AI Project Report

1. Problem Definition

Project Title:

Predicting Crop Yield for Small-Scale Farmers Using Satellite and Weather Data

Problem Statement:

Agricultural productivity is vital for food security, particularly for small-scale farmers who often rely on traditional farming methods. Predicting crop yield in advance can help farmers and policymakers make informed decisions about resource allocation, farming strategies, and market planning. This AI project aims to build a predictive model that estimates maize crop yield using satellite imagery and weather data

Objectives:

To accurately forecast the yield of maize crops before harvest using AI models.

To provide actionable insights that small-scale farmers can use to optimize crop management.

To support agricultural agencies in planning the distribution of resources such as seeds, fertilizers, and irrigation facilities.

Stakeholders:

Small-scale farmers: The end users who will benefit from improved yield predictions and resource planning.

Agricultural policymakers and extension officers: Professionals who can use predictions to guide policy decisions and support farmers more effectively.

Key Performance Indicator (KPI):

Mean Absolute Error (MAE) of the predicted crop yield compared to the actual yield (measured in tons per hectare). A lower MAE indicates better predictive accuracy.

2. Data Collection & Preprocessing

Data Sources:

Remote Sensing Data: Satellite imagery providing vegetation indices such as NDVI (Normalized Difference Vegetation Index), which reflects crop health and growth.

Historical Weather Data: Data on rainfall, temperature, humidity, and sunshine hours, collected from national meteorological services or online APIs.

Potential Bias:

Geographic Bias: Some rural or remote areas may have limited satellite coverage or unreliable weather station data. This can lead to underrepresentation in the dataset, affecting the accuracy of predictions for those regions.

Preprocessing Steps:

Handling Missing Data: Fill missing values using interpolation or imputation techniques to ensure completeness, especially for weather variables like rainfall and temperature.

Normalization: Apply feature scaling (e.g., min-max normalization) to bring all input features to a similar scale, which helps improve model performance.

Feature Engineering: Create new features such as cumulative rainfall, growing degree days (GDD), and drought indices to enhance model inputs and capture key agricultural patterns.