ABSTRACT

Agriculture remains the backbone of the Indian economy, contributing significantly to GDP and employing a large proportion of the population. Despite its importance, the agricultural sector continues to face persistent challenges such as fluctuating climatic conditions, depletion of natural resources, inefficient use of fertilizers and irrigation, low crop productivity, and lack of timely technical assistance. Farmers, particularly in rural regions like Dhule district (Maharashtra), often rely on traditional knowledge and manual observation, which leads to unscientific decision-making and limited productivity.

To address these challenges, this project proposes a **Machine Learning-Based Support System for Predictive Agriculture and Resource Optimization**. The system leverages modern data-driven technologies to predict crop yield, recommend suitable crops, optimize water and fertilizer usage, and identify early signs of disease or crop stress. Machine learning algorithms such as Linear Regression, Random Forest, and Support Vector Machines (SVM) are used to analyze environmental, climatic, and soil-related variables.

The platform is developed using Python (Pandas, NumPy, Scikit-Learn), with model outputs visualized through an interactive dashboard built using Flask and HTML/CSS. By transforming raw agricultural data into actionable insights, the proposed system enables farmers, agronomists, and policy-makers to make informed, data-backed decisions. The solution promotes precision farming, minimizes resource wastage, and improves agricultural sustainability, thereby contributing toward smart agriculture and food security initiatives.