EMERGING METHODS OF EARLY DETECTION OF FOREST FIRES

TEAM ID:PNT2022TMID41540
TEAM LEADER:R.RAGHAVI
TEAM MEMBERS:1.N.BANUMATHI
2.G.JANANI
3.P.JENO JENCY

Project Report

AGENDA:

1.INTRODUCTION

1.1PROJECT OVERVIEW

Traditional forest fire detection methods include satellite monitoring,ground patrol,watch towers,among others,which have high labor and financial costs in return for low efficiency.Current remote sensor technologies are becoming more common,but primarily rely on battery technology for power.

1.2 PURPOSE

Emerging Methods for Early Detection of Forest Fires The project aims to build a model that detects

forest fire using convolutional neural networks.

2.LITERATURE SURVEY

2.1 Existing problem

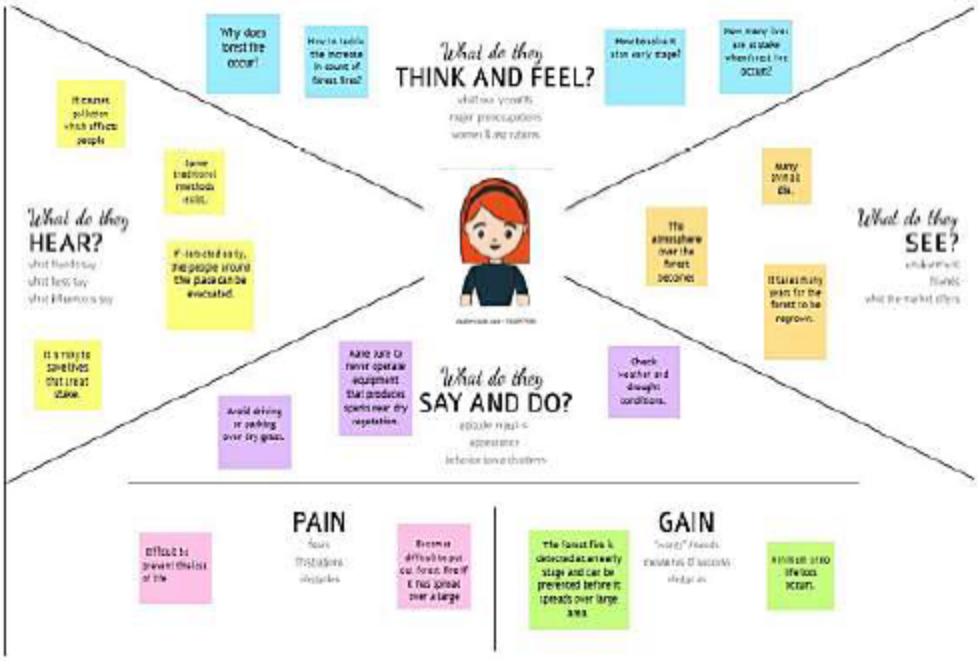
Its is different to predict and detect forest fire in a sparsely populated forest are and its more difficult if the prediction is done using ground based methods like camera or video based approach.satellites can be an important source of data prior to and also during te fire due its reliability and efficience.

2.2.references

https://www.researchgate.net/netpiblication/334418384_Early_Forest_Fire_Detection_Using_Drones_and_Artifical_Intelliegence

3.IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas



3.2Ideation&Brainstroming

Template

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

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

PROBLEM

How might we [your problem statement]?

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

By detects the forest fire

Reduces the air pollution

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Reduces the landslides,soil erosion by protecting strong rooted trees

Reduces the risk of eradication of endangered species

No need of manual monitoring

Reduce CO2

No loss of life and Resources

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!

R.Raghavi

- Detect by smoke
- Detects by climate change

N.Banumathi

- Detects by flame
- Detects any electrical shortage that can cause fire

G.Janani

- Detect by spark
- Detects spark due to lightning

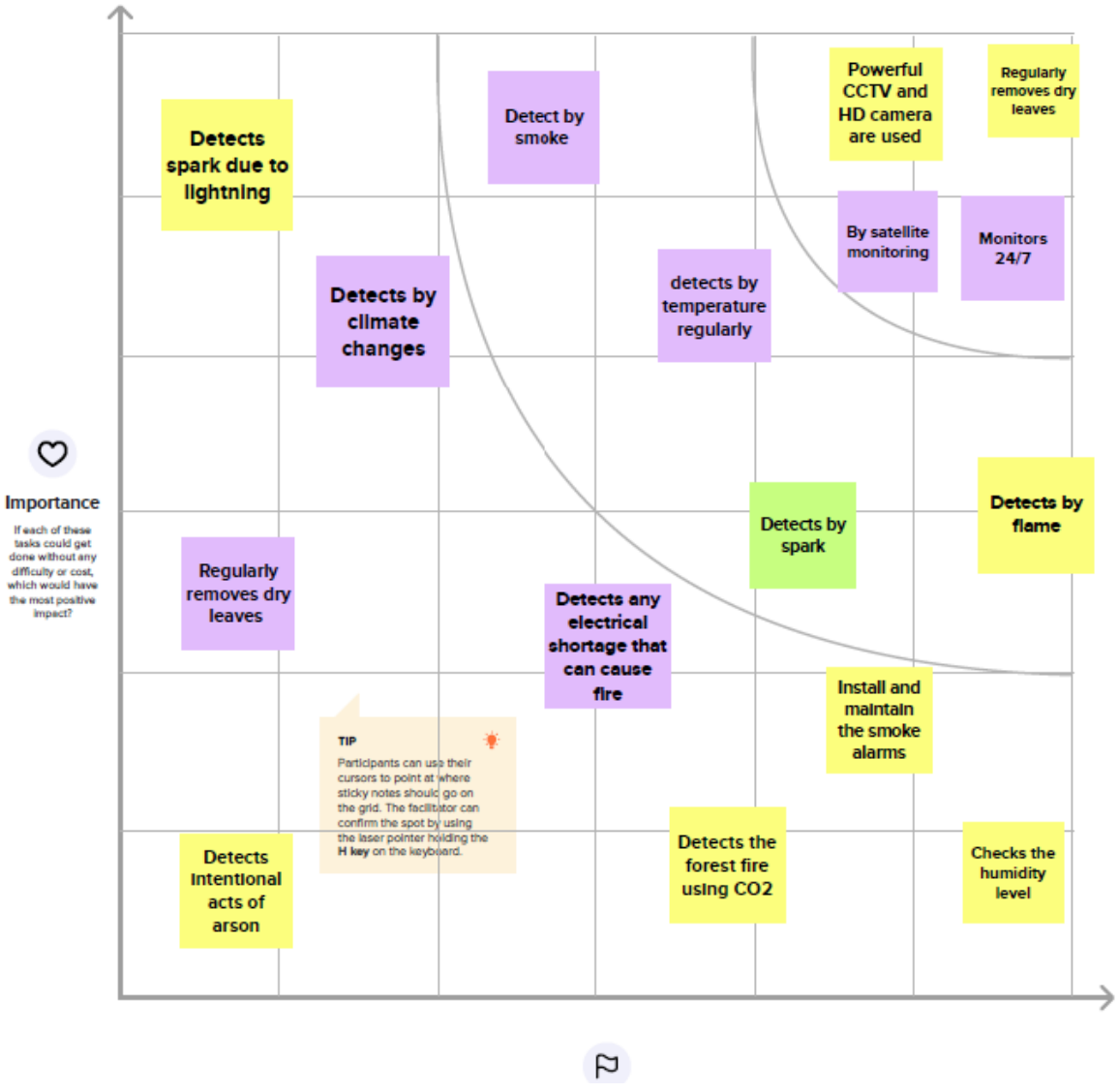
P.Jeno Jency

- Detects by temperature regularly
- Monitors 24/7

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



Proposed solution :

Proposed Solution Template

Date	14 october 2022
Team ID	PNT2022TMID41540
Project Name	Project – Early forest fire detection System
Maximum Marks	2 Marks

Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A forest fire risk prediction algorithm, based on support vector machines, is presented. The algorithm depends on previous weather conditions in order to predict the fire hazard level of a day.
2.	Idea / Solution description	Use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video from the drone cameras.
3.	Novelty / Uniqueness	Real time computer program detect forest fire in earliest before it spread to large.
4.	Social Impact / Customer Satisfaction	Blocked roads and railway lines, electricity, mobile and land telephone lines cut, destruction of homes and industries.
5.	Business Model (Revenue Model)	The proposed method was implemented using the python programming language on the core i3 or greater(CPU and 4GB RAM).
6.	Scalability of the Solution	Computer vision models enable lan cover classification and smoke detection from satellite and ground cameras.

Problem solution fit:

Project Title: EMERGING METHODS FOR EARLY FOREST FIRE DETECTION **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMID41540

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Forest officer Common people

6. CUSTOMER CONSTRAINTS

Satellite allow for detection and monitoring a range of fires,providing information about the location,duration,size,temperature and power output of those fires that would otherwise be unavailable.Satellite data is also critical for observing and monitoring smoke from the fires.

5. AVAILABLE SOLUTIONS

Avoid burning waste around dry grass.obey local laws regarding open fires,including campfires have firefighting tools nearby and handy.
Use fire resistant roofing materials.
Undertake technical checkups regularly.
Monitoring weather analytics,

Explore AS,differentiate

Focus on J&P, tap into BE,

J&P

2. JOBS-TO-BE-DONE / PROBLEMS

Satellite remote sensing offers a useful tool for forest fire detection, monitoring, management and damage assessment. During a fire event, active fires can be detected by detecting the heat, light and smoke plumes emitted from the fires. This application uses real time satellite data to detect and monitor forest fires(sending alerts to mobile devices),and understand fire patterns.

RC

9. PROBLEM ROOT CAUSE

Forest fires cause lots of damage, some of them are-loss of wildlife habitat, extinction of plants and animals, destroy the nutrient rich top soil, reduction in forest cover,loss of valuable timer resources, ozone layer depletion, loss of live hood for tribal people and poor people, increase in global warming.

BE

7. BEHAVIOUR

When the people don't have knowledge about forest fire.

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

Identify strong

3. TRIGGERS

Human caused fires result fires result from camfires left unattended, the burning of debris, equipment use and malfunctions, negligently discared cigarettes, and intentional acts of arson.

4. EMOTIONS: BEFORE / AFTER EM

Before: Unsafe and worries about lives and belongings
After: Safely and relief.

10. YOUR SOLUTION SL

For this problem we use image processing and video analysis so by using satellite imaagr processing we can able to find the fire at the early stage and stop spreading fire in the forest.this model is mainly build by using CNN and machince learing and deep learning.

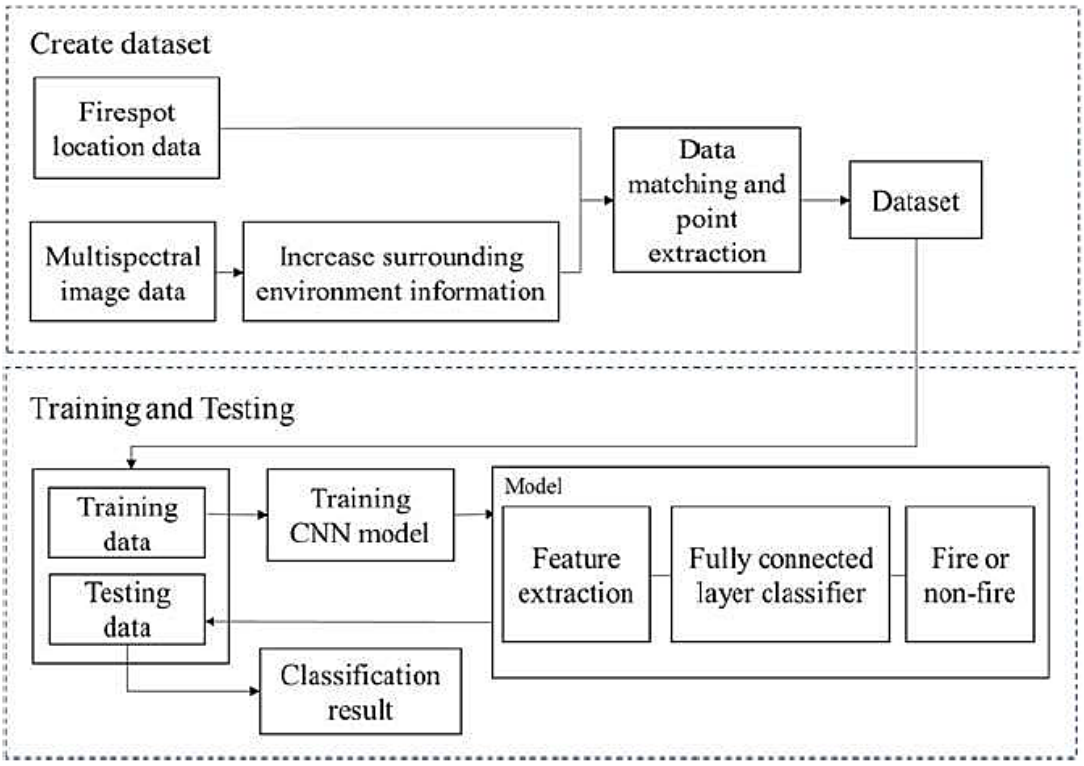
CHANNELS of BEHAVIOUR CH

ONLINE: Fire alert sensor

OFFLOFFINE: Fire awareness program

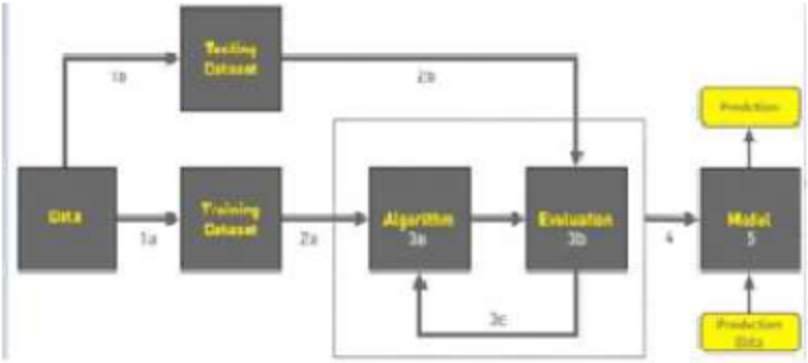
4. REQUIREMENT ANALYSIS

4.1 Functional requirement

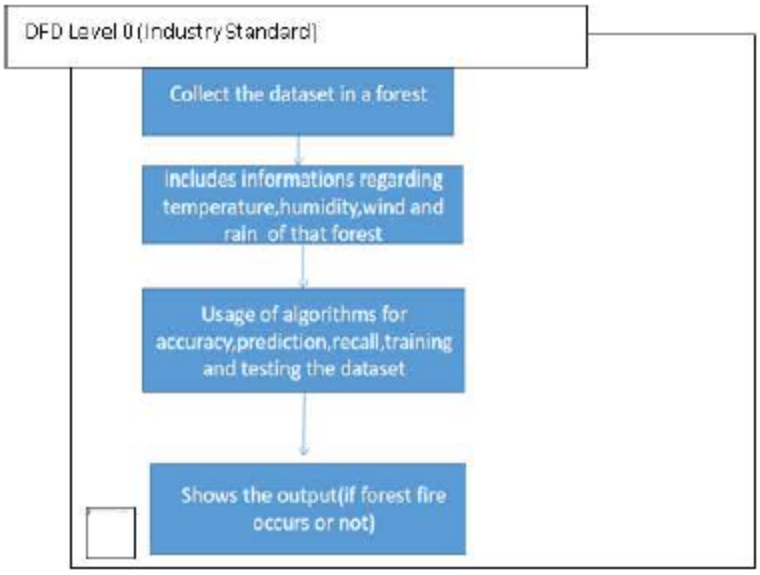


5. PROJECT DESIGN

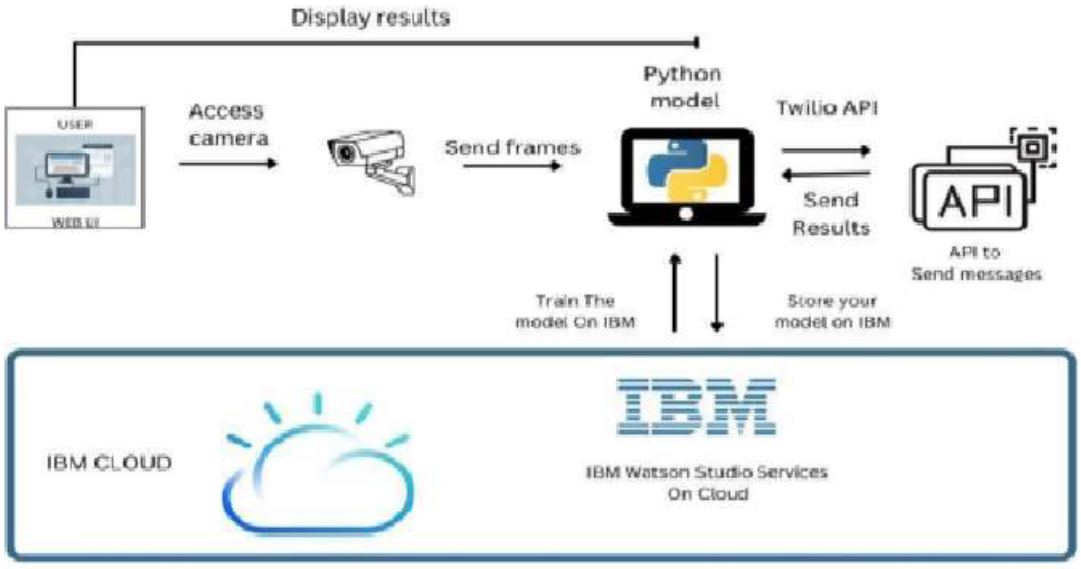
5.1 Data Flow Diagrams



1. COLLECT DATA
2. EVALUATE DATASET
3. IMPLEMENT ALGORITHMS
4. EVALUATE THEACCURACYOF EACH ALGORITHMS



5.2 Solution & Technical Architecture:



5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Environmentalist	Collect the data	USN-1	As an Environmentalist,it is necessary to collect thedata of theforest whichincludes temperature, humidity,wind and rain of theforest	It is necessary to collectthe right data else the prediction may becomewrong	High	Sprint-1
		USN-2	Identify algorithms that can be used forprediction	To collect the algorithm to identify theaccuracy level of each algorithms	Medium	Sprint-2
		USN-3	Identify the accuracy of each algorithms	Accuracy of each algorithm-calculated so that it is easy to obtainthemost accurate output	High	Sprint-2
		USN-4	Evaluate the Dataset	Data is evaluated beforeprocessing	Medium	Sprint-1
		USN-5	Identify accuracy,precision,recall of each algorithms	These values are important for obtaining theright output	High	Sprint-3
		USN-6	Outputs fromeachalgorithm are obtained	It is highly used to predictthe effect and to take precautionary measures.	High	Sprint-4

6.Project Planning and scheduling:

Sprint Delivery schedule:

Sprint	Total story points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint ReleaseDate(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

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

7.1 Feature 1:

We uploaded the dataset that is given and have divided the classes into train set and data set and preprocessed the image.The output is shown here.

In [3]:
```
#Applying ImageDataGenerator functionality to trainset
x_train=train_datagen.flow_from_directory('/content/drive/MyDrive/Dataset/train_set',target_size=(128,128),batch_size=32,class_mode='binary')
```

```
Found 439 images belonging to 2 classes.
```

In [4]:
```
#Applying ImageDataGenerator functionality to testset
x_test=test_datagen.flow_from_directory('/content/drive/MyDrive/Dataset/test_set',target_size=(128,128),batch_size=32,class_mode='binary')
```

```
Found 121 images belonging to 2 classes.
```

7.2 Feature 2:

After the image preprocessing we have done the model building.The model building output is shown here.

In [27]:
```
#Load the saved model
model = load_model("forest1.h5")
```

In [29]:
```
img=image.load_img('/content/drive/MyDrive/Dataset/test_set/with fire/100002_CarrFire_010_large_700x467.jpg')
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)
```

In [31]:
```
pred=model.predict(x)
```

```
1/1 [==============================] - 0s 31ms/step
```

In [32]:
```
pred
```

Out[32]:
```
array([[1.]], dtype=float32)
```

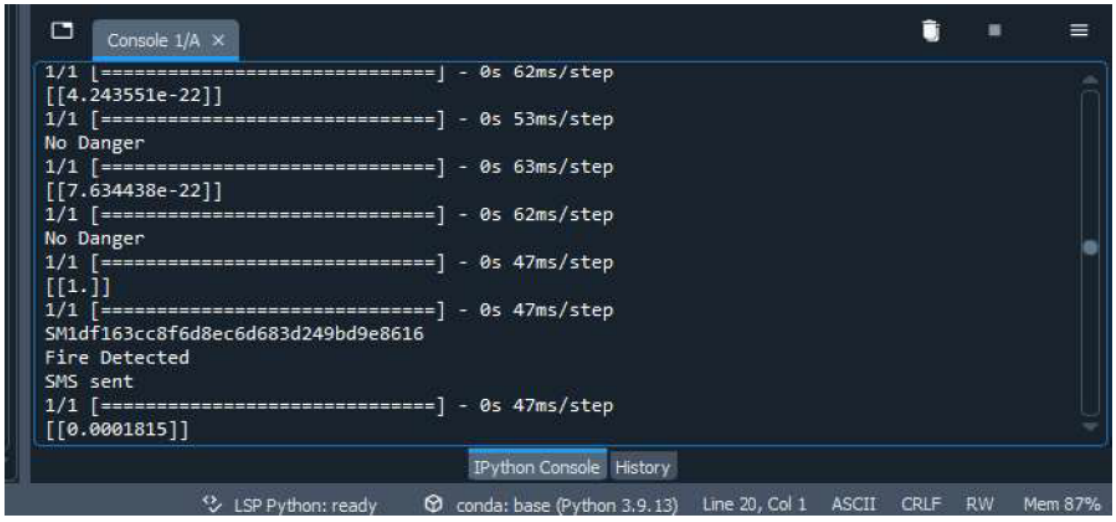
In [ ]:
```

```

By using the above forest1.h5 model we can take our desired output according to the input.

8. TESTING

8.1 Test Cases:

By the showing image of forest fire the desired output of "Forest fire is detected,stay alert" is sent via SMS form twilio service.By showing the image of forest the desired output is no danger.



8.2 User Acceptance Testing:

We have tested our project by showing the image of forest with fire and forest without fire.The output is shown above.

9. RESULTS

9.1 Performance Metrics:

Model evaluation

In [27]:
```
#Load the saved model
model = load model("forest1.h5")
```

In [29]:
```
img=image.load_img('/content/drive/MyDrive/Dataset/test_set/with fire/180802_CarrFire_010_large_700x467.jpg')
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)
```

In [31]:
```
pred=model.predict(x)
```

```
1/1 [==============================] - 0s 31ms/step
```

In [32]:
```
pred
```

Out[32]:
```
array([[1.]], dtype=float32)
```

In [ ]:

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1. Avoid Smoke Inhalation. The most important reason is perhaps the only one you really need.
2. Early Detection. The earlier a fire is detected, the faster it will be that firefighters will respond.
3. Insurance Discounts.
4. 24/7 Monitoring.
5. Easy & Affordable.

DISADVANTAGES:

1. The system is essentially useless if the batteries aren't charged, since it won't work properly.
2. There is a bit of a burden to business owners to always remember to keep the batteries fresh so the system operates properly when you need it most.

11. CONCLUSION

Early fire detection is best achieved by the installation and maintenance of fire detection equipment in all areas of the forest.

12. FUTURE SCOPE

The future will be with multicriteria detection in which the detector will be more of a sensor, with the detection more for the products of combustion, such as carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides in addition to heat and particulate matter.

13. APPENDIX

Source Code: Python code

```
#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
#imort playsound package
from playsound import playsound

#load the saved model
model = load_model(r'forest1.h5')
#define video
video = cv2.VideoCapture(0)
#define the features
name = ['forest','with forest']

account_sid = 'AC557b4c7a685d072baa73125f61031af3'
auth_token = 'a59cd5e5fdfddcc9ab008273557f8f78'
client = Client(account_sid, auth_token)

message = client.messages \
    .create(
        body='Forest fire is detected , stay alert',
        from_='+14247991869',
        to='+918940722793'
    )

print(message.sid)
```

```
#import opencv library
import cv2
#import numpy
import numpy as np
#import images and load_model function from keras
from keras_preprocessing import image
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'forest1.h5')
video = cv2.VideoCapture(0)
name = ['forest','with fire']

while(1):


    success, frame=video.read()
    cv2.imwrite("image.jpg",frame)
    img=image.load_img("image.jpg",target_size=(128,128,3))
    x=image.img_to_array(img)
    x=np.expand_dims(x,axis=0)
    pred=model.predict(x)
    p=pred[0]
    print(pred)
    ##cv2.putText(frame,"predicted class= "+str(name[p]), (100,100),
     ##         cv2.FONT_HERSHEY_SIMPLEX, 1, (0,0,0), 1)
    pred=model.predict(x)


    if pred[0]==1:


        account_sid = 'AC557b4c7a685d072baa73125f61031af3'
```

```
        auth_token = 'a59cd5e5fdfddcc9ab008273557f8f78'
        client = Client(account_sid, auth_token)
        message=client.messages\
        .create(
        body='Forest Fire is Detected, stay alert',
        from_='+14247991869',to='+918940722793')

        print(message.sid)
        print('Fire Detected')
        print('SMS sent')
        playsound(r'C:\Users\My\Downloads\buzzer.mp3')

    else:
        print("No Danger")

        cv2.imshow("image",frame)

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

GitHub Link:https://github.com/IBM-EPBL/IBM-Project-19714-1659704982

Project Demo Link: