PROJECT REPORT

Exploratory Analysis of Rainfall Data in India for Agriculture

Submitted by :

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TABLE OF CONTENTS

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1
7.2 Feature 2
7.3 Database Schema (if Applicable)

8. TESTING

8.1 Test Cases
8.2 User Acceptance Testing

9. RESULTS

9.1 Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

Source Code

GitHub & Project Demo Link

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

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S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Heavy Rainfall may cause huge threat to all living beings, especially in the field of Agriculture. Droughts could do the same too. It may destroy the crops and cause huge loss to Farmers and dependent field workers. Predicting Rainfall is a major task in both summer and Rainy season.
2.	Idea / Solution description	Analysing the previous 10 years datas can give us a rough idea about Rainfall pattern. Using Data Science, we could solve this and predict the Rainfall upto some good extent.
3.	Novelty / Uniqueness	AI, IOT and so many other fields may require different sensors. We are not going to use any kind of equipment. Time of prediction is very less and easy with affordable cost.
4.	Social Impact / Customer Satisfaction	Farmers (they save crops and money), Vegetable sellers(they knows about vegetable stocks and its emergency)
5.	Business Model (Revenue Model)	This could cost really low as a person should develop knowledge in Data science and probably a gadget to develop this. However, deploying as an App attached with other facilities may cost an extra charge.
6.	Scalability of the Solution	Farmers, Vegetable sellers, Citizens

CHAPTER 2

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. 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.

2.2 REFERENCES

LITERATURE SURVEY:

PROJECT TITLE	*AUTHOR*	*OBJECTIVE/OUTCOME*
Spatial analysis of Indian Summer monsoon Rainfall (Mar 26,2014)	Markand Oza C.M.Kishtawal	Understanding the variability in rainfall, analysis of Indian Summer monsoon rainfall using Spatial resolution.
Climate impacts on Indian Agriculture. (16 June,2004)	K.Krishna kumar K.Rupa Kumar R.G.Ashrit N.R.Deshpande J.W.Hansen	Presents about the analysis of Crop-climate relationships for India, using historical predictions.
Exploratory data Analysis of Indian Rainfall Data	Anusha Gajinkar	This Study shows that, India has two monsoon rainfall season one is north west monsoon and second one is south east monsoon.

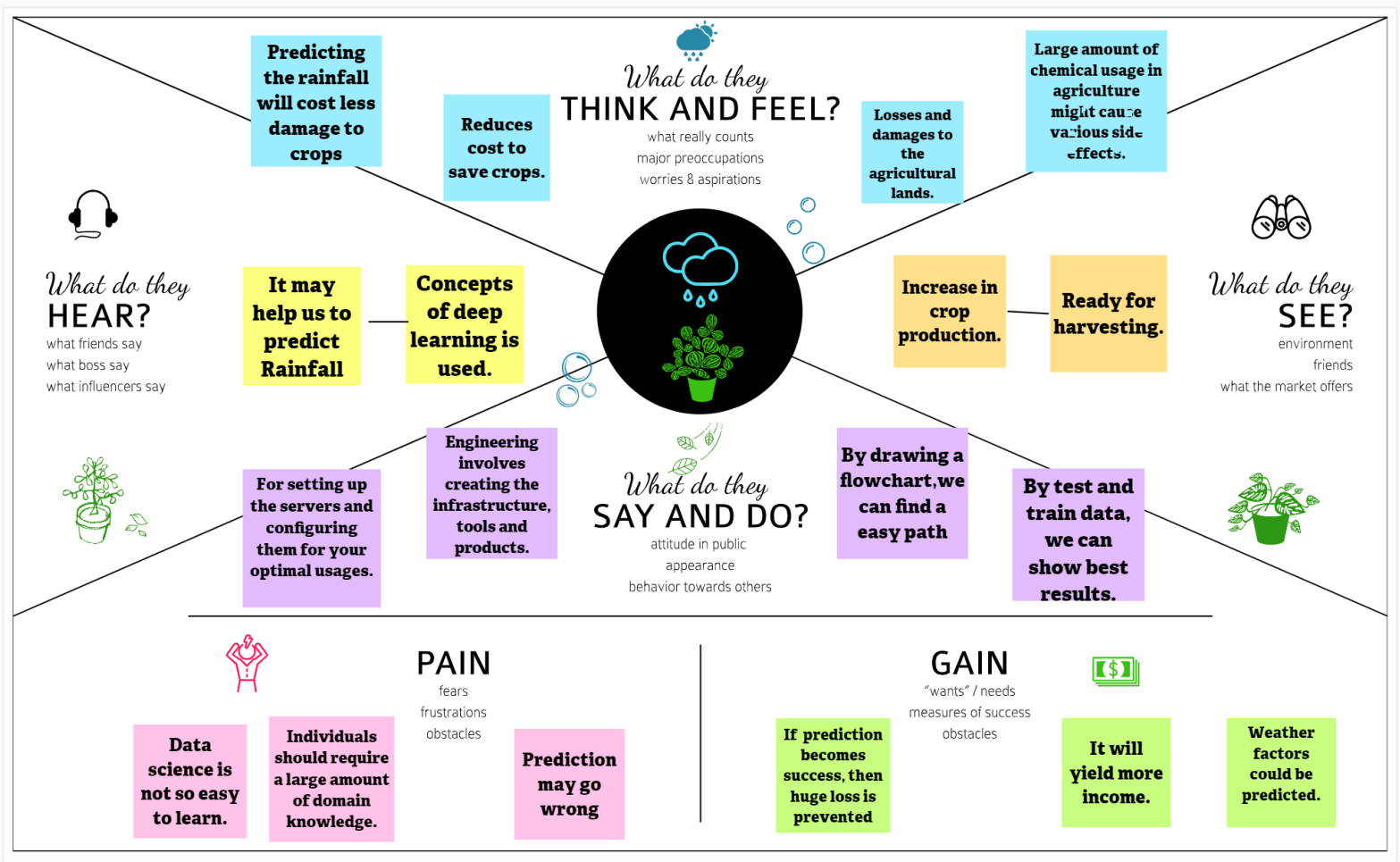
2.3 PROBLEM STATEMENT DEFINITION

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. 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.

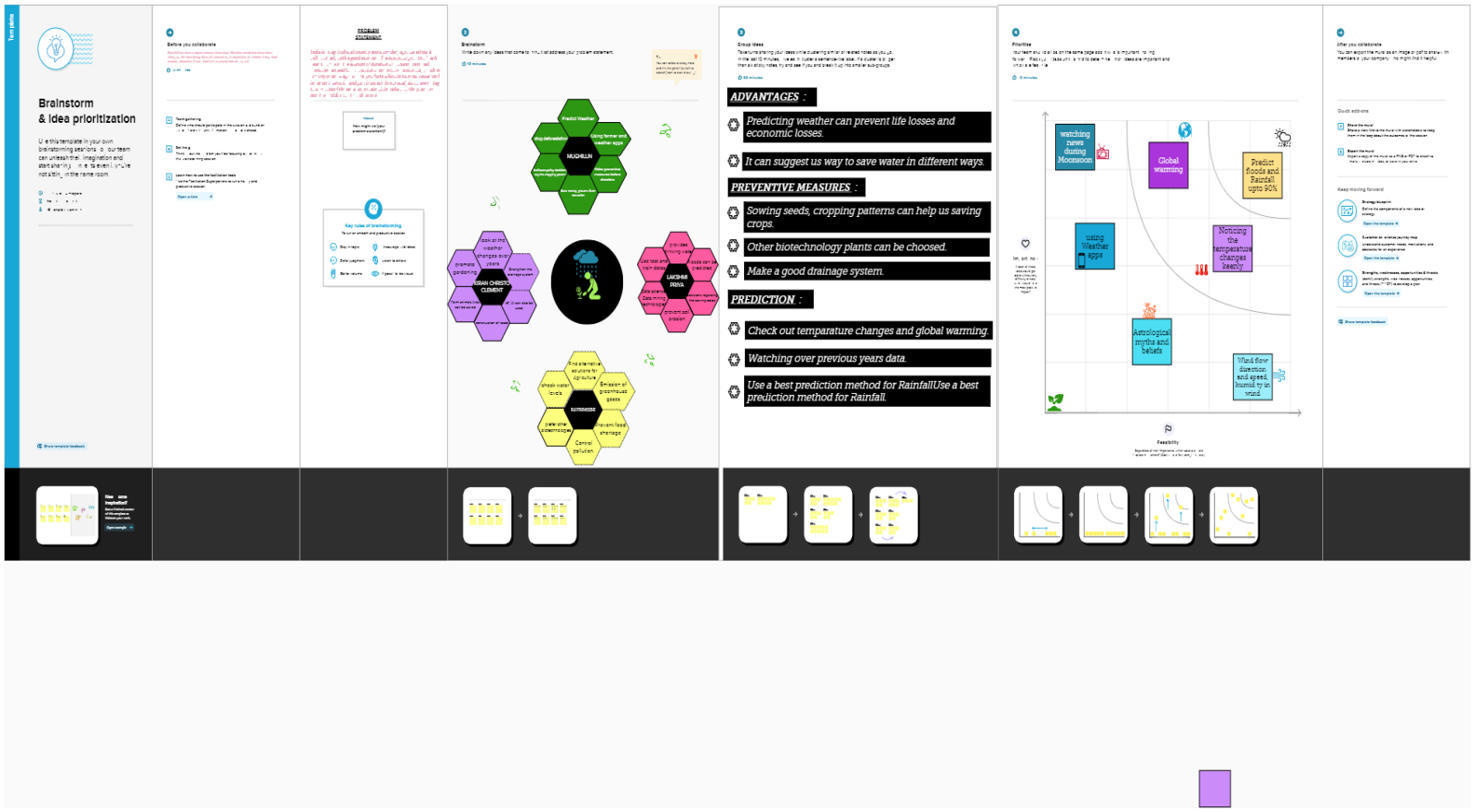
CHAPTER 3

3.IDEATION AND EMPATHY MAP

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Heavy Rainfall may cause huge threat to all living beings, especially in the field of Agriculture. Droughts could do the same too. It may destroy the crops and cause huge loss to Farmers and dependent field workers. Predicting Rainfall is a major task in both summer and Rainy season.
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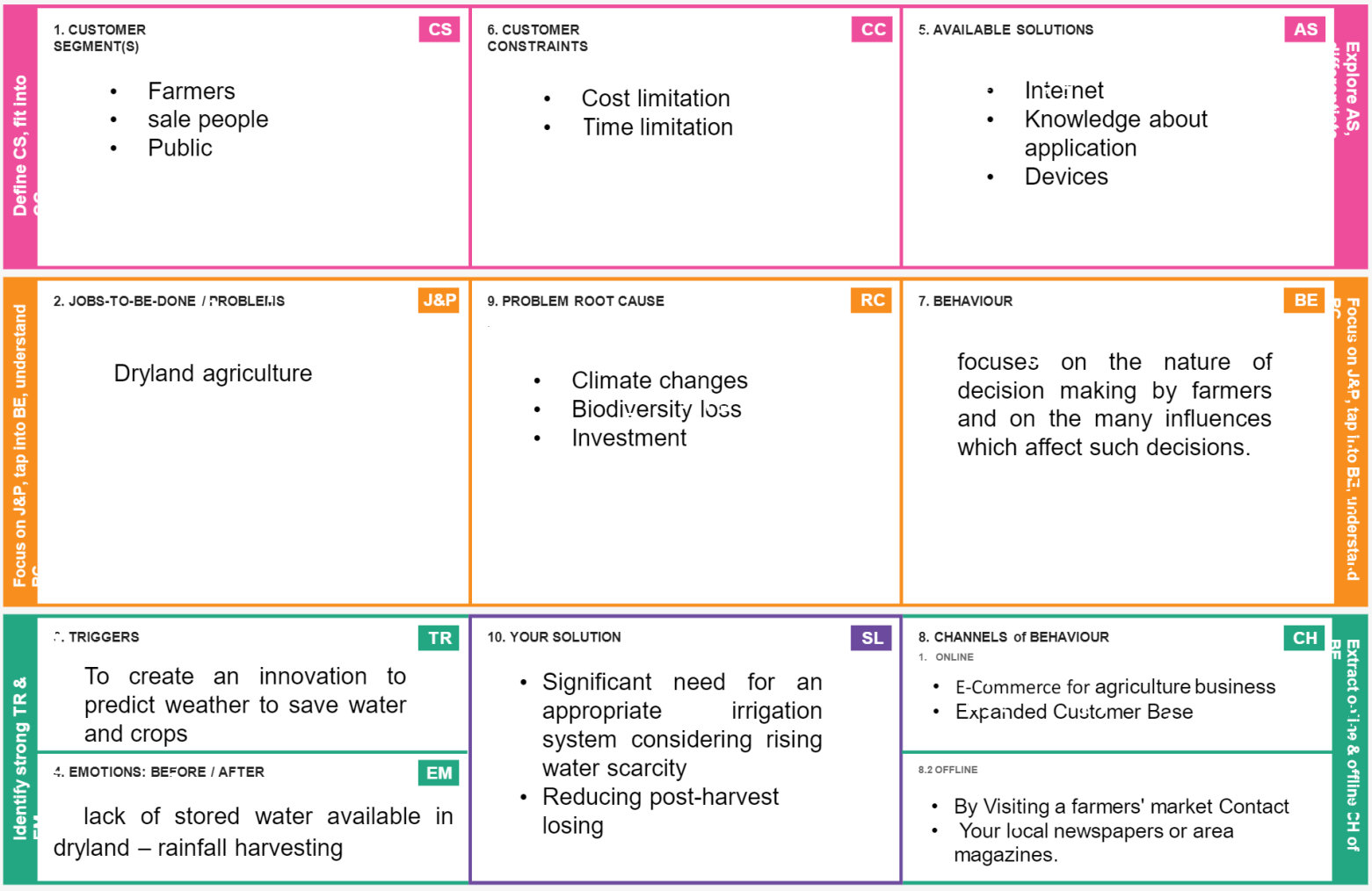
6.	Scalability of the Solution	Farmers, Vegetable sellers, Citizens

3.4 Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 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 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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Can be used anywhere(remote villages to metropolitan cities), anybody (kids to old age)
NFR-2	**Security**	Security is given over the model, so the user can use this with full trust. However, there are no personal details required to use this.
NFR-3	**Reliability**	Good connectivity and a supporting device can provide good results upto an extent.
NFR-4	**Performance**	This model can give a high accuracy prediction.
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.

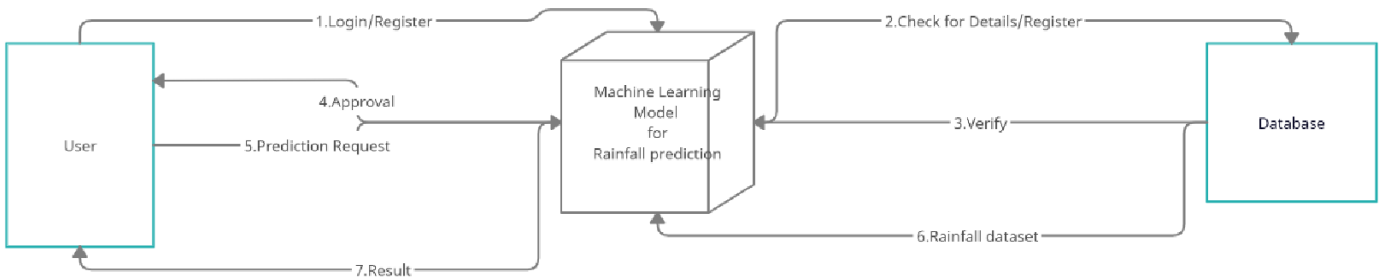
5. PROJECT DESIGN

5.1 Data Flow Diagrams

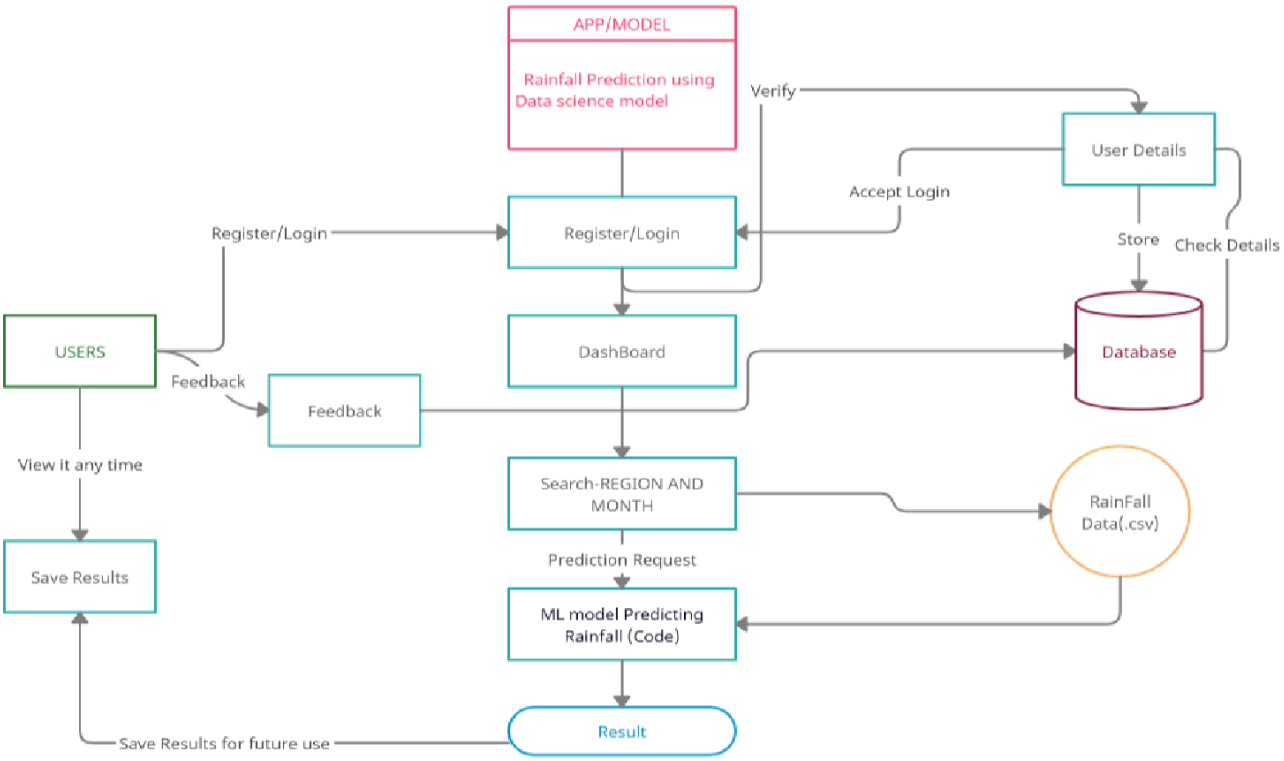
Data Flow Diagrams:

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.

0-LEVEL DATA FLOW DIAGRAM:



2-LEVEL DATA FLOW DIAGRAM:



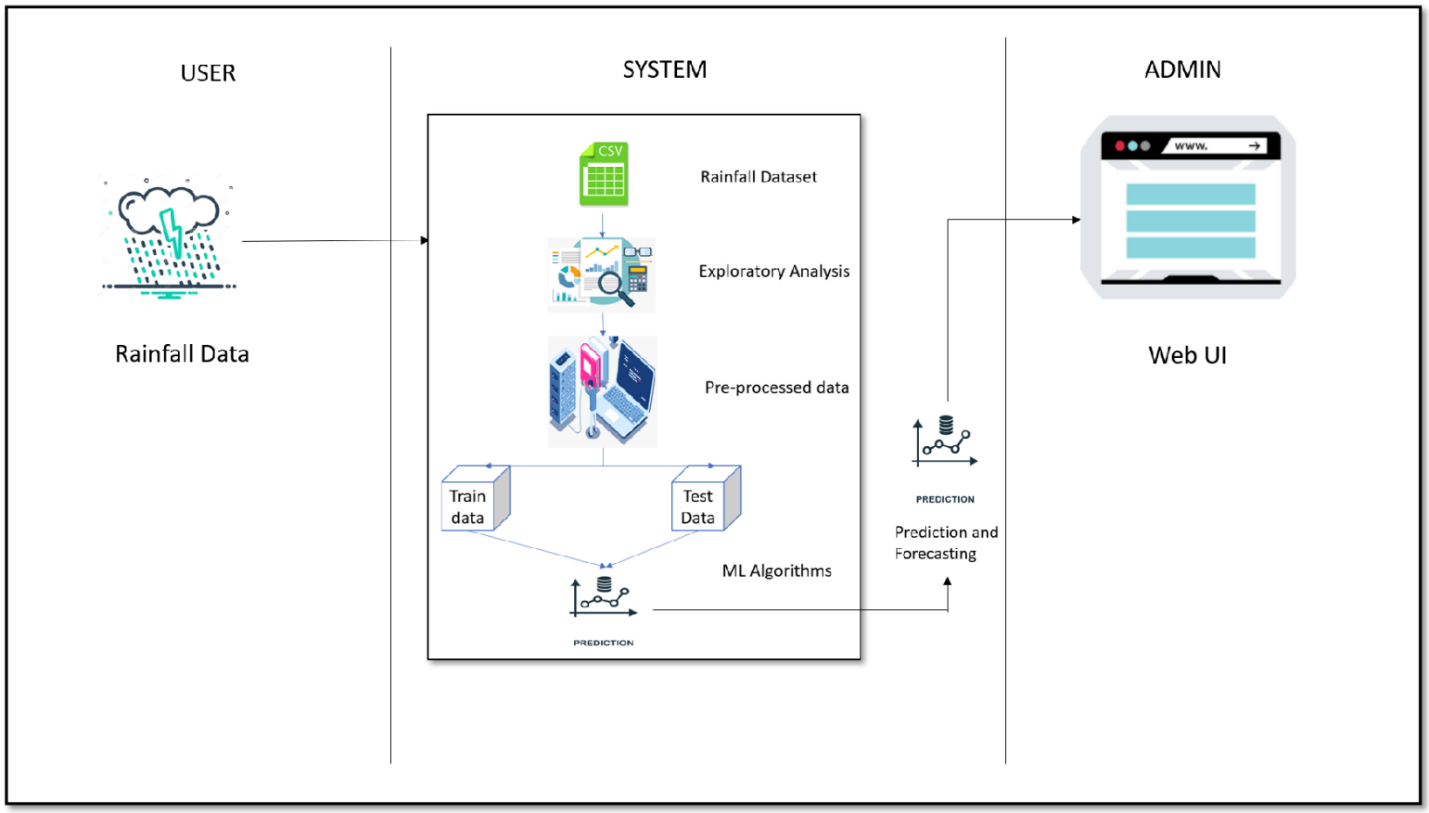
5.2 Solution & Technical Architecture

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Technology architecture associates application components from application architecture with technology components representing software and hardware components.

Its components are generally acquired in the marketplace and can be assembled and configured to constitute the enterprise's technological infrastructure.



5.3 User Stories

User Stories

Use the below template to list all the user stories for the product.

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-2
	Login	USN-3	As a user, I can log into the application through my registered email and password	I can access the dashboard of the system.	High	Sprint-1
		USN-4	User can change their password and can view their search history.	Verification is required and new password should be entered.	HIgh	Sprint-1
		USN-5	The existing credentials should be used for login or multiple systems.		Medium	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 care executive	Support	USN-11	User can ask queries about the system.	I can rectify my doubts	High	Sprint-3
		USN-12	The team must analyse all the queries and debug it in the next update.		High	Sprint-3
		USN-13	Organize for a FAQ session.		Low	Sprint-3

6. PROJECT PLANNING & SCHEDULING

TITLE	DESCRIPTION	DATE
Literature survey & information gathering	Collect the relevant information on project use case, refer the existing solutions, technical papers, research publications etc.	19 SEPTEMBER 2022
Prepare empathy map	Prepare Empathy Map Canvas and List of problem statements	19 SEPTEMBER 2022
Ideation	List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance	19 SEPTEMBER 2022
Proposed solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	24 SEPTEMBER 2022

6.1 Sprint Planning & Estimation

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 pre-processing, Data Visualization.	5	High	Kiran Christo Clement F, Kavinmozhi M
Sprint-1		USN-2	Train Model using Different machine learning Algorithms	5	High	Mughilun T, Lakshmi Priya S
Sprint-1		USN-3	Test the model and give best	10	High	Mughilun T, Lakshmi Priya S
Sprint-2	Registration	USN-4	As a user, they can register for the application through Gmail. Password is set up.	5	Medium	Kiran Christo Clement F, Mughilun T
Sprint-2	Login	USN-5	As a user, they can log into the application by entering email & password	5	Medium	Kavinmozhi M, Lakshmi Priya S
Sprint-2		USN-6	Credentials should be used for multiple systems and verified	4	Medium	Kiran Christo Clement F, Lakshmi Priya S
Sprint-2	Dashboard	USN-7	Attractive dashboard forecasting live weather	6	Low	Mughilun T, Kavinmozhi M
Sprint-3	Rainfall Prediction	USN-8	User enter the location, temperature, humidity	10	High	Lakshmi Priya S , Mughilun T
Sprint-3		USN-9	Predict the rainfall and display the result	10	High	Kavinmozhi M, Kiran Christo Clement F

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	Mughilun T, Kiran Christo Clement F
Sprint-4	Deploy Model	USN-11	Deploy the model in IBM cloud to make user friendly application	10	High	Lakshmi Priya S, Kavinmozhi M

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	24 Oct 2022	29 Oct 2022	20	29 Oct 2022

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	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

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)

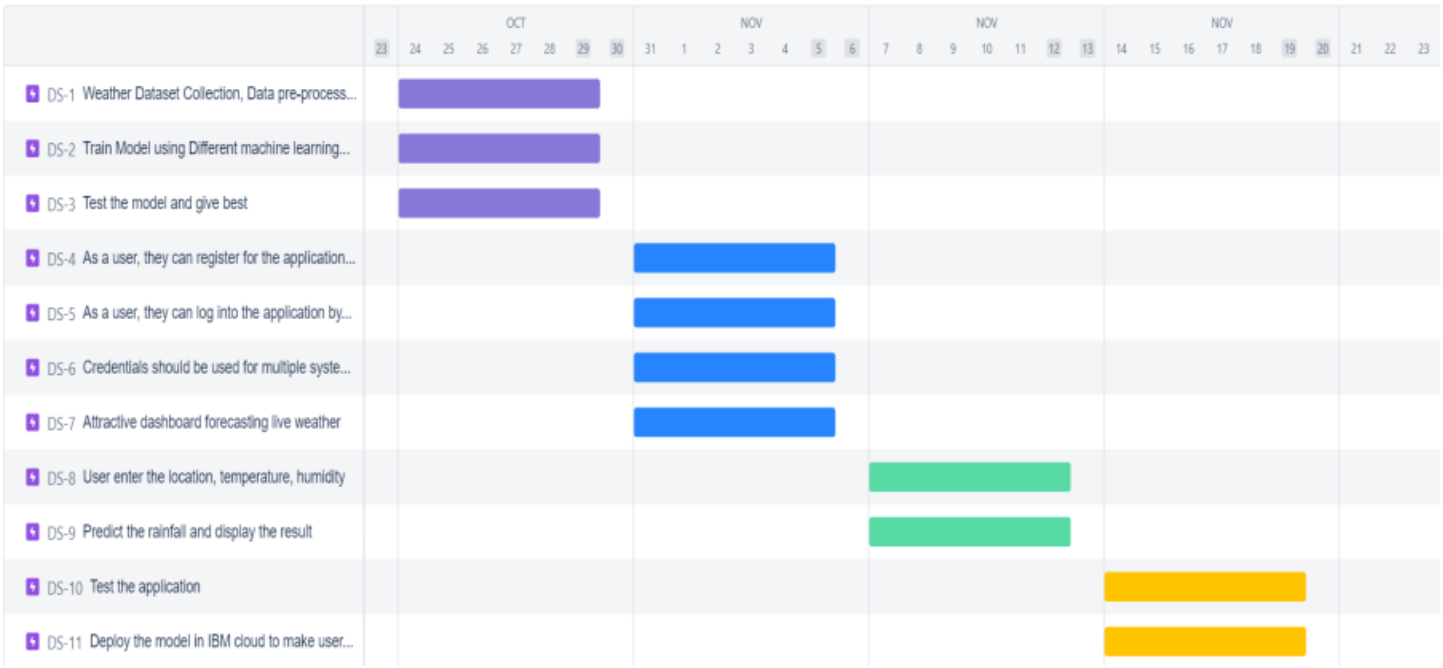
AV= Sprint duration/ Velocity = 20/5 =4

Total Average Velocity=4

6.3 Reports from JIRA

Burndown Chart :

Tool : Jira Software



CHAPTER 7

7 .CODING & SOLUTION

Click here for coding and solution

CHAPTER 8

TESTING

8.1 TEST CASES

Test Case ID	Features	Components	Test Scenario	Steps to execute	Test Data	Expected output	Actual Result	Status	BUG_ID	Executed by
HP_TC_001	UI	Home page	Check UI elements in the home page.	1.Open the page. 2.Check if all the UI elements are displayed.	127.0.0.1:5000	The home page must be displayed properly.	Working Successfully.	PASS		Mughilun, Lakshmi Priya
HP_TC_002	Functionals	Home page	Check if the user can press the **register button**.	1. Open the page. 2. Click on register button.	127.0.0.1:5000	The user should be redirected to **register page**.	Working Successfully	PASS		Kavinmozhi , Kiran Christo clement
RP_TC_001	UI	Register page	Verify UI elements in the register page.	1. Open page. 2. Check all the UI elements	127.0.0.1:5000	The **register page** must be displayed properly	Working Successfully	PASS		Mughilun, Lakshmi Priya
RP_TC_002	Functionals	Register page	Check if the user is able to enter the necessary details(user name, password, e-mail id) and able to press the **register button.**	1. Open page. 2. Enter the details. 3. Press the register button.	127.0.0.1:5000	"**Record added successfully**" message is notified after pressing the register button. If not error is shown.	Working Successfully	PASS		Kavinmozhi , Kiran Christo clement
RP_TC_003	Functionals	Register page	Check if the user can click back button.	1. Press the back button.	127.0.0.1:5000	The page should redirected to **home page**.	Successfully working.	PASS		Mughilun, Lakshmi Priya
HP_TC_003	Functionals	Home page	Check if the user can click the login button.	1. Press the login button	127.0.0.1:5000	The page should redirected to **login page**.	Successfully working.	PASS		Kavinmozhi , Kiran Christo clement

Test Case ID	Features	Components	Test Scenario	Steps to execute	Test Data	Expected output	Actual Result	Status	BUG_ID	Executed by
LP_TC_001	UI	Login page	Verify UI elements in the login page.	1. Open page. 2. Check all the UI elements.	127.0.0.1:5000	The **login page** must be displayed properly.	Successfully working.	PASS		Mughilun, Lakshmi Priya
LP_TC_002	Functionals	Login page	Check if the user is able to enter the necessary details(password, e-mail id) and able to press the **login button.**	1. Enter the details. 2. Press the login button.	127.0.0.1:5000	The page should be redirected to the **prediction page**. If the password and username doesn't match it shows an error.	Successfully working.	PASS		Kavinmozhi , Kiran Christo clement
PP_TC_001	UI	Prediction page	Check UI elements in the Prediction page.	1.Open the page. 2.Check if all the UI elements are displayed.	127.0.0.1:5000	The Prediction page must be displayed properly	Successfully working	PASS		Mughilun, Lakshmi Priya
PP_TC_002	Functionals	Prediction page	Check if the user can enter all the necessary details(MinTemp, MaxTemp,Rain fall,etc...) and able to press **predict** button.	1. Open page. 2. Enter the details. 3. Press the **predict** button.	127.0.0.1:5000	The result will be displayed in the result page.	Successfully working	PASS		Kavinmozhi , Kiran Christo clement
RP_TC_001	UI	Result page	Check whether the result page and back button is visible or not.	Check if result and back button is shown.	127.0.0.1:5000	The result will be shown and back button is displayed.	Successfully working	PASS		Mughilun, Lakshmi Priya

Test Case ID	Features	Components	Test Scenario	Steps to execute	Test Data	Expected output	Actual Result	Status	BUG_ID	Executed by
RP_TC_001	Functionals	Result page	Check whether the back button is working .	1. Open page 2. Press the back button.	127.0.0.1:5000	The page should be redirected to **home page**	Successfully working	PASS		Mughilun, Lakshmi Priya

8.2 USER ACCEPTANCE TEST

8.2.1 DEFEAT ANALYSIS

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

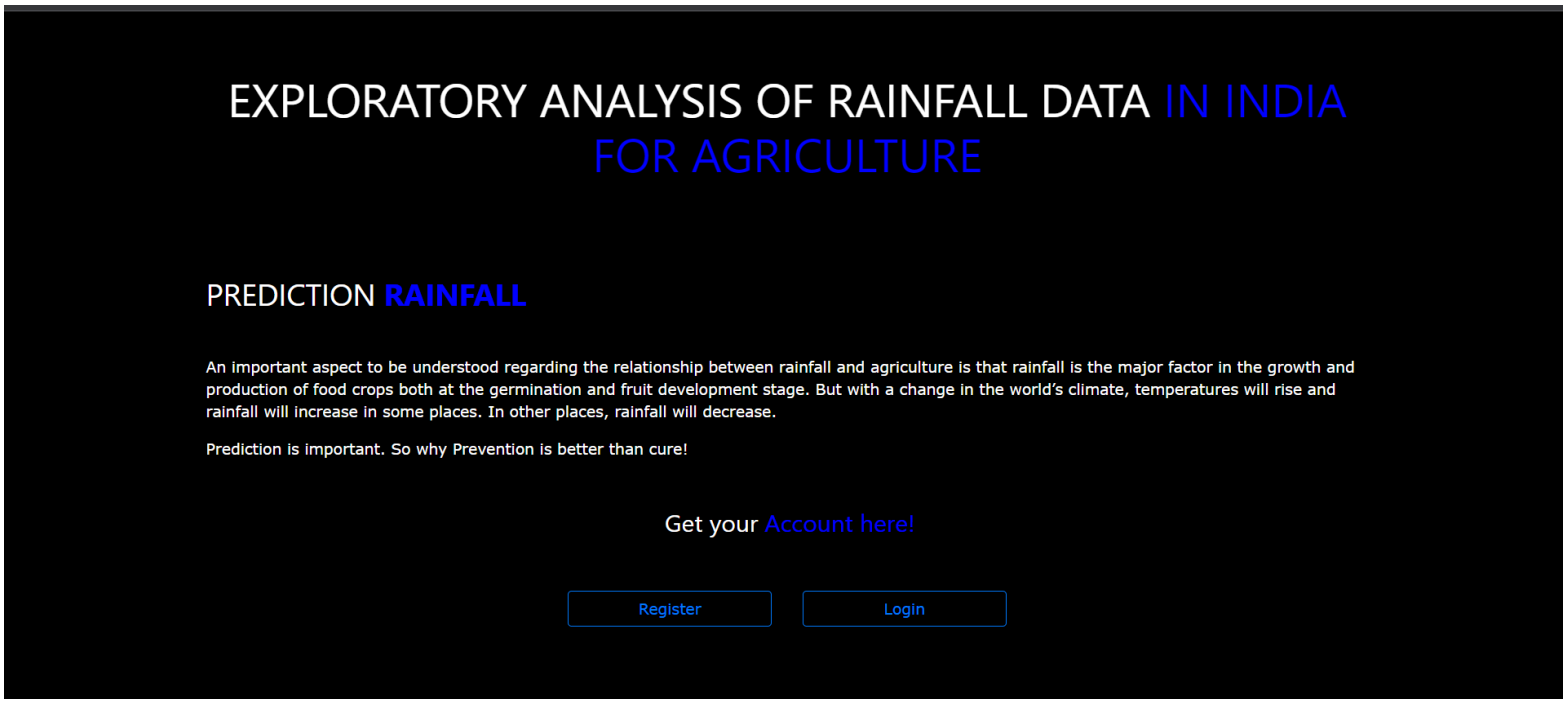
8.2.2 TEST CASES ANALYSIS

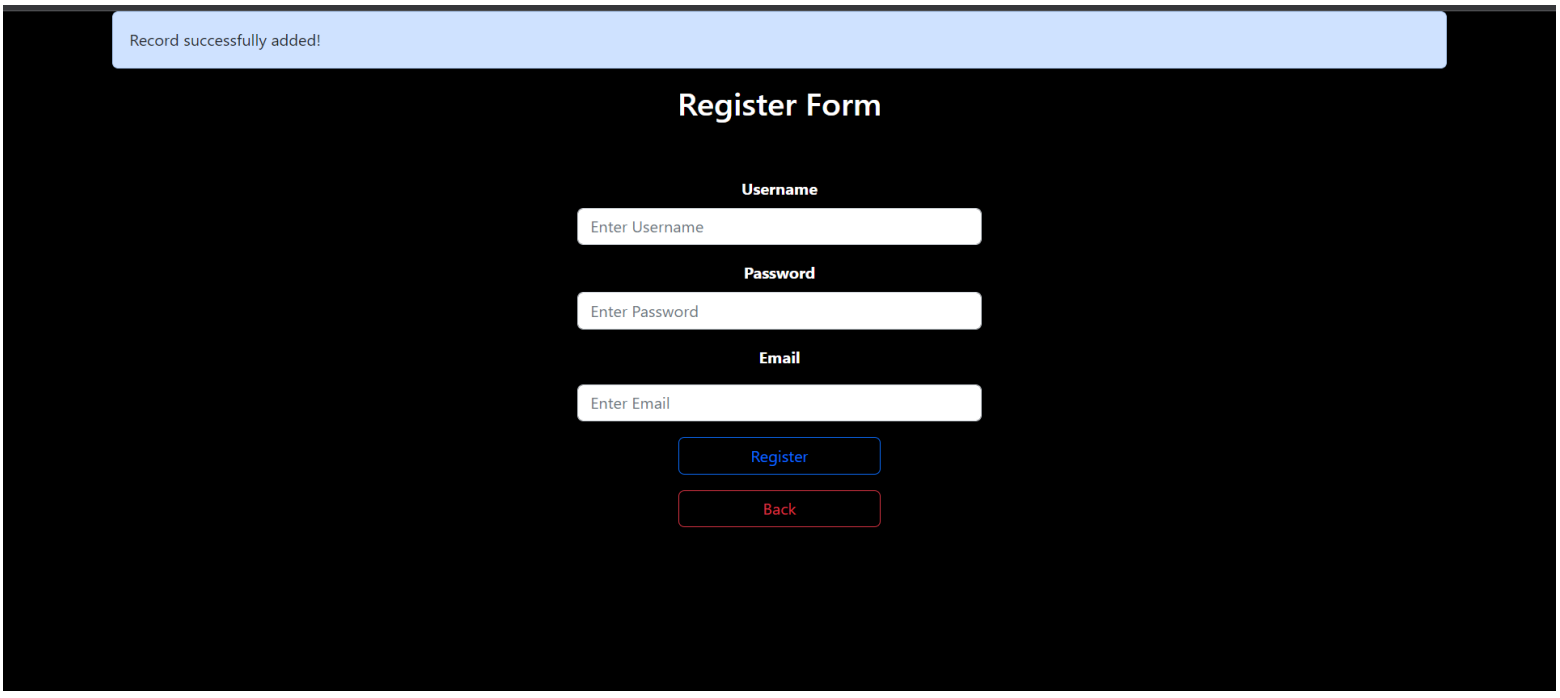
Section	Total Cases	Not Tested	Fail	Pass
Client Application	10	0	3	7
Security	2	0	1	1
Performance	3	0	1	2
Exception Reporting	2	0	0	2

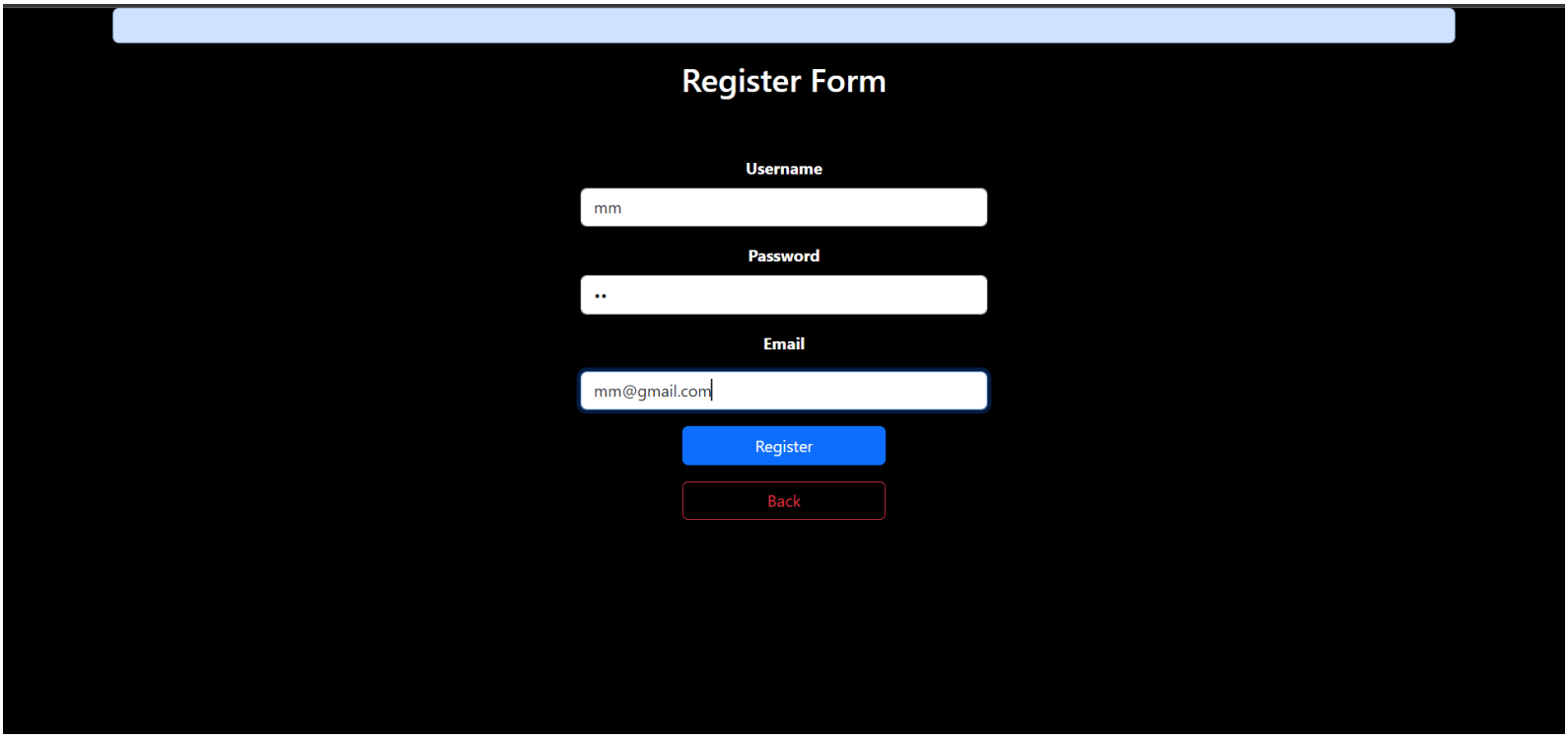
CHAPTER 9

RESULTS

9.1 PERFORMANCE MATRICS :






Register Form
Username
mm
Password
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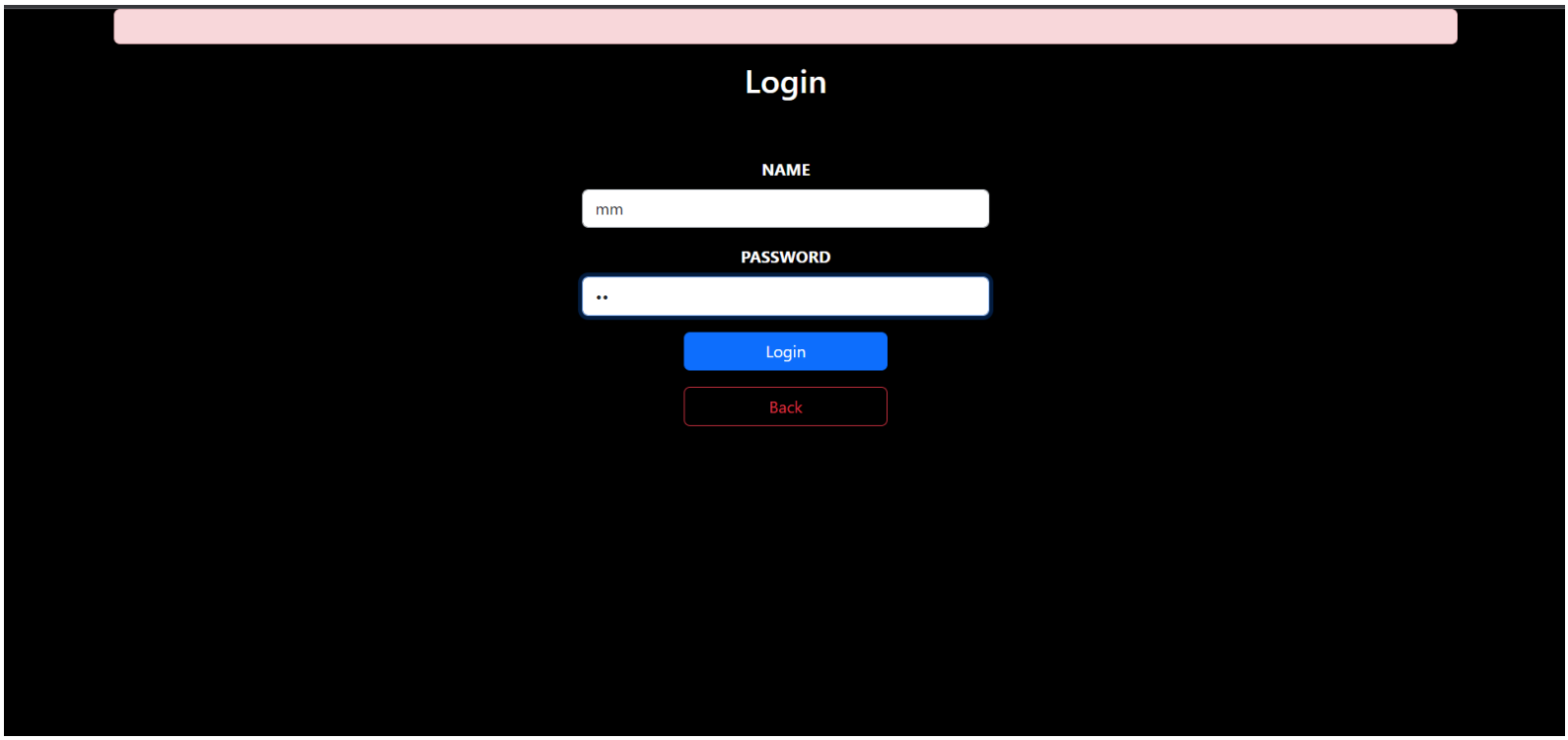
Email
mm@gmail.com
Register
Back


Login
NAME
mm
PASSWORD
••
Login
Back

MinTemp:
34

MaxTemp:
45

Rainfall:
56

Evaporation:
78

Sunshine:
89

WindGustSpeed:
78

WindSpeed9am:
89

WindSpeed3pm:
32

Humidity9am:
89.0

Humidity3pm:
34

Pressure9am:
67

Pressure3pm:
23

Cloud9am:
4

Cloud3pm:
8

Temp9am:
45

Temp3pm:
25

Predict

48.0% No chances of rain today :)

Things we can do

#1. Sow seeds
#2.Vist market for fertilisers.
#3. Never touch electric wires in farm field.
#4. Take precautions against bugs.
#5. Leap Off a Rope Swing.
#6. Remove damaged Crops.
#7. Attend an Outdoor Concert.
#8. Have a Picnic.

Back

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

ADVANTAGES :

- Formers know when large waves are expected
- Aircraft and shipping rely heavily on accurate weather forecasting
- they will know when to plant or harvest their crops
- Regions can be evacuated if hurricanes or floods are expected

DISADVANTAGES :

- Weather is extremely difficult to forecast correctly
- Expensive to monitor so many variables to so many sources
- Computers needed to perform the millions of calculations necessary are expensive
- Weather forecasters get blamed if the weather is different from the forecast

CHAPTER 11

CONCLUSION

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 is performed. These datas helped us in predicting Rainfall .We used lot of algorithms like KNN, XGboost, Random Forest Classifier, Logistic Regression, Kneighbors Classifier, etc. We train and test the data using these algorithms and predict the best one.

CHAPTER 12

FUTURE SCOPE

In future the WEATHER FORECASTING application will have additional features such as:

- Live Location tracking
- News on Live Disasters
- Weather Forecast for next one week
- Will deploy as android app
- Help in predicting which crop will be best suited according to weather conditions