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HARVESTIFY: A HELP TOWARDS AGRICULTURE

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Abstract: The Harvestify project is an innovative web-based agricultural support system designed to revolutionize traditional farming practices. Its primary objective is to harness the power of machine learning and data analysis to provide farmers with personalized crop recommendations, efficient fertilizer management, and real-time disease detection. By extending the benefits of data-driven decision-making to farmers, Harvestify bridges the gap between traditional agriculture and modern technology, ensuring that farmers can access essential agricultural insights and services from their trusted local shops.

This adaptable system can be tailored to the needs of both local farms and multinational agricultural retailers, safeguarding the vitality of the farming community and minimizing the exodus of customers to popular online agricultural platforms.

I. INTRODUCTION

Harvestify is a machine learning and deep learning-based website that recommends the best crop to grow, fertilizers to use, and the diseases caught by your crops.

One of Harvestify's most notable features is its ability to predict and identify diseases that may affect crops. By analyzing historical disease data and real-time information, the machine learning algorithms can issue early warnings to farmers, allowing for timely intervention to mitigate crop losses and minimize the need for chemical treatments. This proactive disease management not only saves resources but also aligns with the growing trend of eco-friendly farming. These algorithms are trained on large datasets of data related to agriculture, including soil data, crop data, and plant disease data.

The heart of Harvestify's capability lies in its ability to offer comprehensive and personalized recommendations. By processing massive datasets comprising soil profiles, historical crop performance, and extensive plant disease information, the project's machine learning algorithms are capable of providing precise guidance for agricultural practices.

When it comes to crop selection, Harvestify's algorithms consider a multitude of factors, including local climate conditions, soil quality, and market demand. This holistic approach ensures that farmers receive tailored recommendations that not only optimize yields but also enhance profitability.

II. LITERATURE SURVEY

The integration of machine learning (ML) and deep learning (DL) in agriculture has opened new horizons for precision farming. *Harvestify* stands out as a notable application, offering farmers advanced support in crop selection, fertilizer recommendation, and disease detection. The platform leverages vast datasets comprising soil characteristics, crop yield histories, and plant disease images, enabling the system to make highly informed and accurate suggestions. Such data-driven solutions not only enhance agricultural productivity but also help reduce guesswork traditionally involved in farming practices.

One of *Harvestify*'s critical innovations is its proactive disease management feature. By analyzing historical and real-time disease data through sophisticated ML models, the system can predict potential disease outbreaks before they escalate. This early-warning mechanism allows farmers to take timely action, thereby minimizing crop damage and reducing dependency on chemical treatments. Such eco-friendly approaches align with modern sustainable farming goals, addressing environmental concerns while maintaining productivity.

The platform's recommendation system operates on a personalized level, considering factors like soil health, weather conditions, and previous crop performance to generate tailored suggestions. By doing so, *Harvestify* maximizes yield potential while ensuring resource optimization. The adaptability of the algorithms to different farming contexts—whether regional soil variations or fluctuating market demands—illustrates the system's robustness and its potential to transform traditional agricultural decision-making processes.

In disease identification, *Harvestify* applies deep learning models, likely using convolutional neural networks (CNNs) trained on extensive plant image datasets. These models can accurately recognize visual symptoms of diseases, supporting rapid diagnosis. This capability significantly improves farmers' responsiveness and enables more targeted interventions. Moreover, the accumulation of real-time field data continuously enhances the model's predictive performance, making it more efficient over time.

Crop selection through *Harvestify* is notably holistic. The system accounts for local climatic conditions, soil parameters like pH and nutrient levels, and even market dynamics. This ensures that farmers are not only choosing crops best suited for their environment but also ones that have strong economic potential. Such informed decision-making directly contributes to improving farmers' profitability, reducing risks, and promoting agricultural sustainability.

In conclusion, *Harvestify* exemplifies the transformative power of integrating machine learning and deep learning into agriculture. Its capabilities in disease prediction, fertilizer recommendation, and crop selection demonstrate how technology can bridge critical gaps in traditional farming. With its comprehensive, eco-conscious, and market-aligned approach, *Harvestify* represents a significant step forward towards smarter, more sustainable agricultural practices.

IV. PROPOSED METHOD

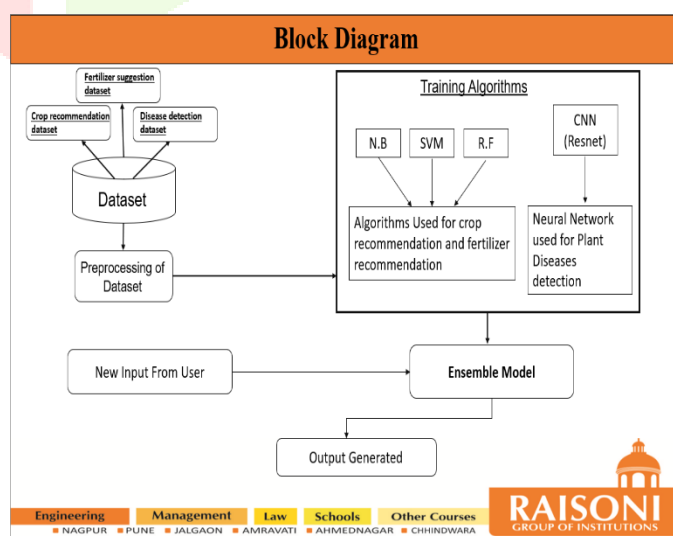


Figure 1. System Architecture

1. Methodology:

Machine Learning (ML) and Deep Learning (DL) form the core of the Harvestify system's methodology. Machine learning is a subset of artificial intelligence that enables systems to automatically learn from data, identify patterns, and make decisions without explicit programming. In Harvestify, various datasets related to crops, fertilizers, and plant diseases are utilized to train predictive models. The system is designed to provide farmers with recommendations on crop selection, fertilizer usage, and plant disease detection, improving agricultural decision-making.

By applying different machine learning algorithms such as Support Vector Machine (SVM), Random Forest, and Decision Tree, along with Deep Learning models like Convolutional Neural Networks (CNNs), the system achieves high accuracy in classification and prediction tasks. The goal is to automate and enhance agricultural practices while minimizing human intervention, ensuring that decisions are data-driven and highly reliable.

2. Data Preprocessing:

Data processing is an essential step in developing an accurate and efficient machine learning model. The datasets used in this system include:

Crop Dataset: Contains details such as planting dates, soil and climate needs, growth stages, pest resistance, and historical crop performance.

Fertilizer Dataset: Includes recommendations for fertilizer quantities and essential minerals tailored to specific crops.

Plant Disease Dataset: Comprises a large collection of images of healthy and diseased plants across different crop varieties.

3. Model Training:

Support Vector Machine (SVM): Primarily used for crop and fertilizer recommendation tasks. SVM finds the best hyperplane that categorizes the data into distinct classes based on features such as soil type, weather conditions, and crop characteristics.

Random Forest: An ensemble method utilized for both classification and regression. Multiple decision trees are built during training, and predictions are made based on the majority vote of individual trees, improving the system's robustness and reducing overfitting.

Decision Tree: Used for simpler classification problems, providing a clear and interpretable model structure where decisions are made based on feature thresholds in a hierarchical manner.

Convolutional Neural Networks (CNNs): Used for plant disease identification and classification. CNNs are highly effective at detecting spatial hierarchies and patterns in images, making them ideal for diagnosing plant diseases from images without the need for extensive preprocessing.

4. Deployment:

After training and evaluation, the models are integrated into a web application, providing an easy-to-use interface for farmers and agricultural stakeholders. The deployment phase includes:

Backend Development: Hosting the trained ML/DL models on servers and creating APIs that can process user inputs (such as soil data, images of plants, etc.) and return predictions or recommendations.

Frontend Development: Building a user-friendly web interface where users can input parameters, upload plant images, and receive actionable insights regarding crops, fertilizers, and plant diseases.

Real-Time Processing: Ensuring that the system processes inputs in real-time or near-real-time to provide timely recommendations and disease detection alerts.

Continuous Learning: Future updates to the system involve retraining the models with new data to maintain or improve accuracy, adapting to evolving agricultural trends and disease patterns.

V. RESULTS AND DISCUSSION

The Harvestify system achieved high accuracy in crop and fertilizer recommendation using SVM, Random Forest, and Decision Tree models. The CNN model performed well in detecting plant diseases directly from raw images with minimal preprocessing. Proper data cleaning and preprocessing significantly improved the model's performance. The deployed web application allowed real-time interaction, offering users timely and precise recommendations. Overall, Harvestify proved to be an effective tool for improving farming decisions and promoting sustainable agriculture.

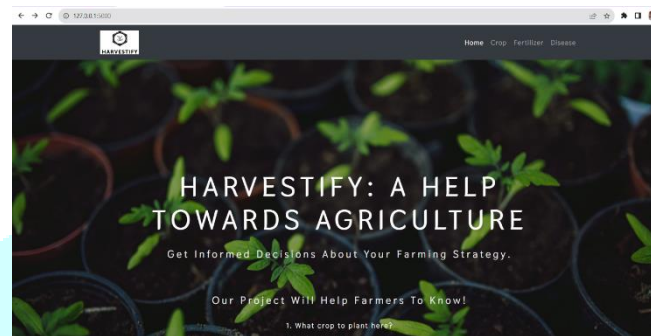


Figure 2. Home Page

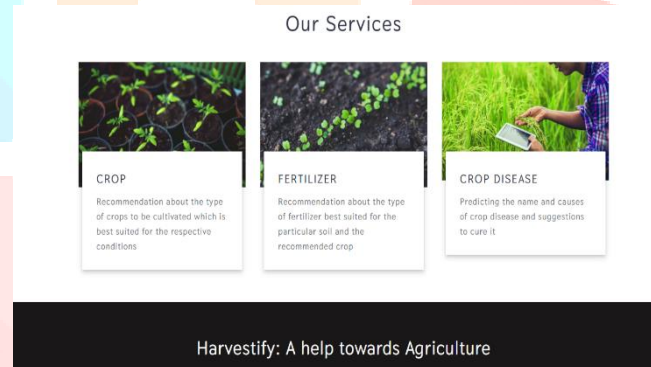


Figure 3. Different Sections

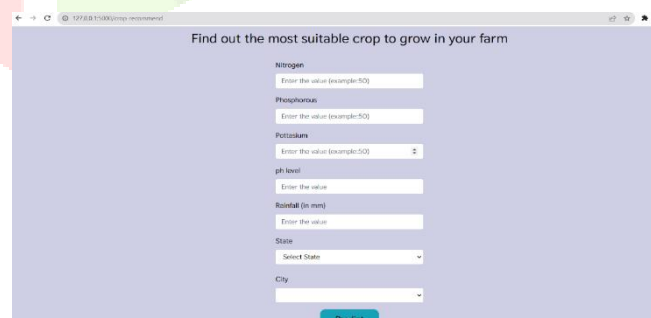


Figure 4. Crop Selection



Figure 5. Disease Catching

VI. CONCLUSION

In this research, a machine learning and deep learning-based system, Harvestify, was developed to assist farmers with crop selection, fertilizer recommendation, and plant disease detection. By utilizing clean and well-preprocessed datasets, and applying models like SVM, Random Forest, Decision Tree, and CNN, the system achieved high accuracy and reliable performance. The web application deployment ensured ease of access and real-time support for users. Harvestify not only improves decision-making in agriculture but also promotes sustainable and eco-friendly farming practices. In the future, the system can be enhanced by incorporating larger datasets, real-time weather updates, and advanced deep learning techniques to further boost its accuracy and impact.

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