CROP RECOMMENDATION SYSTEM

Report of Major Project One

Submitted in partial fulfilment of the requirement for the award of Degree

Bachelor of Technology

(Computer Science and Engineering & AIML)

Submitted to

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL (M.P.)

Submitted

By

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Under the Guidance of

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AIML)

TECHNOCRATS INSTITUTE OF TECHNOLOGY & SCIENCE, BHOPAL (M.P.)

SESSION: 2025-2026

TECHNOCRATS INSTITUTE OF TECHNOLOGY & SCIENCE BHOPAL (M.P.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AIML)

CERTIFICATE

This is to certify that the work embodies in this Synopsis entitled "**CROP RECOMMENDATION SYSTEM**" being submitted by **Nikhil Wankhede (0192Al221069), Tanishk Malviya (0192Al221117), Satyam Lodhi (0192AL221101), Aman Karsharpe (0192AL221012)**, in partialfulfillment of the requirement for the award of Degree of **Bachelor's of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning)** to **Rajiv Gandhi Proudyogiki Vishwavidyalaya,** Bhopal during the academic year 2025-26 is a record of Bonafide piece of work, carried out by them under my supervision and guidance in the **Department of Computer Science and Engineering. Technocrats Institute of Technology & Science, Bhopal.**

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TECHNOCRATS INSTITUTE OF TECHNOLOGY & SCIENCE BHOPAL DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING & AIML

CERTIFICATE OF APPROVAL

The Project entitled "**CROP RECOMMENDATION SYSTEM**" being submitted by **Nikhil Wankhede (0192Al221069), Tanishk Malviya (0192Al221117), Satyam Lodhi (0192AL221101), Aman Karsharpe (0192AL221012)**, has been examined by us and is hereby approved for the award of degree Bachelor of Technology (B.Tech.) in Computer Science & Engineering discipline", for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn there in, but approve the Major Project only for the purpose for which it has been submitted.

Internal Examiner **External Examiner**

Date: **Date:**

TECHNOCRATS INSTITUTE OF TECHNOLOGY & SCIENCE BHOPAL (M.P.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AIML)

DECLARATION

This is **Nikhil Wankhede (0192Al221069), Tanishk Malviya (0192Al221117), Satyam Lodhi (0192AL221101), Aman Karsharpe (0192AL221012)** a student of Bachelor of Technology (B.Tech) in Computer Science & Engineering & AIML discipline, session: 2025-2026, Technocrats Institute of Technology & Science, Bhopal (M.P.) hereby declare that the work presented in this project entitled "**CROP RECOMMENDATION SYSTEM**" is the outcome of my own work, is Bonafide and correct to the best of my knowledge and this work has been carried out taking care of Engineering Ethics.The work presented does not infringe any patented work and has not been submitted to any other university or anywhere else for the award of any degree or any professional diploma.

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1. Abbreviations

- **ML** – Machine Learning
- **EDA** – Exploratory Data Analysis
- **SVM** – Support Vector Machine
- **LR** – Logistic Regression
- **KNN** – K-Nearest Neighbors
- **DT** – Decision Tree
- **RF** – Random Forest
- **UI** – User Interface
- **API** – Application Programming Interface

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2. Chapters

Chapter 1: Introduction

Agriculture is the backbone of the Indian economy, and crop selection plays a crucial role in determining agricultural productivity. Farmers often face difficulties in choosing the most suitable crop due to variations in soil nutrients, pH level, rainfall, and climatic conditions. Traditional crop selection methods are mostly based on experience and local practices, which may not always result in optimal yield.

The **Crop Recommendation System** is developed to address this problem by using machine learning techniques. The system analyzes soil properties such as Nitrogen, Phosphorus, Potassium, pH value, and rainfall data to recommend the most suitable crop for cultivation. The project aims to assist farmers and agricultural planners in making data-driven decisions to improve crop yield and reduce losses.

Chapter 2: Motivation

Existing System

In the existing approach, farmers rely on manual soil testing reports, expert advice, or past experience to decide which crop to grow. These methods are time-consuming and may not consider multiple influencing factors together.

Pros of Existing System

• Simple and traditional approach
• No technical knowledge required
• Based on local farming experience

Cons of Existing System

• Lack of accuracy and data analysis
• Cannot handle multiple soil parameters efficiently
• Time-consuming decision-making
• No automated recommendation system
• Difficult to predict crop suitability scientifically

Motivation for Proposed System

The motivation behind this project is to design an intelligent crop recommendation system using machine learning that can analyze multiple soil and environmental factors simultaneously. The proposed system reduces dependency on manual judgment, provides accurate recommendations, and supports sustainable agriculture through technology.

Chapter 3: Facilities Required for Project Work

Software Requirements

• Python Programming Language
• Jupyter Notebook
• Scikit-learn Library
• Pandas and NumPy
• Matplotlib and Seaborn
• Flask Web Framework
• HTML & CSS
• VS Code / Anaconda

Hardware Requirements

• PC/Laptop with minimum 16 GB RAM
• Intel i5 or above processor
• Stable Internet connection

Chapter 4: Methodology / Technical Details

The development of the Crop Recommendation System follows a systematic machine learning workflow:

1. **Dataset Collection**
   A publicly available crop recommendation dataset containing soil nutrients, pH value, rainfall, temperature, humidity, and crop labels was used.
2. **Data Preprocessing**
   Missing values, duplicates, and inconsistent entries were handled. Categorical data was encoded, and numerical features were scaled where required.
3. **Exploratory Data Analysis (EDA)**
   Various visualizations such as histograms, boxplots, and correlation heatmaps were used to understand data distribution, detect outliers, and analyze feature relationships.
4. **Model Development**
   Multiple classification algorithms were implemented and evaluated:
   • Logistic Regression
   • K-Nearest Neighbors (KNN)
   • Support Vector Machine (SVM)
   • Decision Tree
   • Random Forest
5. **Model Evaluation**
   Models were evaluated using accuracy score, confusion matrix, and classification report. The best-performing model was selected.
6. **Model Deployment**
   The trained model was saved using a **.pkl** file and integrated into a Flask-based web application for user interaction.

Chapter 5: Output / Result

The final system successfully predicts the most suitable crop based on user-provided soil and environmental inputs. Among the tested models, Support Vector Machine (SVM) achieved the highest accuracy and consistent performance. The web interface allows users to input soil parameters and receive instant crop recommendations.

The system demonstrates reliable prediction capability and provides meaningful insights for agricultural decision-making.

Chapter 6: Conclusion

The **Crop Recommendation System** effectively applies machine learning techniques to solve a real-world agricultural problem. By analyzing soil and environmental parameters, the system provides accurate crop recommendations that can help improve productivity and reduce crop failure risks. The project highlights the importance of data-driven solutions in modern agriculture and demonstrates practical implementation of machine learning concepts.

Chapter 7: Future Scope

- Integration of real-time weather data APIs
- Fertilizer recommendation module
- Yield prediction for recommended crops
- Mobile application development
- Multi-language user interface for farmers

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3. References

1. Kaggle – Crop Recommendation Dataset
2. Scikit-learn Official Documentation
3. Python Machine Learning – Sebastian Raschka
4. Introduction to Machine Learning – Ethem Alpayd

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4. Appendix: DATASET DESCRIPTION

The dataset used in this project includes soil nutrients (N, P, K), pH value, rainfall, temperature, humidity, and crop labels. The data was cleaned and preprocessed before training machine learning models.

A.1 Dataset Features

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Soil pH
- Rainfall
- Temperature
- Humidity
- Crop Label (Target Variable)

A.2 Description of Input and Target Variables

- **Input Variables**: Soil nutrients, pH value, rainfall, temperature, and humidity
- **Target Variable**: Crop type to be recommended
