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FOREST FIRE DETECTION USING DRONE

Dr. S. Mary Praveena,
Associate Professor,
Department of ECE
Sri Ramakrishna Institute of Technology, Coimbatore, India

B.Akshaya, B.B.Devipriya, U.Divya, K.Mirudhula
Department of ECE
Sri Ramakrishna Institute of
Technology, Coimbatore, India

Abstract—Forest fires are a major reason behind forest degradation and have wide ranging adverse ecological, economic and social impacts, including loss of valuable timber resources, degradation of catchment areas, loss of biodiversity and extinction of plants and animals. In the recent times forests of Amazon and Australia faced a serious a threat to both wildlife and mankind. It also caused an enormous loss to both the countries. This paper describes early detection of fire by sectionally dividing the forest for efficient monitoring. The flame sensor is used to detect fire and a drone is employed as a mobile object which monitors the respective section. This drone travels from one pole to a different every alternate hour and gets charged while it's on a pole, because the pole has solar array. There is a timer also used at the poles which indicate the time of arrival and time of departure of the drone. The transponders are accustomed receive and transmit the signals. By this detection the nearby department of local government can get the precise location of the wildfire and early measures will be taken accordingly.[1]

Key Words: *Forest fire, Drone, Flame Sensor*

I. INTRODUCTION

Forest plays a significant role in all sorts of lives. It nurtures environments, provides homes for wildlife, offers abundant job opportunities, and also contributes to a 2 significant proportion to economic wealth. Every year, however, millions and millions of hectares of forest are destroyed by forest fires, which severely damages ecological systems and also the safety of wildlife, and cause many countless dollars property loss. Wildfires are unwanted and unplanned fires, including lightning-caused fires, unauthorized human-caused fires, and escaped prescribed fire projects. If we see the statistics, they discovered that in 2019 there have been 50,477 fire outbreaks and 58,083 in 2018, according to a piece of writing of National Interagency Fire Center (NIFC). About 4.7 million acres were burned in 2019 while there have been 8.8 million acres burned in 2018. There are many various technologies that are getting used for fire detection and monitoring. These include satellite imaging, remotely piloted vehicles (RPV), or sensors. However, these methods do not provide real-time detection and monitoring of fire. Some drawbacks of those technologies include:

Forest fires are not detected in early stages, Satellites have longer time lags, and Sensors become an infeasible solution due to it small range. Even if we use spectral imaging, it would not give an accurate result in the dark or in adverse atmospheric condition. Nowadays, to prevent forest fires at the proper time, personnel are employed to protect the forest, pitting their life at risk. Unmanned aerial vehicles (UAVs) with image processing and remote sensing is a better choice to provide real-time monitoring and detection of forest fires. UAV is a faster and mobile solution, and at the same time, it is a low-cost solution to observe forests. The calibration of UAVs with remote sensors will add more value to pre - existing methods. additionally, UAVs are able to operate in hazardous areas that cannot be safely reached by humans. There are several methods to detect the forest fires including the watch towers monitoring using satellite images but it is still not sufficient due to complex forest infrastructure which needs lot of trained persons to control. so as to shield these huge stretches of land and biodiversity, there is a crucial need to possess an incredible surveillance and early caution structures for the fire whilst in its establishing 3 diploma of spreading shall be managed which can prevent it unfolds. Usually so you can prevent fire in a forest vicinity there may additionally be an enormous dependency on man power [4]. An efficient mechanism to avert forest fire can also be laid down in an exceedingly greater way for it should be beneficial to officials and woodland involved authority. Through this approach, we create a machine if you desire to help the woodland fire protection people to govern undesirable results on forest ecosystems and the nature. For this purpose, sensing surroundings may be deployed with a large vast range of wireless sensor nodes [5]. A wooded fire area may be a natural disaster consisting of a fireplace which destroys a forested

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location, and may be a splendid risk to those who live in forests as well as the wildlife. Forest fires are usually started off by using lightning, however additionally by way of human negligence or arson, and might burn many square kilometers [6]. We propose to develop a real-time forest fire monitoring system employing a UAV and remote sensing technique. The drone is provided with sensors, a mini processor and camera. Data from different sensors and therefore the images taken by the camera are processed by the Raspberry Pi 3, which acts as a processor. The results of the information processing are sent to a server to be accessible online.

II. EXISTING METHOD

Over the last few years, global climate change and human-caused factors have a significant impact on the environment. a number of these events include heat waves, droughts, dust storms, floods, hurricanes, and wildfires. Wildfires have extreme consequences on local and global ecosystems and cause serious damages to infrastructure, injuries, and losses in human lives; therefore, fire detection and also the accurate monitoring of the disturbance type, size, and impact over large areas is becoming increasingly important. to the present end, strong efforts are made to avoid or mitigate such consequences by early fire detection or fire risk mapping. Traditionally, forest fires were mainly detected by human observation from fire lookout towers and involved only primitive tools, like the Osborne fire Finder; however, this approach is inefficient, because it is liable to human error and fatigue. On the other hand, conventional sensors for the detection of warmth, smoke, flame, and gas typically take time for the particles to achieve the purpose of sensors and activate them. additionally, the range of such sensors is comparatively small, hence, a large number of sensors must be installed to hide large areas.

III. PROPOSED METHOD

A fire in its early stages might not even have a flame or it could be hidden beneath the forest canopy. On the other hand, smoke appears prior to flame and may be detected from distant. However, during night-time operations, the smoke becomes invisible. Therefore, for a strong and continuous forest fire detection system, it is important to go for detection and Monitoring of forest fires through sensors and send to IoT cloud. The flame sensor and therefore the ESP8266-01 module are connected to the Raspberry pi, for recording sensor data and sending it to devices linked with push bullet API. The Raspberry pi, is then attached to the body of the drone. The drone on approaching to a fire sense it with the assistance of the flame sensor and sends the information via the WI-FI module. The successful implementation of a fire detection algorithm that is robust under environmental conditions, and has high accuracy, combined with the safe UAV flight control strategies can make UAV-based forest fire detection the most preferred choice. the strategy proposed in our system has the potential for real implementation and the presented results will guide future research towards finding an optimized forest fire detection algorithm.

IV. HARDWARE AND SOFTWARE

A HARDWARE

1 Raspberry Pi

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first-generation Raspberry Pi. Additionally, it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs. The image is transformed from RGB to Grayscale as it is easy to detect faces in the Grayscale.



Fig -1: Raspberry Pi

2 Flame-sensor

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.



Fig -2: Flame-sensor

3 ESP8266

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espress if system. It is mostly used for development of IoT (Internet of Things) embedded applications.



Fig -3: ESP8266

4 Camera Module

The 0.3MP OV7670 Camera Module with High-Quality SCCB Connector is a low voltage CMOS image sensor; that provides the full functionality of a single-chip

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Video Graphics Array camera and image processor in a small footprint package.



Fig -4: Camera module

5 Lithium polymer battery

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium-poly and others), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte.



Fig -5: Li-Po Battery

B SOFTWARE

1 Pushbullet:

Pushbullet is one of the fastest and easiest way to get links, notes, lists, files, and addresses both from your desktop computer to your mobile device and vice versa. All of this is done from the Push bullet Android app, the service's Web site, or one of the browser extensions for Chrome or Firefox.



Fig -6: Pushbullet

2 Programming languages:

Python:

Python is an interpreted high-level general purpose programming language. Its design philosophy emphasizes code readability with its use of significant indentation. Its language constructs as well as its object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects. Python is dynamically-typed and garbage-collected.

PuTTY:

PuTTY supports many variations on the secure remote terminal, and provides user control over the SSH encryption key and protocol version, alternate ciphers such as AES, 3DES, RC4, Blowfish, DES, and Public key authentication. PuTTY uses its own format of key files – PPK (protected by Message Authentication Code)

V. RESULT AND DISCUSSION

The main objective of this work is to model and develop a synergistic integration of mature technologies based on UAVs, stationary thermal/optical cameras assisted by a fire risk assessment model. In this paper, the development of an integrated forest monitoring system for early fire detection and assessment by using efficient hardware and software solutions is addressed. The proposed system could enable interested parties to react immediately, accurately and appropriately to a forest fire event.

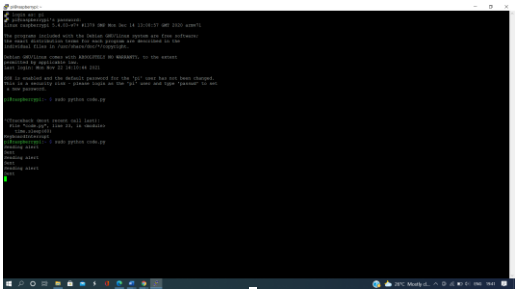


Fig -6: puTTY output

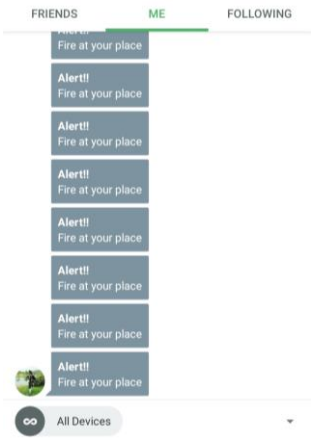


Fig -7: Pushbullet Alert

VI. CONCLUSION

The system for early forest fire detection is still in its development stage. We are still waiting for some equipment to be purchased, but we have planned and discussed the actual implementation. We have performed a thorough research and some simulation experiments and we believe that we follow the right way to achieve the goal. We also believe that we apply adequate approach that is also up-to-date. We think that the system could enhance the available platforms for fire detection and we hope that such improvement could significantly reduce the damages caused by untimely or late fire detection. The system can be a powerful tool that enable the key authorities to take decisions based on accurate data. The great advantage of the system is the combination of steady and mobile sensors, that result in a minimization of the cost with respect to the obtained resolution.

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AUTHORS

- Dr. S. Mary Praveena
- B.Akshaya
- B.B.Devipriya
- U.Divya
- K.Mirudhula

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