

Project Design Phase-I
Proposed Solution Template

Date	19 September 2022
Team ID	PNT2022TMID34045
Project Name	Emerging Methods For Early Detection Of Forest Fire
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	It is difficult to predict and detect Forest Fire in a sparsely populated forest area and it is more difficult if the prediction is done using ground-based methods like Camera or Video-Based approach. Satellites can be an important source of data prior to and also during the Fire due to its reliability and efficiency.
2.	Idea / Solution description	The simplest of these solutions is the establishment of a network of observation posts - both cheap and easy to accomplish, but also time-consuming for the involved people. The constant evolution of the information and communication technologies has led to the introduction of a new generation of solutions for early detection and even prevention of forest fires. ICT-based networks of cameras and sensors and even satellite-based solutions were developed and used in the last decades. These solutions have greatly decreased the direct involvement of humans in the forest fire detection process, but have also proven to be expensive and hard to maintain.
3.	Novelty / Uniqueness	Optical/thermal cameras deployed on the observation towers together with the other sensors such as smoke, temperature, and humidity sensors might detect the hazards in the closed environment rather than in the open environment as these sensors need vicinity to the fire or smoke. The information obtained through these sensors is not appropriate. Distance covered by these methods could be limited, and to cover a large area, more sensors have to be deployed that might incur expenses. Through the deployment of UAV, large areas could be covered, and the images with high spatial and temporal resolutions could be captured properly. The operational cost is very low when compared with the other methods.

4.	Social Impact / Customer Satisfaction	Some 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 the accurate monitoring of the disturbance type, size, and impact over large areas is becoming increasingly important. To this end, strong efforts have been 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, such as the Osborne fire Finder; however, this approach is inefficient, as it is prone to human error and fatigue. On the other hand, conventional sensors for the detection of heat, smoke, flame, and gas typically take time for the particles to reach the point of sensors and activate them. In addition, the range of such sensors is relatively small, hence, a large number of sensors need to be installed to cover large areas
5.	Business Model (Revenue Model)	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.
6.	Scalability of the Solution	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 modelling techniques presented in this paper can also be extended to various natural disaster prediction models.