EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES

PROJECT REPORT

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PROJECT REPORT

1. **INTRODUCTION**

    1.1 Project Overview

1. INTRODUCTION

1.1 Project overview:

Fire can make major hazards in this hectic world. All buildings and vehicles used in public transportation have fire prevention and fire protection systems due to the accelerated number in the fire incidents. Also, many of the firms conduct a mock fire drill in every occurrence of months to protect their employees from the fire. This would help them to understand what to do or what not to do when a fire situation happens. Forests are one of the main factors in balancing the ecology. It is very harmful when a fire occurs in a forest. But most of the time, the detection of forest fire happens when it spread over a wide region. Sometimes, it could not be possible to stop the fire. As a result, the damage of the environment is higher than predictable. The emission of large amount of carbon dioxide (CO2) from the forest fire damages the environment. As well as it would lead to complete disappearance of rare species in the world. Also, it can make an impact on the weather, and this make major issues like earthquakes, heavy rains, floods and so on.

A research study shows an automatic fire detection can be divided into three groups: aerial, ground and borne detection. The ground-based systems use several staring black and white video cameras are used in fire detection which detect the smoke and compares it with the natural smoke. The main benefit of using this system is high temporal resolution and spatial resolution. So that, the detection is easier.2But these mechanisms still have some drawbacks in detecting the early stage of the fire. So that, it is highly important to introduce a system to detect the fire early as possible.

Moreover, information regarding the seat of the hearth is invaluable for the rapid deployment of fire- fighters. Therefore, early detection, containment at the primary stages and extinguishment of a fireplace before it spreads are crucial for wildfire Management.

Purpose

Forest fires as of late have been annihilating both for normal biological system, biodiversity and woodland economy. With expanding populace weight and change in worldwide atmosphere situation, there is an expansion in level of fires that are a significant reason for declining Indian woodlands. As indicated by woodland study report of India, 50 % of backwoods regions in nation are fire inclined (going from 50 to 90 % in certain conditions of nation). Around 6 % of the woods are inclined to extreme fire harms. The reason for this planned framework is tomanufacture a dependable fire location framework so as to know dynamic status of backwoods temperature in specific conditions. It is about the sensors and dynamic checking framework to dodge a significant fire and genuine harm to woods.

2. LITERATURE SURVEY

2.1Existing problem

The existing system for detecting fire are smoke alarms and heat alarms. The main disadvantage of the smoke sensor alarm and heat sensor alarms are that just one module is not enough to monitor all the potential fire prone places. The only way to prevent fire is to cautious at the time. Even if they are installed in every nook andcorner, it just is not sufficient for an efficient output consistently. As the number of smoke sensor requirement increase the cost will also increase to its multiple. The proposed system can produce consistent and highly accurate alerts within seconds of accident of the fire. It reduces cost because only one software is enough to power the entire network of surveillance. Research is active on this field by data scientists and machine learning researchers. The real challenge is to minimize the error in detection of fire and sending alerts at the right time.The idea of this research is to fabricate a system through IoT sensors, which is arbitrarily spread in the forest and to make a self-sorted out powerful system between the sensors to cover all the enormous territories in the forest that will used to maintain a strategic distance from the fire harm whenever. The capacity of the sensor is to identify fire in the inclusion region between the time intermission of each 5-10 minutes. At the point when the fire is recognized the entirety of the sensor in the region will be dynamic and order to stop the normal assignment. The concept is to build early fire detector using Arduino which is connected with different IoT sensors. Putting all efforts to develop a smarter system by connecting it to a webpage and monitoring the developed system statistics controlled by the Arduino programming. The use of latest technology can help to prevent the catastrophic accidents in forests. The aim is to early detect the fireplace in forest by considering the several factor like smoke, temperature, humidity, flame and based on the data we get from this programming, the forest department will be able to take an appropriate decision and the rescue team will be able to arrive on time at exact location. Consider, if it is a large region and it produces more carbon monoxide than the ordinary vehicle traffic. Surveillance of the danger areas and an early detection of fireplace can appreciably shorten the response time and additionally decrease the practicable injury as nicely as the fee of firefighting. Known rule applies here: 1 minute – 1 cup of water, 2 minutes - 100 liters of water, 10 minutes - 1000 liters of water. The goal is to notice the fireplace as quicker as possible, its actual localization and early notification to the fire devices. When fire starts then the flammable texture may likewise issues fuel to the hearth focal spot. The spot at that point will expand and more extensive. The first phase of start is alluded as "surface fire‟ stage. This may feed on abutting bushes and the fire will turn into higher and transforming into "crown fire‟. Generally, at

this stage the hearth transforms into wild and injury which end up being extreme that could stay for quite long time while depending on atmosphere conditions and the territory. Forest fire detection using optimized solar–powered ZigBee wireless sensor networks- In this paper, they have developed system for Forest Fire Detection which overcomes the demerits of the Existing technologies of Forest Fire Detection. It can be ensured that the system developed can be implemented on a large scale with its promising results. The system is provided with low-power elements, higher versions of Zigbee, Maximum power point tracking Algorithm is used in order to make the system run for longer periods efficiently. Forest fires are a very serious problem in many countries, and global warming may contribute to make this problem worse. Experts agree that, in order to prevent these tragedies from happening, it is necessary to invest in new technologies and equipment that enable a multifaceted approach. This paper describes a WSN for early detection of forest fires. This network can be easily deployed at areas of special interest or risk. There are two types of nodes from the physical structure point of view: SNs, to collect data from the environment, and CNs, to gather data from the SNs and transmit the information to a Control Centre. The nodes also can be in different functioning modes. This enables a proper and seamless configuration of the network, provides redundancy, and ensures there will be full temporal and geographical coverage in the deployment zone. The information gathered is related not only to early detection purposes but also to environment monitoring to maximize the WSN usage. This environmental data can also be employed to firefighting preventive tasks such as vegetation modelling, microclimate studies, and propagation model parametrization.

Characteristics	Flaming	Smoldering
Emissions	Light gases Particles high in EC	Hydrocarbons, PAH's, mercaptans, partially oxidized gases, particles lower in EC
Flames	visible	not visible
Extent of reaction (combustion efficiency)	Reactions tend to go to completion (90-95%)	Incomplete combustion reaction (60-90%)
O_2 concentrations	>= 15%	>= 5%
Temperature	>300°C (peak of 1800°K)	< 300°C
Combustion efficiency [1]	About 90-95%	About 60-90%

TABLE 1. Comparison of different techniques

In this paper, a forest fire detection algorithm is proposed. The algorithm uses YCbCr color space since it effectively separates luminance from chrominance and is able to separate high temperature fire center pixels because the fire at the high temperature center region is white. The final results show that the proposed system has good detection rates and fewer false alarms, which are the main crucial problems of the most existing algorithms. The presences of fire in video streams are indicated by semantic events. Most of the existing systems can only be used for the videos obtained from stationary cameras and videos obtained from the controlled lightening conditions. These existing automatic fire detection systems cannot be used for video streams obtained from mobile phones or any hand held devices. It was decried as a global tragedy. Lit by farmers, the fires raged through villages, destroyed ecosystems and pumped climate-warming pollution into the atmosphere.

References

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10. A. Koubaa and B. Qureshi, “Dronetrack: Cloud-basedreal-time object then testing our model by providing the data that is allocated for testing. We can use our saved model file for video analysis of forest fire and use it in realtime surveillance camera for real time prediction.

2.3. Problem Statement Definition

1. In earlier times fires were detected with the help of watching towers or using satellite images.
2. Satellites collect images and send it to the monitoring authority which will decide by seeing images that it is a fire or not.
3. But this approach was very slow as the fire may have spread in the large areas and caused so much damage before the rescue team came.
4. In the watching tower method, there was a man always standing on the tower who would monitor the area and inform if there was fire.

5. This method was also slow because before the man got to know about the fire it may have spread in the inner parts of forest, also it always requires a man who must be present there.

6. Since, we know that some areas, especially forest areas are large so it is practically impossible to put a man in every part of forest from where they can monitor the forest area.

7. So, both these approaches of watching towers and satellite images failed to detect fire as early as possible to reduce the damage done by fire Problems in fire detection:

8. There were mainly two problems in fire detection as discussed:

9. (a). Judging criteria for the fire: Edge is set, on the off chance that the worth is more noteworthy than edge, it is a fire, else not.

10. So, this problem was removed by using machine learning techniques by many researchers.

11. (b). Connection of nodes: Traditional systems used cables to connect alarm with the detectors.

12. Cable was mainly of copper. But copper wire may be costly or it can suffer from fault in the mid-way.

13. So, this problem was removed using wireless sensor networks.

14. So, with the advancement in technology researchers find an efficient method to detect forest fire with the help of Wireless Sensor Network.

15. Fire can be identified by conveying sensor hubs in timberland regions by which they illuminate about fire.

16. Conveying sensor hubs in the timberland regions means placing sensors in every part of the forest and mostly in the prone areas where risk of 9 catching fire is more. With the use of wireless sensor networks, now it is easy to detect the fire in large areas as soon as possible.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Conservationist	save animals and stop deforestation	The forest fire becoming bigger disruption	It mitigate the protection of ecosystem	frustrating
PS-2	Government	Increase the economy of the country	Rate of forest fire increasing in time	It impact on economy of the country	dissapointing

3.IDEATION & PROPOSED SOLUTION

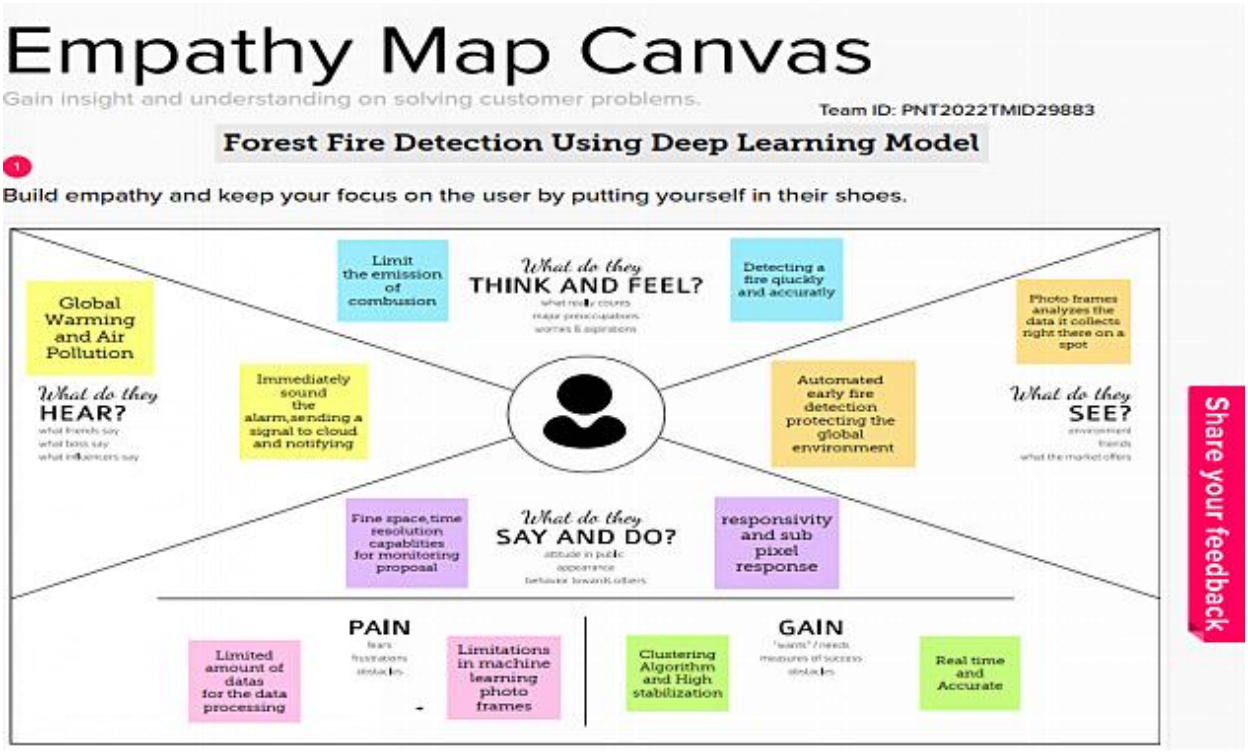
3.1 Empathy Map Canvas

i. An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community.

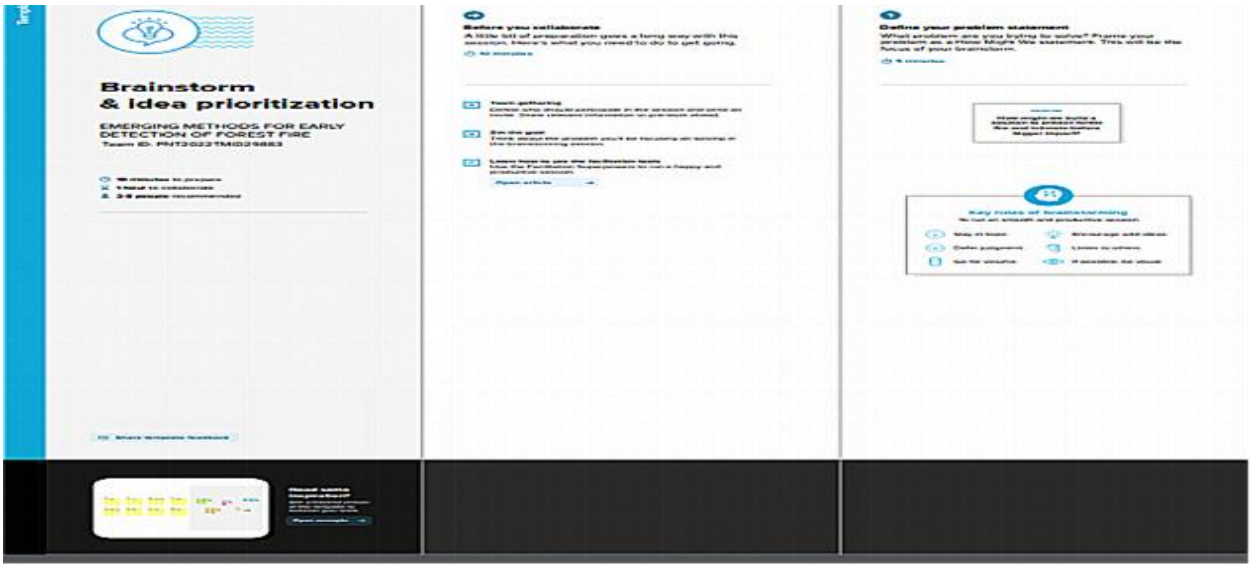
ii. An empathy map is an effective visualization template that helps analyze the behavior and emotions of customers and users. Empathy maps not only detect the behaviors but highlight possible mediums for brands to communicate with their customers in a better way

iii. Empathy maps can also be used to collect data directly from the users. Used alongside user interviews, survey answers, etc., you can also have a user fill in an empathy map themselves. This often reveals aspects of the user that may have remained unsaid or not thought of.

iv. Each of the four quadrants comprises a category that helps us delve into the mind of the user. The four empathy map quadrants look at what the user says, thinks, feels, and does.



Ideation & Brainstorming


Brainstorm
& idea prioritization
EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRE
Before you collaborate
Define your problem statement
Key rules of brainstorming

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

GOWTHAM R

- Monitoring weather conditions
- Prediction of core reason
- Checking manually through in-person
- Setting alarm notification
- Monitoring using satellites
- Using robots instead of humans

KATHIRVEL T

- Implementing automatic fire extinguisher
- Analyzing the geographical area
- Sending notification to nearest forest officials
- Monitoring using thermal cameras
- Setting sound alarms across the forest to save animals
- Using different approaches for various data collection and combines them

HARINI S

- Using sensors approaches
- Prediction using moisture level of sand
- Using quicker action extinguisher
- Monitoring using drones
- Solving bigger impact by aerial patrols
- Giving priority based on the higher temperature places

ANNAPOORANI S

- Regular observation and maintenance
- Preservating by past conditions
- Using UAV for extinguishers
- Monitoring 24x7 using cameras
- Analyzing probability of the forest fire in that location
- Using Wireless approach for the system

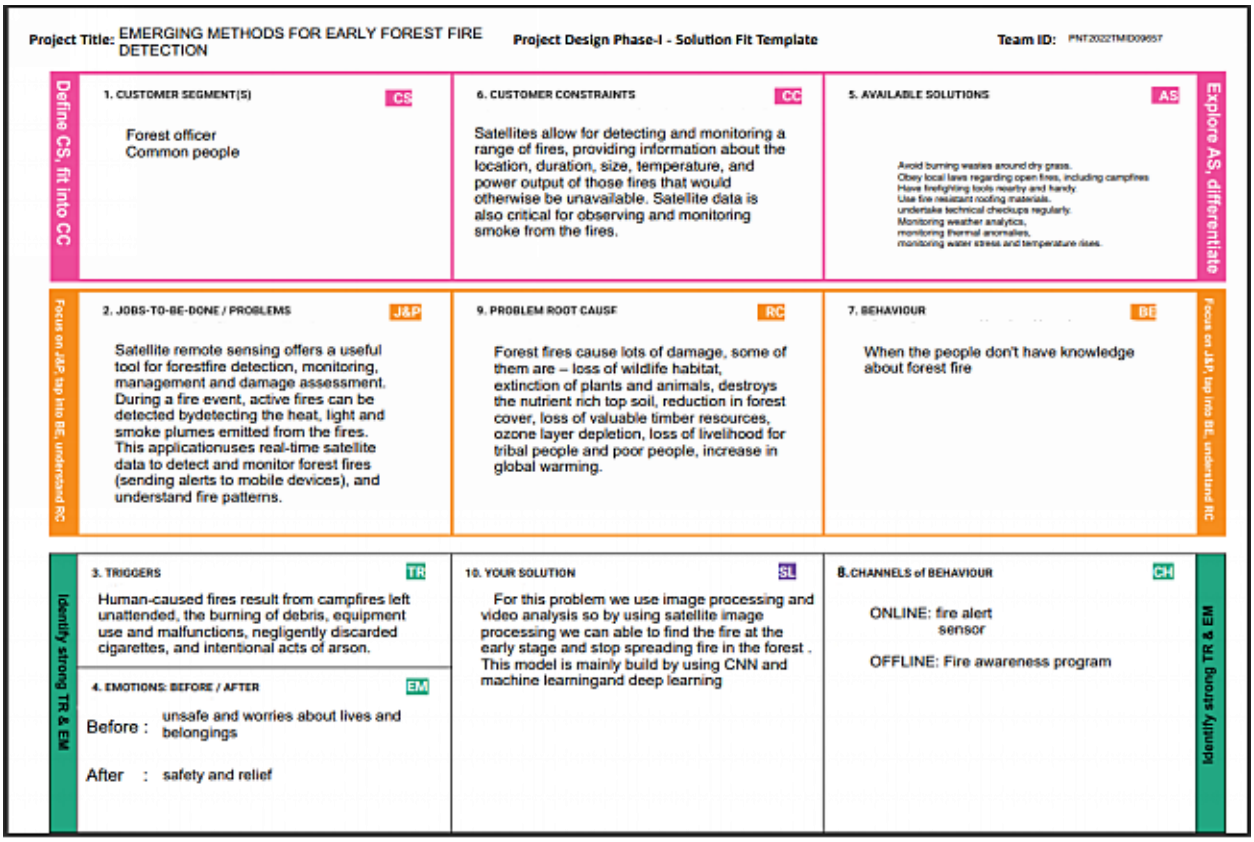
3.2 Proposed Solution

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

/no	Parameter	Description
•	Problem Statement (Problem to be solved)	AI based Emerging methods for early detection of forest fires
•	Idea/ Solution description	A solution is needed that detects fires early by detecting smoke, hydrogen and other gases released by pyrolysis in the early stages of a wildfire, buying firefighters valuable time to extinguish the fire before it spreads out of control. Sensing solutions from Bosch Sensortec can help to reduce wildfires.
•	Novelty/ Uniqueness	Remote sensing Machine learning Wildfire prediction Data mining using Artificial intelligence

•	Social Impact / Customer Satisfaction	The most important factors in the fight against the forest fires include the earliest possible detection of the fire event , the proper categorisation of the fire and fast response from the fire services . Several different types of forest fires are known , including ground fires , surface fires and crown / tree fires . Each of these types of forest fires is specific and the proper counteractions against it must be considered and implemented to successfully fight it . Over the years the detection of forest fires has been conducted in different ways , ranging from the use of forest outposts to fully automated solutions
•	Business Model (Revenue Model)	The annual losses from forest fires in India for the entire country have been moderately estimated at Rs 440 crores (US$ 107 millin).
•	Scalability of the Solution	Aerial-based systems gained recently a lot of attention due to the rapid development of UAV technology. Such systems provide a broader and more accurate perception of the fire, even in regions that are inaccessible or considered too dangerous for fire-fighting crews. In addition, UAVs can cover wider areas and are flexible, in the sense that they monitor different areas, as needed

a. **Problem Solution fit**



4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

4.1.1.High Priority

1. The system shall take training sets of fire images and recognize whether there is a fire or the beginning of a fire (smoke) or if there is no fire
2. The system shall send a notification to the admin when it recognizes a fire in the image given
3. The system shall take real inputs of camera images and determine whether the image contains a fire or not
4. The system shall be able to take images with a variety of sizes and convert it to one fixed image to be used throughout the application.

5. The system shall run as a service on either a Windows or Linux operating system.
6. In the event that the computer on which the system is running shuts down, the system service should start automatically when the computer restarts

4.1.2.Medium Priority

1. The system shall provide following facility that will allow web pages that the user is permitted to access. The system must support the following facility:
    a. Send alert message
    b. Customer data management

4.1.3.Low Priority

1. The system shall allow the user's status to be stored for the next time he returns to the web site. This will save the user x minutes per visit by not having to reenter already supplied data.
2. The system shall provide information about event log of forest.

4.2 Non-Functional Objectives

4.2.1.Reliability

i. The system shall be completely operational at least x% of the time.
ii. Down time after a failure shall not exceed x hours.

4.2.2.Usability

iii. Customer should be able to use the system in his job for x days .
iv. A user who already knows what camera he is using should be able to connect and view that page in x seconds.

4.2.3.Performance

v. The system should be able to support x simultaneous users.

vi. The mean time to view a web page over a 56Kbps modem connection shall not exceed x seconds..

4.2.4.Security

vii. The system shall provide password protected access to web pages that are to be viewed only by users.

4.2.5.Supportability

viii. The system should be able to accommodate many camera links.

ix. The system web site shall be viewable from chrome or any browser.

4.2.6.Interfaces

The system must interface with

x. The cloudant db for customer and customer log information

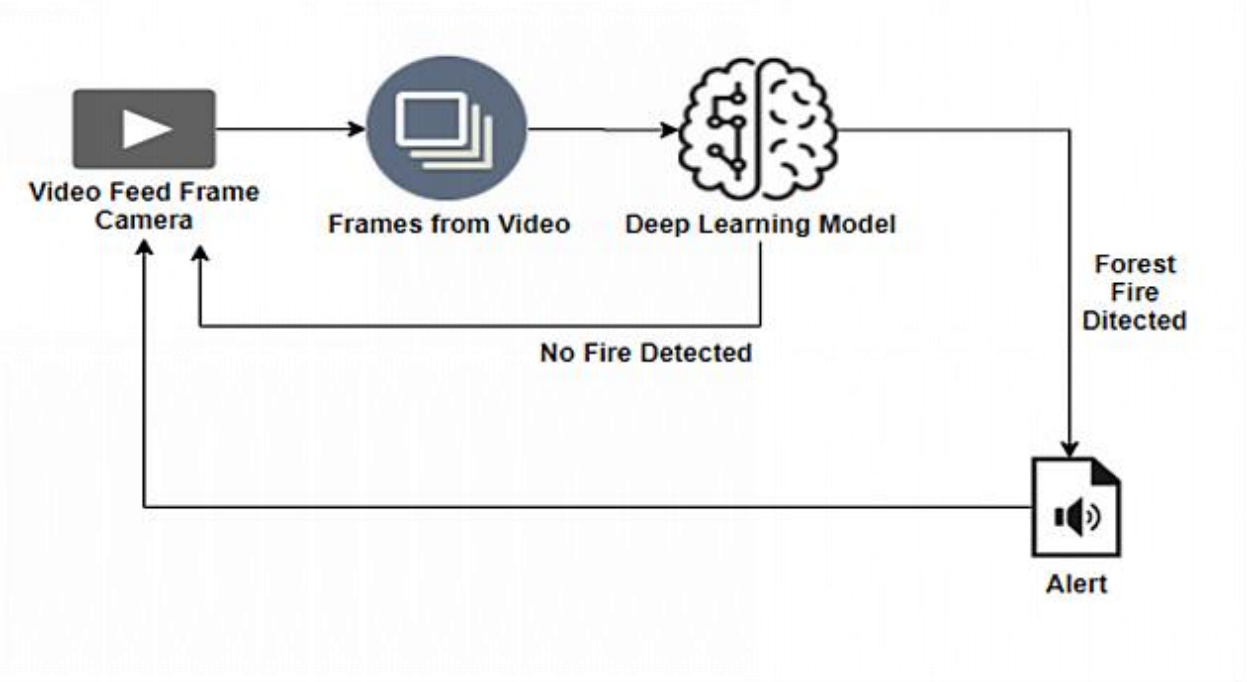
xi. The acquired web site search engine.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

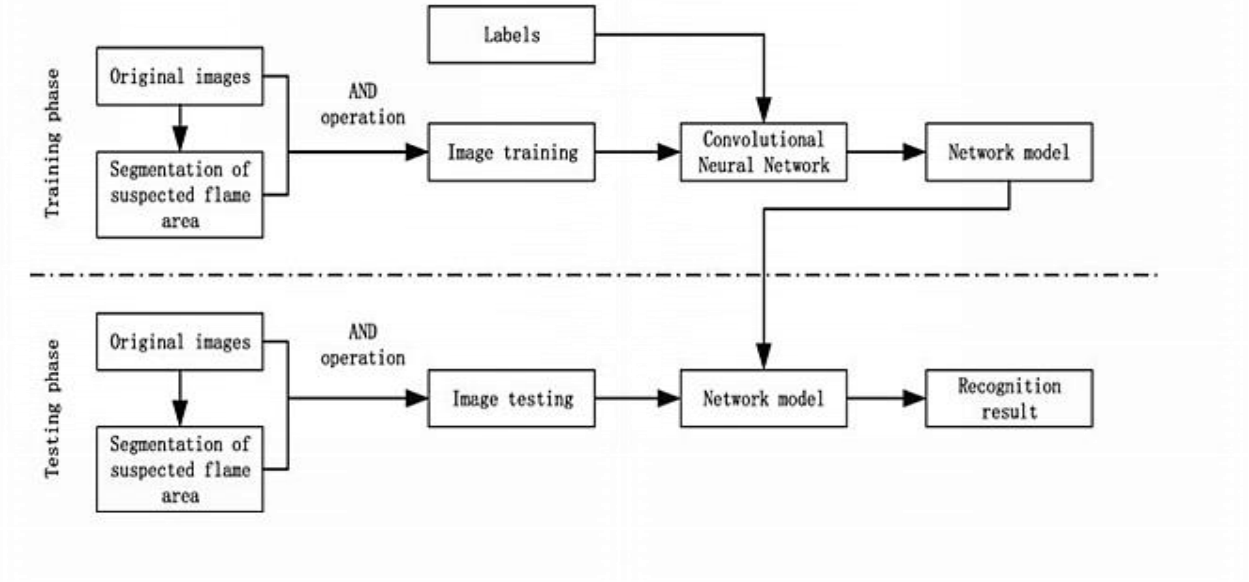
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.
Example:

FLOW



- It is difficult to predict and detect Forest Fire in a sparsely populated forest area.
- It is more difficult if the prediction is done using ground-based methods like Camera or Video-Based approach.
- Satellites can be an important source of data prior to and also during the Fire due to its reliability and efficiency.
- The various real-time forest fire detection and prediction approaches, with the goal of informing the local fire authorities.
- If the fire is not detected ,it will send the result to the frame camera.if the forest fire will detected the alert will go to the video feed frame camera.

DFD:

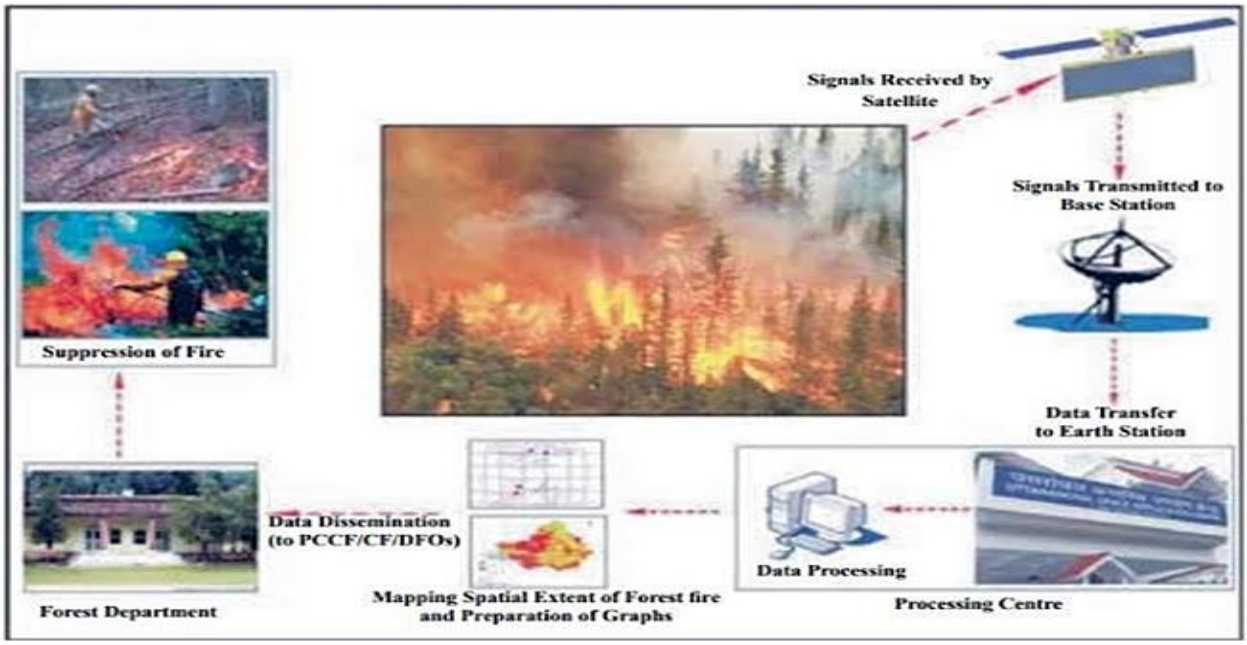


5.2 **Solution & Technical Architecture**

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

5.3 User Stories



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

User Type	Functional Requirement (Epic)	User Story Number	User Story I Task	Acceptance criteria	Priority	Release
Environmentalist	Collect the data	USN-1	As an Environmentalist.it is necessary to collect the data of the forest which includes temperature,humidity,wind and rain of the forest	It is necessary to collect the right data else the prediction may become wrong	High	Sprint-1
		USN-2	Identify algorithms that can be used for prediction	To collect the algorithm to identify the accuracy level of each algorithms	Medium	Sprint-2
	Implement Algorithm	USN-3	Identify the accuracy of each algorithms	Accuracy of each algorithm-calculated so that it is easy to obtain the most accurate output	High	Sprint-2
		USN-4	Evaluate the Dataset	Data is evaluated before processing	Medium	Sprint-1
	Evaluate Accuracy of Algorithm	USN-5	Identify accuracy,precision,recall of each algorithms	These values are important for obtaining the riaht output	High	Sprint-3

6. PROJECT PLANNING & SCHEDULING

6.1. Sprint Planning & Estimation

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

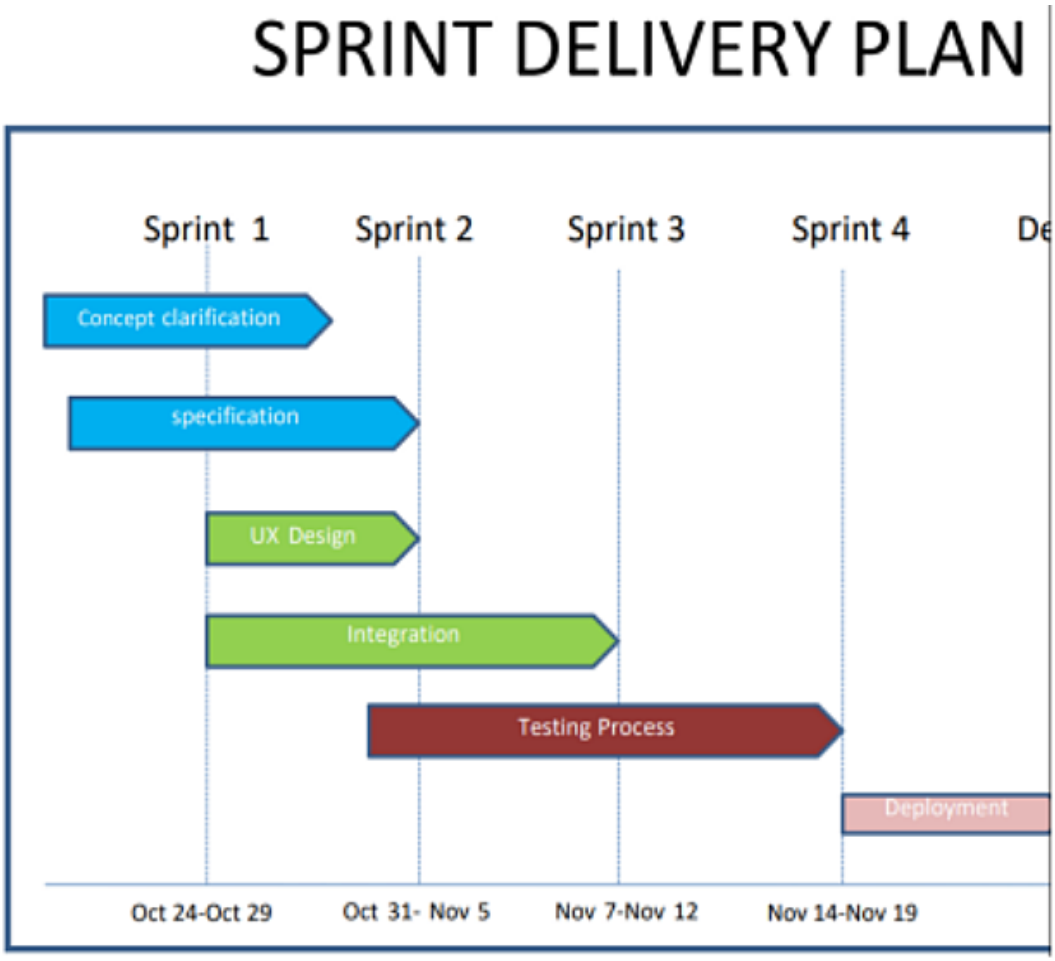
Use the below template to create product backlog and sprint schedule

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.	2	High	R.Gowtham
Sprint-1	User Confirmation	USN-2	As a User, I will receive confirmation email once I have registered for the application	1	Medium	S.Annapoorani
Sprint-1	Login	USN-3	As a User, I can log into the application by entering email & password	2	High	S.Harini
Sprint-2	Interface Sensor	USN-1	A sensor interface is a bridge between a device and any attached sensor. The interface takes data collected by the sensor and outputs it to the	2	High	T.Kathirvel R.Gowtham

			attached device.			
Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	R.Gowtham S.Annapoorani S.Harini T.Kathirvel
Sprint-4	Web Application	USN-1	As a User, I will show the current Information of the Forest.	1	Medium	S.Annapoorani S.Harini

Project Tracker, Velocity & Burndown 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	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022



6.3 Reports from JIRA

JIRA has categorized reports in four levels, which are −

1.6.1. Agile

1.6.2. Issue Analysis

1.6.3. Forecast & Management

1.6.4. Others

VELOCITY: SPRINT - 1

Sprint duration = 5 days

Velocity of team = 20 points

Average Velocity (AV) = $\frac{\text{Velocity}}{\text{Sprint duration}}$

$AV = 20/5 = 4$

Average Velocity = 4

VELOCITY: Sprint 1 - 4

Sprint duration = 20 days

Velocity of team = 80 points

Average Velocity (AV) = $\frac{\text{Velocity}}{\text{Sprint duration}}$

$AV = 80/20 = 4$

Total Average Velocity = 4

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

```
import
numpy
as np
          import os
          from tensorflow.keras.models import load_model
          from tensorflow.keras.preprocessing import image
          from flask import Flask,render_template,request
```

```
from twilio.rest import Client
import cv2
import numpy as np
from playsound import playsound
from flask import Flask, render_template

app=Flask(__name__)

model=load_model("ffd_model.h5")

@app.route('/')
def index():
return render_template("index.html")
text=''
@app.route('/predict',methods=['GET','POST'])
def upload():
if request.method=='POST':
f=request.files['image']
filepath=os.path.join('static/',f.filename)
f.save(filepath)
img=image.load_img(filepath,target_size=(128,128))
x=image.img_to_array(img)
x = np.expand_dims(x,axis=0)
pred = model.predict(x)
y = int(pred[0][0])
if(pred==1):
account_sid = os.environ['TWILIO_ACCOUNT_SID']
auth_token = os.environ['TWILIO_AUTH_TOKEN']
client = Client(account_sid,auth_token)
msg = client.messages.create(
body="Fire Detected! Get to safety immediately!!!!",
from_=os.environ['TWILIO_PHONE_NUMBER'],
to=os.environ['PHONE_NUMBER']
)
print(msg.sid)
text='FIRE DETECTED!!! SMS SENT!!'
playsound('alert.mp3')
else:
text='NO FIRE'
return text

if __name__=='__main__':
app.run(debug=False)
```

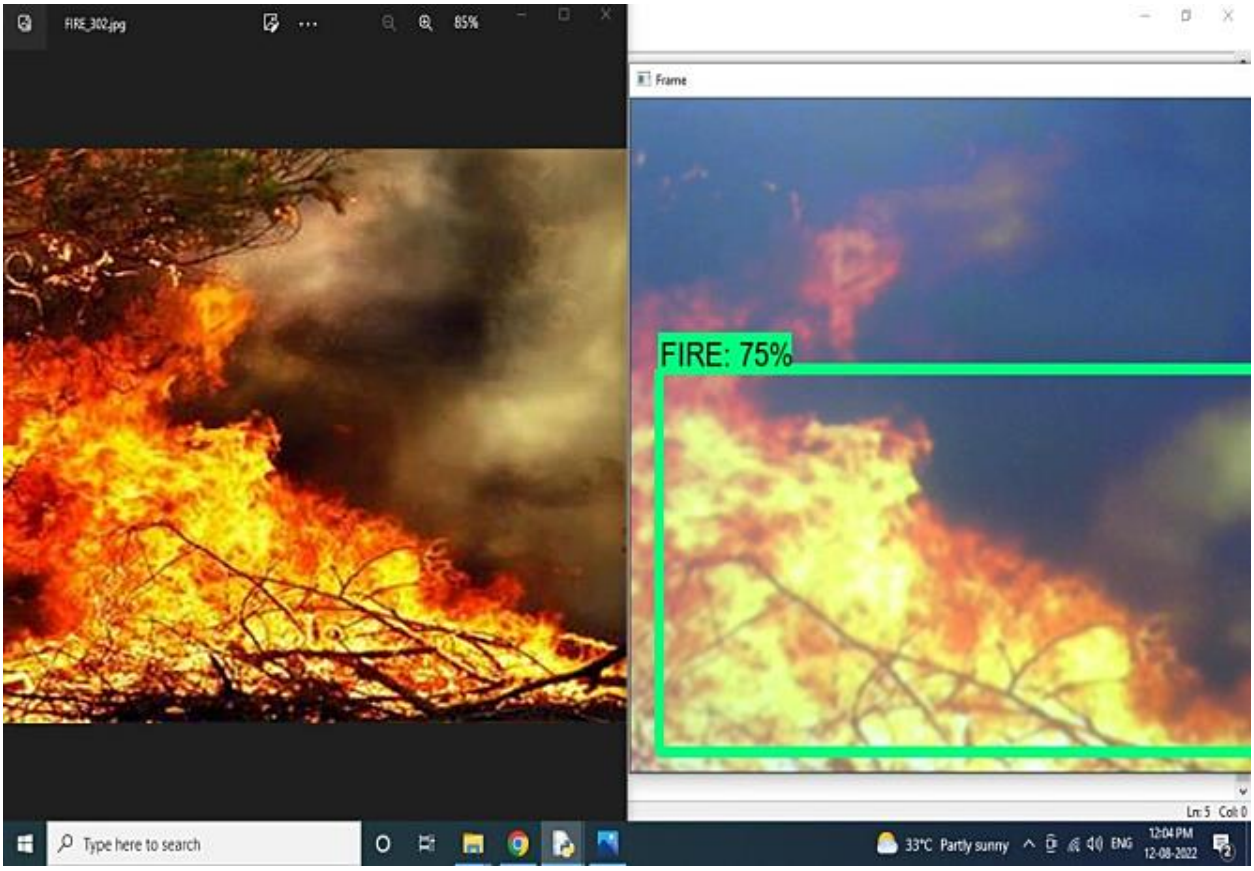
8. TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data		Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
UI_TC_001	UI	Home Page	Verify user is able to see the page properly without any error		1.Enter URL(http://127.0.0.1:5000) and click go 2. Wait for the page to load		The page is to rendered as per usual	Working as expected	Pass				Kathiravel T
FN_TC_001	Functional	Home Page	Verify user is able to upload the image		1.Enter URL and click go 2. Click on 'Upload' button and select the image to predict	image3.jpg	The user should be able to upload the image and press the predict button	Working as expected	Pass				Harini S Gowtham R
FN_TC_002	Functional	Home page	Verify user is able to hear the alert sound in case of fire		1.Enter URL and click go 2. Click on 'Upload' button and select the image to predict 3.Then press the 'Predict' button 4. Wait for the result to be displayed	image1.jpg	The user should hear the alert in the background when fire is detected	Working as expected	Pass				Kathiravel T
FN_TC_003	Functional	Home Page	Verify that the user doesn't get wrong output		1.Enter URL and click go 2. Click on 'Upload' button and select the image to predict 3.Then press the 'Predict' button 4. Wait for the result to be displayed 5. Wait for the text to appear to see the prediction if fire is not detected	image2.jpg	The model should predicts properly and the output should given out as per the image given by the user	Working as expected	Pass				Gowtham R Harini S
M_TC_001	Functional	Model	Verify that the user receives the message for different set of images		1.Enter URL and click go 2. Click on 'Upload' button and select the image to predict 3.Then press the 'Predict' button 4. Wait for the result to be displayed 5. Wait for the message to appear on the registered phone number after the text on the screen has appeared	image3.jpg	The user receives the message for each case where fire is detected correctly	Working as expected	Pass				Annapoorani S Harini S
M_TC_002	Functional	Model	Verify if all images supported by the model works		1.Enter URL and click go 2. Click on 'Upload' button and select the image to predict 3.Then press the 'Predict' button	image5.tiff	User should have uploaded the image	Not Working	Fail				Gowtham R

9. RESULTS

9.1. Performance Metrics



Value obtained from three sensor, if any Infrared ray detected, it gives output as IR detected, Sensor activated! Similarly, if there is any temperature change it will show Abnormal temperature and its intensity. For any smoke detection it output as Smoke detected and sensor value.Above image is result obtained from the trained ML model showing count for damaged and intact homes.

10. ADVANTAGES & DISADVANTAGES

Advantages:

1. **It refreshes the habitat zones:** Fire clears out plants and trees to make more natural resources available to the habitat. Fewer trees mean more water becomes available for the remaining plants and animals that call the area their home. New grass and shrubs are food sources for a number of animals as well. A ground cover that comes back after a fire becomes a new micro-habitat. Everything is refreshed with a fire.

2. **Low-intensity fires don't usually harm trees:** The bark of a tree is like an armored shell against fire, pests, and other things that could damage them. Most forest fires burn at low- temperature levels

when conditions are optimal and this causes minimal damage to the trees of the forest when it occurs. The end result is a clearing of the ground floor of the forest while the trees are able to continue standing majestically.

3. **Decreases the Wastes on Forests:** Forests have a lot of waste that ends up building up over time and these wastes can help create wildfires. If a large wildfire breaks out it might take weeks to control it and the damage it can cause is just too extensive to understand for us. Waste such as dead leaves on the ground can be pretty useful for wildfires to feed on and small forest fires just deal with these wastes properly without going out of control.

Disadvantages:

1. **A forest fire sets up the potential for soil erosion to occur:** Forest fires clear the underbrush away and encourage new growth, but there is a period of time between the fire and the new growth where the forest is vulnerable.

2. **Forest fires always bring death in some form:** Maybe it's just the weak plants of the forest that are killed during a fire, but there is always some sort of death that happens when a fire occurs. Sometimes it is the firefighters who are tasked with stopping the fire. It could be animals or pets.

3. **Uncontrolled fires can cause localized air pollution:** Despite the amount of global development that has occurred, there are many forests that are difficult or nearly impossible to reach. Fires in these areas are left to burn in an uncontrolled fashion and this creates air pollution which can affect the local environment and make it difficult to breathe.

11. CONCLUSION

This project will help in early detection of forest fire and the prevention. It also involves the risk factor of analyzing the drone images of affected areas using machine learning algorithm which overcomes the existing project. This system detects the fire conditions in a short time before any fire accidents spreads over the forest area. The scope of using video frames in the detection of fire using machine learning is challenging as well as innovative. If this system with less error rate can be implemented at a large scale like in big factories, houses, forests, it is possible to prevent damage and loss due to random fire accidents by making use of the Surveillance System.

12. FUTURE SCOPE

Future Scope In future, we are planning to install smart water tank system in dense forest where reachability of resources and firefighters is difficult. In addition to that we will be updating the system with more features and reliability. We will also include a high pitch sound system that will keep away the animals from the site of fire.The proposed system can be developed to more advanced system by integrating wireless sensors with CCTV for added protection and precision. The algorithm shows great promise in adapting to various environment.