Project Report

Natural Disasters Intensity Analysis and Classification using Artificial Intelligence

Submitted By

PNT2022TMID33170

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Table Of Content

CHAPTER 1
INTRODUCTION

1.1 PROJECT OVERVIEW

Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies and even lead to permanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, floods, and wildfires. Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems, but detection of natural disasters still faces issues due to the complex and imbalanced structures of images. To tackle this problem, we developed a multilayered deep convolutional neural network model that classifies the natural disaster and tells the intensity of disaster of natural The model uses an integrated webcam to capture the video frame and the

video frame is compared with the Pre-trained model and the type of disaster is **Identified and showcased on the OpenCV window.**

1.2 PURPOSE

The main aim of our project is to detection and monitoring the To minimize the effect of fire breakout by controlling in its early stage also to protect Domestic by informing about the breakout to the respective forest department as early as possible . We have implemented the IOT technology to achieve our objective.

CHAPTER 2
LITERATURE SURVEY

2.1 EXISTING PROBLEM

Natural disasters are unpredictable events, Hartawan et al. enhanced multilayer perceptron algorithm by including convolutional neural network implemented on raspberry pi to find out the victims of natural disasters using streaming cameras and to aid the evacuation team to rescue the disaster victims. Amit et al. proposed applying automatic natural disaster detection to a convolutional neural network using the features of disaster from resized satellite images of landslide and flood detections. Aerial images are able to show more specific and wider surface area of the ground, which helps acquire a vast amount of information about the occurrence of disaster.

2.2 REFERENCES

1. Mignan A., Broccardo M. Neural network applications in earthquake prediction (1994–2019): Meta-analytic and statistical insights on their limitations. *Seism. Res. Lett.* 2020;**91**:2330–2342. doi: 10.1785/0220200021.

2. Tonini M., D'Andrea M., Biondi G., Degli Esposti S., Trucchia A., Fiorucci P. A Machine Learning-Based Approach for Wildfire Susceptibility Mapping. The Case Study of the Liguria Region in Italy. *Geosciences.* 2020;**10**:105. doi: 10.3390/geosciences10030105.

3. Islam A.R.M.T., Talukdar S., Mahato S., Kundu S., Eibek K.U., Pham Q.B., Kuriqi A., Linh N.T.T. Flood susceptibility modelling using advanced ensemble machine learning models. *Geosci. Front.* 2021;**12**:101075. doi: 10.1016/j.gsf.2020.09.006.

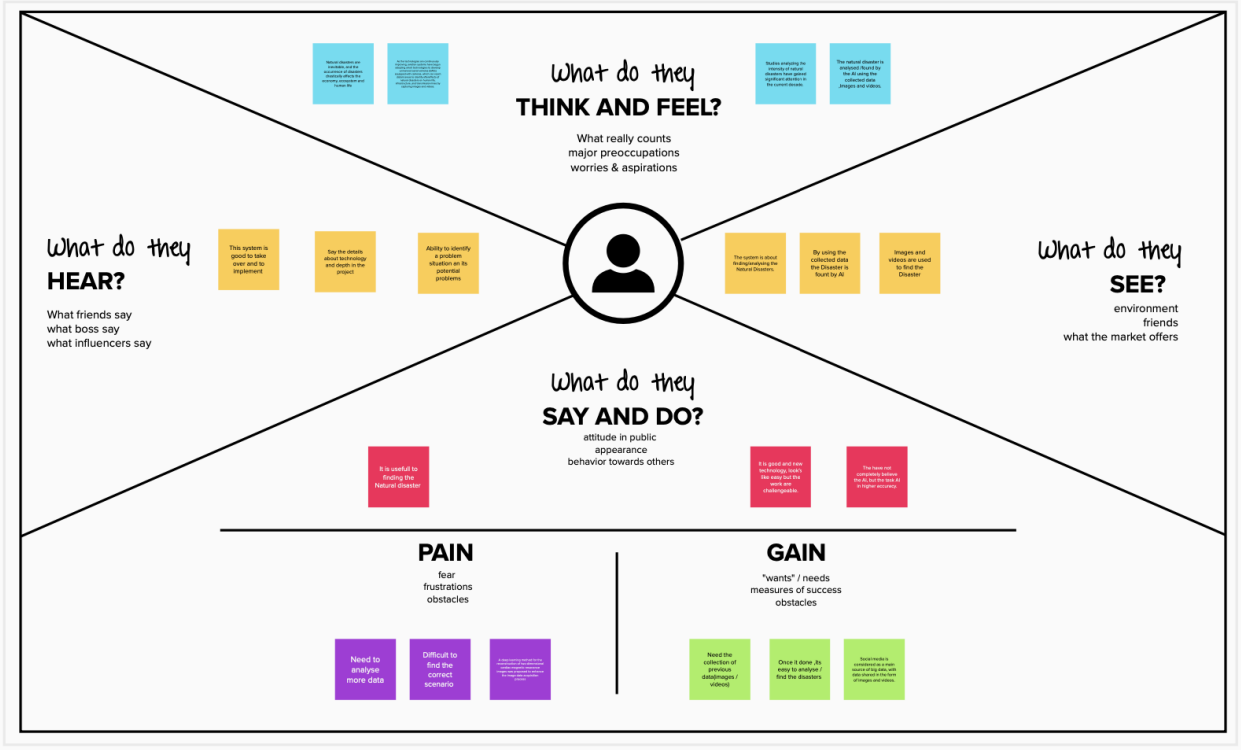
CHAPTER 3
IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

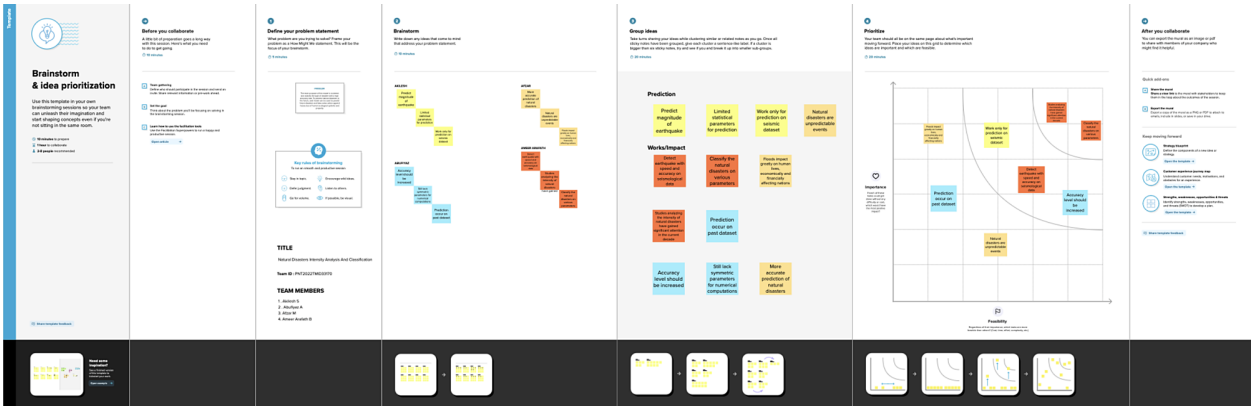
Empathy Map

Gain insight and understanding on solving customer problems

Building empathy and keep your focus on the user by putting yourself in their shoes.



3.2 IDEATION & BRAINSTORMING



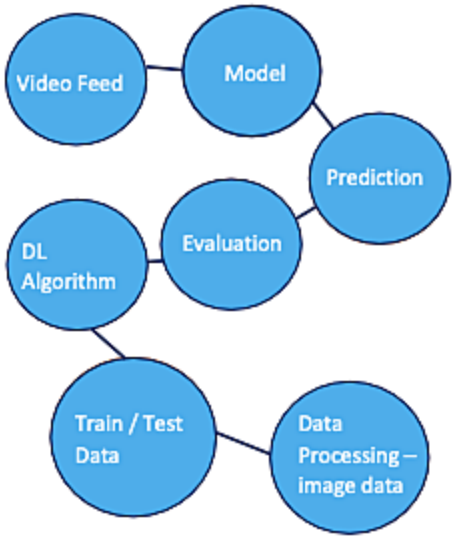
3.3 PROPOSED SOLUTION

Project Design Phase-I
Proposed Solution Template

Date	02/10/2022
Team ID	PNT2022TMID33170
Project Name	Natural Disasters Intensity Analysis And Classification
Maximum Marks	2 Marks

Proposed Solution Template:

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	Natural Disasters Intensity Analysis and Classification
2.	Idea / Solution description	Disaster can be caused by naturally occurring events. Due to the complex and imbalanced structures of images it is difficult to find the disaster. Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems
3.	Novelty / Uniqueness	we developed a multilayered deep convolutional neural network model that classifies the natural disaster and tells the intensity of disaster
4.	Social Impact / Customer Satisfaction	• Natural disaster drastically affect human lives and economic situations. • With the help of a neural network, it is possible to predict floods and save the masses from the disaster. • Locating the victims in a short time is complex task. Convolutional neural networks make it possible to help rescue team to locate the

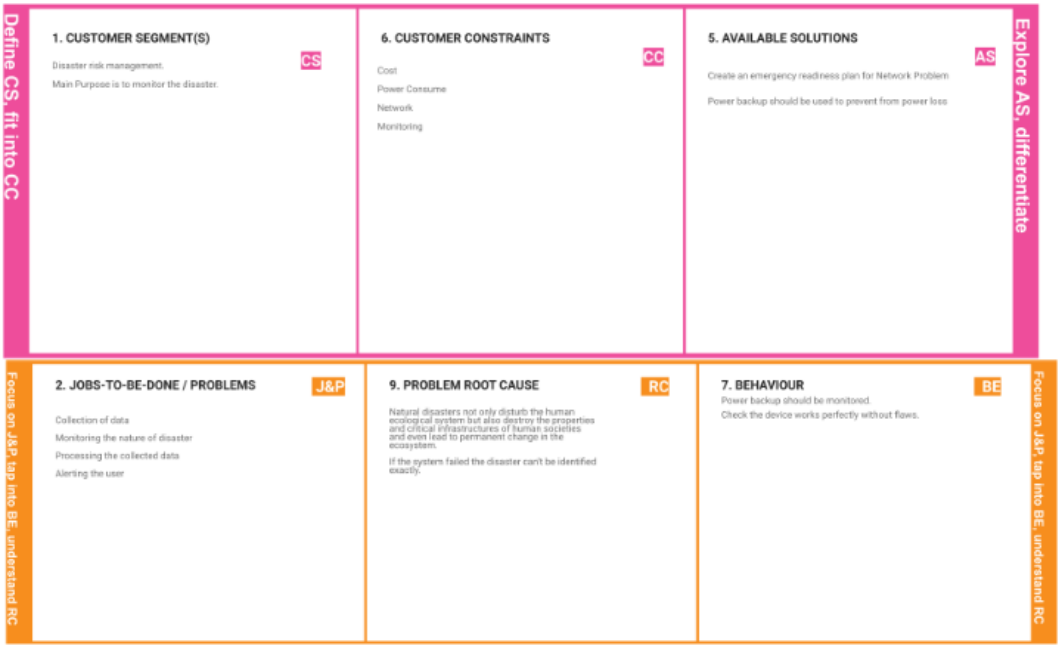
		location of victims with help of collected information's from images acquired from the unmanned aerial vehicle.
5.	Model (Revenue Model)	Natural Disasters Intensity Analysis and Classification with parameters involved in it.
		
6.	Scalability of the Solution	▪ Many researchers have attempted to use different deep learning methods for detection of natural disasters. ▪ Cost will be reasonable and efficient monitoring.

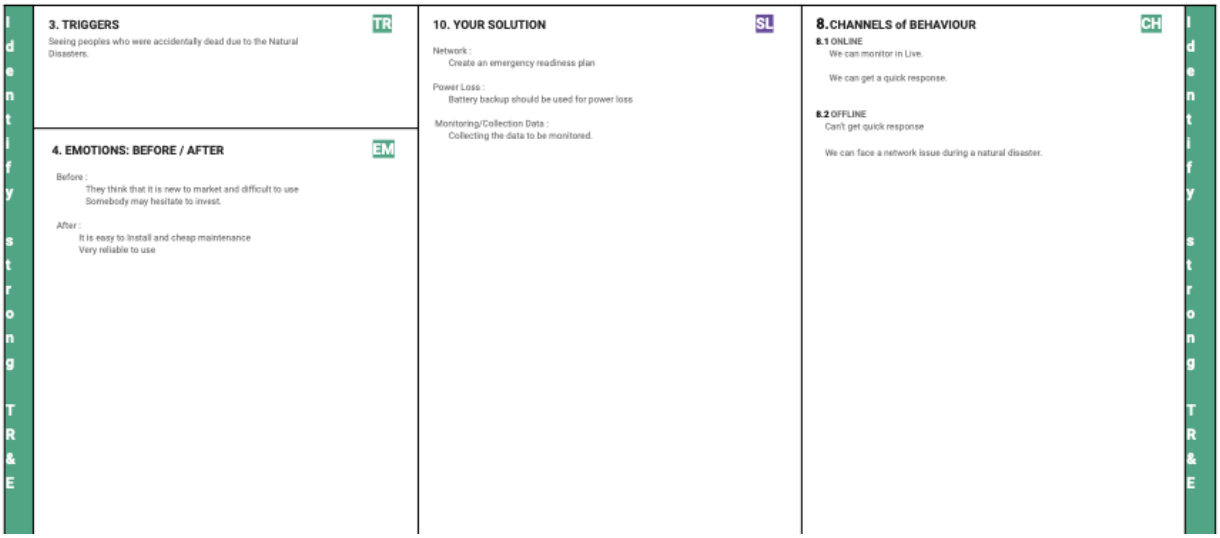
3.4 PROBLEM SOLUTION FIT

Project Title: Natural Disasters Intensity Analysis and Classification using Artificial Intelligence

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID33170





CHAPTER 4
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREME

FUNCTIONALREQUIREMENTS:

-Following are the functional requirements of the proposed solution

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	17 October 2022
Team ID	PNT2022TMID33170
Project Name	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence
Maximum marks	4 marks

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	Registration through website google mail
FR-2	User Confirmation	Confirmation by means of Email or OTP
FR-3	User Login	Login through site or App using respective username and secret word
FR-4	User Access	Get to the web
FR-5	User Upload	Can't able to upload the information by client
FR-6	User Solution	Data report should be generated and delivered to user for per every 24 hours
FR-7	User Data Sync	API interface to increase to invoice system

Non-functional Requirements:

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

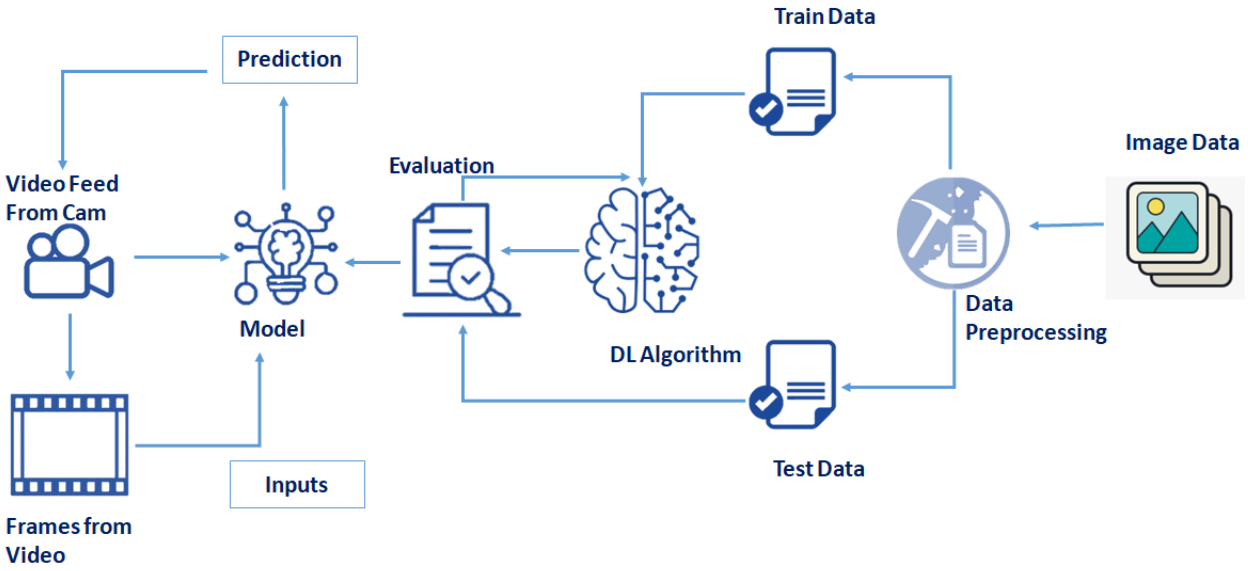
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to access will be in good quality. easy to install . climate monitoring.
NFR-2	**Security**	Access permissions for the particular system information may only be changed by the system's data administrator.
NFR-3	**Reliability**	The database update process must roll back all related updates when any update fails.

NFR-4	**Performance**	Very quick and highly performance to find the natural disaster

NFR-5	**Availability**	Modern module arrangement mustn't affect front page, item pages, and check out pages availability and mustn't take longer than one hour. The rest of the pages that will experience problems must show a notice with a timer showing when the framework is attending to be up once more
NFR-6	**Scalability**	Ready to increment adaptability by including memory, servers, or disk space. On the other hand, we can compress information, utilize optimizing calculations. The website participation restrain must be adaptable enough to bolster 500,000 clients at a time

CHAPTER 5
PROJECT DESIGN

Data Flow Diagram



5.2 SOLUTION & TECHNICAL ARCHITECTURE


1.Introduction
2. Artificial Intelligence overview
2a. Supervised Learning
2b. Unsupervised Learning
2c. Reinforcement Learning
Applications of Artificial Intelligence
3. Pre-disaster management
3a. Predicting a disaster
3b. Early signals
4. Crowd evacuation
5.post disaster
6.Pandemic management
7.Challenges, open issue and Future research directions.
5a. Detecting changes
5b. Extracting useful information from social media sites
5c. Minimizing future disaster risks
6a. Prediction and diagonals of a pandemic
6b. Social distancing
6c. Entent to which economy is affected
6d. Classifying area into Red, Orange anf green according too apread during a pandemic

CHAPTER 6
PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Project Planning Phase
Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	27 October 2022
Team ID	PNT2022TMID33170
Project Name	Natural disasters intensity analysis and classification using artificial intelligence
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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 that.	2	Low	Akilesh
Sprint-1	Registration	USN-2	As a user, I will receive confirmation email once I have registered for the application.	3	High	Abufiyaz
Sprint-1	Login	USN-3	As a user, I adapt to logging into the system with credentials.	2	Low	Ameer Arafath
Sprint-1	Designation of Region	USN-4	As a user, I can collect the dataset and select the region of interest to be monitored and analysed.	5	Medium	Afzar

Sprint-2	Analysis of required phenomenon	USN-5	As a user, I can regulate certain factors influencing the action and report on past event analysis.	4	High	Afzar
Sprint-2	Algorithm selection	USN-6	As a user, I can choose the required algorithm for specific analysis.	4	Medium	Abufiyaz
Sprint-2	Training and Testing	USN-7	As a user, I can train and test the model using the algorithm.	4	High	Ameer Arafath
Sprint-3	Detection and analysis of data	USN-8	As a user, I can detect and visualise the data effectively.	4	High	Akilesh
Sprint-3	Model building	USN-9	As a user, I can build with the web application.	8	High	Ameer Arafath
Sprint-4	Report generation	USN-10	As a user, I can generate detailed report on product data analysis.	4	High	Abufiyaz
Sprint-4	Model deployment	USN-11	As an administrator, I can maintain third party services.	8	High	Ameer afafath

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	12	6 Days	24 Oct 2022	29 Oct 2022	12	29 Oct 2022
Sprint-2	12	6 Days	31 Oct 2022	05 Nov 2022	12	05 Nov 2022
Sprint-3	12	6 Days	07 Nov 2022	12 Nov 2022	12	12 Nov 2022
Sprint-4	12	6 Days	14 Nov 2022	19 Nov 2022	12	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$\text{Average velocity} = \text{Sprint duration} / \text{velocity} = 12/6 = 2$$

Burndown 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.

CHAPTER 7
CODING & SOLUTIONING

app.py 5

app.py > ...

```python
from flask import Flask,render_template,request
import cv2
import os
from tensorflow.keras.models import load_model
tensorflow ='tensorflow-macos'
import tensorflow
import numpy as np


app = Flask(__name__,template_folder="templates")
model=load_model("disaster.h5")
print(model)

@app.route('/',methods=['GET'])
def index():
    return render_template('home.html')

@app.route('/home.html',methods=['GET'])
def home():
    return render_template('home.html')

@app.route('/intro.html',methods=['GET'])
def about():
    return render_template('intro.html')

@app.route('/upload.html',methods=['GET','POST'])
def upload():
    return render_template('upload.html')

```

(import) load_model: Any

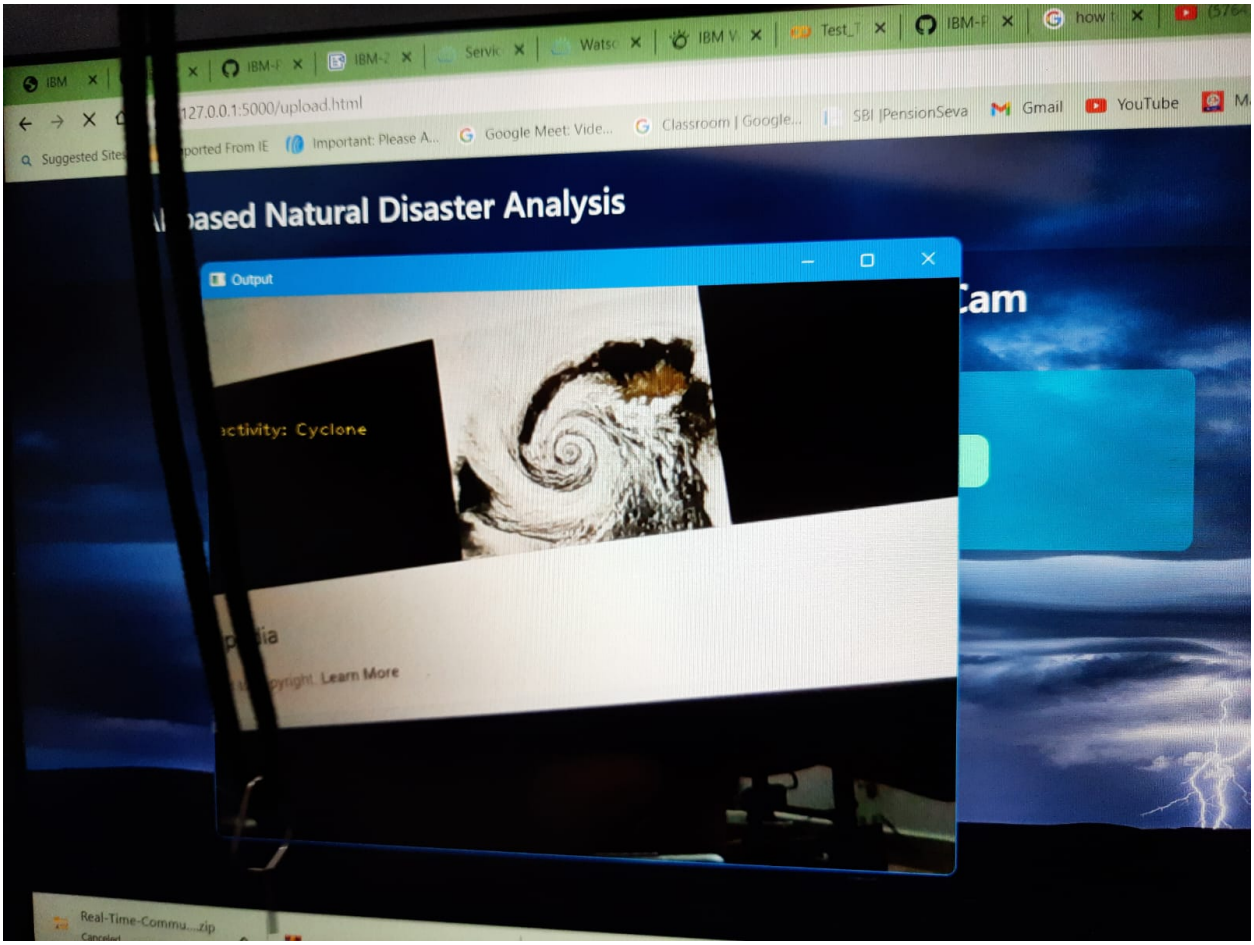
```python
@app.route('/uploader.html',methods=['GET','POST'])
def predict():
    cap=cv2.VideoCapture(0)
    while(True):
        _,frame = cap.read()
        frame=cv2.flip(frame,1)
        while(True):
            (grabbed,frame) = cap.read()
            if not grabbed:
                break
            output = frame.copy()
            frame = cv2.cvtColor(frame,cv2.COLOR_BGR2RGB)
            frame = cv2.resize(frame,(64,64))
            x=np.expand_dims(frame,axis=0)
            result = np.argmax(model.predict(x),axis=1)
            index=['Cyclone','Earthquake','Flood','Wildfire']
            result = str(index[result[0]])
            #print(result)
            cv2.putText(output,"activity: {}".format(result),(10,120),cv2.FONT_HERSHEY_PLAIN,1,(0,255,255),1)
            cv2.imshow("Output",output)
            key=cv2.waitKey(1) & 0xFF
            if key==ord('q'):
                break
    print("[INFO]cleaning up...")
    cap.release()
    cv2.destroyAllWindows()
    return render_template("upload.html")

if __name__ == '__main__':
        app.run(host='0.0.0.0',port=5000,debug=True)
```

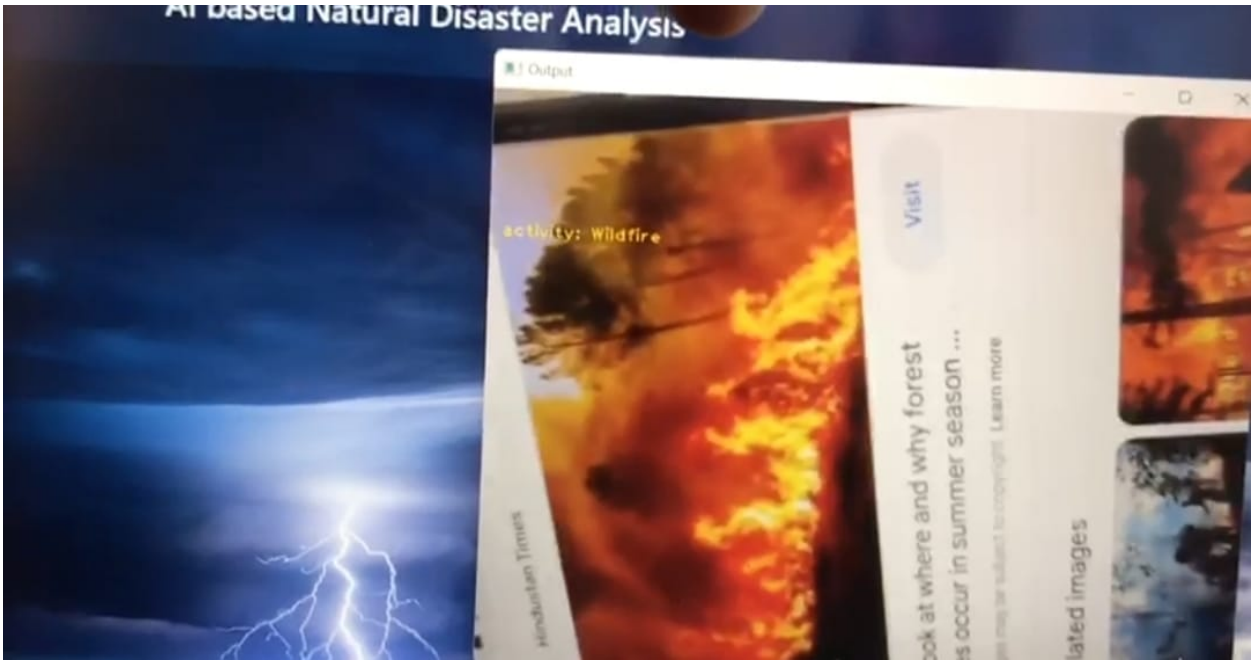
Chapter 8
TESTING

Date	13-Nov-22
Team ID	PNT2022TMID33170
Project Name	Natural Disasters Intensity Analysis a
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
HO_TC_OO1	Functional	Home Page	Verify user is able to see the Disaster container box		Search/to know about the disaster	Hmimg.png	Redirec to the selected content	Working as expected	Pass
HO_TC_OO2	Functional	Home Page	verify the user can navigate through the button.		1.Enter URL and click go 2.Click on webcam to open webcam 3.Click on intro to get redirect to intro page	Hmimg.png	Application should show below UI elements: Page redirection ,Show Button	Working as expected	Pass
LoginPage_TC_OO3	Functional	Intro page	Verify the use can abole to read the content in the intro page		1.Click the Intro button. 2.Intro of the page will be displayed	int.png	User should navigate to intro page	Working as expected	Pass
LoginPage_TC_OO4	Functional	Webcam	Verify user is able to redirect to web cam page		1.Click the webcam button	web.png	Redirect to the webcam page	Working as expected	Pass
LoginPage_TC_OO4	Functional	Webcam	Verify user is able toaccess the cam using web cam button		1.Click the web cam button	cam.png	camera will be displayed to view result	Working as expected	Pass
LoginPage_TC_OO5	Functional	Webcam - Result	Verify user is able to see the expected result throug the web cam		1.View the displayed result	res.png	Disaster will be predicted and will be displayes in pop-up output	Working as expected	Pass

CHAPTER 9
RESULT





CHAPTER 10
ADVANTAGES & DISADVANTAGES

ADVANTAGES:

The proposed system detects the Natural Disaster 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 the Nural network. It minimizes the human effort as it works automatically. This is very affordable 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.

DISADVANTAGES :

The electrical interference diminishes the effectiveness of radio receiver. The main drawback is that it has less coverage range areas and stable network connection.

CHAPTER 11
CONCLUSION

Many researchers have attempted to use different deep learning methods for detection of natural disasters. However, the detection of natural disasters by using deep learning techniques still faces various issues due to noise and serious class imbalance problems. To address these problems, we proposed a multilayered deep convolutional neural network for detection and intensity classification of natural disasters. The proposed method works in two blocks—one for detection of natural disaster occurrence and the second block is used to remove imbalanced class issues. The results were calculated as average statistical values: sensitivity, 97.54%; specificity, 98.22%; accuracy rate, 99.92%; precision, 97.79%; and F1-score, 97.97% for the proposed model. The proposed model achieved the highest accuracy as compared to other state-of-the-art methods due to its multilayered structure. The proposed model performs significantly better for natural disaster detection and classification, but in the future the model can be used for various natural disaster detection processes.

CHAPTER 12
FUTURE SCOPE

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

AI should be trained well ,so the level od prediction will be increased,better accuracy ptediction

This project has endless potential and can always be enhanced to become better. Implementing this concept in the real world will benefit several industries and reduce the

workload on many workers, enhancing overall work efficiency.

GITHUB

https://github.com/IBM-EPBL/IBM-Project-2242-1658467954

PROJECT DEMO

Demo Project Link