Project Report

Emerging Methods for Early Detection of Forest Fires

Submitted By

Team ID: PNT2022TMID33633

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CHAPTER 1
INTRODUCTION
1.1 PROJECT OVERVIEW
Continuous monitoring of open space is of the utmost importance for the protection of forests against fire.Collected data in real time provide fast intervention of relevant services to extinguish the fire. Timely information about the appearance of fire reduce the number of areas affected by this fire and thereby minimizes the costs of fire extinguishing and the damage caused in the woods. The current way of detecting fire in an open area in Serbia is not in real time, and due to this, it is necessary to implement modern technology of collecting data related to early detection of fires. This paper

presents an integral project of forest-fire protection on the territory of Serbia in order to provide the reference for the application of terrestrial automated system for early detection and prediction of forest fires. An automated system could be comprised of infrared and high-resolution TV camera surveillance, covering a large part of the forest area and forest land.

1.2 PURPOSE

The flow of the proposed architecture is shown in Figure 1. The video input is captured from the camera, and the other inputs, such as wind speed, wind directions, and IR image sensing, are calculated using the sensors mounted on the UAV for navigation. These images are provided as input to the deep learning models, and they check for the existence of the fire. The region is predicted clearly since there is the possibility of more projections of the images provided to the model due to the 3D modeling. Further detection is made, and the details are stored in the database for further analysis.

CHAPTER 2 LITERATURE SURVEY

2.1 EXISTING PROBLEM

Some of the relevant literary works in this field are briefed below: Forest covers one-fourth of Karnataka's land area; India's forests and biodiversity are under severe threat and pressure. Forest fires are generally caused by extreme hot and dry weather, lightning, and human carelessness. To protect these vast swaths of forest land, early precautionary measures to control fire spread must be implemented.

2.2 REFERENCES

[1] Official webpage of the European Forest Fire Information System at: http://effis.jrc.ec.europa.eu/
[2] Official webpage of the Copernicus Earth Observation Programme at: http://www.copernicus.eu

2.3 PROBLEM STATEMENT DEFINITION

An Enormous disastrous fire that spread over a timberland or area of forest which prompts harm in Natural life, people, property and Climate. The significant Causes Are Lightning. Flashes from Rock falls. Volcanic Ejection or some other manual Start from

the People deliberately which prompts the accompanying drawbacks: A backwoods fire sets up the potential for soil erosion to occur, Forest fires always bring
death to life of humans and animals, Uncontrolled fires can cause localized air pollution, Homes can be destroyed without compensation.

CHAPTER 3 IDEATION AND PROPOSED SOLUTION

1. Imaging sensors in sun-synchronous satellites include three multispectral imaging sensors,
namely advanced very-high-resolution radiometer moderate resolution imaging spectro radiometer and visible infrared imaging radiometer suite whose data have also been used for wildfire detection. The advanced very-high-resolution radiometer is a multipurpose imaging instrument that measures the reflectance of the Earth and has been used for global monitoring of cloud cover, sea surface temperature, ice,
snow, and vegetation cover characteristics.
2. Regarding satellite imagery from geostationary satellites, important work for fire and smoke
detection has already been performed using the advanced Himawari imager sensor of the
Himawari-8 weather satellite. Himawari 8 is a new generation of Japanese geostationary weather
satellites operated by the Japan Meteorological Agency. AHI-8 has significantly higher radiometric,
spectral, and spatial resolution than its predecessor.

3.1 EMPATHY

Title : Emerging Methods for Early Detection of forest fires

Domain name : Artificial Intelligence

Leader Name : Vasuki P

Team Members : Saranya K

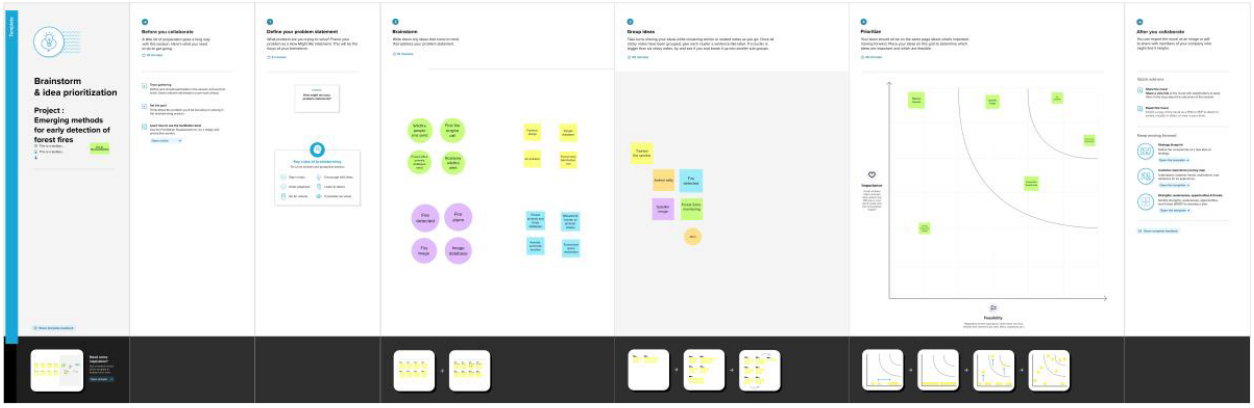
Kiruthika P

Vijayalakshmi G

Mentor Name : Mahesh Kumar K

EMPATHY MAP:

3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

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)	Forest fire prediction constitutes a significant component of forest fire management. It plays a major role in resource allocation, mitigation and recovery efforts. This paper presents a description and analysis of forest fire prediction methods based on artificial intelligence. A novel 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	• Avoid burning wastes around dry grass. • Don't start a fire on a windy day. • Use a can or fire pit. • Never burn household wastes when any regulations of wildfire prevention policy prohibit it. • Don't throw explosives and combustibles into the fire.
3.	Novelty / Uniqueness	Whenever you smoke, douse your butts with water and place them in a fire-proof container to safely dispose of after you're sure they've gone out. And whatever you do, don't toss them on the ground. The device detects the high temperature , if the forest burns , the smoke will be absorbed and it prevents the forest.
4.	Social Impact / Customer Satisfaction	Forest fires cause a loss of natural resources, depleting of soil biomass resulting in the loss of various mobile nutrient

5.	Business Model (Revenue Model)	• Drones • Robots • satellites.
6.	Scalability of the Solution	Forest fire prediction constitutes a significant component of forest fire management. It plays a major role in resource allocation, mitigation and recovery efforts. This paper presents a description and analysis of forest fire prediction methods based on artificial intelligence. A novel 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 -The problem is done.

3.4 PROBLEM SOLUTION FIT

Problem Solution fit

Project name:

Team Id : PNT2022TMIDxxxxxx

1.Customer segments:- In the early days for detecting the fire hazards by following some segments 1.Terrestrial Systems 2.Traditional Methods 3. Deep Learning Methods these are the segments which they used in their early days	6.Customer constrains:- The primary constraint on the fire detection system is to detect a developing fire prior to belt ignition, or as quickly as possible thereafter before the onset of rapid flame spread can begin	5.Available solutions Ionization smoke detectors (the most common in home use) detect the particles in smoke. As smoke passes through the chamber, the particles are ionized. These particles may then be detected by charged plates in the detector
2.Jobs to be done :- When the fire alarm system detects smoke, heat, or water movement, it alerts occupants of the building using both audible and visible alarms. These alarms will be bright, loud, obnoxious, and impossible to ignore, which help mobilize individuals to follow your evacuation plan.	9.Problem route cause:- Fire alarm systems are in place to do two major things; detect fire and alert occupants of the fire while giving them enough time to vacate the area. ... Dirty Smoke Detectors Dirt. Dust. Lint. Small Insects.	7.Behavior:- fire alarm system warns people when smoke, fire, carbon monoxide or other fire-related emergencies are detected. These alarms may be activated automatically from smoke detectors and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations.
3.Triggers:- Automatic initiating devices – automatic initiation devices trigger the fire alarm system automatically when a fire happens. These devices include heat, flame and smoke detection. When heat, flames or smoke is detected, the devices send a signal to a central control panel that activates the system. 4.Emotions:-	10.Solution:- Hence electronic circuits can be designed for the fire based alarms and they provide very high efficiency and can be used for the security reasons. Early fire detection is best achieved by the installation and maintenance of fire detection equipment in all rooms and areas of the house or building.	8.Channels of behavior:- Fire alarm control panel. Initiation devices. Pull stations. Smoke detectors. Duct detectors. Heat detectors. Beam detectors.
we should handle our emotions in the mature way .if you have undergone with an emotion it will be the end for you.so holding the emotion whatever happen just be calm and try to overcome it .we should avoid over emotion in hazard's time.		

CHAPTER 4
REQUIREMENT ANALYSIS
4.1 FUNCTIONAL REQUIREMENTS
FUNCTIONALREQUIREMENTS:
-Following are the functional requirements of the proposed solution

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Video surveillance start	Start surveillance through remote control
FR-2	Forest monitoring	Continuous monitoring through camera
FR-3	Detect fire	Fire is detected through CNN model
FR-4	Alert	Alert the forest officials through message

NON-FUNCTIONALREQUIREMENTS:
-Following are the non-functional requirements of the proposed solution.

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Reliability**	Model is safe to install
NFR-2	**Security**	More secure environment

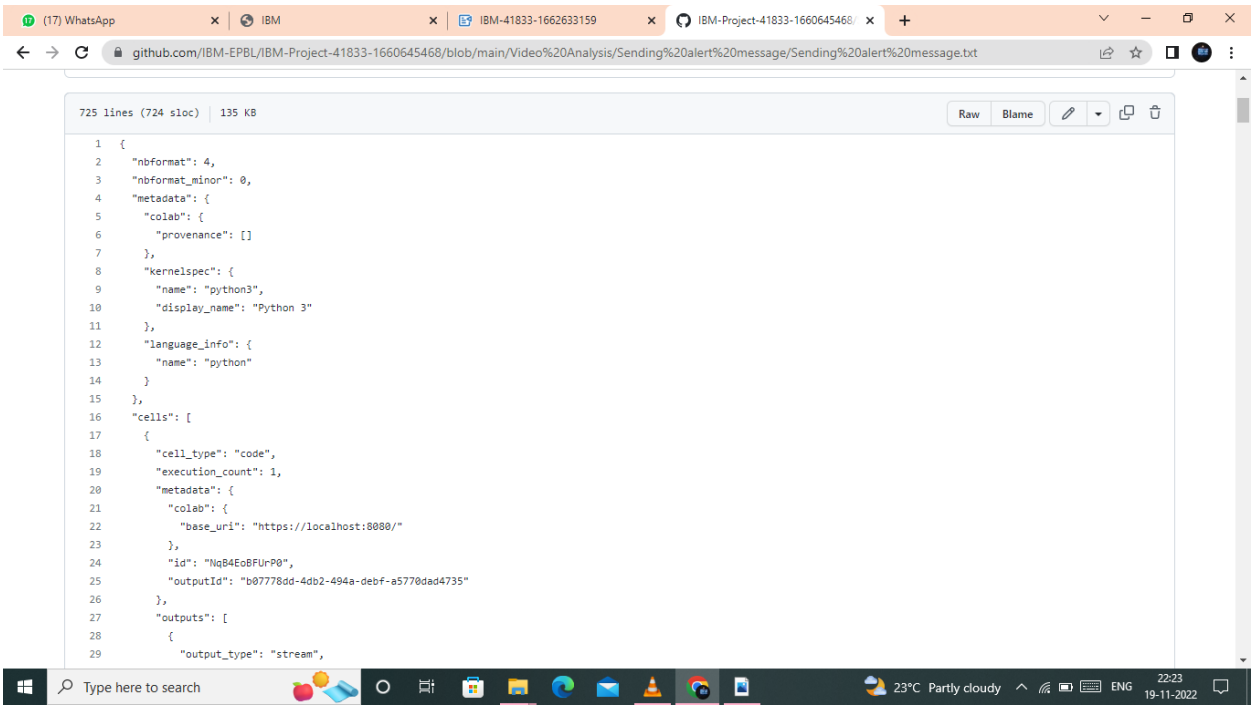
PROJECT DESIGN
6.1 SPRINT PLANNING AND ESTIMATION

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	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application.	20	High	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G
Sprint-2	Input	USN-3	Whenever the fire is detected, the information is given to the database.	20	High	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G
Sprint-2		USN-4	When it is the wildfire then the alarming system is activated.	20	High	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G
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	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G
Sprint-4	Action	USN-6	Required actions will be taken in order to controlled erupted wildfire by reaching as early as possible to the destination with the help of detecting systems.	20	High	Vasuki.P Saranya.K Kiruthika.S Vijayalakshmi.G

CHAPTER 7

CODING & SOLUTIONING

People Send Message: - Sending Alert message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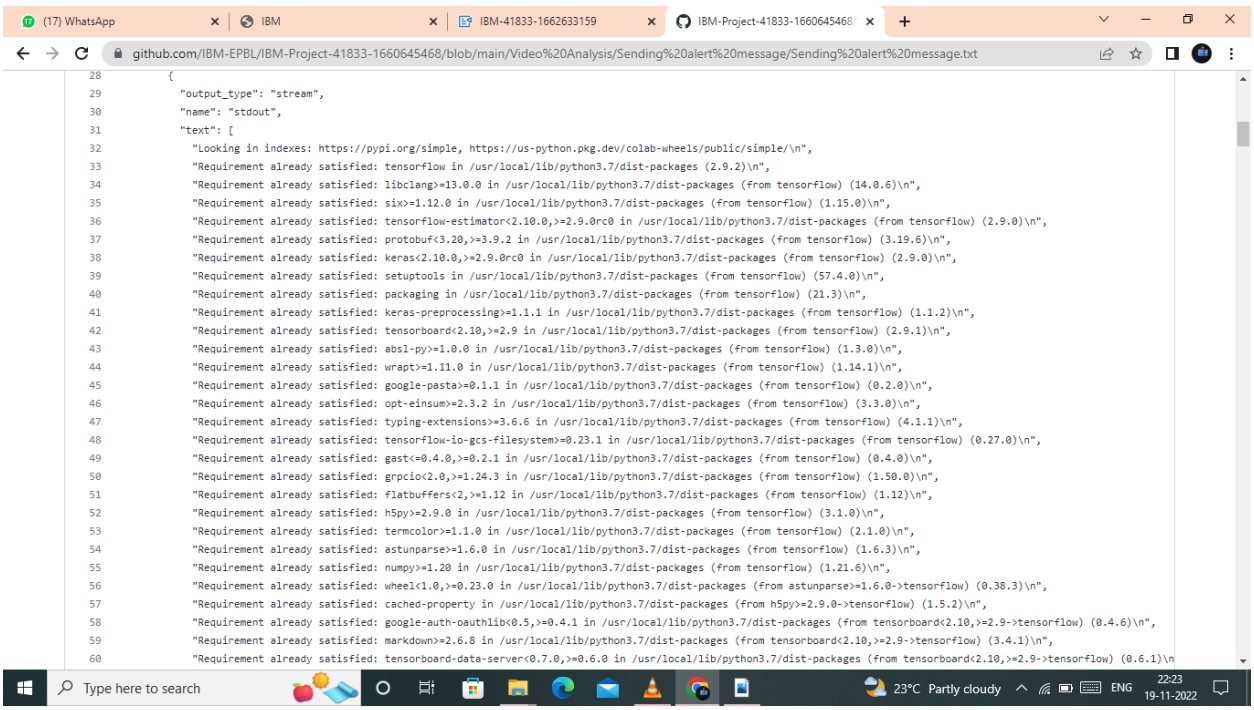
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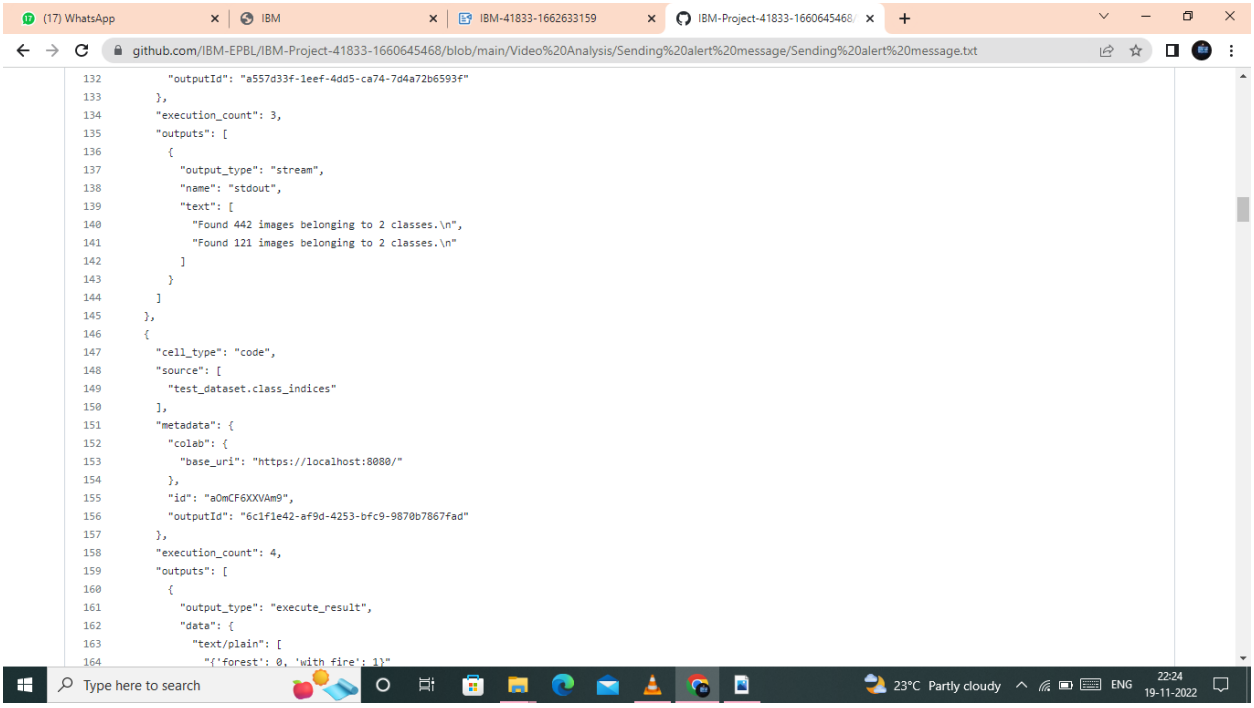
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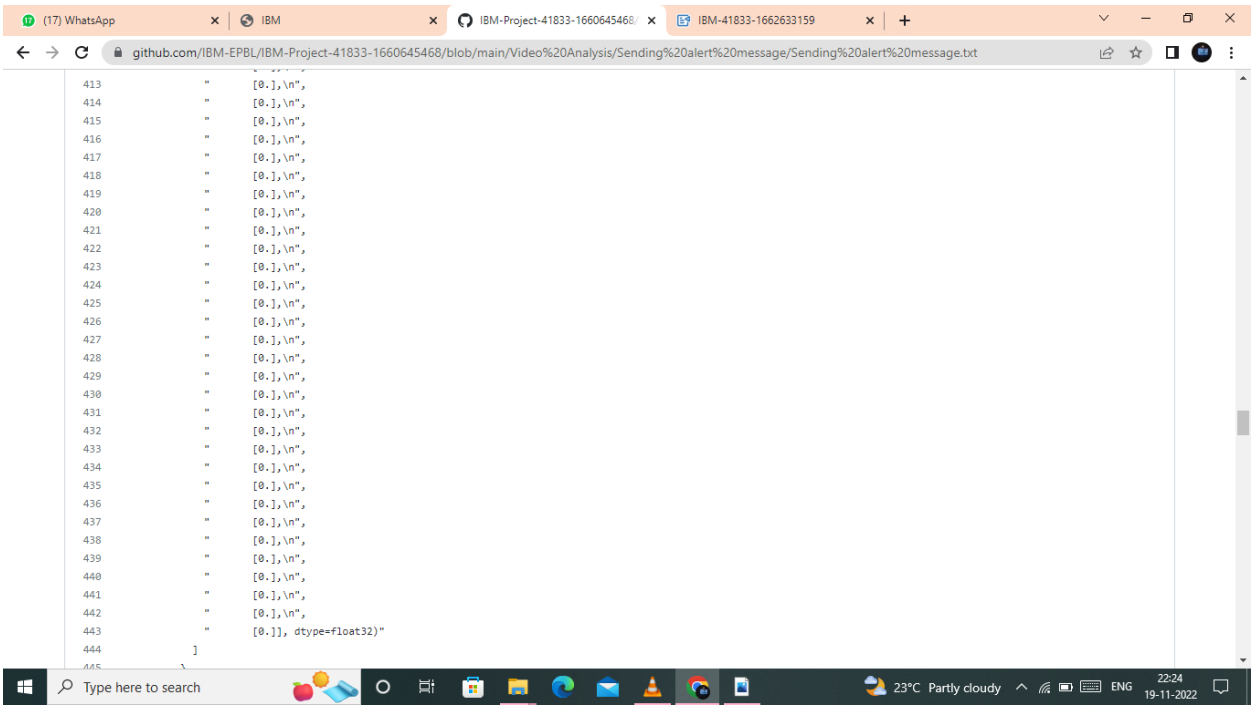
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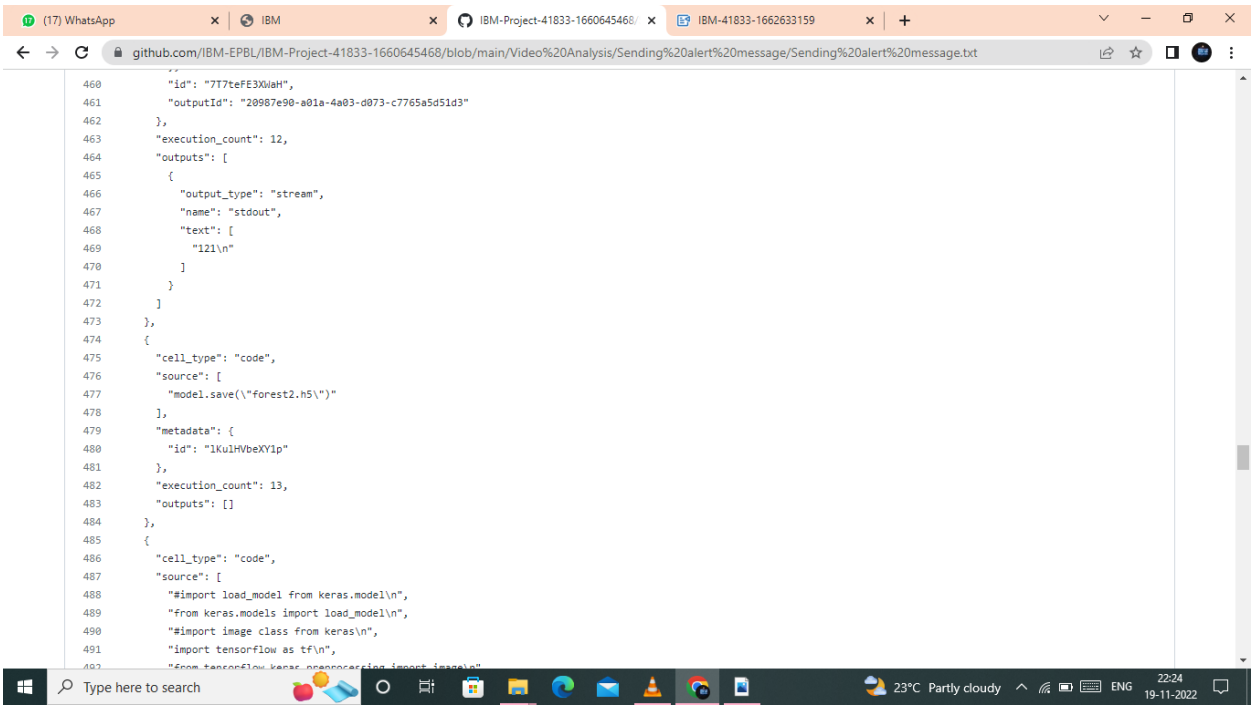
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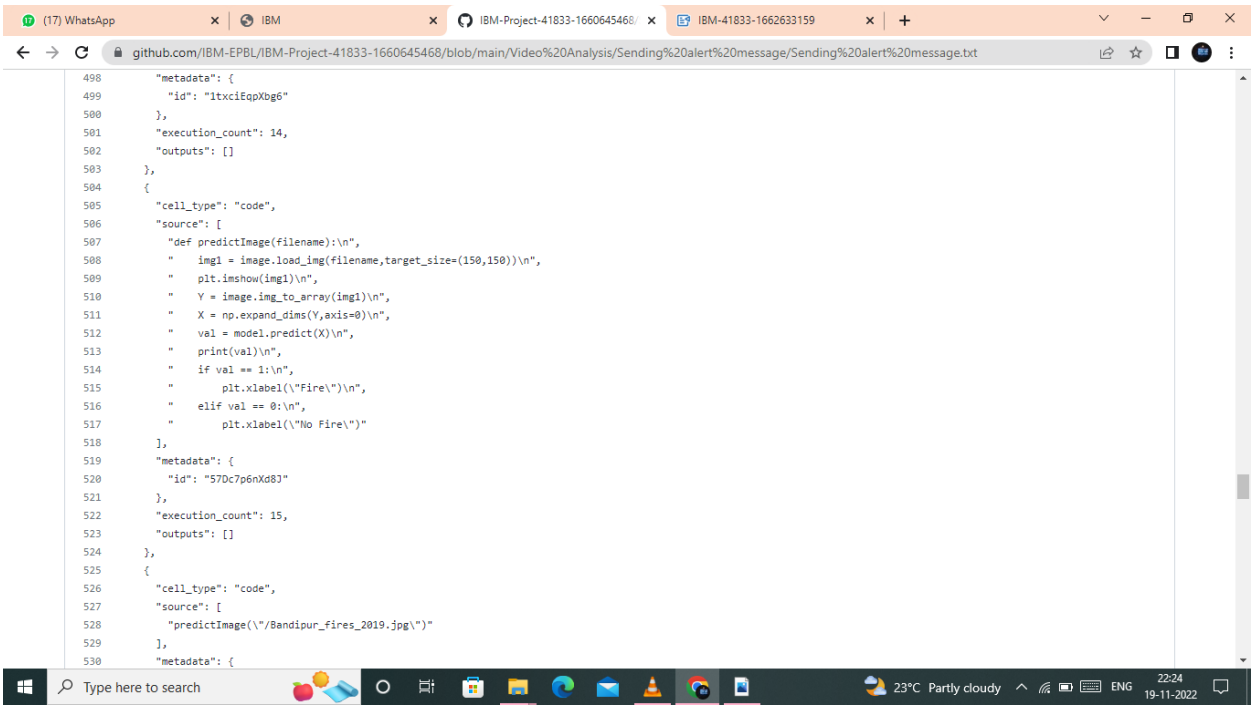
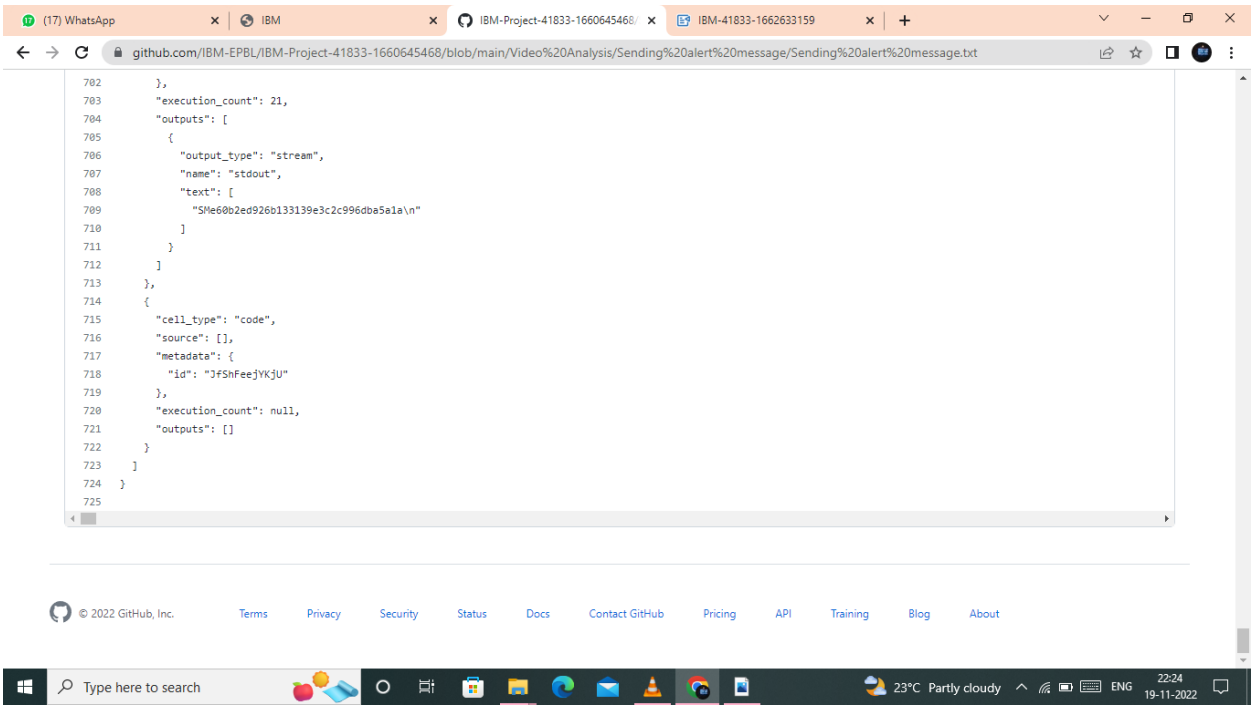


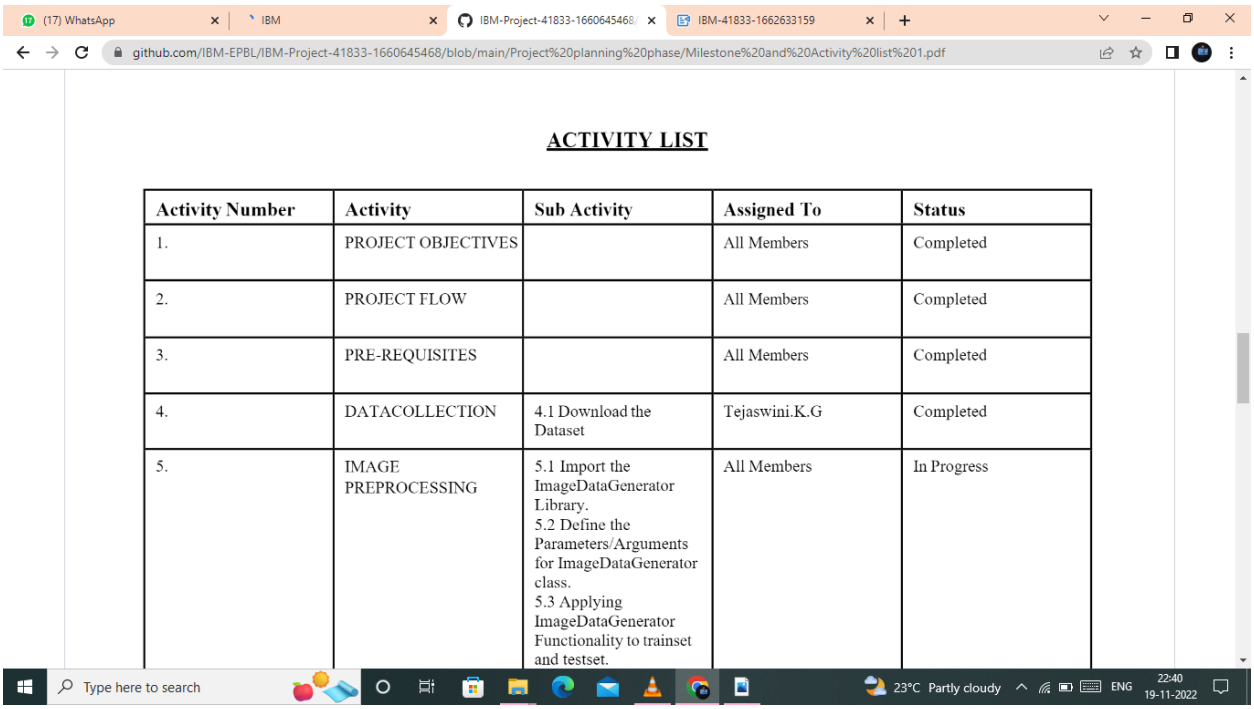


MILESTONE AND ACTIVITY LIST

MILESTONE LIST:

MILESTONE LIST

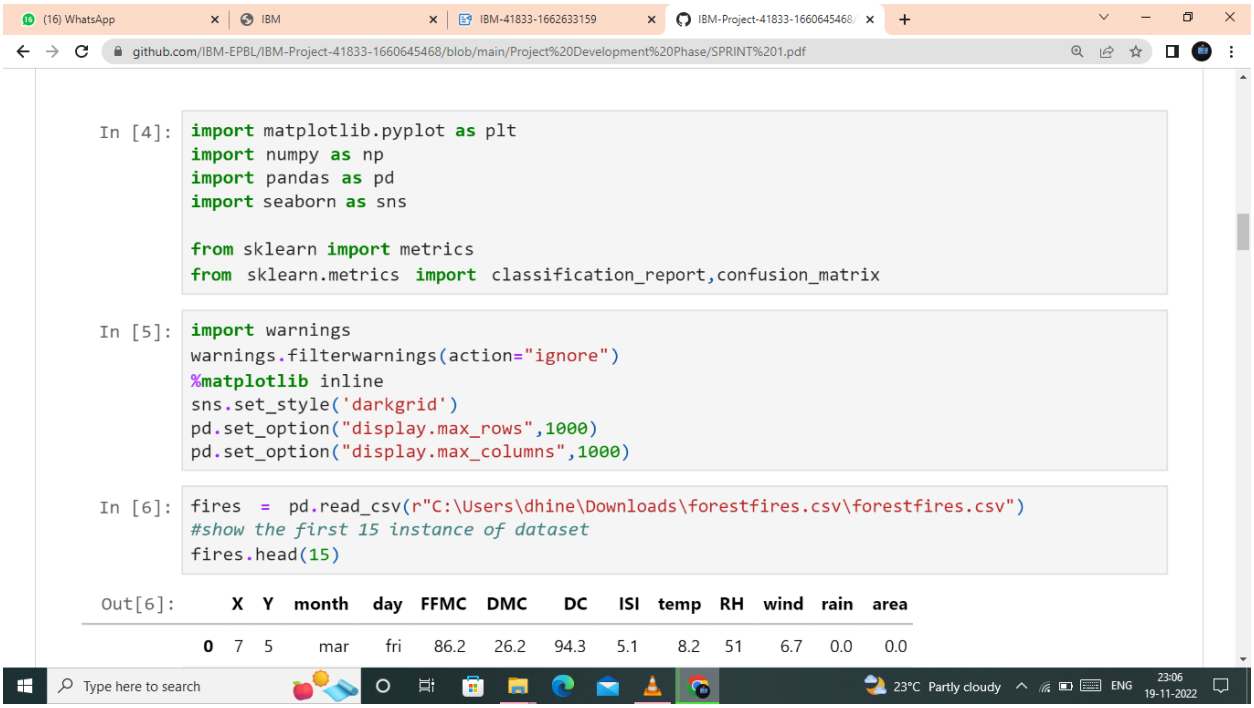
Milestone Name	Milestone Number	Description	Mandatory
Project Objectives	M-01	We will be able to learn to prepare dataset, image processing, working with CNN layers, read images using OpenCV and CNNfor computer vision AI	Yes
Project Flow	M-02	A project management process flowchart is a graphical aid, designed to visualize the sequence of steps to be followed throughout the project management process	Yes
Pre-Requisites	M-03	To complete this project, we should have known following project such as Keras, TensorFlow, Python, Anaconda, OpenCV, Flask, Scikit-learn etc.…	Yes
Prior Knowledge	M-04	One should have knowledge on the Supervised Learning, CNN andRegression Classification and Clustering, ANN	Yes
Data collection	M-05	We can collect dataset from different open sources like kaggle.com,UCI machine learning etc.	Yes
Image Preprocessing	M-06	Importing the ImageDataGenerator libraries, Define Parameters/Arguments for ImageDataGenerator class, Applying Image Data Generator Functionality to trainset and test set	Yes
Model Building	M-07	Importing the model building libraries, Initializing the model, Adding CNN layers, Adding Dense layers, Configuring the learningProcess, Train the model, Save the model, Predictions.	Yes
Video Analysis	M-08	Opencv for video processing, creating an account in twilio service and sending alert message	Yes
Train CNN model	M-09	Register for IBM Cloud and train Image Classification Model	Yes
Ideation Phase	M-10	Prepare Literature Survey on the selected Project and InformationGathering, empathy map and ideation	Yes
Project Design Phase-I	M-11	Prepare Proposed solution , problem-solution fit and SolutionArchitecture	Yes
Project Design Phase-II	M-12	Prepare Customer journey, functional requirements, Dataflowdiagram and Technology Architecture	Yes
Project Planning Phase	M-13	Prepare Milestone list, Activity list and Sprint Delivery Plan	Yes
Project Development Phase	M-14	Project Development delivery of Sprint 1, Sprint 2, Sprint 3, Sprint 4	Yes



ACTIVITY LIST

Activity Number	Activity	Sub Activity	Assigned To	Status
1.	PROJECT OBJECTIVES		All Members	Completed
2.	PROJECT FLOW		All Members	Completed
3.	PRE-REQUISITES		All Members	Completed
4.	DATACOLLECTION	4.1 Download the Dataset	Tejaswini.K.G	Completed
5.	IMAGE PREPROCESSING	5.1 Import the ImageDataGenerator Library. 5.2 Define the Parameters/Arguments for ImageDataGenerator class. 5.3 Applying ImageDataGenerator Functionality to trainset and testset.	All Members	In Progress

SPIRINT 1:



```
In [4]: import matplotlib.pyplot as plt
        import numpy as np
        import pandas as pd
        import seaborn as sns

        from sklearn import metrics
        from sklearn.metrics import classification_report,confusion_matrix
```

```
In [5]: import warnings
        warnings.filterwarnings(action="ignore")
        %matplotlib inline
        sns.set_style('darkgrid')
        pd.set_option("display.max_rows",1000)
        pd.set_option("display.max_columns",1000)
```

```
In [6]: fires = pd.read_csv(r"C:\Users\dhine\Downloads\forestfires.csv\forestfires.csv")
        #show the first 15 instance of dataset
        fires.head(15)
```

Out[6]:

	X	Y	month	day	FFMC	DMC	DC	ISI	temp	RH	wind	rain	area
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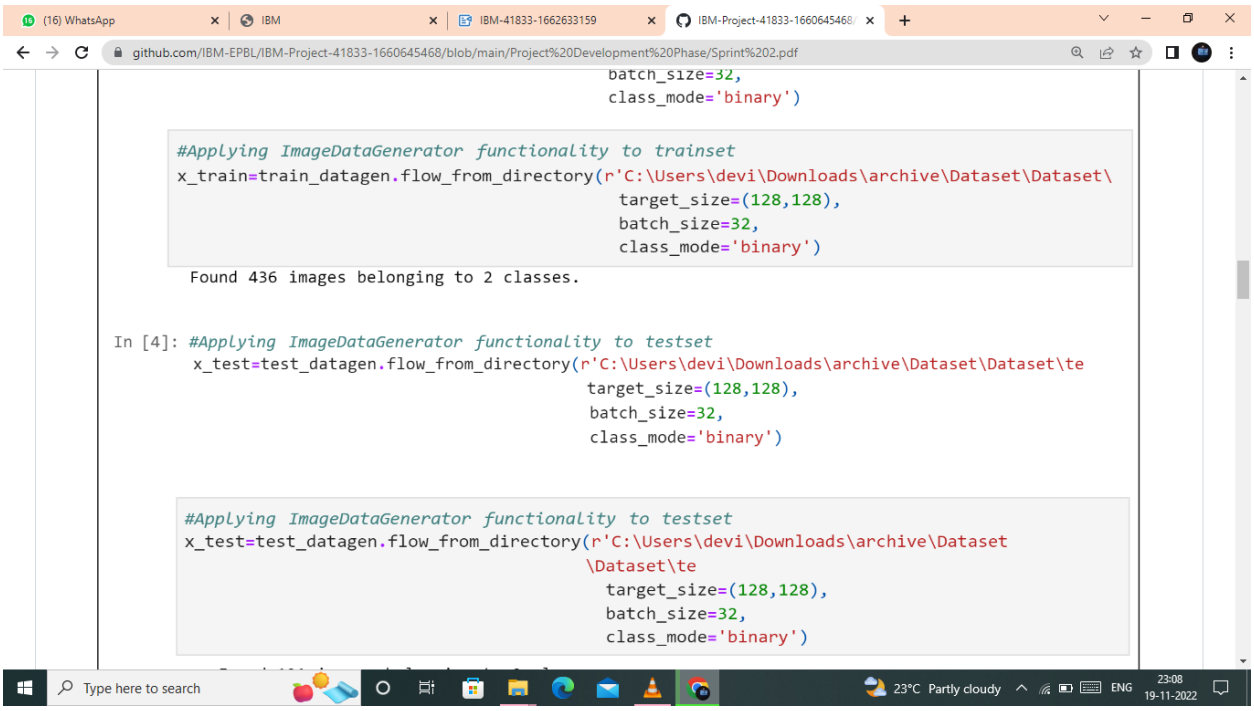

```
                                                batch_size=32,
                                                class_mode='binary')

#Applying ImageDataGenerator functionality to trainset
x_train=train_datagen.flow_from_directory(r'C:\Users\devi\Downloads\archive\Dataset\Dataset\
                                           target_size=(128,128),
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                                           class_mode='binary')
```

```
Found 436 images belonging to 2 classes.
```

```
In [4]: #Applying ImageDataGenerator functionality to testset
        x_test=test_datagen.flow_from_directory(r'C:\Users\devi\Downloads\archive\Dataset\Dataset\te
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                                                class_mode='binary')
```
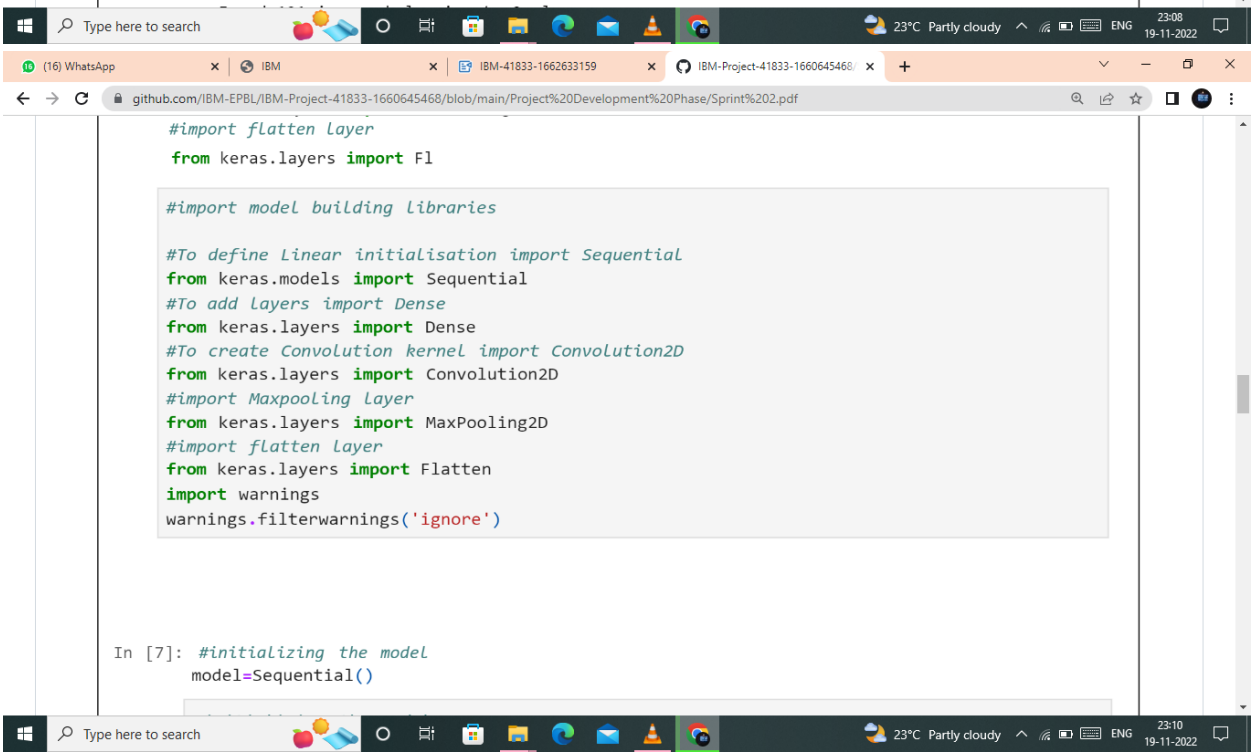

```
#Applying ImageDataGenerator functionality to testset
x_test=test_datagen.flow_from_directory(r'C:\Users\devi\Downloads\archive\Dataset
                                        \Dataset\te
                                          target_size=(128,128),
                                          batch_size=32,
                                          class_mode='binary')
```

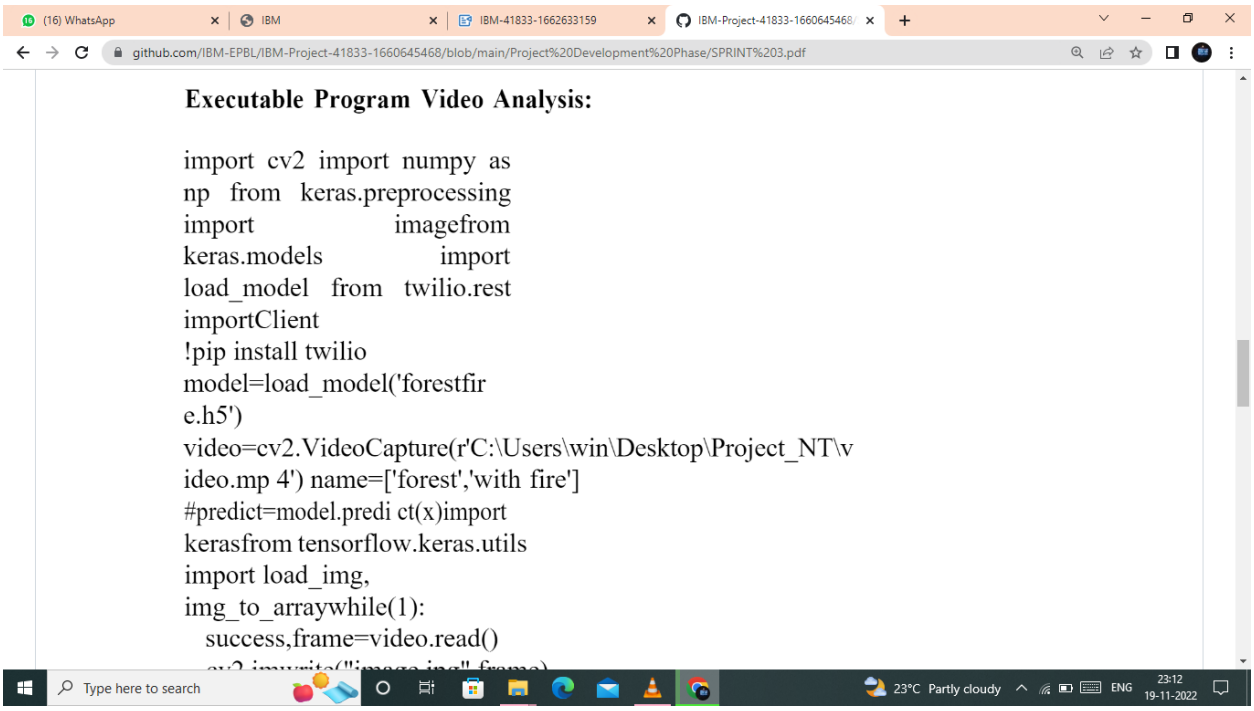


```
#import flatten layer
from keras.layers import Fl
```

```
#import model building libraries

#To define Linear initialisation 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')
```

```
In [7]: #initializing the model
        model=Sequential()
```

SPIRINT 3:


(16) WhatsApp
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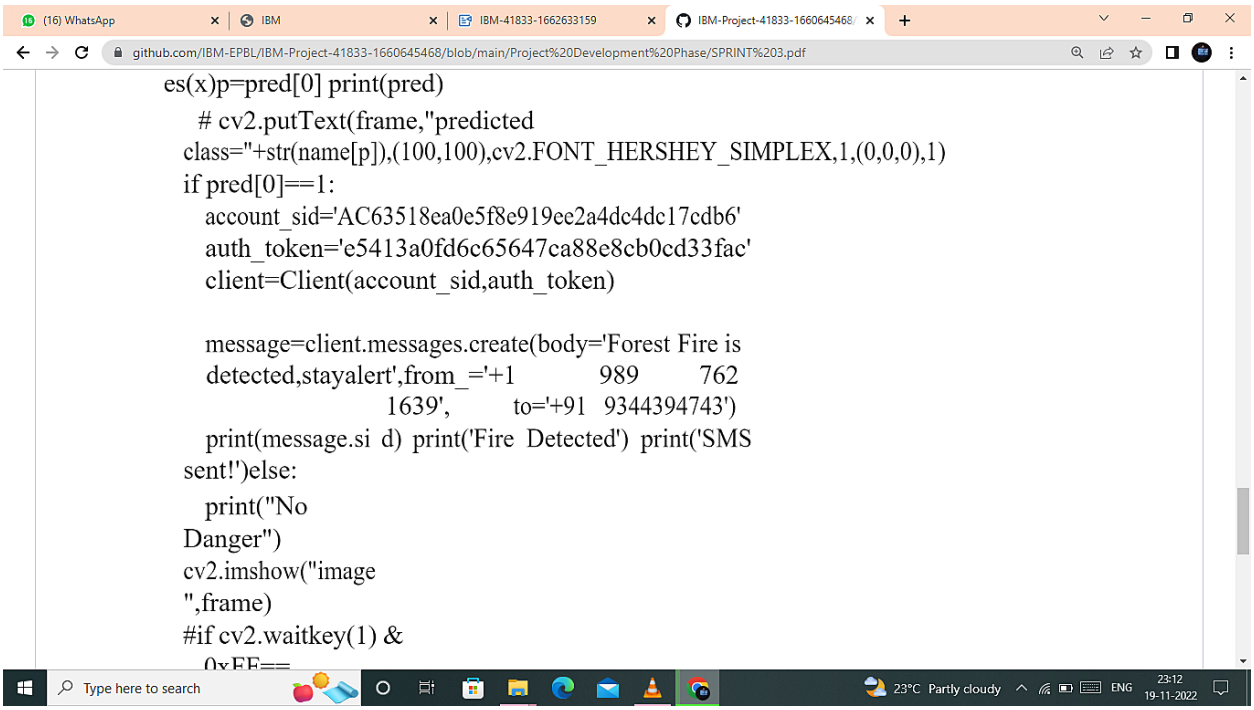
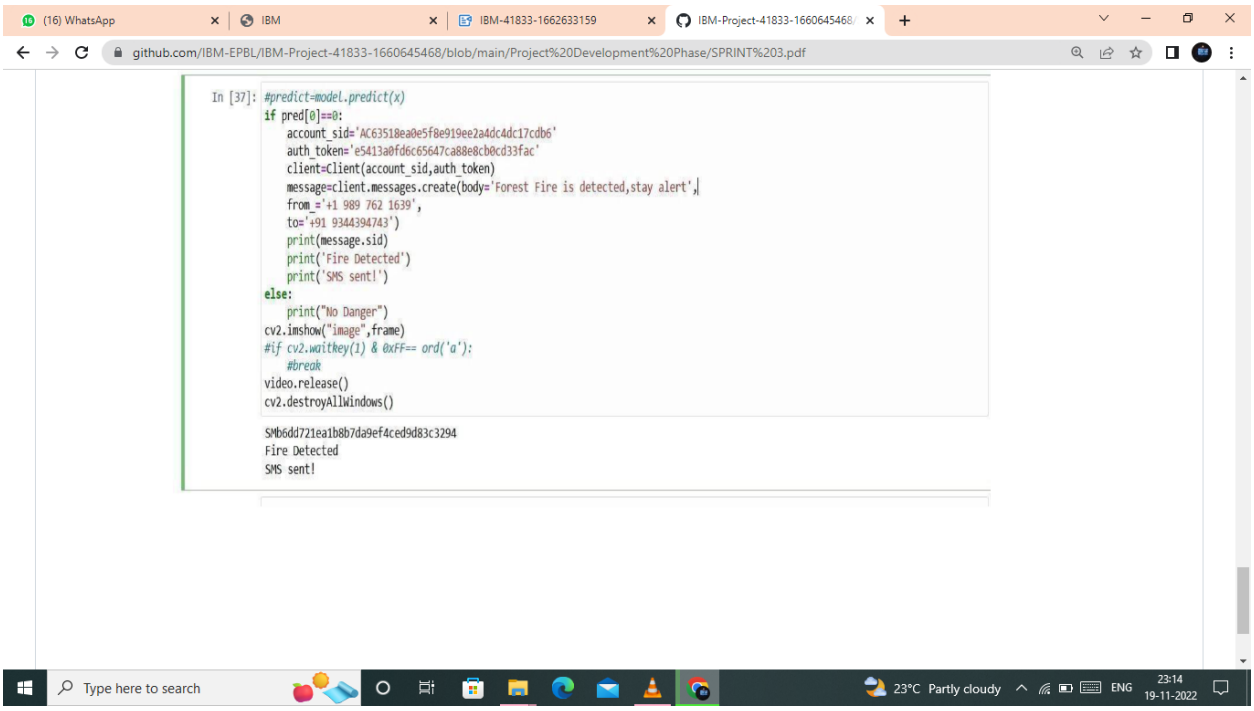
IBM-41833-1662633159
IBM-Project-41833-1660645468
github.com/IBM-EPBL/IBM-Project-41833-1660645468/blob/main/Project%20Development%20Phase/SPRINT%203.pdf
Executable Program Video Analysis:
import cv2 import numpy as np from keras.preprocessing import imagefrom keras.models import load_model from twilio.rest importClient
!pip install twilio
model=load_model('forestfir e.h5')
video=cv2.VideoCapture(r'C:\Users\win\Desktop\Project_NT\v ideo.mp 4') name=['forest','with fire']
#predict=model.predi ct(x)import kerasfrom tensorflow.keras.utils import load_img, img_to_arraywhile(1):
success,frame=video.read()
Type here to search
23°C Partly cloudy
ENG
23:12
19-11-2022


(16) WhatsApp
IBM
IBM-41833-1662633159
IBM-Project-41833-1660645468
github.com/IBM-EPBL/IBM-Project-41833-1660645468/blob/main/Project%20Development%20Phase/SPRINT%203.pdf
es(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)
if pred[0]==1:
account_sid='AC63518ea0e5f8e919ee2a4dc4dc17cdb6'
auth_token='e5413a0fd6c65647ca88e8cb0cd33fac'
client=Client(account_sid,auth_token)
message=client.messages.create(body='Forest Fire is detected,stayalert',from_='+1 989 762 1639', to='+91 9344394743')
print(message.si d) print('Fire Detected') print('SMS sent!')else:
print("No Danger")
cv2.imshow("image ",frame)
#if cv2.waitkey(1) &
Type here to search
23°C Partly cloudy
ENG
23:12
19-11-2022

SPIRINT 3 :


(16) WhatsApp
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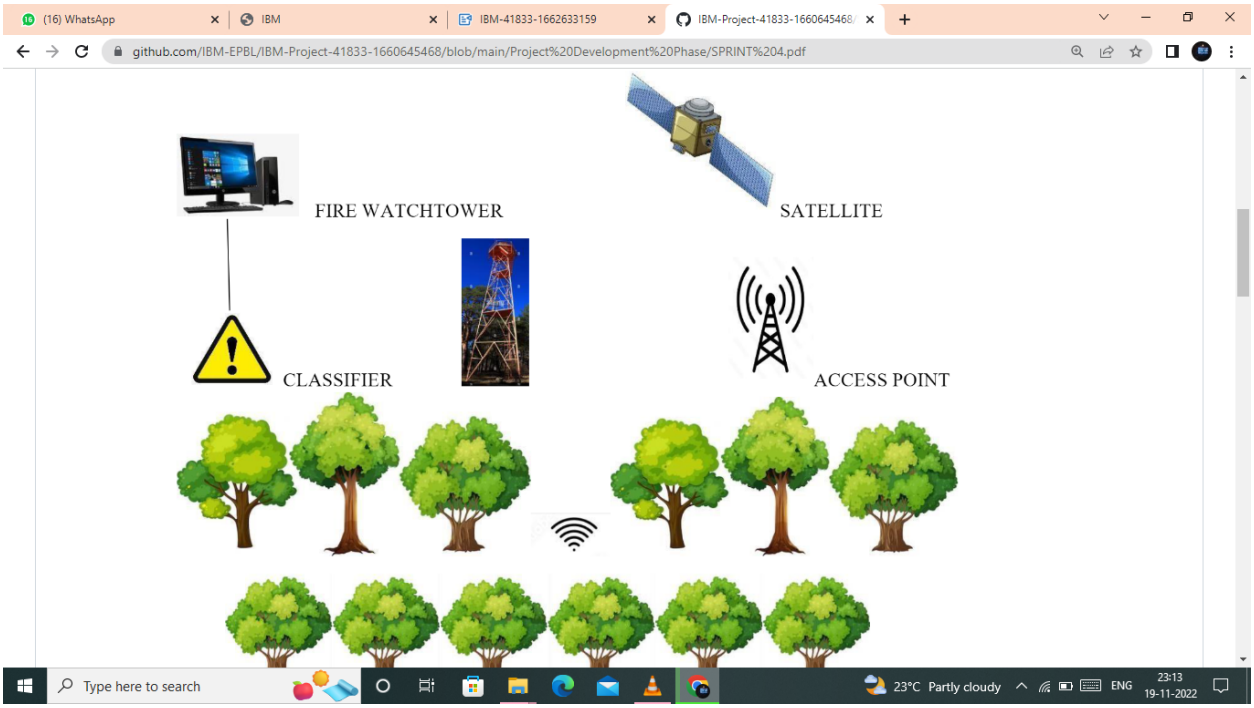
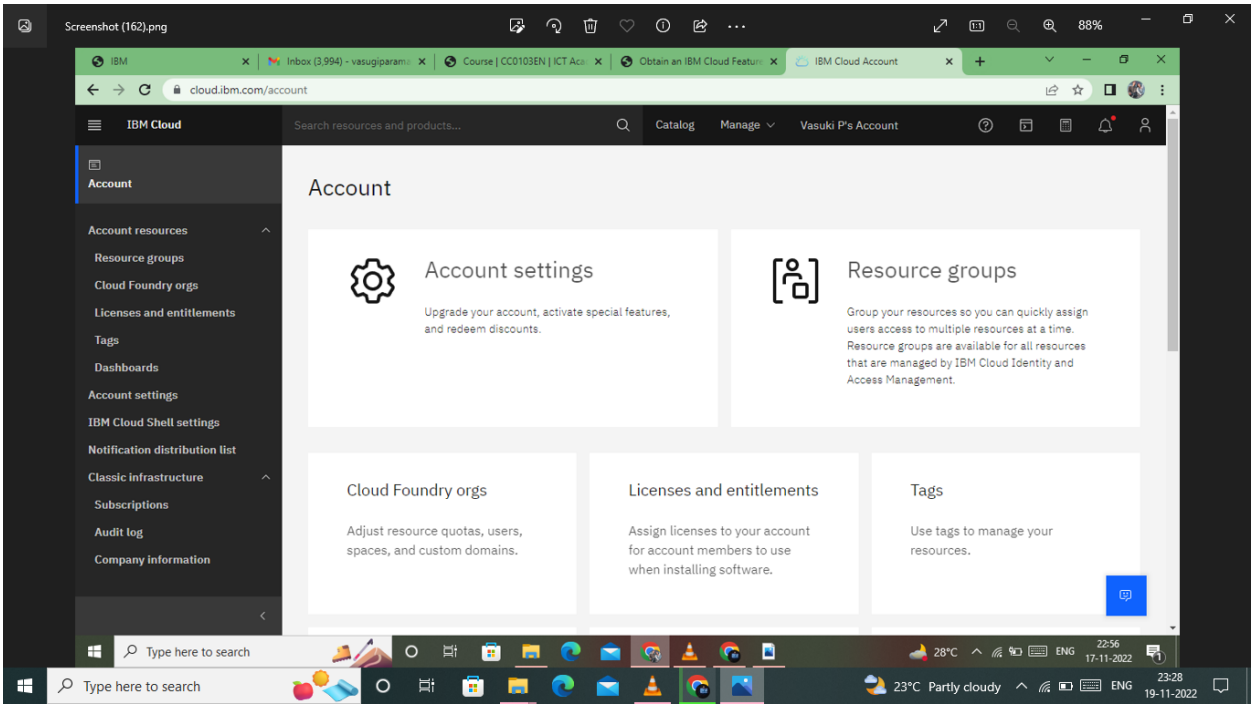
IBM-Project-41833-1660645468
github.com/IBM-EPBL/IBM-Project-41833-1660645468/blob/main/Project%20Development%20Phase/SPRINT%203.pdf
In [37]:
#predict=model.predict(x)
if pred[0]==0:
account_sid='AC63518ea0e5f8e919ee2a4dc4dc17cdb6'
auth_token='e5413a0fd6c65647ca88e8cb0cd33fac'
client=Client(account_sid,auth_token)
message=client.messages.create(body='Forest Fire is detected,stay alert',
from_='+1 989 762 1639',
to='+91 9344394743')
print(message.sid)
print('Fire Detected')
print('SMS sent!')
else:
print("No Danger")
cv2.imshow("image",frame)
#if cv2.waithey(1) & 0xFF== ord('a'):
#break
video.release()
cv2.destroyAllWindows()
SMb6dd721ea1b8b7da9ef4ced9d83c3294
Fire Detected
SMS sent!
Type here to search
23°C Partly cloudy
ENG
23:14
19-11-2022

SPIRINT 4:



IBM CLOUD DEPLOYMENT :



GET REPO LINK:

https://github.com/IBM-EPBL/IBM-Project-41833-1660645468