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| **EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES**  IBM-Project-52650-1661060112  **NALAIYA THIRAN PROJECT**  **BASED LEARNING ON PROFESSIONAL READLINESS FOR INNOVATION,**  **EMPLOYNMENT AND ENTERPRENEURSHIP**  **A PROJECT REPORT**  ***Submitte*d by**  **DHARANIDHARAN.L [510419106007]**  **BARANIDHARAN.M [510419106003]**  **LINGESWARAN.R [510419106014]**  **VENKATESH.A [510419106031]**  **TAMILPRAKASH.T [510419106027]**      **TEAM ID :** PNT2022TMID29525  **INDUSTRY MENTOR :** SHANTHI  **FACULTY MENTOR :** A.ELANGOVAN  **ARUNAI ENGINEERING COLLEGE**  Tiruvannamalai - 606601  Section Break(Next Page)-    **LITERATURE SURVEY**  **EMERGING** **METHODS** **FOR** **EARLY** **DETECTION** **OF** **FOREST** **FIRES**  **TECHNOLOGY** **:** ARTIFICIAL INTELLIGENCY  **BATCH** **:** B7- 1A3E  **TEAM** **LEADER** **:** DHARANIDHARAN.L  **TEAM** **MEMBER** **1** **:** BARANIDHARAN.M  **TEAM** **MEMBER** **2** **:** LINGESWARAN.R  **TEAM** **MEMBER** **3** **:** VENKATESH.A  **TEAM** **MEMBER** **4** **:** TAMILPRAKASH.T  **PAPER** **1:** Early Detection of Forest and Land Fires  **Published** **Year** **:** 2022  **Author** **:** Alya Faryanti Purbahapsari, and Irene B. Batoarung  **Journal** **Name** **:** KnE Social Sciences  **Summary** **:** Over the years, early detection of forest and land fires has been conducted using hotspot data provided by the National Institute of Aeronautics and Space (LAPAN), based on its interpretation of satellite images. The hotspot data have tremendously helped firefighting efforts and further enforcement. However, the system has several shortcomings, especially due to its inability to distinguish forest and land fires from other hot surfaces or fires caused by common human activities. Furthermore, this method also requires labor-intensive verification, and heavily relies on human factors for advanced analysis and validation. Recently, the DG of Law Enforcement of the Ministry of Environment and Forestry (DGLE MoEF) has been piloting a new approach through advancement in artificial intelligence, called Geospatial Artificial Intelligence (GeoAI). By utilizing recorded satellite image data from 2017 - 2019, the machine has been trained to recognize the pattern and tone of the image in burnt areas so that it can validate the presence of the burnt area based on the history of Sentinel-2 imagery for the past week at each cluster. DGLE MoEF found that the burnt area data processed by GeoAI has better accuracy than the hotspot count for forest and land fire identification. |

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| **PAPER** **2:** Forest Fire Smoke Detection  **Published** **Year** **:** 2022  **Author** **:** Yaowen Hu  **Journal** **Name** **:** Knowledge-Based Systems  **Summary** **:** Forest fires are a huge ecological hazard, and smoke is an early characteristic of forest fires. Smoke is present only in a tiny region in images that are captured in the early stages of smoke occurrence or when the smoke is far from the camera. Furthermore, smoke dispersal is uneven, and the background environment is complicated and changing, thereby leading to inconspicuous pixel-based features that complicate smoke detection. In this paper, we propose a detection method called multioriented detection based on a value conversion-attention mechanism module and Mixed-NMS (MVMNet). First, a multioriented detection method is proposed. In contrast to traditional detection techniques, this method includes an angle parameter in the data loading process and calculates the target’s rotation angle using the classification prediction method, which has reference significance for determining the direction of the fire source. Then, to address the issue of inconsistent image input size while preserving more feature information, Softpool-spatial pyramid pooling (Soft-SPP) is proposed. Next, we construct a value conversion-attention mechanism module (VAM) based on the joint weighting strategy in the horizontal and vertical directions, which can specifically extract the colour and texture of the smoke. Ultimately, the DIoU-NMS and Skew-NMS hybrid nonmaximum suppression methods are employed to address the issues of smoke false detection and missed detection. Experiments are conducted using the homemade forest fire multioriented detection dataset, and the results demonstrate that compared to the traditional detection method, our model’s mAP reaches 78.92%, mAP 50 reaches 88.05%, and FPS reaches 122. |

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| **PAPER** **3:** Fire Detection Using Deep Learning  **Published** **Year** **:** 2020  **Author** **:** Suhas.G and Abhishek B  **Journal** **Name** **:** International Journal of Progressive Research in Science and  Engineering  **Summary** **:** From sprawling urbans to dense jungles, fire accidents pose a major threat to the world. These could be prevented by deploying fire detection systems, but the prohibitive cost, false alarms, need for dedicated infrastructure, and the overall lack of robustness of the present hardware and software-based detection systems have served as roadblocks in this direction. In this work, we endeavor to make a stride towards detection of fire in videos using Deep learning. Deep learning is an emerging concept based on artificial neural networks and has achieved exceptional resultsin various fields including computer vision. We plan to overcome the shortcomings of the present systems and provide an accurate and precise system to detect fires as early as possible and capable of working in various environments thereby saving innumerable lives and resources. Fire accidents pose a serious threat to industries, crowded events, social gatherings, and densely populated areas that are observed across India. These kinds of incidents may cause damage to property, environment, and pose a threat to human and animal life. According to the recent National Risk Survey Report [1], Fire stood at the third position overtaking corruption, terrorism, and insurgency thus posing a significant risk to our country’s economy and citizens. The recent forest-fires in Australia reminded the world, the destructive capability of fire and the impending ecological disaster, by claiming millions of lives resulting in billions of dollars in damage. Early detection of fire- accidents can save innumerable lives along with saving properties from permanent infrastructure damage and the consequent financial losses. In order to achieve high accuracy and robustness in dense urban areas, detection through local surveillance is necessary and also effective. Traditional opto-electronic fire detection systems have  major disadvantages: Requirement of separate and often redundant systems, fault-prone hardware systems, regular maintenance, false alarms and so on. Usage of sensors in hot, dusty industrial conditions is also not possible. Thus, detecting fires through surveillance video stream is one of the most feasible, cost-effective solution suitable for replacement of existing systems without the need for large infrastructure installation or investment. The existing video-based machine learning models rely heavily on domain knowledge and feature engineering to achieve detection therefore, have to be updated to meet new threats. |

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| **PAPER** **4:** Emerging Methods for Early Detection of Forest Fires Using Unmanned Aerial Vehicles and Lorawan Sensor Networks  **Published** **Year** **:** 2018  **Author** **:** Georgi Hristov, Jordan Raychev, Diyana Kinaneva, Plamen Zahariev  **Journal** **Name** **:** EAEEIE Annual Conference (EAEEIE)  **Summary** **:** 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 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. To fight forest fires, different solutions were employed throughout the years. They ware primary aimed at the early detection of the fires. 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. In this paper we will discuss and present two different emerging solutions for early detection of forest fires. 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. In the next chapter of the paper, we will present and discuss the possibilities for development of systems for early forest fire detection using LoRaWAN sensor networks and we will analyse and present some of the hardware and software components for the realisation of such sensor networks. The paper will also provide another point-of-view, which will present the involvement of students in the development and in the use of both systems and we will analyse the advantages and the benefits, which the students will gain from their work on and with these solutions. |

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| **PAPER** **5:** Early Forest Fire Detection Using Drones and Artificial Intelligence  **Published** **Year** **:** 2019  **Author** **:** Diyana Kinaneva, Georgi Hristov, Jordan Raychev  **Journal** **Name** **:** International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)  **Summary**: Forest and urban fires have been and still are serious problem for many countries in the world. Currently, there are many different solutions to fight forest fires. These solutions mainly aim to mitigate the damage caused by the fires, using methods for their early detection. In this paper,we discuss a new approach for fire detection and control, in which modern technologies are used. In particular, we propose a platform that uses Unmanned Aerial Vehicles (UAVs), which constantly patrol over potentially threatened by fire areas. The UAVs also utilize the benefits from Artificial Intelligence (AI) and are equipped with on-board processing capabilities. This allows them to use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video input from the drone cameras. Several different scenarios for the possible use of the UAVs for forest fire detection are presented and analyse in the paper, including a solution with the use of a combination between a fixed and rotary-wing drones.  **PAPER** **6:** Forest Fire Detection Through Various Machine Learning Techniques using Mobile Agent in Wireless Sensor Network  **Published** **Year** **:** 2016  **Author** **:** Anupam Mittal, Geetika Sharma, Ruchi Aggarwal  **Journal** **Name** **:** International Research Journal of Engineering and Technology  **Summary** **:** Wireless sensor networks monitor dynamic environments that change suddenly over time. Machine learning also inspires many practical solutions that less energy consumption and to increase network lifetime. This paper provides review of machine learning techniques for detection of forest fire in wireless sensor network. Forests play an important role for supporting the human environment and Forest fires are among the largest dangers for forest preservation. Wireless Sensor Networks are used to forest fire detection. |

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| **PAPER** **7:** Forest Fire Detection Solution Based on UAV Aerial Data  **Published** **Year** **:** 2015  **Author** **:** Lan Zhang, Bing Wang, Weilong Peng  **Journal** **Name** **:** International Journal of Smart Home  **Summary** **:** This software provides functions on processing UAV (unmanned aerial vehicle) aerial image data according to the requirements of forestry area application on UAV platform.It gives a real-time and remote watch on fire in Greater Xing’ an Mountains, simultaneously the UAV is flying and getting the aerial data, helping users quickly master the number and location of fire points. Monitoring software covers functions including fire source detection module, fire location module, fire range estimation module, and report generation module. Mutual cooperation among the various modules improves operational efficiency and detection reliability of the system. What’s more, user-friendly visual interface is provided to give a convenience in user operation and interaction.  **PAPER** **8:** Artificial Intelligence for Forest Fire Prediction  **Published** **Year** **:** 2010  **Author** **:** George E. Sakr, Imad H. Elhajj, George Mitri  **Journal** **Name** **:** IEEE/ASME International Conference on Advanced Intelligent Mechatronics- IEEE XPLORE  **Summary** : Forest fire prediction constitutes a significant component of forest fire management. It plays a major role in resource allocation, mitigation and recovery efforts. This paper presents a description and analysis of forest fire prediction methods based on artificial intelligence. A novel forest fire risk prediction algorithm, based on support vector machines, is presented. The algorithm depends on previous weather conditions in order to predict the fire hazard level of a day. The implementation of the algorithm using data from Lebanon demonstrated its ability to accurately predict the hazard of fire occurrence. |

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| **PAPER** **9:** An Intelligent System For Effective Forest Fire Detection Using Spatial Data  **Published** **Year** **:** 2010  **Author** **:** Dr.N.Radhakrishnan, K.Angayarkkani  **Journal** **Name** **:** International Journal of Computer Science and Information Security (IJCSIS)  **Summary** **:** The explosive growth of spatial data and extensive utilization of spatial databases emphasize the necessity for the automated discovery of spatial knowledge. In modern times, spatial data mining has emerged as an area of voluminous research. Forest fires are a chief environmental concern, causing economical and ecological damage while endangering humanlives across the world. The fast or early detection of forest fires isa vital element for controlling such phenomenon. The application of remote sensing is at present a significant method for forest fires monitoring, particularly in vast and remote areas. Different methods have been presented by researchers for forest fire detection. The motivation behind this research is to obtain beneficial information from images in the forest spatial data and use the same in the determination of regions at the risk of fires by utilizing Image Processing and Artificial Intelligence techniques.  **PAPER** **10:** Real-Time Forest Fire detection with Wireless Sensor Networks  **Published** **Year** **:** 2005  **Author** **:** Liyang Yu, Neng Wang  **Journal** **Name** **:** International Conference on Wireless Communications, Networking & Mobile Computing-IEEE XPLORE  **Summary:** In this paper, we propose a wireless sensor network paradigm for real-time forest fire detection. The wireless sensor network can detect and forecast forest fire more promptly than the traditional satellite-based detection approach. This paper mainly describes the data collecting and processing in wireless sensor networks for real-time forest fire detection. A neural network method is applied to in-network data processing. We evaluate the performance of our approach by simulations. |

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| **Ideation** **Phase**  **Empathize** **&** **Discover**   |  |  | | --- | --- | | Date | 10 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | Emerging Methods for Early Detection of Forest Fires | | Maximum Marks | 4 Marks |   **Empathy** **Map** |

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| **Template**    **Brainstorm**  Use this template in your own  brainstorming sessions so your team can unleash their imagination and  start shaping concepts even if you're not sitting in the same room.  **10** **minutes** to prepare  **1** **hour** to collaborate  **2-8** **people** recommended  [**Share** **template** **feedback**](https://muralco.typeform.com/to/CiqaHVat?typeform-source=app.mural.co)  **Need** **some** **inspiration?**  See a finished version of this template to  kickstart your work.  [**Open** **example**](https://app.mural.co/template/e5a93b7b-49f2-48c9-afd7-a635d860eba6/93f1b98d-b2d2-4695-8e85-7e9c0d2fd9b9)  **&** **idea** **prioritization** |  | | **1**  **Define** **your** **problem** **statement**  What problem are you trying to solve? Frame your  problem as a How Might We statement. This will be the focus of your brainstorm .  **5** **minutes**   |  | | --- | | Problem Statement  It is important to fix this problem because since everything in our day to day life is becoming/being converted to digital from a physical/analog entity.  It is necessary to access information from anywhere. It reduces the hassles of  getting knowledge and information that has happened before and will promote everyone to know better about the current events and will motivate everyone to gain profound knowledge in their interests . It wouldn't look weird when | | **2** | | | | | | **3** | **4** |  | |
| **After** **you** **collaborate**  **Share** **the** **mural**   |  | | --- | |  |   **A**  You can export the mural as an image or pdf to share with members of your company who might find it helpful .    **Quick** **add-ons**  **Share** **a** **view** **link** to the mural with stakeholders to keep  them in the loop about the outcomes of the session .  **B** **Export** **the** **mural**  Export a copy of the mural as a PNG or PDF to attach to  emails, include in slides, or save in your drive .  **Keep** **moving** **forward**  **Strategy** **blueprint**  Define the components of a new idea or  strategy.  [**Open** **the** **template**](https://app.mural.co/template/e95f612a-f72a-4772-bc48-545aaa04e0c9/984865a6-0a96-4472-a48d-47639307b3ca) | |
| **Before** **you** **collaborate**  A little bit of preparation goes a long way with this  session . Here’s what you need to do to get going .  **10** **minutes** | | **Brainstorm**  Write down any ideas that come to mind that address your problem statement.  **10** **minutes** | | | | | **TIP**  You can select a sticky note  and hit the pencil [switch to  sketch] icon to start drawing! | **Group** **ideas**  Aadhavan p  Simple  Navigation  Make the  news  **Mohamed** **Mustha**   |  | | --- | |  |   Supporting virtual  Setting Keyword Alerts   |  | | --- | | 24/7 News  accessible |   Take turns sharing your ideas while clustering similar or related notes as you go.  In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger  than six sticky notes, try and see if you and break it up into smaller sub-groups.  **20** **minutes**  accessible  through all  devices  **Manojkumar** **K**  Can  Automate  increase Backlinks  your  content  delvery  process  **N**   |  | | --- | |  |   secure and  Keep the  Spam Free  trusted ecosystem  UI simple  and  intuitive   |  | | --- | |  |   User can  customize  easily  events  **Vijay** **R**   |  | | --- | |  |   Media  monitoring  service | **Prioritize**  Your team should all be on the same page about what's important moving  forward. Place your ideas on this grid to determine which ideas are important and  which are feasible.  **20** **minutes**   |  | | --- | | Make the  news  accessible  through all  devices |   secure and  trusted  ecosystem    **Importance**  Can  increase Backlinks  If each of these  tasks could get  done without any  difficulty or cost,  which would have  the most positive  impact?  Spam  Free  Supporting  virtual  events    **Feasibility**  Regardless of their importance, which tasks are more  feasible than others? (Cost, time, effort, complexity, etc.) |
| |  | | --- | | **A** |  |  | | --- | | **B** | | **Team** **gathering**  Define who should participate in the session and send an  invite . Share relevant information or pre-work ahead.  **Set** **the** **goal**  Think about the problem you'll be focusing on solving in  the brainstorming session . |
| **Aadhavan** **P** **Manojkumar** **K** **Mohamed** **Musthapa** **N** **Vijay** **R** | | | | | |
| Very little resource usage | Keep the  news  relevant and  short  Customisable profile  Deliver news,  according to  the persons  internet  Bookmark news  Straight forward sigh up process | Focus on lead  All in one place  Track how often user visit area | Syndicate  your  content  Weather updates  Improved On-  Time  Performance | Market trends tracking  Alternate  communication Channel  Its Save user Time  Use only  Competitor  Analysis  Increases  Productivity  Competitive  Receive  Browsing  with  keyword on  the web  trusted  sources  Identify the  bloggers  and  influencers  Create  better and  more  targeted  content  information and  onlythe Curated  you need focused | |
| **C** | **Learn** **how** **to** **use** **the** **facilitation** **tools**  Use the Facilitation Superpowers to run a happy and  productive session . |
| [**Openarticle**](https://support.mural.co/en/articles/2113740-facilitation-superpowers) | |  | | | | | |
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|  | | **Key** **rules** **of** **brainstorming**  To run an smooth and productive session |  | | | | | | |  | | --- | |  | | **Customer** **experience** **journey** **map**  Understand customer needs, motivations, and  obstacles for an experience .  [**Open** **the** **template**](https://app.mural.co/template/b7114010-3a67-4d63-a51d-6f2cedc9633f/c1b465ab-57af-4624-8faf-ebb312edc0eb) |
|  | | Stay in topic . Encourage wild ideas . |  | | | | | |
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|  | | Defer judgment. Listen to others . |  | | | | | |
|  | |  | | | | | |  | **Strengths,** **weaknesses,** **opportunities** **&** **threats**  Identify strengths, weaknesses, opportunities,  and threats (SWOT) to develop a plan .  [**Open** **the** **template**](https://app.mural.co/template/6a062671-89ee-4b76-9409-2603d8b098be/ca270343-1d54-4952-9d8c-fbc303ffd0f2) |
|  | | Go for volume . If possible, be visual . |  | | | | | |
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**Identity** **strong** **TR** **&** **EM**

**Identity** **strong** **TR** **&** **EM**

**EMERGING** **METHODS** **FOR** **EARLY** **FOREST** **FIRE** **DETECTION** **Project** **Design** **Phase-I** **-** **Solution** **Fit** **Template** **Team** **ID:** **PNT2022TMID29525**

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| **Define** **CS,** **fit** **into** **CC** | **1.** **CUSTOMER** **SEGMENT(S)**  Forest officer  Common people | |  | | --- | | **CS** | | **6.** **CUSTOMER** **CONSTRAINTS** | |  | | --- | | **CC** | | **AS**  **5.** **AVAILABLE** **SOLUTIONS**  Avoid burning wastes around dry grass.  Obey local laws regarding open fires, including campfires Have firefighting tools nearby and handy.  Use fire resistant roofing materials.  undertake technical checkups regularly.  Monitoring weather analytics,  monitoring thermal anomalies,  monitoring water stress and temperature rises. | **Explore** **AS,Differentiate** |
| Satellites allow for detecting and monitoring a range of fires , providing information about the location, duration, size, temperature, and power output of those fires that would otherwise be unavailable. Satellite data is also critical for observing and monitoring smoke from the fires. | |

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| **Focous** **on** **J&P,** **tap** **into** **BE,** **understand** **RC** | **2.** **JOBS-TO-BE-DONE** **/** **PROBLEMS** **J&B**  Satellite remote sensing offers a useful tool for forest fire detection, monitoring, management and damage assessment. During a fire event, active fires can be detected by detecting the heat, light and smoke plumes emitted from the fires.  This application uses real-time satellite data to detect and monitor forest fires (sending alerts to mobile devices), and understand fire patterns. | **9.** **PROBLEM** **ROOT** **CAUSE** | |  | | --- | | **RC** | | **7.** **BEHAVIOUR** | |  | | --- | | **BE** | | **Focous** **on** **J&P,** **tap** **into** **BE,** **understand** **RC** |
| Forest fires cause lots of damage, some of them are - loss of wildlife habitat, extinction of plants and animals, destroys the nutrient rich top soil, reduction in forest cover, loss of valuable timber resources, ozone layer depletion, loss of livelihood for tribal people and poor people, increase in global warming. | | When the people don't have knowledge about forest fire | |

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| **3.** **TRIGGERS** | |  | | --- | | **TR** | |  | | **8.CHANNELS** **OF** **BEHAVIOUR** | |  | | --- | | **CH** | |
| **10.** **YOUR** **SOLUTIONS** | **SL** |
| Human-caused fires result from campfires left unattended, the burning of debris, equipment use and malfunctions, negligently discarded cigarettes, and intentional acts of arson. | | For this problem we use image processing and video analysis so by using satellite image  processing we can able to find the fire at the  early stage and stop spreading fire in the forest .  This model is mainly build by using CNN and machine learningand deep learning | | ONLINE: fire alert  sensor  OFFLINE: Fire awareness program | |
| **4.** **EMOTIONS:** **BEFORE** **/** **AFTER** **EM** **Before:** Unsafe and worries about lives and belongings  **A**fter: Safety and relief | |
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| **Proposed** **Solution**   |  |  | | --- | --- | | Date | 15 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | Emerging Methods for Early Detection of Forest  Fires |   **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) | A forest fire risk prediction algorithm, based on support vector machines, is  presented. The algorithm depends on previous  weather conditions in order  to predict the fire hazard level of a day. | | 2 | Idea / Solution  description | Use Artifical Intelligence  methods for recognition and detection of smoke or fire, based on the still images or the video input from the  drone cameras. | |

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| |  |  |  | | --- | --- | --- | | 3 | Novelty / Uniqueness | Real time computer program  detect forest fire in earliest before it spread to larger  area. | | 4 | Impact on society | Affects the atmosphere  oxygen content. And also some medicinal plants are also destroyed. | | 5 | Business Model  (Revenue Model) | The proposed method was  implemented using the  Python programming  language. | | 6 | Scalability of the  Solution | Computer vision models enable land cover  classification and smoke  detection from satellite and  ground cameras | |

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| ***Emerging*** ***Methods*** ***For*** ***Early*** ***Detection*** ***Of***  ***Forest*** ***Fires*** |
| *PNT2022TMID29525*  *Team* *id:*  *Forest* *fire* *detected*    *Deep* *learning*   |  | | --- | | *Frames* *from* *video* |   *No* *fire* *detected*  *Camera*  *User*    *Forest*  *Alarm* |

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| **Customer** **Journey**   |  |  | | --- | --- | | Date | 15 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | EMERGING METHODS FOR  EARLY DETECTION OF FOREST  FIRE | |

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| **Dataflow** **Diagram**   |  |  | | --- | --- | | Date | 15 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | Emerging Methods for Early Detection of Forest Fires | | Maximum Marks |  | | |
| Dataflow chart: |  |

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| **Functional** **Requirements**   |  |  | | --- | --- | | Date | 15 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | Emerging methods for early detection of forest fires |   **Functional** **Requirements:** | | | | |
|  | **S.No.** | **Functional**  **Requirement**  **(Epic)** | **Sub** **Requirement** **(Story** **/** **Sub-** **Task)** |  |
| 1 | **User** **Registration** | • Registration through Form  • Registration through wildfire portal.  • Registration by the forest ranger |
| 2 | **User**  **Confirmation** | • Confirmation via Email  • Confirmation via access code |
| 3 | **Data** **Prediction** | • We create computer models to predict wildfire potential under a range of potential  climate futures.  • Using different projections of temperature and  precipitation, scientists  predict where and when  wildfires are most likely to occur. |

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| |  |  |  | | --- | --- | --- | | 4 | **Using** **Sensors** | The sensors are installed in the  forest fire detection system using artificial intelligence deployed as early wildfire warming tool. |     **Sensor** |

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| **Technology** **Architecture**   |  |  | | --- | --- | | Date | 15 October 2022 | | Team ID | PNT2022TMID29525 | | Project Name | Emerging Methods for Early Detection of Forest Fires | | Maximum Marks |  | |

**PROJECT** **PLANNING** **PHASE**

**MILESTONE** **&** **ACTIVITY** **LIST**

|  |  |
| --- | --- |
| **Date** | 07 November 2022 |
| **Team** **ID** | PNT2022TMID29525 |
| **Project** **Name** | Emerging Methods for Early Detection of Forest Fires |

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| --- | --- | --- |
| **TITLE** | **DESCRIPTION** | **DATE** |
| **Literature** **Survey** | A Literature Survey is a systematic method for identifying ,evaluating and interpreting the work produced by researchers ,scholars.. Our literature survey says that forest fires have become a frequent and dangerous disaster as a result of climate change. | 10 October 2022 |
| **Empathy** **Map** | An Empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Essentially ,an empathy map is square divided into four quadrants with the user or client in the middle .Each of the four quadrants comprises a category that helps us delve into the mind of the user. The four quadrants are look at what the user says, think, feels and does. | 11 October 2022 |
| **Ideation-**  **Brainstorming** | Brainstorming is a group problem solving method that involves the spontaneous contribution of creative ideas and solution. | 12 October 2022 |

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| **Define** **Problem**  **Statement** | A Problem Statement is a concise description of the problem or issues a project seeks to address. The problem statement identifies the current state, the desired future state and any gaps between the two. | 15 October 2022 |
| **Problem** **Solution** **Fit** | Problem solution fit is occurs when you have evidence that customers care about certain jobs, pains and gains .This helps us to understand the thoughts of the customer their likes, behavior, emotions etc. | 15 October 2022 |
| **Proposed** **Solution** | Proposed solution is a technical solution to be provided by the implementation  agency in response to the requirements  and the objectives of the project | 15 October 2022 |
| **Solution**  **Architecture** | Solution Architecture is a very complex process I.e. it has a lot of subprocesses and branches. It helps in understanding  the components and features to  complete our project. | 15 October 2022 |
| **Customer** **Journey** | It refers to the path of interactions an  individual has with your brand, product and services .It describe both direct and indirect interactions about a brand at an event | 15 October 2022 |
| **Functional**  **Requirement** | Functional requirements are the primary way that a customer  communicates their requirements to the project team. It has specific features like usability, security, reliability, performance, availability and scalability. | 15 October 2022 |

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| **Data** **Flow**  **Diagrams** | Data Flow Diagram is a graphical or visual representation using standardized set of symbols and notations to describe business operations through data movement. | 15 October 2022 |

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| **Technology**  **Architecture** | Technology Architecture is a better defined version of solution architecture .It describes the logical software and hardware capabilities that are required to support the deployment of data and application services | 15 October 2022 |
| **Prepare** **Milestone** **&**  **Activity**  **List** | It helps us to understand and evaluate our own progress and accuracy so far. | 16 October 2022 |
| **Sprint** **Delivery** **Plan** | Sprint planning is an event in scrum that kicks off the sprint. The purpose of sprint planning is to define what can be delivered in the sprint and how that work will be achieved. | On Progress |

**Project** **Planning** **Phase**

**Project** **Planning** **Template** **(Product** **Backlog,** **Sprint** **Planning,** **Stories,** **Story** **points)**

|  |  |
| --- | --- |
| Date | 24 October 2022 |
| Team ID | PNT2022TMID29525 |
| Project Name | Emerging Methods for Early Detection of Forest Fires |

**Product** **Backlog,** **Sprint** **Schedule,** **and** **Estimation** **(4** **Marks)**

Use the below template to create product backlog and sprint schedule

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional**  **Requirement**  **(Epic)** | **User** **Story**  **Number** | **User** **Story** **/** **Task** | **Story**  **Points** | **Priority** | **Team** **Members** |
| Sprint- 1 | Registration | USN- 1 | As a user, I can register for the application by entering my email, password, and confirming my password. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |
|  |  | USN-2 | As a user, I will receive confirmation email once I have registered for the application usage. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |
| Sprint-2 | Input | USN-3 | Whenever the fire is detected, the information is given to the database. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |

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| --- | --- | --- | --- | --- | --- | --- |
| Sprint-2 |  | USN-4 | When it is the wildfire then the alarming system is activated. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |
| Sprint-3 | Output | USN-5 | And the alarm also sent to the corresponding departments and made them know that the wildfire is erupted. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |
| Sprint-4 | Action | USN-6 | Required actions will be taken in order to control erupted wildfire by reaching as early as possible to the destination with the help of detecting systems. | 20 | High | D HARANIDHARAN L  BARANIDHARAN M  LINGESHWARAN R  TAMILPRAKASH T  VEN KATESH A |

**Project** **Tracker,** **Velocity** **&** **Burn** **down** **Chart:** **(4** **Marks)**

**Project** **Tracker:**

**Velocity:**

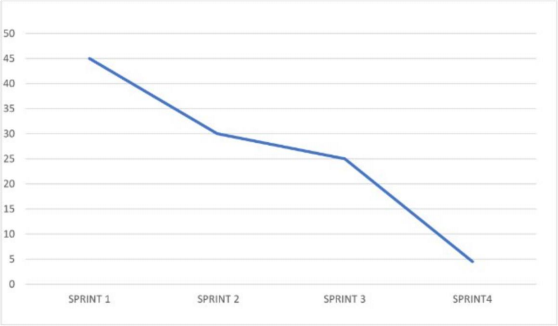
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Total**  **Story**  **Points** | **Duration** | **Sprint** **Start** **Date** | **Sprint** **End**  **Date(Planned)** | **Story** **Points** **Completed** **(as** **on** **Planned** **End** **Date)** | **Sprint** **Release**  **Date(Actual)** |
| Sprint- 1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint-3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)



**Burn** **down** **chart:**

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as scrum. However, burn down charts can be applied to any project containing measurable progress over time.



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In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

|  |
| --- |
| **import** keras |

|  |
| --- |
| pip install twilio |

Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/

Collecting twilio

Downloading twilio-7.15.2-py2.py3-none-any.whl (1.4 MB)

|████████████████████████████████ | 1.4 MB 5.3 MB/s

Requirement already satisfied: requests>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from twilio) (2.23.0)

Requirement already satisfied: pytz in /usr/local/lib/python3.7/dist-packages (from twilio) (2022.6)

Collecting PyJWT<3.0.0,>=2.0.0

Downloading PyJWT-2.6.0-py3-none-any.whl (20 kB)

Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests>=2.0.0->twilio) (2022.9.24)

Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests>=2.0.0->twilio) (3.0.4)

Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packages (from requests>=2.0.0->twilio) (1.24. 3)

Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests>=2.0.0->twilio) (2.10)

Installing collected packages: PyJWT, twilio

Successfully installed PyJWT-2.6.0 twilio-7.15.2

|  |
| --- |
| **from** matplotlib **import** pyplot **as** plt  **from** keras.preprocessing.image **import** ImageDataGenerator |

|  |
| --- |
| train datagen**=**ImageDataGenerator(rescale**=**1.**/**255,shear range**=**0.2,rotation range**=**180,zoom range**=**0.2,horizontal flip**=True**)  test datagen**=**ImageDataGenerator(rescale**=**1.**/**255,shear range**=**0.2,rotation range**=**180,zoom range**=**0.2,horizontal flip**=True**) |

|  |
| --- |
| x train**=**train datagen**.**flow f rom directory( '/content/drive/MyDrive/Dataset/train set',target size**=**(64,64),batch size**=**32,class mode**=** 'binary') |

Found 86 images belonging to 2 classes.

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Out[ ]:

In [ ]:

In [34]:

In [35]:

Out[35]:

|  |
| --- |
| x test**=**test datagen**.**flow f rom directory( '/content/drive/MyDrive/Dataset/test set',target size**=**(64,64),batch size**=**32,class mode**=** 'binary') |

Found 86 images belonging to 2 classes.

|  |
| --- |
| *#to* *define* *the* *linear* *Initialisation* *import* *sequential*  **from** keras.models **import** Sequential  *#to* *add* *layers* *import* *Dense*  **from** keras.layers **import** Dense  *#to* *create* *Convolutional* *kernel* *import* *convolution2D*  **from** keras.layers **import** Convolution2D  *#import* *Maxpooling* *layer*  **from** keras.layers **import** MaxPooling2D  *#import* *flatten* *layer*  **from** keras.layers **import** Flatten  **import** warnings  warnings**.**filterwarnings( 'ignore') |

|  |
| --- |
| model **=** Sequential() |

|  |
| --- |
| model**.**add(Convolution2D(32,(3,3),input shape**=**(64,64,3),activation**=** 'relu'))  *#add* *maxpooling* *layers*  model**.**add(MaxPooling2D(pool size**=**(2,2)))  *#add* *faltten* *layer*  model**.**add(Flatten()) |

|  |
| --- |
| *#add* *hidden* *layers*  model**.**add(Dense(150,activation**=** 'relu'))  *#add* *output* *layer*  model**.**add(Dense(1,activation**=** 'sigmoid')) |

|  |
| --- |
| model**.**compile(loss**=** 'binary crossentropy',optimizer**=**"adam",metrics**=**["accuracy"]) |

|  |
| --- |
| model**.**fit generator(x train,steps per epoch**=**14,epochs**=**10,validation data**=**x test,validation steps**=**4) |

Epoch 1/10

3/14 [=====>........................] - ETA: 1:20 - loss: 1.4232 - accuracy: 0.6977

WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or generator can generate at least `steps per epoch \* epochs` batches (in this case, 140 batches). You may need to use the repeat() function when building your dataset.

WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or generator can generate at least `steps per epoch \* epochs` batches (in this case, 4 batches). You may need to use the repeat() function when building your dataset.

14/14 [==============================] - 90s 5s/step - loss: 1.4232 - accuracy: 0.6977 - val loss: 2.0288 - val accuracy: 0.3488

|  |
| --- |
| model**.**save("forest.h5") |

|  |
| --- |
| *#import* *load* *model* *from* *keras.model*  **from** keras.models **import** load model  *#import* *image* *from* *keras*  **from** tensorflow.keras.preprocessing **import** image  **import** numpy **as** np  *#import* *cv2*  **import** cv2  *#load* *the* *saved* *model*  model**=**load model("/content/drive/MyDrive/forest1.h5")  img**=**image**.**load img( '/content/drive/MyDrive/Dataset/test set/with fire/forest fire 10.jpg')  plt**.**imshow(img)  plt**.**show()  x**=**image**.**img to array(img)  res**=**cv2**.**resize(x,dsize**=**(64,64),interpolation**=**cv2**.**INTER CUBIC)  *#expand* *the* *image* *shape*  x**=**np**.**expand dims(res,axis**=**0) |



|  |
| --- |
| pred**=**model**.**predict(x)  pred **=** int(pred[0][0])  pred  int(pred) |

1/1 [==============================] - 0s 67ms/step

1



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In [36]:

|  |
| --- |
| **if** pred**==**1:  print( 'Forest fire')  **from** twilio.rest **import** Client  print( 'Forest fire')  account sid**=** 'ACae95ea785737954a0a96c91f64101221'  \_  auth token**=** '0d013e13203434b42e0916c191b9fc6f'  \_  client**=**Client(account sid,auth token)  message**=**client**.**messages \  **.**create(  body**=** 'forest fire is detected,stay alert',  *#use* *twilio* *free* *number*  from **=** '+18588081954',  *#to* *number*  to**=** '+918248133285')  print(message**.**sid)  print("Fire detected")  print("SMS Sent!")  **elif** pred**==**0:  print( 'No Fire') |

Forest fire

Forest fire

SMfd6ed5dc5c2e5be6b6e049d48c989355

Fire detected

SMS Sent!



**PROJECT VIDEO LINK :** [**https://youtu.be/HxwR9ZWQ5Q0**](https://youtu.be/HxwR9ZWQ5Q0)

**GITHUB PROFILE LINK :** [**https://github.com/IBM-EPBL/IBM-Project-52650-1661060112**](https://github.com/IBM-EPBL/IBM-Project-52650-1661060112)