# EMERGING METHODS OF EARLY DETECTION OF FOREST FIRES

**TEAM ID:PNT2022TMID41540**
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# 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.This combination is a technology to create a system capable to detect wildfires more accurately. This project examines current state-of-the-forest using image processing and detect the forest fires.

## 1.2 PURPOSE

Emerging Methods for Early Detection of Forest Fires The project aims to build a model that detect forest fire using convolutional neural networks.

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# 2.LITERATURE SURVEY

## 2.1 Existing problem

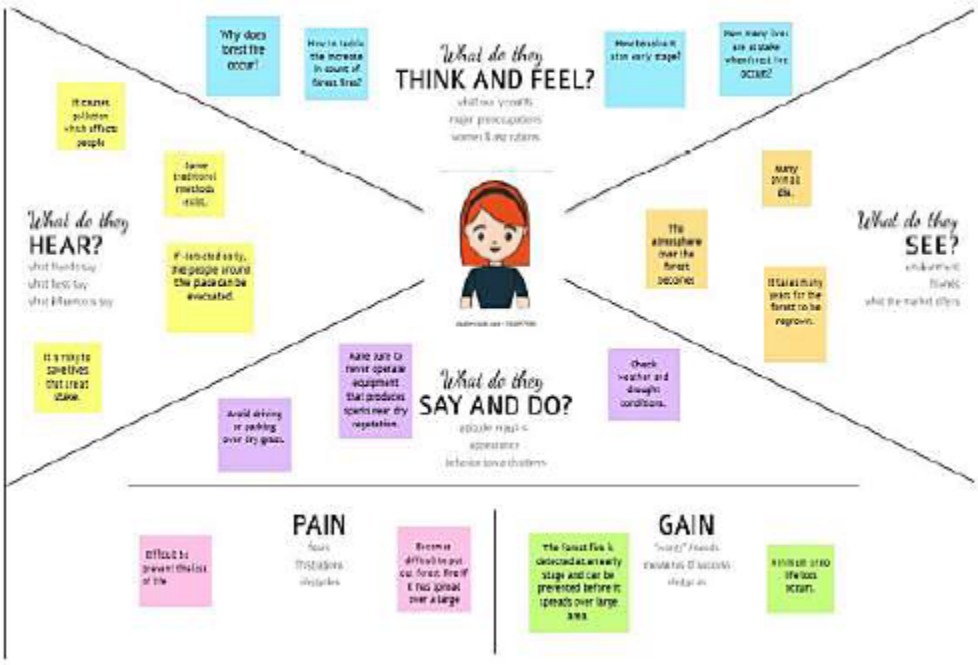
Its is different to predict and detect forest fire in a sparsely populated forest are and its more difficult if the prediction is done using ground based methods like camera or video based approach.satellites can be an important source of data prior to and also during te fire due its reliability and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



# 3.2 Ideation&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 →

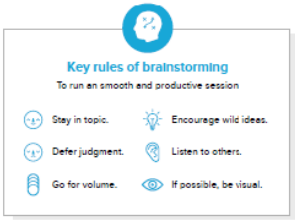
### 1 Define your problem statement

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]?



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

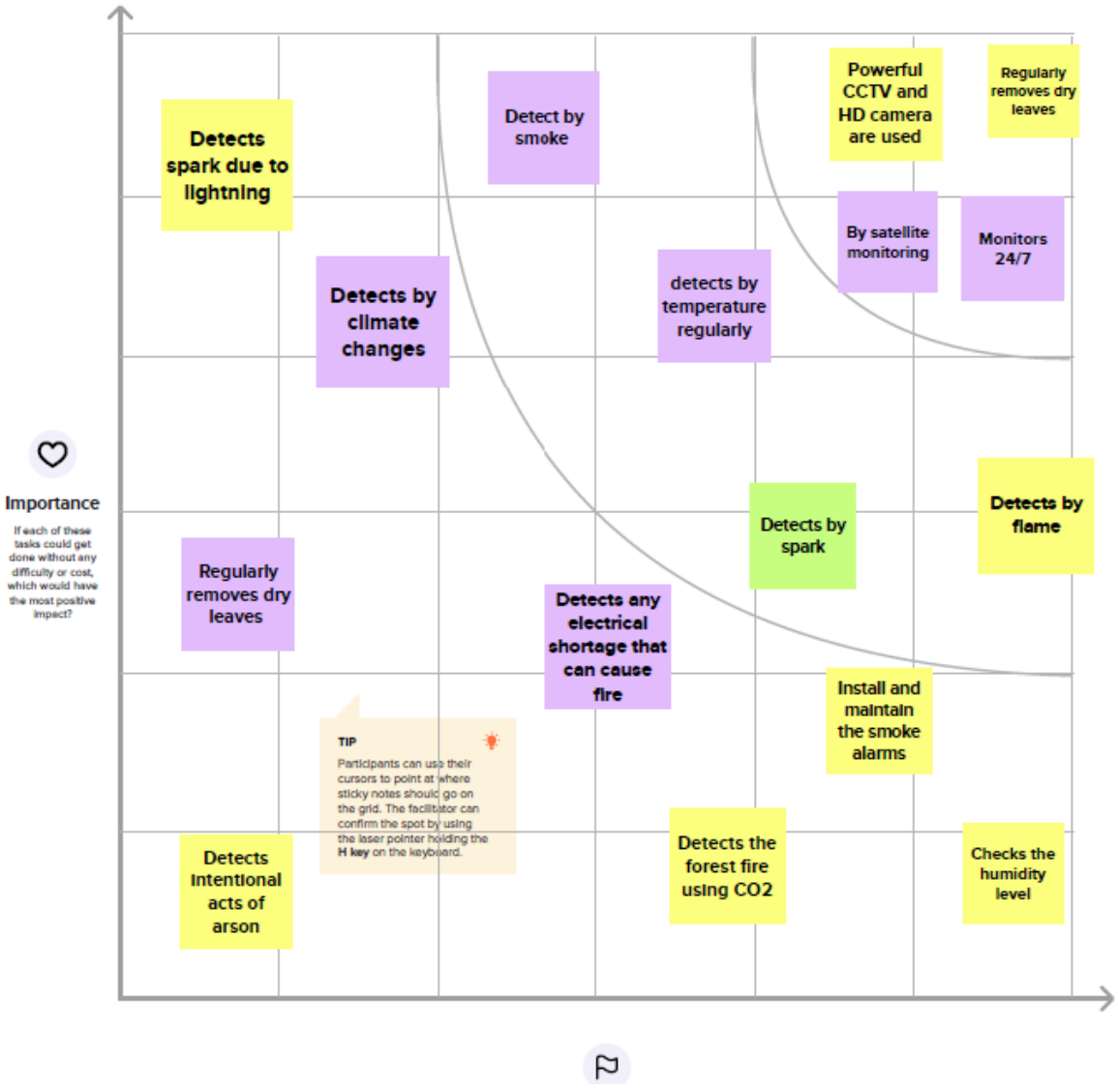
### P.Jeno Jency

- 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 |

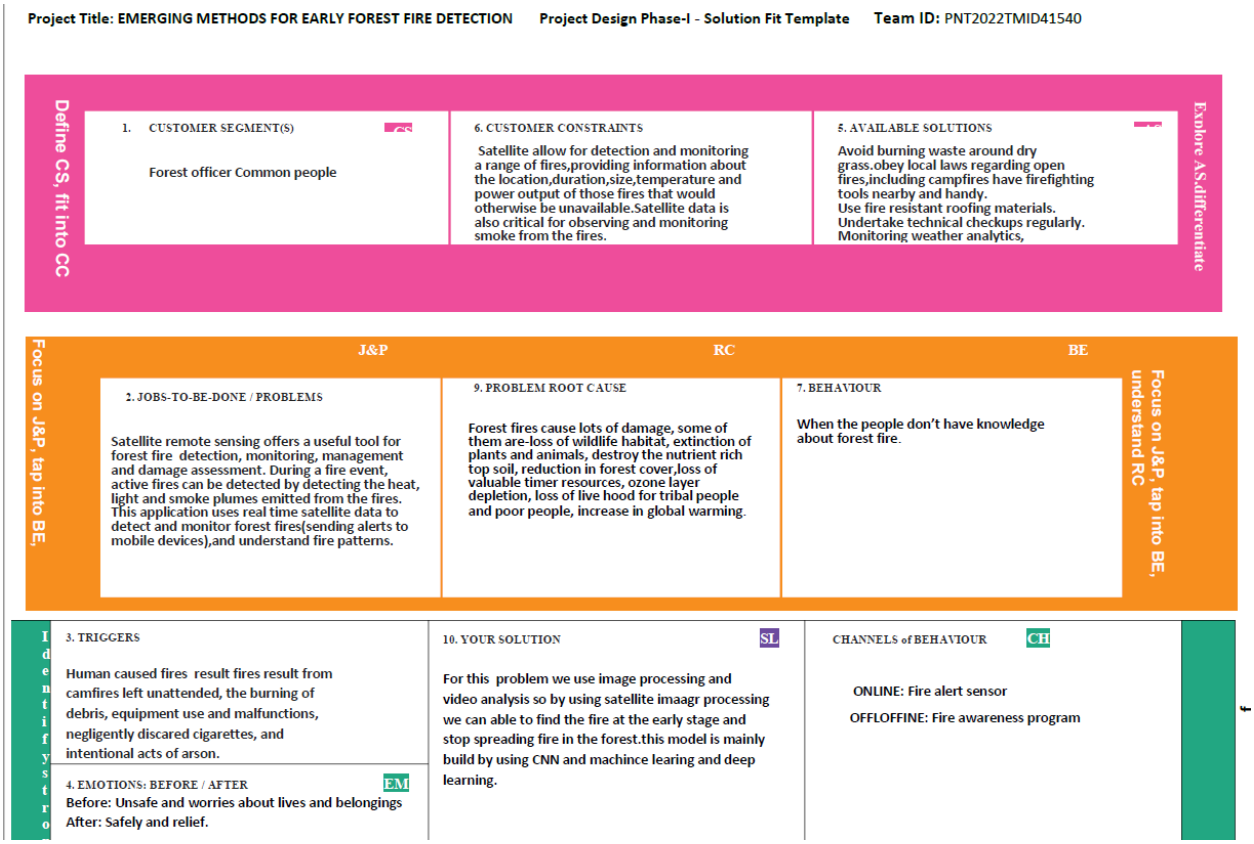
**Proposed Solution Template:**

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. |

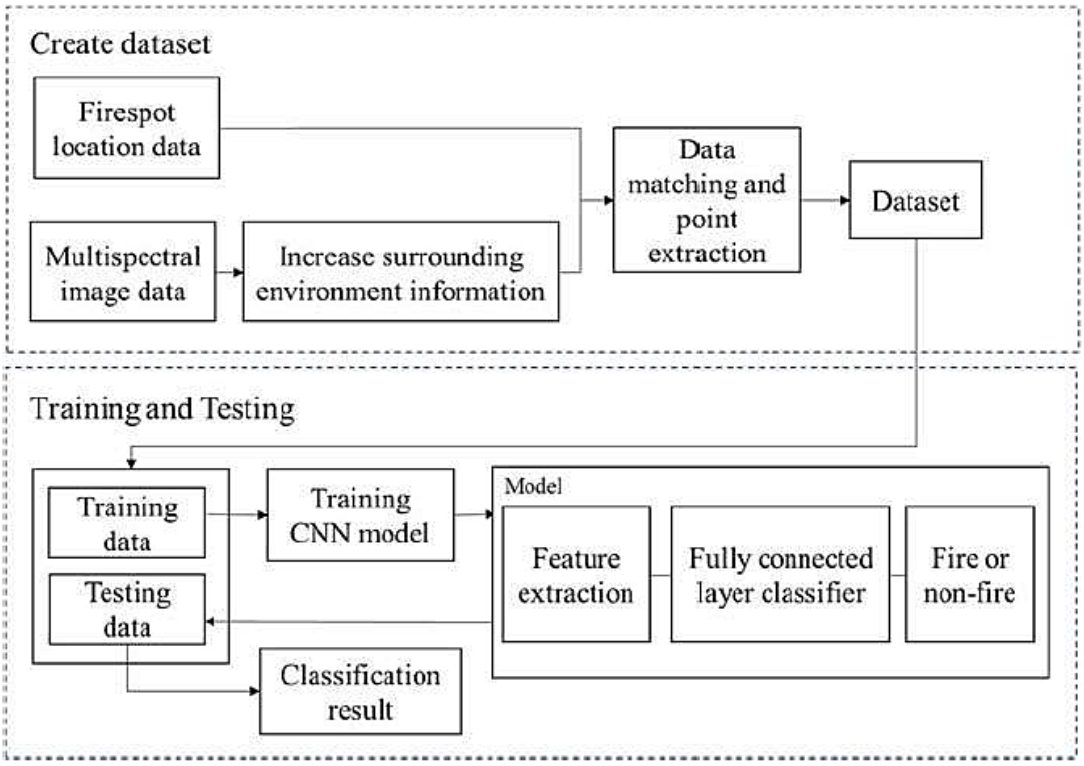
# Problem solution fit:

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



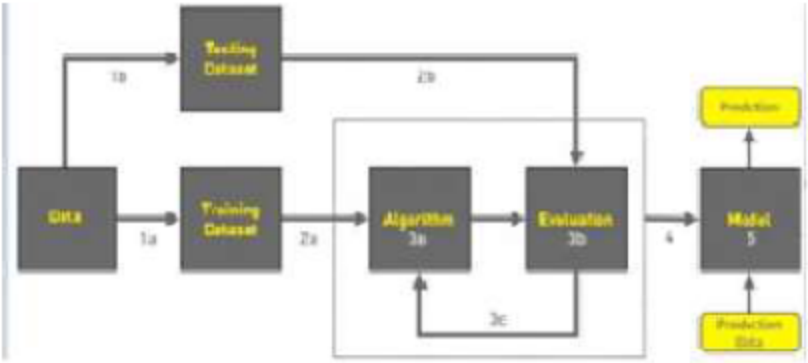
# 4. REQUIREMENT ANALYSIS

## 4.1 Functional requirement

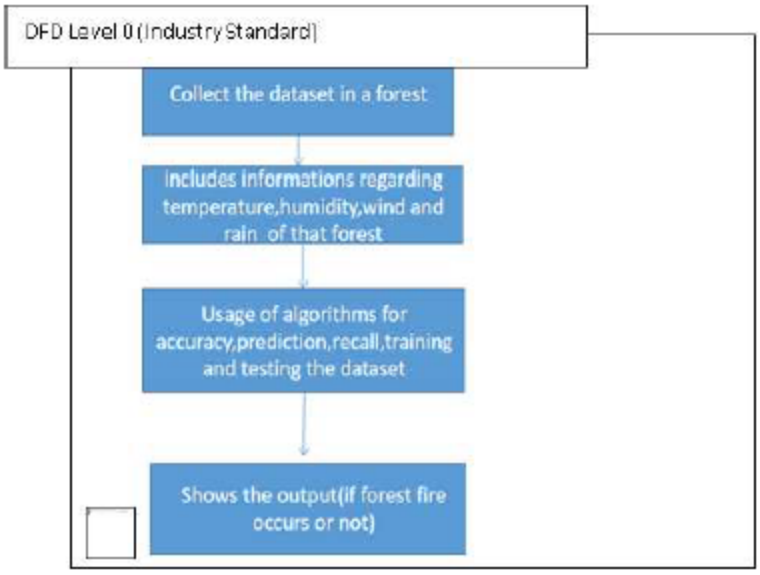


# 5. PROJECT DESIGN

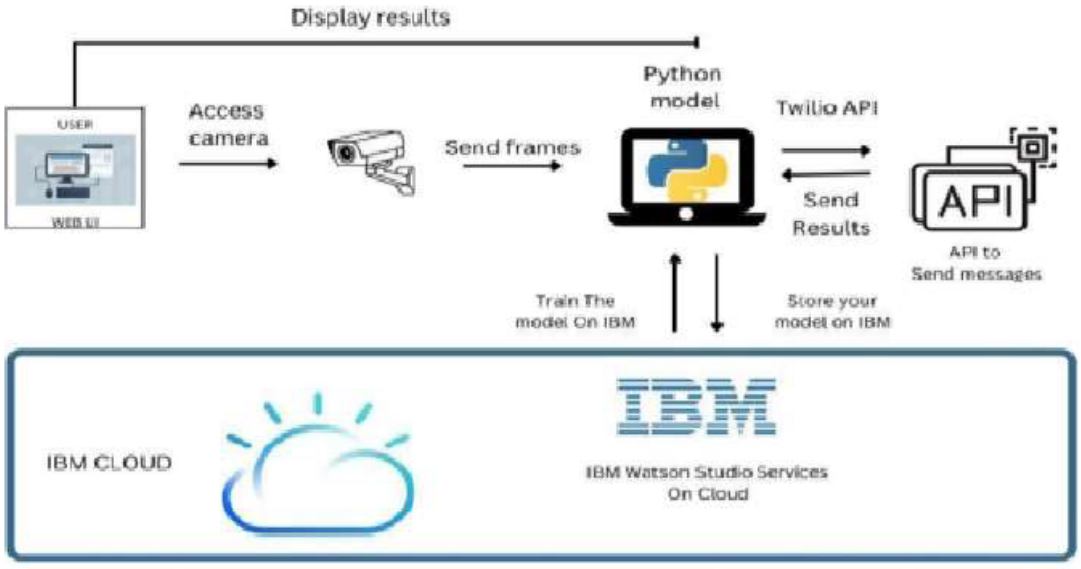
## 5.1 Data Flow Diagrams




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:

## 6.2 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)
```

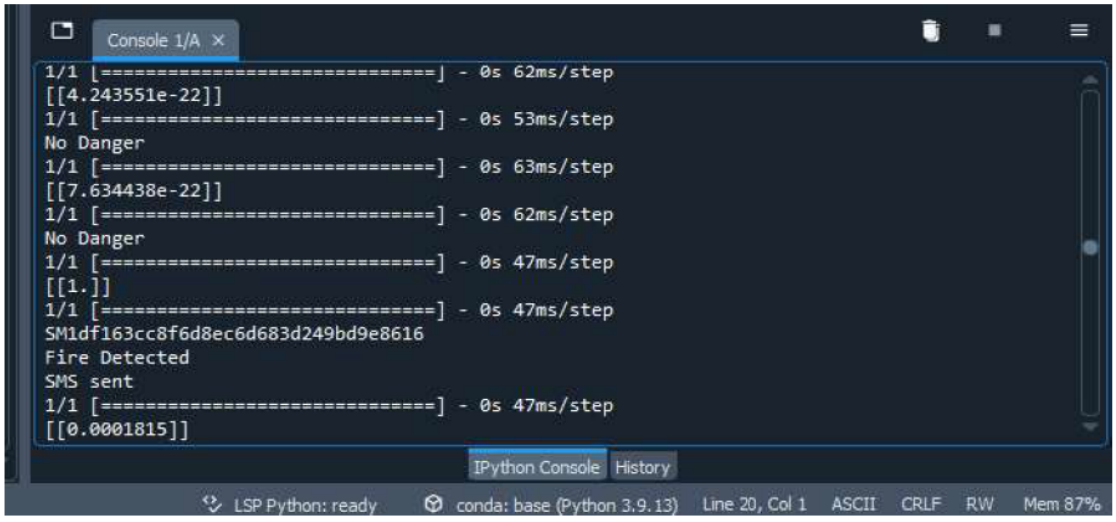
In [ ]:
```

```

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 Detcted,stay alert',
from_='+1424799189',to='+91890722793'

print(message.sid)
print('Fire Detected')
print('SMS sent')
playsound(r':\users\My\Downloads\buzzer.mps')
 else:
print("No danger")

cv2.imshow("image",frame)

if cv2.waitkey(1)&oxFF==ord('a');

if cv2.waitkey(1)&0xFF('a')
break
video.release()
cv2.destroyAllWindows()
```

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

**Project Demo Link:** https://youtu.be/J1AWJM1Npzg