476 incidents affecting an area of 108,282.39 hectares, with economic losses exceeding 54 million Euros. Therefore, technological advances in the area of robotics can help both in reducing the number of incidents and the costs. In this context, the project's goal is to create an autonomous UAV capable of performing tasks such as fire supervision and monitoring in rural regions. Forest fires are being monitored and identified using unmanned aerial vehicles (UAVs) with onboard vision-based technology (UAVs). Although vision-based approaches might be useful in this work, the focus of this study was on their development rather than information on the platform or navigation methods used. In a first phase, a system made up of numerous UAVs was used to search for and identify fires, and in a second phase, it was used to train for fire suppression missions. This study, which was produced on numerous platforms and marks a significant development, provided comparable results to this work, but only gathered data in simulation settings, rather than putting their methodologies and algorithms into practice on real platforms. The work presented a set of UAVs in charge of taking images of forest fires in real time in order to analyze the evolution of the fire with the integration of all the information, focusing on the development of a perception system for the monitoring of fires within teams formed by different vehicles.

9.Clasiffication Table

	YEAR	TECHNIQUES USED	PROBLEM TACKLED	AUDIENCE TACKLED	CRETERIA 1	CRETERIA 2	CRETERIA 3	CREATERIA 4	TOTAL SCORE
[4]	2020	Cloud computing, IoT sensors.	Unmanned Aerial Vehicle (UAV)	Open areas, agricultural etc.	1	1	0.5	1	4
[5]	2019	UAV (Unmanned Aerial Vehicle) aeronautical picture.	The present observation frameworks for FF absence need	forests and mountains	1	1	1	1	3
[6]		present two different emerging solutions for early detection of forest fires	They ware primary aimed at the early detection of the fires	Early Forest Fire Detection Using Lorawan Sensor	0.5	0.5	0.5	1	3
[7]	2020	The novelty of system is real-time	This article aims to design an early	The cities surrounded by forests	1	1	0.5	1	3.5
[8]	2016	Challenges in Forest Fire Monitoring with Small UAVS	proposed system	Regulative in Republic of Croatia	1	1	1	1	5
[9]	2016	The demand of predicting exact fire area in forest	The usage of virtual Neural Network System (SNNS).	powerful computational tools	0.5	0.5	1	1	3.5
[10]	2017	open source technology, smart sensors, better	Agriculture monitoring	Agriculture	1	1	1	1	3
[11]	2018	The developed Fire Detection IoT prototype .	One of the main objectives	Smart Forest is a derived concept	1	1	1	1	3
[12]	2018	UAV-Based Emergency Detection	This paper proposes	ecosystems for smart city	1	1	1	1	3.5
[13]	2018	The developed Fire Detection IoT prototype	One of the main objectives of Smart Forests	Smart Forest	0.5	0.5	0.5	1	3.5
[14]	2019	Mutual cooperation among the various	It gives a real-time and remote	requirements of forestry area	1	1	1	1	4
[15]	2017	The concept of the paper is CMS	prevention and timely dealing with forest fires becomes essential.	These systems will help European CMS	1	1	1	1	4
[16]	2017	using drones, camera, and wireless sensor	prevention and timely dealing with forest fires	Forests	1	1	1	1	5
[17]	2020	technologies used in early fire warning system	Three types of systems are identified.	fire detection systems based on optical remote	1	1	0.5	1	4
[18]	2019	dvanced and modern Information	These technologies help improve the infrastructure of smart cities	In the context of smart cities.	0.5	0.5	1	1	3.5
[19]	2019	Unmanned Aerial Vehicles (UAVs)	In the proposed algorithm, each UAV	The main distinction	1	1	1	0.5	3
[20]	2019	The system is composed, relative humidity, wind speed and CO_2	Through website the users can see the radius.	Forest fires	1	1	0.5	1	3.5
[21]	2018	Recent technological and scientific advances in the manufacturing processes	Besides being used for capturing of aerial photos and videos, the unmanned aerial vehicles	Nature parks, forest agencies and even governmental institutions	1	0.5	1	1	4

[22]	2018	trend of deep learning	Missions such as search and rescue or forest	The purpose of detecting human existence	1	1	1	1	3.5
[23]	2016	Four elements are needed to start and sustain a fire: (1) fuel, (2) heat	The present general inventive	Forests	1	0.5	0.5	1	4
[24]	2017	using drones (Unmanned Aerial Vehicles, UAV)	A special emphasize we give to the communicatio n	using drones (Unmanned Aerial Vehicles, Av)	0.5	0.5	1	1	4
[25]	2016	smart Arduino fire detection sensor	proposed a smart Arduino fire detection sensor simulation	types of disaster monitoring system using smart-phones are under active studying.	1	1	0.5	1	4
[26]	2017	Four elements are needed to start and sustain a fire	including the transmission of pictures and/or streaming	Agricultures and forests	1	0.5	0.5	0.5	3.5
[27]	2020	To make better predictions on the fire probability	To provide the autonomous capabilities to the proposed	Forest fires are one of the main reasons for environment	1	1	0.5	1	5
[28]	2016	Recent Regulations on Drones	The goal of this survey paper.	It is expected that drones	1	0.5	0.5	1	3.5
[29]	2020	using the Recognition service of Amazon Web Service (AWS)	work for night-time forest fire and	Last year's Goosing-Sokcho Forest fires	0.5	1	0.5	0.5	4
[30]	2020	GSM modem associated with the system. To get real-life data without putting human lives in danger, an IoT technology.	To address this problem, this study aims to implement a smart fire detection.	House concerns for builders, designers, and property residents	1	1	0.5	0.5	3.5

Figure 6 Classification Table (Part 2)

10. Conclusion

So, in the end we conclude that the equipment's which are used for forest fire detection are unique and efficient they are costly but they reduce the fire rate, they are chargeable and able to work for remote areas too, and there is very little human involvement includes they are easy to control no big team is needed for this task with few devices we can observe the large area, in future researchers can use camera too with these UAVs.

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