Final Project Report

Predicting Plant Growth Stages with Environmental and Management Data Using Power BI

1. Introduction

1.1 Project Overview

Agriculture plays a vital role in ensuring food security, and understanding plant growth behaviour is essential for improving crop productivity. This project focuses on analyzing plant growth stages using environmental and management data such as soil type, sunlight hours, water frequency, fertilizer type, temperature, and humidity. Using Power BI, the project provides data-driven insights through interactive visualizations and dashboards to help identify optimal conditions for plant growth.

1.2 Objectives

- To analyze plant growth data using Power BI
- To identify key environmental and management factors influencing growth milestones
- To create interactive dashboards for data exploration
- To support data-driven decision-making in agriculture and greenhouse management

2. Project Initialization and Planning Phase

2.1 Define Problem Statement

Inconsistent plant growth caused by varying environmental and management conditions makes it difficult for farmers and greenhouse managers to determine optimal practices. Without analytical tools, identifying the factors that influence plant growth milestones becomes challenging.

2.2 Project Proposal (Proposed Solution)

The proposed solution leverages Power BI to analyze plant growth data and visualize patterns using charts, KPIs, and decomposition trees. DAX measures and calculated columns are used to enhance analytical depth and identify growth-optimizing conditions.

2.3 Initial Project Planning

The project was planned in multiple phases:

- Data collection and understanding
- Data preprocessing and transformation
- Visualization and dashboard creation
- Performance testing and documentation

Each phase was executed systematically to ensure accuracy and clarity.

3. Data Collection and Preprocessing Phase

3.1 Data Collection Plan and Raw Data Sources Identified

The dataset was collected from Kaggle's *Plant Growth Data Classification* dataset. It is publicly available and provided in CSV format. The dataset includes environmental and management variables relevant to plant growth analysis.

3.2 Data Quality Report

The dataset was examined for missing values, duplicates, and inconsistencies. No missing or duplicate records were found. Numerical values were validated for realistic ranges, and categorical fields were checked for consistency.

3.3 Data Exploration and Preprocessing

Data preprocessing was performed using Power Query in Power BI. Data types were assigned correctly, calculated columns were created for temperature range, humidity level, and growth categories, and DAX measures were used to calculate averages and growth milestone metrics.

4. Data Visualization

4.1 Framing Business Questions

Key business questions were framed to analyze:

- Growth milestone variation by soil type
- Impact of water frequency on growth
- Influence of temperature and humidity
- Effectiveness of fertilizer types
- Sunlight exposure impact on plant growth

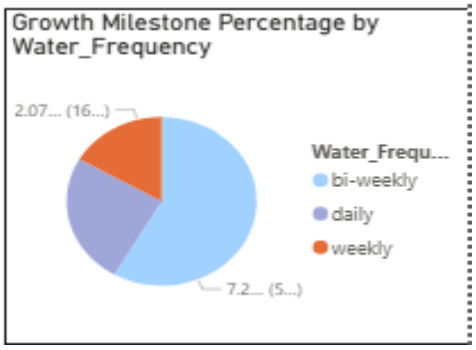
4.2 Developing Visualizations

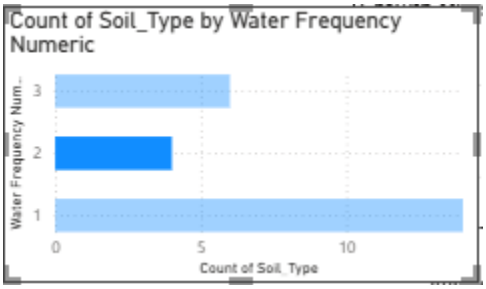
Various visualizations were created including:

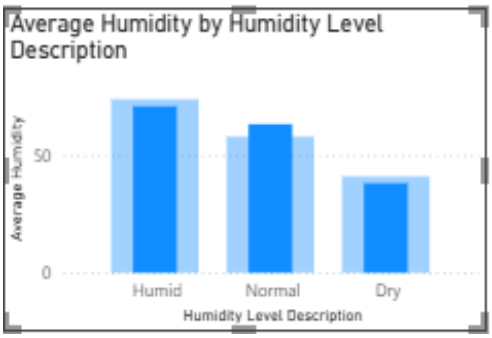
- Bar charts
- Column charts
- Pie charts

- KPI cards
- Scatter plots

These visuals helped identify trends, comparisons, and contributing factors.







5. Dashboard

5.1 Dashboard Design File

The Power BI dashboard was designed with KPI cards at the top showing:

- Average Temperature

- Average Humidity
- Average Sunlight Hours

Interactive filters and slicers allow users to dynamically explore data. The layout is clean, responsive, and user-friendly.

6. Report

6.1 Story Design File

The Power BI report presents a logical story starting from high-level KPIs to detailed analysis. Insights derived from soil type, watering frequency, temperature, humidity, fertilizer, and sunlight are clearly communicated using visuals.

7. Performance Testing

7.1 Utilization of Data Filters

Multiple slicers were implemented for soil type, water frequency, fertilizer type, temperature range, and humidity level to enable dynamic filtering.

7.2 Number of Calculation Fields

The project includes multiple calculated fields such as:

- Average Temperature
- Average Humidity
- Average Sunlight Hours
- Growth Milestone Count
- Growth Milestone Percentage

7.3 Number of Visualizations

The dashboard and report together contain more than **10 visualizations**, including KPI cards and analytical charts.

8. Conclusion / Observation

The analysis reveals that loam soil, daily watering, moderate sunlight, warm temperatures, and humid conditions lead to higher plant growth milestones. Chemical fertilizers show higher effectiveness compared to organic fertilizers. The project successfully demonstrates how Power BI can be used for agricultural data analysis and decision-making.

9. Future Scope

- Integration of real-time IoT sensor data
- Predictive modeling using machine learning
- Expansion of dataset with seasonal and crop-specific data
- Deployment of dashboards for real-world farm monitoring

10. Appendix

10.1 Source Code

DAX expressions and Power BI transformations are implemented within the https://github.com/NancyVerma21/PowerBI-Plant-Growth-Analysis/raw/refs/heads/main/Plant_Growth_Analysis_PowerBI_Nancy.pbix file.

10.2 GitHub & Project Demo Link

- GitHub Repository: https://github.com/NancyVerma21/PowerBI-Plant-Growth-Analysis
- Project Demo Video: https://drive.google.com/drive/folders/1zHbprKzZfcm_rBhwla4sWxGe9FxJWJXV?usp=sharing