

**MEENAKSHI COLLEGE OF ENGINEERING**  
**B.TECH-INFORMATION TECHNOLOGY**  
**INTERNET OF THINGS**  
**LITERATURE SURVEY**

**EMERGING METHOD FOR EARLY  
DETECTION OF FOREST FIRE  
TEAM ID PNT2022TMID27778**

**TEAM MEMBERS:**

**TEAM LEADER- M.PRIYANKA**

**M.RAHAT SAFANA**

**P.S.SNEHA**

**S.SWETHA**

# **1.INTRODUCTION**

## **1.1 PROJECT OVERVIEW**

This has a negative impact on the ecology, especially when there is a forest fire, and makes it highly hazardous for animals to stay there. An automated system that can identify any fire situation through any of the alarm systems is needed to prevent such losses. This study examines the development, applications, and momentum of the Internet of Things in the field of firefighting. The article also survey that was carried out to determine research trends and challenges in fire initiatives. The fire Internet of Things(IoT) connects numerous items with organizations within the fire domain as its major objective. Unmanned aerial vehicle (UAV) is a new type of aircraft that has been utilized in the existing system the disadvantages of this paper is based on only smoke image observed from the camera. Sometimes it not detect correctly. So in proposed system we have used color format called YCbCR is a family of color space used to clarify the clear image of fire during forest fire .

## **1.2 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 to manufacture 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.

# **1. LITERATURE SURVEY**

## **2.1 EXISTING PROBLEM**

The fire Internet of Things(IoT) connects numerous items with organizations within the fire domain as its major objective. Unmanned aerial vehicle (UAV) is a new type of aircraft that has been utilized in the existing system the disadvantages of this paper is based on only smoke image observed from the camera. Sometimes it not detect correctly.

## 2.2REFERENCE

- 1.Yuan C, Zhang Y M, Liu Z X. A survey on technologies for automatic forest fire monitoring fighting using unmanned aerial vehicles and remote sensing techniques[J]. Canadian Journal of Forest Research, 2015.
- 2.Piccinini P, Calderara S, Cucchiara R. Reliable smoke detection in the domains of image energy and color[C]. The 15th IEEE International Conference on Image Processing, 2008
- 3.Tung T X, Kim J M. An effective four-stage smoke-detection algorithm using video images for early fire-alarm systems[J]. Fire Safety Journal, 2011.
- 3.Toreyin B U, Dedeoglu Y, Cetin A E. Contour based smoke detection in video using wavelets[C]. 2006 European Signal Processing Conference. 2006
- 4.Cucchiara R, Grana C, Piccardi M. Detecting moving objects, ghosts, and shadows in video streams[J]. IEEE Transactions on Pattern Analysis Machine Intelligence, 2003.

## 2.3 PROBLEM STATEMENT

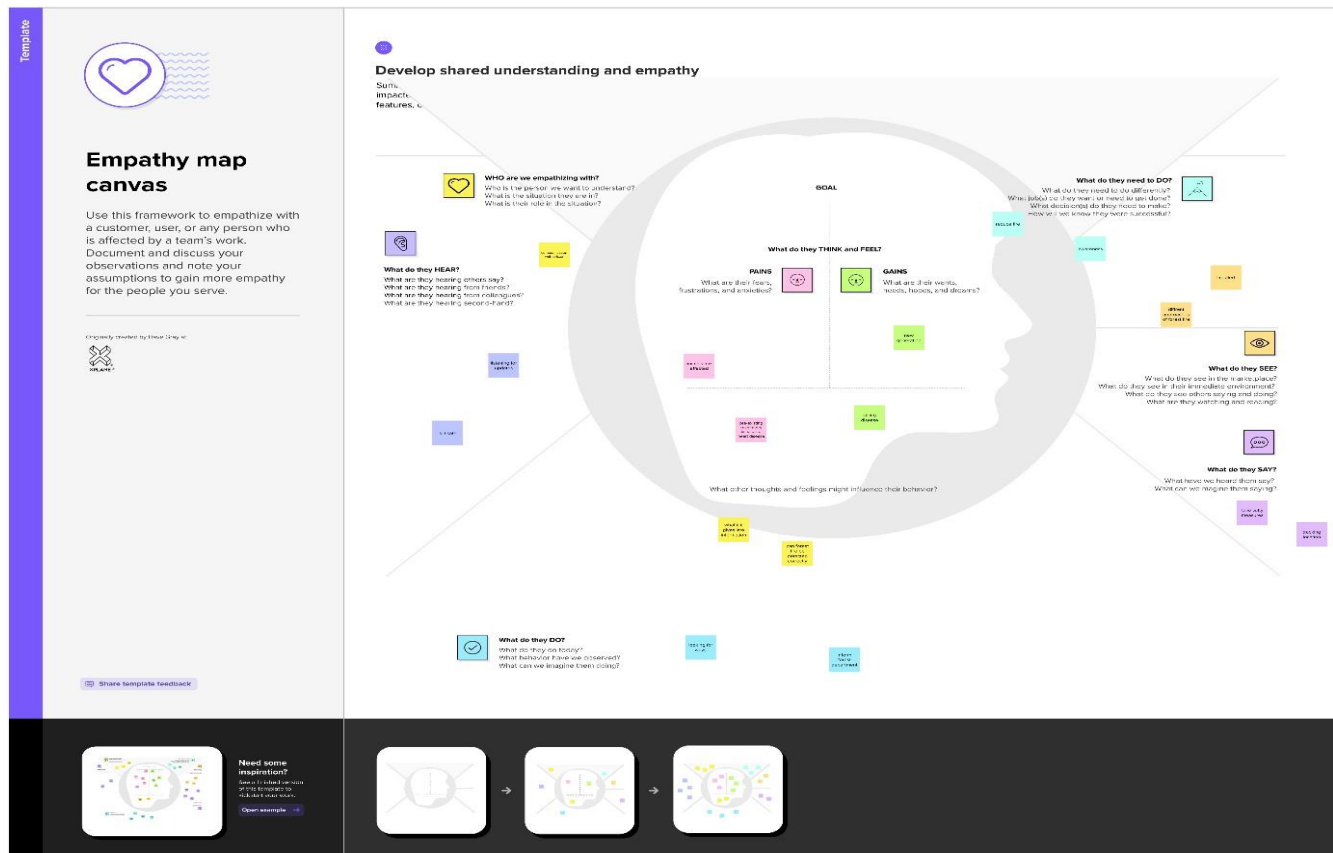


Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Wildfires reporter	Reduce consumption of deforestation prone product	Sometime it may incorrect image and loss of valuable timber resources	Forest fires bring death to life of humans and animals	Difficult to concentrate
PS-2		Detect a fire quickly and accurately		Uncontrolled fires cause localized air pollution	Easily confused

## 3. IDEATION AND PROPOSED SOLUTION

### 3.1 Empathy Map Canvas:


An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



## 3.2 IDEATION AND BRAINSTORM

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. 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.

### Step-1: Team Gathering, Collaboration and Select the Problem Statement



## Brainstorm & idea prioritization

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

➔

#### 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

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**A Team gathering**  
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

**B Set the goal**  
Think about the problem you'll be focusing on solving in the brainstorming session.

**C Learn how to use the facilitation tools**  
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) ➔

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

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PROBLEM

How might we [your problem statement]?



#### Key rules of brainstorming

To run a smooth and productive session

🗣️ Stay in topic.	💡 Encourage wild ideas.
🕒 Defer judgment.	👂 Listen to others.
🗨️ Go for volume.	👁️ If possible, be visual.

### Step-2: Brainstorm, Idea Listing and Grouping

2

## Brainstorm

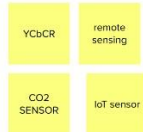
Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

### TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

#### Priyanka



#### Rahat Safana



#### PS Sneha



#### Swetha



## Step-3: Idea Prioritization

3

### Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

### TIP

Add customisable tags to sticky notes to make it easier to find, remove, replace, and organise important ideas as themes unfold your mind.

Navigation app can used to find the direction and control the movement from one place to another place.

Milesight co2 sensor run on battery and they able to detect accuracy

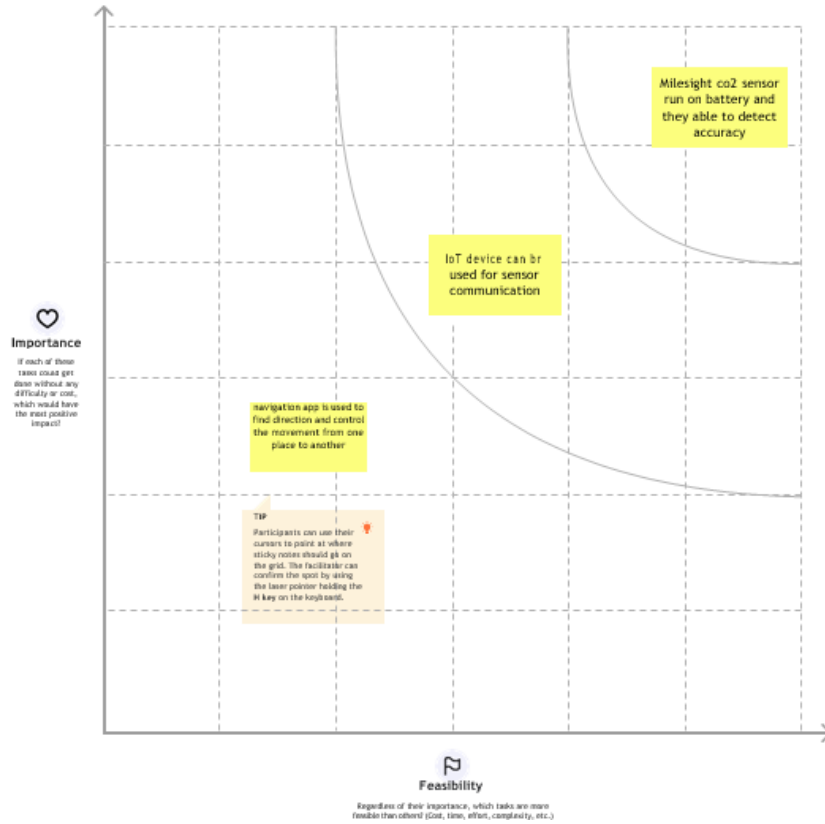
Remote sensing is used to detect forest fire for identifying the geographic analysis

4

## 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





### 3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	This project will reduce the detecting a fire quickly and accurately and providing early warning notification, a fire detection
2.	Idea / Solution description	Provides colour based YCbCR to give better image.
3.	Novelty / Uniqueness	Detect of forest fire using bosch sensor
4.	Social Impact / Customer Satisfaction	Cause air pollution, threaten biodiversity and spoil the aesthetics of an area
5.	Business Model (Revenue Model)	Sings with forest fire detection
6.	Scalability of the Solution	Using the bosch and navigation every wildfire detection is less than 60 sec

## 3.3 PROPOSED SOLUTION FIT

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> Who is your customer? i.e. working parents of 0-5 y.o. kids	<b>6. CUSTOMER CONSTRAINTS</b> What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.	<b>5. AVAILABLE SOLUTIONS</b> Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital note-taking	Explore AS, differentiate
	1.Forest department controller 2.Firefighters 3.workers	1.Detects only fired areas 2.Tracks location 3.disrupt transformation 4.communication	1.trying to control forest fire 2.cover your body with soil 3.Breath the air close to the ground	
Focus on J&P, tap into BE, understand RC	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.	<b>9. PROBLEM ROOT CAUSE</b> What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.	<b>7. BEHAVIOUR</b> What does your customer do to address the problem and get the job done? (a) Directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)	Focus on J&P, tap into BE, understand RC
	1.maintain and improve the quality of the forest 2.Check equipment to ensure that it is operating properly	1. Unmanned aerial vehicle (UAV) is a new type of aircraft that has been utilized in the existing system the disadvantages of this paper is based on only smoke image observed from the camera. Sometimes it not detect correctly. So in proposed system we have used colour format called YCbCr is a family of color space used to clarify the clear	1.Sensors are directly monitored 2.Safety measure should be taken 3.maintain data accuracy	
Identify strong TR & EM	<b>3. TRIGGERS</b> What triggers customers to act? e.g. seeing their <del>xxxxxx</del> installing solar panels, reading about a more <del>xxxxxx</del> solution in the news. The weather is a huge risk factor when it comes to potential wildfire. The level of humidity in the air, the dryness of fuels such as fallen timber, the amount of wind, and the temperature.	<b>10. YOUR SOLUTION</b> If you are writing an existing business, write down your current solution <del>xx</del> in the canvas, and check how much it <del>xx</del> reality. If you are writing on a new business proposition, then keep it blank until you <del>xx</del> in the canvas and come up with a solution that <del>xx</del> within customer limitations, solves a problem and matches customer <del>xxxxxx</del> . This project will reduce the detecting a fire quickly and accurately and providing early warning notification, a fire detection.	<b>8. CHANNELS of BEHAVIOUR</b> ONLINE What kind of actions do customers take online? Extract online channels from #7 OFFLINE What kind of actions do customers take <del>xxxxxx</del> Extract <del>xxxxxx</del> channels from #7 and use them for customer development. Online- 1.save time	Identify strong TR & EM
	<b>4. EMOTIONS: BEFORE / AFTER</b> How do customers feel when they face a problem or a job and afterwards? e.g. lost, unsure + confused, in control - use it in your communication strategy & design. 1.Physical injuries 2.Animal affects 3.Trees 4.economic consequences		2.Navigation app for tracking fire location 3.feedback 4.detection on drone Offline- 1.Inform to forestry department	

## 4. REQUIRMENT ANALYSIS

### 4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Getting alert message from sensor
FR-2	User Confirmation	Conform the location by navigation app

### 4.2 Non-functional Requirements:

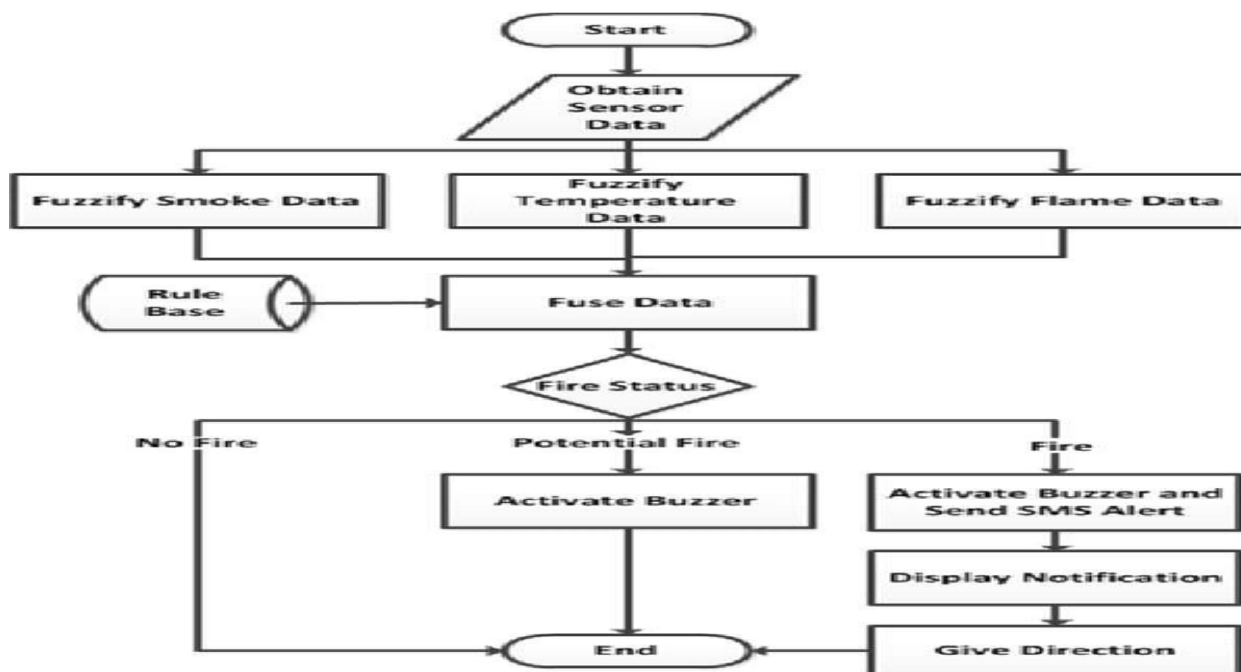
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	Temperature sensor and smoke sensor are deployed at certain distances so that the whole forest area can be kept inside the view in order to detect the ignition alarming temperature and the range of carbon dioxide gas (CO2).
NFR-2	<b>Security</b>	Inserting image processing to the sensor are help to detect fire
NFR-3	<b>Reliability</b>	It reduces fires and awareness and tracks fired location correctly
NFR-4	<b>Performance</b>	When fires gets detected in sensor it identify the fire and alert sounds within 5 sec
NFR-5	<b>Availability</b>	It will detect the fire quickly and accurately 24/7, security.
NFR-6	<b>Scalability</b>	It can identify the all captured fire at the same time

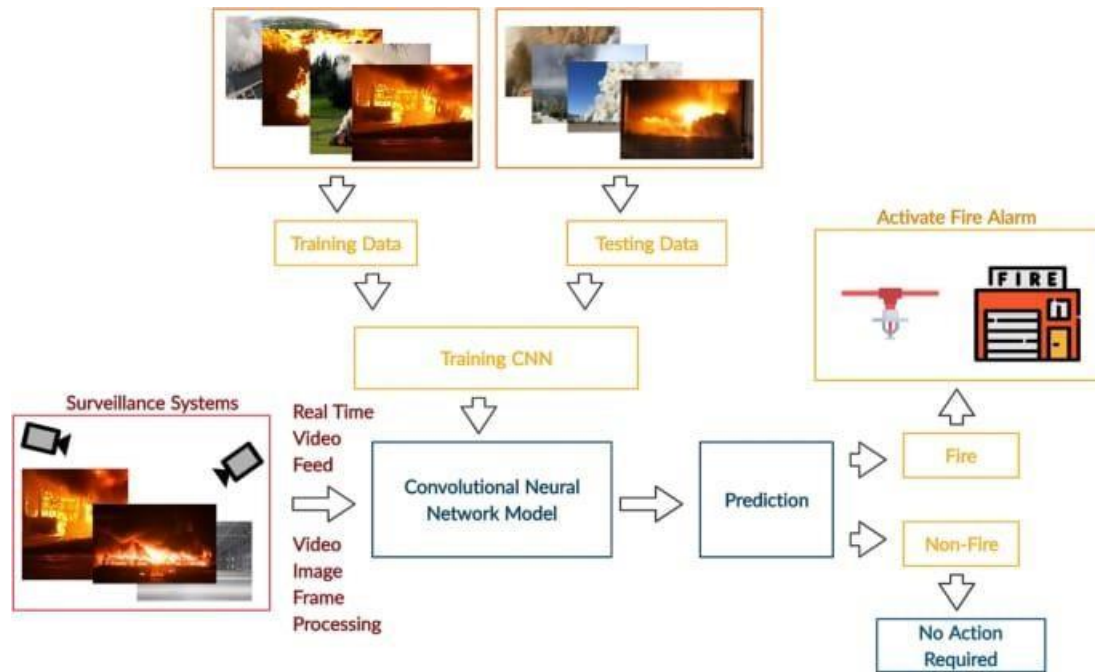
## 5.PROJECT DESIGN

### 5.1 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.



## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE



## 5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story I Task	Acceptance criteria	Priority	Release
Environmental list	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 right output	High	Sprint-3

## 6. PROJECT PLANNING AND SCHEDULING

### 6.1 SPRINT PLANNING AND ESTIMATION

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

### 6.2 SPRINT DELIVERY

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:

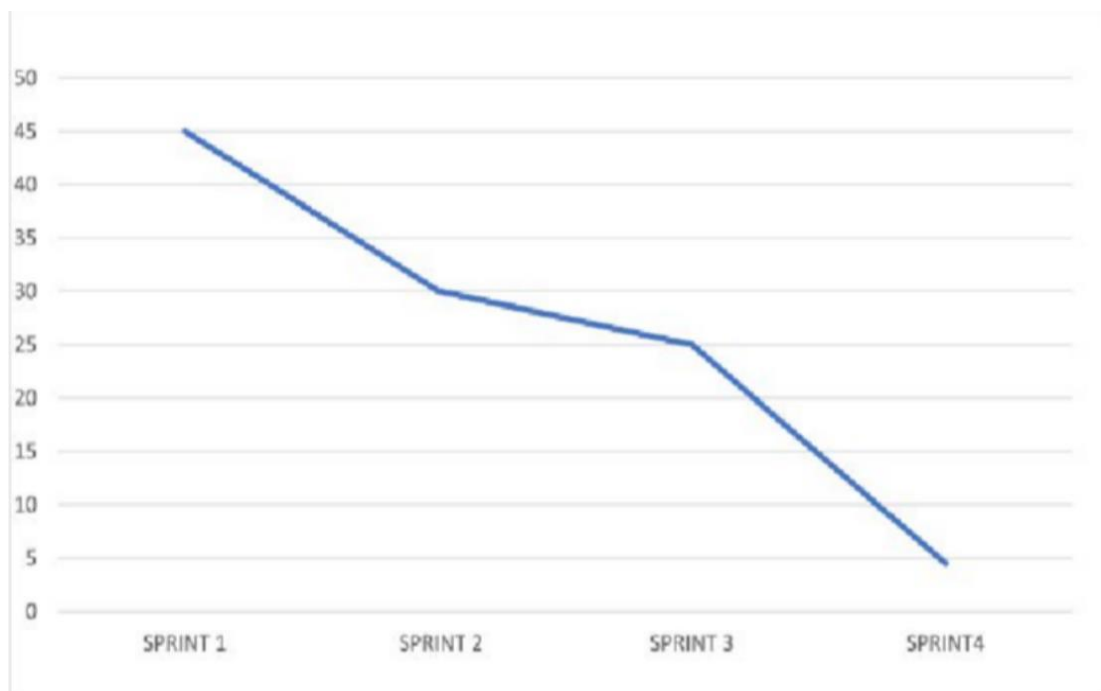
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per

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

sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

## Burn down chart:

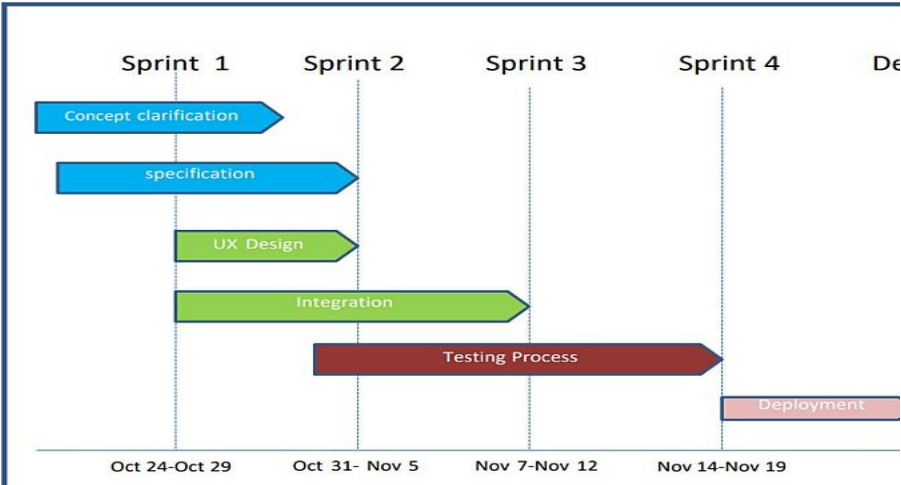
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as scrum. However, burn down charts can be applied to any project containing measurable progress over time.





# 6.3 REPORT FROM JIRA

## SPRINT DELIVERY PLAN



JIRA has categorized reports in four levels, which are –

- i. Agile
- ii. Issue Analysis
- iii. Forecast & Management
- iv. Others

**VELOCITY: SPRINT - 1**

**Sprint duration** = 5 days

**Velocity of team** = 20 points

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

$$AV = 20/5 = 4$$

**Average Velocity = 4**

**VELOCITY: Sprint 1 - 4**

**Sprint duration** = 20 days

**Velocity of team** = 80 points

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

$$AV = 80/20 = 4$$

**Total Average Velocity = 4**

## 7. CODING AND SOLUTION

a. Feature 1

```
!pip install tensorflow
!pip install opencv-python
!pip install opencv-
contrib-pythonimport
tensorflow as tf
import numpy as np
from tensorflow
import keras
import os
import cv2
from tensorflow.keras.preprocessing.image import ImageDataGenerato
from tensorflow.keras.preprocessing
import image
train=ImageDataGenerator(rescale=1./255,
                        shear_ra
                        nge=0.2,
                        rotation_
                        range=1
                        80,
                        zoom_ra
                        nge=0.2,
                        horizonta
                        l_flip=Tr
                        ue)

train =
ImageDataGenerator(rescale=1
/255)test =
ImageDataGenerator(rescale=1
/255)
train_dataset = train.flow_from_directory("/content/drive/MyDrive/Dataset/train_set",
                                target_siz
                                e=(128,12
                                8),
                                batch_size
                                = 32,
                                class_mod
                                e =
                                'binary' )
test_dataset = test.flow_from_directory("/content/drive/MyDrive/Dataset/test_set",
                                target_siz
                                e=(128,12
                                8),
```

```

        batch_size
        = 32,
        class_mod
        e =
        'binary' )

test_dataset.class_indices
#to define linear initialisation import
sequentialfrom keras.models import
Sequential
#to add layer
import Dense from
keras.layers import
Dense
#to create convolution kernel import
convolution2Dfrom keras.layers import
Convolution2D
#import Maxpooling layer
from keras.layers import
MaxPooling2D#import
flatten layer
from keras.layers
import Flattenimport
warnings
warnings.filterwarnin
gs('ignore')model
=Sequential()

#add convolutional layer from
tensorflow.keras.preprocessing import image
train=ImageDataGenerator(rescale=1./255,
        shear_ra
        nge=0.2,
        rotation_
        range=1
        80,
        zoom_ra
        nge=0.2,
        horizonta
        l_flip=Tr
        ue)

train =
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/255)
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        target_siz

```

```

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        batch_size
        = 32,
        class_mod
        e =
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        e=(128,12
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        batch_size
        = 32,
        class_mod
        e =
        'binary' )

test_dataset.class_indices
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#import Maxpooling layer
from keras.layers import
MaxPooling2D#import
flatten layer
from keras.layers
import Flattenimport
warnings
warnings.filterwarnin
gs('ignore')model
=Sequential()
#add convolutional layer
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activati
on='relu')) #add maxpooling layer
model.add(MaxPooling2D(pool
_size=(2,2)))#add flatten layer
model.add(Flatten())
model.add(Dense(150,activation='relu'))

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=5,validation_data=x_test,validation_steps=4)  
model.save("/content/drive/MyDrive/archive(1)/forest1.h5")  
predictions =  
model.predict(test_dataset)  
predictions =  
np.round(predictions)  
predictions  
print(len(predictions))  
#import load_model from  
keras.modelfrom  
keras.models import  
load_model#import  
image class from keras  
import tensorflow as tf  
from tensorflow.keras.preprocessing  
import image#import numpy  
import  
numpy  
as np  
#import  
cv2  
import cv2  
#load the saved model  
model =  
load_model("/content/drive/MyDrive/archive(1)/forest1.h  
5")def predictImage(filename):  
img1 =  
image.load_img(filename,target_size=(128,
```

```

128))Y = image.img_to_array(img1)
X =
np.expand_dims(Y
,axis=0)val =
model.predict(X)
print(val)
if val == 1:
    p
r
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"
f
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"
)
e
l
i
f
v
a
l
=
=
0
:
    print("no fire")
predictImage("/content/drive/MyDrive/Dataset/test_set/with fire/19464620_401.jpg")

```

## b.Feature 2

```

!pip install tensorflow
!pip install opencv-python
!pip install opencv-
contrib-pythonimport
tensorflow as tf
import numpy as np
from tensorflow
import keras
import o

```

```

import cv2

from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image

train=ImageDataGenerator(rescale=1./255,
                        shear_range=0.2,
                        rotation_range=180,
                        zoom_range=0.2,
                        horizontal_flip=True)

```

```

train = ImageDataGenerator(rescale=1/255)
test = ImageDataGenerator(rescale=1/255)
train_dataset = train.flow_from_directory("/content/drive/MyDrive/Dataset/train_set",
                                        target_size=(128,128),
                                        batch_size = 32,
                                        class_mode = 'binary' )
test_dataset = test.flow_from_directory("/content/drive/MyDrive/Dataset/test_set",
                                        target_size=(128,128),
                                        batch_size = 32,
                                        class_mode = 'binary' )

```

```

test_dataset.class_indices

```

```

#to define linear initialisation import sequential

```

```

from keras.models import Sequential

```

```

#to add layer import Dense

```

```

from keras.layers import Dense

```

```

#to create convolution 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()

```

```

#add convolutional layer

```

```

model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))

```

```

#add maxpooling layer

```

```

model.add(MaxPooling2D(pool_size=(2,2)))

```

```

#add flatten layer

```

```

model.add(Flatten())

```

```

model.add(Dense(150,activation='relu'))

```

```

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=5,validation_data=x_test,validation_steps=4)
model.save("/content/drive/MyDrive/archive(1)/forest1.h5")
predictions = model.predict(test_dataset)
predictions = np.round(predictions)
predictions
print(len(predictions))
#import load_model from keras.model
from keras.models import load_model
#import image class from keras
import tensorflow as tf
from tensorflow.keras.preprocessing import image
#import numpy
import numpy as np
#import cv2
import cv2
#load the saved model
model = load_model("/content/drive/MyDrive/archive(1)/forest1.h5")
def predictImage(filename):
    img1 = image.load_img(filename,target_size=(128,128))
    Y = image.img_to_array(img1)
    X = np.expand_dims(Y,axis=0)
    val = model.predict(X)
    print(val)
    if val == 1:
        print(" fire")
    elif val == 0:
        print("no fire")
    predictImage("/content/drive/MyDrive/Dataset/test_set/with fire/19464620_401.jpg")
pip install twilio
pip install playsound
#import opencv librariy
import cv2
#import numpy
import numpy as np
#import image function from keras
from keras.preprocessing import image
#import load_model from keras
from keras.models import load_model

```

```

#import client from twilio API
from twilio.rest import Client
#import playsound package
from playsound import playsound
#load the saved model
model = load_model(r'/content/drive/MyDrive/archive(1)/forest1.h5')
#define video
video = cv2.VideoCapture('/content/Fighting Fire with Fire _ Explained in 30 Seconds.mp4')
#define the features
name = ['forest','with forest']
account_sid='ACfb4e6d0e7b0d25def63044919f1b96e3'
auth_token='f9ae4fc4a617a527da8672e97eefb2d8'
client=Client(account_sid,auth_token)
message=client.messages \
.create(
    body='Forest Fire is detected, stay alert',
    from_='+1 302 248 4366',
    to='+91 99400 12164'
)
print(message.sid)
pip install pygobject
def message(val):
    if val==1:
        from twilio.rest import Client
        print('Forest fire')
        account_sid='ACfb4e6d0e7b0d25def63044919f1b96e3'
        auth_token='f9ae4fc4a617a527da8672e97eefb2d8'
        client=Client(account_sid,auth_token)
        message=client.messages \
        .create(
            body='forest fire is detected, stay alert',
            #use twilio free number
            from_='+1 302 248 4366',
            #to number
            to='+91 99400 12164')
        print(message.sid)
        print("Fire detected")
        print("SMS Sent!")
    elif val==0:
        print('No Fire')
from matplotlib import pyplot as plt

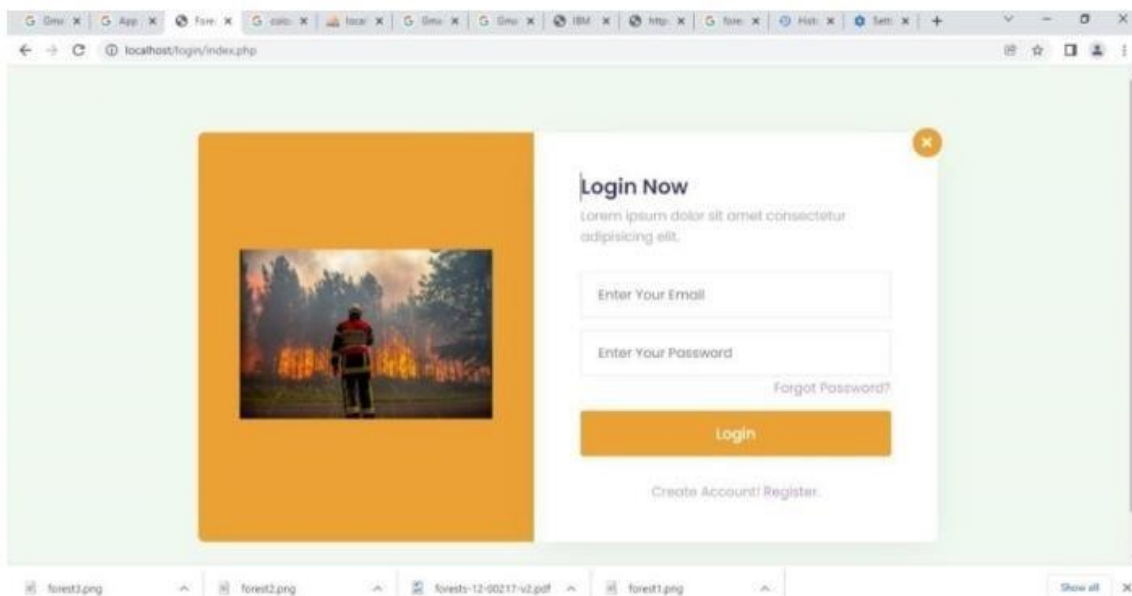
```

```

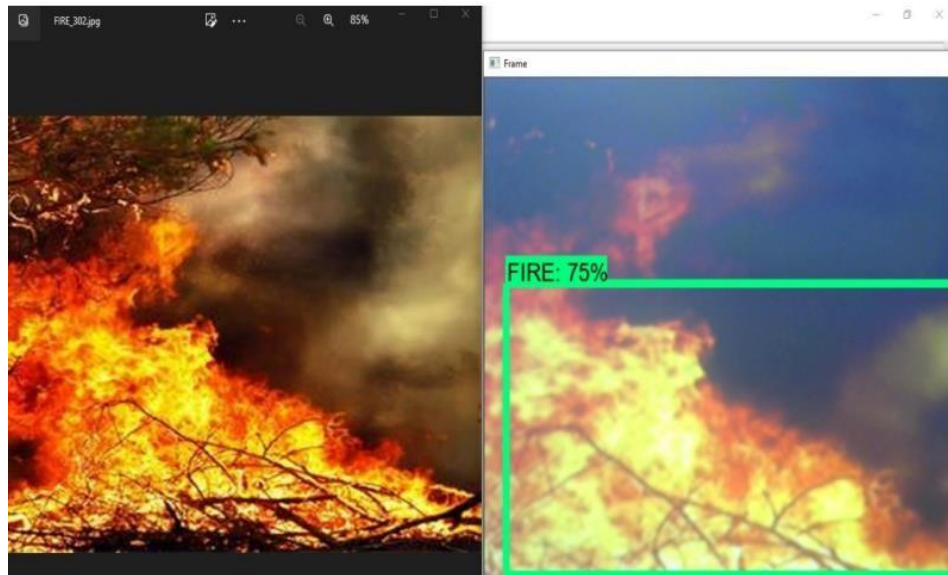
#import load model from keras.model
from keras.models import load_model
#import image from keras
from tensorflow.keras.preprocessing import image
img1 = image.load_img('/content/drive/MyDrive/Dataset/test_set/with
fire/Wild_fires.jpg',target_size=(128,128))
Y = image.img_to_array(img1)
x = np.expand_dims(Y,axis=0)
val = model.predict(x)
plt.imshow(img1)
plt.show()
message(val)
img2 =
image.load_img('/content/drive/MyDrive/Dataset/test_set/forest/1200px_Mountainarea.jpg',target_size=(128,1
28))
Y = image.img_to_array(img2)
x = np.expand_dims(Y,axis=0)
val = model.predict(x)
plt.imshow(img2)
plt.show()
message(val)

```

## 8.TESTING



## 9.RESULTS



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



## 10. ADVANTAGES & DISADVANTAGES

**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.

1. **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.

**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.

**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.

1. **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.

# 1.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.

# 2.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 highpitch sound system that will keep away the animals from the site of fire. The proposed system can be developed to more advanced systemby integrating wireless sensors with CCTV for added protection and precision. The algorithm shows great promise in adapting tovarious environment.

**DEMO LINK:**

[https://www.youtube.com/embed/tLLSVqQYB\\_A](https://www.youtube.com/embed/tLLSVqQYB_A)

**GITHUB:** [IBM-EPBL/IBM-Project-11300-1659287127: Emerging Methods for Early Detection of Forest Fires \(github.com\)](https://github.com/IBM-EPBL/IBM-Project-11300-1659287127)

