Project Design Phase-I
Proposed Solution Template

Date	26 October 2022
Team ID	PNT2022TMID47227
Project Name	Emerging methods for early detection of forest fires
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)	Forest fires are a major environmental issue, creating economic and ecological damage while endangering human lives. There are typically about 100,000 wildfires in the United States every year. Over 9 million acres of land have been destroyed due to treacherous wildfires. 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. The various real-time forest fire detection and prediction approaches, with the goal of informing the local fire authorities. Now the goal is to do detect forest fire in forest areas.
2.	Idea / Solution description	We proposed a novel system for detecting fire using Convolutional Neural Networks (CNN). Detection of fire can be extremely difficult using existing methods of smoke sensors installed in the buildings. They are slow and cost inefficient due to their primitive design and technology. This paper critically analyzes the scope of Artificial intelligence for detection and sending alerts with video from CCTV footages. This project uses self-built dataset containing video frames with fire. The data is then preprocessed and use the CNN to build a machine learning model. The test set of the dataset is given as input for validating the algorithm and experiments are noted. The project focus on building cost efficient and highly accurate machine that can be used in almost any use case of fire detection.
3.	Novelty / Uniqueness	In our project , we use CNN-convolutional neural networks to detect fire with the help of live video footage through anti-fire

		surveillance systems. The paper proposes YOLOv2convolutional neural network is one of the best solutions for detecting fire and smoke both indoor and out door environment. You only look once (YOLO) isa deep learning model for object detection, YOLOv2is the next version which has been upgraded to rectify the setbacks of YOLO namely the inaccuracy to locate and mark the region of interest in the images and the lower recall rate compared to other region-oriented algorithms. Thus, increasing the efficiency of the architecture. They started with an input image of size 128x128x3. They used convolutional layers to map the features on the input image. The features extracted are then given as input to YOLOv2 object detection subnetwork. YOLOv2 Transform layer is implemented to improve network stability for object localization.
4.	Social Impact / Customer Satisfaction	The findings of the project are greatly satisfying. The system detected fire with an accuracy rate of 93 %. The result obtained show promise for implementation of Convolutional neural networks for detecting fire compared to other neural networks. The system combines several training data intelligently for calculating and reduce false alarm rates with fully connected network. Then this data is passed to decision-making algorithm to classify whether there isa fire or not. Although it has minor detection errors in some images, the overall performance and statistics are super-efficient. The only downfall is that it is a bit slow because it needs more computational power to produce results. The score of false alarm may be reduced by cleaning the data more and more. When implementing the rate of false alarm should be kept to minimum.
5.	Business Model (Revenue Model)	We propose a cost-effective fire detection using CNN from surveillance videos. This project critically analyses the statistics of deaths due to fire. So, their focus is to propose a system that is home friendly and commercial. This project gives us an insight of how to carefully select the data properly, how to analyse the computational complexity and detection accuracy. For reducing the complexity of larger patches, they reduce dimensionality. The model is tested with two different datasets for validation purposes and results are compared. They achieved an accuracy of 93.5% on the first dataset and an 86% on the next dataset.

6.	Scalability of the Solution	The sensor measures the temperature, smoke density, CO concentration. The paper proposes a neural network to work on the data obtained from the sensor. The decision-making algorithm use a single detector reading continuously to detect fire or smoke based on a threshold or limit. Radial basis function (RBF) network is used for the object detection. It is type of neural network which generate local response to the input using local approximations. The output is divided into fire ,smouldering fire, no fire according to the output of hidden layers of the network. The results of this experimentation shows this system achieved an error rate of 2.3% chance of fire, small fire 1.8%, no fire with 1%. The authors claim the network can improve it ability to adapt to different unpredictable situations. Further scope of improvements suggested are by collaborating data from different sources