# Ideation Phase
# Literature Survey

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| Team ID | PNT2022TMID11740 |
| Project Name | Emerging Methods for Early Detection of Forest Fires |

| S.NO | Title | Author | Abstract |
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| 1 | FOREST FIRE DETECTION USING MACHINE LEARNING | PRAGAT<br><br>SEJAL SHAMBHUWANI<br><br>PIYUSHA UMBRAJKAR | Detection of forest fire should be fast and accurate as they may cause damage and destruction at a large scale. Recently, Amazon forest confronted a devastating forest fire which remained obscured for over 15 days. Hence resulting in huge loss of ecosystem and adversely affecting the global conditions. As the technology is developing, Wireless Sensor Networks (WSN) is gaining importance in recent research areas as it has shown its usefulness in warning disasters and save lives[1]. As soon as an unusual event is noticed in the networks, an event is detected through the sensor devices placed at distributed locations. This event detection information is passed to the base station and decision is taken. Due to the static configuration of such sensor data in WSN generally lead to false alarm generation [2]. In such a scenario we can use machine learning algorithms to prevent false alarm since they get configured efficiently in dynamic nature, that too automatically .Therefore for eliminating the static essence of WSN, we present a machine learning algorithm imbibed with WSN. In this paper, we propose a decision tree machine learning approach for detecting events. |
| 2 | A framework for use of wireless sensor networks in forest fire detection and monitoring | YUNUS EMREASLAN<br><br>IBRAHIMKORPEOGLU<br><br>OZGURULUSOY | Forest fires are one of the main causes of environmental degradation nowadays. Current surveillance systems for forest fires lack in supporting real-time monitoring of every point of a region at all times and early detection of fire threats. Solutions using wireless sensor networks, on the other hand, can gather sensory data values, such as temperature and humidity, from all points of a field continuously, day and night, and, provide fresh and accurate data to the fire-fighting center quickly. However, sensor networks face serious obstacles like |

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| | | | limited energy resources and high vulnerability to harsh environmental conditions, that have to be considered carefully. In this paper, we propose a comprehensive framework for the use of wireless sensor networks for forest fire detection and monitoring. Our framework includes proposals for the wireless sensor network architecture, sensor deployment scheme, and clustering and communication protocols. The aim of the framework is to detect a fire threat as early as possible and yet consider the energy consumption of the sensor nodes and the environmental conditions that may affect the required activity level of the network. We implemented a simulator to validate and evaluate our proposed framework. |
| 3 | A Review on Early Forest Fire Detection Systems Using Optical Remote Sensing | PANAGIOTIS BARMPOUTIS<br><br>PERIKLIS PAPAIOANNOU<br><br>KOSMAS DIMITROPOUOS<br><br>NIKOS GRAMMALIDIS | The environmental challenges the world faces nowadays have never been greater or more complex. Global areas covered by forests and urban woodlands are threatened by natural disasters that have increased dramatically during the last decades, in terms of both frequency and magnitude. Large-scale forest fires are one of the most harmful natural hazards affecting climate change and life around the world. Thus, to minimize their impacts on people and nature, the adoption of well-planned and closely coordinated effective prevention, early warning, and response approaches are necessary. This paper presents an overview of the optical remote sensing technologies used in early fire warning systems and provides an extensive survey on both flame and smoke detection algorithms employed by each technology. Three types of systems are identified, namely terrestrial, airborne, and space borne-based systems, while various models aiming to detect fire occurrences with high accuracy in challenging environments are studied. Finally, the strengths and weaknesses of fire detection systems based on optical remote sensing are discussed aiming to contribute to future research projects for the development of early warning fire systems. |
| 4 | Emerging methods for early detection of forest fires using unmanned aerial vehicles and | GEORGI HRISTOV<br><br>JORDAN RAYCHEV<br><br>DIYANA KINANEVA | Forest fires are occurring throughout the year with an increasing intensity in the summer and autumn periods. These events are mainly caused by the actions of humans, but different nature and |

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| | LORAWAN sensor networks | PLAMEN ZAHARIEV | environmental phenomena, like lightning strikes or spontaneous combustion of dried leafs or sawdust, can also be credited for their occurrence. Regardless of the reasons for the ignition of the forest fires, they usually cause devastating damage to both nature and humans. Forest fires are also considered as a main contributor to the air pollution, due to the fact that during every fire huge amounts of gases and particle mater are released in the atmosphere. In this paper we will discuss and present two different emerging solutions for early detection of forest fires 2. A Review on Early Forest Fire Detection Systems Using Optical Remote Sensing PANAGIOTIS BARMPOUTISx1 PERIKLIS PAPAIOANNOUx2 KOSMAS DIMITROPOUOSx3 NIKOS GRAMMALIDIS x4 The first of these solutions involves the use of unmanned aerial vehicles (UAVs) with specialized cameras. Several different scenarios for the possible use of the drones for forest fire detection will be presented and analysed, including a solution with the use of a combination between a fixed-wind and a rotary-wing UAVs. |
| 5 | Forest Fire Detection System | SANGJOON CHA<br><br>CHRIS CANTU<br><br>PEDRO CANTU<br><br>JOSE FLORES<br><br>DR. NANTAKAN WONGKASEM<br><br>DR. HEINRICH FOLTZ | The world is burning. As global warming continues to display a statistical rise in global average temperatures and various environmental factors continue to contribute to the rise in forest fires, the need for a wireless detection system to recognize these fire hazards and that can successfully alert the necessary first responders is becoming more and more apparent. Such a detection and alert system would be able to potentially save billions of dollars in property, infrastructure, and environmental costs and damages, preserve wildlife habitats and ecosystems that are directly affected by forest fires, and prevent the displacement of countless families from their homes that neighbor forested areas and regions. Therefore, we have come together as an engineering team to propose and develop a prototype solution to these issues using our acquired technical knowledge as senior electrical engineering students for our senior design project this semester. Our project idea entitled, |

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| | | | "Forrest Fire Detection System," will be comprised of multiple systems working in tandem: a LoRa antennae system that will wirelessly transmit sensor data to an accessible website, a solar PV power supply, and a data retrieval gateway and alert system. In summary, we aim to reduce the social, economical, and environmental impacts brought on by forest fires. |
| 6 | Forest Fire Modelling and Early Detection using Wireless Sensor Networks | MOHAMED HEFEEDA<br><br>MAJID BAGHERI | Early detection of forest fires is the primary way of minimizing their damages. We present the design of a wireless sensor network for early detection of forest fires. We first present the key aspects in modelling forest fires according to the Fire Weather Index (FWI) System which is one of the most comprehensive forest fire danger rating systems in North America. Then, we model the forest fire detection problem as a node k-coverage problem ($k \geq 1$) in wireless sensor networks. We propose approximation algorithms for the node k-coverage problem which is shown to be NP-hard. We present a constant-factor centralized algorithm, and a fully distributed version which does not require sensors know their locations. Our simulation study demonstrates that our algorithms: activate nearoptimal number of sensors, converge much faster than other algorithms, significantly prolong (almost double) the network lifetime, and can achieve unequal monitoring of different zones in the forest. |