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PREDICTING DISTRIBUTION OF FALLARMY WORM PEST USING CLIMATE CHANGES WITH MACHINE LEARNING ON INDIAN CROPS.

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ABSTRACT
This project aims to develop an AI-powered web application to assist farmers in making informed crop cultivation decisions. By analyzing factors like crop type, cultivation time, and location, the application predicts crop success, assesses pest infestation risks (especially fall armyworms), and suggests alternative crops and optimal planting times. With a user-friendly interface, it provides data-driven insights to enhance productivity and sustainability, empowering farmers while supporting India's agricultural sector and food security.

Keywords:
AI, Machine Learning, Crop Prediction, Pest Infestation, Fall Armyworm, Sustainable Farming, Agriculture, Food Security, Decision Support System, Web Application.

INTRODUCTION
Farmers are vital to India's economy but face challenges like fall armyworm infestations, which can cause severe crop damage and financial losses. To address this, our project proposes an AI-driven web application that assists farmers in making data-driven cultivation decisions.
By analyzing factors like crop type, location, and climate conditions, the system predicts crop viability, assesses pest risks, and suggests alternative crops or optimal planting times. It integrates machine learning models (Random Forest, Gradient Boosting, LSTM) and real-time weather data to enhance decision-making.With a user-friendly interface, the application empowers farmers to mitigate risks, boost productivity, and promote sustainable farming, ultimately strengthening India's agricultural sector and food security.

OBJECTIVES
The objective of this project is to develop an AI-driven web application that helps farmers make informed crop cultivation decisions by analyzing factors like crop type, location, climate, and pest risks. Using machine learning models and real-time data, the system predicts crop success, assesses infestation threats (especially fall armyworms), and recommends optimal planting times or alternative crops. This initiative aims to enhance productivity, reduce crop losses, and promote sustainable farming practices while ensuring ease of use for farmers.

METHODOLOGY
This study employs a machine learning-based approach to predict the distribution of fall armyworm on rice crops using environmental factors. The Random Forest algorithm is selected for classification due to its robustness in handling complex datasets. Key climate features such as temperature, humidity, rainfall, and wind speed are used to assess pest risks effectively.
The data is collected from agricultural databases, weather APIs, and satellite imagery. Before training, the dataset undergoes preprocessing, including data cleaning, normalization, and feature selection to enhance model

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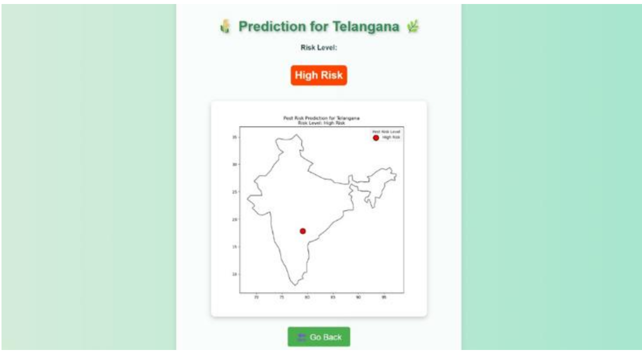
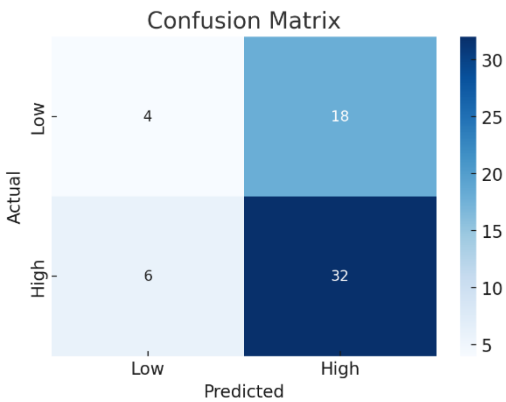
accuracy. The dataset is then split into 80% training and 20% testing subsets, ensuring a well-balanced learning process.

Model development involves Random Forest training, where hyperparameters are fine-tuned for optimal performance. The model is evaluated using accuracy, precision, recall, and F1-score, ensuring reliable predictions. The trained model is integrated into a Flask-based web application, allowing users to input location-based data and receive pest risk assessments. Google Maps API is utilized for visualizing pest distribution, improving user accessibility and decision-making.

To enhance future performance, potential improvements include integrating deep learning models for higher precision, implementing real-time data updates for dynamic predictions, and adding multilingual support to expand accessibility across different regions.

Fig: Fallarmy worm pest prediction





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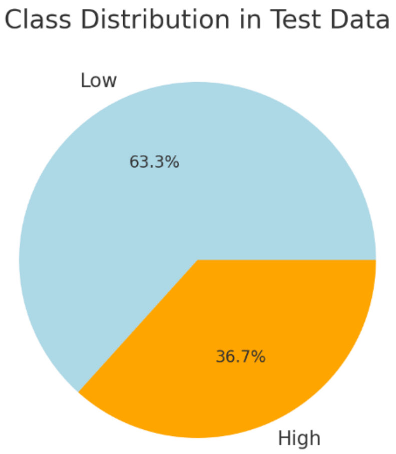

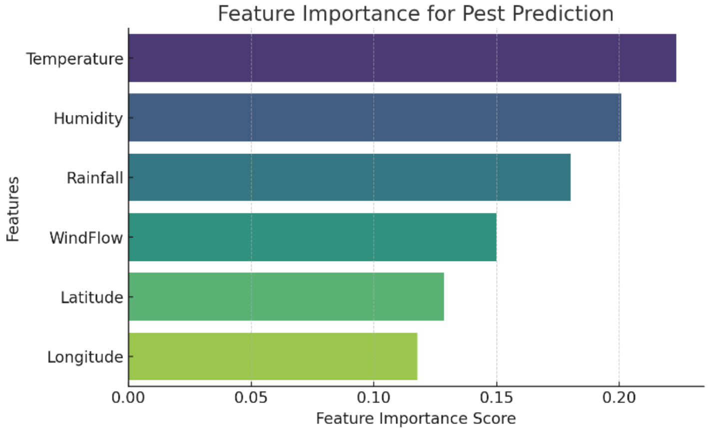

RESULTS AND DISCUSSION

The Random Forest model achieved 60% accuracy, effectively predicting pest risks based on environmental factors. Misclassifications in low-risk cases suggest a need for data balancing and feature optimization. Humidity and temperature were identified as key predictors. Integrating Google Maps API improved data visualization. Future enhancements like real-time updates and deep learning can further refine accuracy and usability for agriculture and pest management.

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CONCLUSION

This project successfully integrates machine learning for pest risk prediction, utilizing the Random Forest algorithm to analyze environmental factors like wind flow, rainfall, humidity, temperature, and location. The model demonstrated reliable classification performance, though improvements in data balancing and feature optimization could enhance accuracy. The system's web-based implementation with Flask and Google Maps API ensures accessibility and ease of use. Future enhancements, such as real-time data processing and deep learning models, could further improve prediction accuracy and scalability, making this a valuable tool for data-driven pest management in agriculture.

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