**SBM COLLGE OF ENGINEERING AND TECHNOLOGY**

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## BONAFIDE CERTIFICATE

Certified that this project titled **“EXPLORATORY ANALYSIS OF RAINFALL DATA IN INDIA FOR AGRICULTURE”** is the bonafide work of **"PALPANDI.S (921619106045), AMARNATH.M (921619106004), SELVAGANESH.B (921619106055), MUTHALAGAN.M (921619106040)”** who carried out the project work under my supervision.

**PROJECT REPORT SUBMISSION**

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## A.ABSTRACT

Exploratory Analysis Of RainFall Data In India For Agriculture  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 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.

Focus of this research is to use the machine learning regression models that can predict rainfall in the most effective way on the given data. Regression is the statistical empirical technique that is vastly used in many areas like in business, behavioral sciences, and climatic prediction[Kannan et al., 2010]. Regression is supervised learning, it is a statistical approach that finds the relation between the variables and is used for predicting the outcome based on the relationship between the variable that is acquired by the data. There are five machine learning regression models that will be used named Decision tree regression, KNN regression, Multiple linear regression,RFE(Random forest regression), and Support Vector Machine regression and compare which models perform well. Hence after applying the models, we can see the measurement of the rainfall in MM(millimeter), and according to the need for crops, the prediction can be used. In the current dataset, we do not have features for the season of the crop that are Kharif, Rabi, and Zaib, so more features will also be added according to the season of the crops which will be more help-full for the agriculture sectors to understand more about rainfall.There are various research that has been done and various numerical weather forecasts have been introduced for predicting the weather but they have some limitations

By deploying the model we can integrate the flask with the Endpoint scoring.Using this flask Framework we can create a web application which displays or predicts Chance of Rain today and No chance for rain today.

# CHAPTER 1

## 1.INTRODUCTION

### 1.1 PROJECT OVERVIEW

India is an agriculture country, 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. 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.

Weather plays a very important role in agriculture production and has an influence on the growth development, and yield of crops. Weather aberration can cause physical damage to crops and soil erosion. The quality of crops from the field to the market depends on the weather. Bad weather can adversely affect the quality of crop during transportation or storage. The findings brought about by shifting through databases and studies to conclude things like this in agricultural processes can bring about remarkable changes.

## 1.2 PURPOSE

Agriculture is the backbone of the Indian economy. For agriculture, the most important thing is water source, i.e. rainfall. The prediction of the amount of rainfall gives alertness to farmers by knowing early they can protect their crops from rain.The main motive of the project is to predict the amount of rainfall in a particular division or state well in advance. We predict the amount of rainfall using past data.Rainfall prediction is one of the challenging tasks in weather forecasting process. Accurate rainfall prediction is now more difficult than before due to the extreme climate variations. Machine learning techniques can predict rainfall by extracting hidden patterns from historical weather data.Good prediction of rainfall provides knowledge and know in advance to take precautions and have better strategy about theirs crops. Rainfall also depends on geographic locations hence is an arduous task to predict.The main aim of this study is to develop the rainfall prediction system and predict the rainfall with better accuracy with the use of Machine Learning classification algorithms. Rainfall of a location based on input parameters that will be provided by the user. The parameters include date, location, maximum temperature, minimum temperature, humidity, wind direction, evaporation etc.

# CHAPTER 2
# LITERATURE SURVEY

## 2.1 EXISTING PROBLEM

A bad rainfall prediction can affect the agriculture mostly framers as their whole crop is depend on the rainfall and agriculture is always an important part of every economy. So, making an accurate prediction of the rainfall somewhat good. There are number of techniques are used of machine learning but accuracy is always a matter of concern in prediction made in rainfall.So our project helps to predict the correct rainfall.

## 2.2 REFERENCES

1.Kumar Abhishek. Abhay Kumar, Rajeev Ranjan, Sarthak Kumar,\" A Rainfall Prediction Model using Artificial Neural Network\", 2012 IEEE Control and System Graduate Research Colloquium (ICSGRC2012), pp. 82-87, 2012.

2. G. Geetha and R. S. Selvaraj, “Prediction of monthly rainfall in Chennai using Back Propagation Neural Network model,” Int. J. of Eng. Sci. and Technology, vol.

3.Gupta D, Ghose U. A Comparative Study of Classification Algorithms for Forecasting Rainfall. IEEE. 2015.

## 2.3 PROBLEM SOLUTION DEFINITION

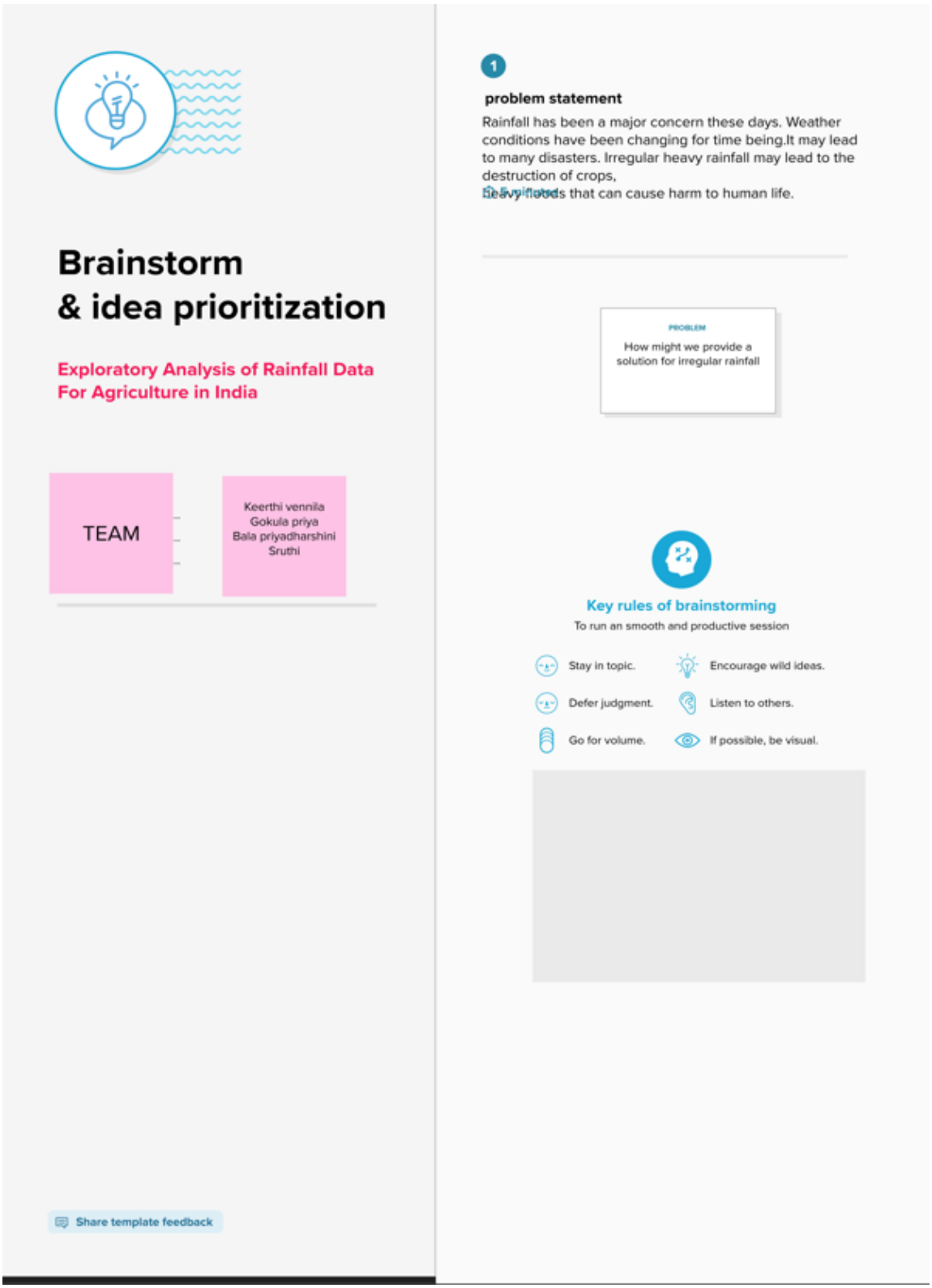
Rainfall has been a major concern these days. Weather conditions have been changing for time being. Rainfall forecasting is important otherwise, it may lead to many disasters. Irregular heavy rainfall may lead to the destruction of crops, heavy floods that can cause harm to human life. It is important to exactly determine the rainfall for effective use of water resources, crop productivity, and pre-planning of water structures. Thus, our problem is to analyse the rainfall data in India in order to help the growth of agriculture by predicting the occurrence of heavy rainfall to prevent flooding and damage in crops.

# CHAPTER 3

# IDEATION AND PROPOSED SOLUTION

## 3.1 EMPATHY MAP CANVAS

## 3.2 IDEATION AND BRAINSTROMING:



## 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!

**Bala priyadharshini**


**Gokulapriya**


**Sruthi**

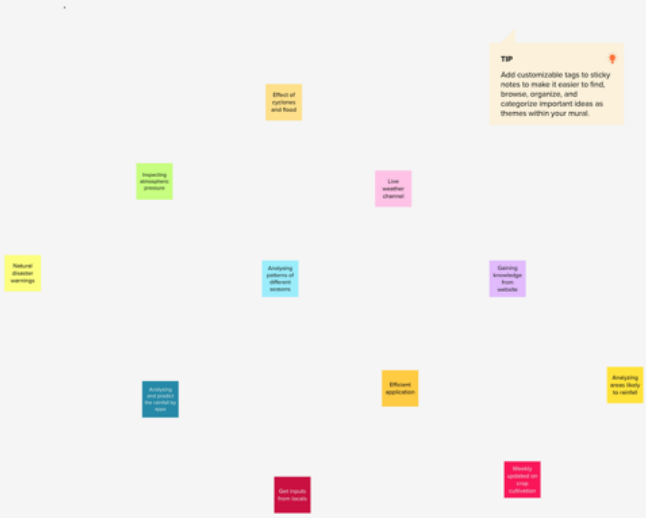

**Keerthi vennila**


## 3

### Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, 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

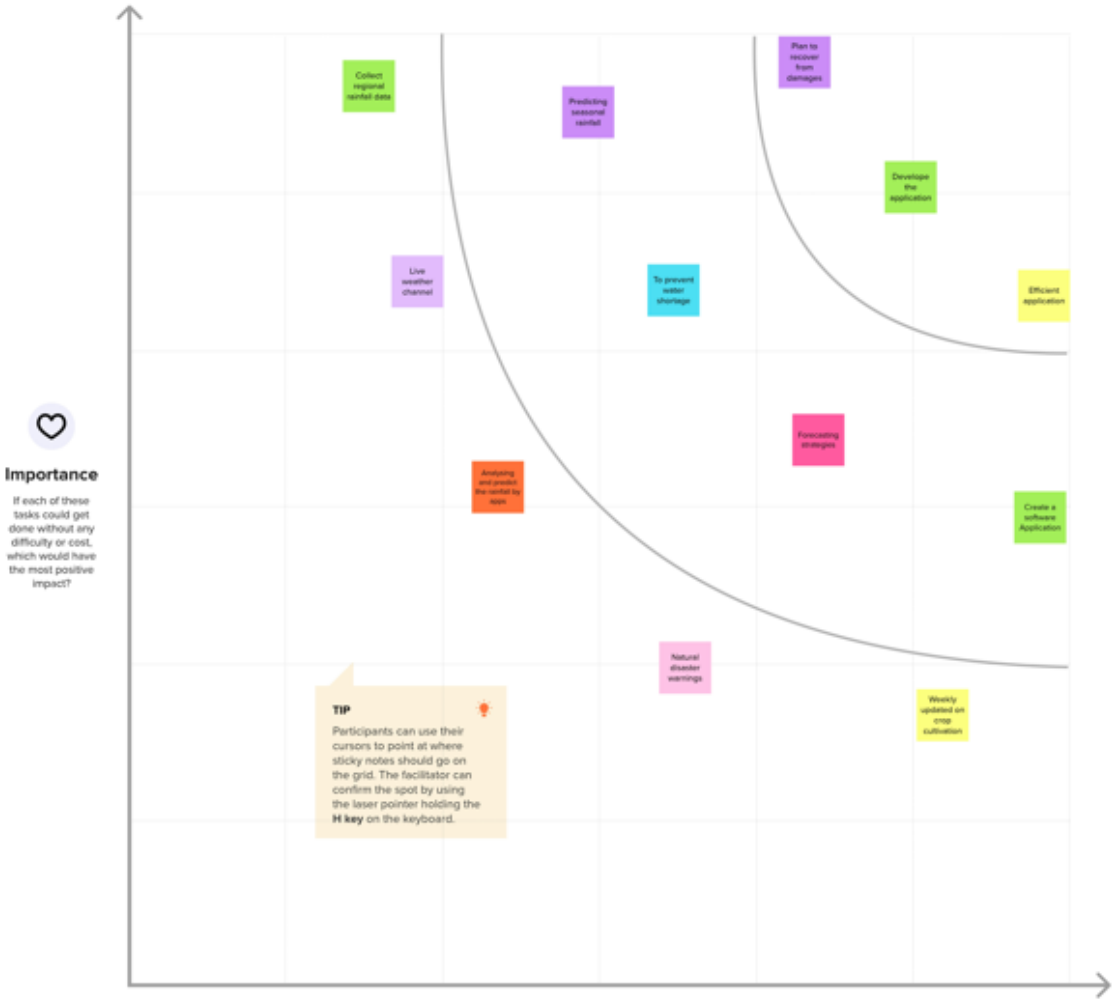


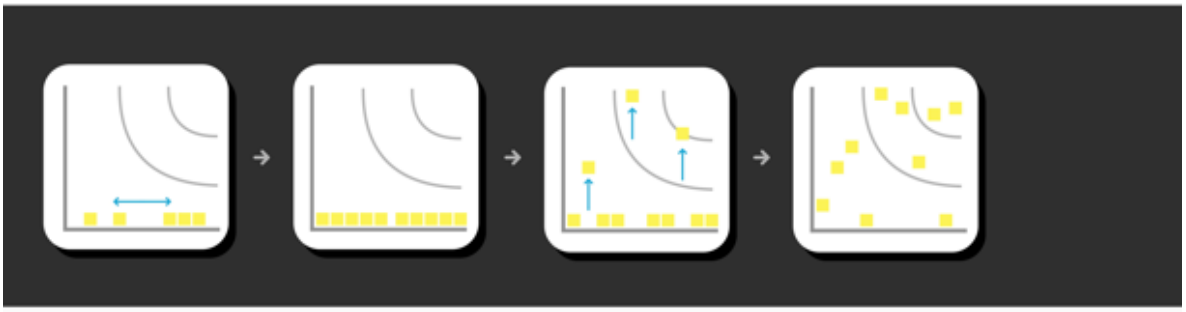

4

## 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



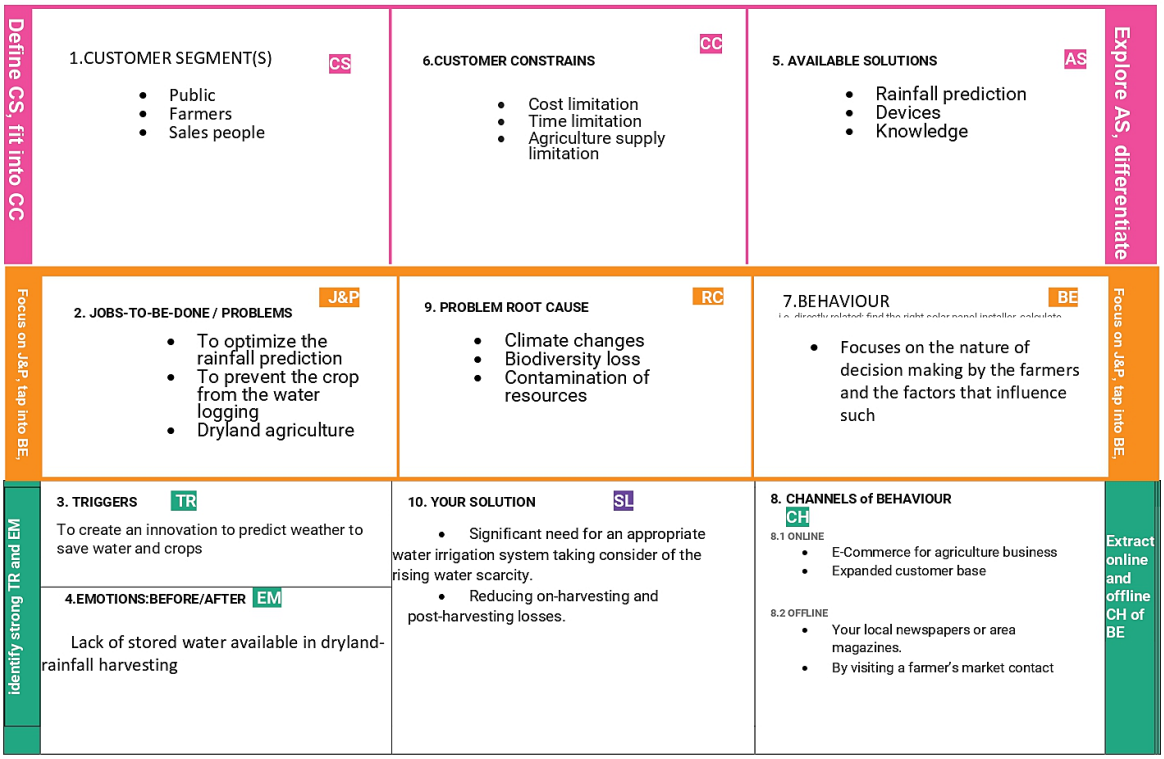
## 3.3 PROPOSED SOLUTION

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | ●Heavy and irregular rainfall can have many impacts like destruction of crops and farming lands.<br>●Limited Food Access<br>●Unsustainable Agriculture Practices<br>●Leading to poor growth and overall health of crop |
| 2. | Idea / Solution description | ● NWP models are used as the primary tools for the prediction of irregular heavy rainfall events.<br>● We use the machine learning algorithm, as we can process big data and real-time data streams with mixed value types. |
| 3. | Novelty / Uniqueness | ●Easily predict the rainfall<br>●precipitation and other Earth observing datasets are used for tropical cyclones |
| 4. | Social Impact / Customer Satisfaction | ● It will help the farmers to take precautionary steps to minimize the losses and consider technological solutions to improve their production |
| 5. | 5. Business Model (Revenue Model) | ●Collaboration in agriculture-sector<br>● Providing technological solution |
| 6. | Scalability of the Solution | ● it facilitates policy decisions regarding the cropping pattern, sowing date, construction of roads and providing drinking water to urban and rural |

# 3.4 PROBLEM SOLUTION FIT

**Project Design Phase-I - Solution Fit**

**Project Title:** **Exploratory analysis of rainfall data in india for agriculture**
**Team ID:** PNT2022TMID44338



# CHAPTER-4

# REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form and Gmail<br>Registration through LinkedIN |
| FR-2 | User Confirmation | Confirmation via Email and OTP |
| FR-3 | User Login | Using the registered email id and password as login credentials. |
| FR-4 | Profile Dashboard | Viewing the profile and changing password |
| FR-5 | Visualization | Visualize the user specific data in different forms |
| FR-6 | Feedback and support | Collecting feedback against the accuracy of the prediction for further improvement and feature inclusion in other modules or functionalities. |

## 4.2 NON FUNCTIONAL REQUIREMENT

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

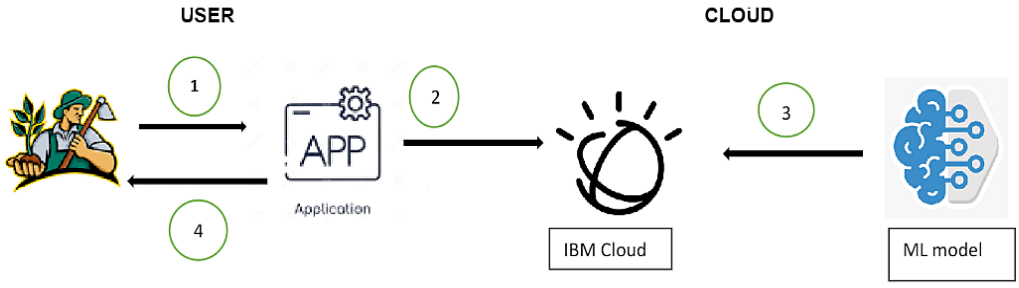
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | Usability | The Farmer and other people can easily use the application and it is user friendly to prior knowledge is required for using it. |
| NFR-2 | Security | Providing secure system requirements and then determine authenticity, originality and security. |
| NFR-3 | Reliability | The system will provide the prediction without any errors and failures for a specific time. |
| NFR-4 | Performance | Predictions are as same as the true values, so the performance is higher. |
| NFR-5 | Availability | Available to different group of farmers for 24/7. |
| NFR-6 | Scalability | The Application should be in the way of adding new functionalities or modules without affecting the existing functionalities |

# CHAPTER-5

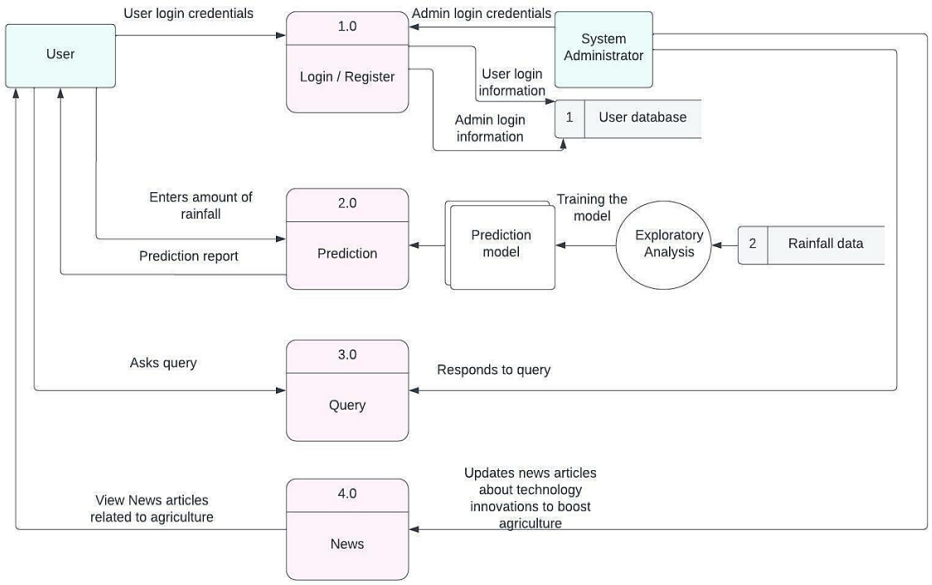
# PROJECT DESIGN

## 5.1 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.

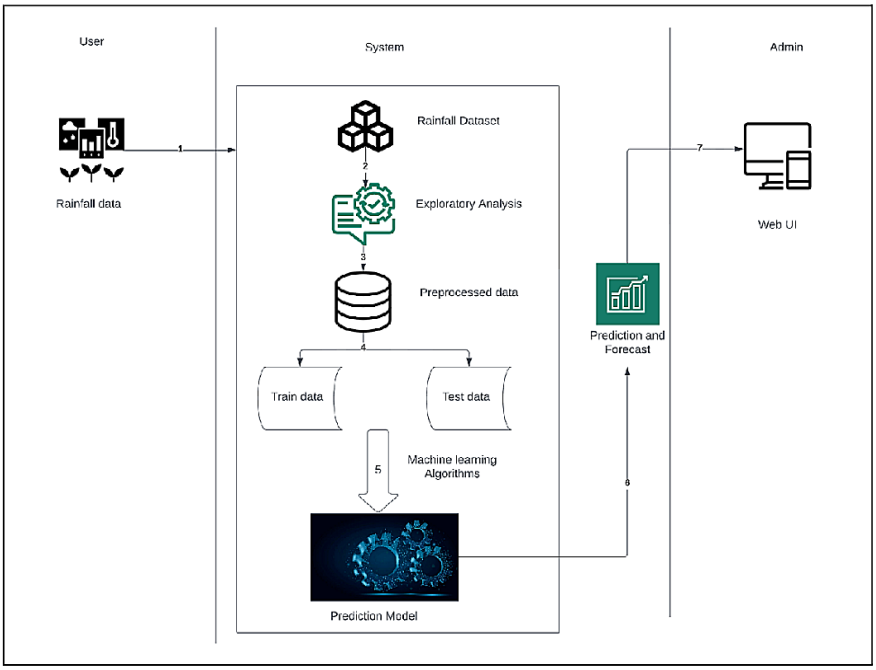


Example: DFD Level 0 (Industry Standard):




# 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

**Technical Architecture:**



## 5.3 USER STORIES

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (web 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 |
| | Registration | USN-2 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | Medium | Sprint-2 |
| | Login | USN-3 | As a user, I can log into the application by entering email & password | I can access the system | High | Sprint-1 |
| | Dashboard | USN-4 | As a user, I can view the details about the system and can navigate through the pages. | I can navigate through pages | High | Sprint-3 |
| | Prediction | USN-5 | As a user, I can enter the rainfall amount and get the prediction results | I can get the prediction result | High | Sprint-4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | News | USN-6 | As a user, I can view latest news articles related to agriculture | I can view the articles | Medium | Sprint-3 |
| Customer Care Executive | Contact | USN-7 | As a user, I can ask queries regarding the system | I can clarify my doubts | High | Sprint-3 |
| | Chat bot | USN-8 | As a user, I can interact with chatbot to ask queries | I can get my queries clear instantly | Low | Sprint-4 |
| Administrator | Login | USN-9 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can view and update the system | High | Sprint-1 |
| | Prediction | USN-10 | As a user, I can see the prediction result from the model trained by the system administrator | I can train the prediction model | High | Sprint-3 |

# CHAPTER-6
# PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING & ESTIMATION

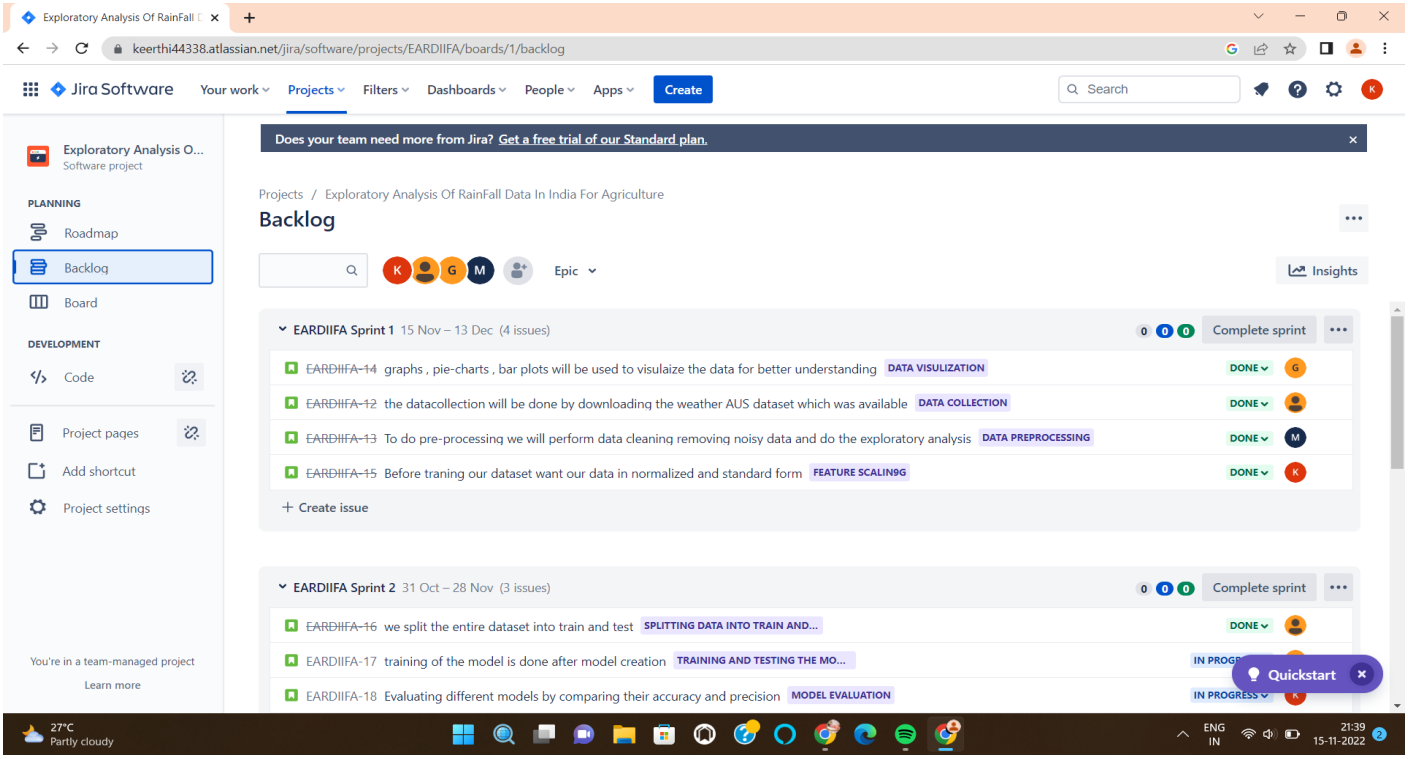
| Sprint | Functional Requirements | User Story Number | User Story/Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Data Collection | USN-1 | The data collection will be done by downloading the weatherAUS dataset which was available | 4 | High | S.Palpandi |
| Sprint-1 | Data Preprocessing | USN-2 | To do pre-processing we will perform data cleaning removing data and do the exploratory analysis | 5 | High | B.Selvaganesh |
| Sprint-1 | Data visualization | USN-3 | Grapics,Pie-charts,bar plots will be used to visualize the data for better understanding | 6 | High | M.Muthalagan |
| Sprint-1 | Feature Scaling | USN-4 | Before training our dataset want our data in normalized and standard | 7 | Medium | M.Amarnath |
| Sprint-2 | Splitting data into train and test | USN-5 | We split the entire dataset into train and test | 5 | Medium | B.Selvaganesh |
| Sprint-2 | Training and Testing the model | USN-6 | Training of the model is done after model creation | 3 | Medium | M.MMuthalagan |

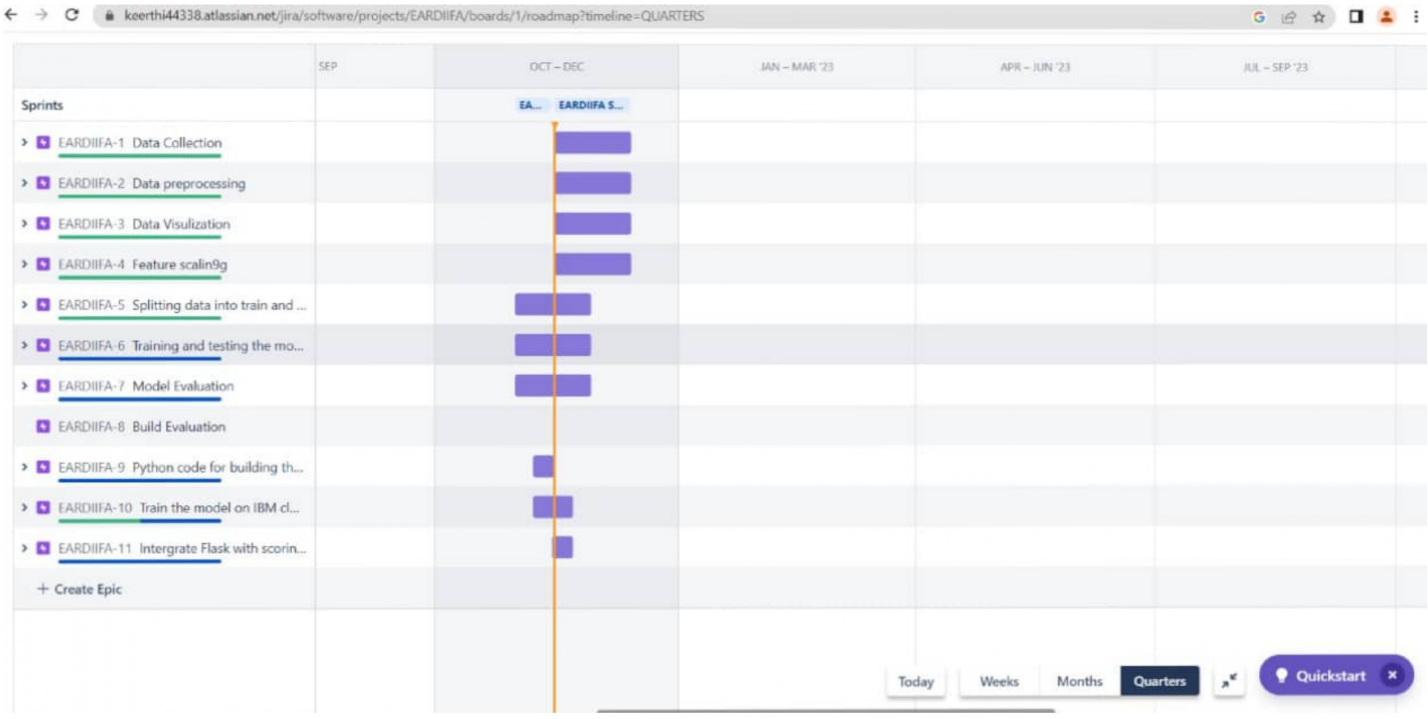
| | | | | | | |
|---|---|---|---|---|---|---|
| Sprint-2 | Model Evaluation | USN-7 | Evaluating different models by comparing their accuracy and precision | 6 | Low | S.Palpandi |
| Sprint-3 | Build HTML code | USN-8 | Further HTML pages will be developed using the same user interface and will connected to the main page | 7 | High | M. Amarnath |
| Sprint-3 | Python code for building the web application | USN-9 | Backend of the web page will be done using python | 8 | High | B.Selvaganesh |
| Sprint-4 | Train the model on IBM Cloud | USN-10 | Using IBM cloud Watson to store our machine learning model and connect it with the web page | 9 | High | M.Muthalagan |
| Sprint-4 | Integrate Flask with scoring end points | USN-11 | Integrating the web page with ML model using flask | 10 | High | S.Palpandi |

### 6.2 SPRINT DELIVERY SCHEDULE

| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date(Planned) | Story Points Completed | Sprint Release Date(Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2002 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint-3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

# 6.3 REPORTS FROM JIRA





# CHAPTER-7
# CODING & SOLUTIONING(EXPLAIN THE FEATURES ADDED IN THE PROJCET ALONG WITH CODE)

## 7.1 FEATURE 1

The application has an interactive user interface where user needs to upload all the necessary details to predict the rainfall.

**index.html**

```
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<title>Rainfall Prediction</title>
</head>
<body background="https://wallpaperaccess.com/full/701614.jpg" text="black">
<div class="login">
 <center><h1>Rainfall Prediction</h1></center>
 <b> <h2>Please enter the following details</h2></b>
 <!-- Main Input For Receiving Query to our ML -->
 <form action="{{ url_for('predict')}}"method="post">

 </style></head>

     <label for="Location">Location:</label>
      <select id="Location" name="Location">
          <option value=2>Albury</option>
          <option value=4> BadgerysCreek</option>
          <option value=10>Cobar</option>
          <option value=11>CoffsHarbour</option>
          <option value=21>Moree</option>
          <option value=24>Newcastle</option>
          <option value=26>NorahHead</option>
          <option value=27>NorfolkIsland</option>
          <option value=3e>Penrith</option>
          <option value=34>Richmond</option>
```

```
        <option value=37>Sydney</option>
        <option value=38>SydneyAirport</option>
        <option value=42>Waggawagga</option>
        <option value=45>Williamtown</option>
        <option value=47>Wollongong</option>
        <option value=9>Canberra</option>
        <option value=48>Tuggeranong</option>
        <option value=23>MountGinini</option>
        <option value=5>Ballarat</option>
        <option value=6>Bendigo</option>
        <option value=35>Sale</option>
        <option value=19>MelbourneAirport</option>
        <option value=18>Melbourne</option>
        <option value=2>Mildura</option>
        <option value=25>Nhil</option>
        <option value=33>Portland</option>
        <option value=44>Watsonia</option>
 <input type="text"  id="temp"   placeholder="MinTemp">
<input type="text"  id="temp"   placeholder="MaxTemp">
<input type="text"  id="temp"   placeholder="Rainfall">
<input type="text"  id="temp"   placeholder="WindGustSpeed"> <br><br>
        
<input type="text"  id="temp"   placeholder="WindSpeed9am">  
<input type="text"  id="temp"   placeholder="WindSpeed3pm">   
<input type="text"  id="temp"   placeholder="Humidity9am">  
<input type="text"  id="temp"   placeholder="Humidity3pm">   
<input type="text"  id="temp"   placeholder="Pressure9am"> <br><br> 
<input type="text"  id="temp"   placeholder="Pressure3pm">  
<input type="text"  id="temp"   placeholder="Temp9am"> 
<input type="text"  id="temp"   placeholder="Temp3pm">  
<input type="text"  id="temp"   placeholder="WindSpeed3pm"> 
<input type="text"  id="temp"   placeholder="year">  <br><br>  
<input type="text"  id="temp"   placeholder="month"> 
<input type="text"  id="temp"   placeholder="day">
</style></head>
<br><br> 
```

```
<label for="RainToday"> RainToday:</label>
 <select id=RainToday  name= "RainToday" >
       <option value=2>No</option>
       <option value=4>Yes</option>
 </select>   


<label for="windGustDir"> WindGustDir:</label>
<select id=WindGustDir  name= "windGustDir" >
       <option value=14>W</option>
       <option value=15>WNW</option>
       <option value=0>WSW</option>
       <option value=7>NE</option>
       <option value=13>NNW</option>
       <option value=10>N</option>
       <option value=2>NNE</option>
       <option value=1>SW</option>
       <option value=6>ENE</option>
       <option value=11>SSE</option>
       <option value=12>S</option>
       <option value=9>NW</option>
       <option value=3>SE</option>
       <option value=8>ESE</option>
       <option value=5>E</option>
       <option value=4>SSW</option>
</select>   

<label for="windDir9am"> WindDir9am:</label>
<select id=windDir9am  name= "windDir9am" >
       <option value=14>W<option>
       <option value=15>WNW<option>
       <option value=16>WSW<option>
       <option value=23>NE<option>
       <option value=29>NNW<option>
       <option value=26>N<option>
       <option value=18>NNE<option>
```

```
            <option value=17>SW<option>
            <option value=22>ENE<option>
            <option value=27>SSE<option>
            <option value=28>S<option>
            <option value=25>NW<option>
            <option value=19>SE<option>
            <option value=24>ESE<option>
            <option value=21>E<option>
            <option value=20>SSW<option>
        </select>   

         <label for="windDir3pm"> WindDir3pm:</label>
         <select id=windDir3pm  name= "windDir3pm" >
            <option value=14>W<option>
            <option value=15>WNW<option>
            <option value=0>WSW<option>
            <option value=7>NE<option>
            <option value=13>NNW<option>
            <option value=10>N<option>
            <option value=2>NNE<option>
            <option value=1>SW<option>
            <option value=6>ENE<option>
            <option value=11>SSE<option>
            <option value=12>S<option>
            <option value=9>NW<option>
            <option value=3>SE<option>
            <option value=8>ESE<option>
            <option value=5>E<option>
            <option value=4>SSW<option>
            </select>   



<br>

<br><br>
```

```
<button type="submit" class="btn btn-primary btn-block btn-large"
style="height:30px;width:200px">Predict</button>

  </form>
<br>

  {{ prediction_text }}


  <br>
  <br>
  <img src="{{url_3}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <img src="{{url_1}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <img src="{{url_4}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <br>
  <br>
  <img src="{{url_2}}" alt="Submit Form" height="150"
width="711" onerror="this.style.display='none'"/>

</div>
</body>
</html>
```

### 7.2 FEATURE 2

**app.py**

```
import numpy as np
import pickle
import joblib
import matplotlib
import matplotlib.pyplot as plt
import time
import pandas
import os
from flask import Flask, request, jsonify, render_template
app = Flask(__name__)
model = pickle.load(open('C:\\Users\\intec\\rainfall.pkl', 'rb'))
scale = pickle.load(open('C:\\Users\\intec\\scale.pkl', 'rb'))
@app.route('/')# route to display the home page
def home():
    return render_template('index.html') #rendering the home page
@app.route('/predict', methods=[ "POST", "GET"])# route to show the predictions in a
web UI
def predict():
    # reading the inputs given by the user
    input_feature=[x for x in request.form.values() ]
    features_values=[np.array(input_feature)]
    names=[['Location','Mintemp','Maxtemp','Rainfall','WindGustSpeed',
    'Windspeed9am', 'WindSpeed3pm', 'Humidity9am', 'Humidity3pm',
    'Pressure9am', 'Pressure3pm', 'Temp9am', 'Temp3pm', 'RainToday',
    'WindGustDir', 'WindDir9am', 'WindDir3pm', 'year', 'month', 'day']]
    data = pandas.DataFrame(features_values, columns=names)
    data = scale.fit_transform(data)
    data = pandas.DataFrame(data,columns = names)
        # predictions using the loaded model file
    prediction = model.predict(data)
    pred_prob = model.predict_proba(data)
    print(prediction)
    if prediction == "Yes":
```

```
        return render_template("chance.html")
    else:
        return render_template("nochance.html")
        # showing the prediction results in a UI
if __name__ == "__main__":
    app.run(host='127.0.0.1',debug=False)
```

# CHAPTER-8

# 8. TESTING

## 8.1 TEST CASES

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

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Print Engine | 7 | 0 | 0 | 7 |
| Client Application | 51 | 0 | 0 | 51 |
| Security | 2 | 0 | 0 | 2 |
| Outsource Shipping | 3 | 0 | 0 | 3 |
| Exception Reporting | 9 | 0 | 0 | 9 |
| Final Report Output | 4 | 0 | 0 | 4 |
| Version Control | 2 | 0 | 0 | 2 |

## 8.2 USER ACCEPTANCE TESTING

### Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issuesof the Exploratory Analysis of Rainfall Data in india for Agriculture project at the time of the release to User Acceptance Testing (UAT).

### Defect Analysis

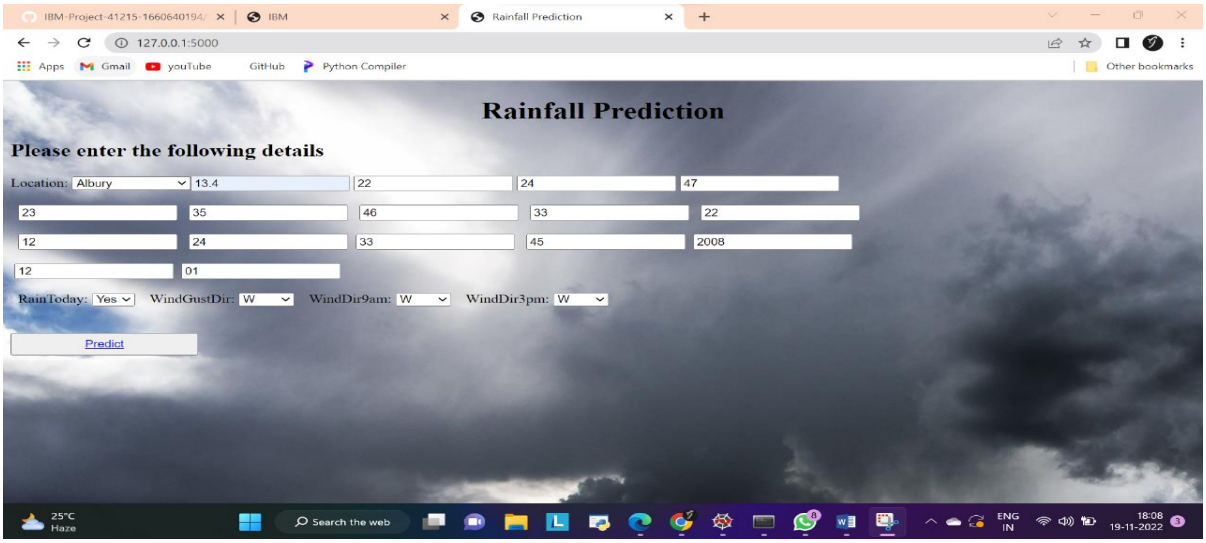
This report showsthe number of resolved or closed bugs at each severity level, and how they were resolved

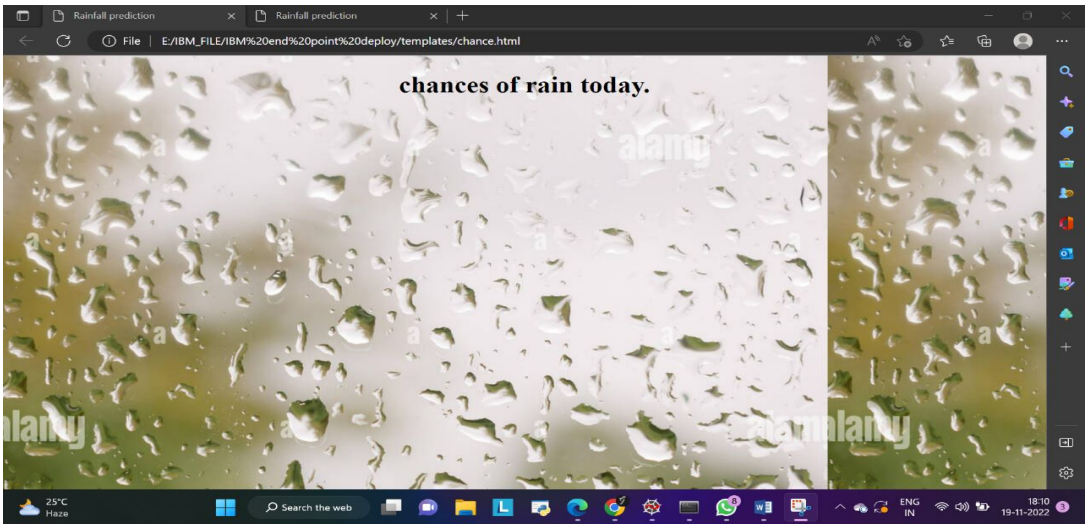
| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 10 | 4 | 2 | 3 | 20 |
| Duplicate | 1 | 0 | 3 | 0 | 4 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 11 | 2 | 4 | 20 | 37 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 24 | 14 | 13 | 26 | 77 |

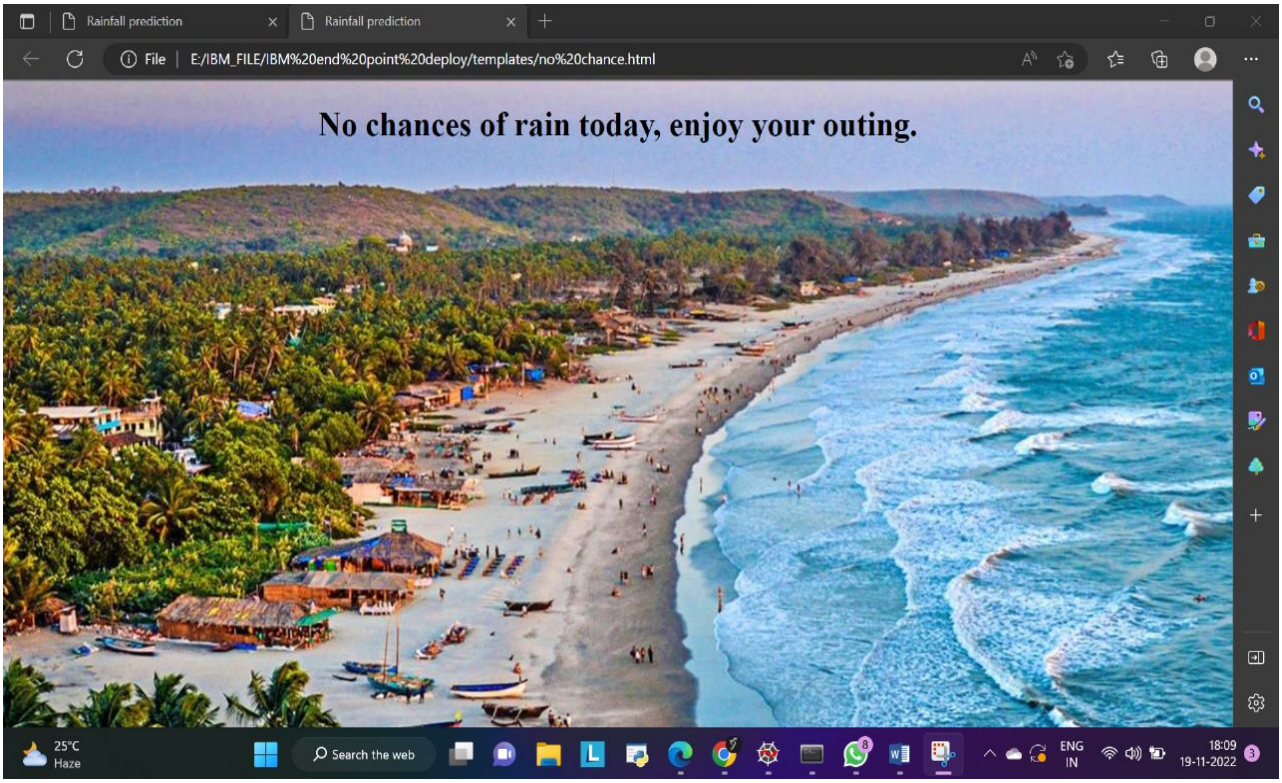
# CHAPTER-9

# RESULTS

## 9.1 PERFORMANCE METRICS




Rainfall prediction
Rainfall prediction
File | E:/IBM_FILE/IBM%20end%20point%20deploy/templates/no%20chance.html
No chances of rain today, enjoy your outing.
25°C
Haze
Search the web
ENG
IN
18:09
19-11-2022

# CHAPTER-10

# ADVANTAGES & DISADVANTAGES

## ADVANTAGES:

1.Keeping Your Plants and Grass Well-Watered.

- Rainfall totals matter most when you're trying to keep your lawn and garden healthy. Too much or too little water can cause issues for your yard.

2.Identifying Weather Patterns and Trends for Your Neighborhood.

Monitoring rainfall amounts can even help you determine what outdoor activities to plan for the day.

3. Knowing the Best Times for Planting.

- Since some plants need more water than others, every type of plant has an ideal rainfall amount for seed germination and to stay healthy throughout the season, with some plants needing more water than others.

4.Identifying Potential Conditions for Flooding.

- Monitoring rainfall totals becomes even more critical if you're in an area that's prone to flooding. A rain gauge lets you identify potential flooding conditions that could adversely impact your yard and home.

5.Getting Better Rainfall Data.

- Though there are some ways to track rainfall -- such as local weather channels and news websites -- they usually don't have very precise data. Their measurements are often limited to specific regions and geographical locations.

## DISADVANTAGES:

1.Forecasts are never 100% accurate.

It's hard to predict the future. Even if you have a great process in place and forecasting experts on your payroll, your forecasts will never be spot on.

2.It can be time-consuming and resource-intensive..

Forecasting involves a lot of data gathering, data organizing, and coordination. Companies typically employ a team of demand planners who are responsible for coming up with the forecast.

3.It can also be costly.

Forecasting is a business practice that every company engages in to one extent or another. And it can be hugely valuable, providing those companies who have implemented a solid forecasting process with a leg up on their competition.

## 11. CONCLUSION

Rainfall Prediction is the application area of data science and machine learning to predict the state of the atmosphere. It is important to predict the rainfall intensity for effective use of water resources and crop production to reduce mortality due to flood and any disease caused by rain. This paper analyzed various machine learning algorithms for rainfall prediction such as MLR.

## 12.FUTURE SCOPE

Predicting weather accurately doesn't just help our daily lives but has deeper impact for food security and disaster management. Good news for monsoon-dependent India is that we are getting better at predicting. New technologies, such as Internet of Things (IoT) and Artificial Intelligence (AI) are helping meteorological experts to give better information to predict agricultural output and natural disasters.

# CHAPTER 13

# APPENDIX

## SOURCE CODE

### index.html

```
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<title>Rainfall Prediction</title>
</head>
<body background="https://wallpaperaccess.com/full/701614.jpg" text="black">
<div class="login">
<center><h1>Rainfall Prediction</h1></center>
 <b> <h2>Please enter the following details</h2></b>

 <!-- Main Input For Receiving Query to our ML -->
 <form action="{{ url_for('predict')}}"method="post">

 </style></head>

      <label for="Location">Location:</label>
      <select id="Location" name="Location">
         <option value=2>Albury</option>
         <option value=4> BadgerysCreek</option>
         <option value=10>Cobar</option>
         <option value=11>CoffsHarbour</option>
         <option value=21>Moree</option>
         <option value=24>Newcastle</option>
         <option value=26>NorahHead</option>
         <option value=27>NorfolkIsland</option>
         <option value=3e>Penrith</option>
         <option value=34>Richmond</option>
         <option value=37>Sydney</option>
         <option value=38>SydneyAirport</option>
         <option value=42>Waggawagga</option>
         <option value=45>Williamtown</option>
```

```
        <option value=47>Wollongong</option>
        <option value=9>Canberra</option>
        <option value=48>Tuggeranong</option>
        <option value=23>MountGinini</option>
        <option value=5>Ballarat</option>
        <option value=6>Bendigo</option>
        <option value=35>Sale</option>
        <option value=19>MelbourneAirport</option>
        <option value=18>Melbourne</option>
        <option value=2>Mildura</option>
        <option value=25>Nhil</option>
        <option value=33>Portland</option>
        <option value=44>Watsonia</option>
  <input type="text"  id="temp"   placeholder="MinTemp">
 <input type="text"  id="temp"   placeholder="MaxTemp">
 <input type="text"  id="temp"   placeholder="Rainfall">
 <input type="text"  id="temp"   placeholder="WindGustSpeed"> <br><br>
        
 <input type="text"  id="temp"   placeholder="WindSpeed9am">  
 <input type="text"  id="temp"   placeholder="WindSpeed3pm">   
 <input type="text"  id="temp"   placeholder="Humidity9am">  
 <input type="text"  id="temp"   placeholder="Humidity3pm">   
 <input type="text"  id="temp"   placeholder="Pressure9am"> <br><br> 
 <input type="text"  id="temp"   placeholder="Pressure3pm">  
<input type="text"  id="temp"   placeholder="Temp9am"> 
<input type="text"  id="temp"   placeholder="Temp3pm">  
<input type="text"  id="temp"   placeholder="WindSpeed3pm"> 
<input type="text"  id="temp"   placeholder="year">  <br><br>  
<input type="text"  id="temp"   placeholder="month"> 
<input type="text"  id="temp"   placeholder="day">
</style></head>
<br><br> 


<label for="RainToday"> RainToday:</label>
<select id=RainToday  name= "RainToday" >
<option value=2>No</option>
```

```
<option value=4>Yes</option>
 </select>   


  <label for="windGustDir"> WindGustDir:</label>
  <select id=WindGustDir  name= "windGustDir" >
            <option value=14>W</option>
            <option value=15>WNW</option>
            <option value=0>WSW</option>
            <option value=7>NE</option>
            <option value=13>NNW</option>
            <option value=10>N</option>
            <option value=2>NNE</option>
            <option value=1>SW</option>
            <option value=6>ENE</option>
            <option value=11>SSE</option>
            <option value=12>S</option>
            <option value=9>NW</option>
            <option value=3>SE</option>
            <option value=8>ESE</option>
            <option value=5>E</option>
            <option value=4>SSW</option>
     </select>   

      <label for="windDir9am"> WindDir9am:</label>
      <select id=windDir9am  name= "windDir9am" >
            <option value=14>W<option>
            <option value=15>WNW<option>
            <option value=16>WSW<option>
            <option value=23>NE<option>
            <option value=29>NNW<option>
            <option value=26>N<option>
            <option value=18>NNE<option>
            <option value=17>SW<option>
            <option value=22>ENE<option>
            <option value=27>SSE<option>
            <option value=28>S<option>
```

```
            <option value=25>NW<option>
            <option value=19>SE<option>
            <option value=24>ESE<option>
            <option value=21>E<option>
            <option value=20>SSW<option>
        </select>   

         <label for="windDir3pm"> WindDir3pm:</label>
         <select id=windDir3pm  name= "windDir3pm" >
            <option value=14>W<option>
            <option value=15>WNW<option>
            <option value=0>WSW<option>
            <option value=7>NE<option>
            <option value=13>NNW<option>
            <option value=10>N<option>
            <option value=2>NNE<option>
            <option value=1>SW<option>
            <option value=6>ENE<option>
            <option value=11>SSE<option>
            <option value=12>S<option>
            <option value=9>NW<option>
            <option value=3>SE<option>
            <option value=8>ESE<option>
            <option value=5>E<option>
            <option value=4>SSW<option>
            </select>   



<br>

<br><br>

<button type="submit" class="btn btn-primary btn-block btn-large"
style="height:30px;width:200px">Predict</button>

  </form>
```

<br>

  {{ prediction_text }}


  <br>
  <br>
  <img src="{{url_3}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <img src="{{url_1}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <img src="{{url_4}}" alt="Submit Form" height="180"
width="233" onerror="this.style.display='none'"/>
  <br>
  <br>
  <img src="{{url_2}}" alt="Submit Form" height="150"
width="711" onerror="this.style.display='none"/>

</body>
</html>

**Chance.html**

```
 <!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<title>Rainfall prediction</title>
</head>


<body background="C:\Users\intec\OneDrive\Desktop\Rain.jpg" text="black">

  <div class="login">
   <center><h1>chances of rain today.</h1></center>
</body>
</html>
```

**Nochance.html**

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="UTF-8">
  <title>Rainfall prediction</title>
 </head>


<body
background="https://cdn.tourradar.com/s3/tour/1500x800/139566_d97baf8c.jpg"
text="black">
<div class="login">
<center><h1>No chances of rain today, enjoy your outing.</h1></center>
</body>
</html>
```

**app.py**

```
import numpy as np
import pickle
import joblib
import matplotlib
import matplotlib.pyplot as plt
import time
import pandas
import os
from flask import Flask, request, jsonify, render_template

app = Flask(__name__)
model = pickle.load(open('C:\\Users\\intec\\rainfall.pkl', 'rb'))
scale = pickle.load(open('C:\\Users\\intec\\scale.pkl', 'rb'))
@app.route('/')# route to display the home page
def home():
    return render_template('index.html') #rendering the home page
@app.route('/predict', methods=[ "POST", "GET"])# route to show the predictions in a
web UI
```

```
def predict():
    # reading the inputs given by the user
    input_feature=[x for x in request.form.values() ]
    features_values=[np.array(input_feature)]
    names=[['Location','Mintemp','Maxtemp','Rainfall','WindGustSpeed',
    'Windspeed9am', 'WindSpeed3pm', 'Humidity9am', 'Humidity3pm',
    'Pressure9am', 'Pressure3pm', 'Temp9am', 'Temp3pm', 'RainToday',
    'WindGustDir', 'WindDir9am', 'WindDir3pm', 'year', 'month', 'day']]
    data = pandas.DataFrame(features_values, columns=names)
    data = scale.fit_transform(data)
    data = pandas.DataFrame(data,columns = names)
        # predictions using the loaded model file
    prediction = model.predict(data)
    pred_prob = model.predict_proba(data)
    print(prediction)
    if prediction == "Yes":
        return render_template("chance.html")
    else:
        return render_template("nochance.html")
        # showing the prediction results in a UI
    if __name__ == "__main__":
    app.run(host='127.0.0.1',debug=False)
```

**Github link:** https://github.com/IBM-EPBL/IBM-Project-36417-1660294977

**Project Demonstration:** https://drive.google.com/file/d/1X1DN8Jk0KhRzjADklxpbcm242qlciag-/view?usp=drivesdk