PROJECT PLANNING PHASE-1

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

In order to protect the forest resources, which are essential for supporting life on Earth, from sudden fire and smoke outbreaks. The forest management group does require this gadget. in places at risk of fire.

6. CUSTOMER CONSTRAINTS CC

The devastation is caused by greenhouse gases and changes in the climate. The human tendency to consume resources greedily is another important contributing cause to forest fires

5. AVAILABLE SOLUTIONS AS

For the purpose of detecting forest fires, existing systems use optical sensors. The sensors alert the office of forest management when a fire is spotted. In addition, satellites are utilised to find IR rays seen in forested areas

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

By releasing a lot of carbon dioxide, carbon monoxide, and fine particulate matter into the environment, the main issue is weather and climate. As a result, air pollution can lead to a variety of health problems, such as respiratory and cardiovascular disorders.

9. PROBLEM ROOT CAUSE RC

The following are some rationales
1. Lightning, a natural occurrence
2. Man-made causes: cigarettes, naked flames, and electric sparks
Therefore, ongoing care and observation are required to protect natural resources in order to save lives.

7. BEHAVIOUR BE

When fire is detected the sytem which is implemented to monitor the forests sets the alarm to ring, that is it gives the signal through which fire management team and the forest committee tries to call off the fire. Thus, the aim is to recognise the fire as early as possible to prevent spread of fire which will cause further damage and it'll become difficult to control.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

Due to the existence of a great deal of dry grass all around and the possibility of the campfire remaining scorched, the uncontrolled behaviour toward burned cigarettes can spread.

4. EMOTIONS: BEFORE / AFTER EM

Since the variables that affect a wildfire's course and intensity are erratic and subject to alter at any time, they can be very stressful. People who have experienced wildfires may experience severe anxiety and mood swings.

10. YOUR SOLUTION SL

We have presented a method to detect forest fires early using CCTV camera surveillance, which can detect fire in both indoor and outdoor activities, in order to reduce these losses. In order for the forest management office to stop the damage brought on by the fire, immediate alarms must be given to them

8. CHANNELS of BEHAVIOUR CH

Online detection: As a result, the chatbot or the API can connect over the internet to provide you with information on the forest's present condition.
Offline Detection: As a result, the forest managers can notify surrounding residential areas or raise awareness through the media (news, radio).

Identify strong TR & EM

Project flow

Team Id	PNT2022TMID52354
Date	7 November 2022
Project Name	Emerging Methods For Early Detection Of Forest Fires

Project Flow is a measure of the amount of change that is expected to occur within a project over time. It depicts the progression of a project product from conception and design to delivery and deployment. The project flow describes the predefined sequence of activities required to plan, produce, deliver, and maintain the project product, and also the information, materials, and resources needed by the project.

There are key factors that add to project flow, These elements are as follows:

- ✓ Project tasks and activities
- ✓ Any interactions between activities and tasks
- ✓ Resources and budget
- ✓ Time limits and activity schedules
- ✓ Information required to keep project activities running
- ✓ Deliverable for the project.

The project flow for this project is as follows:

- The user interacts with a web camera to read the information from a images or video inputs.
- Once the model gets the input image from the video frame, if a fire is detected, it is displayed on the console, an alerting sound is generated, and an alert message is sent to the authorities.

If we want to complete the above goals,then we need to complete the following process:

1. **DATASET COLLECTION:**

- Collect the dataset/information about forest fire or we need to create it.

In Artificial intelligence or machine learning dataset collection is the process of collect the information of our targeted data.in this project we need collect all the information about forest fire in image or video formatted data .then we need to process and train the data for our machine learning model.

The significance of collecting accurate and appropriate data

Regardless of the field of study or preferred method of data definition (quantitative vs. qualitative), accurate data collection is critical to the integrity of research. The use of appropriate data collection instruments (existing, modified, or newly developed) as well as clearly defined instructions for their proper use reduces the possibility of errors occurring.

Among the consequences of improperly collected data are

- Inability to accurately answer research questions
- inability to replicate and validate the study
- distorted findings resulting in resource waste
- deceiving other researchers into pursuing fruitless avenues of investigation, compromising decisions for public policy
- and harming both human and animal subjects are just a few of the problems that can arise.

2.IMAGE PREPROCESSING:

Image Pre-processing is very important to create a model .First we need to collect all the images and save it with one common directory. And then we create a label for all the images data. Because machine can learn all the information of the images with label.so we must need to give the labelled data on my machine. All the images are must be captured by high quality camera. After we complete the process above then we need to segregate the dataset into train and test data.

• Import the library for the Image Data Generator.

• Specify the arguments and parameters for the Image Data Generator class

- Applying it to the train set and test set.

MODEL BUILDING:

Model building is a crucial part of this project. Before we create a model we must be complete all the pre-processing steps like datasets collection and pre-processing the images.model building play a vital role in machine learning development because its allows you to predict and detect the object using given data.

Steps to build the model

- Import the necessary libraries to build the model.
- Separate the dataset to train and test.
- Developing the CNN algorithm.
- Developing the CNN layers like convolution and hidden layers.

- Add the path for train and test folder to machine.
- Train the data for machine.
- Save the model.
- Finally test the model.

Testing the model and Alerting process

- Test the image and video using open CV.
- Configure the twillio module for SMS service.
- Send the alert SMS service if the fire were detected.

Emerging Methods for Early Detection of Forest Fires

Project Objectives

Team I'd	PNT2022TMID52354
Date	7 November 2022
Project Name	Emerging Methods For Early Detection Of Forest Fires

PROJECT OBJECTIVES :

- For the success of the project, we need the objectives. The objectives of the project are framed to carry out the project. The framed objectives are moves the project to get the desired output.
- The main part of the project is to create a information for detect the forest fire. Because, that information about starting stage of fire burning is helps to prevent the forest fire before.
- This kind of idea can be done by using the CNN algorithm & Deep Learning with Artificial Intelligence Technology.

- The objectives of the project is given below :
  - ✓ At first thing, we will be know the preparing process of the dataset
  - ✓ And then we will be create a image processing
  - ✓ Then we will be understand the working principle of the Convolutional Neural Network layers
  - ✓ Must we know the process of Open CV method to read the images
  - ✓ If we know the computer vision AI problems, first we know the CNN algorithm
  - ✓ We need to fit the camera in correct and safe location

- If we completing the mentioned task in above, we can find the prediction model of the forest fire at an early stage.

Project Design Phase-I
Proposed Solution Template

Date	14 October 2022
Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum Marks	2 Marks

Proposed Solution Template:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Forests are one of the main factors in balancing the ecology.Forest fires are one of the most worrisome natural disasters,destroying thousands of acres of forests and nearby urban zones,affecting plant,animals and human life.So, the fire detection is important in this scenario. Finding of the exact location of the fire and sending notification to the fire authorities soon after the occurrence of fire can make a positive impact.
2.	Idea / Solution description	Our solution aims at collecting the dataset to test and train the model . The damage and the cost for distinguish fire because of forest fire can be reduced when the fire detected early as possible. So, the fire detection is important in this scenario. Finding of the exact location of the fire and sending notification to the fire authorities soon after the occurrence of fire can make a positive impact. We have implemented a fire detection system to detect fire by capturing images. The system uses CNN(convolutional neural network), and image processing techniques. .

3.	Novelty / Uniqueness	Real time computer program detect forest fire in earliest before it spread to larger area. Our proposed system depends on using AI to make it cheaper and easier for the forest management. Accuracy and timely prediction using AI, CNN and API made it possible.
4.	Social Impact / Customer Satisfaction	The destroying homes, wildlife habitat and timber, and polluting the air with emissions harmful to human health. The proposed solution fulfills the satisfaction requirements of the customer as it provides instant alerts on fire detection which helps the forest officer to take action as soon as possible.
5.	Business Model (Revenue Model)	• A working model in which mini cameras continuously monitor the forest area and capture live images from satellites is a trained model that automatically detects fire or smoke. • This proposed model can detect the exact location of the fire and can be activated by SMS.The fire officer can implement quick responses and preventive measures.
6.	Scalability of the Solution	✓ The device should be compatible with a minimum of 4GB RAM and WINDOWS 10 (x64 bit) and 100 GB ROM to support usage of various software like PYTHON 3.6.5. ✓ Testing and training undergo using latest technology like KERAS ,TENSORFLOW ,NUMPY and PILLOW.

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Emerging Methods for Early Detection of Forest Fires

Batch B9-3A5E

Team ID - PNT2022TMID52354

College: Annai college of Engineering and technology

Industry Mentor(s) Name: Shanthi

Faculty Mentor(s) Name: Tamilarasi A N

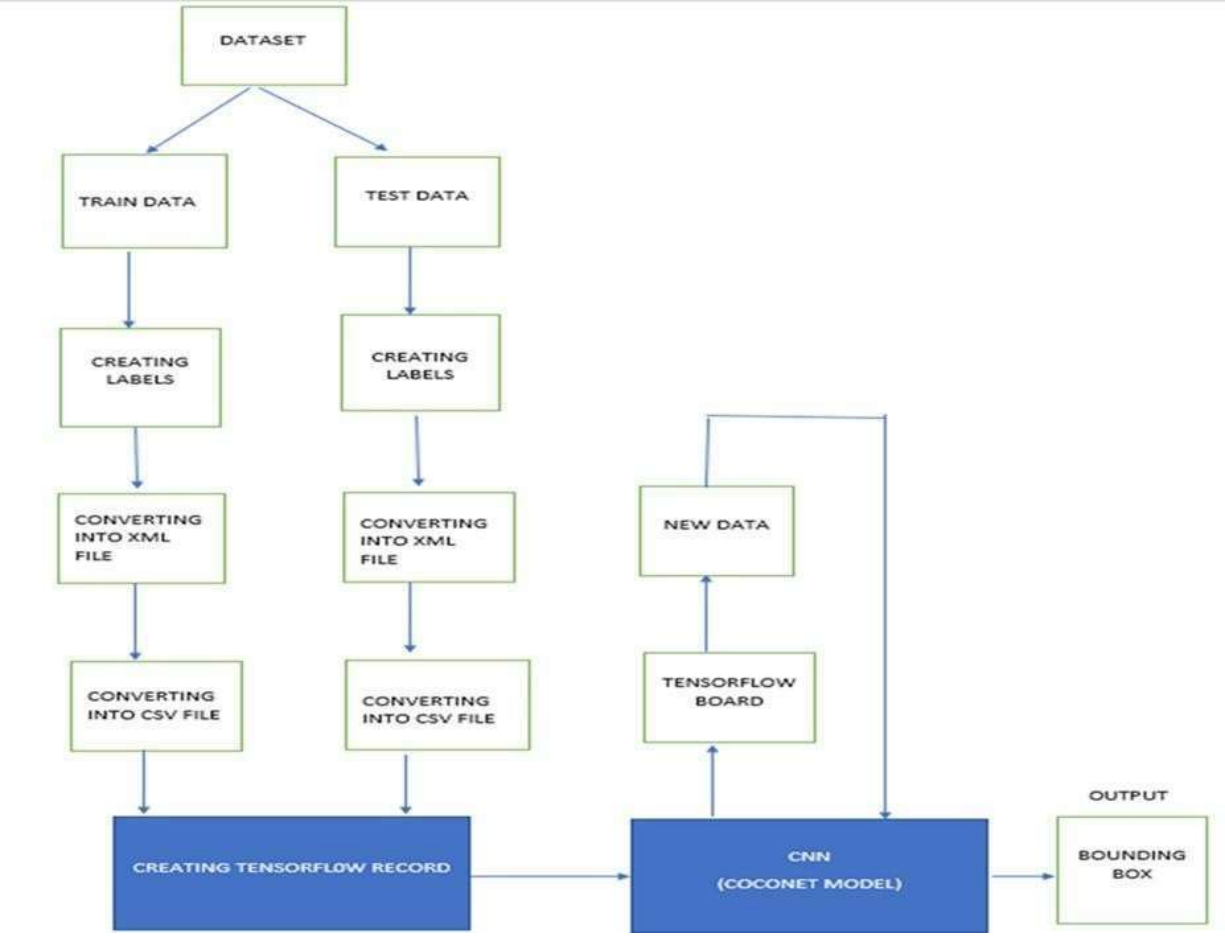
Batch Members
- Baranika S -820519104008
- Saratha P -820519104030
- Dhivya M -820519104012
- Thirisha p -820519104034

Project phase-1

Solution Architecture

Date	14 October 2022
Team id	PNT2022TMID52354
Project name	Emerging Methods for Early Detection of Forest Fires
Maximum Mark	4 marks

Solution Architecture:



Project Planning Phase

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

Date	18 October 2022
Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum Marks	8 Marks

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	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application usage.	20	High	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P
Sprint-2	Input	USN-3	Whenever the fire is detected, the information is given to the database.	20	High	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P
Sprint-2		USN-4	When it is the wildfire then the alarming system is activated.	20	High	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
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	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P
Sprint-4	Action	USN-6	Required actions will be taken in order to controlled erupted wildfire by reaching as early as possible to the destination with the help of detecting systems.	20	High	BARANIKA.S SARATHA.P DHIVYA.M THIRISHA.P

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

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

Velocity:

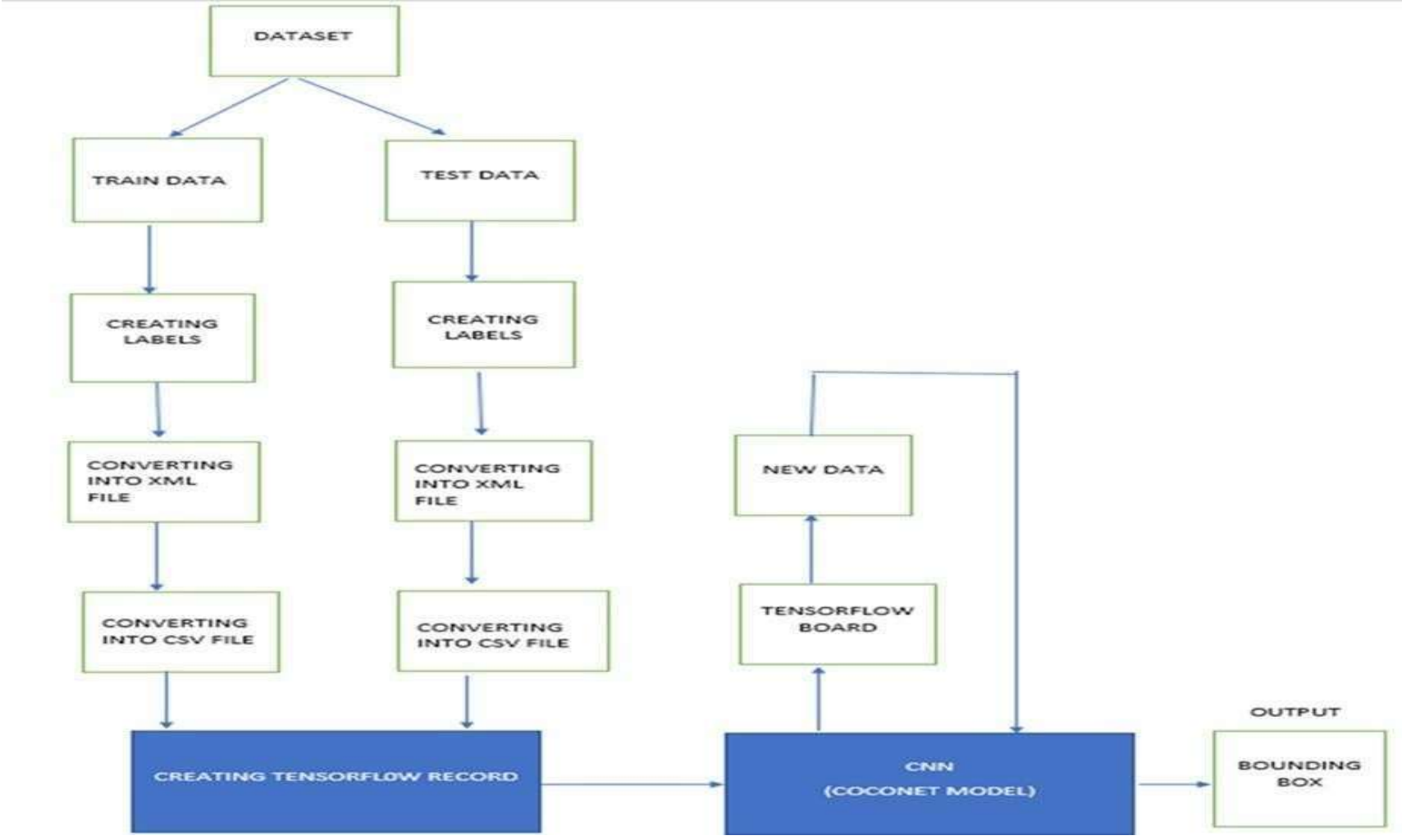
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	22 October 2022
Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum Marks	4 Marks

Technical Architecture:


DATASET
TRAIN DATA
TEST DATA
CREATING LABELS
CREATING LABELS
CONVERTING INTO XML FILE
CONVERTING INTO XML FILE
CONVERTING INTO CSV FILE
CONVERTING INTO CSV FILE
CREATING TENSORFLOW RECORD
NEW DATA
TENSORFLOW BOARD
CNN (COCONET MODEL)
OUTPUT
BOUNDING BOX

PROBLEM SOLUTION DIAGRAM:

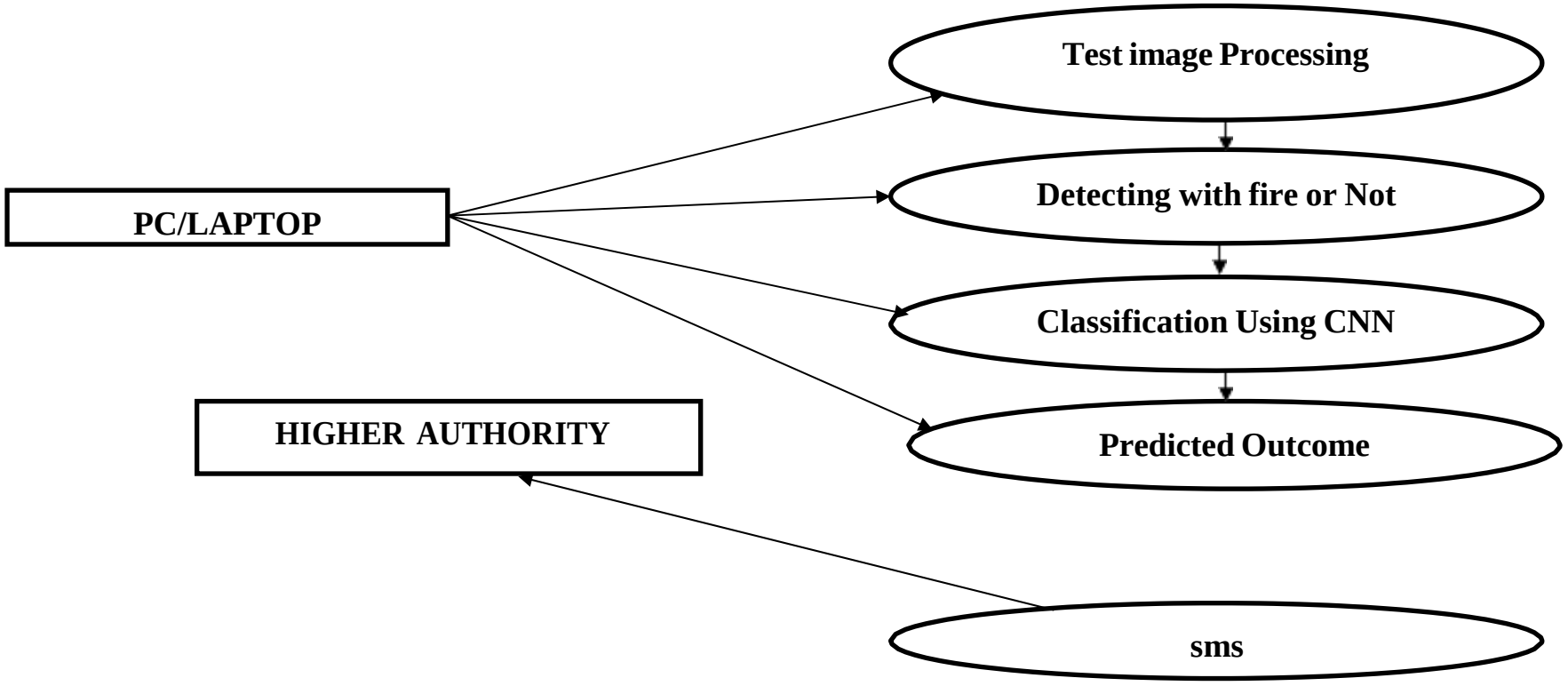


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User interface	This project will be interact with real time camera	Image processing
2.	Application logic	Process logic in this project	python
3.	camera	Data processing	Cctv camera
4.	Database	Train and test data folder	Labelled dataset ,From kaggle
5.	Cloud database	Database service	Ibm
6.	Database system	File storage	Local file system on computer or pc
7.	Deep learning model	Purpose of model	Real time object detection and image processing
8.	Infrastructure	deployment	Local and ibm server

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	We use open source frameworks and library/modules.	Python,tensorflow Keras,keras api opencv
2.	Security Implementations	We use real time camera to detect the fire and send the data.	Twilio sms module,opencv,python
3.	Scalable Architecture	We use image processing technique.	CNN(convolutional nueral network).
4.	Availability	We use this application to everywhere specailly for forest and place like posible to fire.	Cctv camera,image/video processing technique called cnn.
5.	Performance	The cnn algorithm is detect the fire with high accuracy compare to other machine / deep learning algorithm.	CNN(convolutional nueral network),image processing.

Forest Fire Detection System

Presented by: Sangjoon Cha, Chris Cantu, Pedro Cantu, Jose Flores
Dr. Nantakan Wongkasem, Dr. Heinrich Foltz
Department of Electrical Engineering & Computer Science

Abstract

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, “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.

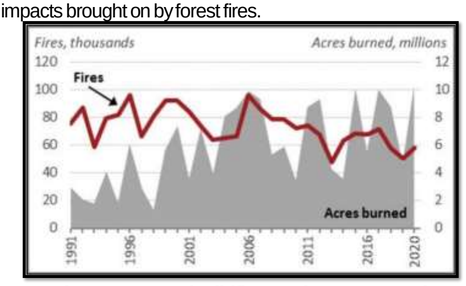


Figure 1 : Annual Wildfires and Acres Burned.

Introduction

Wildfires are unplanned and unwanted fires, including lightning-caused fires, unauthorized human-caused fires, and escaped prescribed fire projects. Nationwide data compiled by the National Interagency Fire Center (NIFC) indicate that the number of annual wildfires is variable but has decreased slightly over the last 30 years and that the number of acres impacted annually, while also variable, generally has increased (see *Figure 1*). Since 2000, an annual average of 70,685 wildfires burned an annual average of 7.1million acres. This figure is more than double the average annual acreage burned in the 1990s (3.3 million acres), although a greater number of fires occurred annually in the 1990s (78,600 on average).

Utilizing RF and designed antennae, our prototype solution would aim to reduce these statistics by assessing wildfire locations, direction, and severity in order to brief and notify the necessary fire response teams to prevent greater ecological, infrastructural, and societal damages. The Feather LoRa transceiver/receiver system would adequately be able to perform this task using its accessible frequencies in combination with the various detection sensors and modules for the Arduino microcontroller that we have shown to be quite effective at doing so. We have presented our findings and testing results in this presentation.

Methodology

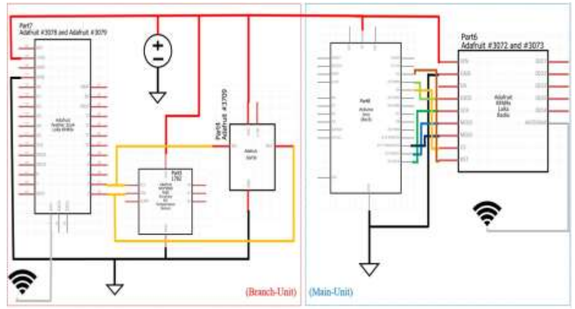
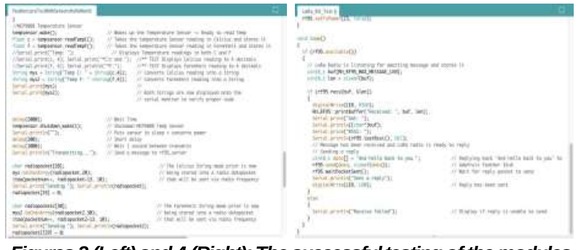


Figure 2: System Schematic with Microcontroller.

As shown above in Figure 2, the whole system is separated in Branch-Unit and Main-Unit. The Branch-Unit has sensors that can detect wildfire by obtaining CO2 and temperature values. When the microcontroller receives data output from the two sensors, the data will be transmitted to the Main-Unit by RF circuits which are comprised of a LoRa transceiver and microstrip patch antenna. On the other hand, in a Main-Unit Bow-Tie antenna, which has the radiation output of an omni-pattern, receives the signal from the microstrip patch antenna which has a radiation of point-to-point. In Main-Unit, the microcontroller checks up if the situation turns to an emergency. This procedure occurs when both the CO2 and temperature sensors exceed the threshold value that the user has established.



Figures 3 (Left) and 4 (Right): The successful testing of the modules and sensor data being converted to data strings to be transmitted and received by the LoRa transmission system.

The code is still in its early stages of development. The main objective was to learn and adapt to the Arduino IDE platform while gaining better understanding of how the sensors would interact with the Feather LoRa board and the LoRa radio receiver. The code being rudimentary is a byproduct of our inexperience with the Arduino IDE, however, this leaves great room for improvement and revisions. In its bare form, this code is able to check if both the Gas and Temperature sensors are properly wired to the Feather LoRa board. Once these connections have been verified, the code then initializes the onboard LoRa radio. Afterwards, the code then starts to gather data from the Gas and Temperature sensor and stores it into a string. This string is then converted into a radio data-packet that will be transmitted by the onboard LoRa radio at 915Mhz.

Results & Discussions

Patch Antenna—S1, 1

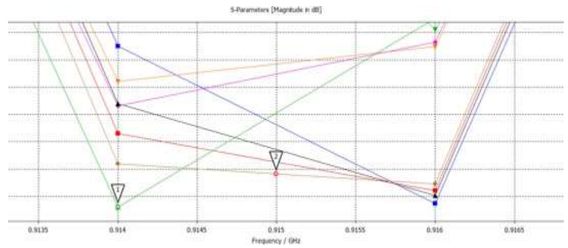


Figure 5: Microstrip Patch S-Parameters of Succeed Model

After several trials were executed, a microstrip patch antenna that has –27.837 dB at 915MHz was successfully designed. To achieve this result, the size of patch is increased by few mms since the original calculation is appeared that it has relatively high frequency around 1.1GHz.

Patch Antenna—Bandwidth

The bandwidth of patch antenna can be calculated as (Frequency at –6dB prior the target frequency—Frequency at –6dB after the target frequency) / {(Frequency at –6dB prior the target frequency + Frequency at –6dB after the target frequency)/2} * 100. In this graph, the bandwidth is (0.93965—0.89098) / { (0.93965+0.89098) / 2 } * 100 = 5.317%. In general, bandwidth over 5% is able to be used as a well-developed antenna.

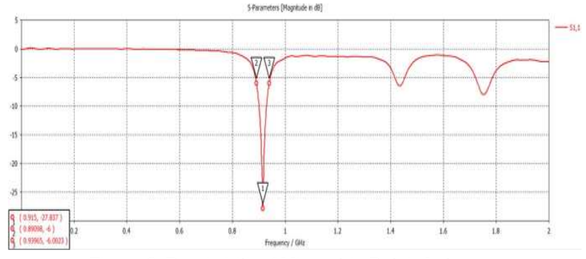


Figure 6: Bandwidth of Microstrip Patch Antenna.

In *Figure 7*, the far-field of designed microstrip patch antenna represents the point-to-point radiation of patch antenna. This radiation enables the signal transmitted from branch unit to main unit directly. It is showing 6.953dBi at 915MHz. On the other hand, the main unit is supposed to have omni-directional radiation to catch up the signal from each branch unit.

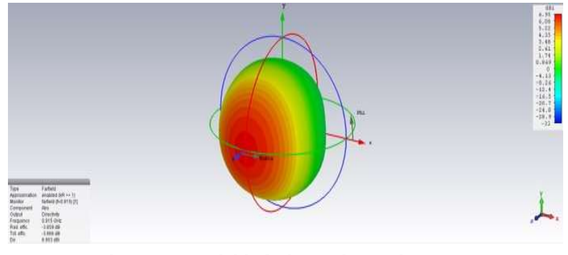


Figure 7: Far-Field of Microstrip Patch Antenna.

Conclusions & Future Work

To limit the damage caused by forest fires and to control the start of fires and its spread, we have presented in this study a method of early detection of forest fires. This method is based on three steps: Estimate the general risk level of the forest, assess and predict in several places the existence or not of fires, and alert the necessary first responders to quell the spread of the fires.

The originality of this work lies in the use of a wireless sensor and RF network distributed over the entire forest area and the deep learning methods to predict in real-time a possible origination and predicted path of the forest fire.

The current system will be implemented on a large scale with multiple sensor nodes to power and augment the data set in order to improve the accuracy and collaboration of data between multiple nodes. We plan in future work to use wind direction sensors to properly estimate and locate the start of the fire, and to collaborate with SpaceX's Star Link Program to monitor rural forest areas as well.

Acknowledgements

This work was supported by the University of Texas Rio Grande Valley (UTRGV) and Electrical Engineering Department faculty members: Dr. Nantakan Wongkasem and Dr. Heinrich Foltz. Their continued guidance during the completion of our Senior Design project presented today was essential and supportive to our progression throughout.

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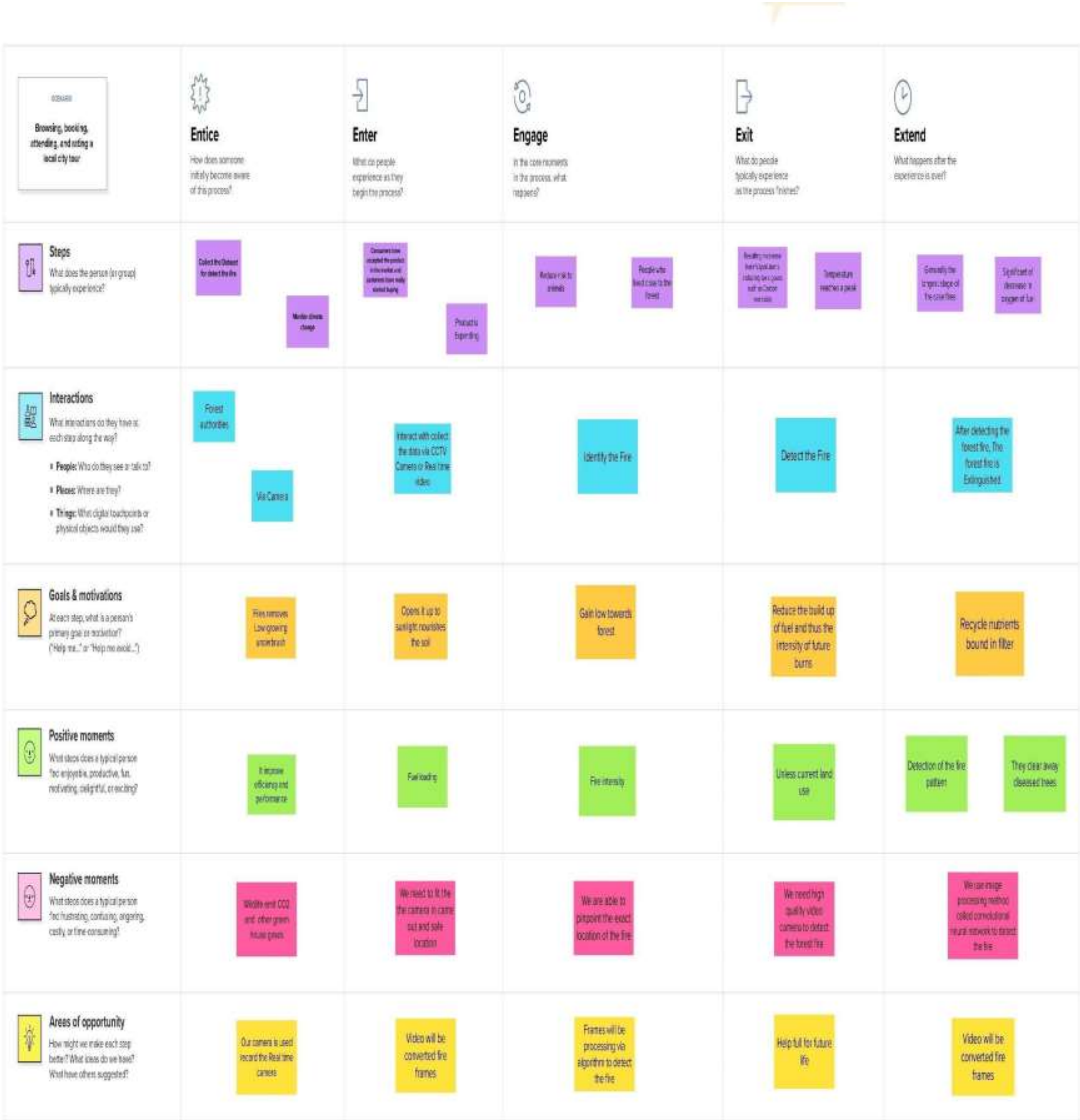
Project Design Phase –II

Customer Journey Map

Date	22 October 2022
Team ID	PNT2022TMID52354
Project Name	Emerging Methods For Early Detection of Forest Fires
Maximum Marks	4 Marks

Customer journey:


Browsing, booking, attending, and rating a local city tour
Entice
How does someone initially become aware of this process?
Enter
What do people experience as they begin the process?
Engage
In the core moments in the process, what happens?
Exit
What do people typically experience as the process finishes?
Extend
What happens after the experience is over?
Steps
What does the person (or group) typically experience?
Collect the Dataset for detect the fire
Monitor climate change
Products Expending
Temperature reaches a peak
Interactions
What interactions do they have at each step along the way?
People: Who do they see or talk to?
Places: Where are they?
Things: What digital touchpoints or physical objects would they use?
Forest authorities
Via Camera
Interact with collect the data via CCTV Camera or Real time video
Identify the Fire
Detect the Fire
After detecting the forest fire, The forest fire is Extinguished
Goals & motivations
At each step, what is a person's primary goal or motivation? ("Help me..." or "Help me avoid...")
Fires removes Low growing underbrush
Opens it up to sunlight nourishes the soil
Gain low towards forest
Reduce the build up of fuel and thus the intensity of future burns
Recycle nutrients bound in filter
Positive moments
What steps does a typical person find enjoyable, productive, fun, motivating, delightful, or exciting?
It improve efficiency and performance
Fuel loading
Fire intensity
Unless current land use
Detection of the fire pattern
They clear away diseased trees
Negative moments
What steps does a typical person find frustrating, confusing, angering, costly, or time-consuming?
Wildfire emit CO2 and other green house gases
We need to fit the the camera in came out and safe location
We are able to pinpoint the exact location of the fire
We need high quality video camera to detect the forest fire
We use image processing method called convolutional neural network to detect the fire
Areas of opportunity
How might we make each step better? What ideas do we have? What have others suggested?
Our camera is used record the Real time camera
Video will be converted fire frames
Frames will be processing via algorithm to detect the fire
Help full for future life
Video will be converted fire frames

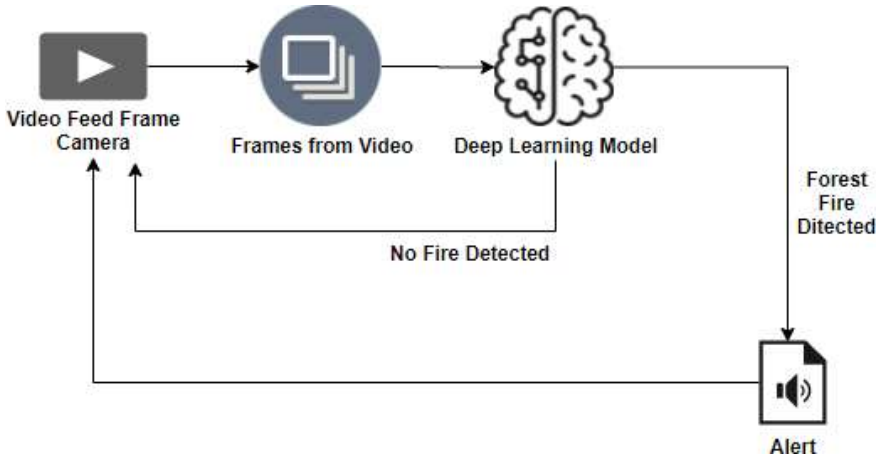
Project Design Phase-II
Data Flow Diagram & User Stories

Date	22 October 2022
Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum Marks	4 Marks

Data Flow Diagrams:

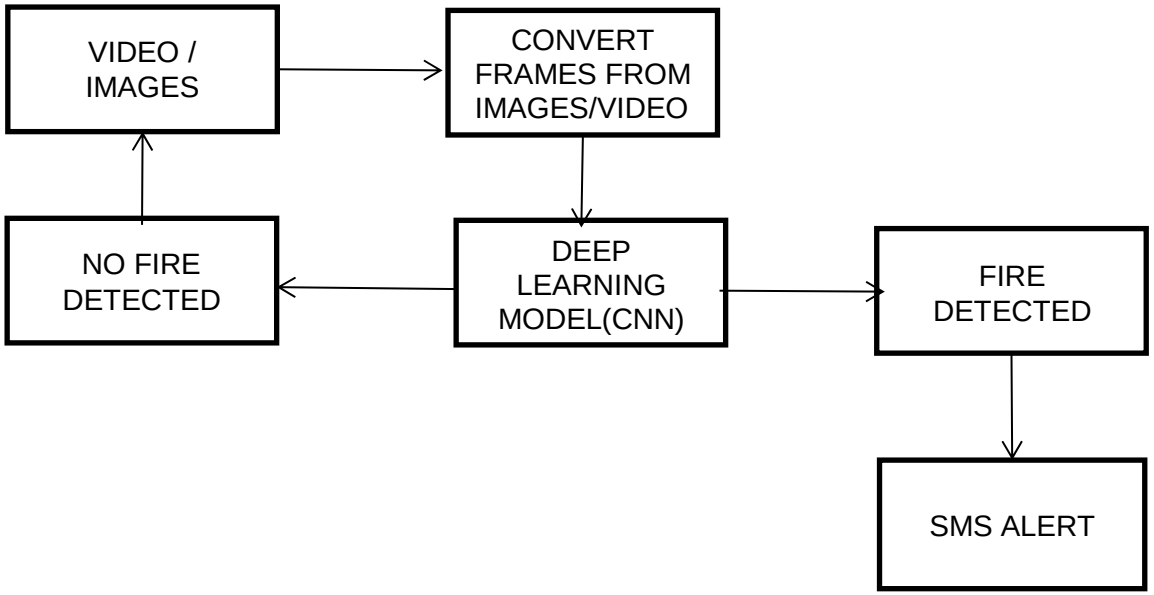
The traditional visual representation of how information moves through a system is a data flow diagram (DFD). A tidy and understandable DFD can graphically represent the appropriate amount of the system requirement. It demonstrates how information enters and exits the system, what modifies the data, and where information is kept.

Example:



- In an under populated forest area, it is challenging to predict and detect forest fires.
- If the forecast is made using ground-based methods like camera or video-based approach, it is more complicated.
- Due to their reliability and efficiency, satellites can be a valuable source of data both prior to and during the Fire.
- the various methods for forecasting and detecting forest fires in real-time, with the aim of informing the local fire authorities.
- It will send the outcome to the frame camera if no fire is detected.

DIAGRAM :



User stories:

Use the below template to list all the user stories for the product.

User Type	Functioal Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Environmentalist	Collect thedata	USN-1	It is necessary for an animal rights activist to gather information about forest fires.	We must collect the correct data.because of prediction.	High	Sprint-1
		USN-2	Determine which algorithms can be used for prediction.	To gather the algorithms and determine each algorithm's accuracy .	Medium	Sprint-2
	Implement Algorithm	USN-3	Determine each algorithm's accuracy.	Accuracy of the algorithm is must to be calculated .	High	Sprint-2
		USN-4	assess the data set.	Data is preprocessing before the training.	High	Sprint-1
	Evaluate Accuracy of Algorithm	USN-5	Decide the precision, accuracy, as well as recall of each algorithm.	Accuracy is important to detect the seviearity of fire	High	Sprint-3

Project Design Phase – II

Solution requirements (functional and non-functional)

Date	22 October 2022
Team I'd	PNT2022TMID52354
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Maximum marks	4 marks

FUNCTIONAL REQUIREMENTS :

Following are the functional requirements of the proposed solution .

FR No.	FunctionalRequirement(Epic)	Sub Requirement (Story/Sub-Task)
FR -1	Images surveillance start	Start surveillance from satellites is a trained model
FR -2	Image processing is being used to monitor the fire	Exact location monitoring through camera
FR -3	Detect the fire	Fire is detected through CNN model
FR -4	Alert	sending notification to the fire authorities

NON-FUNCTIONAL REQUIREMENTS:

Following are the non-functional requirement of the proposed solution.

NFr.no	Non-functional requirement	Description
Nfr-1	**Usability**	Usability is a unique and significant perspective to analyse user requirements, which can further improve the design quality, according to AI devices with machine learning.
Nfr-2	**Security**	▪ HD and powerful CCTV cameras are used. ▪ The fire is found using image processing and 24-hour monitoring.
Nfr-3	**Reliability**	A real-time and dependable fire detection method for an early warning system is required to ensure an effective response to an incident.
Nfr-4	**Performance**	• The system is intended to monitor forest fires through image processing via a camera. • CCTV cameras are used to process images and detect forest fires. • The twilio module is used to send the forest officer an alert message.
Nfr-5	**Availability**	○ By progressing to a more advanced system that uses real-time CCTV cameras to detect and alert on fires. ○ The convolutional neural network algorithm is extremely useful for detecting fire in captured images.

Nfr-6	**Scalability**	By detecting forest fires early, we can prevent loss of life as well as resource damage while decreasing air pollution, landslides, soil erosion, and Emission emissions into the environment.

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Team members	BARANIKA S SARATHA P DHIVYA M THIRISHA P

MILESTONE LIST

Milestone Name	Milestone Number	Description	Mandatory	
Project Objects	M	We will be able to learn to prepare dataset, image processing, working with CNN layers, read images using OpenCV and CNN for computer vision AI	Yes	-
Project Flow	M-02	A project management process flowchart is a graphical aid, designed to visualize the sequence of steps to be followed throughout the project management process	Yes	
Pre-Requisites	M-03	To complete this project, we should have known following project such as Keras, Tensor Flow, Python ,Anaconda, OpenCV, Flask, Scikit-learn etc.…	Yes	

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Train CNN model	M-09	Register for IBM Cloud and train Image Classification Model	Yes	
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Project Design Phase-I	M-11	Prepare Proposed solution , problem-solution fit and Solution Architecture	Yes	
Project Design Phase-II	M-12	Prepare Customer journey ,functional requirements, Dataflow diagram and Technology Architecture	Yes	
Project Planning Phase	M-13	Prepare Milestone list , Activity list and Sprint Delivery Plan	Yes	

Project Development Phase	M-14	Project Development delivery of Sprint 1, Sprint 2, Sprint 3, Sprint 4	Yes	

ACTIVITY LIST

Activity Number	Activity	Sub Activity	Assigned To	Status
1.	PROJECT OBJECTIVES		All Members	Completed

2.	PROJECT FLOW		All Members	Completed

3.	PRE-REQUISITES		All Members	Completed
4.	PRIOR KNOWLEDGE		All Members	Complete
5.	DATA COLLECTION	5.1 Download the Dataset 5.2 Technology Architecture	All Members	Completed
6.	IMAGE PREPROCESSING	6.1 Import the ImageDataGenerator Library. 6.2 Define the Parameters/Arguments for ImageDataGenerator class. 6.3 Applying ImageDataGenerator Functionality to trainset and test set.	All Members	Completed

7.	MODEL BUILDING	7.1 Importing the model building libraries. 7.2 Initializing the model. 7.3 Adding CNN layers. 7.4 Adding dense layers. 7.5 Configuring the learning process. 7.6 Training the model. 7.7 Saving the model. 7.8 Predictions.	All Members	Completed
8.	VIDEO ANALYSIS	8.1 OpenCV for video processing. 8.2 Creating an account in Twilio service. 8.3 Sending alert message.	All Members	Completed
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10.	IDEATION PHASE	10.1 Literature Review. 10.2 Empathy map. 10.3 Ideation.	All Members	Completed

11.	PROJECT DESIGN PHASE – I	11.1 Proposed Solution. 11.2 Problem solution fit. 11.3 Solution Architecture.	All Members	Completed
12.	PROJECT DESIGN PHASE -II	12.1 Customer journey. 12.2 Functional requirement. 12.3 Data flow Diagrams. 11.4 Technology Architecture.	All Members	Completed
13.	PROJECT PLANNING PHASE	13.1 Prepare milestone and activity list. 13.2 Sprint delivery plan.	All Members	Completed

14.	PROJECT DEVELOPMENT PHASE	14.1 Project development-Delivery of Sprint-1. 14.2 Project development-Delivery of Sprint-2. 14.3 Project development-Delivery of Sprint-3. 14.4 Project development-Delivery of Sprint-4.	All Members	In Progress

Emerging Methods for Early Detection of Forest Fires

Pre-Requisites

Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires

Pre-Requisites:

To complete this project you should have the following software requirements:

Anaconda Navigator:

Anaconda Navigator is a desktop graphical user interface included in Anaconda Distribution that allows you to lunch applications and manage conda packages, environments, and channels without using command line interface commands. Navigator can search for packages on Anaconda .org or in a local Anaconda repository. It is available for windows, macOS, and Linux. For this project, we will be using python, tensor flow, keras, CNN extra… To build Deep learning models you require the following packages.

Python:

Python is a high-level programming language; it abstracts many sophisticated details from the programming code. Python focuses so much on this abstraction that its code can be understood by most novice programmers. Python code tends to be shorter than comparable codes. Python is a dynamic, high level, free open source and interpreted programming language. Our Python Numpy Tutorial provides the basic and advanced concepts of the Numpy.

NumPy in combination with SciPy and Mat-plotlib is used as the replacement to MATLAB as Python is more complete and easier programming language than MATLAB. Prerequisite Before learning Python Numpy, you must have the basic knowledge of Python concepts.

Tensor flow:

To install Tensor Flow, it is important to have "Python" installed in your system. Python version 3.4+ is considered the best to start with Tensor Flow installation. Consider the following steps to install Tensor Flow in Windows operating system. Following are the two **Tensor Flow — Convolutional Neural Networks.**

After understanding machine-learning concepts, we can now shift our focus to deep learning concepts. Deep learning is a division of machine learning and is considered as a crucial step taken by researchers in recent decades. The examples of deep learning implementation include applications like image recognition and speech recognition.

Important types of deep neural networks:

- ✓ Convolutional Neural Networks.
- ✓ Recurrent Neural Networks In this chapter, we will focus on the CNN, Convolutional Neural Networks.

Keras:

Keras runs on top of open source machine libraries like Tensor Flow, Theano or Cognitive Toolkit (CNTK). Theano is a python library used for fast numerical computation tasks. Tensor Flow is the most famous symbolic math library used for creating neural networks and deep learning models. Tensor Flow is very flexible and the primary benefit is distributed computing. CNTK is deep learning framework developed by Microsoft. It uses libraries such as Python, C#, C++ or standalone machine learning toolkits. Theano and Tensor Flow are very powerful libraries but difficult to understand for creating neural networks. Keras is based on minimal structure that provides a clean and easy way to create deep learning models based on Tensor Flow or Theano. Keras is designed to quickly define deep learning models. Well, Keras is an optimal choice for deep learning applications.

Open CV:

Open CV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc.

In Open CV, the CV is an abbreviation form of a computer vision, which is defined as a field of study that helps computers to understand the content of the digital images such as photographs and videos.

Convolutional Neural Network:

Convolutional neural network is one of the most popular ANN. It is widely used in the fields of image and video recognition. It is based on the concept of convolution, a mathematical concept. It is almost similar to multi-layer perception except it contains series of convolution layer and pooling layer before the fully connected hidden neuron layer.

A convolutional neural network uses three basic ideas:

- Local respective fields
- Convolution
- Pooling

Emerging Methods for Early Detection of Forest Fires

PRIOR KNOWLEDGE

Team ID	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires

Supervised learning:

In supervised Learning, the machine learns under supervision. It contains a model that is able to predict with the help of a labelled dataset. A labelled dataset is one where you already know the target answer.

In this case, we have images that are labelled a spoon or a knife .This known data is fed to the machine, which analyses and learns the association of these images based on its features such as shape, size, sharpness, etc. Now when a new image is fed to the machine without any label, the machine is able to predict accurately that it is a spoon with the help of the past data.

Real-Life Application of Supervised Learning:

- Supervised learning is used to assess the risk in financial services or insurance domains in order minimize the risk portfolio of the companies.
- Image classification is one of the key use cases of demonstrating supervised machine learning. For example, Face book can recognize your friend in a picture from an album of tagged photos.
- To identify whether the transactions made by the user are authentic or not.
- The ability of a machine learning, model to identify objects, places, people, and images.

Unsupervised Learning:

In unsupervised learning, the machine uses unbelted data and learns on itself without any supervision. The machine tries to find a pattern in

the unlabeled data and gives a response. Let’s take a similar example is before, but this time we do not tell the machine whether it’s a spoon or a knife.The machine identifies patterns from the give set and groups them based on their patterns,similarities,etc.

Real Life Applications of Unsupervised Learning:

It is a machine learning model based on the algorithm that if you buy a certain group of items, you are less or more likely to buy another group of items.

Semantically similar words share a similar context. People post their queries on websites in their own ways. Semanticclistering groups all these responses with the same meaning in a cluster to ensure that customer finds the information they want quickly and easily. It plays an important role in information retrieval, good browsing experience, and comprehension.

Machine learning models are used to predict the demand and keep up with supply. They are also used to open stores where the demand is higher and optimizing roots for more efficient deliveries according to past data and behaviour.

Unsupervised machine learning models can be used to identify accident-prone areas and introduce safety measures based on the intensity of those accidents.

Problem statement

Ideation phase

Date	4 October 2022
Team I'd	PNT2022TMID52354
Project Name	Emerging Methods for Early Detection of Forest Fires
Maximum mark	2 marks

Problem statement :

The most common hazard in forests is forests fire. They pose a treat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio –diversity and the ecology and environment of region.During summer , when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark.Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth.Traditional methods of fire prevention are not proving effective and it is now essential to raise public awareness on the matter , particularly among those people who live close to or in forested areas.

I am	Humans are responsible for 75% of all forest fire. Naturally occurring forest fires can be caused by lightning,volcanic activity and coal seam fires , though these are relatively rare.
I'm trying to	Using the recent technologies to avoid forest fires in Deep learning based on pre-trained satellite image processing and forest officer can view the recommanable forest fires through Gmail sms so avoid overexposure.

But,	I don’t know much about the recent technology that helps me predict forest fires, and I haven’t found the right solutions for forest fires.
Because	I don’t want to cause devasting damage to both nature and humans, air pollution,every fire huge amounts of gases released in the atmosphere .
Which makes me feel	I’m not capable of early detect the fires and maintaining the area clean of forest but I trying solution for this problem.

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ACTIVITY LIST

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EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRE

1.	PROJECT OBJECTIVES		All Members	Completed

2.	PROJECT FLOW		All Members	Completed

3.	PRE-REQUISITES		All Members	Completed
4.	PRIOR KNOWLEDGE		All Members	Complete
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CONCLUSION & FUTURE WORK

To limit the damage caused by forest fires and to control the start of fires and its spread ,we have presented in this study a method of early detection of forest fires. This method is based on the three steps :Estimate the general risk level of the forest , assess and predict in several places the existence or not of fires ,and alert the necessary first responders to quell the spread of the fires.

The originality of this work lies in the use of a wireless sensor and RF network distributed over th entire forest area and the deep learning methods to predict in real time a possible origination and predicted path of the forest fire.

The current system will be implemented on a large scale with multiple sensor nodes to power and between multiple nodes.we plan in future work to use wind direction sensors to properly estimate and locate the start of the fire, and to collaborate with SpaceX's Star Link Program to monitor rural forest areas as well.

ACKNOWLEDGEMENTS

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