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MULTI CLASS CLASSIFIER FOR CROP YIELD PREDICTION BASED ON NUTRIENTS FEATURES OF THE SOIL

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Abstract: Crop yield prediction is crucial for agricultural decision-making, impacting import-export dynamics, pricing strategies, and crop management practices. Soil quality, determined by nutrients and pH levels, significantly influences crop productivity. Despite advancements, farmers often rely on traditional soil analysis methods. Emerging technologies like Data Mining, AI, Machine Learning, Deep Learning, and Predictive Analytics offer promising avenues for agricultural improvement. Predictive analytics, leveraging historical data, aids in predicting soil nutrient levels for crops like Paddy, Raagi, and Cumbu, enabling proactive measures to optimize yields and mitigate losses. This study proposes a method employing Machine Learning with LSTM to predict crop yields based on geographical and climatic data, capturing temporal dependencies and operating on diverse datasets. Additionally, the system facilitates real-time monitoring of soil nutrient evolution, integrating key chemical elements, rainfall, and temperature data.

Keywords: Support Vector Machines (SVM), Long Short-Term Memory (LSTM)

I. INTRODUCTION

Agriculture stands as the cornerstone of the Indian economy, with crops serving as vital resources cultivated by farmers across the nation. Representing a significant portion of livelihoods, approximately 70% of India's population relies on agriculture for sustenance and income, particularly in rural areas. The success of crop cultivation hinges upon favourable weather conditions and suitable soil compositions, highlighting the intricate relationship between nature's elements and agricultural productivity. Throughout history, humanity's sustenance journey evolved from gathering plants and hunting animals to the establishment of agriculture, which became pivotal in meeting nutritional needs.

The term "agriculture" encompasses a spectrum of human activities aimed at responsibly utilizing Earth's resources to address various needs such as food, Fiber, feed, and fuel. In this pursuit, the classification of crops emerges as a strategic approach to optimize resource utilization effectively.

Crop Categories span across six distinct categories, each serving specific purposes within agricultural frameworks: food crops, feed crops, Fiber crops, oil crops, ornamental crops, and industrial crops.

1.1 Food Crops: Central to human sustenance, food crops encompass fruits, vegetables, and grains like corn, wheat, and rice, catering to global dietary needs.

1.2 Feed Crops: Essential for livestock farming, feed crops like oats and alfalfa provide vital nutrients necessary for animal development, ensuring the sustainability of livestock-based agricultural systems.

1.3 Fiber Crops: Fiber crops, including cotton and hemp, serve as primary sources for textiles and paper products, highlighting their indispensable role in various industrial applications.

1.4 Oil Crops: Crucial for both consumption and industrial utilization, oil crops like canola and corn are processed to extract oils utilized in cooking, industrial manufacturing, and biofuel production, thus addressing diverse societal needs and environmental concerns.

1.5 Industrial Crops: Indispensable for manufacturing processes, industrial crops like rubber and tobacco provide raw materials for a plethora of industrial goods, emphasizing their significance in modern industrialization efforts.

1.6 Ornamental Crops: Ornamental crops such as dogwood and azalea are cultivated for aesthetic purposes in landscaping, contributing to the beautification of residential and commercial environments worldwide.

II. EXISTING SYSTEM

The existing system in agriculture relies heavily on manual methods for predicting suitable crops for a given region. These methods include drawing on experience-based knowledge, seeking expert consultation, conducting soil and water analyses, and considering climate-based factors. However, these manual techniques have limitations, such as subjectivity, inability to account for complex interactions between environmental variables, and being time-consuming. To address these limitations, automated systems utilizing machine learning algorithms have emerged. These algorithms, including decision trees, support vector machines (SVM), artificial neural networks (ANN), random forests, and k-nearest neighbours (KNN), leverage climate, water, and rainfall data for crop prediction. While these algorithms offer accurate predictions, their implementation requires significant computational resources and expertise, which may hinder accessibility for small-scale farmers and agricultural businesses.

III. PROPOSED SYSTEM

The proposed system, "Crops2Go," is a sophisticated web-based application designed to assist farmers in selecting suitable crops based on environmental parameters such as temperature, humidity, pH, rainfall, and soil nutrients (N, P, K). Leveraging data collected from reliable sources, the system undergoes comprehensive preprocessing to ensure data quality, followed by feature extraction to identify crucial variables for crop prediction. Utilizing the LSTM algorithm, the system classifies and predicts optimal crops based on extracted features, trained on historical crop data and environmental factors. Accessible through a user-friendly web interface, the system caters to both system administrators responsible for model maintenance and farmers seeking crop recommendations. Regular performance analysis ensures the accuracy and currency of the model, deployed on a cloud server for widespread accessibility. By integrating climate, water, and soil nutrient data, the proposed system aims to provide farmers with accurate predictions to optimize crop selection and enhance yield and profitability.

IV. EXPERIMENT AND RESULT

Some of the output screen shots of the project execution are given below. This depicts the major of the Multi Class Classifier for “crop yield prediction Based on Nutrient Feature of The Soil”

- User Registration

  This from is used for registering the overall details about the new customer. During registration they need to submit following details are Name, User name, Password, Re-enter password, Mobile number, email address etc.

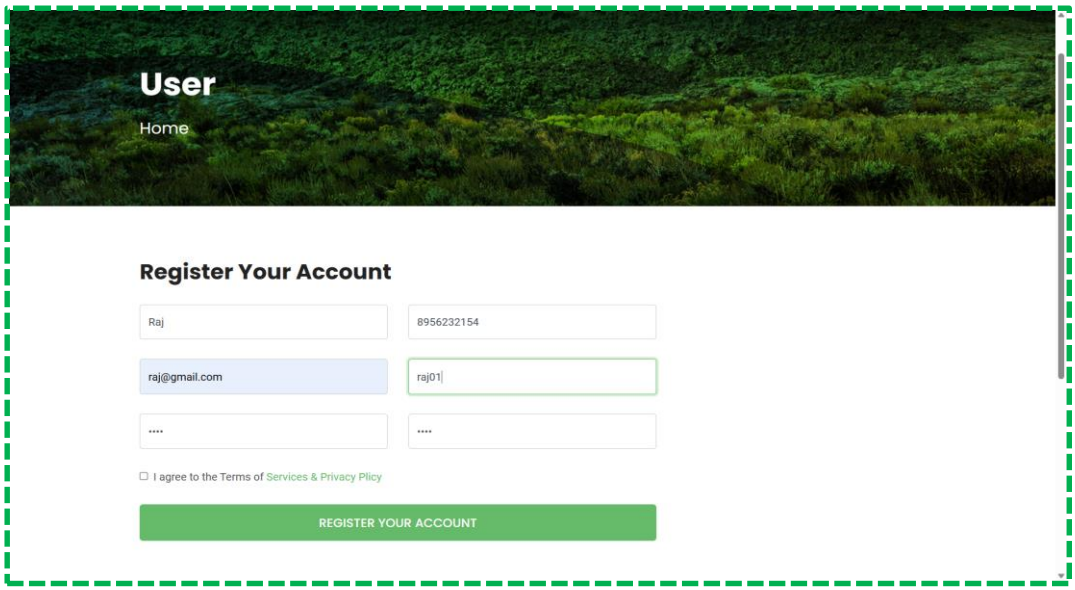

Figure 3.1

- **User Login**

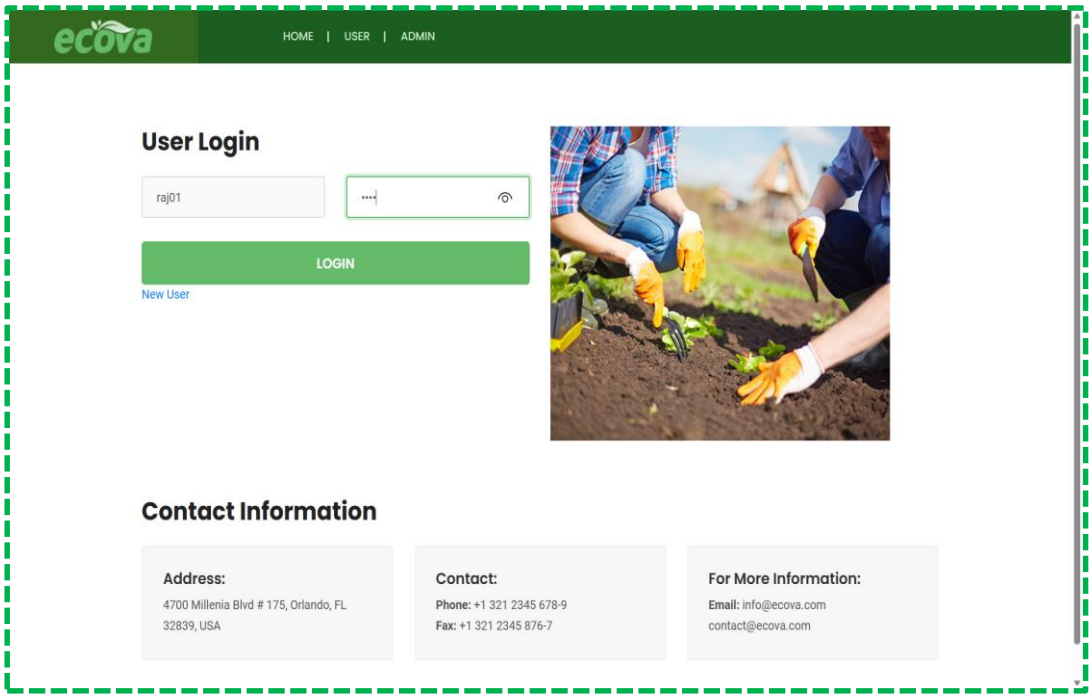

Figure 3.2

This from is used to control all the modules. Which contain admin username and password to control the admin section. The admin modules are given above

- **Testing**

In system testing, the undergoes rigorous evaluation to ensure its effectiveness and accuracy in predicting crop yields. This testing phase involves verifying that the classifier can appropriately process soil nutrient data and provide reliable recommendations for crop selection

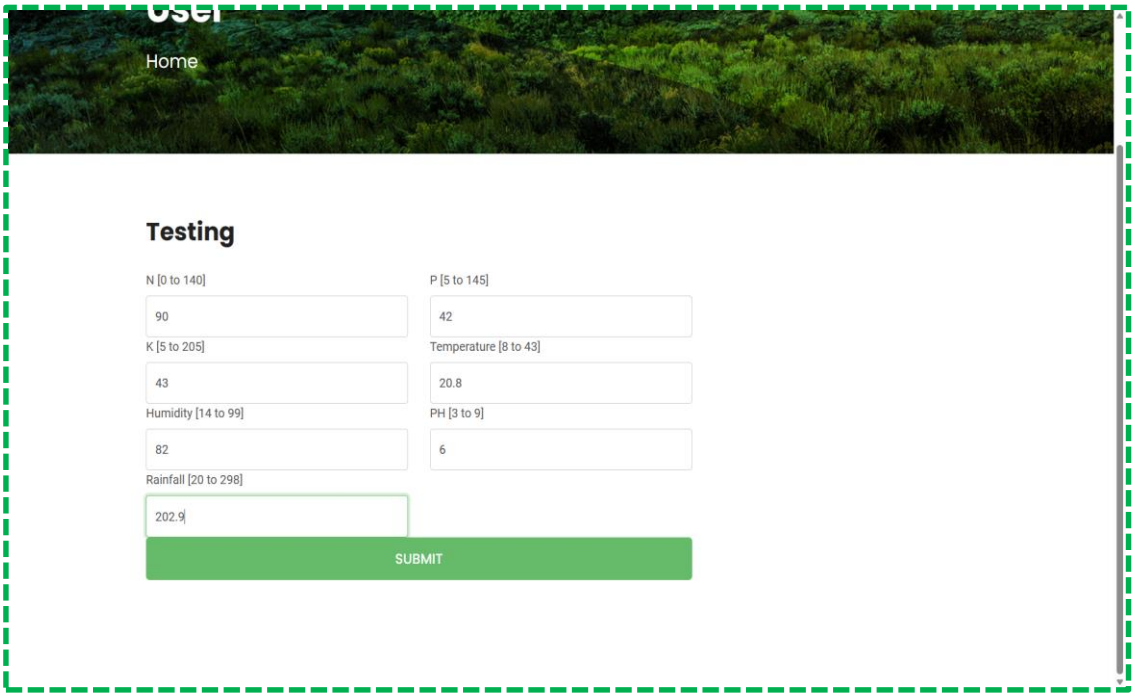

Figure 3.3

- **Result page**

In this page LSTM algorithm predict the n this study, we introduce a multi-class classifier utilizing soil nutrient features for precise crop yield prediction, addressing limitations of traditional methods. Through extensive data collection across diverse agricultural regions, we analysed soil samples for essential nutrients and secondary features like pH and organic matter content.

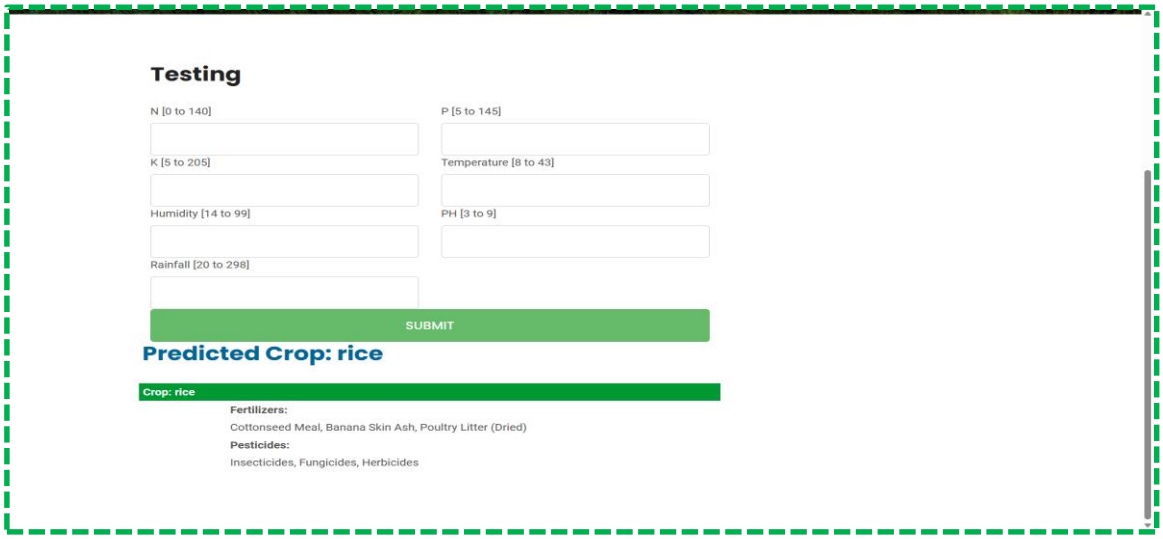

Figure 3.4

V. CONCLUSION

In conclusion, "Crops2Go" is a web-based application that allows farmers or users to predict the best crops to grow based on climate, water, soil NPK and rainfall features using LSTM. The application has been developed using Python Flask, Tensor Flow, Kera's, and MySQL, and it has undergone extensive testing to ensure its functionality, reliability, and accuracy. The system has several modules such as Data Collection, Pre-processing, Feature Extraction, Classification, Prediction, Performance Analysis, and Alerts/Notification module. The datasets used for training and testing the model have been obtained from Kaggle, and they have been adequately described the feasibility study showed that the project is viable and can be successfully implemented. The software testing phase ensured that the system is robust and meets the requirements of the end-users. The test results indicate that the system performs well, and the test cases show that the system meets the expected results. Based on the results of the feasibility study, it is evident that "Crops2Go" is a viable project that can significantly benefit farmers and other users who are interested in agriculture. In conclusion, "Crops2Go" has the potential to be a valuable tool for farmers and users looking to make informed decisions about which crops to grow based on climate, water, and rainfall features.

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