Project Report

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3. Vinnakota Mani Bhanu Raneendra

4. T.Naga pramod

1. INTRODUCTION

1.1Project Overview

The project aims to develop a system for predicting the growth stages of plants based on environmental factors (such as temperature, humidity, and soil conditions) and management practices (such as irrigation, fertilization, and pest control). This prediction model is built using Power BI, leveraging its powerful data visualization capabilities and integration with advanced analytics tools like R and Python. The system will help farmers, agricultural researchers, and decision-makers optimize agricultural practices to improve crop yield and ensure more efficient resource management.

1.2 Purpose

The purpose of this project is to develop a data-driven solution that predicts plant growth stages based on environmental and management data using Power BI. This project aims to provide agricultural professionals, researchers, and decision-makers with the tools to optimize crop yield, improve resource management, and enhance overall agricultural productivity. By leveraging the power of machine learning models and advanced data visualization, the project intends to:

1. **Enhance Agricultural Efficiency**: Provide insights that help optimize the use of resources like water, fertilizers, and pesticides, leading to more sustainable farming practices.
2. **Improve Crop Yield**: By accurately predicting plant growth stages and understanding environmental factors, farmers can make informed decisions that enhance crop health and maximize yield.
3. **Facilitate Data-Driven Decision-Making**: The project empowers agricultural stakeholders with real-time data and predictive insights, allowing them to make informed decisions based on environmental conditions, management practices, and predicted growth trends.
4. **Optimize Management Practices**: Enable farmers to fine-tune their irrigation schedules, fertilization plans, and other management practices according to the predicted growth stages of plants, improving productivity and reducing waste.
5. **Bridge the Gap Between Data and Action**: By integrating machine learning into Power BI's userfriendly interface, the project makes complex data analysis and growth predictions accessible to non-technical users in the agricultural sector.

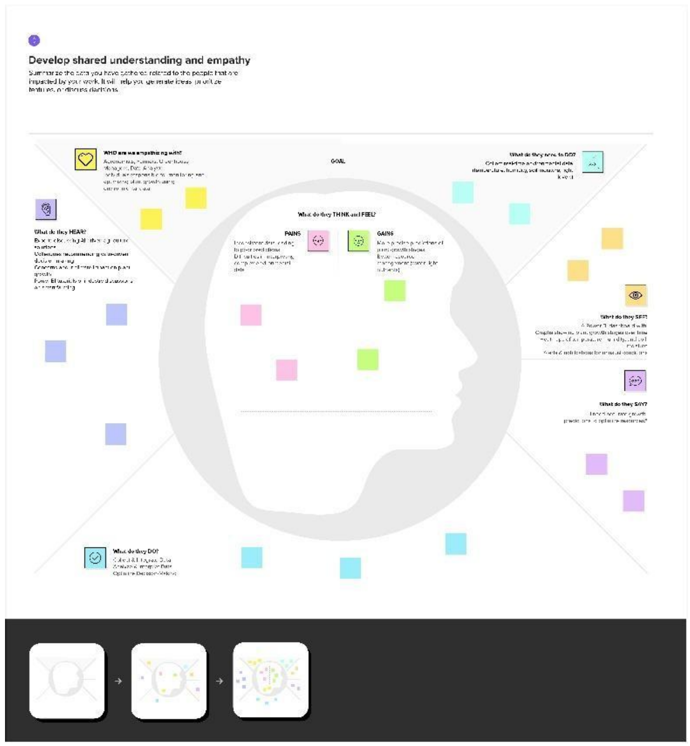
In essence, the project's purpose is to create a tool that helps bridge the gap between environmental data, management practices, and plant growth, thereby fostering smarter, data-driven agricultural practices.

2. IDEATION PHASE

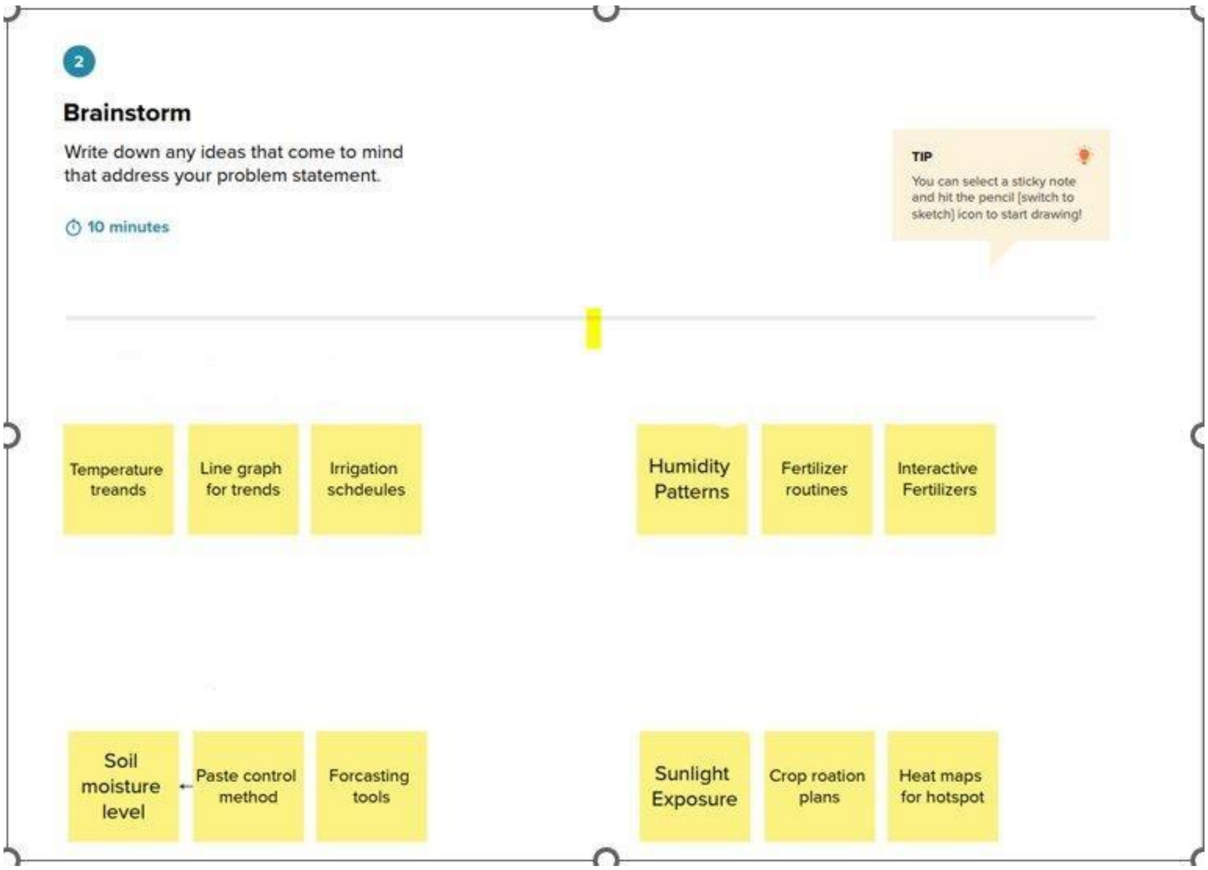
2.1 Problem Statement

In modern agriculture, predicting plant growth stages accurately is a complex challenge that requires considering various environmental factors (such as temperature, soil moisture, and humidity) and management practices (like irrigation, fertilization, and pest control). Traditional methods of assessing plant growth rely heavily on manual observation and experience, which can be time-consuming, inconsistent, and prone to errors. Additionally, these methods often fail to leverage the full potential of available environmental and management data, leading to inefficiencies in resource use and suboptimal crop yields.

2.2 Empathy Map Canvas



2.2 Brainstorming


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!
Temperature treands
Line graph for trends
Irrigation schdeules
Humidity Patterns
Fertilizer routines
Interactive Fertilizers
Soil moisture level
Paste control method
Forcasting tools
Sunlight Exposure
Crop roation plans
Heat maps for hotspot

Cluster 1: Environmental Data

- Temperature trends
- Humidity patterns
- Rainfall data
- Sunlight exposure
- Soil moisture levels

Cluster 2: Management Data

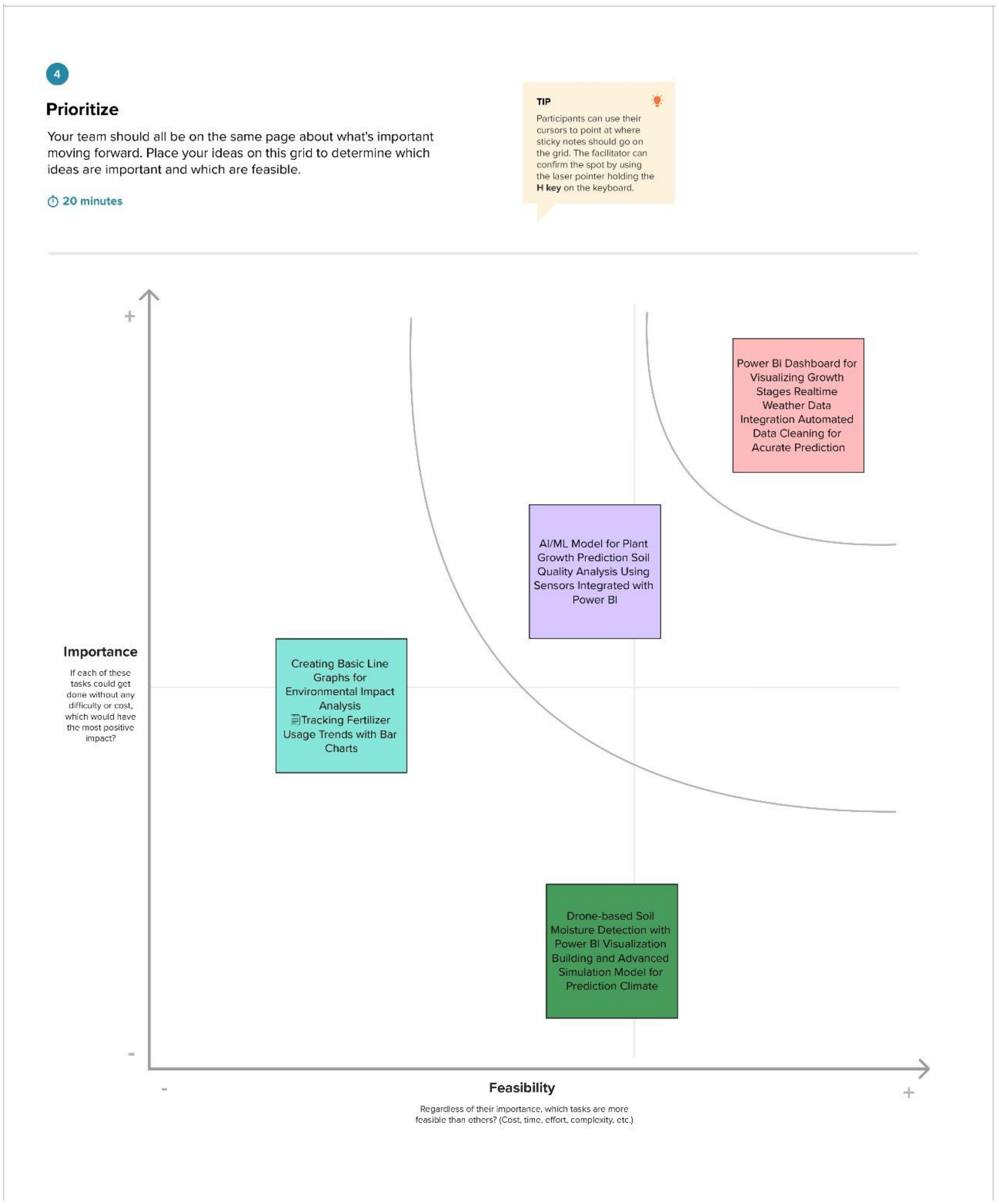
- Irrigation schedules
- Fertilizer routines
- est control strategies
- Crop rotation plans
- Harvest timing

Cluster 3: Power BI Features

- Line graphs for visualizing growth trends
- Interactive filters for comparison
- Forecasting tools for future growth stages
- KPI indicators for crop health insights
- Heat maps for environmental influence

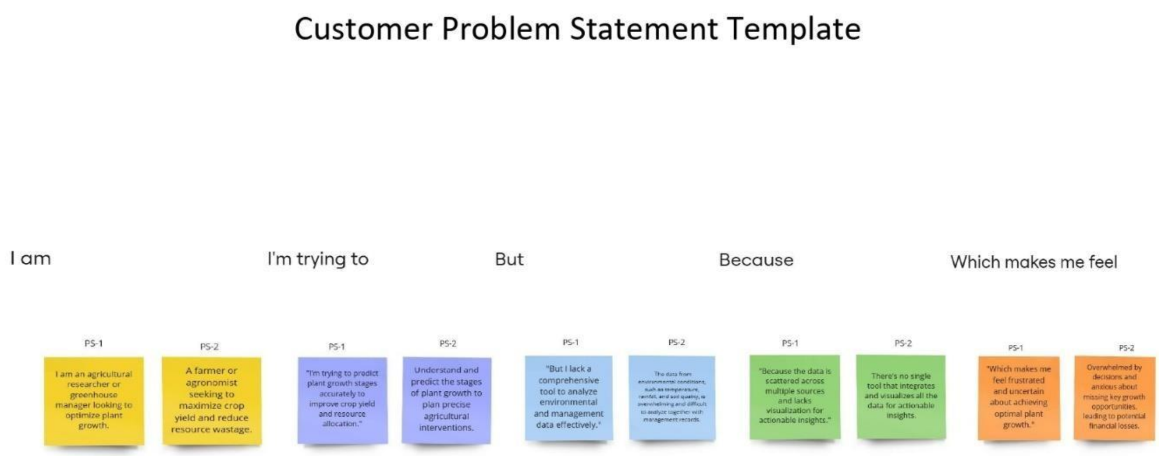
Group of Similar Clusters

- Environmental impact on crop yield
- Reducing crop wastage through prediction
- Top-performing crop regions based on data
- Effects of climate change on plant growth



3 REQUIREMENT ANALYSIS

3.1 Customer Journey map



3.2 Solution Requirement

3.2.1 Functional Requirements

Following are the functional requirements of the proposed solution.

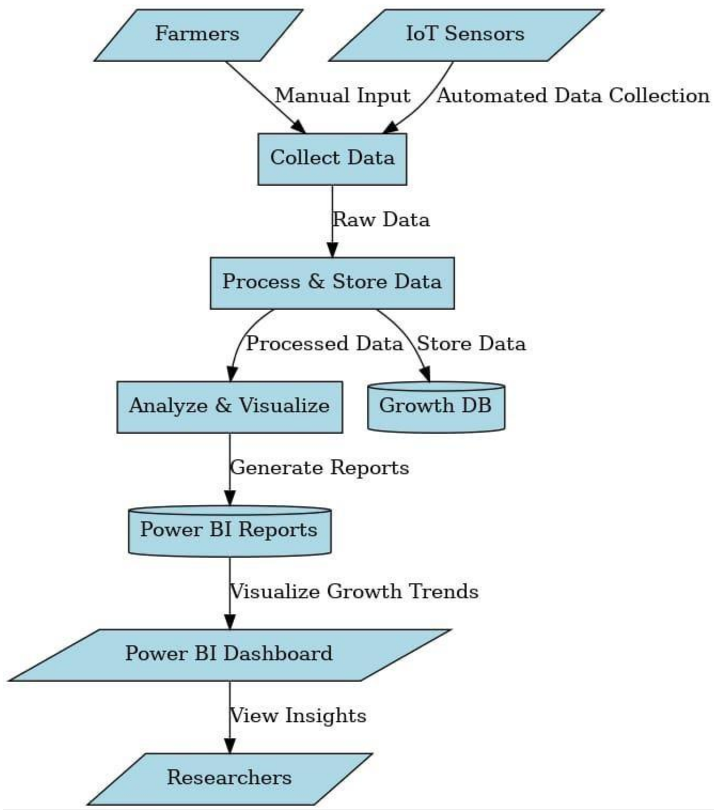
FR No.	**Functional Requirement (Epic)**	**Sub Requirement (Story / Sub-Task)**
FR-1	User Registration	- Registration through Form - Registration through Gmail - Registration through LinkedIn
FR-2	User Confirmation	- Confirmation via Email - Confirmation via OTP
FR-3	Data Integration	- Import Environmental Data - Import Management Data - Data Cleaning and Transformation
FR-4	Data Visualization	- Create Dashboards in Power BI - Display Trends and Correlations - Generate Customized Reports
FR-5	Prediction System	- Develop Machine Learning Models - Predict Plant Growth StagesRecommendations

3.2.2 Non-Functional Requirements

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	The solution must have an intuitive and user-friendly interface.
NFR-2	Security	Ensure secure data storage and user authentication.
NFR-3	Reliability	The system should be highly dependable and provide accurate predictions.

NFR-4	Performance	Maintain fast processing and data visualization even with large datasets.

3.2 Data Flow Diagram



3.4 Technology Stack

Table 1: Application Components

S.No	Component	Description	Technology
1	User Interface	User interfaces like Web UI or Mobile Apps to interact with the Power BI dashboards	HTML, CSS, JavaScript, ReactJS
2	Application Logic-1	Data ingestion logic to extract environmental and management data from various sources	Python
3	Application Logic-2	Speech-to-text logic for audio input (e.g., voice commands for querying plant growth stages)	IBM Watson STT service
4	Application Logic-3	Virtual assistant to answer user queries related to plant growth predictions	IBM Watson Assistant

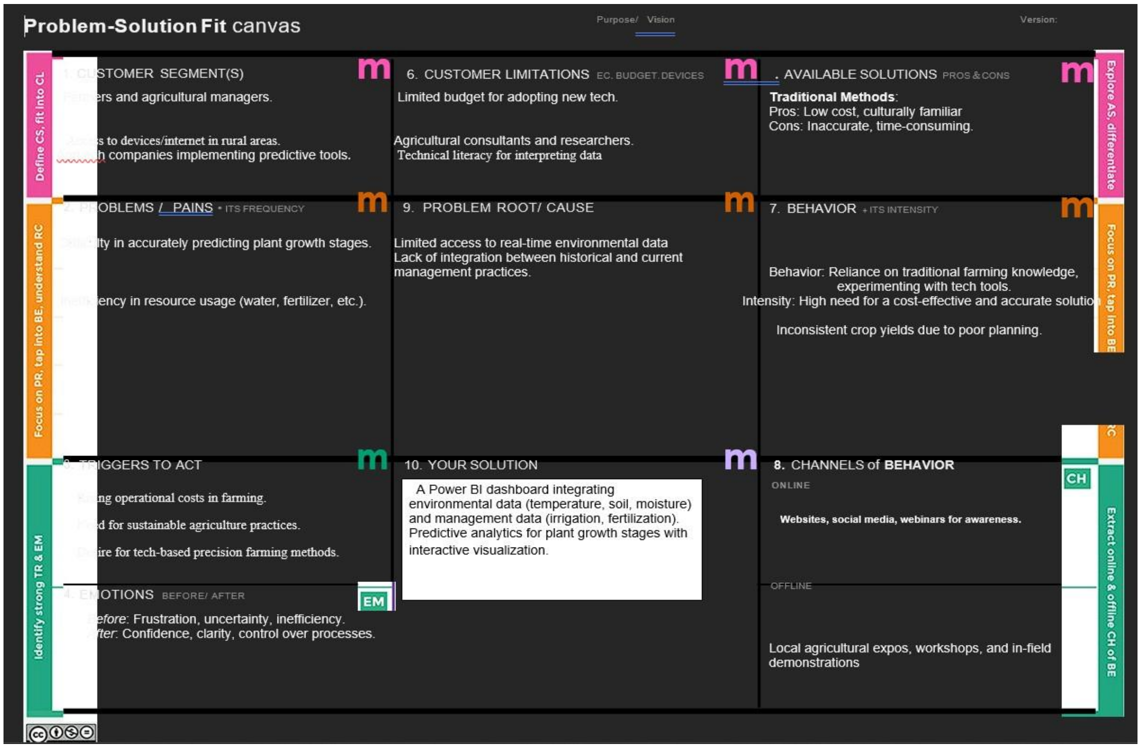
5	Database	Stores raw and transformed data, including historical plant growth and environmental factors	MySQL, NoSQL
6	Cloud Database	Centralized storage of large-scale data for scalability	IBM Cloudant
7	File Storage	Storage for large environmental datasets and model output	IBM Block Storage or Cloud-based storage
8	External API-1	Provides real-time environmental data (e.g., weather conditions)	IBM Weather API
9	External API-2	Identity verification for restricted access (if required)	Aadhar API
10	Machine Learning Model	Predicts plant growth stages based on input data	Custom ML Model (developed in Python)
11	Infrastructure (Server/Cloud)	Deployment of application on a cloud platform for scalability and availability	Kubernetes on IBM Cloud

Table 2: Application Characteristics

S.No	Characteristics	Description	Technology
1	Open-Source Frameworks	Frameworks to build the application frontend or backend	ReactJS, Flask, Django
2	Security Implementations	Implements access controls, encryptions, and secure API calls	SHA-256, IAM Controls, OWASP Guidelines
3	Scalable Architecture	Designed as microservices or a 3-tier architecture for scaling	Kubernetes, Docker
4	Availability	Load balancers and distributed servers ensure consistent access	Load Balancers, Distributed Cloud Servers
5	Performance	Performance optimization using caching and CDNs	CDN, Redis Cache

4 PROJECT DESIGN

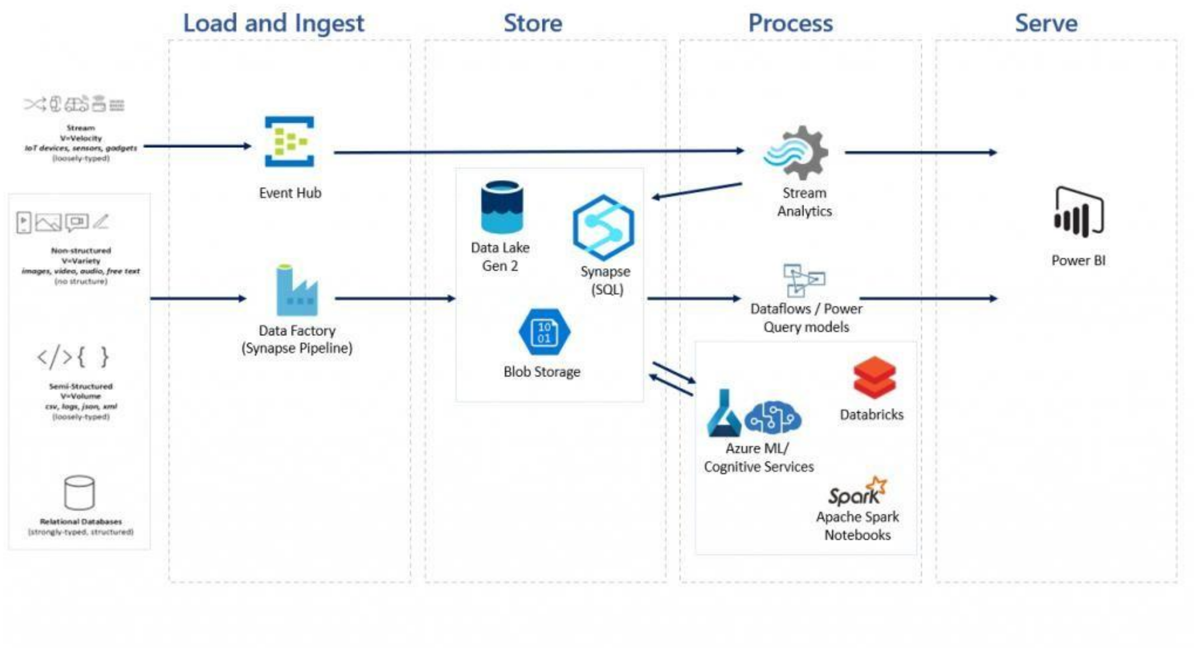
4.1 Problem Solution Fit



4.2 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement	Clearly define the problem that the solution aims to solve.
2.	Idea / Solution Description	Provide a detailed explanation of the proposed idea or solution.
3.	Novelty / Uniqueness	Highlight the innovative aspects or unique features of the solution.
4.	Social Impact / Customer Satisfaction	Explain how the solution benefits society or improves customer experience.
5.	Business Model (Revenue Model)	Describe the financial sustainability of the solution, including how revenue is generated.
6.	Scalability of the Solution	Outline the potential for scaling the solution to reach larger markets or audiences.

4.3 Solution Architecture



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning Product Backlog and Sprint Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task Description	Story Points	Priority	Team Members
Sprint1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Nimma Akash
Sprint1	Registration	USN-2	As a user, I will receive a confirmation email once I have registered for the application.	1	High	Peddi Pavan Kumar
Sprint1	Registration	USN-4	As a user, I can register for the application through Gmail.	2	Medium	Vinnakota Mani Bhanu Raneendra
Sprint1	Login	USN-5	As a user, I can log into the application by entering email & password.	1	High	T.Naga pramod

Sprint2	Registration	USN-3	As a user, I can register for the application through Facebook.	2	Low	T.Naga pramod
Sprint3	Dashboard	To be defined	Define dashboard-specific tasks as necessary.	TBD	TBD	Peddi Pavan Kumar

Project Tracker and Velocity

Sprint	Total Story Points	Duration (Days)	Start Date	End Date (Planned)	Story Points Completed (Planned)	Release Date (Actual)
Sprint1	20	6	2 feb 2025	7 feb 2025	20	29 Oct 2022
Sprint2	20	6	7 feb 2025	12 feb 2025	20	05 Nov 2022
Sprint3	20	6	12 feb 2025	17 feb 2025	TBD	TBD
Sprint4	20	6	17 feb 2025	22 feb 2025	TBD	TBD

Velocity Calculation

- Velocity = Total Story Points / Total Sprint Duration (in days).
- If the team's average velocity is 20 points per sprint (10-day sprint duration), Average Velocity (AV) = 2 story points per day.

Burndown Chart

A burndown chart illustrates:

- X-axis: Sprint duration (time in days).
- Y-axis: Remaining story points.
- It starts with 20 story points at day 0 and decreases daily based on completed points.

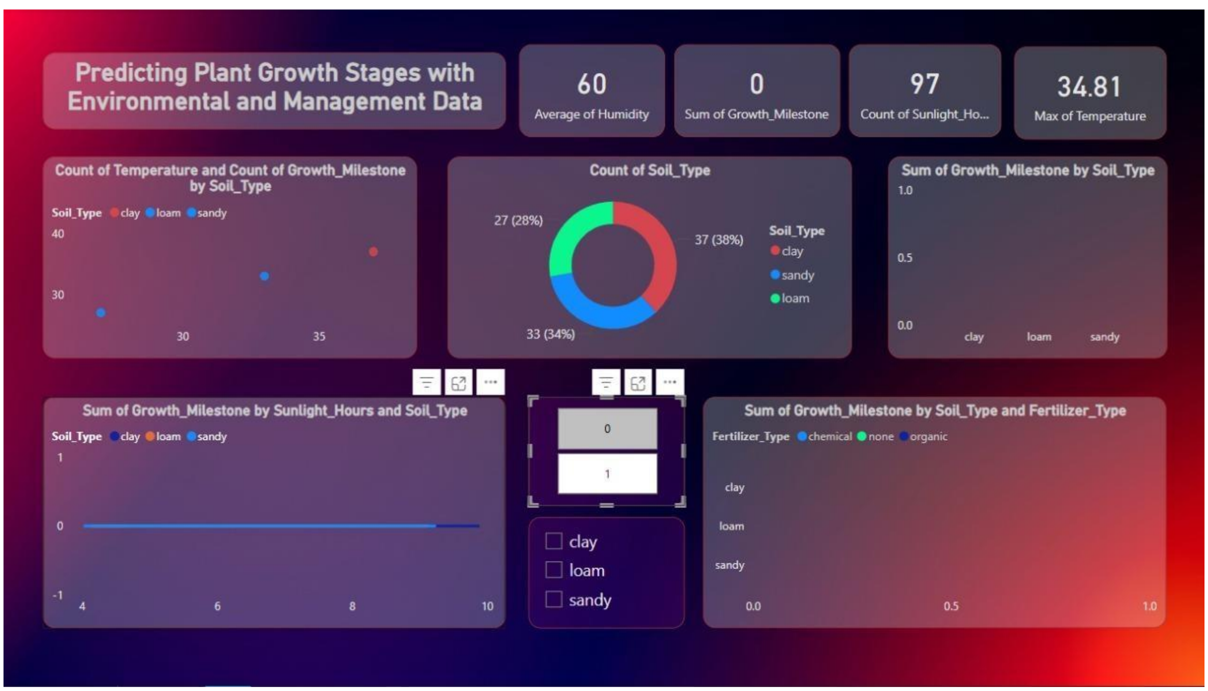
6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

7. RESULTS

7.1 Screenshots of Report and observation

7.2 Screenshot of Dashboard and observation



8. ADVANTAGES & DISADVANTAGES

Advantages

1. Provides data-driven insights for better decision-making.
2. Increases productivity and optimizes resource use.
3. Scalable and user-friendly with Power BI's visualizations.

4. Real-time environmental adaptation improves outcomes.

Disadvantages

1. High initial cost and technical expertise required.
2. Depends heavily on data quality for accuracy.
3. Accessibility challenges in remote areas.
4. Requires ongoing maintenance and retraining.

9. CONCLUSION

The project successfully demonstrates the ability to predict plant growth stages using environmental and management data. The integration of machine learning models with Power BI provides farmers with actionable insights, which can improve resource utilization, crop yield, and overall farm productivity. The solution is scalable, and with continuous data collection, predictions will improve over time.

10. FUTURE SCOPE

Integration with IoT Devices: Real-time integration with environmental sensors can enhance prediction accuracy.

- Advanced Analytics: The system can be extended to provide more advanced analytics, like pest and disease prediction.
- Multi-Crop Support: Expand the model to predict growth stages for various crops.