AgroNexa: A Farm Equipment Renting Portal with ML based Recommendation System

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***Abstract*— Agriculture, the backbone of many economies, faces the dual challenges of increasing food production to meet growing global demand while ensuring the sustainability of farming practices. In the context of India, where agriculture is a way of life for millions, the need for innovation in the sector is more critical than ever. The Farm Equipment Rental Portal, known as "AgroNexa," emerges as a transformative solution to address these challenges. AgroNexa is an online platform that bridges the gap between traditional farming practices and cutting-edge technology. It offers an extensive range of farm equipment available for rent, providing farmers with cost-effective and convenient access to machinery that can boost productivity. This portal leverages the power of digital connectivity to connect equipment owners with farmers seeking specific tools for their agricultural tasks. One of AgroNexa' s distinguishing features is its incorporation of a crop recommendation system.**

***Keywords* – Farmer, Rental, Machine Learning, Website, Portal.**

I. INTRODUCTION

India's agriculture sector holds a pivotal position in its economy, society, and global landscape. India's agriculture sector contributes significantly to the nation's economy. It employs a substantial portion of the population and plays a crucial role in ensuring food security. With approximately 58% of the rural workforce engaged in farming activities, agriculture contributes around 15% to India's Gross Domestic Product (GDP). Despite its significance, India's farming sector faces pressing challenges, including yield gaps, low mechanization levels, and market access barriers. Nonetheless, there are opportunities to modernize the sector through technology adoption, improved irrigation methods, crop diversification, and better supply chain management. These efforts can lead to increased productivity, income generation, and enhanced resilience in the face of global uncertainties.

AgroNexa is one step solution to many of these problems, by introducing “Pay as you go” scheme to farm equipment’s and machinery which removes the burden of buying individual equipment’s by small farmers and at the same time helps them earn additional income by renting any spare equipment’s to other farmers.

It uses a Web-based portal and A Recommendation System which takes into account various perimeters like Amount of Nitrogen(N), Amount of Phosphorus(P), Amount of Potassium(K), rainfall (in cm), temperature, humidity and pH level into account to suggest best crop variety to grow for maximum profit and recommends equipment’s related to it for renting.

II. EXISTING MODEL

Traditionally, farmers have relied on purchasing their own equipment to carry out various farming activities. However, this practice has both

advantages and disadvantages. The emergence of farm equipment rental portals has provided an alternative approach to acquiring the necessary machinery for agricultural operations. In this analysis, we will explore the traditional practice of buying farming equipment, its advantages, and disadvantages in comparison to utilizing a farm equipment rental portal. The advantage of this system is just Ownership and Control. While its Demerits highly outweigh it, those are High Initial Costs, Maintenance Expenses, Depreciation, Limited Usage and Dept traps to buy equipment.

III. PROPOSED MODEL

The proposed system serves as a modern solution to address the challenges and limitations associated with the traditional process of purchasing farming equipment. This innovative platform leverages technology to offer farmers a convenient and cost-effective alternative, allowing them to rent the equipment they need for their agricultural operations.

Key Features of the Proposed System:

1.Equipment Variety:

The Equipment Rental Portal offers a diverse range of farming machinery, ensuring that farmers have access to the specific tools required for their tasks. From tractors and ploughs to seeders and harvesters, the portal provides a comprehensive selection to cater to various farming needs.

2. Cost-Effective Rental Options:

One of the primary benefits of the proposed system is its cost-efficiency. Farmers can rent equipment for specific tasks or seasons without the burden of high initial purchase costs. This flexibility is particularly advantageous for small-scale farmers who may have limited capital.

3. Accessibility and Convenience:

The portal is accessible through the internet, making it easy for farmers to browse equipment options and reserve what they need from the comfort of their homes. This convenience eliminates the need for time-consuming visits to equipment dealers or rental agencies.

4. Maintenance and Support:

The proposed system often includes maintenance and support services provided by the rental provider. This feature relieves farmers of the responsibility of equipment upkeep, ensuring that the machinery is in optimal working condition.

5. Reduced Financial Risk:

By avoiding the significant upfront costs of equipment purchase, farmers can reduce financial risk. This approach also mitigates concerns related to equipment depreciation and resale value.

Advantages of proposed system:

Cost-Efficiency: The primary advantage of the proposed system is its cost-efficiency. Renting equipment reduces the financial burden on farmers, making it an accessible option, especially for those with limited budgets.

Access to Specialized Equipment: The system offers access to a wide array of specialized farming equipment, allowing farmers to choose the most suitable machinery for their specific tasks.

Reduced Maintenance Responsibility: Rental providers typically handle maintenance and repairs, alleviating farmers from the time and cost associated with equipment upkeep.

Flexibility and Adaptability: The system offers flexibility in equipment selection, enabling farmers to adapt to changing needs and agricultural seasons.

1.Web Interface: HTML, CSS, JAVASCRIPT, UI

2.Web Server: Node.js

3.Application services: Business requirements

4.Ml recommendation system: naïve bayes, SVM, random forest, k – nearest neighbor, boosting.

5.Database: sqlite3, MySQL, MongoDB.

IV. WORKING MODULE

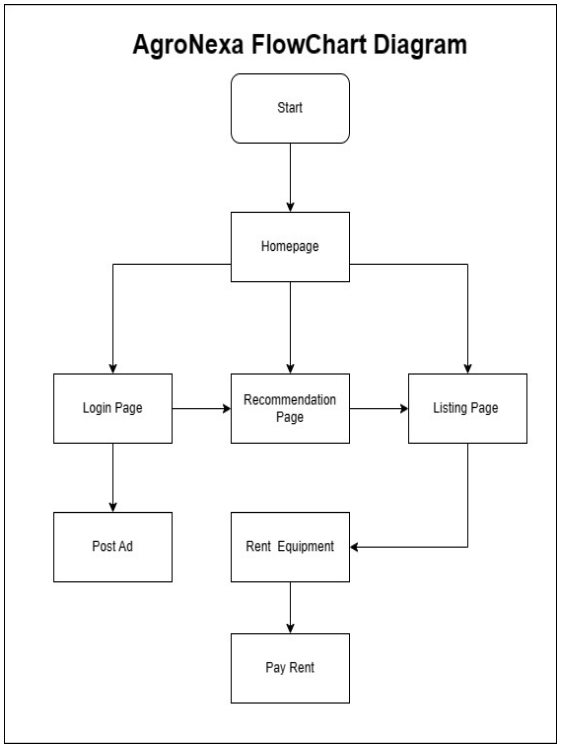
A. *Homepage* - Displays the content of website and briefly explains its purpose, has links to others pages of the website.

B. *Recommendation Page* – Take user input such as Amount of Potassium, Amount Nitrogen, Amount of Phosphorus, Rainfall amount, Temperature and the pH details and recommends a Crop variety to plant and has a link to rent listings related to that plant.

C. *Login Page* - Used to login user or register new user for the website. Crucial part to implement payment system.

D. *Listings Page* - Used to show available rent listings of various equipment's and give basic details about its age and location and expected rent.

E. *Dataset* - Opensource dataset to use for recommendation system design and other data use.



V. IMPLEMENTATION

Precision agriculture is in trend nowadays. It helps the farmers to get informed decision about the farming strategy. Here, I present you a dataset which would allow the users to build a predictive model to recommend the most suitable crops to grow in a particular farm based on various parameters.

This dataset was build by augmenting datasets of rainfall, climate and fertilizer data available for India.

Data fields

• N - ratio of Nitrogen content in soil

• P - ratio of Phosphorous content in soil

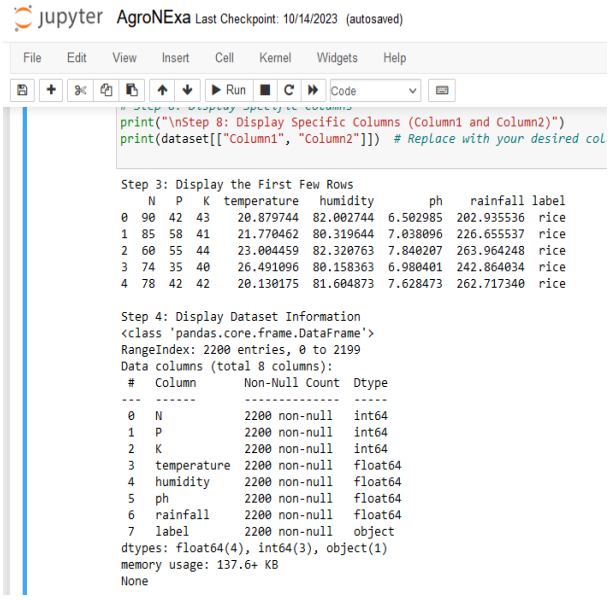
• K - ratio of Potassium content in soil

• temperature - temperature in degree Celsius

• humidity - relative humidity in %

• pH - pH value of the soil

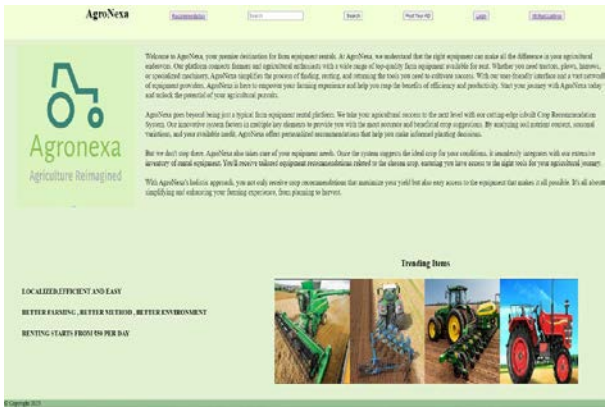
• rainfall - rainfall in mm



Algorithm implementations – Naïve Bayes, SVM, Random Forest, K-nearest neighbour, AdaBoost.

```
In [8]: import pandas as pd
        from sklearn.model_selection import train_test_split
        from sklearn.preprocessing import LabelEncoder
        from sklearn.naive_bayes import GaussianNB
        from sklearn.metrics import accuracy_score

        # Load the dataset from the CSV file
        df = pd.read_csv('Crop_recommendation.csv')

        # Convert categorical data to numerical using Label Encoding
        le = LabelEncoder()
        df_encoded = df.apply(le.fit_transform)

        # Split dataset into features (X) and target (y)
        X = df_encoded.drop(columns=['label'])
        y = df_encoded['label']

        # Split data into training and testing sets
        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

        # Initialize and train the Naive Bayes classifier
        nb_classifier = GaussianNB()
        nb_classifier.fit(X_train, y_train)

        # Predict on the test set
        y_pred = nb_classifier.predict(X_test)

        # Calculate accuracy
        accuracy = accuracy_score(y_test, y_pred)
        print(f'Accuracy: {accuracy * 100:.2f}%')

        Accuracy: 98.86%
```

Web Porttal Implementation -



VI. RESULTS AND DISCUSSION

Naïve bayes accuracy – 98.86%

Svm accuracy – 97.73%

K-nearest neighbour – 88.18%

Random forest – 99.32%

Adaboost – 9.55%

Based on the accuracy results provided for different machine learning algorithms, it's clear that Random Forest achieved the highest accuracy of 99.32%, followed by Naive Bayes with 98.86% accuracy. These high accuracies suggest that both Random Forest and Naïve Bayes are strong candidates for building a recommendation system. However, the choice of algorithm should consider other factors as well:

Accuracy: Random Forest has the highest accuracy, indicating that it's proficient at making accurate predictions. It's suitable for tasks where precision is critical.

Complexity: Random Forest is an ensemble algorithm that combines multiple decision trees, making it more complex and computationally intensive. Naive Bayes, on the other hand, is simpler and computationally efficient.

Interpretability: Naive Bayes is a straightforward algorithm with easily interpretable results. It's easy to understand the reasons behind its predictions. Random Forest, being an ensemble method, may be less interpretable.

Scalability: Naive Bayes is a lightweight algorithm that works well with large datasets.

Random Forest, while powerful, can be slower and resource- intensive with very large datasets.

Robustness: Random Forest is known for handling noisy or missing data well. It's a robust choice when dealing with real-world, messy datasets.

Overfitting: Naive Bayes is less prone to overfitting, while Random Forest can be more prone to overfitting if not carefully tuned.

Algorithmic Requirements: The choice of algorithm may also depend on the specific requirements and constraints of your recommendation system. Consider factors such as Realtime prediction, memory usage, and the need for online learning.

Based on the provided accuracy results alone, Random Forest stands out as the best-performing algorithm. However, the choice between Random Forest and Naive Bayes should consider the trade-offs mentioned above. If interpretability and computational efficiency are essential, Naive

Bayes might be a better choice. If the highest accuracy is the top priority, then Random Forest is the way to go.

VII. CONCLUSION

Building a Farm Equipment Rental Portal with Recommendation System In the ever-evolving landscape of agriculture, the integration of modern technology has become imperative for the sustainability and success of the farming community. Our journey in creating a Farm Equipment Rental Portal with a Crop Recommendation System has been a testament to the potential of innovation in addressing the evolving needs of farmers and agricultural stakeholders.

Throughout this project, we have achieved significant milestones, and our findings and outcomes underscore the following key points:

Empowering Farmers: The central objective of our Farm Equipment Rental Portal is to empower farmers by providing them with a user-friendly platform to access and rent a wide range of farm equipment. By eliminating the barriers associated with equipment ownership, we have made modern, efficient farming practices accessible to all, regardless of farm size or location.

Crop Recommendation System: The Crop Recommendation System embedded within our portal leverages data-driven insights to assist farmers in making informed decisions about the crops they cultivate. By considering various factors, including soil conditions, climate, and market demand, we enable farmers to optimize their crop selection, leading to increased yields and profitability.

Enhancing Efficiency: With our platform, we aim to enhance the efficiency of agricultural operations. By recommending equipment based on the chosen crop, we ensure that farmers have access to the tools that best suit their specific needs, reducing waste and improving productivity.

Sustainability and Environmental Responsibility: Our platform also underscores our commitment to sustainability and environmental responsibility. By helping farmers optimize their crop selection and equipment use, we contribute to more sustainable farming practices, reducing resource wastage and environmental impact.

Machine Learning and Data Analysis: The integration of machine learning techniques for crop recommendation and data analysis for equipment selection has been a critical component of our project's success. These technologies bring data-driven decision-making to the forefront of farming.

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