NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE

PROJECT REPORT

Submitted by

Team ID:PNT2022TMID52144

P.SELIN PRABAVATHY (962719106031)

A.SIVALAKSHMI (962719106032)

T.SIVAMARTIN (962719106033)

R.SORNAMALA (962719106034)

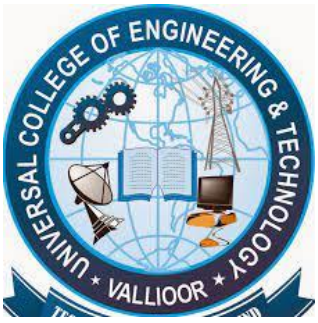
In partial fulfillment for the

award of the degree Of

BACHELOR OF ENGINEERING

In

ELECTRONICS AND COMMUNICATION ENGINEERING



UNIVERSAL COLLEGE OF ENGINEERING AND TECHNOLOGY

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1.INTRODUCTION

1.1Project Overview:

Natural Disasters are catastrophic events with atmospheric and historic origins (hurricanes, floods, tsunamis, earthquakes). That can cause fatalities, property damage and social environment disruption. Natural disasters are the results of a hazard overwhelming highly vulnerable community,often resulting in mortality and morbidity.Over the past decade,over 300 natural disasters occur yearly around the world affecting millions and cost billions.The disaster cycle is a framework used to base a coordinated plan to respond,recover,prevent,and prepare for a disaster.Access to clean water,proper sanitation,food/nutrition,shelter,and the threat of communicable diseases are concerns that have potential to be detrimental to the management of a natural disaster, slowing the recovery process. 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 Open CV window.

1.2 Purpose:

Basically the main objective of natural disaster management is to reduce the damage. However, there are several objectives that are integrated with it. Those are,

1. Identifying the hazard and its cause.

2. Reducing vulnerability and potential losses of hazard.

3. Assessing, reviewing and controlling the risk.
4. Applying efficient, effective, sustainable relief (food, shelter and money), medical and other facilities in disaster affected people thus they can survive.

5. Reducing the damage, death, sufferings and destruction of any natural and human induced disaster.

6. Giving protection to victims.

7. Increasing the strength among people to survive against disasters.

8. Building up capacity in every sector like- individual, social, economic, environmental, regional, national and international.

9. Ensuring the availability of local emergency equipment and transportation.

10.Promote the culture of disaster risk prevention and mitigation at all levels.

2.LITERATURE SURVEY:

2.1 Existing problem:

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.

2.2 References:

[1] "Number of reported disasters by type." [Online]. Available: https://ourworldindata.org/naturaldisasters.

[2] Tuswadi and T. Hayashi, "Disaster Prevention Education in Merapi Volcano Area Primary Schools: Focusing on Students' Perception and Teachers' Performance," Procedia Environ. Sci., vol. 20, pp. 668– 677, 2014.

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2.3 Problem Statement Definition:

The purpose of the problem statement is to identify the issue that is a concern and focus it in a way that allows it to be studied in a systematic way. It defines the problem and proposes a way to research a solution, or demonstrates why further information is needed in order for a solution to become possible.

Problem Statement is inclusive of below answers:

- Who does it affect/does not affect?
- What does it affect/does not affect?
- How does it affect/does not affect?
- When is it a problem/is not a problem.
- Where is it a problem/is not a problem.

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.

The natural disasters disturbs the ecosystem,both humans and animals.(WHO)

In a disaster, you face the danger of death or physical injury. You may also lose your home, possessions, and community. Such stressors place you at risk for emotional and physical health problems. Stress reactions after a disaster look very much like the common reactions seen after any type of trauma.(WHAT)

Wildlife can be killed by the force of the disaster or impacted indirectly through changes in habitat and food availability. Endangered species are especially vulnerable when habitat is destroyed. Water quality is impacted when sewage treatment facilities flood or debris enters reservoirs and waterways.(HOW)

Natural disasters generally constitute an emergency since they require immediate intervention due to their high impact on human health and safety; they affect the normal functioning of working infrastructure, interrupting normal day activities and representing a risk for residents and workers in affected areas.(WHEN)

An area is defined as a hazard prone area if the mortality risk is higher than a certain threshold. A cyclone is defined as a wind storm with a maximum speed of more than 64 knots per hour. The definition includes typhoons and hurricanes.(WHERE)

Problem statement(PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	A farmer	Increase the yield on my land	I couldn't	Of flooding in agricultural area crop damage & disease	Disappointed

3 IDEATION & PROPOSED SOLUTION:

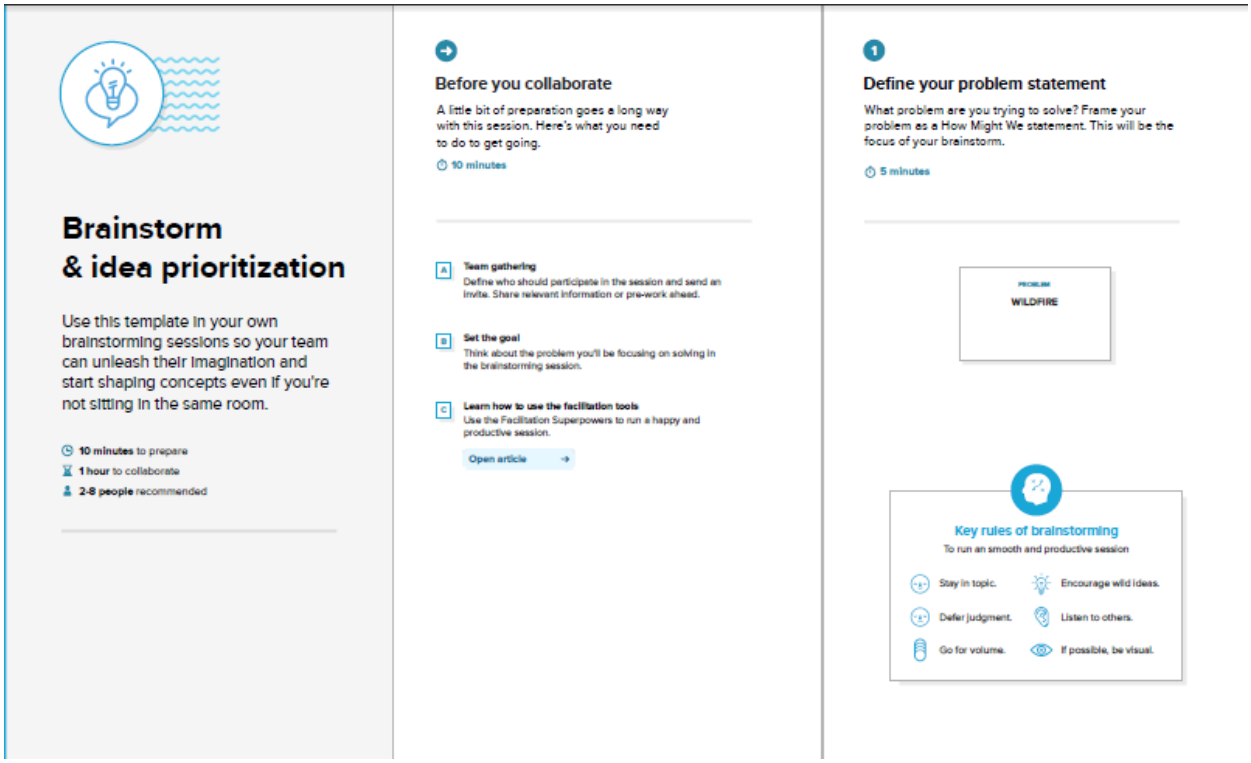
3.1 Empathy Map Canvas:

An empathy map is **a collaborative tool teams can use to gain a deeper insight into their customers**. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community.

1

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

3.2 Ideation & Brainstorming:



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
WILDFIRE

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.

2

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!

Selin Prabavathy

- obey local laws regarding open fires
- keep all flammable objective away from fire
- have firefighting tools nearby and handy
- never leave a fire unattended
- carefully extinguish smoking materials
- drown all fires
- make a fire safe zone around your house
- remove any limbs which overhang the roof
- use fire resistant roofing material

Siva Lakshmi

- check wheather and drought condition
- build your campfire in an open location
- do use your campfire until it's cold
- keep vehicles off dry grass
- regularly maintain your equipment and vehicles
- practice vehicle safety
- avoid burning wastes around dry grass
- don't start a fire on a windly day
- don't throw explosive and combustibles into the fire

Siva Martin

- check the weather
- respect fire danger signs
- never leave a fire unattended
- always fully extinguish any fire
- choose approximation location to set up campfire
- educate the people you are with
- do not throw burning items
- drown all fires
- alert authorities of any smoke in the area

Sorna mala

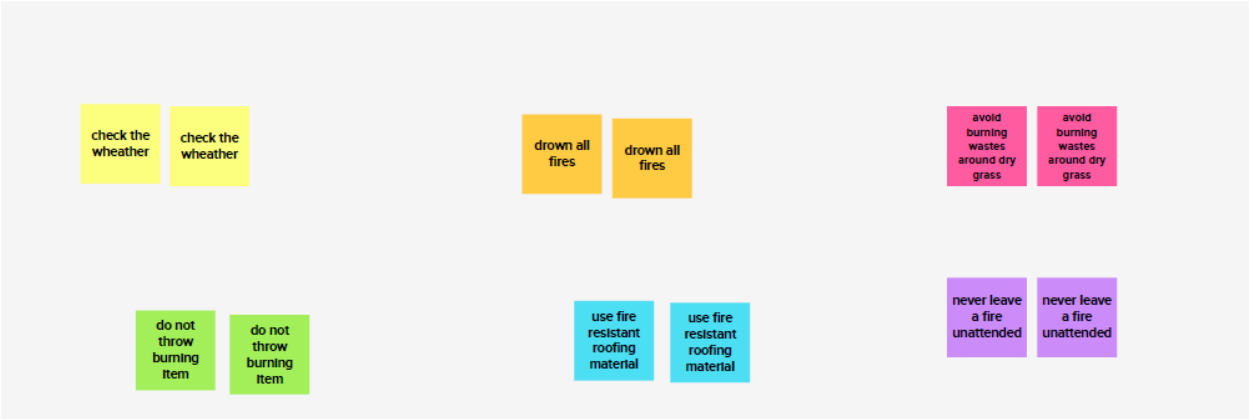
- have an escape plan and practice it
- obey local laws regarding open fires
- don't start a fire on a windly day
- avoid burning wastes around dry grass
- carefully dispose of smoking material
- only use fireworks in clear areas with no woods nearby
- use fire resistant roofing material
- do not throw burning item
- have firefighting tools nearby and handy

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

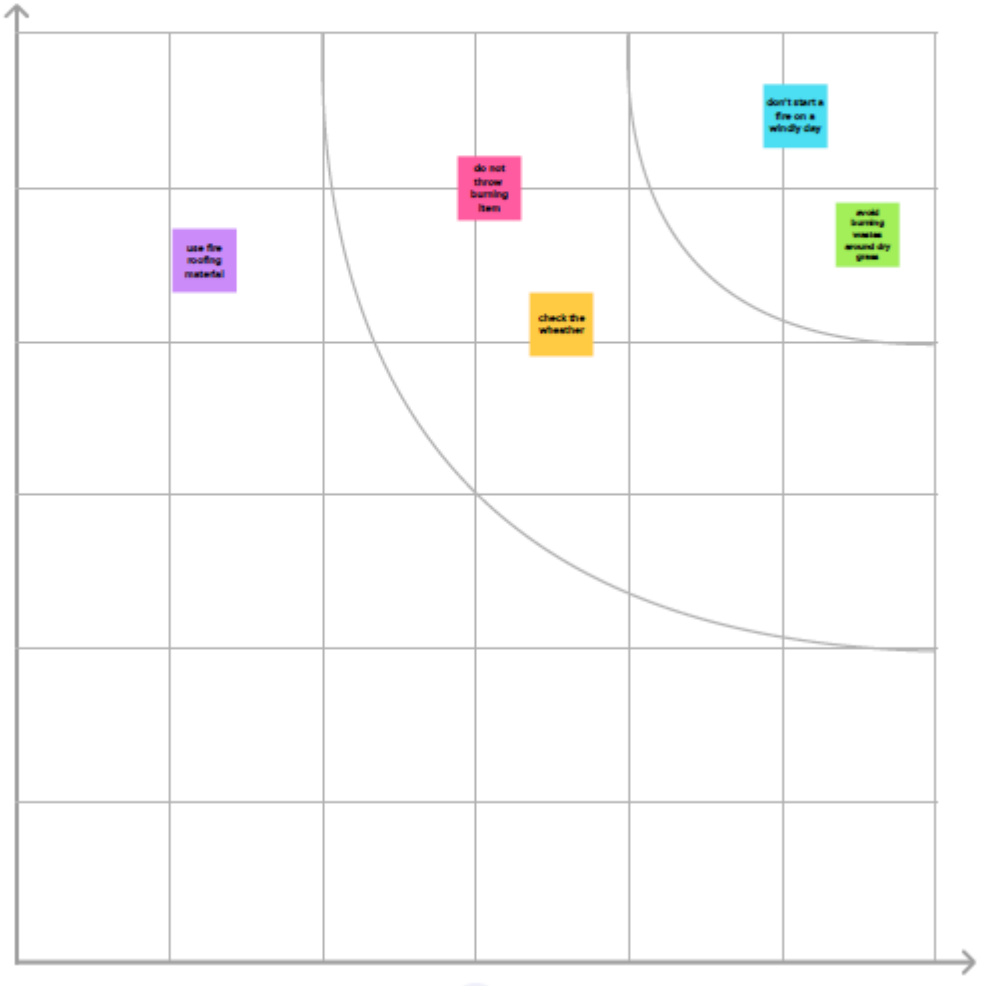


4

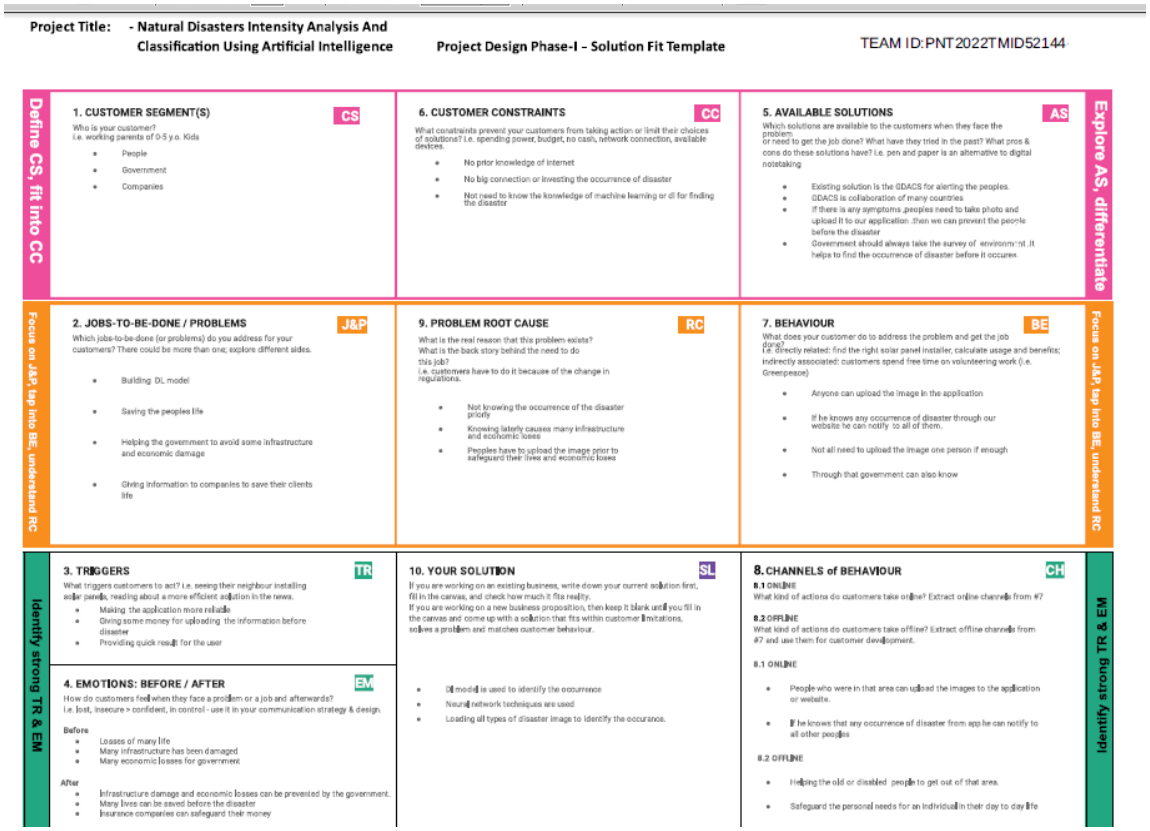
Prioritize

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



3.4 Proposed Solution fit:



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Request Permission	Access permission from web camera.
FR-2	Disaster Prediction	Based on the webcam image, natural disaster is classified.
FR-3	Accuracy	Since the training and testing images are huge, the accuracy is higher.
FR-4	Speed	The generation of results from the input images are faster.
FR-5	Resolution	The resolution of the

		integrated web camera should be high enough to capture the video Frames.
FR-6	User Interface	Maximizing the interaction in Web Designing Service.

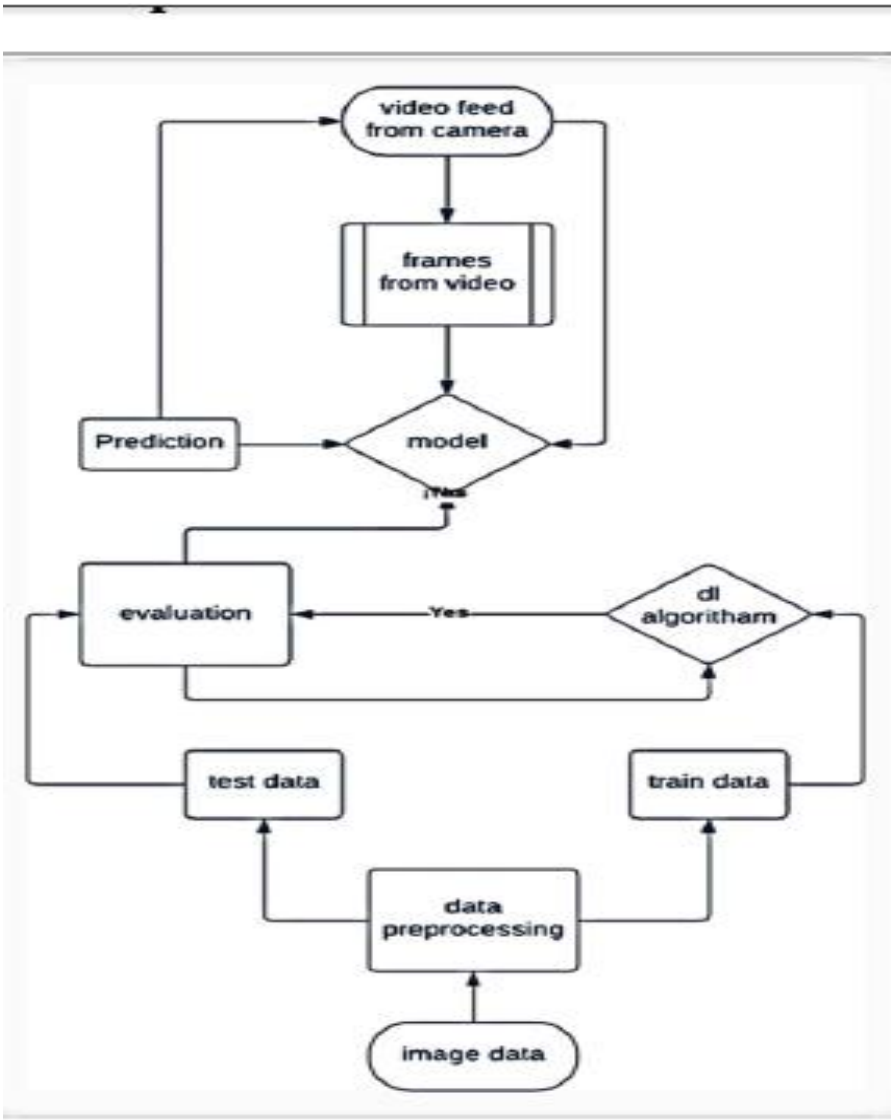
4.2 Non-functional Requirements:

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	Usability	User friendly and classify the disaster easily.
NFR-2	Security	The model is secure due to the cloud deployment models and also there is no login issue.
NFR-3	Reliability	Accurate prediction of the natural disaster and the website can also be fault tolerant.
NFR-4	Performance	It is shown that the model gives almost 90 percent accuracy after continuous training.
NFR-5	Availability	The website will be made available for 24 hours.
NFR-6	Scalability	The website can run on web browsers like Google chrome, Microsoft edge and also it can be extended to the NDRF and customers.

5. PROJECT DESIGN:

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solution & Technical Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

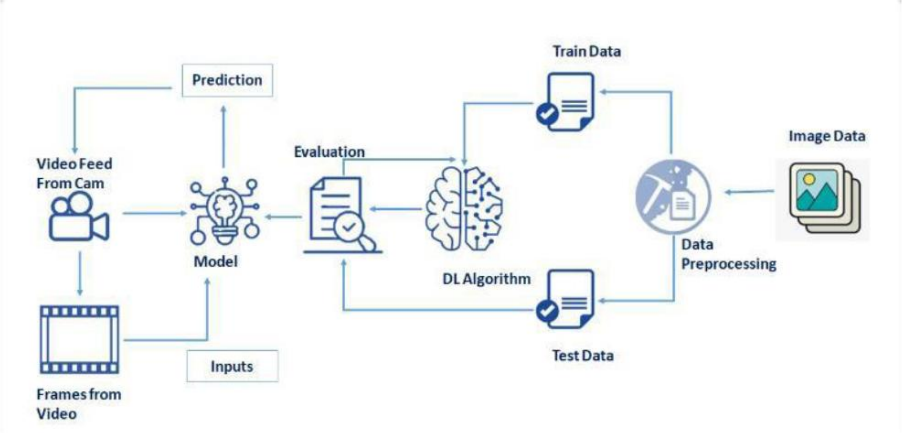
● Find the best tech solution to solve existing business problems.

● Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

● Define features, development phases, and solution requirements.

● Provide specifications according to which the solution is defined, managed, and delivered.

Technical Architecture:



5.3 User Stories:

Sprint	**Function al Requirement (Epic)**	**User story Number**	**User story / Task**	**Story points**	**Priority**	**Team members**
Sprint-1	Registration	USN – 1	As a user, registering into the product using a valid email address	5	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-2	Registration	USN – 2	As a user, registering into the product using avalid username and password	3	Medium	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-1	Authentication	USN – 3	As a user, I adept to logging into the system with credentials	4	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-2	Authentication	USN - 4	As a user, I adept to logging into the system	2	High	P.Selin Prabavathy A.Sivalakshmi

			with OTP			T.Sivamartin R.Sornamala
Sprint-1	Designation of Region	USN – 5	selecting the region of interest to be monitored and analyzed	3	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala

6.PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning and Estimation:

Sprint	**Functional Requirement (Epic)**	**User story Number**	**User story / Task**	**Story points**	**Priority**	**Team members**
Sprint-2	Accumulation of required Data	USN – 7	Gathering data and detailed report on past event analysis	3	Low	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-4	Organizing Unstructured data	USN – 8	Choosing a required algorithm for specific analysis	2	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-2	Algorithm selection	USN – 9	Choosing a required algorithm for specific analysis	6	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-3	Prediction and analysis of data	USN – 10	Predicting and visualizing the data effectively	36	High	P.Selin Prabavathy A.Sivalakshmi T.Sivamartin R.Sornamala
Sprint-4	Report generation	USN – 11	Generating a clear and detailed	3	High	P.Selin Prabavathy A.Sivalaksh

			report on product data analysis			mi T.Sivamartin R.Sornamala

6.2 Sprint Delivery Schedule:

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	12	6 days	24 Oct 2022	29 Oct 2022	12	30 Oct 2022
Sprint-2	14	6 days	31 Oct 2022	5 Nov 2022	14	6 Nov 2022
Sprint-3	6	6 days	07 Nov 2022	12 Nov 2022	6	8 Nov 2022
Sprint-4	6	6 days	14 Nov 2022	19 Nov 2022	6	20 Nov 2022

7 CODING & SOLUTIONING:

Feature 1:

A convolutional neural network is a class of artificial neural networks. It is a Deep Learning algorithm that can take in an input image, assign importance to various objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. The advantage of CNNs is to provide an efficient dense network which performs the prediction or identification efficiently.

Feature 2:

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. A multilayer neural network with appropriate weights has been shown to be able to approximate any input-output function making it an attractive tool for modeling and forecasting.

8. TESTING:

8.1 Test Cases

8.2 User Acceptance Testing

This document serves as a quick reference for the Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy project's test coverage and open issues as of the project's release for user acceptance testing.

Defect Analysis:-

This shows how many bugs were fixed or closed at each severity level and how they were fixed.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	4	5	2	3	14
Duplicate	1	0	3	1	5
External	2	3	0	1	6
Fixed	9	2	4	15	30
Not Reproduced	0	0	1	0	1
Skipped	1	0	1	1	3
Won't Fix	0	5	2	1	8
Totals	17	14	13	22	64

Test-Case Analysis

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	9	0	0	9
Client Application	40	0	0	40
Security	3	0	0	3
Out-source Shipping	3	0	0	3
Exception Reporting	8	0	0	8
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9.RESULTS:

9.1 Performance Metrics:

S.No.	Parameter	Values(Percentage)
1.	Model Summary	-96%
2.	Accuracy	Training Accuracy - 96.5% Validation Accuracy -92.3%
3.	Confidence Score (Only Yolo Projects)	Class Detected - Nil Confidence Score - Nil

Our Project marks the successive performance by implementing in order to be cost effective and more reliable to use and to predict the future from the natural disaster that we are ahead of. The successive way includes the objectives, activities and the approaches for the project. It mainly includes the trained dataset which gives an excessive measure of success which helps to overcome the future from this natural disaster.

10.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

● The use of AI to forecast natural disasters would save millions of lives. Furthermore, the information evaluated by AI-powered systems can aid in understanding the scale and patterns of

natural catastrophes such as floods, earthquakes, and tsunamis, which would aid in improved infrastructure development in disaster-prone areas.

● Disaster management plays an integral role in keeping communities safe. It involves coordinating the resources, such as pollution control systems, and responsibilities, such as following best practice policies, needed to prevent, prepare for, respond to, and recover from emergencies

DISADVANTAGES:

● A forest fire is a natural disaster that cannot be forecasted.

● Sometimes the prediction may fail and result in huge loss.

11. CONCLUSION

Natural disasters inflict severe damage on almost the entire spectrum of social and natural habitats, ranging from housing and shelter, water, food, health, sanitation, and waste management to information and communication networks, supply of power and energy, and transportation infrastructure. The major challenges faced in all disasters include pre-disaster early warning infrastructure; the supply of food and clean drinking water; health and sanitation; information and communication; power and energy for lighting and cooking; waste collection and disposal, including rapid disposal of dead bodies of humans and animals; disaster-proof housing and shelter; emergency and post-disaster shelters; rescue and relief operations; and transport infrastructure. Though it is not possible to prevent most of the disasters, still their effects can be alleviated or mitigated in magnitude by anticipated preparedness. Advanced disaster management technology could provide a critical support system for disaster management authorities at times of disaster-related crises. Such a technology also provides important inputs for any disaster management plan of action in modern times. Communities and individuals have to be educated on pre-disaster planning and preparedness. Awareness must be created amongst masses, for which first-aid training at grass roots level is essential. There should be a National Disaster Plan that defines the tasks of the communities and local health personnel.

For the evaluation of the model ROC and 30% landslide point's residual was used. The results showed that the accuracy of the model was estimated by ANFIS in the study area of 77.48% (good accuracy); this data-mining method depends on the number of pairs of training, experimental and fuzzy data used in the research, and, in particular, by increasing the number of fuzzy rules of the process, more accurate simulation can be provided. So far, different methods have been proposed for landslide susceptibility zonation. The accuracy or the error of each of these methods, as well as the use and comparison of each of these methods, requires knowledge of the foundations on which the methods are based. So far, different approaches to landslide susceptibility zonation have been proposed, but what is certain is that all these methods can provide accurate results with minimal data and costs and at very low levels. Combining these

models with GIS and RS systems not only increases the accuracy of dealing with complex issues and uncertainties, but also leads to the emergence and development of new theories and methods in a variety of issues.

12.FUTURE SCOPE

The term "Natural Disaster" encompasses the complete realm of disaster-related activities. Traditionally people tend to think of disaster management only in terms of the post-disaster actions taken by relief and reconstruction officials; yet disaster management covers a much broader scope, and many modern disaster managers may find themselves far more involved in pre-disaster activities than in post-disaster response. Those are:

1. The refugee field of disaster management is highly specialized and requires not only many development skills but also a broader awareness of political, legal, and humanitarian issues.

2. DM aims and objectives, elements, Natural/man-made Disasters, Victims, Relief Systems.

3. Phases of Disaster Response/Relief Operations, Government's Role.

To Safeguard and make available vital materials, supplies and equipment to ensure the safety and recovery of records from predictable disasters.To reduce the risk of disasters caused by human error, deliberate destruction, and building or equipment failures. Be better prepared to recover from a major natural catastrophe.

In this project we help to build preparedness for threats and hazards by providing a low-risk, costeffective environment to: Test and validate plans, policies, procedures and capabilities. Identify resource requirements, capability gaps, strengths, areas for improvement, and potential best practices. Disaster management aims to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. Disaster Risk Management includes the sum total of all activities, programmes and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover from its losses.

13. APPENDIX:

Source Code:

home.html:

```
<!DOCTYPE html>
<html lang="en">
<title>Home – Natural Disasters Database</title>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
```

<link rel=”stylesheet” href=https://www.w3schools.com/w3css/4/w3.css>
<link rel=”stylesheet” href=https://fonts.googleapis.com/css?family=Lato>
<link rel=”stylesheet” href=https://fonts.googleapis.com/css?family=Montserrat>
<link rel=”stylesheet” href=https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css>
<style>
Body,h1,h2,h3,h4,h5,h6 {font-family: “Lato”, sans-serif}
.w3-bar,h1,button {font-family: “Montserrat”, sans-serif}
.fa-anchor,.fa-coffee {font-size:200px}
</style>
<body>
<!—Navbar □ □

<div class=”w3-bar w3-black w3-card w3-left-align w3-large”>
<i class=”fa fa-bars”></i>
Home
Earthquake
Tsunami
Tornado
<a href=”{%url ‘volcano’%}” class=”w3-bar-item w3-button w3-hide-small w3-padding-large w3- hover-

```
white”>Volcanic Activity</a>
</div>
<!—Navbar on small screens □ □ □
<div id=”navDemo” class=”w3-bar-block w3-white w3-hide w3-hide-large w3-hide-medium
w3-large”>
<a href=”#” class=”w3-bar-item w3-button w3-padding-large”>Earthquake</a>
<a href=”#” class=”w3-bar-item w3-button w3-padding-large”>Tsunami</a>
<a href=”#” class=”w3-bar-item w3-button w3-padding-large”>Tornado</a>
<a href=”#” class=”w3-bar-item w3-button w3-padding-large”>Volcanic Activity</a>
</div>
</div>
<!—Header □ □
<header class=”w3-container w3-grey w3-center” style=”padding:128px 16px”>
<h1 class=”w3-margin w3-jumbo”>Earthquakes</h1>
<p class=”w3-xlarge”>Natural Disasters Database</p>
</header>
<div class=”w3-container”>
<h2>Earthquakes</h2>
<table class=”w3-table-all”>
<tr>
<th>Earthquake_id</th>
<th>Intensity</th>
<th>Date</th>
<th>Country</th>
<th>Place</th>
<th>Latitude</th>
<th>Longitude</th>
{% for quake in all_quakes %}
<tr>
<td>{{quake.earthquake_id}}</td>
<td>{{quake.intensity}}</td>
<td>{{quake.date}}</td>
<td>{{quake.country}}</td>
<td>{{quake.place}}</td>
<td>{{quake.latitude}}</td>
<td>{{quake.longitude}}</td>
</tr>
{% endfor %}
</table>
</div>
<div class=”w3-container”>
<h2>Damage caused by the quakes</h2>
<table class=”w3-table-all”>
<tr>
<th>Earthquake_id</th>
<th>Amount (in million)</th>
```

<th>Deaths (in thousands)</th>
<th>House_destroyed (in thousands)</th>
</tr>

```
{% for d in damage %}
<tr>
<td>{{d.earthquake_id}}</td>
<td>{{d.amount}}</td>
<td>{{d.deaths}}</td>
<td>{{d.house_destroyed}}</td>
</tr>
{% endfor %}
</table>
</div>
<div class=”w3-container w3-black w3-center w3-opacity w3-padding-50”>
<h1 class=”w3-margin w3-xlarge”>Thanks for visiting the website</h1>
</div>
<!—Footer □ □
<footer class=”w3-container w3-padding-40 w3-center w3-opacity”>
<div class=”w3-xlarge w3-padding-20”>
<h1>A Database project </h1>
</footer>
<script>
// Used to toggle the menu on small screens when clicking on the menu buttonFunction
myFunction() {
Var x = document.getElementById(“navDemo”);
If (x.className.indexOf(“w3-show”) == -1) { x.className += “ w3-show”;
} else {
x.className = x.className.replace(“ w3-show”, “”);
}
}
</script>
</body>
</html>
```

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-44046-1664428037