Project Design Phase-I

Date	07 October 2022
Team ID	PNT2022TMID17419
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum Mark	2 Marks

S.No.	Parameter	Description
1.	Problem statement (problem to be solved)	Over the last few decades, forest fires are increased due to deforestation and global warming. Many trees and animals in the forest are affected by forest fires. Technology can be efficiently utilized to solve this problem. Forest fire detection is inevitable for forest fire management. The purpose of this work is to propose deep learning techniques to predict forest fires, which would be cost-effective. The mixed learning technique is composed of YOLOv4 tiny and LiDAR techniques. Unmanned aerial vehicles (UAVs) are promising options to patrol the forest by making them fly over the region. The proposed model deployed on an onboard UAV has achieved 1.24 seconds of classification time with an accuracy of 91% and an F1 score of 0.91. The onboard CPU is able to make a 3D model of the forest fire region and can transmit the data in real time to the ground station. The proposed model is trained on both dense and rainforests in detecting and predicting the chances of fire. The proposed model outperforms the traditional methods such as Bayesian classifiers, random forest, and support vector machines.
2.	Idea / solution description	Recent advancements in technology have overwhelmingly shaped society, the economy, and the environment. With the help of the various state-of-art technologies such as IoT, blockchain, AI, geospatial mapping, and so on, leading to the fifth industrial revolution, which focuses more on solving climate goals in line with the revolution [1]. New requirements in the ecological environment arise due to the expeditious development of

		society. Among the various natural disasters, fire hazard seems to own the characteristics of spreading, and also, it becomes very challenging to control, and thus, it results in heavy destruction that might be irrevocable [2–4]. Over the past few years, there is a tremendous increase in the count, occurrence, and severity of wildfires across the world that has created a great impact on the economy and ecosystem of the country.
3.	Novality / uniqueness	Evolution emerges in the processing, computation, and algorithms. This strives many researchers to pay attention in many domains where they work in the processing of surveillance video streams so that abnormal or unusual actions could be detected. The usage of UAVs is recommended in the detection of forest fire due to the high mobility and ensures the coverage areas at various altitudes and locations at a low cost. Hence, an efficient and scalable UAV is used for detection. This work aims in developing the 3D model for the captured scene. YOLOv4 tiny network is deployed to detect the fire. The accuracy of the detection rate achieved through this model is 91%. The proposed model outperforms the other existing techniques in terms of detecting in the early stage. However, this model is sensitive to the forest with dense fogs and clouds. This is because smoke appears as the same as fog, and the model may misclassify the fog as smoke. As our future works, focus to meet practical detection and meet the necessity of early detection including the generation of the mixed reality model of the forest fire area that gives more information, and prevention analysis will be made easy. The 3D modeling techniques presented in this paper can also be extended to various natural disaster prediction models.
4.	Social impact / customer satisfaction	It has an inadequate resolution, and hence, the data pertinent to the corresponding area would be taken as an average, and it is restricted to a particular pixel that results in the detection of small fires. The predominant limitation is that the satellites cover only a limited area and

		require a preprocessing time before the resurvey of the same region. The other limitations such as the shortage of real-time data and inadequate precision are inapt for persistent monitoring. There is a need for the infrastructure in advance if WSNs are deployed [4]. There is more chance for the destruction of the sensors during the fire, and this might lead to more expensive restoration of the sensors [9]. Several factors such as the static nature of the sensors, their coverage, difficulty in maintenance, the deficit in power independence, and nonscalability are the reasons for the sensor networks to limit their efficiency.
5.	Business Model (Revenue Model)	The flow of the proposed architecture is shown in Figure 1. The video input is captured from the camera, and the other inputs such as wind speed, wind directions, and IR image sensing are calculated using the sensors mounted on the UAV for navigation. These images are provided as input to the deep learning models, and it checks for the existence of the fire. The region is predicted clearly since there is a possibility of more projections of the images provided to the model due to the 3D modeling. Further detection is made, and the details are stored in the database for further.
6.	Scalability of the solution	Flight planning is considered a salient feature in designing the architecture of UAVs [33]. This planning illustrates the division of mass on UAVs and provides a better understanding of the performance analysis of UAVs. Specifically, maximum take-off weights (MTOW) assess the UAV payload capacity at different heights above the ground. The payload of the UAV and the mass of onboard equipment are given in Table 1, and the components of the UAV are depicted in Figure 3. The battery used on the UAV reserves the UAV in GPS-enabled environments for 107 minutes of duration, whereas on the GPS-disabled environment, maximum flight time is 87 minutes.