Blockchain and Data Analytics-based Crop Recommendation System for Precision Farming in IoT Env.

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Abstract

In agriculture, soil is a vital element that decides the quality and yield of agricultural produce. Soil consists of various nutrients such as Nitrogen (N), Phosphorous (P), Potassium (k), pH, and water content. In the first module of this project, we have proposed an algorithm for recommending a set of suitable crops based on various soil attributes. These soil nutrients can be collected in real-time using soil sensors and then they can be deployed in farms where the cultivation takes place. The crop recommendation model will use data from these sensors which would increase the accuracy of the result. In the second module, we have proposed a solution for farmers that would benefit them with an optimized companion crop selection. Our mixed-cropping selection model employs ML algorithms to predict the compatibility among crops. The set of crops suggested by the recommender system is used as an input to the mixed-cropping selection model. The model will then calculate the compatibility score of the crops based on various attributes such as root system, water requirement, harvest period, soil type, growth rate, height, etc., and recommend the most suited crop combination.

Introduction

For the last many decades, our entire ecosystem is highly dependent on agriculture. It includes practicing various activities such as horticulture, aquaculture, livestock production, and farming. Farming is not only essential to a country's economy but also to individuals. In order to enhance crop yield and increase agricultural outputs, farmers employ a variety of methods such as crop rotation, use of organic fertilizers, adopting modern irrigation techniques, and intercropping. In India, intercropping was traditionally done using a method called "mixed cropping," where two or more crops were grown together in the same field. This practice allows farmers to maximize the use of available resources and reduces the risk of crop failure. This raised a concern as farmers usually pick a crop based on their instincts without considering salient factors such as soil health, weather conditions, and market price.
Inconvenient agricultural practices such as monoculture planting, overgrazing of animals, row cropping, tilling or plowing, crop removal, and land-use conversion can lead to soil degradation. Farmers presume that adding readily available fertilizers can improve the quality of their yield in a short period. Repeated use of these fertilizers can lead to the production of contaminated harvests and reduce the long-term fertility of the soil.This invites the need for a fertilizer recommendation system that suggests, fertilizers based on a nutrient deficiency in the soil.
To practice mixed cropping, farmers needed a system that would provide them with the best crop combinations. The mixed-cropping selection model employs ML algorithms to predict the compatibility among crops. The set of crops suggested by the recommender system is used as an input to the mixed-cropping selection model. The model will then calculate the compatibility score of the crops.

Aim and Objective

Aim of the project is to develop a recommendation system that suggests crops that optimizes the yield of the crops. Also we intend to develop an ML- based mixed cropping algorithm in order to predict the most suitable combination of crops.

Problem Statement

Perform Crop recommendation and mixed cropping using ML algorithms

Methodology

Time	Nitrogen(S1)	Potassium(S2)	Phosphorous(S3)	pH(S4)
P_1	2.64	1.56	3.4	5.5
P_2	2.856	1.62	3.65	5.6
P_3	2.94	1.6	3.428	5.5
P_4	3	1.59	3.6	5.7

Table 1 Data from sensors

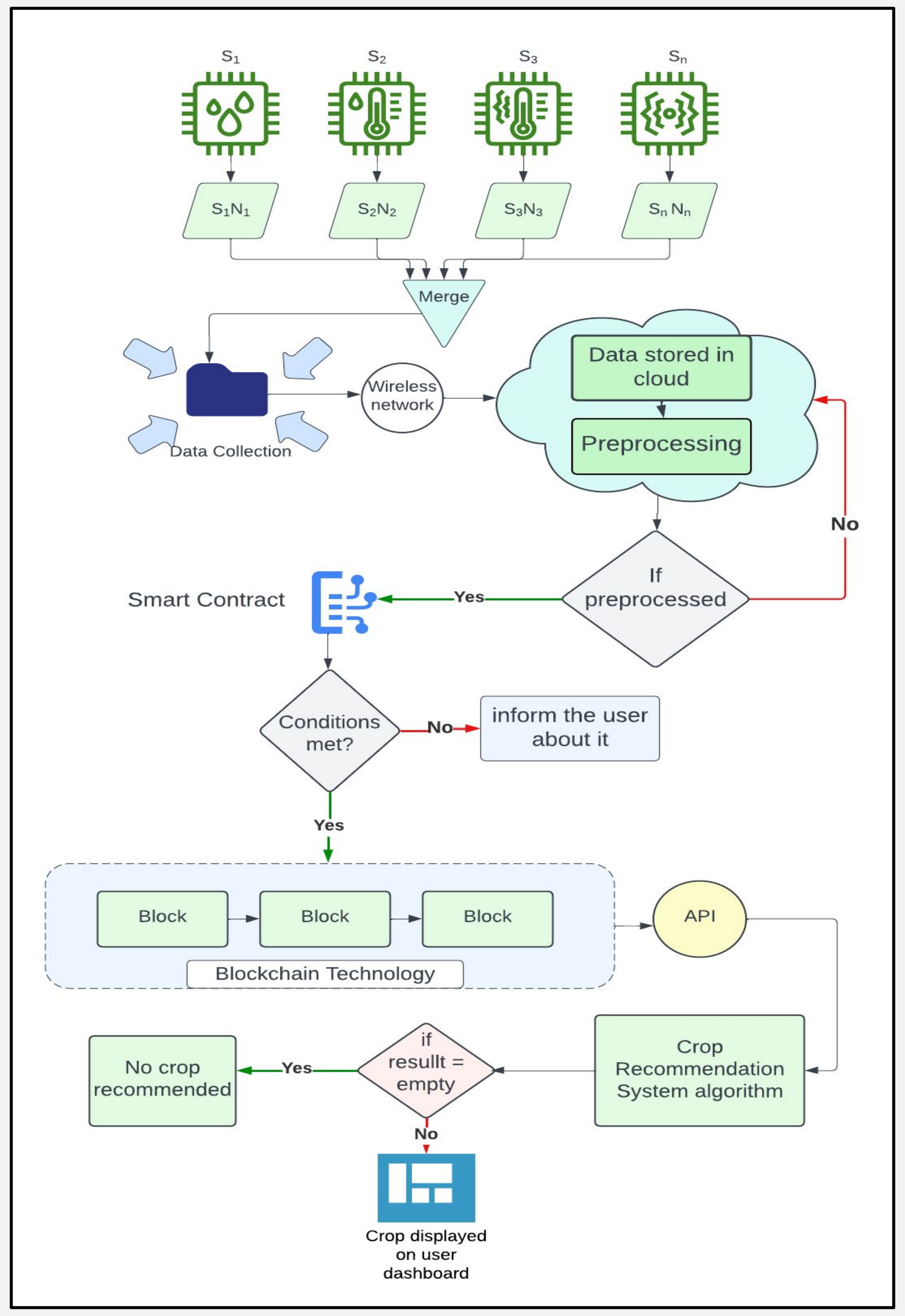

Fig 1. Implementation Of recommender system

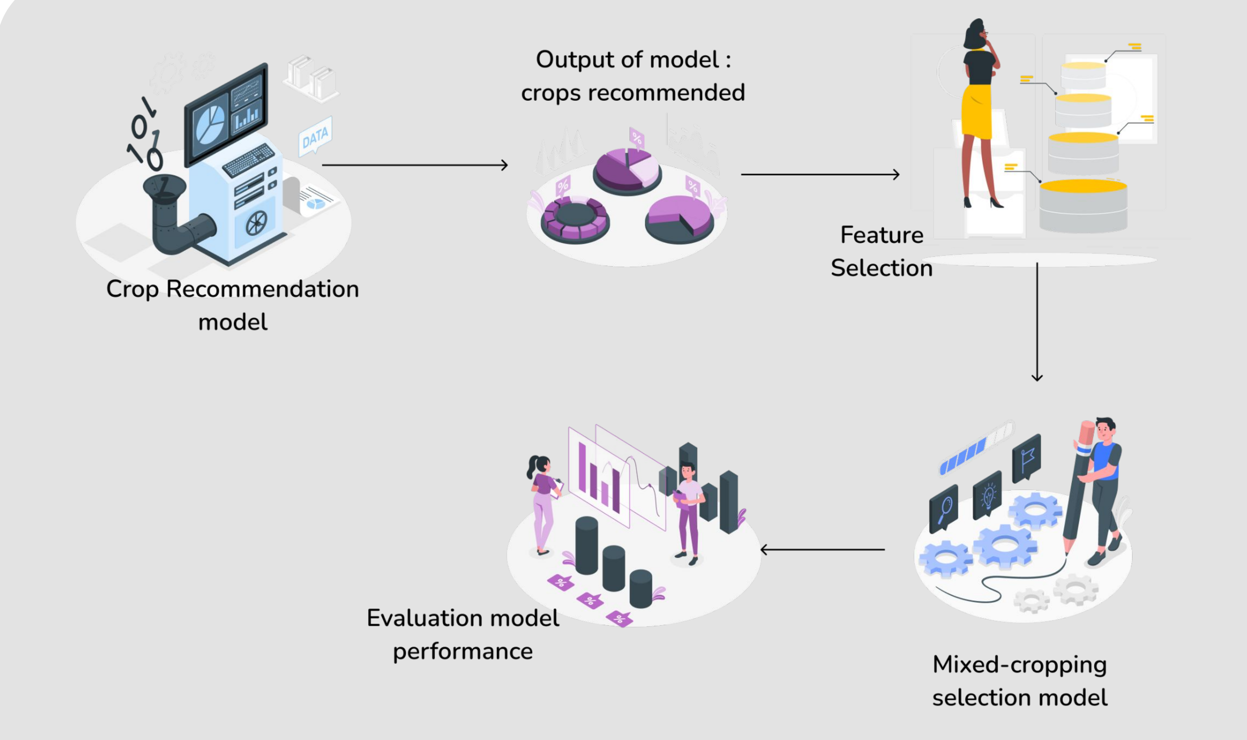

Fig 2. Implementation of mixed cropping model

Results

Crop Recommendation model based results

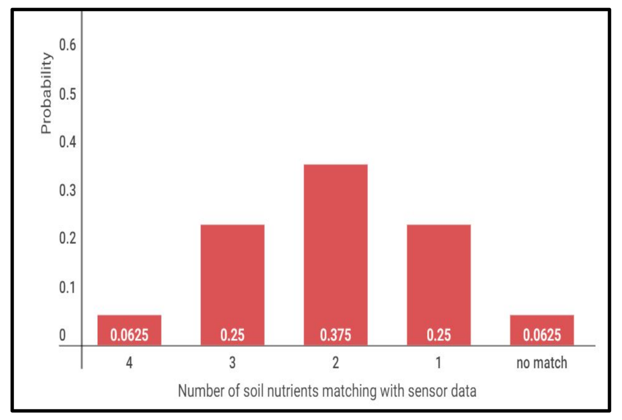

Fig 3.Probability of nutrients matching data

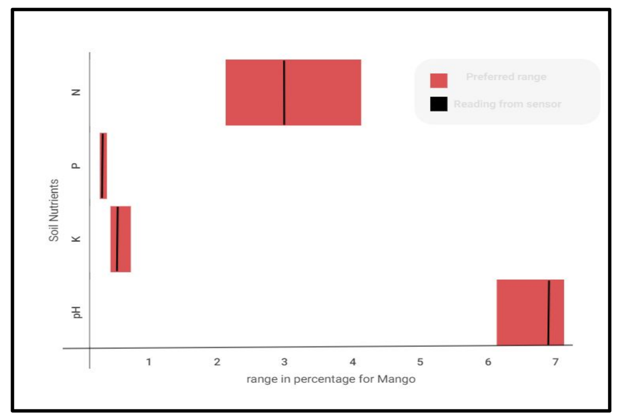

Fig 4. sensor data with 4 matching values

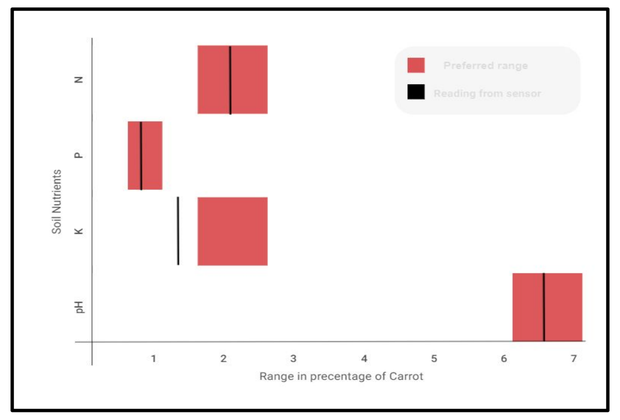

Fig 5. sensor data with 3 matching values

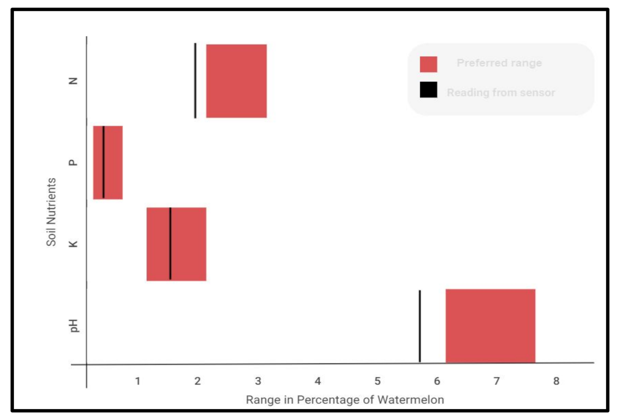

Fig 6. sensor data with 2 matching values

Mixed cropping ML- based results

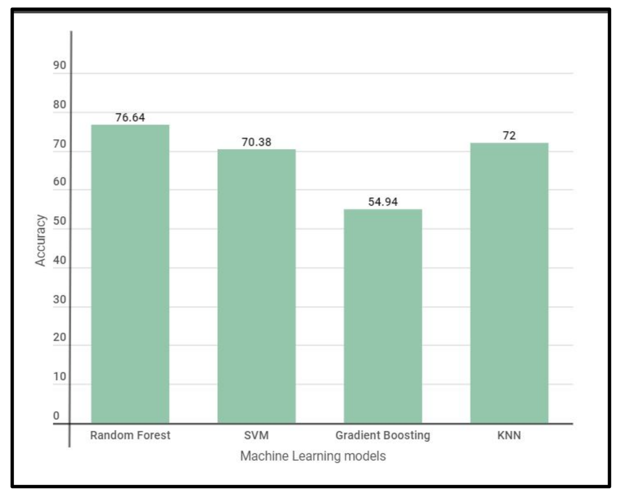

Fig 7. probability of Ml models

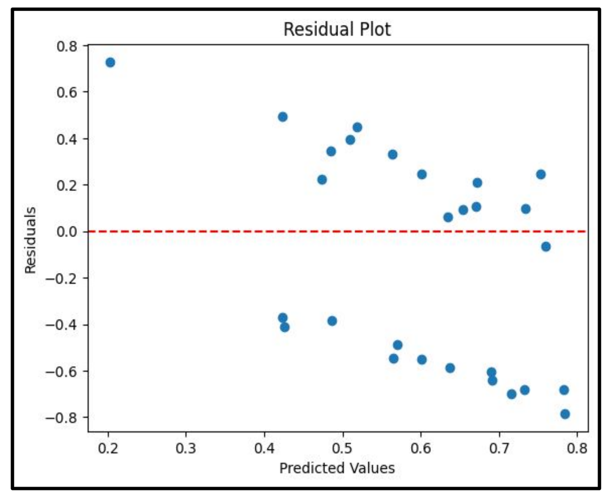

Fig 8. Residual Plot of the ML model

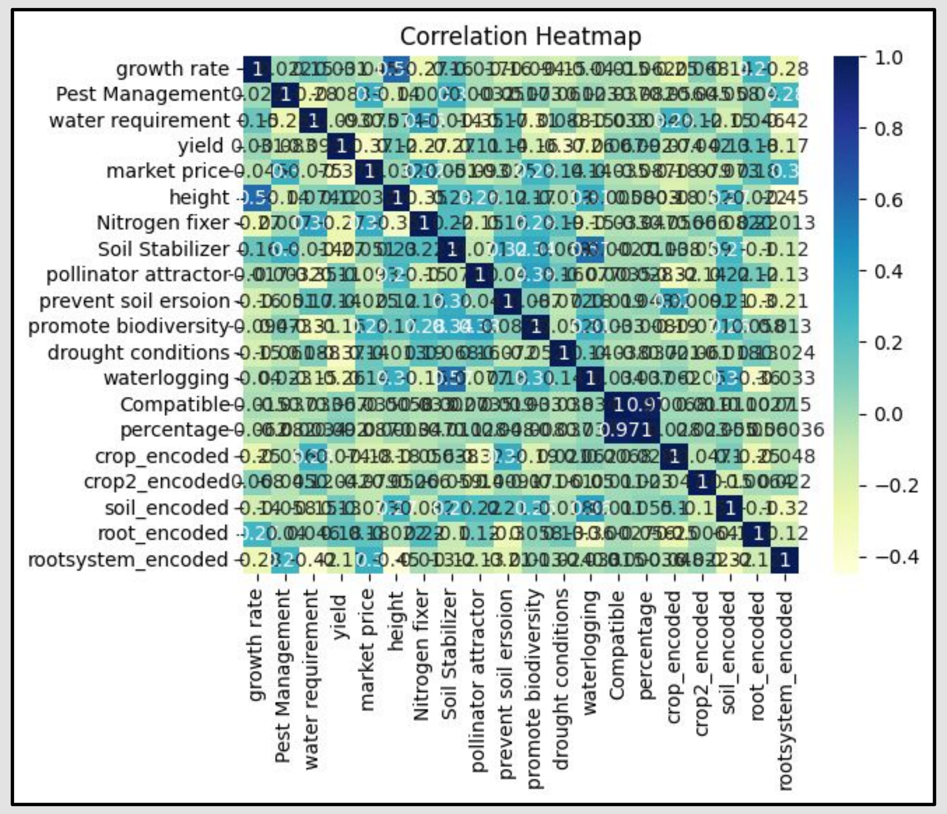

Fig 9. Heatmap of the ML model

Conclusion

We used a recommender system algorithm in order to recommend crops to the farmers based on the soil nutrient attributes such as N, P,K and pH. Soil sensors are deployed in the farm and the readings are transmitted via the cellular network to the cloud. The data from the cloud is procured and then inputted into the algorithm via the blockchain-based system which ensures the traversal of data securely without any intrusion. The algorithm outputs the recommended crops which can be grown on the farm. Furthermore, the crops acquired are used as an input in a mixed-cropping selection model, where it passes through ML algorithms and provides the most beneficial crop combinations. The choice of crops affects the yield and hence with the accuracy of our algorithm, such crop combinations are suggested which promise a healthy harvest and profit for farmers.

Acknowledgements

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