Emerging Methods for Early Detection of Forest Fires

PROJECT REPORT

Submitted by

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INDRODUCTION

1.1 PROJECT OVERVIEW

Forest fires are occurring throughout the year with an increasing strength in the summer and autumn periods.These events are mainly caused by the actions of humans, but different nature and biota phenomena, like lightning strikes or ad-lib combustion of dried leafs or sawdust, can also be credited for their occurrence. Regardless of the reasons for the ignition of the forest fires, they normally cause withering damage to both nature and humans.

Forest fires are also considered as a main contributor to the air pollution, due to the fact that during every fire huge amounts of gases and particle mater are released in the atmosphere. To fight forest fires, different solutions were employed throughout the years. They ware primary aimed at the early detection of the fires. The simplest of these solutions is the formation of a network of observance posts - both cheap and easy to accomplish, but also time-consuming for the involved people.

The constant evolution of the info and communication applied science has led to the debut of a new generation of solutions for early detection and even prevention of forest fires. ICT-based networks of cameras and sensors and even satellite-based solutions were developed and used in the last decades. These solutions have greatly decreased the direct involvement of humans in the forest fire detection process, but have also proven to be expensive and hard to maintain.

1.2 PURPOSE

Detection of forest fire and smoke in wild land areas is done through remote sensing-based methods such as satellites, high-resolution static cameras fixed on the ground, and unmanned aerial vehicles Optical/thermal cameras deployed on the observation towers together with the other sensors such as smoke, temperature, and humidity sensors might detect the hazards in the closed environment rather than in the open environment as these sensors need vicinity to the fire or smoke.

The information obtained through these sensors is not appropriate. Distance covered by these methods could be limited, and to cover a large area, more sensors have to be deployed that might incur expenses. Through the deployment of UAV, large areas could be covered, and the images with high spatial and temporal resolutions could be captured properly.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

Over the last few years, climate change and human-caused factors have a significant impact on the environment. Some of these events include heat waves,droughts, dust storms, floods, hurricanes, and wildfires. Wildfires have extreme consequences on local and global ecosystems and cause serious damages to infrastructure, injuries, and losses in human lives; therefore, fire detection and the accurate monitoring of the disturbance type, size, and impact over large areas is becoming increasingly important. To this end, strong efforts have been made to avoid or mitigate such consequences by early fire detection or fire risk mapping.

Traditionally, forest fires were mainly detected by human observation from fire lookout towers and involved only primitive tools, such as the Osborne fire Finder however, this approach is inefficient, as it is prone to human error and fatigue.

On the other hand, conventional sensors for the detection of heat, smoke, flame, and gas typically take time for the particles to reach the point of sensors and activate them. In addition, the range of such sensors is relatively small, hence, a large number of sensors need to be installed to cover large areas

2.2 REFERENCES

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2. Pradon, B.; Suliman, M.D.H.B.; Sawing, M.A.B. Forest fire susceptibility and risk mapping using remote sensing and geographical information systems (GIS). Disaster Prey. Manag. Into. J. 2007, 16.

3. Gaur, A.; Singh, A.; Kumar, A.; Kuliakan, K.S.; Lola, S.; Kapoor, K.; Srivastava, V.; Kumar, A.; Madhyapradesa, S.C. Fire sensing technologies: A review. IEEE Send. J. 2019, 19, 3191–3202.

4. Kabuki, R.; Frizz i, S.; Bouchouicha, M.; Chennai, F.; Moreau, E. Video smoke detection review: State of the art of smoke detection in visible and IR range. In Proceedings of the 2017 International Conference on Smart, Monitored and Controlled Cities (SM2C), Kerkennah-Sfax, Tunisia, 17 February 2017; pp. 81–86.

5. Allison, R.S.; Johnston, J.M.; Craig, G.; Jennings, S. Airborne optical and thermal remote sensing for wildfire detection and monitoring. Sensors 2016, 16, 1310.

6. Cappellini, Y.; Mattii, L.; Me-cocci, A. An Intelligent System for Automatic Fire Detection in Forests. In Recent Issues in Pattern Analysis and Recognition; Springer: Berlin/Heidelberg, Germany, 1989; pp. 563–570.

7. Chen, T.H.; Wu, P.H.; Chiou, Y.C. An early fire-detection method based on image processing. In Proceedings of the 2004 International Conference on Image Processing (ICIP 04), Singapore, 24–27 October 2004; Volume 3, pp. 1707–1710.

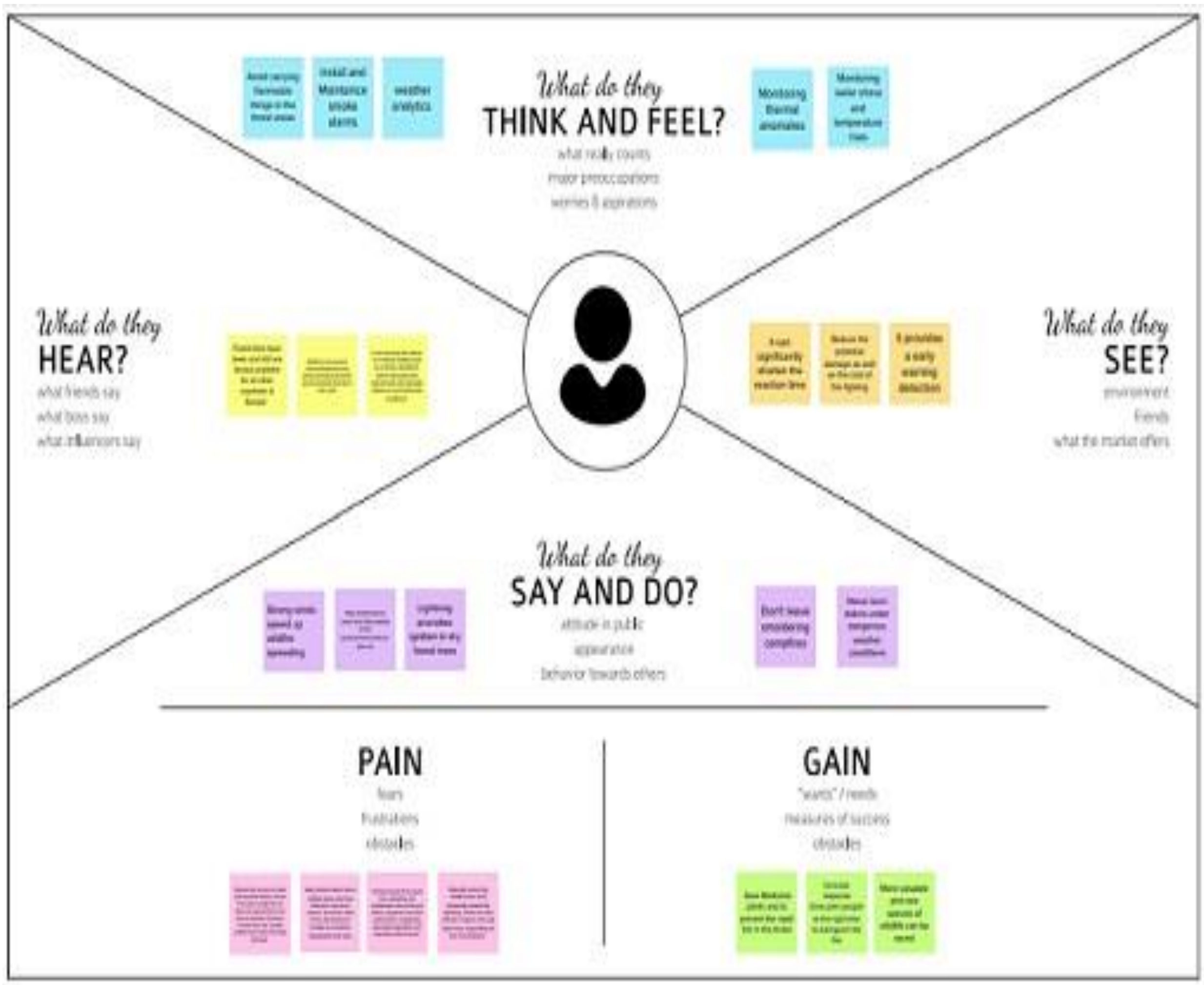
2.2 PROBLEM STATEMENT DEFENITION

Forest fires are a major environmental issue, creating economic and ecological damage while endangering human lives. There are typically about 100,000 wildfires in the United States every year. Over 9 million acres of land have been destroyed due to treacherous wildfires. It is difficult to predict and detect Forest Fire in a sparsely populated forest area and 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 before 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

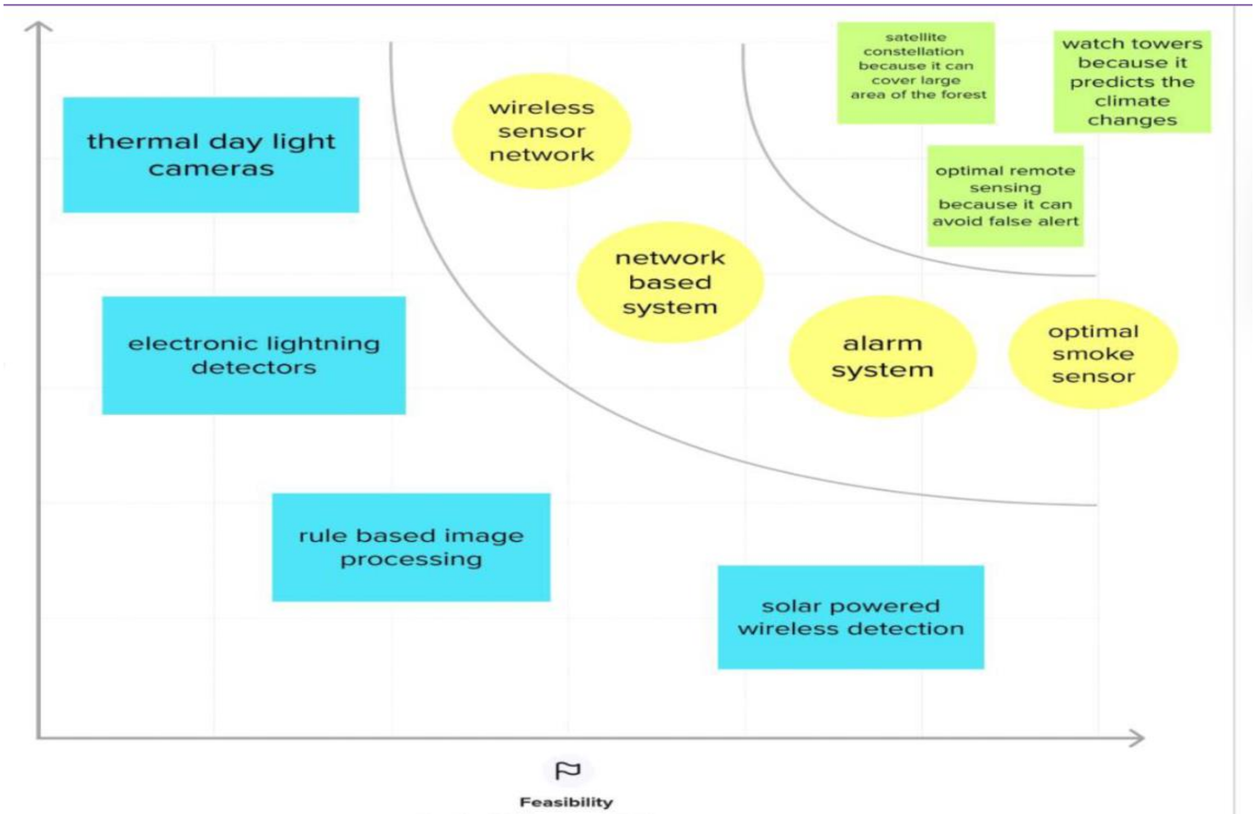
3.IDEATION & PROPOSED SOLUTION

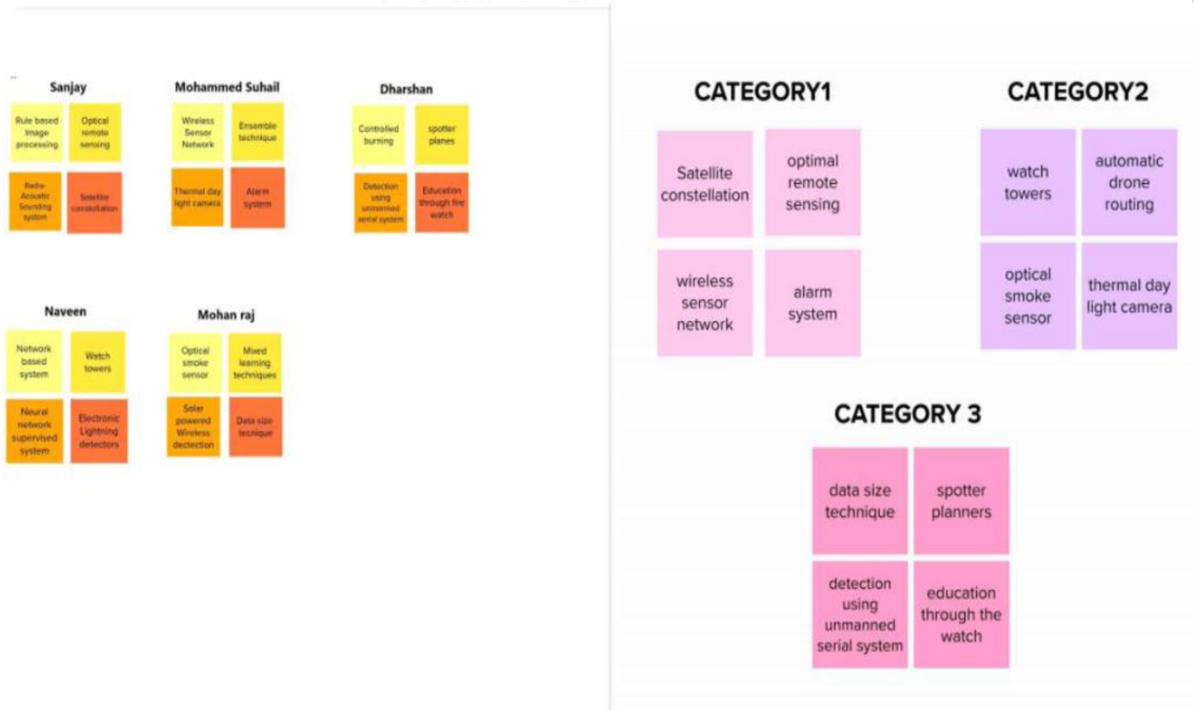
3.1 EMPATHY MAP CANVAS

An **empathy map** is a collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to create a shared understanding of user needs, and aid in decision making.



3.2 IDEATION & BRAINSTORMING

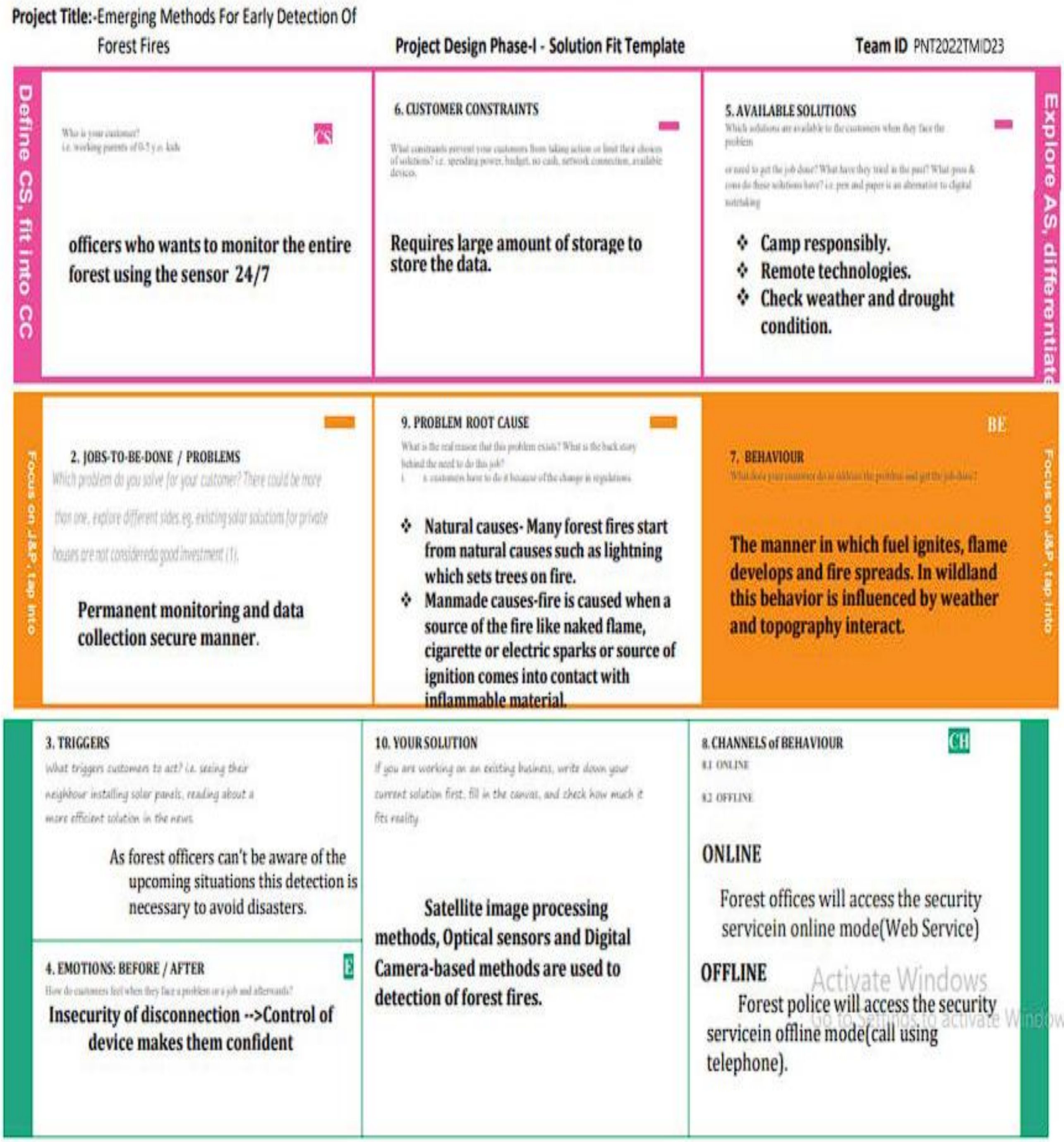




3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Forest and urban fires are still a serious problem for many countries in the world. The (UAVs), which constantly patrol over potentially threatened by fire areas. The UAVs also utilize the benefits from Artificial intelligence (AI) and are equipped with on board processing capabilities.
2.	Idea / Solution description	Recent advances in computer vision, machine learning, and remote sensing technologies offer new tools for detecting and monitoring forest fires, while the development of new materials and microelectronics have allowed sensors to be more efficient in identifying active forest fires.
3.	Novelty / Uniqueness	Permanent monitoring, data collection and processing. Terrestrial-based early detection systems consist of either individual sensors (fixed, PTZ, or 360◦ cameras) or networks of ground sensors.
4.	Social Impact / Customer Satisfaction	Growing public alarm at the problem of largescale forest fires, is evident from an assessment of their past and present repercussions on the population in general.
5.	Business Model (Revenue Model)	Forest sector has strong importance for the economic, social and environmental issues. Portuguese forestry sector is of great importance for the added value creation, for the jobs creation.
6.	Scalability of the Solution	There are several factors that affect the evolution of a wild land fire. It is well known that wind is one of the key parameters to understand the forest fire propagation. Intuitively, the meteorological wind speed tends to drive the main direction of forest fire spread.

3.4 PROPOSED SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

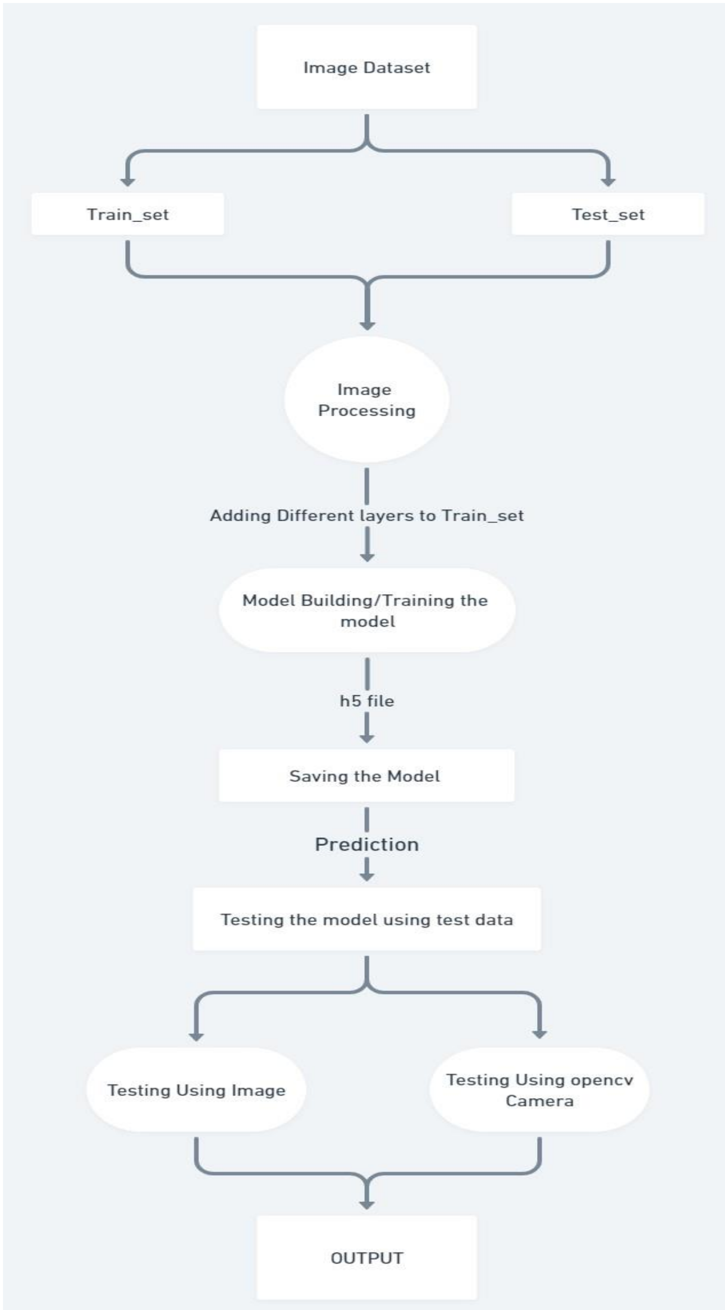
FR. NO.	Functional Requirement	Sub Requirement (Story / Sub-Task)
FR-1	Camera Setting	To analyze the fire prone areas and to set the surveillance camera to collect and observe the region continuously for early detection.
FR-2	Data Model	Data model is defined to predict the forest fire
FR-3	Data Prediction	Scientists create computer models to predict wildfire potential under a range of potential climate futures. Using different projections of temperature and downfall, scientists predict where and when wildfires are likely to occur

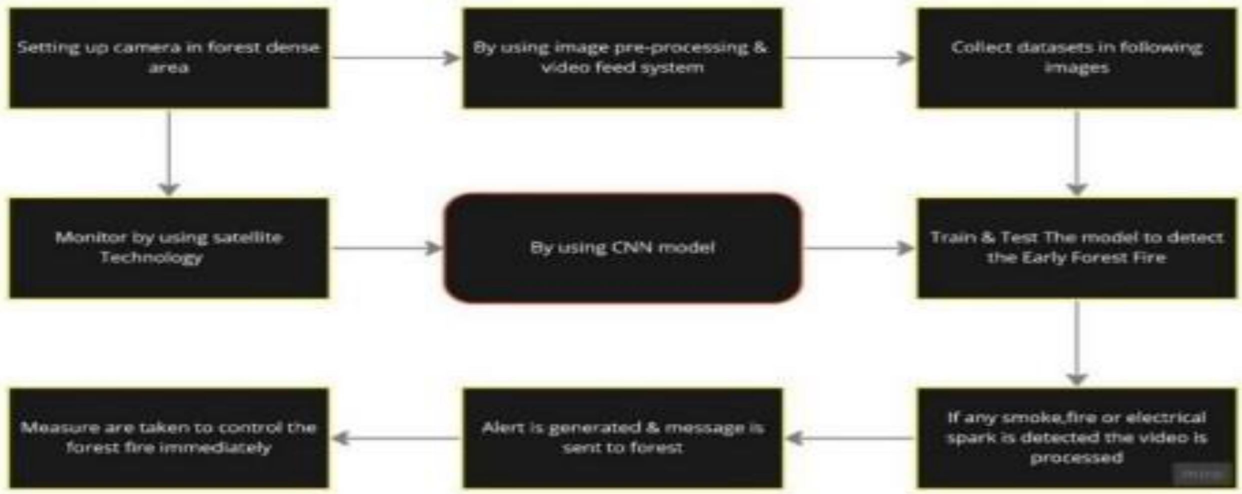
4.2 NON FUNCTIONAL REQUIREMENTS

FR. NO.	Non-Functional Requirement	Description
NFR-1	Usability	Many methods have been proposed to detect forest fires, such as camera-based systems, WSN-based systems, and machine learning coating-based systems, with both positive and negative aspects and performance figures of detection.
NFR-2	Protection	We have designed this project to secure the forest from wild fires.
NFR-3	Performance	In the event of a fire, the primary objective of using drones is to gather situational consciousness, which can be used to direct the efforts of the firefighters in locating and controlling hot spots. Just like urban fires, forest fires to require monitoring so that firefighters know what they are dealing with.

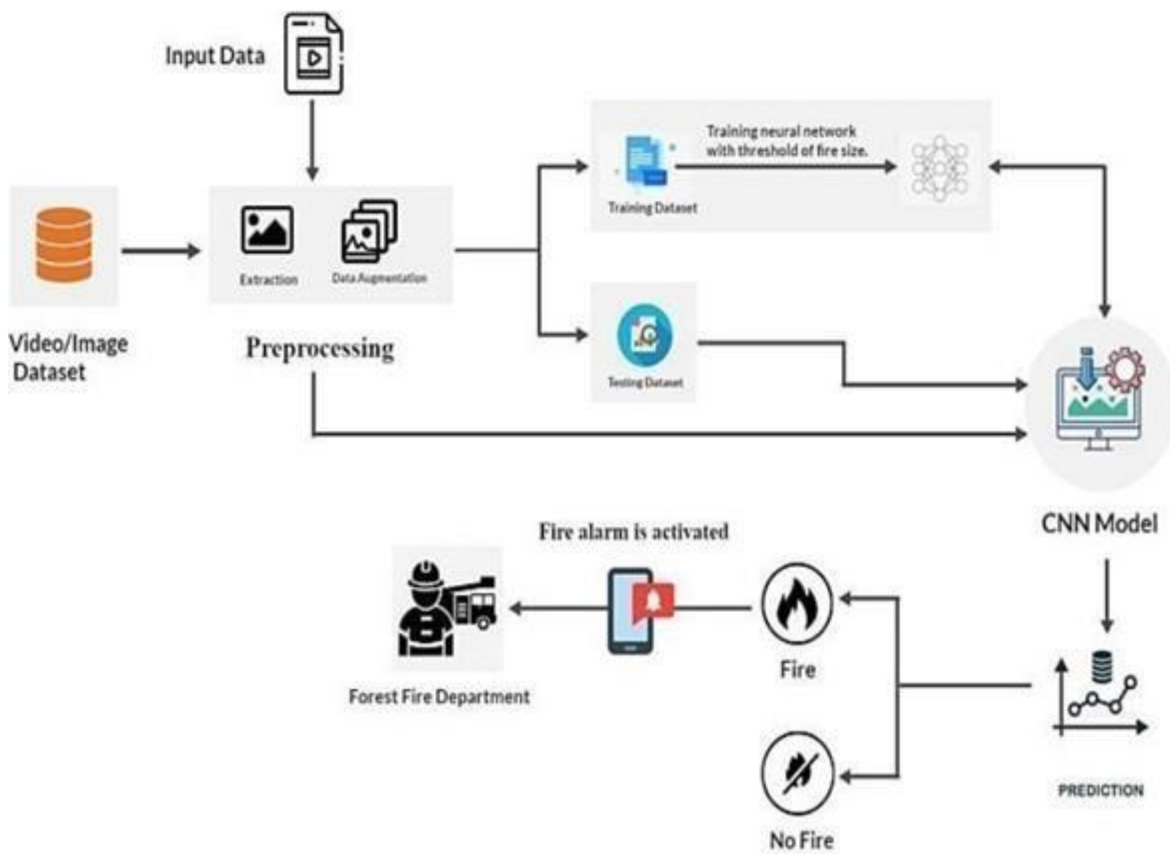
5. PROJECT DESIGN

5.1 DATAFLOW DIAGRAMS





5.2 SOLUTION& TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Forest Manageme nt Team	Setting up a camera	USN-1	As a user, the forest management team has to survey the forest by adding camera to the fire prone areas.	The live video captured can be monitored	High	Sprint-1
		USN-2	As a user, the forest management team can get video feed which is used for processing	The camera sends video or image to the forest centre	High	Sprint-2
		USN-3	Along with forest team, the NGO can also get access of the video to take some early measurement of forest fires.	They can also get the view of the live monitoring of forest	Low	Sprint-1
Technical Team	Image Classificatio n	USN-4	By using CNN Model, the images captured by the camera is classified accordingly by testing & training the model	The model should be able to identify the difference between fire and a normal smoke	Medium	Sprint-2
	Using Open CV	USN-5	The recorded video is under monitoring continuously to determine the detection of early video	Therefore, by using CNN we can determine the input layer, classify the hidden layers and send warnings through output layer	High	Sprint-2
Alert Team	Dashboard	USN-6	Thus, after successful detection of fire by processing images. This, API sends the alert by buzzing the alarm and sends messages through chatbot	Thus, the immediate response which is required for earlier determination through sending quick responses	High	Sprint-2

6.PROJECT PLANNING & SCHEDULING

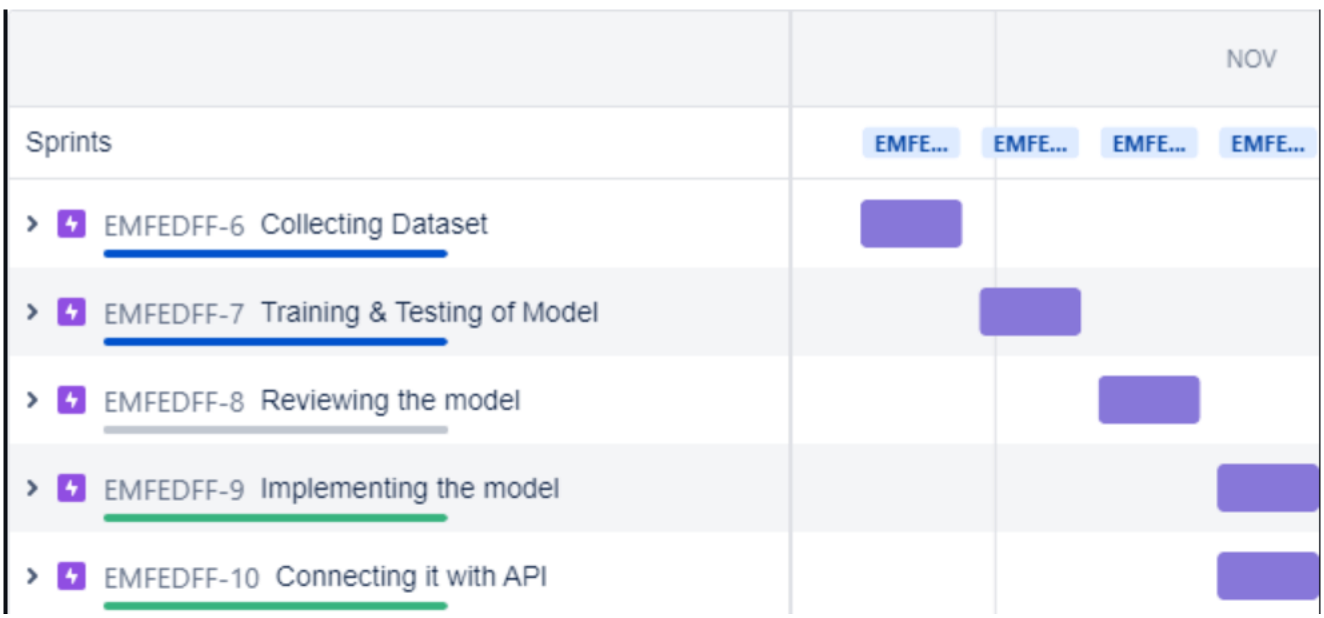
6.1 SPRINT PLANNING&ESTIMATES

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Collecting Dataset	USN-1	To analyze the fire prone areas and to set the surveillance camera to collect and observe the region continuously for early detection.	2	High	Sanjay V
Sprint-2	Training & Testing of Model	USN-2	The collected data are categorized on the basis of parameters set to identify. To train the model, CNN is used to test repeatedly by storing the datasets in server.	1	High	Mohan Raj
Sprint-3	Reviewing the model	USN-3	The main task is to check that the model is efficient to work in real time. Therefore, smallest of error decoded needed to be corrected to avoid future lags.	1	Medium	Naveen Kumar
Sprint-4	Implementing the model	USN-4	The model after testing all it's functionalities is been implemented at forest management offices to get quick responses from the model.	2	High	Mohammed Suhail S
Sprint-4	Connecting it with API	USN-5	The model should connect with API named Twilio, which receives & sends the management with messages.	2	High	Dharshan

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date(Planning)	Story Point Completed (as on Planned End Date)	Sprint Release Date (Actual)
1	20	6 days	24 Oct 2022	29 Oct 2022	20	5 Oct 2022
2	20	6 days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
3	20	6 days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
4	20	6 days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORT FROM JIRA



7.CODING & SOLUTIONING

7.1 FEATURE 1

(a) Sending Alert Messages

- When camera captures the video it sends to the CNN model as a frames
- The predictions are made continuously to protect the forest
- If the model detects the fire in the frame. Then, model sends a alert message to the forest zone officer

SENDING ALERT MESSAGES

```
In [21]: model = load_model(r'forest2.h5')
video = cv2.VideoCapture(r"C:\Users\sanjay\Downloads\pexels-arnav-kainthola-7543653.mp4")
name = ['forest','with fire']

while(1):
    success, frame = video.read()
    cv2.imwrite("image.jpg",frame)
    img = load_img("image.jpg")
    x  = img_to_array(img)
    res = cv2.resize(x, dsize=(128, 128), interpolation=cv2.INTER_CUBIC)
    x = np.expand_dims(res,axis=0)
    pred=model.predict(x)
    p=int(pred[0][0])
    int(p)
    cv2.putText(frame, "predicted  class = " +str(name[p]), (100,100), cv2.FONT_HERSHEY_SIMPLEX, 1, (0,0,0), 1)


   # pred=model.predict(x)
    if p==0:
        account_sid = 'AC5923cf8d29ec11edffab37a3997f3602'
        auth_token = '4bb6b8876615238ab70c45a44b34584e'
        client = Client(account_sid, auth_token)

        message = client.messages \
        .create(
         body='Forest Fire is detected, stay alert',
         from_='+14793363560',
         to='+918838487815')

        print(message.sid)

        print('Fire Detected')
        print ('SMS sent!')
        break
    else:
        print("no danger")
```

```
1/1 [==============================] - 0s 110ms/step
SM4e06f6ab06c6cb9554b56910fee7db47
Fire Detected
SMS sent!
```

7.2 FEATURE 2

(a) Alarming Alert

- When the model senses the fires, it alerts by alarming by producing sound
- It is achieved by using playsound library
- To install playsound library type the command in command box: **’pip install playsound’**

```
In [20]: import cv2
         #import facevec
         import numpy as np
         import smtplib
         from tensorflow.keras.utils import load_img,img_to_array
         from keras.models  import load_model
         from twilio.rest import Client
         from playsound import playsound
```

```
In [21]: model = load_model(r'forest2.h5')
         video = cv2.VideoCapture(r"C:\Users\sanjay\Downloads\pexels-arnav-kainthola-7543653.mp4")
         name = ['forest','with fire']

         while(1):
             success, frame = video.read()
             cv2.imwrite("image.jpg",frame)
             img = load_img("image.jpg")
             x  = img_to_array(img)
             res = cv2.resize(x, dsize=(128, 128), interpolation=cv2.INTER_CUBIC)
             x = np.expand_dims(res,axis=0)
             pred=model.predict(x)
             p=int(pred[0][0])
             int(p)
             cv2.putText(frame, "predicted  class = " +str(name[p]), (100,100), cv2.FONT_HERSHEY_SIMPLEX, 1, (0,0,0), 1)
            # pred=model.predict(x)
             if p==0:
                 account_sid = 'AC5923cf8d29ec11edffab37a3997f3602'
                 auth_token = '4bb6b8876615238ab70c45a44b34584e'
                 client = Client(account_sid, auth_token)

                 message = client.messages \
                 .create(
                  body='Forest Fire is detected, stay alert',
                  from_='+14793363560',
                  to='+918838487815')
                 playsound("C:\Users\sanjay\Downloads\4WY2LZB-message-alert.mp3")
                 print(message.sid)

                 print('Fire Detected')
                 print ('SMS sent!')
                 break
```

8.TESTING

8.1. TEST CASES

Test case ID	Feature Type	Compone nt	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	BUG ID	Executed By
TC_O 01	Data Collection	Dataset	Collecting different set of data sets	Dataset is downloaded from the website	Jupyter notebook	Dataset is collected successfully	Success Of collecti ng dataset	**Pass**	**-**	Sanjay Mohammed Suhail
TC_O 02	Train the model	Model	Training the model to predict the forest fire	By using keras library to train the model	Jupyter notebook	Model is trained successfully	Content of Home page is display ed	**Pass**	**-**	Naveen kumar dharshan
TC_O 03	Save the model	Home	Saves the model as h5 type file	Model.save() is used to save the model	ls -1	Displays the model that present in the directory	Displays the model that present in the directory.	Pass	-	Mohan raj sanjay
PredictiedPa ge_T C_004	Functional	Image prediction	Test the model by using the images	Model.predict() is used to predict the image	Jupyter notebook	Predicts the image with the trained dataset	Predicts the image with the trained dataset.	Pass	-	Naveen kumar Mohammed suhail
PredictedPa ge_TC _004	Functional	Predicted result	Again testing with different set of image to get accuracy of the model	By giving path of an image to predict using the predict() method	Jupyter notebook	Displays e the selected Image	Displays the Selected Imag	Pass	**-**	Mohan raj sanjay

8.2. USER ACCEPTANCE TESTING

8.2.1. Defect Analysis

Resolution	severity 1	severity 2	severity 3	badness 4	subtotal
By Design	1	1	2	0	4
Duplicate	0	0	0	0	0
External	0	0	2	1	3
Fixed	4	2	4	1	11
Not Reproduced	0	0	0	0	0
Skipped	0	0	1	1	2
Won't Fix	0	0	0	1	1
Totals	5	3	9	4	21

8.2.2. TEST CASE ANALYSIS

Section	Total Cases	Not tested	Fail	Pass
Client Application	10	0	0	10
Security	2	0	1	1
Performance	2	0	0	2
Exception Reporting	2	0	0	2
Final Report Output	3	0	0	3

9.RESULTS

9.1. PERFORMANCE METRICES

S. No	Parameter	Values	Screenshot
1.	Model Summary	3,453,121	Layer (type) Output Shape Param # conv2d (Conv2D) (None, 148, 148, 32) 896 max_pooling2d (MaxPooling2D) (None, 74, 74, 32) 0 conv2d_1 (Conv2D) (None, 72, 72, 64) 18496 max_pooling2d_1 (MaxPooling2 (None, 36, 36, 64) 0 conv2d_2 (Conv2D) (None, 34, 34, 128) 73856 max_pooling2d_2 (MaxPooling2 (None, 17, 17, 128) 0 conv2d_3 (Conv2D) (None, 15, 15, 128) 147584 max_pooling2d_3 (MaxPooling2 (None, 7, 7, 128) 0 flatten (Flatten) (None, 6272) 0 dense (Dense) (None, 512) 3211776 dense_1 (Dense) (None, 1) 513 Total params: 3,453,121 Trainable params: 3,453,121 Non-trainable params: 0
2.	Accuracy	Training Accuracy - 0.9665 Validation Accuracy -0.9833	Epoch 1/10 14/14 [==============================] - 96s 7s/step - loss: 0.5717 - accuracy: 0.6552 - val_loss: 0.2805 - val_accuracy: 0.8750 Epoch 2/10 14/14 [==============================] - 84s 6s/step - loss: 0.3266 - accuracy: 0.8434 - val_loss: 0.1193 - val_accuracy: 0.9667 Epoch 3/10 14/14 [==============================] - 74s 5s/step - loss: 0.2247 - accuracy: 0.9227 - val_loss: 0.1184 - val_accuracy: 0.9500 Epoch 4/10 14/14 [==============================] - 75s 5s/step - loss: 0.1682 - accuracy: 0.9425 - val_loss: 0.0206 - val_accuracy: 1.0000 Epoch 5/10 14/14 [==============================] - 82s 6s/step - loss: 0.1173 - accuracy: 0.9620 - val_loss: 0.0631 - val_accuracy: 0.9667 Epoch 6/10 14/14 [==============================] - 76s 6s/step - loss: 0.0925 - accuracy: 0.9741 - val_loss: 0.0169 - val_accuracy: 1.0000 Epoch 7/10 14/14 [==============================] - 80s 6s/step - loss: 0.0884 - accuracy: 0.9714 - val_loss: 0.0194 - val_accuracy: 1.0000 Epoch 8/10 14/14 [==============================] - 72s 5s/step - loss: 0.1050 - accuracy: 0.9661 - val_loss: 0.0455 - val_accuracy: 0.9833 Epoch 9/10 14/14 [==============================] - 70s 5s/step - loss: 0.1032 - accuracy: 0.9676 - val_loss: 0.0044 - val_accuracy: 1.0000 Epoch 10/10 14/14 [==============================] - 92s 6s/step - loss: 0.1144 - accuracy: 0.9665 - val_loss: 0.0807 - val_accuracy: 0.9833

10.. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- The proposed system detects the forest fire at a faster rate compared to existing system. It has enhanced data collection feature.
- The major aspect is that it reduces false alarm and also has accuracy due to various sensors present.
- It minimise the human effort as it works automatically. This is very low-cost due to which can be easily accessed.
- The main objective of our project is to receive an alert message through an app to the respective user.

DISADVANTAGE:

- The electrical interference diminishes the potency of radio receiver.
- The main drawback is that it has less coverage range areas.
- The accuracy is low because to the limited quantity/quality of photos, in the dataset, but this may easily be increased by changing the dataset.

11.CONCLUSION

This type of system is the first of its kind to ensure no further damage is then to forests when there is fire breakout and instantly a message is sent to the user through the App. Immediate response or early warning to a fire breakout is mostly the only ways to avoid losses and biology, cultural heritage damages to a great extent. Therefore the most important goals in fire surveillance are quick and authentic detection of fire. It is so much easier to suppress fire while it is in its early stages. info about progress of fire is highly valuable for managing fire during all its stages. Based on this data the firefighting staff can be guided on target to block fire before it reaches cultural heritage sites and to suppress it quickly by utilise required firefighting equipment and vehicles. With further research and invention, this project can be implemented in various forest areas so that we can save our forests and maintain great environs.

12.FUTURE SCOPE

This project is far from complete and there is a lot of room for betterment. Some of the betterment that can be made to this project are as follows:

- Additional pump can be added so that it automatically sends water when there is a fire breakout. Also industrial sensors can be used for better ranging and accuracy.
- This project has endless potential and can always be enhanced to become better. enforce this concept in the real world will benefit several industries and reduce the workload on many workers, enhancing overall work efficiency.

13.APPENDIX

SOURCE CODE

In [ ]:

```
import keras
from keras.preprocessing.image import ImageDataGenerator
#Define the parameters/arguments for ImageDataGenerator class
train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,rotation_range=180,

test_datagen=ImageDataGenerator(rescale=1./255)
x_train=train_datagen.flow_from_directory(r"C:\Users\sanjay\OneDrive\Desktop\Datase
batch_size=32,class_mode='binary')
x_test=test_datagen.flow_from_directory(r"C:\Users\sanjay\OneDrive\Desktop\Dataset\
batch_size=32,class_mode='binary')


#To define linear intialisation import Sequential
from keras.models import Sequential
#To add layers 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')
#initializing the model
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())
#add hidden layer
model.add(Dense(150,activation='relu'))
#add output layer
model.add(Dense(1,activation='sigmoid'))
#configure the learning process
model.compile(loss='binary_crossentropy',optimizer="adam",metrics=["accuracy"])
#Training the model
model.fit_generator(x_train,steps_per_epoch=14,epochs=10,
validation_data=x_test,validation_steps=4)
model.save("forest2.h5")


#import load_model fromkeras.model
from keras.models import load_model
 #import image class from keras
from tensorflow.keras.preprocessing import image
#import numpy
import numpy as np
#import cv2
import cv2

model = load_model("forest2.h5")
img=image.load_img(r"C:\Users\sanjay\OneDrive\Desktop\Dataset\Test_set\Forest with
x=image.img_to_array(img)
res = cv2.resize(x, dsize=(128, 128), interpolation=cv2.INTER_CUBIC)
#expand the image shape
```

```
x=np.expand_dims(res,axis=0)

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

if (pred==0):
 print("forest with fire")
else:
 print("forest without fire")

model = load_model(r'forest2.h5')
video = cv2.VideoCapture(r"C:\Users\sanjay\Downloads\pexels-arnav-kainthola-754365
name = ['forest','with fire']

while(1):
     success, frame = video.read()
     cv2.imwrite("image.jpg",frame)
     img = load_img("image.jpg")
     x = img_to_array(img)
     res = cv2.resize(x, dsize=(128, 128), interpolation=cv2.INTER_CUBIC)
     x = np.expand_dims(res,axis=0)
     pred=model.predict(x)
     p=int(pred[0][0])
     int(p)
     cv2.putText(frame, "predicted class = " +str(name[p]), (100,100), cv2.FONT_HEI
     # pred=model.predict(x)
     if p==0:
         account_sid = 'AC5923cf8d29ec11edffab37a3997f3602'
         auth_token = '4bb6b8876615238ab70c45a44b34584e'
         client = Client(account_sid, auth_token)
         message = client.messages \
         .create(
         body='Forest Fire is detected, stay alert',
         from_='+14793363560',
         to='+918838487815')
         playsound("C:\Users\sanjay\Downloads\4WY2LZB-message-alert.mp3")
         print(message.sid)

         print('Fire Detected')
         print ('SMS sent!')
         break
     else:
     print("no danger")
     #break
     cv2.imshow("image",frame)

     if cv2.waitKey(1) & 0xFF == ord('a'):
     break
video.release()
cv2.destroyAllWindows()
```

GITHUB :

https://github.com/IBM-EPBL/IBM-Project-23135-1659868915

DEMO VIDEO:

https://drive.google.com/file/d/1JuVKQTCSdxd26Hi4sPbu7WIt8d2SigDl/view?usp=drivesdk