Project Report Format

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Exploratory Analysis Of RainFall Data In India For Agriculture

1. **INTRODUCTION**

   a. Project Overview

      Agricultureis 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. So, it is important to predict the rainfall accurately as much as possible. Exploration and analysis of data on rainfall over various regions of India and especially the regions where agricultural works have been done persistently in a wide range. With the

help of analysis and the resultant data, future rainfall prediction for those regions using various machine learning techniques such as XGBoost classifier, SVM classifiers, Decision tree, Naive bayes classifier, Logistic regression etc.

b. Purpose

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.

2. LITERATURE SURVEY

a. Existing problem

b. References

- They can serve as model to investigate the metabolic processes and behavior/reaction of a cell under chemical or photic stimuli, or determine the dynamic of natural populations in response to variations of environmental conditions. In fact, algae can occasionally bloom in enormous amount becoming a serious public health and environmental problem (Artiola, Pepper, & Brusseau, 2004;Wiersma, 2004).

c. Problem Statement Definition

- 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. Fresh water is always a crucial resource of human survival – not only for the drinking purposes but also for farming,

- Making a good prediction of climate is always a major task now a day because of the climate change.

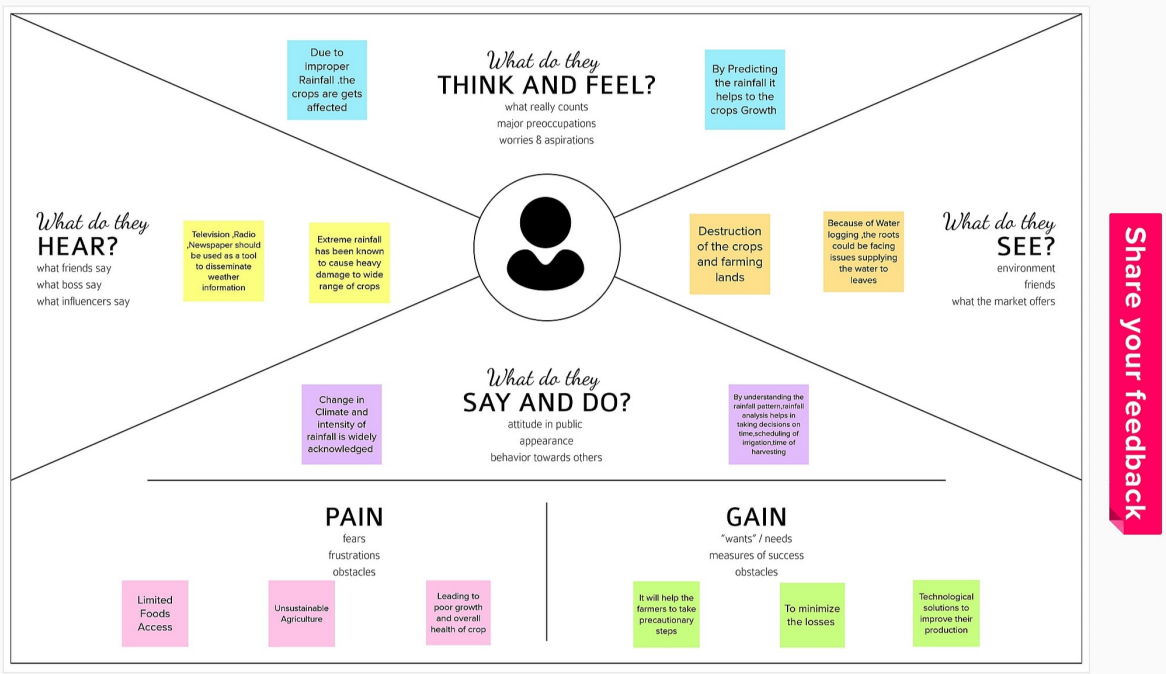
- Now climate change is the biggest issue all over the world. Peoples are working on to detect the patterns in climate change as it affects the

economy in production to infrastructure. So as 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.

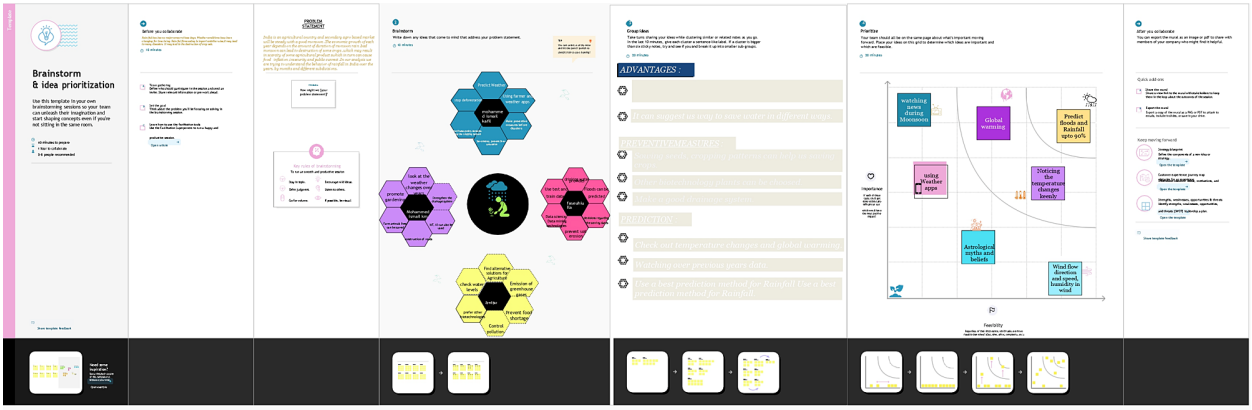
- A bad rainfall prediction can affect the agriculture mostly framers as their whole crop is depend on the rainfall and agriculture is always an important part of every economy. So, making an accurate prediction of the rainfall somewhat good.

3. IDEATION & PROPOSED SOLUTION

a. Empathy Map Canvas



b. Ideation & Brainstorming



c. Proposed Solution

Problem Statement (Problem to be solved):

• 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.

• 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

Idea / Solution description :

• 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. • Provides extra support to maintain the agriculture.

Novelty / Uniqueness:

• This application is useful for the beginners in agriculture.

• Seed maturity selection features are available.

Social Impact / Customer Satisfaction:

• Different types of crops can be planted for good health.

• Helps in producing healthy crops and good fields

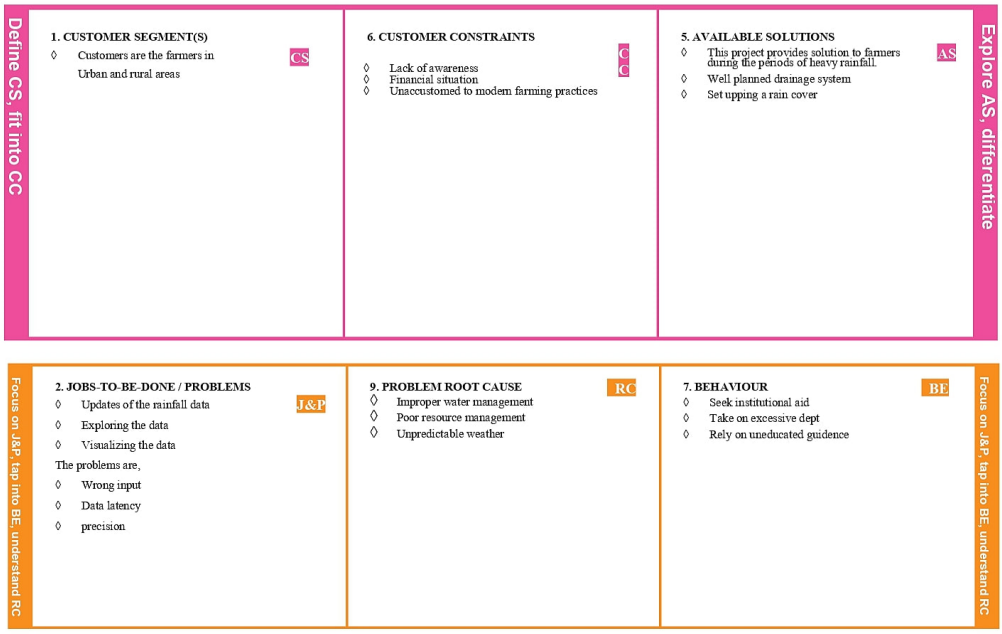
Business Model (Revenue Model):

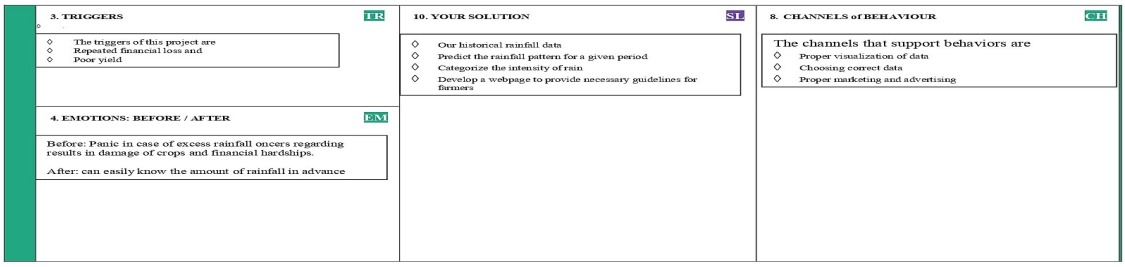
• This comparative study is conducted concentrating on the following aspects: modeling inputs, Visualizing the data, modeling methods, and pre-processing techniques. The results provide a comparison of various evaluation metrics of these machine learning techniques and their reliability to predict rainfall by analyzing the weather data. We will be using classification algorithms such as Decision tree, Random forest, KNN, and xgboost.

Scalability of the Solution:

• When we predict rainfall correctly,it helps growth of crop and yielding will be better.

d. Problem Solution fit





4. REQUIREMENT ANALYSIS

a. Functional requirement

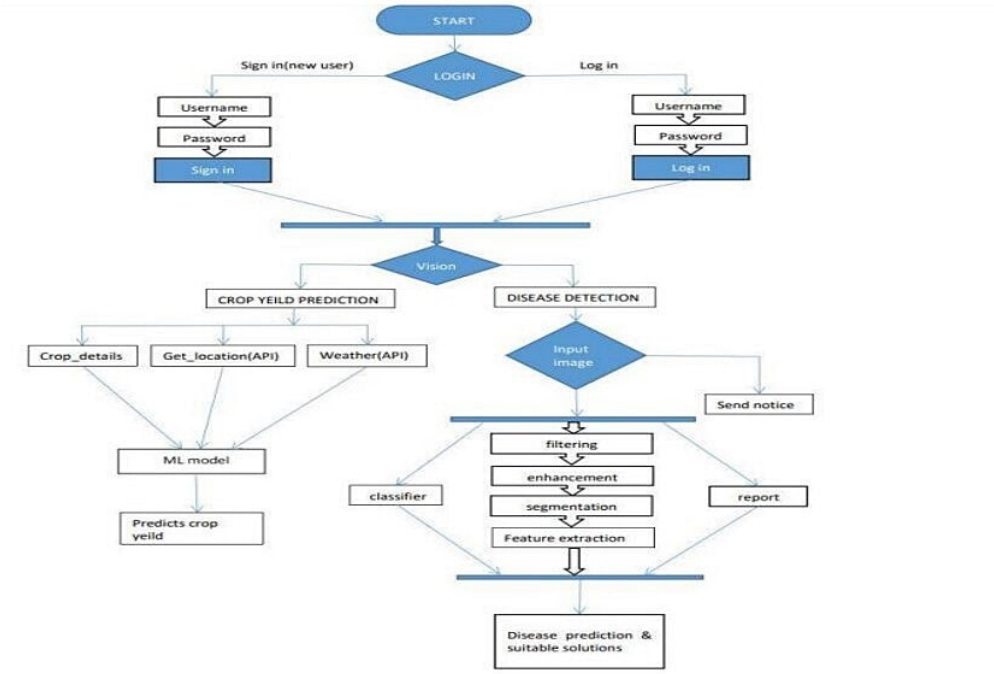
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Import necessary packages	Importing packages like NumPy, pandas, seaborn, etc
FR-2	Download and load dataset	Download the dataset Load the Appropriate dataset
FR-3	Pre-processing of data	Making data suitable for building a good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

b. Non-Functional requirements

FR No	Non-Functional Requirement	Description
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
NFR-4	Performance	The system should output results of different inputs in a reasonable time.
NFR-5	Availability	Any person can use this and this is an open-source model
NFR-6	Scalability	Farmers, Vegetable sellers, citizens can use this, prediction of data is accurate

5. PROJECT DESIGN

a. Data Flow Diagrams



b. Solution & Technical Architecture

S.No	Component	Description	Technology
1.	User Interface	The user interacts with the application through a webUI 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 thewebpage	Flask

5.	Database	Numeric data	MySQL
6.	File Storage	Tostore files suchas prediction report	Local Filesystem
7.	External API	Allows developers access to critical forecasts, alerts,and observations, alongwith other weatherdata	IBM WeatherAPI, etc.
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 ofhistorical and existing data	Predictive modeling
9.	Infrastructure (Server)	Application Deployment on Local System Local Server Configuration: built-in flask web server	Flask web server

c. User Stories

User Type	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Acceptance criteria**	**Priority**	**Release**
Customer (Mobileuser)	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 onceI 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 throughthe entire pages	I can navigate through the pages.	Medi um	Sprint-1
	Prediction	USN-7	User can searchfor the area/ place wherethe user wantsto know the prediction	Searchingf or the regionwith in INDIA onlybe accepted	High	Sprint-1

			of rainfall			
		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 timeperiod		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 (Webuser)	Support	USN-11	User can ask queries aboutthe system.	I can rectifymy 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

6. PROJECT PLANNING & SCHEDULING

a. Sprint Planning & Estimation

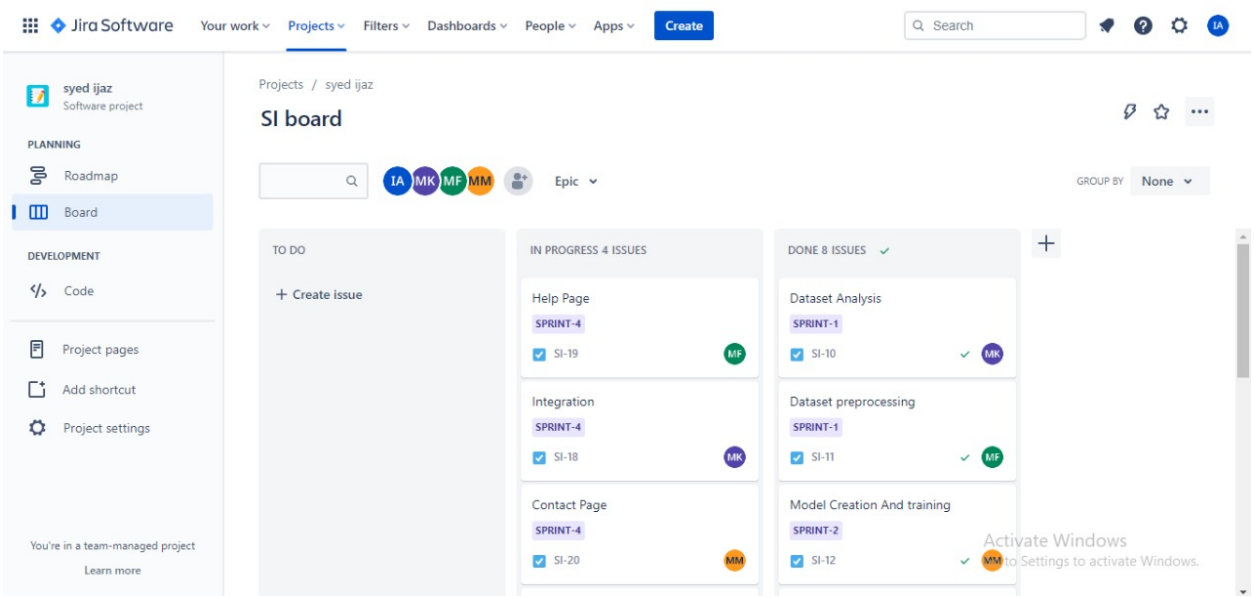
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Dataset Analysis	USN-1	Download theweather dataset and analyze it.	1	High	Ismail Kafil
Sprint-1	Dataset preprocessing	USN-2	Examine the dataset and perform preprocessing steps	1	Medium	Fasehiullah
Sprint-2	Model Creation and Training	USN-3	Create a modelfrom the training data	2	Low	Ismail K M
Sprint-2	Registration	USN-4	As a user,I can register for the application.	2	Low	Ijaz z
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email& password	1	High	Ismail Kafil
Sprint-3	Dashboard	USN-6	As a user, once I log in, I can view the Rainfall Prediction page	1	High	Fasehiullah
Sprint-3	Predictor	USN-7	As a user, I can specify all the values for prediction andget accurate results	1	High	Ismail K M

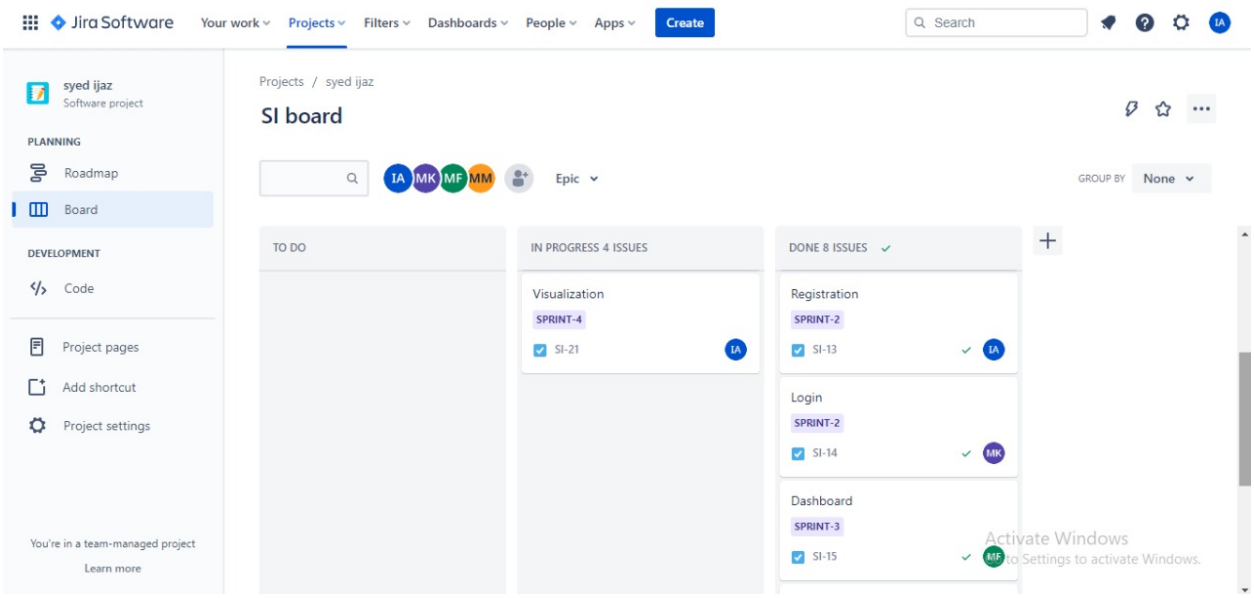
Sprint-3	Base Flask App	USN-8	Integrate Flask and the builtmodel	2	High	Ijaz z
Sprint-4	Integration	USN-9	Integrate the app on IBMcloud	2	High	Ismail Kafil
Sprint-4	Help page	USN-10	As a user, I can get directions on how to use the predictor to gain valuable insights	1	Medium	Fasehiullah

b. Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Contact page	USN-11	As a user, I can get my queries clarified by the admin	1	Medium	Ismail K M
Sprint-4	Visualization	USN-12	As a user,I can visualize the datausing various plots	2	Medium	Ijaz z

c.Reports from JIRA




Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
syed ijaz
Software project
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / syed ijaz
SI board
Epic
GROUP BY
None
TO DO
IN PROGRESS 4 ISSUES
DONE 8 ISSUES
Visualization
SPRINT-4
SI-21
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Login
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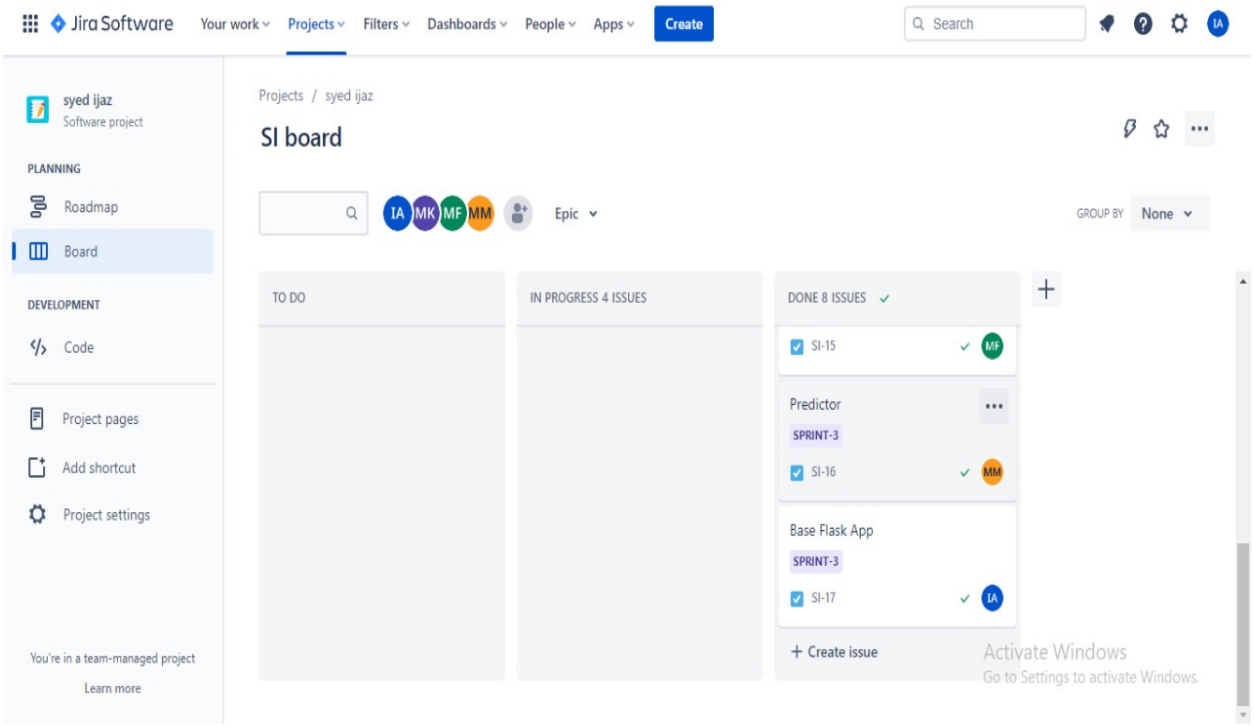
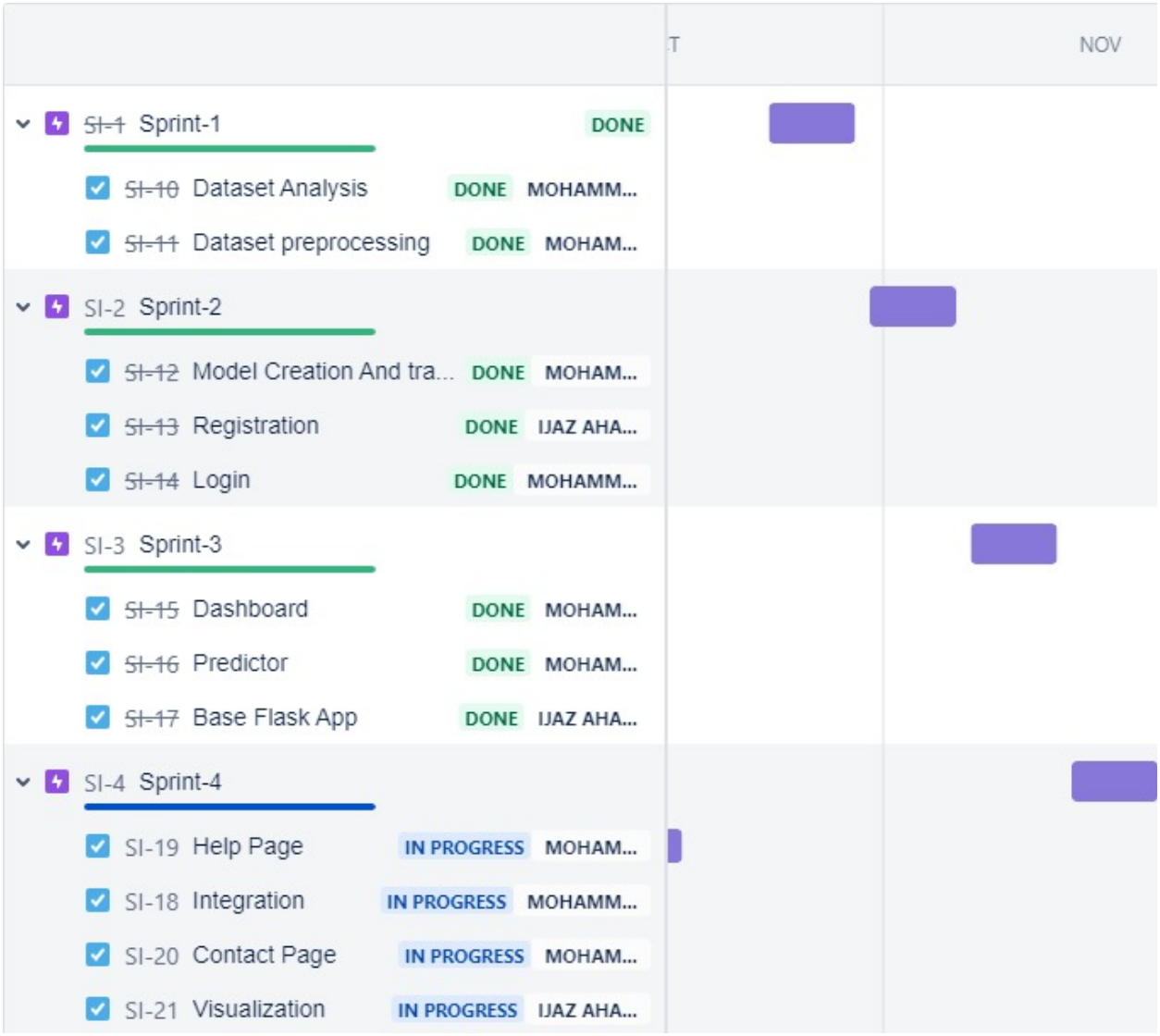
Dashboard
SPRINT-3
SI-15
Activate Windows
Go to Settings to activate Windows.


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
syed ijaz
Software project
PLANNING
Roadmap
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / syed ijaz
SI board
Epic
GROUP BY
None
TO DO
IN PROGRESS 4 ISSUES
DONE 8 ISSUES
SI-15
Predictor
SPRINT-3
SI-16
Base Flask App
SPRINT-3
SI-17
+ Create issue
Activate Windows
Go to Settings to activate Windows.



7. **RESULTS**

    a. Performance Metrics

8. **ADVANTAGES & DISADVANTAGES**

ADVANTAGES:

-Preserves the sequence of dry/wet days , It accounts for different correction different time windows.

-It allows for distinct corrections between mean and variance.

-The frequency of preciption is corrected, no theoretical distribution is

assumed.

DISADVANTAGES:

-It only corrects the mean precipitation.
-Does not account for changes in the lenght of dry/wet spells.
-Requires large computation time and data preparation.

9. 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.

10. APPENDIX

Source Code

python code

```
import pickle
import re
import sqlite3 as sql
import time
import ibm_db

import joblib
import matplotlib
import matplotlib.pyplot as plt
import numpy as np
import pandas
import requests
from flask import Flask, render_template, request

API_KEY = "qJSD5ROm29i2iJGncQiHjCmDMgTx_563xkzVMRZ3Wvw3"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
```

```
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}
conn = ibm_db.connect("DATABASE=bludb;HOSTNAME=125f9f61-9715-46f9-9399-
c8177b21803b.c1ogj3sd0tgtu0lqde00.databases.appdomain.cloud:31048;PORT=31498
;SECURITY=SSL;SSLServerCertificate=DigiCertGlobalRootCA.crt;UID=wcq74792;PWD=N
ogApdfJJmMbemby","","")
app = Flask(__name__)
model=pickle.load(open('rainfall.pkl','rb'))
scale=pickle.load(open('scale.pkl','rb'))
@app.route('/signin',methods =['GET', 'POST'])
def signin():
    global userid
    msg = ''
    if request.method == 'POST' :
        un = request.form['username']
        pd = request.form['password']
        sql = "SELECT * FROM register WHERE username =? AND password=?"
        stmt = ibm_db.prepare(conn, sql)
        ibm_db.bind_param(stmt,1,un)
        ibm_db.bind_param(stmt,2,pd)
        ibm_db.execute(stmt)
        account = ibm_db.fetch_assoc(stmt)
        print (account)
        if account:
            session['loggedin'] = True
            session['id'] = account['USERNAME']
            userid=  account['USERNAME']
            session['username'] = account['USERNAME']
            msg = 'Logged in successfully !'

            return render_template('dashboard.html', msg = msg)
        else:
            msg = 'Incorrect username / password !'
    return render_template('signin.html', msg = msg)
@app.route('/signup', methods=['POST','GET'])
def signup():
```

```
    msg=''
    if request.method == "POST":
        username=request.form['username']
        email=request.form['email']
        pw=request.form['password']
        sql='SELECT * FROM register WHERE email =?'
        stmt = ibm_db.prepare(conn, sql)
        ibm_db.bind_param(stmt,1,email)
        ibm_db.execute(stmt)
        acnt=ibm_db.fetch_assoc(stmt)
        print(acnt)

        if acnt:
            msg='Account already exits!!'

        elif not re.match(r'[^@]+@[^@]+\.[^@]+', email):
            msg='Please enter the avalid email address'
        elif not re.match(r'[A-Za-z0-9]+', username):
            msg='name must contain only character and number'
        else:
            insert_sql='INSERT INTO register VALUES (?,?,?)'
            pstmt=ibm_db.prepare(conn, insert_sql)
            ibm_db.bind_param(pstmt,1,username)
            ibm_db.bind_param(pstmt,2,email)
            ibm_db.bind_param(pstmt,3,pw)
            ibm_db.execute(pstmt)
            msg='You have successfully registered click signin!!'
            return render_template("signin.html")



    elif request.method == 'POST':
        msg="fill out the form first!"
    return render_template("signup.html",msg=msg)
@app.route('/')
def home():
```

```
    return render_template('index.html')
@app.route('/predict',methods=["POST","GET"])
def predict():
    input_feature=[x for x in request.form.values()]
    feature_values=[np.array(input_feature)]

names=[['Location','MinTemp','MaxTemp','Rainfall','WindGustDir','WindGustSpeed','WindDir
9am','WindDir3pm','WindSpeed9am','WindSpeed3pm','Humidity9am','Humidity3pm','Pressu
re9am','Pressure3pm','Cloud9am','Cloud3pm','Temp9am','Temp3pm','RainToday']]
    response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/cae560db-c5dc-4eba-b799-
99e910c25da3/predictions?version=2022-11-04', json=names,
    headers={'Authorization': 'Bearer ' + mltoken})
    print("Scoring response")
    print(response_scoring.json())
    data=pandas.DataFrame(feature_values,columns=names)
    data=scale.fit_transform(data)
    data=pandas.DataFrame(data,columns=names)
    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")
if __name__ == "__main__":
  app.run(debug=True)
```

HTML CODE

```
<!DOCTYPE html>
<html>

<head>
    <meta charset="UTF-8">
    <title>Rainfall prediction</title>
</head>

<body>
```

```
<div class="login">
   <center>
      <h1>Rainfall Prediction</h1>
   </center>

   <h1>Please enter the following details<h1>
         <form action="{{url_for('predict')}}" method="post">
            <label for="Location">Location:</label>
            <select id="Location" name="Location">
               <option value=albury>albury</option>
               <option value=4>badgery</option>
               <option value=10>cobar</option>
               <option value=11>coff</option>
               <option value=21>moree</option>
               <option value=24>newcastle</option>
               <option value=26>norah</option>
               <option value=27>pen</option>
               <option value=30>a</option>
               <option value=34>a</option>
               <option value=37>a</option>
               <option value=38>a</option>
               <option value=42>a</option>
               <option value=45>a</option>
               <option value=47>b</option>
               <option value=9>c</option>
               <option value=40>v</option>
               <option value=23>v</option>
               <option value=5>n</option>
               <option value=6>m</option>
               <option value=35>m</option>
               <option value=19>m</option>
               <option value=18>m</option>
               <option value=20>m</option>
               <option value=25>m</option>
               <option value=33>m</option>
               <option value=44>m</option>
               <option value=5>m</option>
```

```
                <option value=5>m</option>
            </select>   
            <label for="MinTemp"></label>
            <input type="float" id="MinTemp" name="MinTemp" placeholder="MinTemp">
            <label for="MaxTemp"></label>
            <input type="float" id="MaxTemp" name="MaxTemp"
placeholder="MaxTemp">
            <label for="Rainfall"></label>
            <input type="float" id="Rainfall" name="Rainfall" placeholder="Rainfall">
            <label for="Windspeed9am"></label>
            <input type="float" id="Windspeed9am" name="Windspeed9am"
placeholder="Windspeed9am">
            <label for="Windgustspeed"></label>
            <input type="float" id="Windgustspeed" name="Windgustspeed"
placeholder="Windgustspeed">
            <label for="Windspeed3pm"></label>
            <input type="float" id="Windspeed3pm" name="Windspeed3pm"
placeholder="Windspeed3pm">
            <label for="Humidity9am"></label>
            <input type="float" id="Humidity9am" name="Humidity9am"
placeholder="Humidity9am">
            <label for="Humidity3pm"></label>
            <input type="float" id="Humidity3pm" name="Humidity3pm"
placeholder="Humidity3pm">
            <label for="Pressure9am"></label>
            <input type="float" id="Pressure9am" name="Pressure9am"
placeholder="Pressure9am">
            <label for="Pressure3pm"></label>
            <input type="float" id="Pressure9pm" name="Pressure3pm"
placeholder="Pressure3pm">
            <label for="Temp9am"></label>
            <label for="Cloud9am"></label>
            <input type="float" id="Cloud9am" name="Cloud9am"
placeholder="Cloud9am">
            <label for="Cloud3am"></label>
            <input type="float" id="Cloud3am" name="Cloud3am"
placeholder="Cloud3am">
```

```
            <input type="float" id="Temp9am" name="Temp9am"
placeholder="Temp9am">
            <label for="Temp3pm"></label>
            <input type="float" id="Temp3pm" name="Temp3pm"
placeholder="Temp3pm">


            <label for="RainToday">RainToday:</label>
            <select id="Rain" name="RainToday">
              <option value=2>YES</option>
              <option value=4>NO</option>
            </select>
            <label for="Windgustdir">Windgustdir:</label>
            <select id="Windgustdir" name="Windgustdir">
              <option value=2>W</option>
            </select>
            <label for="Winddir9am">Winddir9am:</label>
            <select id="Winddir9am" name="Winddir9am">
              <option value=2>W</option>
            </select>
            <label for="Winddir3pm">Winddir3pm:</label>
            <select id="Winddir3pm" name="Winddir3pm">
              <option value=2>W</option>
            </select>




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

```
  </div>
</body>

</html>
```

GitHub & Project Demo Link

GitHub link: https://github.com/IBM-EPBL/IBM-Project-42195-1660655698.git