HINDUSTHAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University,
Chennai, Accredited with "A" Grade by NAAC) Valley Campus, Pollachi Main Road, Coimbatore
641 032.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROJECT REPORT ON

HX 8001 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

(Naalaiya Thiran Program)

PROJECT TITLE

Exploratory Analysis of Rain Fall Data in India for Agriculture

TEAM ID: PNT2022TMID10487

TEAM MEMBERS:

1. GUDIPATI SAIKIRAN (TEAM LEAD)
2. GOWTHAM
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MENTOR:

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M.CHINNAPPARAJAN

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EXPLORATORY ANALYSIS OF RAINFAL DATA IN INDIA FOR AGRICULTURE

PROJECT REPORT

1.Introduction:

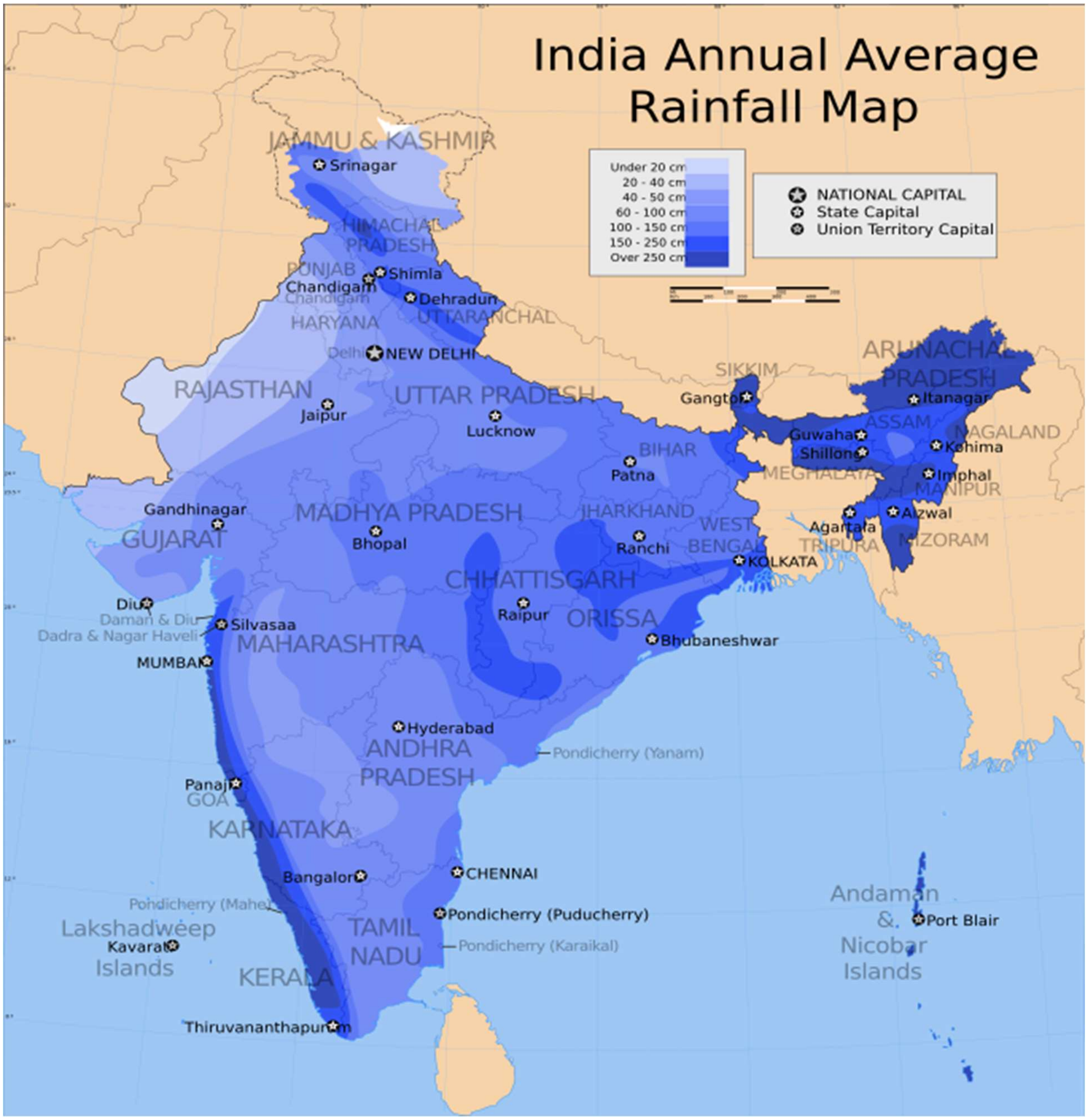
Rainfall has been a major concern these days. Weather conditions have been changing for time being. Rainfall forecasting is important otherwise, it may lead to many disasters. Irregular heavy rainfall may lead to the destruction of crops, heavy floods that can cause harm to human life. It is important to exactly determine the rainfall for effective use of water resources, crop productivity, and pre-planning of water structures.

This comparative study is conducted concentrating on the following aspects: modeling inputs, Visualizing the data, modeling methods, and preprocessing techniques. The results provide a comparison of various evaluation metrics of these machine learning techniques and their reliability to predict rainfall by analyzing the weather data.

We will be using classification algorithms such as Decision tree, Random forest, KNN, and xgboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. Once the model is saved, we integrate it with flask application and also deploy the model in IBM.

1.1 Project Overview :

India is an agricultural country and secondary agro based market will be steady with a good monsoon. The economic growth of each year depends on the amount of duration of monsoon rain, bad monsoon can lead to destruction of some crops, which may result in scarcity of some agricultural products which in turn can cause food inflation, insecurity and public
unrest. In our analysis we are trying to understand the behavior of rainfall in India over the years, by months and different subdivisions.



The Indian summer monsoon typically lasts from June-September,with large areas of western and central India receiving more than 90% of their total annual precipitation during the period, and southern and northwestern India receiving 50%-75% of their total annual rainfall.Overall, monthly totals average 200-300 mm over the country as a whole, with the largest values observed during the heart of the monsoon season in July and August.

There was an early start to monsoon conditions during 1996, with monsoonal rains completely covering India by 30 June, 2 weeks earlier than normal. There was also a late finish to the monsoon season, with a complete withdrawal of monsoonal rains from India not seen until 11 October. For the area as a whole, rainfall was above normal during June and July, near normal during August, slightly below normal during September, and then substantially above normal during October. In fact, average October totals nearly equalled those observed during September.

1.2 Purpose :

The main purpose of EDA is to help look at data before making any assumptions. It can help identify obvious errors, as well as better understand patterns within the data, detect outliers or anomalous events, find interesting relations among the variables

One of the primary purposes of exploratory data analysis is to identify issues early on to ensure that the data going into machine learning (ML) models is both accurate and consistent and will provide valid, unbiased results.

This analysis will provide useful information for water resources planner, farmers and urban engineers to assess the availability of water and create the storage accordingly. The mean, standard deviation and coefficient of variation of monthly and annual rainfall was calculated to check the rainfall variability.

2.LITERATURE SURVEY

2.1 Existing Problem

Weather conditions changes then and often. This can lead to Severe threats to all the living beings including human beings. So predicting weather, especially Irregular heavy rainfall can cause huge floods and economic losses. This also decreases crop productivity and may lead into Food shortage. Collection of previous 10 years data may give us an idea about the pattern of Rainfall. Using all these Datas, Appropriate farming activities can be performed. These datas can help us in predicting Rainfall .We will using lot of algorithms like KNN, XGboost, etc. We will train and test the data using these algorithms and predict the best one.

2.2 References

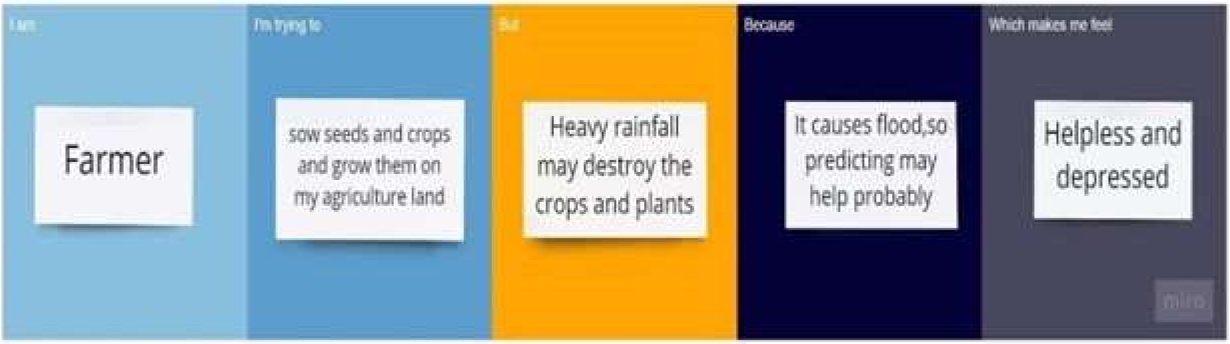
S.NO	Y EAR	AUTHOR	TITLE	CONTENT
1	2017	S. Cramer, M.Kampouridis, A. A. Freitas, and A. K. Alexandridis	An extensive evaluation of seven machine learning methods	Rainfall prediction in weather derivatives.
2	2016	S. Zhang, L. Lu, J. Yu, and H. Zhou	Short-term water level prediction using different artificial intelligent models	Geoinformatics, AgroGeoinformatics

3	2016	S. Zainudin , D. S. Jasim , and A. A. Bakar	Comparative Analysis of Data Mining Techniques	Rainfall Prediction
4	2013	R. Venkata Ramana, B. Krishna, S. R. Kumar, and N. G. Pandey	Monthly Rainfall Prediction Using Wavelet Neural Network Analysis	Wavelet Neural Network Analysis, Water Resource
5	2013	D. Nayak, A. Mahapatra, and P. Mishra	A Survey on Rainfall	Artificial Neural Network
			Prediction	

Problem Statement :

Weather conditions changes then and often. This can lead to Severe threats to all the living beings including human beings. So predicting weather, especially Irregular heavy rainfall, Droughts can cause huge economic losses. This also decreases crop productivity and may lead into Food shortage. Predicting the Rainfall plays a vital role in our life time. Farmers will get benefit due to this and Our country's GDP will rise. Collection of previous 10 years data may give us an idea about the pattern of Rainfall. Using all these Datas, Appropriate farming activities can be performed. Water is the vital mineral for a life. So, these datas can help us in predicting Rainfall during summer days to save water.

Agriculture definitely requires gallons of waters.



I am

Farmer

I'm trying to

sow seeds and crops and grow them on my agriculture land

But

Heavy rainfall may destroy the crops and plants

Because

It causes flood,so predicting may help probably

Which makes me feel

Helpless and depressed

Customer Problem Statement :

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Farmer	Predict the heavy rainfall to take precautiona ry measures to protect the crops from destruction	Can't predict the heavy rainfall	The climate changes made difficult to make the season as usual	Sad and anxious

PS-2	Department agencies	Make a continuous and good supply of the crops	The crops are destructed and are in shortage.	The heavy rainfall can’t be predicted beforeha nd	Frustrated

3.IDEATION & PROPOSED SOLUTION

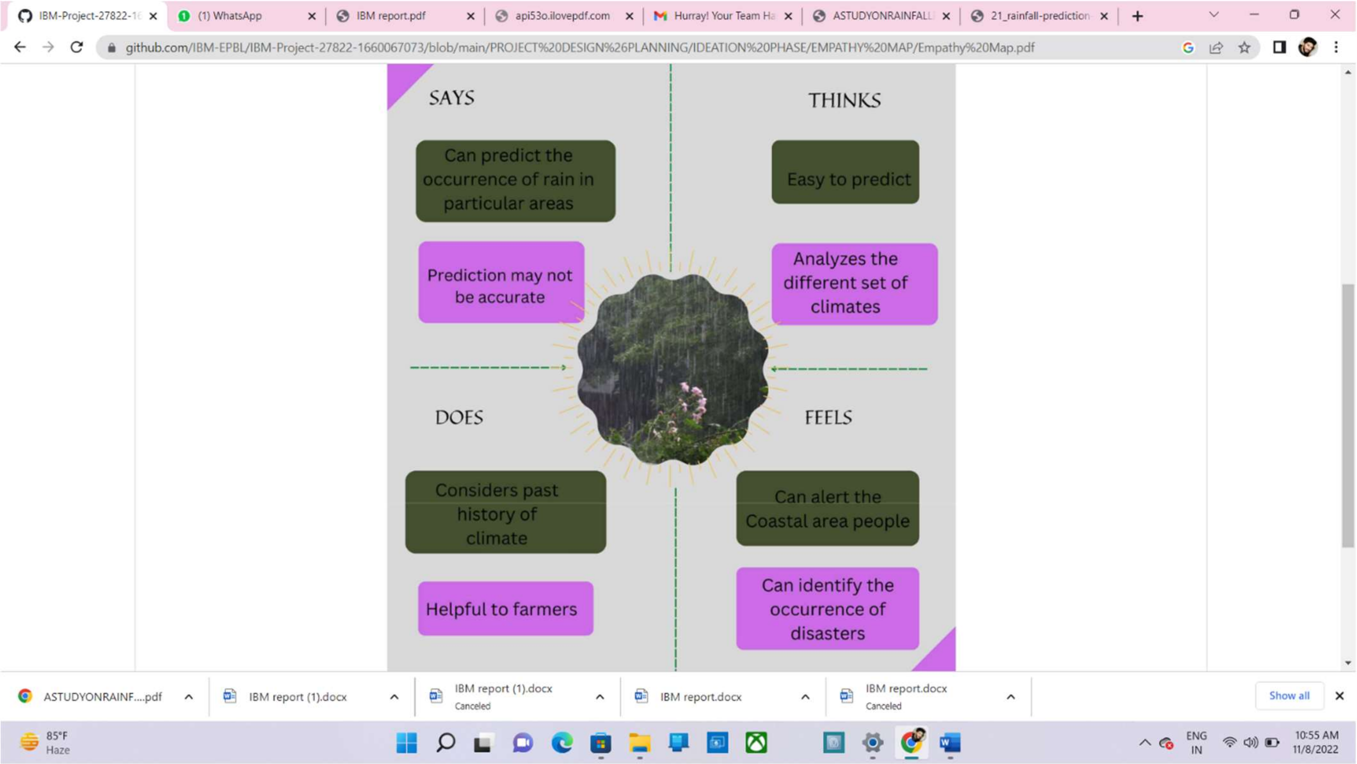
3.1 Empathy Map & Canvas

Definition:

An empathy map is a collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to

1) create a shared understanding of user needs.

2) aid in decision making.


github.com/IBM-EPBL/IBM-Project-27822-1660067073/blob/main/PROJECT%20DESIGN%26PLANNING/IDEATION%20PHASE/EMPATHY%20MAP/Empathy%20Map.pdf

SAYS

Can predict the occurrence of rain in particular areas

Prediction may not be accurate

THINKS

Easy to predict

Analyzes the different set of climates

DOES

Considers past history of climate

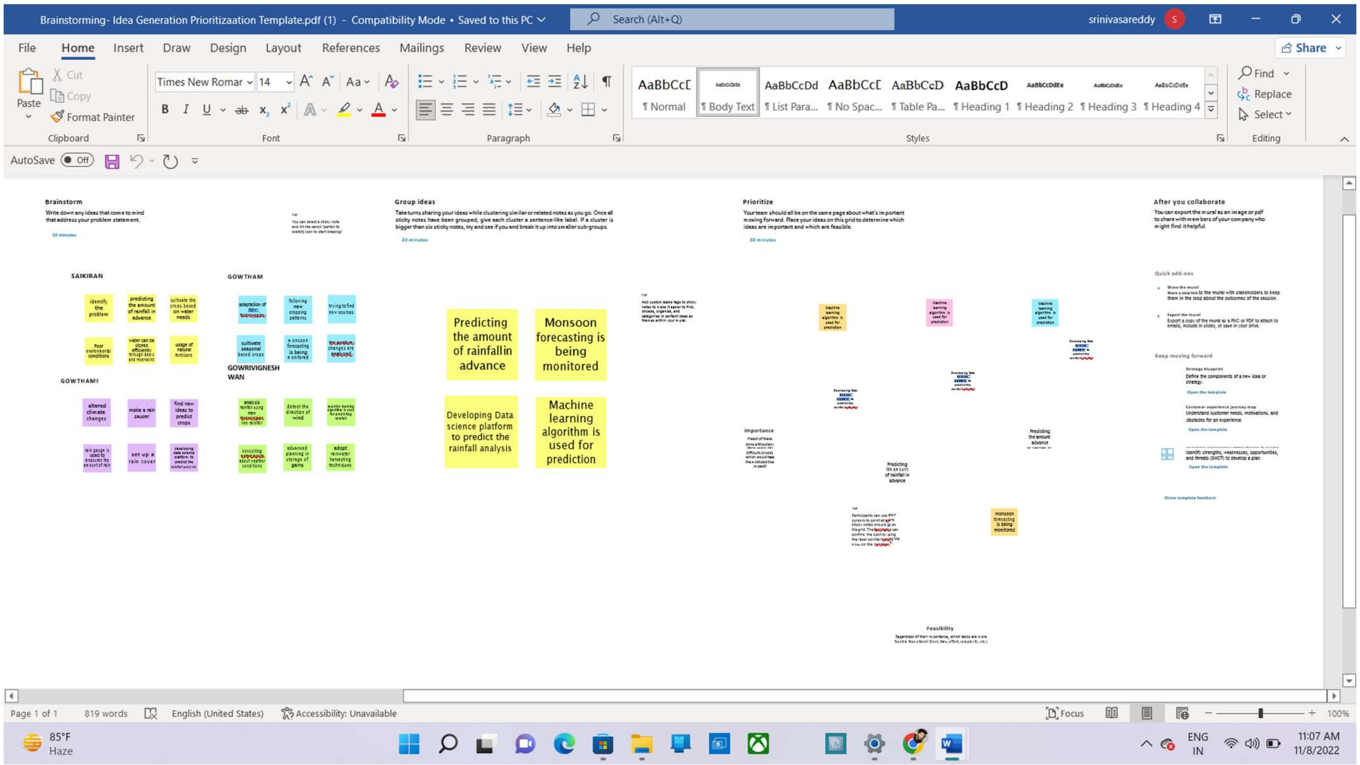
Helpful to farmers

FEELS

Can alert the Coastal area people

Can identify the occurrence of disasters

3.2 Ideation & Brainstorming


Brainstorming- Idea Generation Prioritizaation Template.pdf (1) - Compatibility Mode • Saved to this PC
File
Home
Insert
Draw
Design
Layout
References
Mailings
Review
View
Help
Share
AutoSave Off
Page 1 of 1
819 words
English (United States)
Accessibility: Unavailable

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!

SAIKIRAN

identify the problem

predicting the amount of rainfall in advance

cultivate the crops based on water needs

Poor environmental conditions

water can be stored efficiently through dams and reservoirs

usage of natural fertilizers

GOWTHAM

adaptation of new [illegible]

following new cropping patterns

trying to find new sources

cultivate seasonal based crops

monsoon forecasting is being monitored

[illegible] changes are analysed

GOWTHAMI

altered climate changes

make a rain saucer

find new ideas to predict crops

rain gauge is used to measure the amount of rain

set up a rain cover

developing data science platform to predict the rainfall analysis

GOWRIVIGNESHWAN

analysis rainfall using new [illegible] like rainfall

detect the direction of wind

machine learning algorithm is used for predicting rainfall

consulting [illegible] about weather conditions

advanced planning in storage of grains

adopt rainwater harvesting techniques

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

Predicting the amount of rainfallin advance

Monsoon forecasting is being monitored

Developing Data science platform to predict the rainfall analysis

Machine learning algorithm is used for prediction

TIP

Add custom table tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

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

Machine learning algorithm is used for prediction

Machine learning algorithm is used for prediction

Machine learning algorithm is used for prediction

Developing Data [illegible] to predict the rainfall [illegible]

Developing Data [illegible] to predict the rainfall [illegible]

Developing Data [illegible] to predict the rainfall [illegible]

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Predicting the amount advance

Predicting the amount of rainfall in advance

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.

monsoon forecasting is being monitored

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- Share the mural
  Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
- Export the mural
  Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

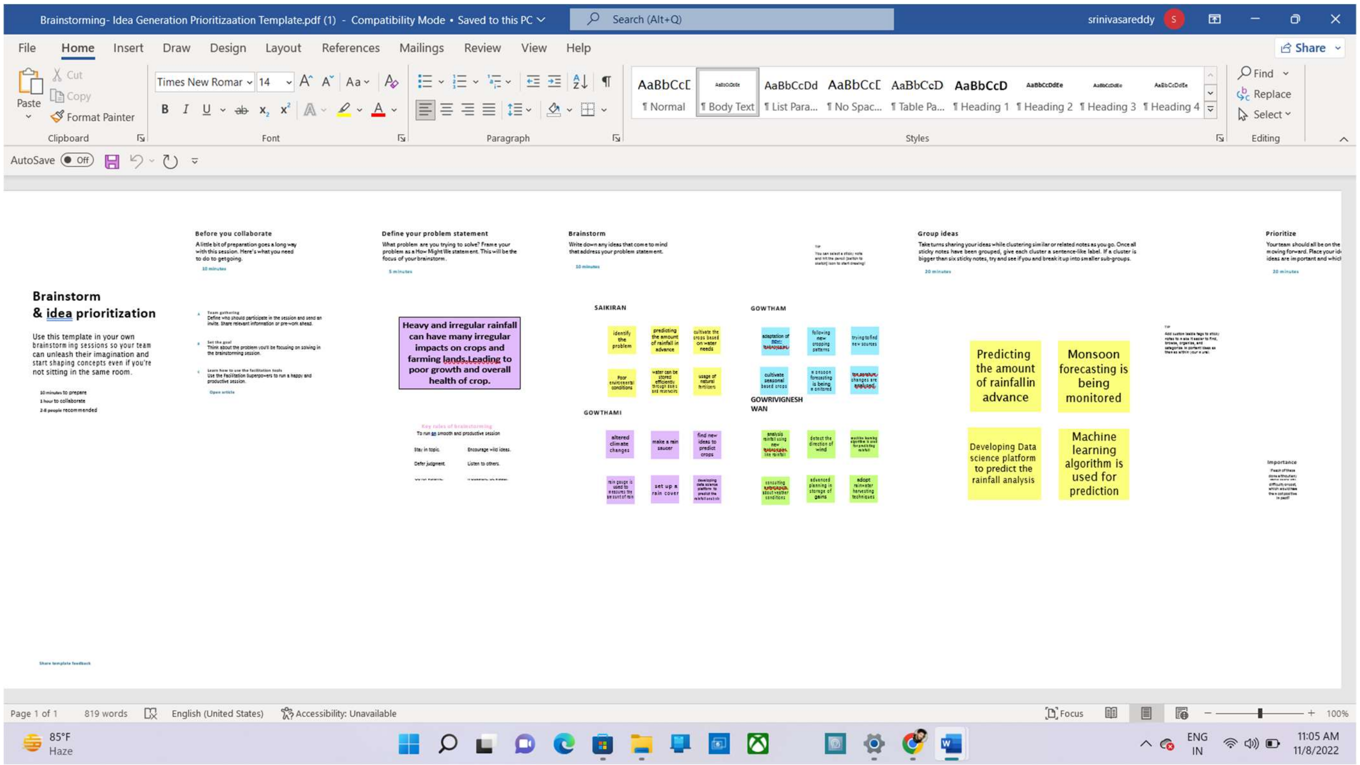
Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template

Share template feedback



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 getgoing.

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

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

Heavy and irregular rainfall can have many irregular impacts on crops and farming lands.Leading to poor growth and overall health of crop.

Key rules of brainstorming
To run an smooth and productive session

Stay in topic.
Encourage wild ideas.
Defer judgment.
Listen to others.

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!

SAIKIRAN

identify the problem
predicting the amount of rainfall in advance
cultivate the crops based on water needs
Poor environmental conditions
water can be stored efficiently through dams and reservoirs
usage of natural fertilizers

GOWTHAM

adaptation of new [illegible]
following new cropping patterns
trying to find new sources
cultivate seasonal based crops
monsoon forecasting is being monitored
[illegible] changes are analysed

GOWTHAMI

altered climate changes
make a rain saucer
find new ideas to predict crops
rain gauge is used to measures the amount of rain
set up a rain cover
developing data science platform to predict the rainfall analysis

GOWRIVIGNESHWAN

analysis rainfall using new [illegible] like rainfall
detect the direction of wind
machine learning algorithm is used for predicting rainfall
consulting [illegible] about weather conditions
advanced planning in storage of gains
adopt rainwater harvesting techniques

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

Predicting the amount of rainfallin advance

Monsoon forecasting is being monitored

Developing Data science platform to predict the rainfall analysis

Machine learning algorithm is used for prediction

TIP
Add custom table tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Prioritize

Your team should all be on the moving forward. Place your ide ideas are important and which

20 minutes

Importance
If each of these done without any difficulty or cost, which would have the most positive in past?

Share template feedback

3.3 Proposed Solution

Proposed Solution Template:

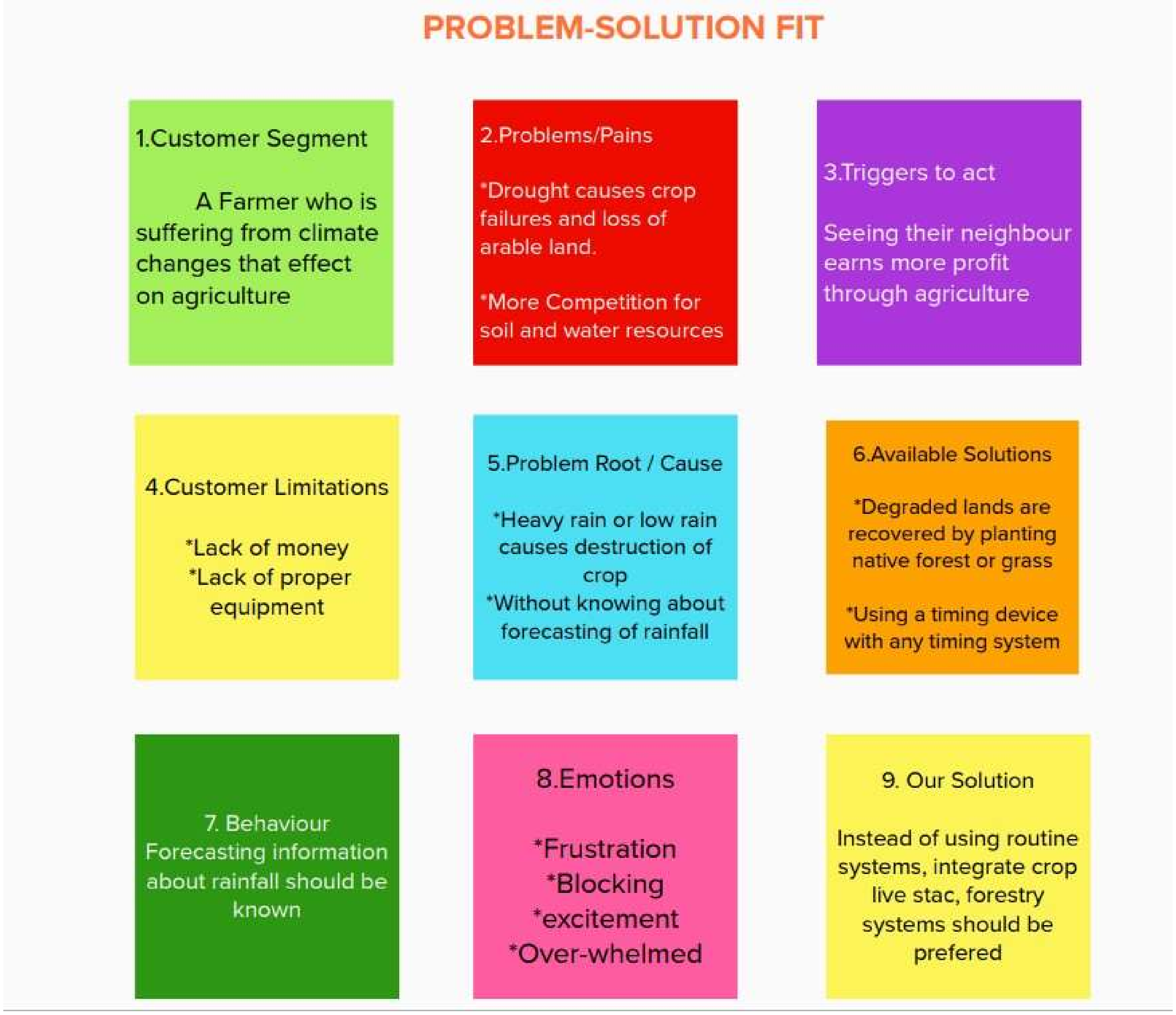
S.No.	Parameter	Description

1.	Problem Statement (Problem to be solved)	1. Climate is a important aspect of human life. So, the Prediction should accurate as much as possible. In this paper we try to deal with the prediction of the rainfall which is also a major aspect of human life and which provide the major resource of human life which is Fresh Water. 2. Now climate change is the biggest issue all over the world. Peoples are working on to detect the patterns in climate change as it affects the economy in production to infrastructure
2.	Idea / Solution description	1. In rainfall also making prediction of rainfall is a challenging task with a good accuracy rate. Making prediction on rainfall cannot be done by the traditional way, so scientist is using machine learning and deep learning to find out the pattern for rainfall prediction. 2. Provides extra support to maintain the agriculture.

3.	Novelty / Uniqueness	1. This application is useful for the beginners in agriculture. 2. Seed maturity selection features are available.
4.	Social Impact / Customer Satisfaction	1. Different types of crops can be planted for good health. 2. Helps in producing healthy crops and good fields.
5.	Business Model (Revenue Model)	• This comparative study is conducted concentrating on the following aspects: modeling inputs, Visualizing the data, modeling methods, and pre-processing techniques. The results provide a comparison of various evaluation metrics of these machine learning techniques and their
		reliability to predict rainfall by analyzing the weather data. We will be using classification algorithms such as Decision tree, Random forest, KNN, and

		xgboost.
6.	Scalability of the Solution	• When we predict rainfall correctly,it helps growth of crop and yielding will be better.

3.4 Problem Solution



PROBLEM-SOLUTION FIT

1.Customer Segment

A Farmer who is suffering from climate changes that effect on agriculture

2.Problems/Pains

*Drought causes crop failures and loss of arable land.

*More Competition for soil and water resources

3.Triggers to act

Seeing their neighbour earns more profit through agriculture

4.Customer Limitations

*Lack of money
*Lack of proper equipment

5.Problem Root / Cause

*Heavy rain or low rain causes destruction of crop
*Without knowing about forecasting of rainfall

6.Available Solutions

*Degraded lands are recovered by planting native forest or grass

*Using a timing device with any timing system

7. Behaviour
Forecasting information about rainfall should be known

8.Emotions

*Frustration
*Blocking
*excitement
*Over-whelmed

9. Our Solution

Instead of using routine systems, integrate crop live stac, forestry systems should be prefered

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

NFR-1	**Usability**	The system should be easy to use.
NFR-2	**Security**	Security is given over the model, so the user can use this with full trust. The system should protect the data and information related to the farms.
NFR-3	**Reliability**	Good connectivity and a supporting device . The system should be reliable and not crash when using it.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Import necessary packages	Importing packages like NumPy, pandas, seaborn, etc
FR-2	Download and load dataset	Download the dataset Load the Appropriate dataset
FR-3	Pre-processing of data	Making data suitable for building a good model
FR-4	Building Machine learning model	Choose the best algorithm. Check for the best optimised result.
FR-5	Train the data	Train the model using training data.
FR-6	Test the model	Test the model for the best evaluation and analysing.

4.2 Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description

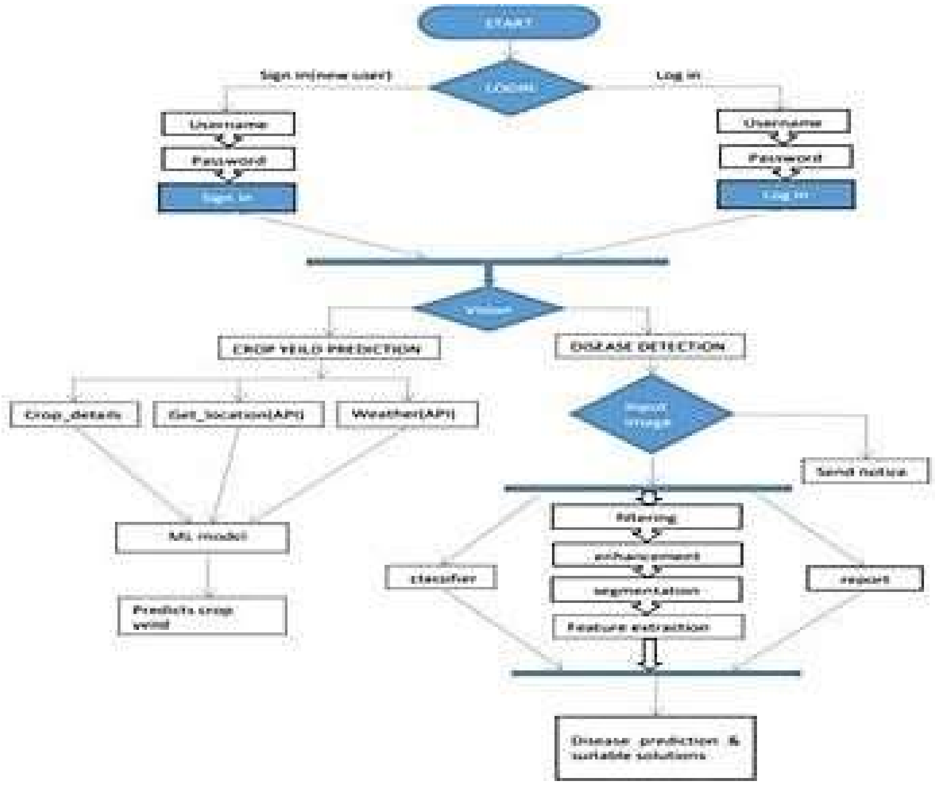
NFR-4	**Performance**	The system should output results of different inputs in a reasonable me..
NFR-5	**Availability**	Any person can use this and this is an open-source model.
NFR-6	**Scalability**	Farmers, Vegetable sellers, ci zens can use this, predic on of data is accurate.

5. PROJECT DESIGN

5.1 Data Flow Diagrams:

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 Technical Architecture:

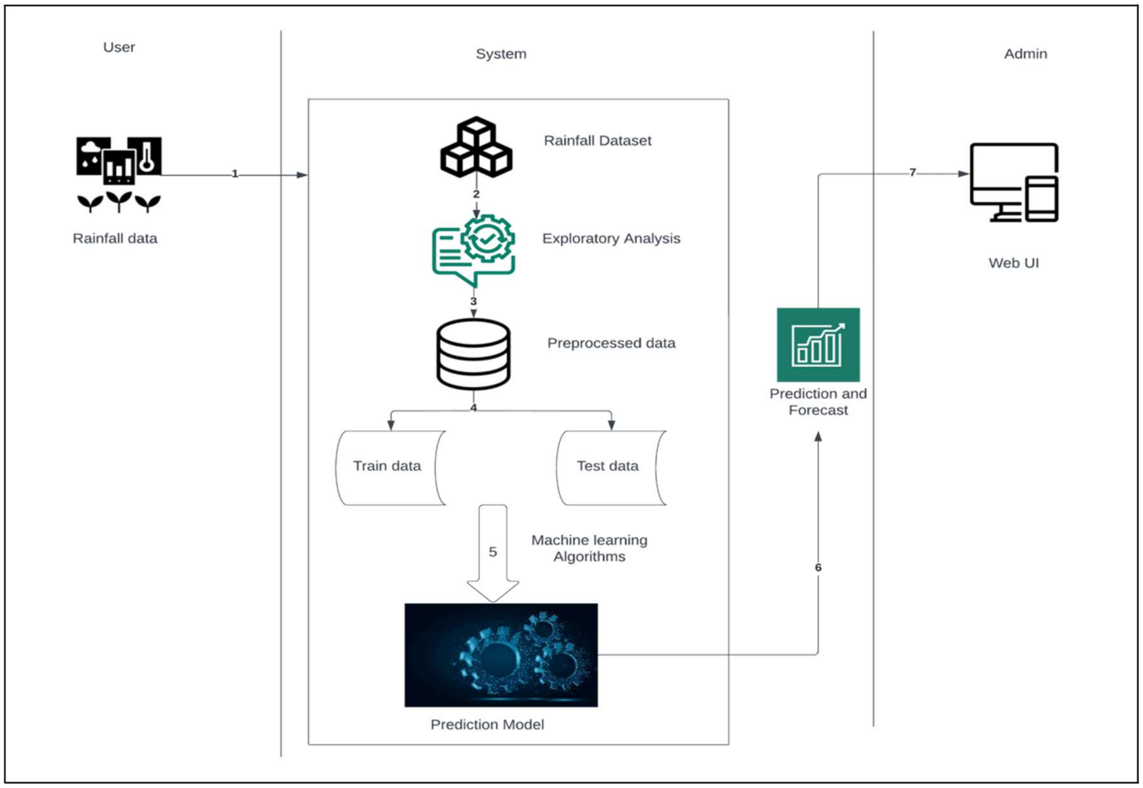
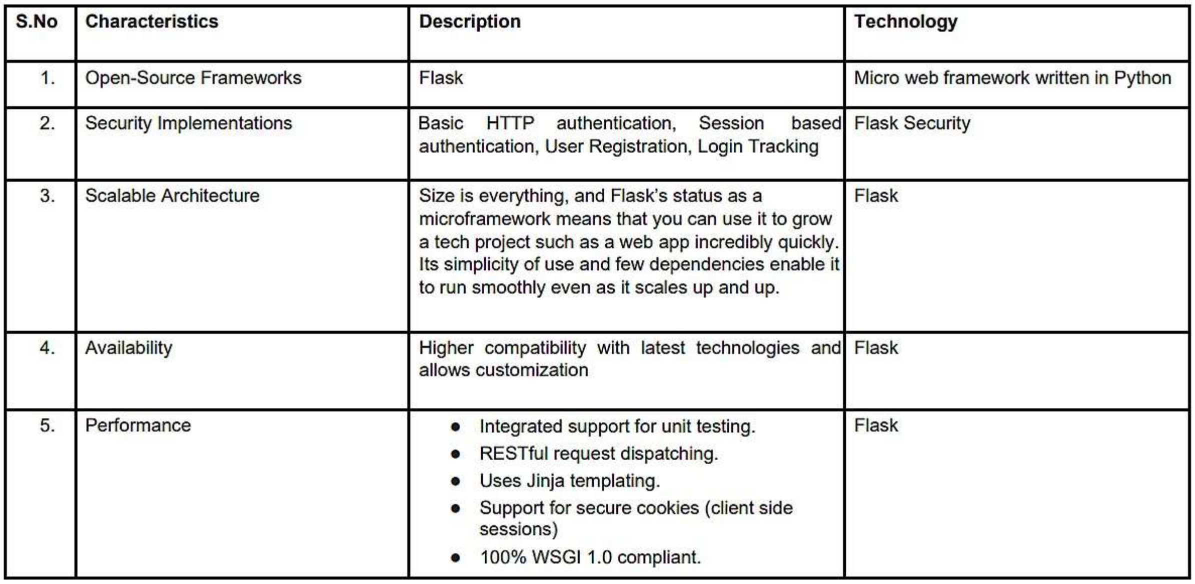


Table-1 : Components & Technologies:

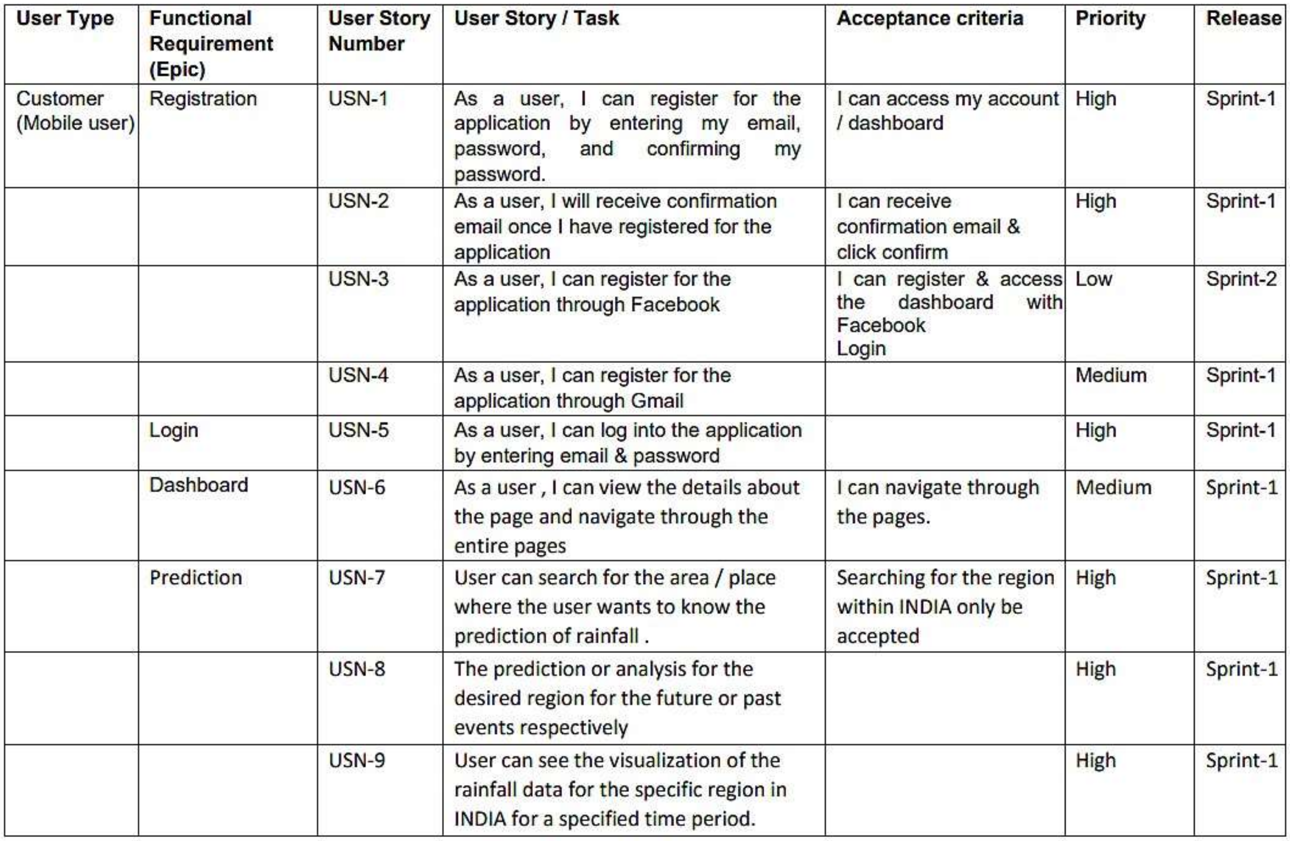
S.No	Component	Description	Technology
1.	User Interface	The user interacts with the application through a web UI and a chatbot	HTML, CSS, python, Flask
2.	Application Logic-1	Logic for registration Registration	Python
3.	Application Logic-2	Logic for login to the application	Python
4.	Application Logic-3	Integrating machine learning model and the webpage	Flask
5.	Database	Numeric data	MySQL
6.	File Storage	To store files such as prediction report	Local Filesystem
7.	External API	Allows developers access to critical forecasts, alerts, and observations, along with other weather data.	IBM Weather API
8.	Machine Learning Model	Predictive modeling is a statistical technique using machine learning and data mining to predict and forecast likely future outcomes with the aid of historical and existing data	Predictive modeling
9.	Infrastructure (Server)	Application Deployment on Local System Local Server Configuration: built-in flask web server	Flask web server

Table-2: Application Characteristics:

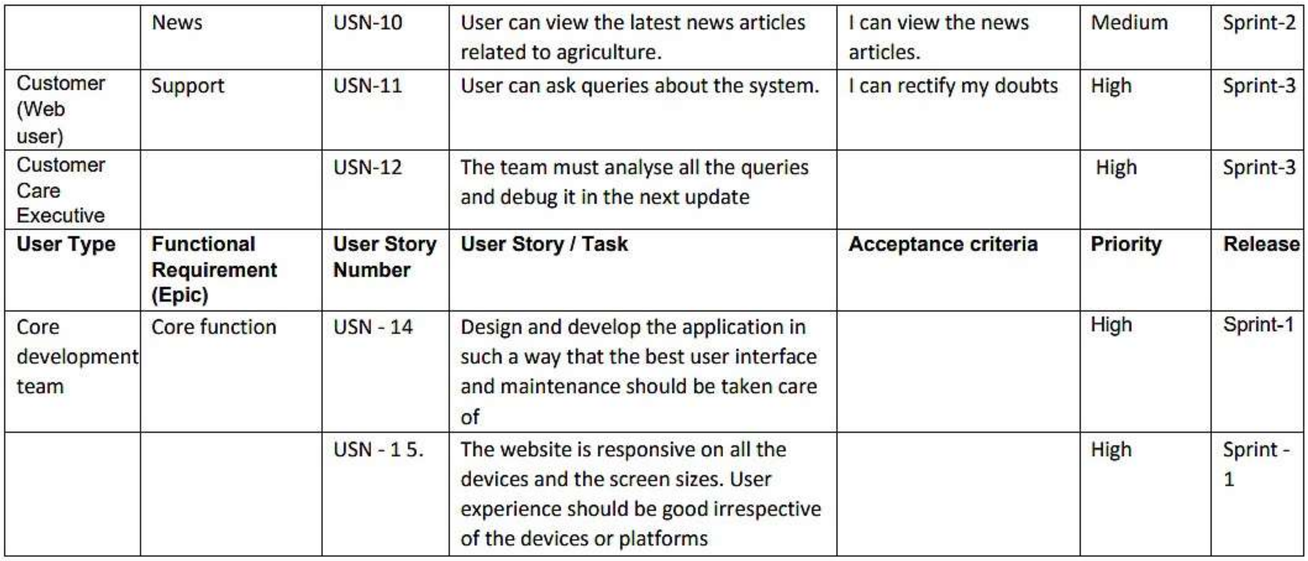


S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Flask	Micro web framework written in Python
2.	Security Implementations	Basic HTTP authentication, Session based authentication, User Registration, Login Tracking	Flask Security
3.	Scalable Architecture	Size is everything, and Flask's status as a microframework means that you can use it to grow a tech project such as a web app incredibly quickly. Its simplicity of use and few dependencies enable it to run smoothly even as it scales up and up.	Flask
4.	Availability	Higher compatibility with latest technologies and allows customization	Flask
5.	Performance	● Integrated support for unit testing. ● RESTful request dispatching. ● Uses Jinja templating. ● Support for secure cookies (client side sessions) ● 100% WSGI 1.0 compliant.	Flask

5.3 User Stories:



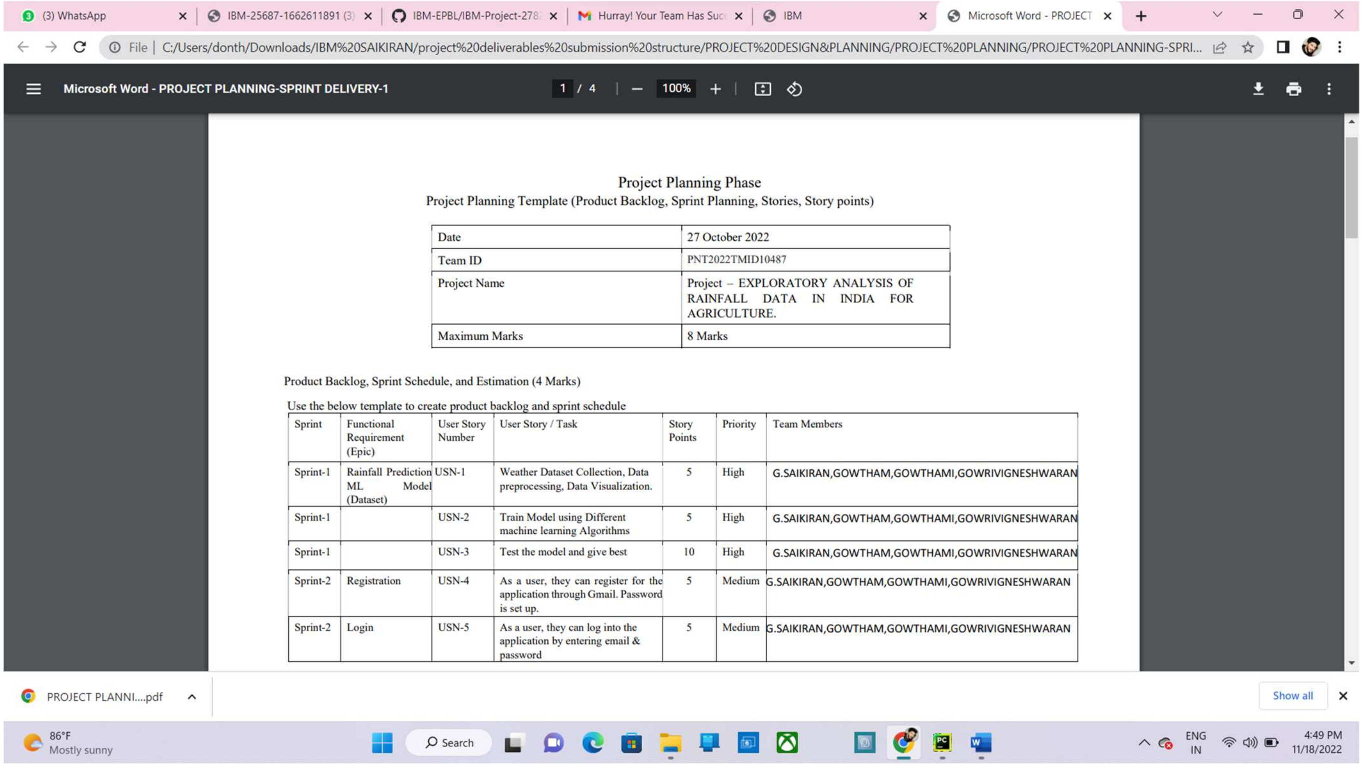
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-6	As a user , I can view the details about the page and navigate through the entire pages	I can navigate through the pages.	Medium	Sprint-1
	Prediction	USN-7	User can search for the area / place where the user wants to know the prediction of rainfall .	Searching for the region within INDIA only be accepted	High	Sprint-1
		USN-8	The prediction or analysis for the desired region for the future or past events respectively		High	Sprint-1
		USN-9	User can see the visualization of the rainfall data for the specific region in INDIA for a specified time period.		High	Sprint-1



	News	USN-10	User can view the latest news articles related to agriculture.	I can view the news articles.	Medium	Sprint-2
Customer (Web user)	Support	USN-11	User can ask queries about the system.	I can rectify my doubts	High	Sprint-3
Customer Care Executive		USN-12	The team must analyse all the queries and debug it in the next update		High	Sprint-3
User Type	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Acceptance criteria**	**Priority**	**Release**
Core development team	Core function	USN - 14	Design and develop the application in such a way that the best user interface and maintenance should be taken care of		High	Sprint-1
		USN - 1 5.	The website is responsive on all the devices and the screen sizes. User experience should be good irrespective of the devices or platforms		High	Sprint - 1

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Delivery Schedule:


(3) WhatsApp
IBM-25687-1662611891 (3)
IBM-EPBL/IBM-Project-278
Hurray! Your Team Has Succ
IBM
Microsoft Word - PROJECT
File | C:/Users/donth/Downloads/IBM%20SAIKIRAN/project%20deliverables%20submission%20structure/PROJECT%20DESIGN&PLANNING/PROJECT%20PLANNING/PROJECT%20PLANNING-SPRI...
Microsoft Word - PROJECT PLANNING-SPRINT DELIVERY-1
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Show all
86°F
Mostly sunny
Search
ENG
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4:49 PM
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Project Planning Phase

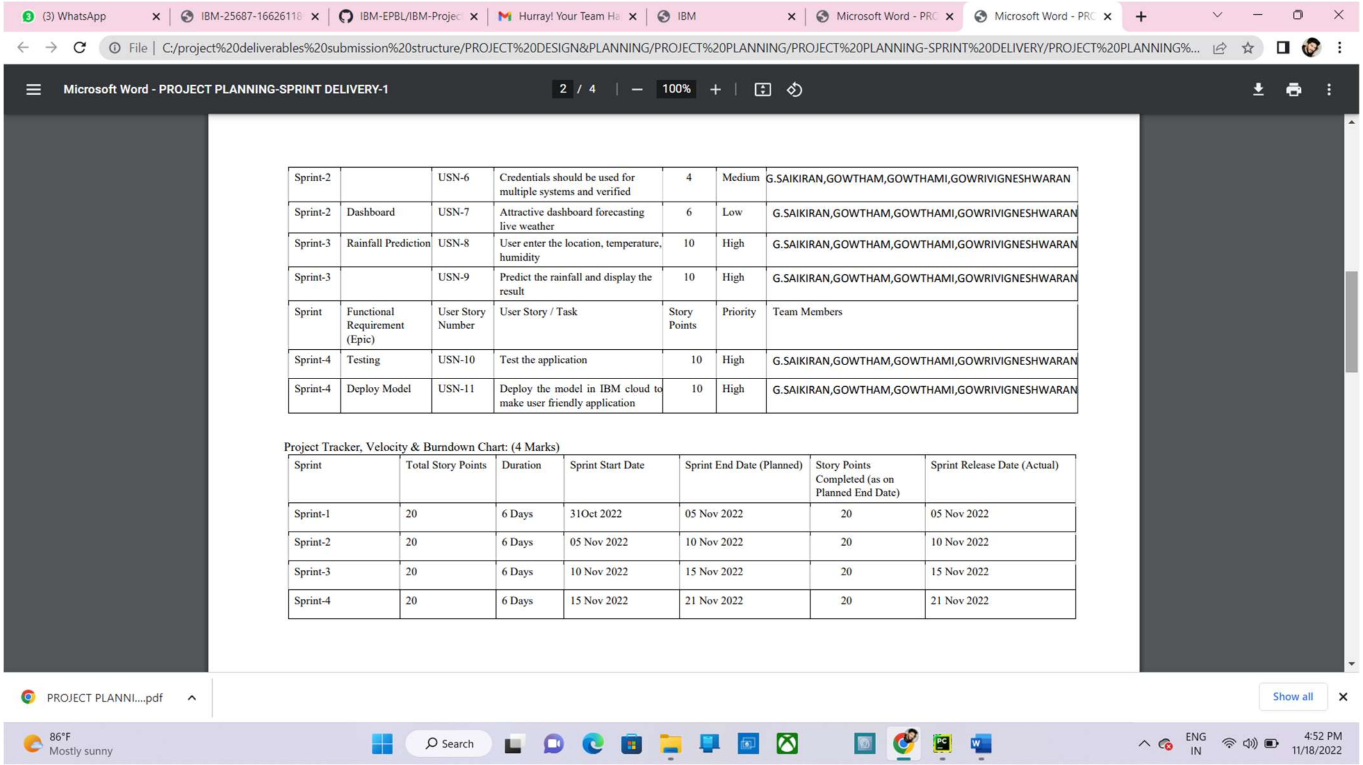
Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	27 October 2022
Team ID	PNT2022TMID10487
Project Name	Project – EXPLORATORY ANALYSIS OF RAINFALL DATA IN INDIA FOR AGRICULTURE.
Maximum Marks	8 Marks

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Rainfall Prediction ML Model (Dataset)	USN-1	Weather Dataset Collection, Data preprocessing, Data Visualization.	5	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-1		USN-2	Train Model using Different machine learning Algorithms	5	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-1		USN-3	Test the model and give best	10	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-2	Registration	USN-4	As a user, they can register for the application through Gmail. Password is set up.	5	Medium	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-2	Login	USN-5	As a user, they can log into the application by entering email & password	5	Medium	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN


(3) WhatsApp
IBM-25687-16626118
IBM-EPBL/IBM-Projec
Hurray! Your Team Ha
IBM
Microsoft Word - PRC
Microsoft Word - PRC
File | C:/project%20deliverables%20submission%20structure/PROJECT%20DESIGN&PLANNING/PROJECT%20PLANNING/PROJECT%20PLANNING-SPRINT%20DELIVERY/PROJECT%20PLANNING%...
Microsoft Word - PROJECT PLANNING-SPRINT DELIVERY-1
2 / 4
100%
PROJECT PLANNI....pdf
Show all
86°F
Mostly sunny
Search
ENG
IN
4:52 PM
11/18/2022

Sprint-2		USN-6	Credentials should be used for multiple systems and verified	4	Medium	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-2	Dashboard	USN-7	Attractive dashboard forecasting live weather	6	Low	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-3	Rainfall Prediction	USN-8	User enter the location, temperature, humidity	10	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-3		USN-9	Predict the rainfall and display the result	10	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Testing	USN-10	Test the application	10	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN
Sprint-4	Deploy Model	USN-11	Deploy the model in IBM cloud to make user friendly application	10	High	G.SAIKIRAN,GOWTHAM,GOWTHAMI,GOWRIVIGNESHWARAN

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	20	6 Days	31Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-2	20	6 Days	05 Nov 2022	10 Nov 2022	20	10 Nov 2022
Sprint-3	20	6 Days	10 Nov 2022	15 Nov 2022	20	15 Nov 2022
Sprint-4	20	6 Days	15 Nov 2022	21 Nov 2022	20	21 Nov 2022

Velocity:

Imagine we have a 5-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)

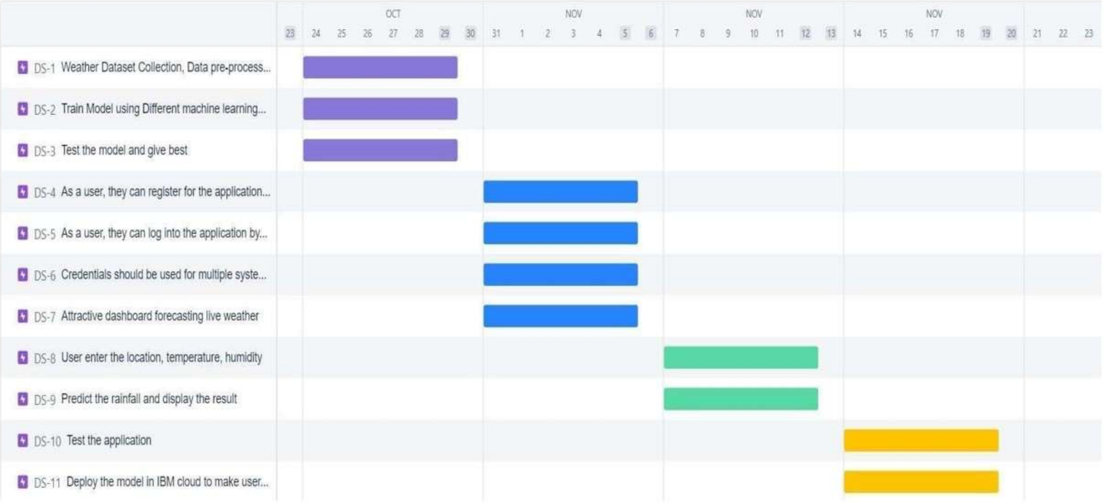
AV= Sprint duration/ Velocity = 20/5 =4

Total Average Velocity=4

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.

Tool : Jira Software



DS-1 Weather Dataset Collection, Data pre-process...

DS-2 Train Model using Different machine learning...

DS-3 Test the model and give best

DS-4 As a user, they can register for the application...

DS-5 As a user, they can log into the application by...

DS-6 Credentials should be used for multiple syste...

DS-7 Attractive dashboard forecasting live weather

DS-8 User enter the location, temperature, humidity

DS-9 Predict the rainfall and display the result

DS-10 Test the application

DS-11 Deploy the model in IBM cloud to make user...

6.2 Sprint Planning & Estimation:

TITLE	DESCRIPTION	DATE
Literature survey & information gathering	Collect the relevant information on project use case, refer the existing solutions, technical papers, research publications etc.	12 SEPTEMBER 2022
Prepare empathy map	Prepare Empathy Map Canvas and List of problem statements	14 SEPTEMBER 2022

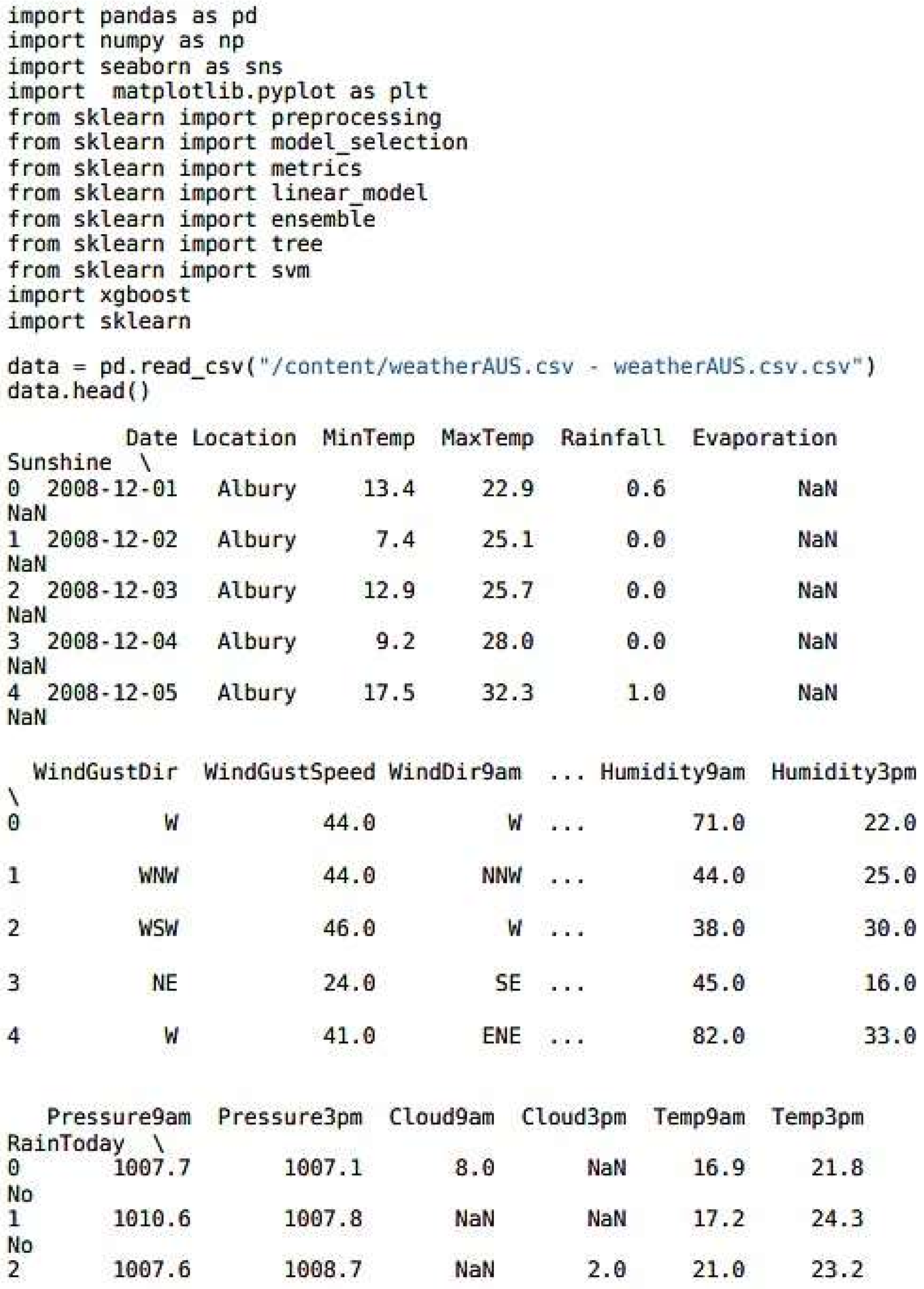
Ideation Proposed solution	List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	22 SEPTEMBER 2022 24 SEPTEMBER 2022
Problem solution fit	Prepare problem - solution fit document & Solution Architecture	19 OCTOBER 2022 (resubmitted)
Solution Architecture	Prepare Solution Architecture document	resubmitted)19 OCTOBER 2022 (

Customer journey	Prepare the customer journey maps to understand the user interactions & experiences with the application	19 OCTOBER 2022
Solution requirement	Prepare the Functional Requirement Document	19 OCTOBER 2022
Data flow diagrams	Prepare the Data Flow Diagrams	19 OCTOBER 2022
Technology architecture	Prepare Technology Architecture of the solution	19 OCTOBER 2022
Prepare Milestone & activity list	Prepare the Milestone & activity list of the project	26 OCTOBER 2022
Project development – delivery of sprint – 1,2,3 & 4	Develop & submit the developed code by testing it	In process …

7.CODING & SOLUTIONING

(Explain the features added in the project along with code)

7.1 Feature 1



```
import pandas as pd
import numpy as np
import seaborn as sns
import  matplotlib.pyplot as plt
from sklearn import preprocessing
from sklearn import model_selection
from sklearn import metrics
from sklearn import linear_model
from sklearn import ensemble
from sklearn import tree
from sklearn import svm
import xgboost
import sklearn

data = pd.read_csv("/content/weatherAUS.csv - weatherAUS.csv.csv")
data.head()
```

```
         Date Location  MinTemp  MaxTemp  Rainfall  Evaporation
Sunshine  \
0  2008-12-01   Albury     13.4     22.9       0.6          NaN
NaN
1  2008-12-02   Albury      7.4     25.1       0.0          NaN
NaN
2  2008-12-03   Albury     12.9     25.7       0.0          NaN
NaN
3  2008-12-04   Albury      9.2     28.0       0.0          NaN
NaN
4  2008-12-05   Albury     17.5     32.3       1.0          NaN
NaN

  WindGustDir  WindGustSpeed WindDir9am  ... Humidity9am  Humidity3pm
\
0           W           44.0          W  ...        71.0         22.0

1         WNW           44.0        NNW  ...        44.0         25.0

2         WSW           46.0          W  ...        38.0         30.0

3          NE           24.0         SE  ...        45.0         16.0

4           W           41.0        ENE  ...        82.0         33.0


   Pressure9am  Pressure3pm  Cloud9am  Cloud3pm  Temp9am  Temp3pm
RainToday  \
0       1007.7       1007.1       8.0       NaN     16.9     21.8
No
1       1010.6       1007.8       NaN       NaN     17.2     24.3
No
2       1007.6       1008.7       NaN       2.0     21.0     23.2
```

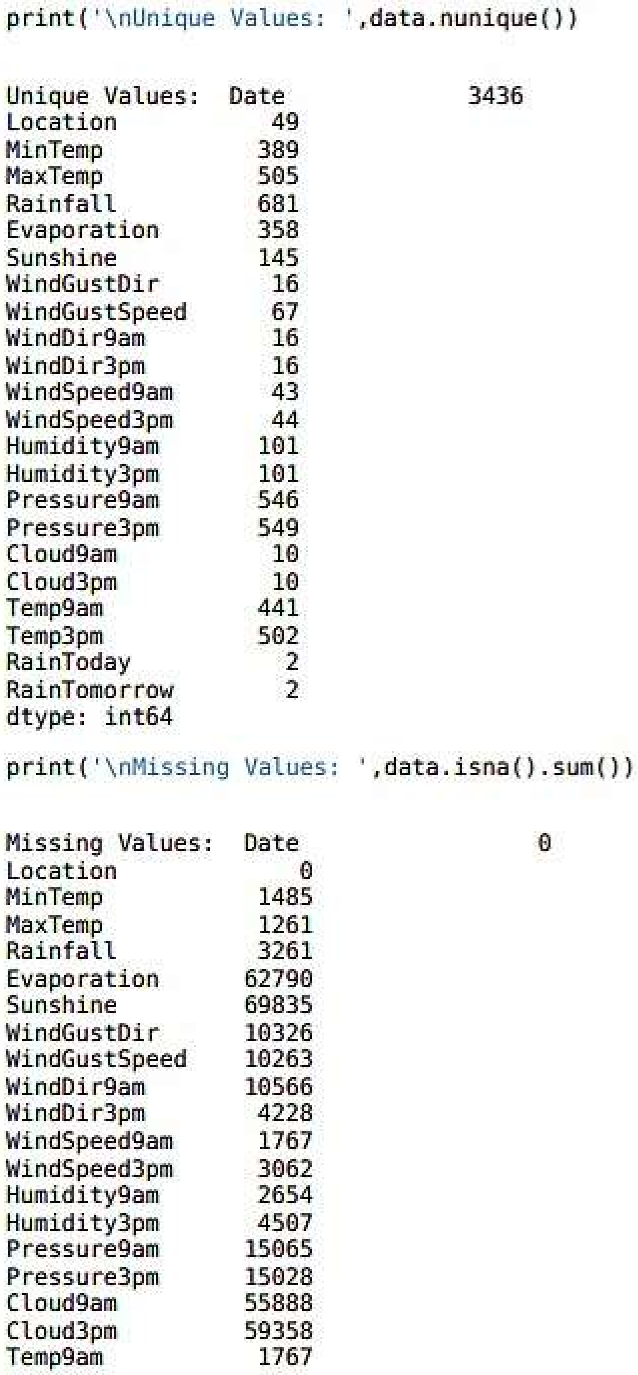
```
No
3       1017.6       1012.8       NaN       NaN     18.1     26.5
No
4       1010.8       1006.0       7.0       8.0     17.8     29.7
No

   RainTomorrow
0            No
1            No
2            No
3            No
4            No

[5 rows x 23 columns]
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 145460 entries, 0 to 145459
Data columns (total 23 columns):
 #   Column         Non-Null Count   Dtype  
---  ------         --------------   -----  
 0   Date           145460 non-null  object 
 1   Location       145460 non-null  object 
 2   MinTemp        143975 non-null  float64
 3   MaxTemp        144199 non-null  float64
 4   Rainfall       142199 non-null  float64
 5   Evaporation    82670 non-null   float64
 6   Sunshine       75625 non-null   float64
 7   WindGustDir    135134 non-null  object 
 8   WindGustSpeed  135197 non-null  float64
 9   WindDir9am     134894 non-null  object 
 10  WindDir3pm     141232 non-null  object 
 11  WindSpeed9am   143693 non-null  float64
 12  WindSpeed3pm   142398 non-null  float64
 13  Humidity9am    142806 non-null  float64
 14  Humidity3pm    140953 non-null  float64
 15  Pressure9am    130395 non-null  float64
 16  Pressure3pm    130432 non-null  float64
 17  Cloud9am       89572 non-null   float64
 18  Cloud3pm       86102 non-null   float64
 19  Temp9am        143693 non-null  float64
 20  Temp3pm        141851 non-null  float64
 21  RainToday      142199 non-null  object 
 22  RainTomorrow   142193 non-null  object 
dtypes: float64(16), object(7)
memory usage: 25.5+ MB
```

```
data.shape
```

```
(145460, 23)
```



```
print('\nUnique Values: ',data.nunique())
```

```
Unique Values:  Date             3436
Location           49
MinTemp           389
MaxTemp           505
Rainfall          681
Evaporation       358
Sunshine          145
WindGustDir        16
WindGustSpeed      67
WindDir9am         16
WindDir3pm         16
WindSpeed9am       43
WindSpeed3pm       44
Humidity9am       101
Humidity3pm       101
Pressure9am       546
Pressure3pm       549
Cloud9am           10
Cloud3pm           10
Temp9am           441
Temp3pm           502
RainToday           2
RainTomorrow        2
dtype: int64
```

```
print('\nMissing Values: ',data.isna().sum())
```

```
Missing Values:  Date                 0
Location             0
MinTemp           1485
MaxTemp           1261
Rainfall          3261
Evaporation      62790
Sunshine         69835
WindGustDir      10326
WindGustSpeed    10263
WindDir9am       10566
WindDir3pm        4228
WindSpeed9am      1767
WindSpeed3pm      3062
Humidity9am       2654
Humidity3pm       4507
Pressure9am      15065
Pressure3pm      15028
Cloud9am         55888
Cloud3pm         59358
Temp9am           1767
```

```
Temp3pm          3609
RainToday        3261
RainTomorrow     3267
dtype: int64
```

```
data.describe()
```

```
             MinTemp        MaxTemp       Rainfall   Evaporation  \
count  143975.000000  144199.000000  142199.000000  82670.000000
mean       12.194034      23.221348       2.360918      5.468232
std         6.398495       7.119049       8.478060      4.193704
min        -8.500000      -4.800000       0.000000      0.000000
25%         7.600000      17.900000       0.000000      2.600000
50%        12.000000      22.600000       0.000000      4.800000
75%        16.900000      28.200000       0.800000      7.400000
max        33.900000      48.100000     371.000000    145.000000

           Sunshine  WindGustSpeed   WindSpeed9am  WindSpeed3pm  \
count  75625.000000  135197.000000  143693.000000  142398.000000
mean       7.611178      40.035230      14.043426      18.662657
std        3.785483      13.607062       8.915375       8.809800
min        0.000000       6.000000       0.000000       0.000000
25%        4.800000      31.000000       7.000000      13.000000
50%        8.400000      39.000000      13.000000      19.000000
75%       10.600000      48.000000      19.000000      24.000000
max       14.500000     135.000000     130.000000      87.000000

         Humidity9am    Humidity3pm   Pressure9am    Pressure3pm  \
count  142806.000000  140953.000000  130395.00000  130432.000000
mean       68.880831      51.539116    1017.64994    1015.255889
std        19.029164      20.795902       7.10653       7.037414
min         0.000000       0.000000     980.50000     977.100000
25%        57.000000      37.000000    1012.90000    1010.400000
50%        70.000000      52.000000    1017.60000    1015.200000
75%        83.000000      66.000000    1022.40000    1020.000000
max       100.000000     100.000000    1041.00000    1039.600000

           Cloud9am      Cloud3pm        Temp9am       Temp3pm
count  89572.000000  86102.000000  143693.000000  141851.00000
mean       4.447461      4.509930      16.990631      21.68339
std        2.887159      2.720357       6.488753       6.93665
min        0.000000      0.000000      -7.200000      -5.40000
25%        1.000000      2.000000      12.300000      16.60000
50%        5.000000      5.000000      16.700000      21.10000
75%        7.000000      7.000000      21.600000      26.40000
max        9.000000      9.000000      40.200000      46.70000
```

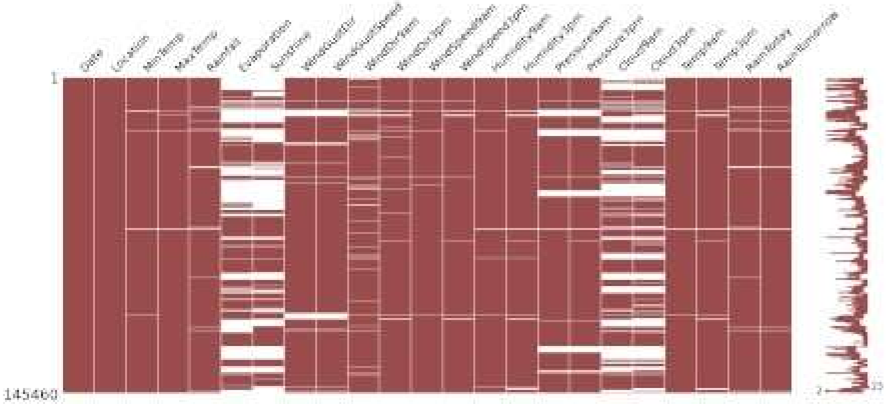
```
data.isnull().sum()
```

```
Date                0
Location            0
```

```
MinTemp           1485
MaxTemp           1261
Rainfall          3261
Evaporation      62790
Sunshine         69835
WindGustDir      10326
WindGustSpeed    10263
WindDir9am       10566
WindDir3pm        4228
WindSpeed9am      1767
WindSpeed3pm      3062
Humidity9am       2654
Humidity3pm       4507
Pressure9am      15065
Pressure3pm      15028
Cloud9am         55888
Cloud3pm         59358
Temp9am           1767
Temp3pm           3609
RainToday         3261
RainTomorrow      3267
dtype: int64
```

```
import missingno as msno
msno.matrix(data,color=(0.60,0.300,0.300),fontsize=20)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff0c1783bd0>
```



```
data_cat = data[['RainToday', 'WindGustDir', 'WindDir9am',
'WindDir3pm']]
data.drop(columns=['Evaporation', 'Sunshine', 'Cloud9am',
'Cloud3pm'],axis=1,inplace=True)
data.drop(columns=['RainToday', 'WindGustDir', 'WindDir9am',
'WindDir3pm'],axis=1,inplace=True)
```

```
data['MinTemp'].fillna(data['MinTemp'].mean(), inplace=True)

data['MaxTemp'].fillna (data['MaxTemp'].mean(), inplace=True)

data['Rainfall'].fillna (data['Rainfall'].mean(), inplace=True)

data['WindGustSpeed'].fillna (data['WindGustSpeed'].mean(),
inplace=True)

data['WindSpeed9am'].fillna (data['WindSpeed9am'].mean(),
inplace=True)

data['WindSpeed3pm'].fillna (data['WindSpeed3pm'].mean(),
inplace=True)

data['Humidity9am'].fillna (data[ 'Humidity9am'].mean(), inplace=True)

data['Humidity3pm'].fillna (data['Humidity3pm'].mean(), inplace=True)

data['Pressure9am'].fillna (data[ 'Pressure9am'].mean(), inplace=True)

data['Pressure3pm'].fillna (data['Pressure3pm'].mean(), inplace=True)

data['Temp9am'].fillna (data['Temp9am'].mean(),inplace=True)

data['Temp3pm'].fillna(data['Temp3pm'].mean(),inplace=True)


cat_names=data_cat.columns

import numpy as np


from sklearn.impute import SimpleImputer
imp_mode= SimpleImputer (missing_values=np.nan, strategy =
'most_frequent')

data_cat= imp_mode.fit_transform(data_cat)

data_cat = pd.DataFrame(data_cat,columns=cat_names)

data = pd.concat([data, data_cat],axis=1)

data.corr()
```

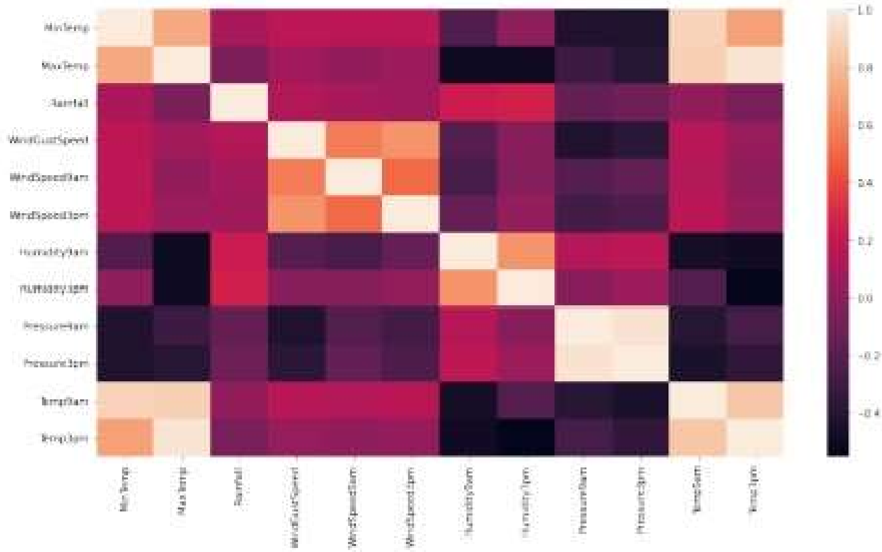
```
                MinTemp   MaxTemp  Rainfall  WindGustSpeed
WindSpeed9am  \
MinTemp        1.000000  0.733400  0.102706       0.172553
0.173404
MaxTemp        0.733400  1.000000 -0.074040       0.065895
```

```
0.014294
Rainfall       0.102706 -0.074040  1.000000       0.126446
0.085925
WindGustSpeed  0.172553  0.065895  0.126446       1.000000
0.577319
WindSpeed9am   0.173404  0.014294  0.085925       0.577319
1.000000
WindSpeed3pm   0.173058  0.049717  0.056527       0.657243
0.512427
Humidity9am   -0.230970 -0.497927  0.221380      -0.207964     -
0.268271
Humidity3pm    0.005995 -0.498760  0.248905      -0.025355     -
0.030887
Pressure9am   -0.423584 -0.308309 -0.159055      -0.425760     -
0.215339
Pressure3pm   -0.433147 -0.396622 -0.119541      -0.383938     -
0.165388
Temp9am        0.897692  0.879170  0.011069       0.145904
0.127592
Temp3pm        0.699211  0.968713 -0.077684       0.031884
0.004476

               WindSpeed3pm  Humidity9am  Humidity3pm  Pressure9am  \
MinTemp            0.173058    -0.230970     0.005995    -0.423584
MaxTemp            0.049717    -0.497927    -0.498760    -0.308309
Rainfall           0.056527     0.221380     0.248905    -0.159055
WindGustSpeed      0.657243    -0.207964    -0.025355    -0.425760
WindSpeed9am       0.512427    -0.268271    -0.030887    -0.215339
WindSpeed3pm       1.000000    -0.143458     0.016275    -0.277604
Humidity9am       -0.143458     1.000000     0.659072     0.131503
Humidity3pm        0.016275     0.659072     1.000000    -0.025848
Pressure9am       -0.277604     0.131503    -0.025848     1.000000
Pressure3pm       -0.239659     0.176009     0.048695     0.959662
Temp9am            0.161060    -0.469641    -0.216964    -0.397131
Temp3pm            0.027587    -0.490709    -0.555608    -0.265532

               Pressure3pm   Temp9am   Temp3pm
MinTemp          -0.433147  0.897692  0.699211
MaxTemp          -0.396622  0.879170  0.968713
Rainfall         -0.119541  0.011069 -0.077684
WindGustSpeed    -0.383938  0.145904  0.031884
WindSpeed9am     -0.165388  0.127592  0.004476
WindSpeed3pm     -0.239659  0.161060  0.027587
Humidity9am       0.176009 -0.469641 -0.490709
Humidity3pm       0.048695 -0.216964 -0.555608
Pressure9am       0.959662 -0.397131 -0.265532
Pressure3pm       1.000000 -0.441459 -0.360707
Temp9am          -0.441459  1.000000  0.846141
Temp3pm          -0.360707  0.846141  1.000000
```

```
cor=data.corr()
```

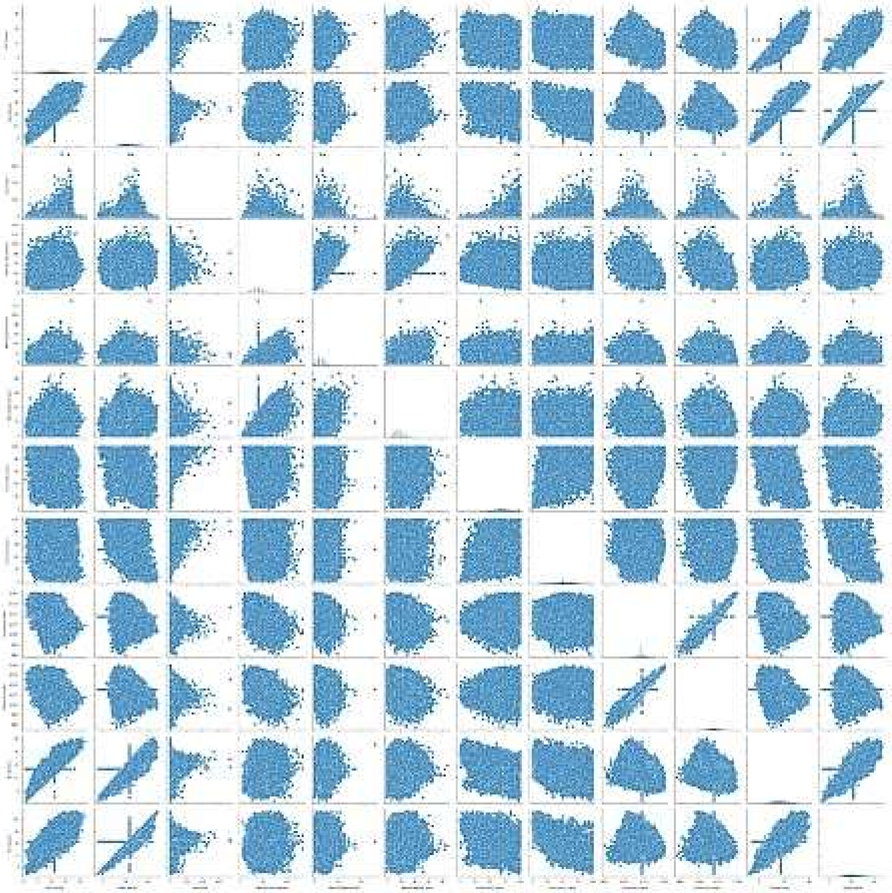
```
plt.figure(figsize=(15,8))
sns.heatmap(data=cor,xticklabels=cor.columns.values,yticklabels=cor.co
lumns.values)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb321e2bc10>
```



```
sns.pairplot(data)
```

```
<seaborn.axisgrid.PairGrid at 0x7fb31479d610>
```



```
plt.figure(figsize=(15,8))
data.boxplot()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb30f56ec50>
```

```
0          W        WNW
1        NNW        WSW
2          W        WSW
3         SE          E
4        ENE         NW
```

```
df.shape
```

```
(142193, 19)
```

```
x=df.drop('RainTomorrow',axis=1)
y=df['RainTomorrow']
```

```
x.head()
```

```
         Date Location  MinTemp  MaxTemp  Rainfall  WindGustSpeed  \
0  2008-12-01   Albury     13.4     22.9       0.6           44.0
1  2008-12-02   Albury      7.4     25.1       0.0           44.0
2  2008-12-03   Albury     12.9     25.7       0.0           46.0
3  2008-12-04   Albury      9.2     28.0       0.0           24.0
4  2008-12-05   Albury     17.5     32.3       1.0           41.0

   WindSpeed9am  WindSpeed3pm  Humidity9am  Humidity3pm
Pressure9am  \
0          20.0          24.0         71.0         22.0       1007.7

1           4.0          22.0         44.0         25.0       1010.6

2          19.0          26.0         38.0         30.0       1007.6

3          11.0           9.0         45.0         16.0       1017.6

4           7.0          20.0         82.0         33.0       1010.8


   Pressure3pm  Temp9am  Temp3pm RainToday WindGustDir WindDir9am
WindDir3pm
0       1007.1     16.9     21.8        No           W          W
WNW
1       1007.8     17.2     24.3        No         WNW        NNW
WSW
2       1008.7     21.0     23.2        No         WSW          W
WSW
3       1012.8     18.1     26.5        No          NE         SE
E
4       1006.0     17.8     29.7        No           W        ENE
NW
```

```
x_main=x.drop(['Date','Location','WindGustDir','WindDir9am','WindDir3p
m'],axis=1)
x_main.head()
```

```
4           7.0          20.0         82.0         33.0       1010.8


   Pressure3pm  Temp9am  Temp3pm RainTomorrow RainToday WindGustDir  \
0       1007.1     16.9     21.8           No        No           W
1       1007.8     17.2     24.3           No        No         WNW
2       1008.7     21.0     23.2           No        No         WSW
3       1012.8     18.1     26.5           No        No          NE
4       1006.0     17.8     29.7           No        No           W

  WindDir9am WindDir3pm
0          W        WNW
1        NNW        WSW
2          W        WSW
3         SE          E
4        ENE         NW
```

```
df=data.dropna()
df.head()
```

```
         Date Location  MinTemp  MaxTemp  Rainfall  WindGustSpeed  \
0  2008-12-01   Albury     13.4     22.9       0.6           44.0
1  2008-12-02   Albury      7.4     25.1       0.0           44.0
2  2008-12-03   Albury     12.9     25.7       0.0           46.0
3  2008-12-04   Albury      9.2     28.0       0.0           24.0
4  2008-12-05   Albury     17.5     32.3       1.0           41.0

   WindSpeed9am  WindSpeed3pm  Humidity9am  Humidity3pm  
Pressure9am  \
0          20.0          24.0         71.0         22.0       1007.7

1           4.0          22.0         44.0         25.0       1010.6

2          19.0          26.0         38.0         30.0       1007.6

3          11.0           9.0         45.0         16.0       1017.6

4           7.0          20.0         82.0         33.0       1010.8


   Pressure3pm  Temp9am  Temp3pm RainTomorrow RainToday WindGustDir  \
0       1007.1     16.9     21.8           No        No           W
1       1007.8     17.2     24.3           No        No         WNW
2       1008.7     21.0     23.2           No        No         WSW
3       1012.8     18.1     26.5           No        No          NE
4       1006.0     17.8     29.7           No        No           W

  WindDir9am WindDir3pm
```

```
   MinTemp  MaxTemp  Rainfall  WindGustSpeed  WindSpeed9am  
WindSpeed3pm  \
0     13.4     22.9       0.6           44.0          20.0  
24.0   
1      7.4     25.1       0.0           44.0           4.0  
22.0   
2     12.9     25.7       0.0           46.0          19.0  
26.0   
3      9.2     28.0       0.0           24.0          11.0  
9.0   
4     17.5     32.3       1.0           41.0           7.0  
20.0   

   Humidity9am  Humidity3pm  Pressure9am  Pressure3pm  Temp9am  
Temp3pm  \
0         71.0         22.0       1007.7       1007.1     16.9  
21.8   
1         44.0         25.0       1010.6       1007.8     17.2  
24.3   
2         38.0         30.0       1007.6       1008.7     21.0  
23.2   
3         45.0         16.0       1017.6       1012.8     18.1  
26.5   
4         82.0         33.0       1010.8       1006.0     17.8  
29.7   

  RainToday  
0        No  
1        No  
2        No  
3        No  
4        No  
```

```
x_p=pd.get_dummies(x_main,columns=['RainToday'])
x_p.head()
```

```
   MinTemp  MaxTemp  Rainfall  WindGustSpeed  WindSpeed9am  
WindSpeed3pm  \
0     13.4     22.9       0.6           44.0          20.0  
24.0   
1      7.4     25.1       0.0           44.0           4.0  
22.0   
2     12.9     25.7       0.0           46.0          19.0  
26.0   
3      9.2     28.0       0.0           24.0          11.0  
9.0   
4     17.5     32.3       1.0           41.0           7.0  
20.0   

   Humidity9am  Humidity3pm  Pressure9am  Pressure3pm  Temp9am  
```

```
Temp3pm  \
0         71.0         22.0       1007.7       1007.1     16.9
21.8
1         44.0         25.0       1010.6       1007.8     17.2
24.3
2         38.0         30.0       1007.6       1008.7     21.0
23.2
3         45.0         16.0       1017.6       1012.8     18.1
26.5
4         82.0         33.0       1010.8       1006.0     17.8
29.7

   RainToday_No  RainToday_Yes
0             1              0
1             1              0
2             1              0
3             1              0
4             1              0
```

```
from sklearn.preprocessing import LabelEncoder
lb=LabelEncoder()
y_main=pd.DataFrame(lb.fit_transform(y),columns=['RainTomorrow'])
y_main.head()
```

```
   RainTomorrow
0             0
1             0
2             0
3             0
4             0
```

```
from sklearn.preprocessing import StandardScaler
```

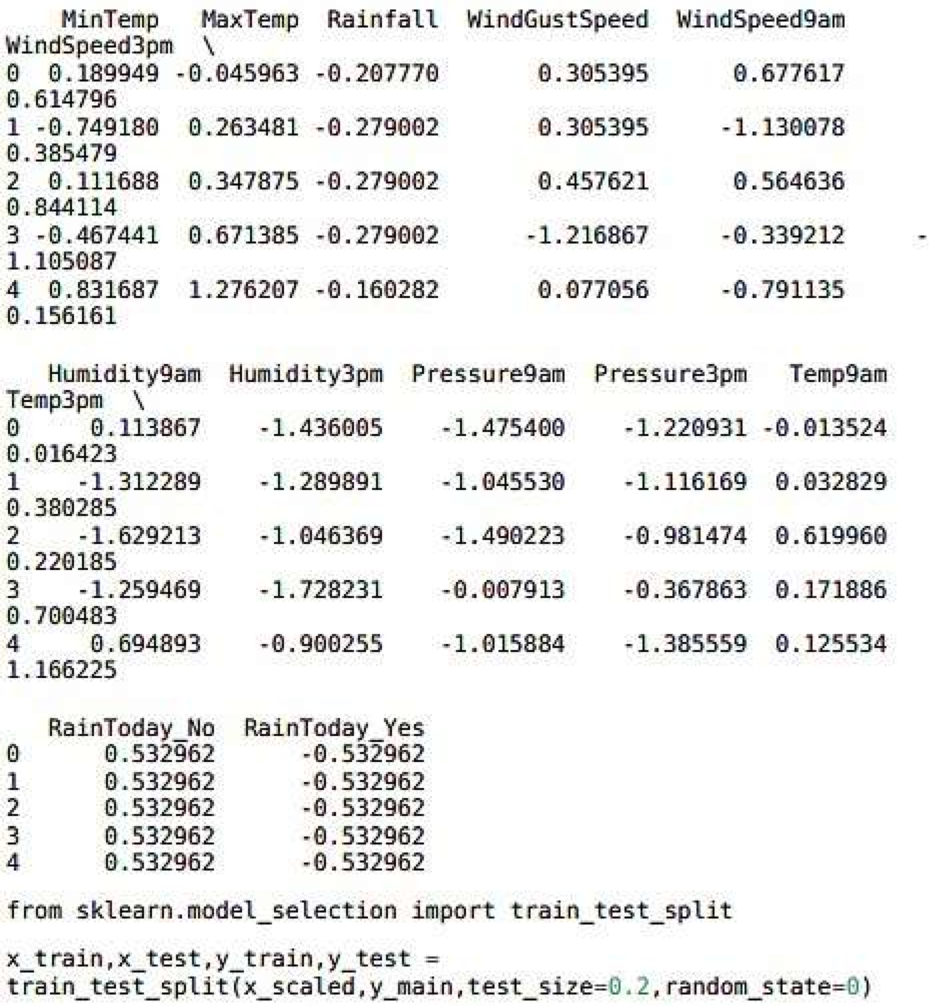
```
names = x.columns
```

```
names
```

```
Index(['Date', 'Location', 'MinTemp', 'MaxTemp', 'Rainfall',
'WindGustSpeed',
       'WindSpeed9am', 'WindSpeed3pm', 'Humidity9am', 'Humidity3pm',
       'Pressure9am', 'Pressure3pm', 'Temp9am', 'Temp3pm',
'RainToday',
       'WindGustDir', 'WindDir9am', 'WindDir3pm'],
      dtype='object')
```

```
sc=StandardScaler()
```

```
x_scaled=pd.DataFrame(sc.fit_transform(x_p),columns=x_p.columns)
x_scaled.head()
```



```
    MinTemp   MaxTemp  Rainfall  WindGustSpeed  WindSpeed9am
WindSpeed3pm  \
0  0.189949 -0.045963 -0.207770       0.305395      0.677617
0.614796
1 -0.749180  0.263481 -0.279002       0.305395     -1.130078
0.385479
2  0.111688  0.347875 -0.279002       0.457621      0.564636
0.844114
3 -0.467441  0.671385 -0.279002      -1.216867     -0.339212     -
1.105087
4  0.831687  1.276207 -0.160282       0.077056     -0.791135
0.156161

   Humidity9am  Humidity3pm  Pressure9am  Pressure3pm   Temp9am
Temp3pm  \
0     0.113867    -1.436005    -1.475400    -1.220931 -0.013524
0.016423
1    -1.312289    -1.289891    -1.045530    -1.116169  0.032829
0.380285
2    -1.629213    -1.046369    -1.490223    -0.981474  0.619960
0.220185
3    -1.259469    -1.728231    -0.007913    -0.367863  0.171886
0.700483
4     0.694893    -0.900255    -1.015884    -1.385559  0.125534
1.166225

   RainToday_No  RainToday_Yes
0      0.532962      -0.532962
1      0.532962      -0.532962
2      0.532962      -0.532962
3      0.532962      -0.532962
4      0.532962      -0.532962
```

```
from sklearn.model_selection import train_test_split

x_train,x_test,y_train,y_test =
train_test_split(x_scaled,y_main,test_size=0.2,random_state=0)
```

7.2 Feature 2:

MODEL BULIDING

Training And Testing The Model

```
XGBoost=xgboost.XGBRFClassifier()
Rand_forest=sklearn.ensemble.RandomForestClassifier()
svm=sklearn.svm.SVC()
Dtree=sklearn.tree.DecisionTreeClassifier()
GBM=sklearn.ensemble.GradientBoostingClassifier()
log=sklearn.linear_model.LogisticRegression()

# Training the every model with Train data
model1=XGBoost.fit(x_train,y_train)
model2=Rand_forest.fit(x_train,y_train)
model3=svm.fit(x_train,y_train)
model4=Dtree.fit(x_train,y_train)
model5=GBM.fit(x_train,y_train)
model6=log.fit(x_train,y_train)
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/preprocessing/
_label.py:98: DataConversionWarning: A column-vector y was passed when
a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
/usr/local/lib/python3.7/dist-packages/sklearn/preprocessing/_label.py
:133: DataConversionWarning: A column-vector y was passed when a 1d
array was expected. Please change the shape of y to (n_samples, ), for
example using ravel().
  y = column_or_1d(y, warn=True)
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
DataConversionWarning: A column-vector y was passed when a 1d array
was expected. Please change the shape of y to (n_samples,), for
example using ravel().
  This is separate from the ipykernel package so we can avoid doing
imports until
/usr/local/lib/python3.7/dist-packages/sklearn/utils/validation.py:993
: DataConversionWarning: A column-vector y was passed when a 1d array
was expected. Please change the shape of y to (n_samples, ), for
example using ravel().
  y = column_or_1d(y, warn=True)
/usr/local/lib/python3.7/dist-packages/sklearn/ensemble/_gb.py:494:
DataConversionWarning: A column-vector y was passed when a 1d array
was expected. Please change the shape of y to (n_samples, ), for
example using ravel().
  y = column_or_1d(y, warn=True)
/usr/local/lib/python3.7/dist-packages/sklearn/utils/validation.py:993
: DataConversionWarning: A column-vector y was passed when a 1d array
was expected. Please change the shape of y to (n_samples, ), for
```

8.TESTING

TESTING REPORT

Testing of an individual software component or module is termed as Unit Testing. It is typically done by the programmer and not by testers, as it requires detailed knowledge of the internal program design and code.

The Code was developed in 3 separate parts-

1. AI Model developed using Jupyter Notebook
2. Web Front end was developed using VS Code
3. Backend Database was developed using MongoDB

PROJECT NAME	Exploratory Analysis of RainFall Data in India for Agriculture
PROJECT TYPE	APPLIED DATA SCIENCE
DEVELOPER	Praveen
LANGUAGE	PYTHON,HTML,CSS,JAVA SCRIPT
TOTAL NUMBER OF TEST CASES	50
NUMBER OF TEST CASES EXCUTED	49
NUMBER OF TEST CASES PASSED	45
NUMBER OF TEST CASES FAILED	4-DUE TO TECHNICAL ISSUES

UNIT TESTING:

Unit testing is carried out screen-wise, each screen being identified as an object. Attention is diverted to individual modules, independently to one another to locate errors .Thishas enabled the detection of errorsin coding and logic

.Thisisthe first level of testing.In this, codes are written such thatfromone module ,we can move on to the next module according to the choice weenter.

SYSTEM TESTING:

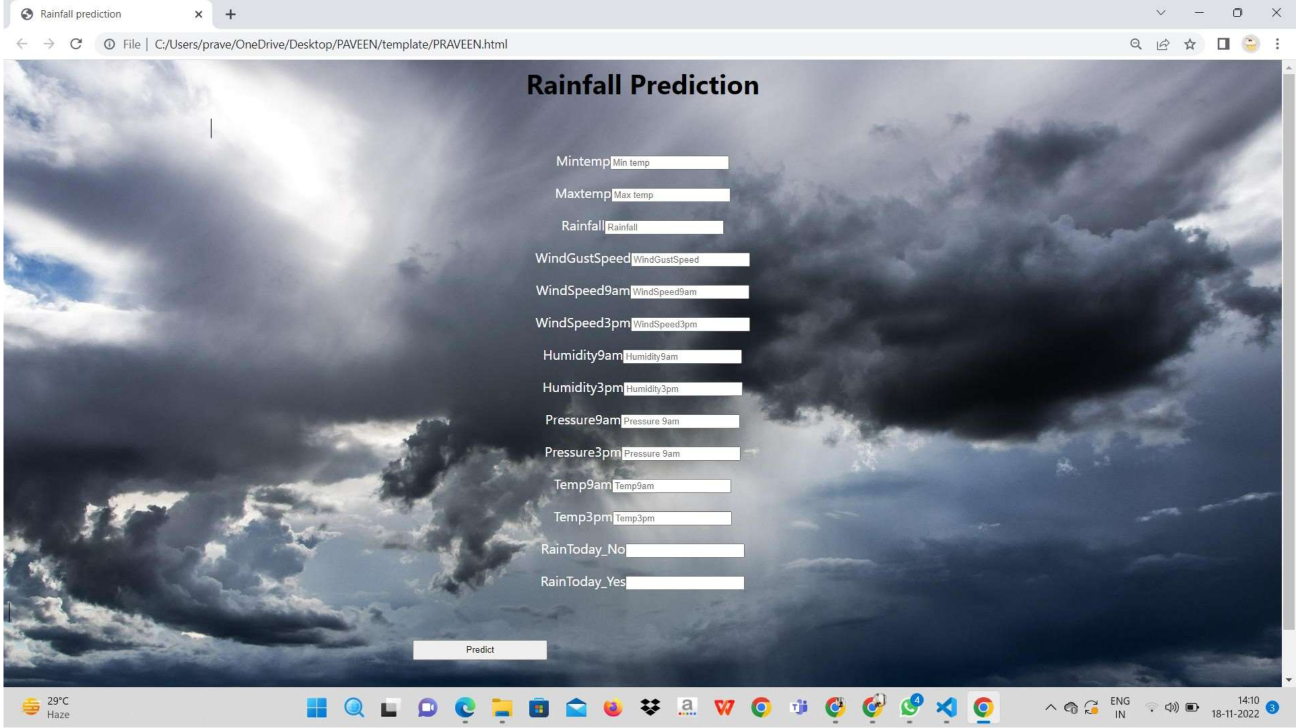
In this, the entire system was tested as a whole with all forms, code, modules and class modules .System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences.

It is a series of different tests that verifies that all system elements have been properly integrated and perform allocated functions.

System testing makes logical assumptions that if all parts of the system are correct, the goal will be successfully achieved. Testing is the process of executing the program with the intent of finding errors.

Testing cannot show the absence of defects, it can only show that software errors are present.

9.RESULTS


Rainfall prediction
File | C:/Users/prave/OneDrive/Desktop/PAVEEN/template/PRAVEEN.html
29°C
Haze
ENG
IN
14:10
18-11-2022

Rainfall Prediction

Mintemp Min temp

Maxtemp Max temp

Rainfall Rainfall

WindGustSpeed WindGustSpeed

WindSpeed9am WindSpeed9am

WindSpeed3pm WindSpeed3pm

Humidity9am Humidity9am

Humidity3pm Humidity3pm

Pressure9am Pressure 9am

Pressure3pm Pressure 9am

Temp9am Temp9am

Temp3pm Temp3pm

RainToday_No

RainToday_Yes

Predict

***By clicking the referred values in the above html above page then we can ge the chance basing on the inforation stored in the dataset what we have**

***here is the data set value information we have it.**

Advantages of EDA:

- It gives us valuable insights into the data.
- It helps us with feature selection (i.e using PCA)
- Visualization is an effective way of detecting outliers.

Disadvantages of EDA:

- If not perform properly EDA can misguide a problem.
- EDA does not effective when we deal with high-dimensional data.

Applications of Exploratory Data Analysis:

- Let’s analyze the applications of Exploratory Data Analysis with a use case of univariate analysis where we will seek the measurement of the central tendency of the data:

- Measurement of central tendency gives us an overview of the univariate variable. Central tendency is the measurement of Mean, Median, and Mode.
- Mean is the simple average where the median is the 50% percentile and Mode is the most frequently occurring value. Suppose we want the get the knowledge about the salary of a data scientist.
- Also, suppose we have carefully collected data of the data scientist with similar expertise and experience range.

Now if we want to get the average it is simply the total salary of all the data scientists of the sample divided by the number of data scientists in the sample or population. But if you think carefully the average salary is not a proper term because in the presence of some extreme values the result will be skewed. Suppose for maximum cases the salary is between 8-10 LPA and for one or two cases it is 32 LPA. Now adding all these the average will be skewed. Median is more suitable for such situations, it is more robust to outliers.

Conclusion:

In this article, we have discussed the various methodologies involved in exploratory data analysis, the applications, advantages, and disadvantages it. We also walked through the sample codes to generate the plots in python using seaborn and Matplotlib libraries. EDA is the art part of data science literature which helps to get valuable insights and visualize the data.

Scope for future work:

Acceptance and use of weather information based farm advisories is likely to occur gradually. Farmers need time to try out new information, experience the benefits, and accept the results. Technology is changing rapidly whereas the mindset of the farmers changes slowly. Experiencing accurate information and beneficial outcomes leads to trust building which certainly will encourage educated farmers to adopt the advisories. The following points may be taken into consideration while planning the future studies.

- Need to make these impact studies an integral part of the Agro advisory services of the country. Need to develop AAS service based decision support system for managing weather variability in reducing the negative impacts on yield.
- Improving package of practices for major crops keeping in view the weather sensitive crop stages and weather sensitive farm operations for reducing cost of cultivation and improving yield and increasing net returns. Need to improve the forecast quality during the sowing operations of kharif crops.
- Studies may be undertaken to quantify the value of medium range weather forecast in Nitrogen fertilizer management in arable crops. The N fertilizer advice may be tested through determining the uptake efficiency. The

changes in N leaching, de-nitrification and crop N uptake due to the forecast quality needs to be assessed.

- Yield and gross profit changes may then be linked to N uptake. 99 Need to integrate Medium Range Weather Forecast with extended range forecast for better planning of the field operations particularly for sowing and mid-season corrections incase of drought.
- The impact studies should be replicated in other crops of the region. Similar studies are also needed in other AAS units in India. The successful implementation of the scientific agro-meteorological forecasts need blending with local technologies like traditional methods so that farmers can readily adopt and be benefited from these scientific forecast.
- There is need to deliver district level weather based advisories through an automated dissemination system. In addition to the agriculture sector there is need to carry out similar studies in other weather sensitive sectors of economy as systematic and reliable data on the scope and dimensions of the relationship of weather and various user sectors is lacking.
- Better understanding of use and value of weather forecast may help substantially reduce the risks to life and property. For example, if there is knowledge about how many people and how much property is actually at risk to floods, one may be able to develop better strategies to reduce that undefined risk.
- In addition to the general lack of knowledge of the societal context of weather events, there is also limited understanding of how decision makers could and actually use weather information. The significance of this study seems to call for a wide range of interests to support the similar efforts on other sectors such as aviation, power etc.
- The power firms like the Power Grid Corporation of India (PGCIL) require location specific quantitative forecast of Maximum/ Minimum Temperatures, Rainfall, Clouds, Wind Speed/direction four days in advance to run their Load Forecast models and the Power Distribution models.

- PGCIL estimates about 5-12 % saving on power equivalent to Rs 110 crore per month through use of weather forecast of higher accuracy (>70%) Therefore to undertake work in such spheres, there is urgent need to form a cohesive group of meteorologists (forecasters and researchers), users, and representatives from related fields (economics, policy makers, etc.).
- Although the entire meteorological community ought to be concerned with the outcome of that decision-making process, one should not try to do this in meteorological terms only. Public policy-makers must make difficult economic decisions that include issues of human safety, as well as purely economic factors.
- Decision making in weather sensitive sectors of economy must be made with knowledge of the economic impacts of weather forecasts, rather than without that quantitative information.

References:

- Das Gupta, M. and Rizvi, S. R. H. (2001): An Overview of Meteorological Data Decoding and Pre-processing Operational at NCMRWF, NCMRWF Tech. Rep. No: NMRF/TR/1/2001, 33pp.

- Kumar A, Parvinder Maini, Rathore,L.S. and S.V.Singh, 2000: An operational medium range local weather forecasting system developed in India Int. J. Climatol., (a journal of Royal Meteorological Society), 20: 73-87.

- Maini Parvinder, 2006: Development of Statistical-Dynamical Models for Location Specific Weather Forecast. (PhD Thesis), Andhra University, 242pp.

Annexure:

Annexure-I

Following are the verification scores that have been used for verifying the rainfall and temperature forecasts disseminated to the AAS units on a bi-weekly basis

(a) Measures of obtaining skill of Yes/No rainfall

In the following 2×2 contingency table, if Y stands for occurrence of rain and N stands for non-occurrence then

Forecast (Rain)	Observed (Rain)	
	Yes	No
Yes	*YY*	*YN*
No	*NY*	*NN*

The total number of cases (M) is given by:

$$M = YY+YN+NY+NN$$

i. Ratio Score

Ratio Score (*RS*), also known as the Hit Rate or Percentage Correct, measures the proportion of correct forecasts. The *RS* varies from 0 to 100 with 100 indicating perfect forecasts.

$$RS = \frac{correct\ forecasts}{total\ forecasts} = \frac{(YY+NN)}{M} \times 100$$

ii. Hanssen and Kuipers' Score

Hanssen and Kuipers' Score (*HKS*) (Woodcock, 1976, 1981) is the ratio of economic saving over climatology due to the forecast to that of a set of perfect forecasts. In *HKS* the reference hit rate in the denominator is for random forecasts that are constrained to be unbiased.

$$HKS = \frac{correct\ forecast - (correct\ forecast)_{\text{random}}}{M - (correct\ forecast)_{\text{random, unbiased}}}$$

$$HKS = \frac{(YY * NN - YN * NY)}{(YY+NY)(YN+NN)}$$

That is, the imagined random reference forecasts in the denominator have a marginal distribution that is equal to the (sample) climatology (Wilks, 1995).The value of *HKS* varies from –1 to +1. If all forecast are wrong (i.e. $YY = NN = 0$) then it is –1, and if all forecast are perfect (i.e. $YN = NY = 0$) then it is +1, and random forecasts receive a score of 0.

(b) Criteria for obtaining usability of Quantitative Precipitation (QP)

Error Structure for verification of Quantitative Precipitation

	Observed rainfall ≤10mm	Observed rainfall > 10mm
Correct	*Diff ≤ 0.2 mm*	*Diff ≤ 2% of obs*
Usable	*0.2 mm< Diff ≤ 2.0mm*	*2% of obs < Diff ≤ 20% of obs*
Unusable	*Diff >2.0 mm*	*Diff > 20% of obs*

where Diff stands for Absolute difference of observed and forecasted in mm and obs stands for observed rainfall in mm

(c) Measures of obtaining skill of temperature

Correlation Coefficient (*r*) and Root Mean Square Error (*RMSE*) are calculated for obtaining the skill of the model in forecasting maximum and minimum temperatures.

(i) Correlation coefficient can be defined as

$$r(f_i, o_i) = \frac{\sum (f_i - \bar{f})(o_i - \bar{o})}{\left[\sum (f_i - \bar{f})^2 \sum (o_i - \bar{o})^2\right]^{1/2}}$$

(ii) Root Mean Square Error (*RMSE*)**:** The *RMSE* is the square root of Mean Square Error (*MSE)* which measures the degree of correspondence between the forecasts and observations in terms of the average squared difference between f_i and o_i.

Where $$RMSE = \left(\frac{1}{n}\sum (f_i - o_i)^2\right)^{1/2}$$

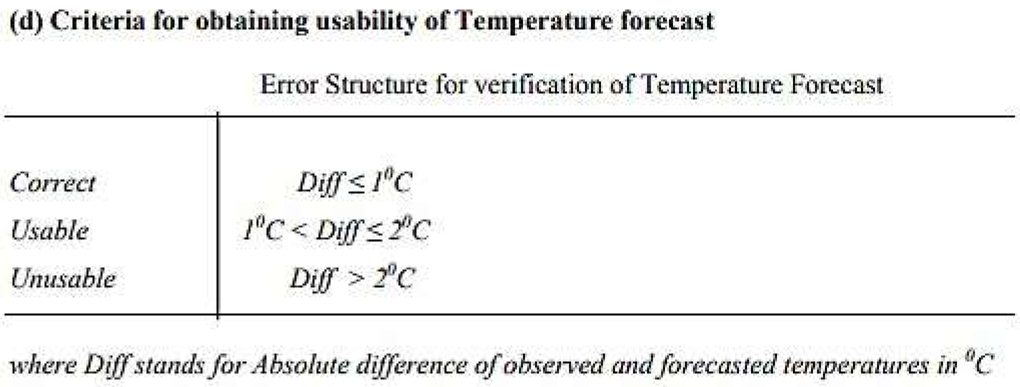
f_i = *forecast value*

$\overline{f}$ = *mean forecast value*

o_i = *observed value*

$\overline{o}$ = *mean observed alue*

n = total no : of observations / forecast



(d) Criteria for obtaining usability of Temperature forecast

Error Structure for verification of Temperature Forecast

Correct	$Diff \leq 1^{0}C$
Usable	$1^{0}C < Diff \leq 2^{0}C$
Unusable	$Diff > 2^{0}C$

where Diff stands for Absolute difference of observed and forecasted temperatures in ^{0}C

GITHUB LINK : https://github.com/IBM-EPBL/IBM-Project-27822-1660067073