NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE

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1.INTRODUCTION

1.1 PROJECT OVERVIEW

Natural disasters are large-scale geological or meteorological events that have the potential to cause loss of life or property. A disaster is a result of a natural or man-made hazard impacting a vulnerable community. It is the combination of the hazard along with exposure of a vulnerable society that results in a disaster. The project aims at building a deep learning model that can classify and tell the intensity of a natural disaster based on images. The project uses a multilayered deep convolutional neural network as the main model architecture and also it uses various techniques to enhance the model performance and robustness such as data augmentation, transfer learning, and ensemble methods. The project can have various applications and use cases for disaster management and response such as providing timely and accurate information, assessing the damage and impact, and facilitating the recovery and reconstruction.

1.2 PURPOSE

The purpose of natural disaster intensity analysis and classification using AI is to build a deep learning model that can classify and tell the intensity of a natural disaster based on images. This can help to overcome losses in ecosystems, human lives, and properties by providing timely and accurate information for disaster management and response. It can also be integrated with other technologies such as geographic information systems, remote sensing, and social media to provide a comprehensive and multidimensional view of the disaster situation and impact.

2. REQUIREMENT ANALYSIS

2.1 FUNCTIONAL REQUIREMENTS

The following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**LOGIN**	Login by giving a mobile number, gmail or google account and their loca on.
FR-2	**ALERT**	The alert message is given to all the users when the cyclone hits.
FR-3	**MONITORING**	Continuous monitoring of cyclones and climate changes.
FR-4	**REPORTS**	Keeping the records of the previous cyclone and refer news from meteorologist for live updates.
FR-5	**END USERS**	The information is sent to the farmers using the database.
FR-6	**END GOAL**	Inform farmers about the cyclone and its intensity.

2 .2 NON-FUNCTIONAL REQUIREMENTS

The following are the non-functional requirements of the proposed solution :

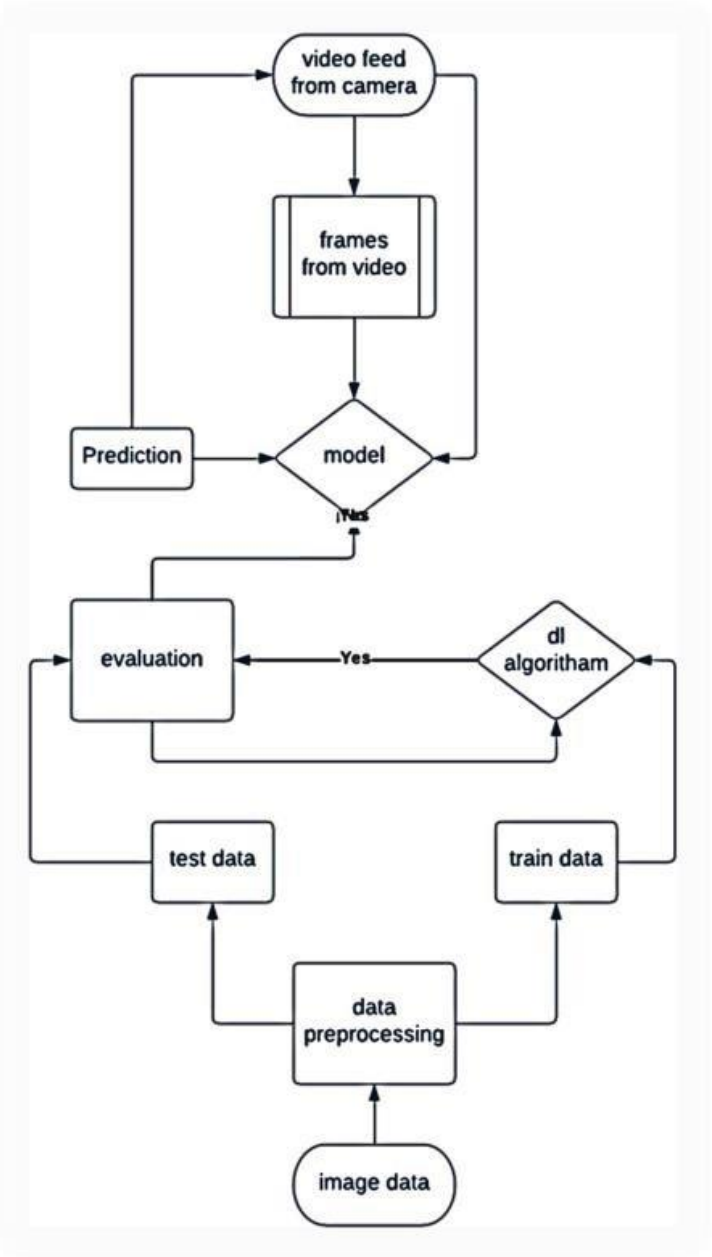
FR No.	Non-Functional Requirement	Description
NFR-1	**USABILITY**	While using this system, people turn on their current loca on. They receive alert messages as no fica on. The local officials can also inform and guide their nearby people and farmers by an alert message.
NFR-2	**SECURITY**	It does not share any personal informa on to strangers. Their informa on is to be encrypted and
NFR-3	**RELIABILITY**	As the details collected from satellite image and meteorologist and updated details in this system, so it is trustworthy.
NFR-4	**PERFORMANCE**	It runs in minimum storage space. It will run efficiently when 1000 users login the same time.
NFR-5	**AVAILABILITY**	It should be available in all Android phones and laptops.

NFR-6	**SCALABILITY**	As the product we created is user friendly and it will be very useful for farmers and agriculture.

3. PROJECT DESIGN

3.1 DATA FLOW DIAGRAM

A data-flow diagram is a way of representing a flow of data through a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself.



3.2 USER STORIES

A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	LOGIN	USN-1	As a farmer, I can login by giving mobile number, gmail or google account and their location.	I can prepare myself from cyclone and storing enough food and essentials	High	Sprint- 1
	ALERT	USN-2	As a farmer, I can receive the alert message when the cyclone hits.	I can know about current climatic conditions and upcoming weather conditions	High	Sprint- 2
	MONITORING	USN-3	As a farmer, I can view the continuous monitoring of cyclone and climatic changes.	I can know where the cyclone hits and how much impacts it may creates	High	Sprint- 3

	REPORTS	USN-4	As a farmer, I can keep the records of the previous cyclone and refer news from meteorologist for live updation.	I can receive the alert messages when the disaster occurs	High	Sprint- 4
	END USERS (farmers)	USN-5	As a farmer, I can receive the information from the database.	I should ensure that any stored seeds or harvested crops are carefully protected from wind and flooding	High	Sprint- 5

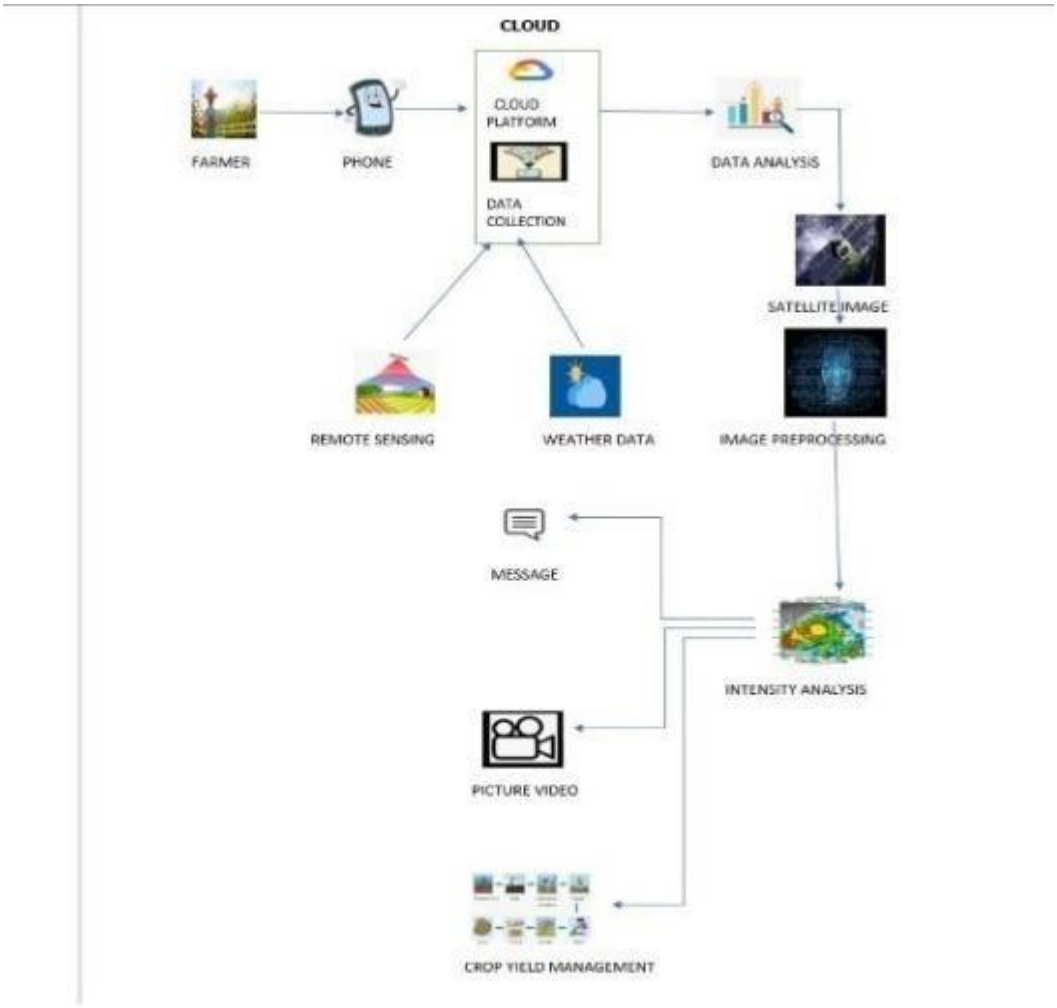
3.3 SOLUTION AND TECHNICAL ARCHITECTURE

SOLUTION ARCHITECTURE

A solution architecture (SA) is an architectural description of a specific solution. SAs combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).

TECHNOLOGY STACK

A tech stack is the combination of technologies a company uses to build and run an application or project. Sometimes called a “solutions stack,” a tech stack typically consists of programming languages, frameworks, a database, front-end tools, back-end tools, and applications connected via APIs.



4. PROJECT PLANNING AND SCHEDULING

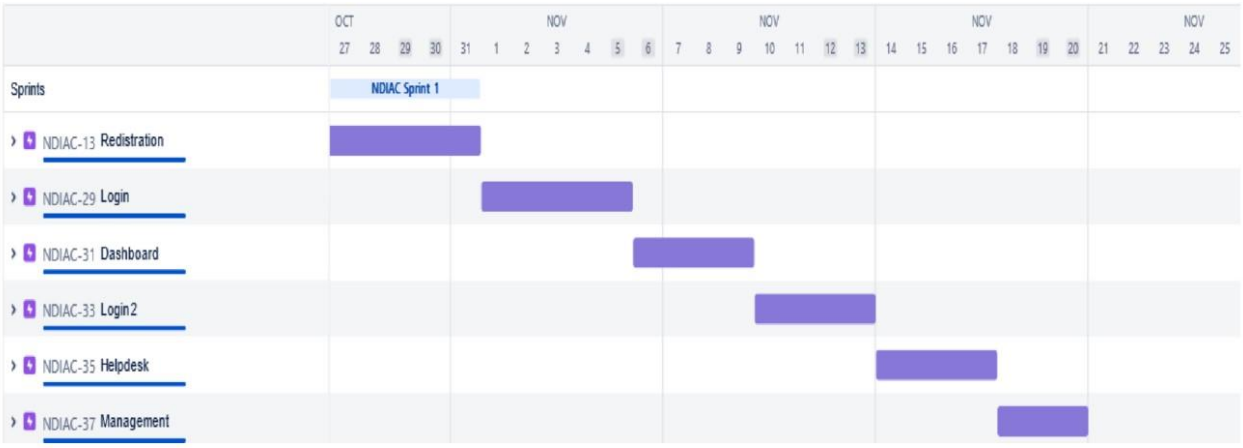
4.1 SPRINT PLANNING AND ESTIMATION

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.	2	High	Syed Ashik Ahamed
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Hariharan
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Navinkumar
Sprint-2		USN-4	As a user, I can register for the application through Gmail	2	Medium	Vignesh
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	Syed Ashik Ahamed
Sprint-1	Dashboard	USN-6	As a user, I can access the services and information provided in the dashboard	2	High	Hariharan
Sprint-1	login	USN-7	As a user, I can log into the web application and access the dashboard	2	High	Navinkumar
Sprint-4	Helpdesk	USN-8	As a user, I can get the guidance from the customer care	1	High	Vignesh
Sprint-3	Management	USN-9	As an administrator, I can collect new datasets and keep the model trained	2	High	Syed Ashik Ahamed
Sprint-3		USN-10	As an administrator, I can update other features of the application	2	Medium	Hariharan
Sprint-3		USN-11	As an administrator, I can maintain the information about the user	2	Medium	Navinkumar
Sprint-4		USN-12	As an administrator, I can maintain third-party services	1	Low	Vignesh

4.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on planned End Date)
Sprint 1	8	6 Days	26 Oct 2022	31 Oct 2022	8
Sprint 2	4	6 Days	01 Nov 2022	06 Nov 2022	4
Sprint 3	6	6 Days	07 Nov 2022	12 Nov 2022	6
Sprint 4	2	6 Days	13 Nov 2022	18 Nov 2022	2

4.3 REPORTS FROM JIRA



5. CODING AND SOLUTIONING

5.1 FEATURE 1:

HTML

Home page:

```
<!DOCTYPE html>

<html>
                <head>
                        <title>Home page</title>
                </head>
                <body>
                        <a href = "Intro page.html">Intro page </a>
                        <a href = "Upload page.html">Upload page </a>

                        <h1>AI BASED NATURAL DISASTER ANALYSIS</h1>
                        <img src = "D:\Disasters\CYCLONE.jpg">
                        <img src = "D:\Disasters\EARTHQUAKE.jpg">
                        <img src = "D:\Disasters\FLOOD.jpg">
                        <img src = "D:\Disasters\FOREST FIRE.jpg">
                          </body>
</html>
```

Intro page:

```
<!DOCTYPE html>

<html>
                <head>
                        <title>Intro page</title>
                </head>
                <body>
                        <a href = "Home page.html">Home page </a>
                        <a href = "Upload page.html">Upload page </a>

                        <h1>AI BASED NATURAL DISASTER ANALYSIS</h1>
                         <p>A Disaster is a serious problem occuring over a short or long period of time that causes widespread human, material, economic or environm
                          </body>
</html>
```

Upload page:

```
<!DOCTYPE html>

<html>
                        <head>
                                <title>Upload page</title>
                        </head>
                        <body>
                                <a href = "Intro page.html">Intro page </a>
                                <a href = "Home page.html">Home page </a>

                                <h1>AI BASED NATURAL DISASTER ANALYSIS</h1>
                                <img src = "D:\Emergency\Emergency alert.jpeg">
                          </body>
</html>
```

5.2 FEATURE 2:

PYTHON

```
from flask import Flask, render_template,request import cv2

import tensorflow from tensorflow.keras.models import

load_model from werkzeug.u ls import secure_filename app=

Flask(__name__,template_folder="templates")

model=load_model('disaster.h5') print("Loaded model from

disk") @app.route('/', methods=['GET']) def index():     return

render_template('home.html') @app.route('/home',

methods=['GET'])  def home():     return

render_template('home.html') @app.route('/intro'.

methods['GET']) def about():     return

render_tempalte('intro.html') @app.route('/upload',

methods=['GET', 'POST'])
```

```
def predict():      cap=
cv2.VideoCapture(0)
while True:
  _, frame = cap.read()
frame = cv2.flip(frame,1)
while True:
          (grabbed, frame) =vs.read()
if not grabbed:
break
          if W is None or H is None:                (H,W) =
frame.shape[:2]                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]])                cv2.putText(output, "ac vity:
{}", 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...")
vs.release()
cv2.destroyAllWindows()
return
render_template("upload.html")


if __name__ == '__main__' :
        app.run(host='0.0.0.0', port=8000, debug=False)
```

6. TESTING

6.1 TEST CASES

Section	Total Cases	Not Tested	Fail	Pass
Client Application	10	0	3	7
Security	2	0	1	1
Performance	3	0	1	2
Exception Reporting	2	0	0	2

6.2 USER ACCEPTANCE TESTING

DEFECT ANALYSIS

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Total
By Design	1	0	1	0	2
Duplicate	0	0	0	0	0
External	0	0	2	0	2
Fixed	4	1	0	1	6
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	1	1
Won't Fix	1	0	1	0	2
Total	6	1	4	3	14

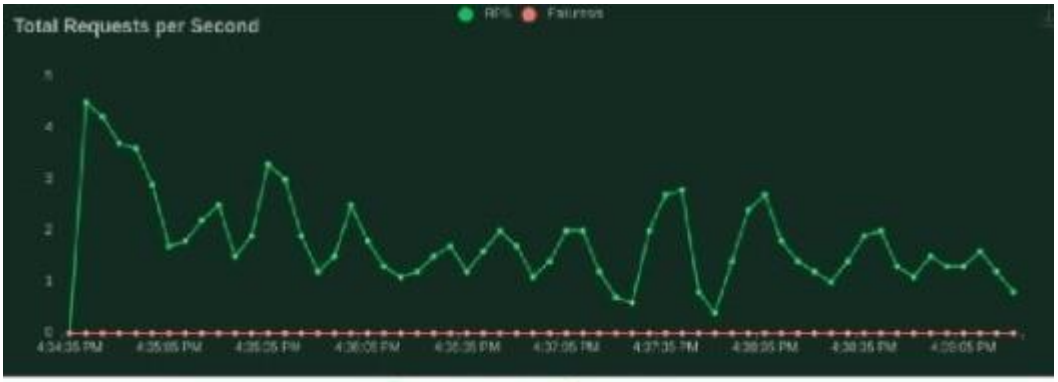
7.RESULTS

7.1 PERFORMANCE METRICS

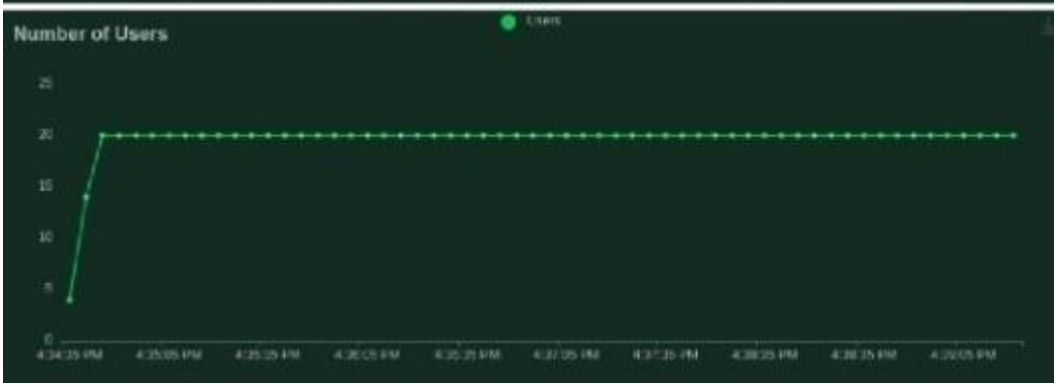
Locust Test Report

During: 11/20/2022, 12:20:34 PM - 11/20/2022, 12:29:21 PM

Script:: locustfile.py


Total Requests per Second
All
Failures


Response Times (ms)
Median Response Time
95th percentile


Number of Users
Users

8. CONCLUSION

Artificial intelligence has the potential to enhance the detection and classificationof natural disasters, as well as the resilience and relief efforts
of affected communities. By using deep learning techniques, AI can analyze complex and imbalanced images of disasters and provide accurate and timely information. However, AI also faces challenges such as data quality, ethical issues, and human-AI collaboration. Therefore, it is essential to develop robust and reliable AI systems that can complement human expertise and judgment in disaster management.

AI can help predict the occurrence and impact of natural disasters by using historical data, satellite imagery, and weather models. This can enable early warning systems and preparedness plans for vulnerable areas. AI can also assist in the recovery and reconstruction of disaster-affected regions by providing insights into the needs and priorities of the survivors, as well as the best allocation of resources and funds.

AI can also support the learning and improvement of disaster management practices by analyzing the lessons learned from past disasters and identifying the gaps and opportunities for future interventions.

9. FUTURE SCOPE

To develop more advanced and efficient deep learning models that can handle the complexity and diversity of natural disaster images, and provide accurate and reliable results.

To integrate multiple sources and types of data, such as text, audio, video, and sensor data, to enhance the analysis and classification of natural disasters and their impacts.

To explore the ethical and social implications of using AI for natural disaster management, such as the privacy, security, and accountability of the data and the algorithms, and the potential biases and risks of the AI outputs.

To evaluate the performance and impact of AI for natural disaster management, and compare it with other methods and tools, such as human experts, traditional models, and manual processes.

To foster the collaboration and communication among different stakeholders, such as researchers, practitioners, policymakers, and communities, to share the best practices and challenges of using AI for natural disaster management, and to co-create solutions that meet the needs and expectations of the users.

To promote the awareness and education of the public and the decision-makers on the benefits and limitations of AI for natural disaster management, and to encourage the participation and feedback of the affected people and groups.