KRISHISAHAYOGI - AN ARTIFICIAL INTELLIGENCE BASED SOFTWARE SYSTEM FOR AGRICULTURE

GANGASAGAR H L

[1]G.A.T.E QUALIFIED COMPUTER SCIENCE ENGINEER [AIR 1517]
[1]COMPUTER SCIENCE ENGINEERING,
[1]SAPTHAGIRI COLLEGE OF ENGINEERING, BANGALORE ,INDIA

Abstract - Krishisahayogi an artificial intelligence-based software system, recommends crops based on analysis of soil texture, soil pH, and estimated temperature. Thence directing to the nearby suitable market, where the recommended crops' can be sold for better profits' . The software systems help in making agriculture a profitable venture.

Index Terms - Price prediction, Crops recommendation, Soil pH, Soil Texture, Image processing, Deep Learning (CNN, ANN), Machine learning, Open CV, Tensorflow keras, skimage, geocoder, openweathermap, fbprophet.

I. Introduction

Agriculture and the country are intrinsically linked, forming the backbone of rural economies worldwide. Agriculture sustains livelihoods, fosters community ties, and shapes cultural identities. In rural areas, agriculture not only provides food security but also generates employment opportunities across the value chain, from farming to processing and distribution. The health of a country's agriculture sector often mirrors its economic well-being, with fluctuations in crop yields and livestock production directly impacting GDP and trade balances. Moreover, agriculture fosters environmental stewardship, as rural landscapes often serve as vital ecosystems. Sustainable agricultural practices are increasingly recognized as essential for mitigating climate change and preserving biodiversity. In essence, agriculture is not just a sector; it's a cornerstone of rural life and a key driver of national economies, shaping the fabric of countries worldwide.

Farmers face a relentless struggle in finding the right crop for their land and climate, navigating a maze of uncertainties. Even when they do, accessing suitable markets poses another formidable challenge. The mismatch between demand and supply often leads to price fluctuations, rendering agriculture an unpredictable venture. Without adequate support and infrastructure, profitability remains elusive. This cycle perpetuates the plight of farmers, inhibiting the growth of the agricultural sector. Addressing these systemic hurdles is crucial for transforming farming into a sustainable and lucrative business.

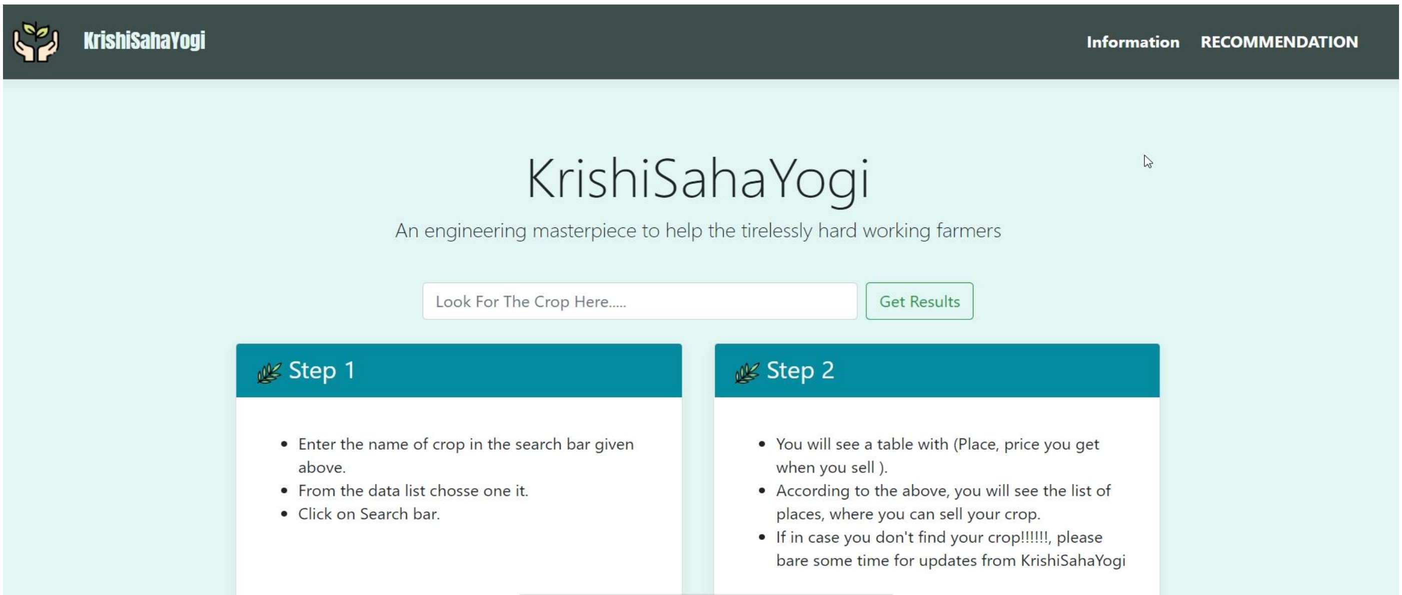

Fig.1 Home Screen of Krishisahayogi

Krishisahayogi addresses the aforementioned gap effectively. Achieving optimal crop yield hinges on providing the appropriate environmental conditions, tailored to the unique characteristics of each crop. This knowledge may not always be readily available to farmers. Utilizing a software system with a robust research foundation, It recommends crops best suited to the land's profile. This informed guidance empowers farmers to invest in crops that promise high yields. Additionally, the software identifies suitable markets where these recommended crops can be sold at profitable rates. Ultimately, It facilitates increased profits by providing valuable insights that would otherwise remain unknown.

II. Literature survey

Gangasagar HL, Anuradha Badage. et al [1] The authors conducted a study titled "Soil pH Determination Using Mobile Phone Captured Image," wherein they gathered soil samples from diverse locations across the state. To ensure accurate soil photo capture without interference, they devised a black-box setup. Subsequently, they processed the images using OpenCV to extract various color channels. Concurrently, soil pH measurements obtained via sensor were documented in a CSV file. These data were then fed into an Artificial Neural Network (ANN) model for analysis. The resulting model was employed to predict soil pH based on images captured via mobile phones. Notably, the R-squared score of the MinMax Random Forest Regressor reached 0.686, indicating a promising level of accuracy in the predictions.

Gangasagar HL, Anuradha Badage . et al [2] The authors of "Crop Price Prediction Using Machine Learning Algorithms" gathered data from the reputable source agmarknet.in. They utilized 80% of the collected data for model preparation, reserving the remaining 20% for testing purposes. Employing various machine learning algorithms including Linear Regression, Decision Tree Regressor, and Random Forest Regressor, they achieved an impressive accuracy of 92.77% with the latter. Consequently, the Random Forest Regressor was selected for prediction deployment.

Bhawna J. Chilke. et al [3] "Determination of Soil pH by using Digital Image Processing Technique-A Review", the authors captured a digital image, resized the image and removed all the unwanted noises. The image is then portioned into multiple parts for extraction of meaningful region of interest. All the necessary features were extracted from the captured image and classification was applied where each pattern is classified into one of the distinct classes making use of KNN, PCA, ANN, SVM algorithm based on the requirement.

Pandit Samuel, B.Sahithi. et al [4] "CROP PRICE PREDICTION SYSTEM USING MACHINE LEARNING ALGORITHMS" states that, price prediction in agricultural field is very essential for the real data to predict the crop price of next rotation. Data needs to analyzed, cleaned and undergo exploratory data analysis (EDA) to understand parameters in data and different data mining techniques were used to build a precise model for price prediction. ML algorithms such as Linear Regression, Decision Trees, XGBoost and Neural Networks were used for price prediction, among which XGBoost gave good performance.

Prof.S.K.Honawad, Prof.S.S.Chinchali. et al [5] "Soil Classification and Suitable Crop Prediction", the authors state that the images captured have different intensity of light and are not illuminated as much as the mean value and the solution for this is modulating the amazing camera exactly will reduce this effect and also the removal of artifacts is necessary by a method called image rectification.

F.M.Riese, S.Keller. et al [6] "Soil Texture Classification With 1d Convolutional Neural Networks Based On Hyperspectral Data", the authors evaluate the performance of CNN approaches and compare them to a random forest classifier using the LUCAS(Land Use/Cover Area Frame Statistical Survey (LUCAS) dataset consisting of 22,000 datapoints of various images.

Pedro Augusto de Oliveira Moraisa. et al [7] "Predicting soil texture using image analysis" , soil samples were dried at for 48 h followed by grinding using a Tecnosolo TE 330 soil grinder. Samples were then sieved to < 2 mm, bagged, and labelled and 7 variants namely RGB, HSV, Grayscale, RGB + HSV, RGB + Grayscale, HSV + Grayscale, RGB + HSV + Grayscale. PLS2 was employed instead of PLS1 owed to the fact that these samples present high correlation, r2=0.98. Chemicals used for the testing is Sodium hydroxide (NaOH), Hydrogen peroxide (H_2O_2).

Małgorzata Charytanowiczand Piotr Kulczycki. et al [8] "An Image Analysis Algorithm for Soil Structure Identification", the authors prepared the soil samples, and captured the soil tomographic slices and applied with contrast enhancement technique on the original soil images thus extracting the color components from the enhanced image. Then unsupervised segmentation technique based on the complete gradient clustering algorithm was used for detecting the pore space from the segmented images.

Prototype [Basic Version]

Part 1: Based on the uploaded soil image, after processing the image, our trained models estimate the soil pH and texture. Additionally, we utilize the location's latitude and longitude to extract one month of weather prediction data from the OpenWeather API, determining the minimum and maximum temperatures. Considering these factors, we provide recommendations for crops along with an approximate number of days required for yield. This basic version operates within budget constraints, offering suggestions for crops that are suitable for specific soil conditions.

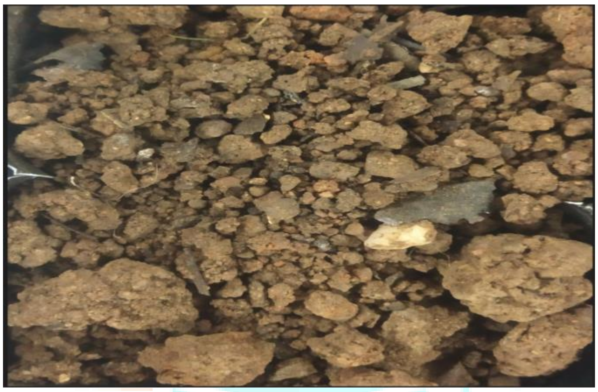

Fig. 2 Testing Soil (Clay Soil with pH 7.00)

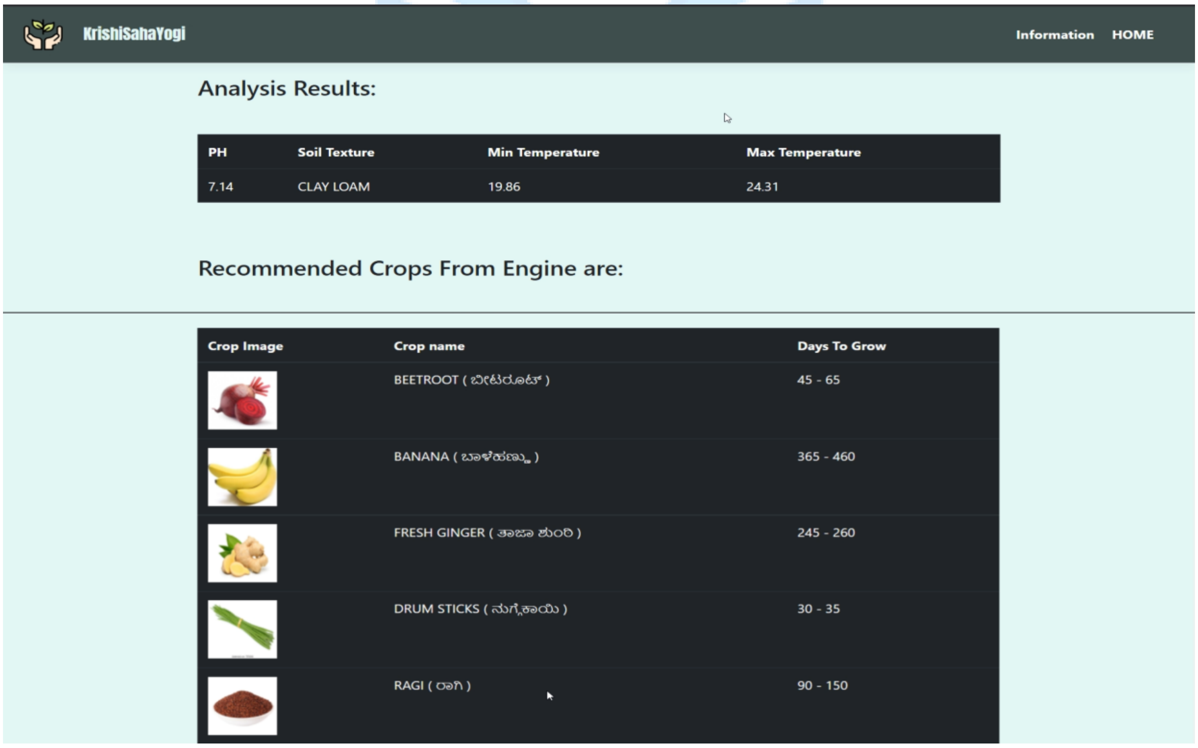

Fig. 3 Testing Result From The Prototype

Part 2: To maximize profits from the crops grown by farmers, it's advisable to sell the harvested produce at nearby APMC or markets. Clicking on the provided link will direct you to the recommended APMC, ensuring optimal selling conditions. However, in the updated version, establishing connections with industries and potential customers can further enhance profitability.

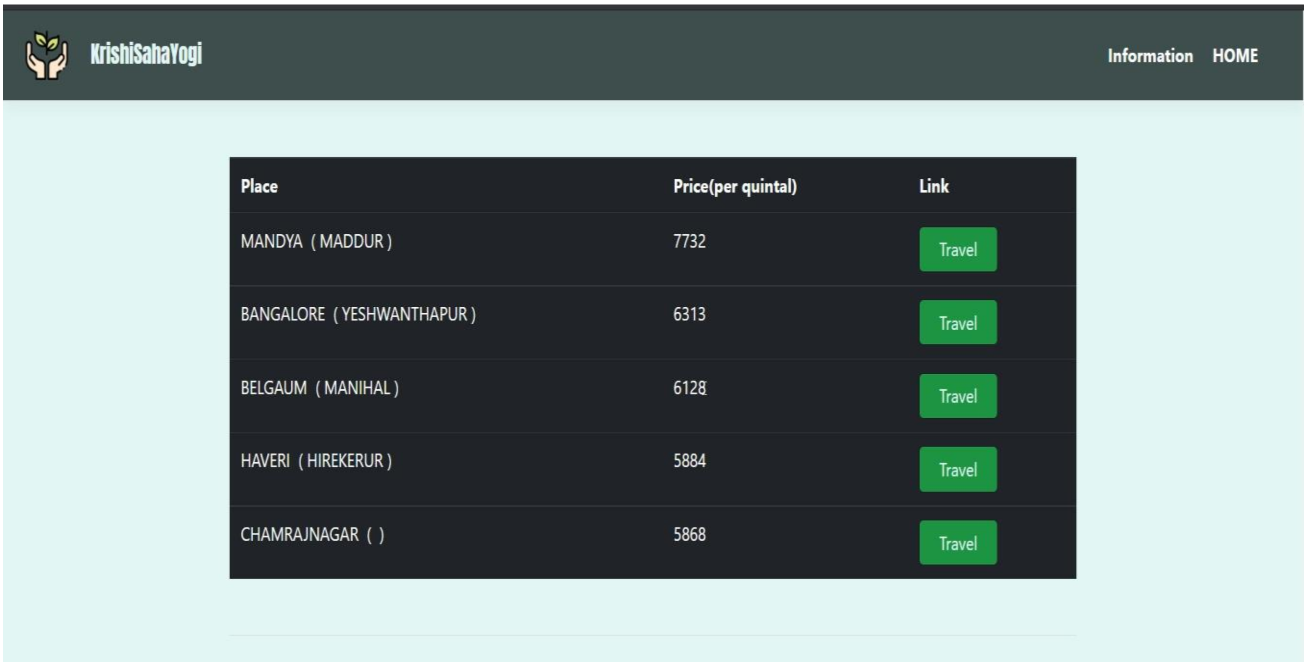

Fig 3. Alasande Grams results in nearby APMCs where one can yield greater profits.

III. FUTURE ENHANCEMENTS

1. Exploring additional sensor-related data, such as soil moisture retention duration, in conjunction with IoT-driven automation and solar pump integration guided by AI, holds significant potential to boost crop yield. Delving into precise insights on lucrative crops will propel software capabilities to unprecedented heights.

2. Incorporating real-time data from reliable sources for crops aids in the analysis and strategic selling of produce, ensuring they reach the appropriate market for optimal profit.

3. Preventing Bio-magnification through Organic Farming: Many individuals consume fruits and vegetables under the assumption that they are healthy choices, unaware of the pesticides used in their cultivation. These pesticides are applied to prevent crop damage and ensure profitability upon sale. However, prioritizing profit over health can lead to detrimental consequences. By incentivizing organic farming practices and providing support in terms of fair pricing and market access, we can foster a shift towards a healthier nation.

IV. CONCLUSIONS

Agriculture-based economies drive national stability, food security, and rural development. They provide vital employment opportunities, especially in developing nations, fostering economic growth and reducing poverty. Additionally, agriculture sustains essential industries like food processing and distribution, ensuring societal well-being and serving as a cornerstone for national prosperity.

Krishisahayogi, an AI-driven software system, guides farmers along the optimal path to maximize their profits. Employment in agriculture falls within the realm of unorganized sectors, yet it significantly contributes to a country's GDP, serving as the backbone of its economy. Should this sector falter, it jeopardizes food security, forcing reliance on foreign sources and hampering economic growth. To bolster contributions from agriculture, it is imperative to render this sector more appealing and lucrative. Through the integration of AI and IoT, this software promises enhanced profitability for crop yields.

V. REFERENCES

[1] Gangasagar HL, Jovin Dsouza, Bhagyashree B Yargal , Arun Kumar SV, Anuradha Badage "Soil pH Determination Using Mobile Phone Captured Image" *International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 07 | p-ISSN: 2395-0072. July 2021*

[2] Gangasagar HL , Jovin Dsouza , Bhagyashree B Yargal , Arun Kumar SV , Anuradha Badage "Crop Price Prediction Using Machine Learning Algorithms. *" Volume 9, Issue 10 .e-ISSN: 2319-8753, p-ISSN: 2320-6710 IJIRSET, October 2020.*

[3] Bhawna J. Chilke, Neha B. Koawale, Divya M. Chandran "Determination of Soil pH by using Digital Image Processing Technique-A " *International Conference on Recent Trends in Engineering Science and Technology (ICRTEST 2017), Volume: 5 Issue:1 (Special Issue 21-22 January 2017).*

[4] Pandit Samuel, B.Sahithi, T.Saheli, D.Ramanika, N.Anil Kumar "Crop Price Prediction System using Machine Learning Algorithms." *Quest Journals Journal of Software Engineering And Simulation, Vol. 06, No. 01, 2020, Pp. 14-20.*

[5] Prof.S.K.Honawad, Prof.S.S.Chinchali, Prof.Krunal Pawar, Prof.Pradeep Deshpande, "Soil Classification and Suitable Crop Prediction", *IOSR Journal of Computer Engineering (IOSR-JCE), 2017.*

[6] F.M.Riese, S.Keller, "Soil Texture Classification With 1d Convolutional Neural Networks Based On Hyperspectral Data, Computer Vision and Pattern Recognition" , *Corell University, 2019*

[7] Pedro Augusto de Oliveira Moraisa , "Predicting soil texture using image analysis" , *Microchemical Journal 146, Elsevier 2019.*

[8] Małgorzata Charytanowiczand Piotr Kulczycki, "An Image Analysis Algorithm for Soil Structure Identification, Advances in Intelligent Systems and Computing" *323, Springer International Publishing Switzerland 2015.*

[9] Anastasia Sofou, Georgios Evangelopoulos, and Petros Maragos, "Soil Image Segmentation and Texture Analysis: A Computer Vision Approach", *Ieee Geoscience And Remote Sensing Letters, Vol. 2, No. 4, October 2005.*

[10] Implementation Video Youtube https://www.youtube.com/watch?v=KVREaiWKa8s&t=85s