A Review of Forest Fire Detection using IOT

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***Abstract*—Forest fires develop in natural environments such as forests and spread uncontrollably, burning millions of hectares of land globally and causing economic and environmental damage in addition to human deaths. Traditional methods of forest fire monitoring and detection involve the use of individuals to monitor the environment, which can be dangerous and costly in terms of human resources. To prevent such losses, equipment that can identify any fire threat in real-time is essential in this industry. Many strategies are employed, including the Internet of Things (IoT). This document presents a summary of various forest fire detection using the Internet of Things.**

***Index Terms*—wireless sensor networks, forest fire, Internet of Things, sensor nodes.**

I. INTRODUCTION

Forests cover approximately 30% of the world's land area and play a crucial role in supporting the economy and environment. They provide various resources, including medical materials and household necessities. Forests help mitigate environmental issues, such as preventing overheating and reducing pollution caused by human activities.

However, forest fires pose a significant threat. They can spread rapidly, causing extensive damage, loss of human lives, and harm to animals and trees. Forest fires can result from natural causes like lightning or human-made factors such as smoking or other activities. Natural fires are harder to predict and often lead to more extensive damage.

Recent years have seen an increase in forest fire damage. Statistics show that in 2016, over 65,000 wildlife were affected, increasing to around 71,500 in 2017, with 10 million acres burned. Awareness campaigns have helped reduce damage, with around 55,900 wildlife affected and 8.6 million acres burned.

The United States experiences a high number of forest fires, emphasizing the need for early detection and preventive measures. Governments and forest departments have implemented actions to reduce fires, including restricting access, prohibiting fire-causing materials, and using monitoring cameras.

To further mitigate forest fire damage, modern technology can be employed. Quick information dissemination through technology is vital for rapid response. Devices equipped with modern technologies can help provide immediate alerts to authorities, enabling them to take prompt action and minimize forest fire damage.

Identify applicable funding agency here. If none, delete this.

II. LITERATURE REVIEW

In [1] implementing a low-cost infrastructure for Smart Forests using mobile objects and mobile hubs to detect fire The same approach can be extrapolated to a great variety of applications in Forests: water, soil and air quality; fauna dynamics; endangered species studies. In [2] implement an IoT based system which is self-sustaining and would predict and detect the forest fires and sends the exact location to concerned officials which would help fire fighting personnel to extinguish the fire in the location where it starts slowly. This would prevent the fire to spread over a huge area and also able to take precautionary measures in order to prevent the fire which may occur in near future. In[3]determining the fire locations based on specified sensor data and double check with satellite image set for predicting the fire in advance.The two modules respectively namely early fire detection feeds the locations that may raise the fire and alert the UAVs and UAVs functioning enables the number of UAVs from the control station to reach the pipeline open water valves and carry the loads to the desired locations specified in longitude and latitude.

III. METHODOLOGY

Smart Forests: fire detection service[1] implemented WPAN, Bluetooth Low Energy sensors. Bluetooth sensors were chosen because are cheaper than Wi-Fi ones, making possible a bigger number of sensors in the forest - Bluetooth Low Energy provides a theoretical range over 100 meters. The smart-phones receive data from them and, after processing the data, send it to the Smart Forest Server, to be stored and to notify entities about the events occurred. The sensors are located at tree tops, and also at undergrowth, to easily detect abruptly temperature and humidity changing due fire. Every guard has a smart-phone, and almost every visitor. An application that provides park information about trails, fauna and vegetation, may be offered in association with Mobile Hubs to incentive people install that.

Forest Fire Alerting System With GPSCo-ordinates Using IoT[2] implemented an idea to detect the fire in the forest by using modern equipments. The system is proposed to detect

TABLE I
LITERATURE REVIEW COMPARISON

Sl.No	Methodology	Research Contribution	Research Gap
[1]	Edge Computing solution based on the notion of Mobile Hubs (M-Hubs). The Fire Detection IoT prototype application created is based on the ContextNet middleware and employs Event Processing Agents (EPAs) that operate on smart phones carried by forest guards.	. Mobile Hub appears as an option for edge computing in Smart Environments. Preliminary results showed that MHubs can connect to 2,500 mobile objects, receiving data from temperature and humidity and processing all these data before notifying Smart Forest Server.	Each Mobile Hub needs a lot of money to implement.
[2]	Sensors are used to detect the fire in the forest, with detecting the fire the exact location of the fire is detected and located to the nearby forest officer. So the system is a complete IoT based system were the activities of the system is continuously monitored and the monitoring details are stored in online pages which is viewed by the officer regularly.	Wi-Fi module contains a component called ESP8266 which has some special features which is used to transmit the information to the officers through cloud or through online mode.GPS module where the exact location of the fire can be detected and located.	The systemneeds to be robust to withstand all the climate changes which may affect its functioning.
[3]	The system is based on IoT where networked devices are communicated based on the identification of certain activities, and will propagate such information to another in the internet mode. After identification of fire, the unmanned aerial vehicles (UAVs) are used to carry water clusters to the required spots to avoid such fire incidents.	The two modules respectively namely early fire detection feeds the locations that may raise the fire and alert the UAVs and UAVs functioning enables the number of UAVs from the control station to reach the pipeline open water valves and carry the loads to the desired locations specified in longitude and latitude.	The entire process is fully automated without any human intervention. This process may also to be redefined in terms of routing and increased performance in the future.

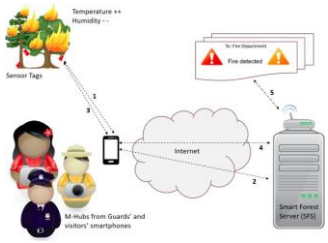

Fig. 1. Fire detection using M-Hubs and ContextNet middleware [1]

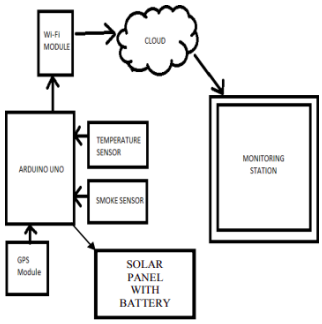

Fig. 2. Block diagram of model [2]

the fire in the forest and also to alert the forest officer about the fire in the forest. Here a microcontroller is used to control the system activities, some sensors are used to detect the fire in the forest, with detecting the fire the exact location of the fire is detected and located to the nearby forest officer. So the system is a complete IoT based system were the activities of the system is continuously monitored and the monitoring details are stored in online pages which is viewed by the officer regularly. The details are stored as a data and this data can be viewed at any time Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Fully Smart fire detection and prevention in the authorized forests [3] implemented two modules such as Fire Detection using sensors and satellite system and UAV using wireless routing algorithm.Early fire detection: In this, sensors such as temperature, smoke and color sensors are used to determine the location where fire to be identified or fire is going to be generated. These images and satellite images of that permitted zone watching images are matching, and then it alerts the control station and directs the drones with location as input.UAV functioning: In this, each UAV has a unique digital identifier. According to the number of locations, the number of UAVs is directed to carry out the mission. The UAVs who are directed would go to the first the nearest pipeline and gets the loaded water balloons. The adaptive routing method such as distributed routing is applied and is dynamic in nature.

According to the intensity of the location, the balloon of that capacity is filled with water. That filled balloon would

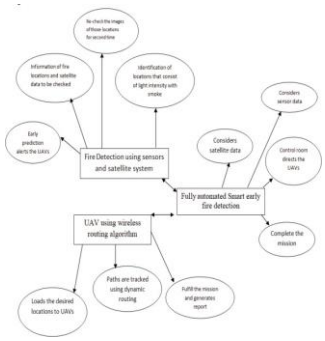

Fig. 3. Architecture of Fully Automated Smart Early Fire Detection System [3]

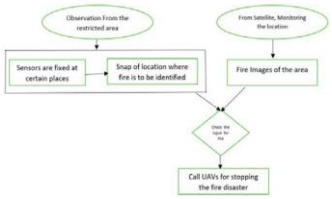

Fig. 4. Theme of detection of fire [3]

be released from the pipeline open valve, and that could be taken by the alerted UAV to the desired location. Based on the severity of the fire location, other drones are also assigned for fulfilling the mission.

Early fire detection: In this, sensors such as temperature, smoke and color sensors are used to determine the location where fire to be identified or fire is going to be generated. These images and satellite images of that permitted zone watching images are matching, and then it alerts the control station and directs the drones with location as input. At a time, many be many such locations are also to be also raised.

UAV functioning: In this, each UAV has a unique digital identifier. According to the number of locations, the number of UAVs is directed to carry out the mission. The UAVs who are directed would go to the first the nearest pipeline and gets the loaded water balloons. That filled balloon would be released from the pipeline open valve, and that could be taken by the alerted UAV to the desired location.

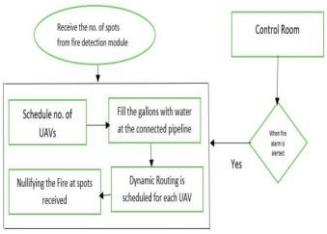

Fig. 5. Theme of Scheduling the UAVs [3]

CONCLUSION

Science and technology is panacea for all our growing problems. Predicting the natural processes are highly complex and our system needs to be tested against real time conditions. Though our system is self- sustaining and standalone, other factors which would affect the hardware were tested against time. It shall be implemented in small forest areas where chances of occurrence of forest fires were high.

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