IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 11, May 2023

Intelligent Crop Recommendation System using Machine Learning

Sanjivani Kadam[1], Tejal Survase[2], Siddhi Velapure[3], Mayuri Swami[4], Ratan Kore[5], Prapti Atkale[6]
Assistant Professor, Department of Computer Science and Engineering[1]
Students, Department of Computer Science and Engineering[2,3,4,5,6]
SVERI's College of Engineering, Pandharpur, Maharashtra, India
Punyashlok Ahilyadevi Holkar Solapur University, Gopalpur, Pandharpur, Maharashtra, India

Abstract: *Intelligent crop recommendation systems have gained significant attention in modern agriculture for their potential to optimize crop selection and enhance agricultural productivity. This report aims to provide a comprehensive analysis of existing intelligent crop recommendation systems and propose a novel framework for future system development. The report explores the current state-of-the-art in the field, identifies the key components and functionalities of existing systems, and evaluates their strengths and limitations. Building upon this analysis, a proposed system framework is presented, encompassing data acquisition, preprocessing, machine learning algorithms, recommendation generation, and user interface. The proposed system addresses the limitations of existing systems and leverages emerging technologies for improved accuracy, scalability, and sustainability. The report concludes with a discussion on the potential impact of the proposed system on agricultural practices and highlights future research directions*

Keywords: *Agriculture, Maximum Crop Yield, Fertilizer Suggestion, Environmental Factor, Economic Factor, Machine Learning(ML), Plant Disease Classification*

I. INTRODUCTION

In recent years, there has been a growing need for efficient and sustainable agricultural practices to meet the increasing demand for food production. One critical aspect of successful farming is the selection of suitable crops for specific environmental conditions, soil characteristics, and market demands. However, this task can be challenging for farmers due to the complexity and variability of these factors. To address this challenge, intelligent crop recommendation systems have emerged as valuable tools for optimizing crop selection. These systems leverage advanced technologies such as machine learning, data analytics, and artificial intelligence to provide data-driven recommendations to farmers. By analyzing large volumes of agricultural data, including historical crop yields, climate data, soil information, and market trends, these systems can offer personalized and accurate crop recommendations. The fundamental goal of an intelligent crop recommendation system is to enhance agricultural productivity and profitability while minimizing environmental impact. By suggesting the most suitable crops based on the specific conditions of a farm, these systems can help farmers make informed decisions and maximize their yields. Additionally, intelligent crop recommendation systems can aid in resource management by optimizing the use of fertilizers, pesticides, and water, thus reducing waste and potential harm to the environment.

The success of intelligent crop recommendation systems relies heavily on the quality and diversity of the data used for analysis. Integration of various data sources, such as satellite imagery, weather stations, soil sensors, and market data, provides a comprehensive understanding of the agricultural landscape. With access to real-time and historical data, these systems can continuously learn and adapt, improving the accuracy of their recommendations over time.

Furthermore, intelligent crop recommendation systems can consider multiple objectives and constraints, such as crop rotation, disease resistance, and market demand, to provide holistic and tailored recommendations to farmers. By considering a wide range of factors, these systems help optimize crop selection for long-term sustainability and economic viability.

II. LITERATURE REVIEW

[1] S.Pudumalar*, E.Ramanujam*, R.HarineRajashreeń, C.Kavyań, T.Kiruthikań, J.Nishań. :: In a country like India in which agriculture plays a dominant role. The prosperity of nation increases because of farmers prosperity. Thus our work would help farmers in sowing the right seed based on soil requirements to enhance productivityand gain profit out of such a technique. Thus the farmers can plant the right cropimproving their income and also increasing the gross productivity of the state. Our future work is focused on an upgraded data set with a large number of attributes and also implements yield prediction

[2] Shikha Ujjainia, Pratima Gautam, S. Veenadhari :: From the above analysis, it has been concluded that technology has achieved that level of competency by which agriculture can easily predict cropyielding production. Machine learning technology proposed the model integrated form of a concept. By estimating the different parameters of biosystems has been recognized that the technology used for making the crop yielding prediction device is very much variegated. The parameters of biosystems vary concerning changing location and a single concept of algorithm is not sufficient to fulfill the requirement of crop prediction.

[3] Mahendra Choudhary, Rohit Sartandel, Anish Arun, LeenaLadge SIES Graduate School of Technology, Maharashtra, India Corresponding author: Rohit Sartandel, Email:rohit.sartandel18@siesgst.ac.i :: At present, our farmers are not using technology and analytics productively, so there is a probability of fallacious crop selection for cultivation, which will reduce theirincome. To fend off such dropping, we have developed a farmer-friendlysystem with a graphical user interface (GUI) that will predict which crop would be the best fit for a specific plot of land. This system will also furnish details on the essential nutrients to add to the soil and help them to pick out crop diseases. As a result, farmers are more likely to make the proper decisions for crop selection, and farmers will
benefit from earning more profits. With the help of more composite algorithms, the efficiency of the model can be increased. To boost the efficiency of crop selection and yield, incorporate the crop recommendation system with yield prediction. By increasing the dataset's size and by including more crop information and pictures of infected plants, the efficiency of the model can be increased.

II. PROPOSED SYSTEM

The proposed system harnesses the power of data analysis technology to actively monitor and update crop yield rates. Its primary objective is to introduce a robust crop selection method that effectively tackles the challenges faced by farmers and the agricultural sector. By maximizing crop yield rates, this approach seeks to make a substantial contribution to the overall improvement of the Indian economy.

One of the key strengths of the system lies in its ability to consider diverse land conditions and accurately identify the quality of crops. Through this process, the system distinguishes high-quality crops, enabling farmers to make informed decisions about their cultivation choices. To enhance the precision of crop predictions, the system leverages an ensemble of classifiers, such as Decision Tree and Random Forest classifiers. By combining the outputs of multiple classifiers, the system enhances decision-making capabilities, leading to more reliable predictions and improved efficiency.

The integration of ensemble classifiers into the decision-making process further strengthens the overall system performance. By incorporating the insights and predictions from multiple classifiers, the system attains higher accuracy and better adaptability. This integration ensures that the proposed system maximizes the potential of data analysis technology and effectively addresses the challenges faced by farmers and the agricultural sector. In summary, the proposed system capitalizes on data analysis technology to continually monitor and update crop yield rates. Its core objective is to introduce a comprehensive crop selection method that overcomes existing agricultural challenges. By prioritizing the maximization of crop yield rates, the system aims to contribute significantly to the advancement of the Indian economy. Through its consideration of diverse land conditions, accurate crop quality identification, and integration of ensemble classifiers, the system enhances prediction accuracy, decision-making capabilities, and overall system efficiency.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 11, May 2023

2.1 Being System

The proposed project introduces a novel model aimed at addressing existing agricultural challenges. The system's key focus is to guide farmers in maximizing crop yield and selecting the most profitable crops for specific regions.

By considering economic and environmental conditions, the proposed model offers crop selection recommendations that prioritize both maximizing yield and meeting the country's increasing food demand. The model predicts crop yield based on factors such as state, district, area, and season, while also assisting in determining the optimal timing for fertilizer application.

For production-related inputs, the user provides information on the state, district, season, crop, and area. For crop recommendation, the user provides details on the state, district, season, and area. Based on these inputs, the model predicts the crop yield for a specific crop and suggests the most profitable crop option, along with the ideal time for fertilizer application.

The primary objective of the system is to offer a diverse range of crops suitable for each season. By providing guidance in crop selection, the proposed system aims to minimize farmers' challenges and maximize overall yield.

Overall, the proposed system presents a valuable solution that assists farmers in selecting crops, maximizing yield, and overcoming difficulties in decision-making.

III. PROPOSED WORKFLOW

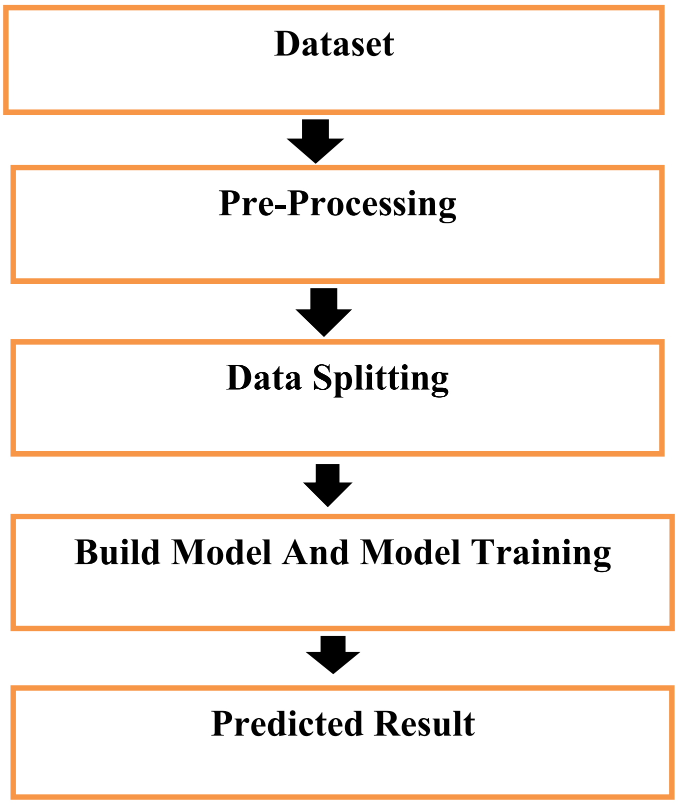


Fig: Proposed Workflow

IV. IMPLEMENTATION

4.1 Input Dataset

The dataset provided to the system as inputs which include parameters like soil pH, humidity, N, P, K, temperature rainfall and the labels of the crops which are going to be given by a system as output.

IJARSCT

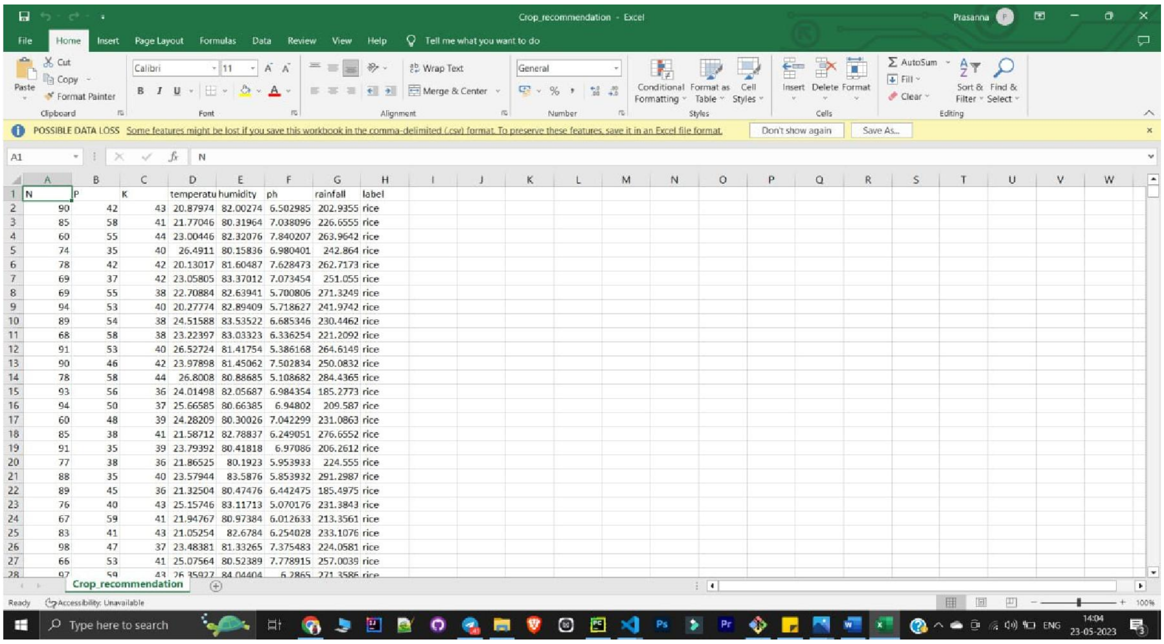
ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 11, May 2023



	N	P	K	temperatu	humidity	ph	rainfall	label
2	90	42	43	20.87974	82.00274	6.502985	202.9355	rice
3	85	58	41	21.77046	80.31964	7.038096	226.6555	rice
4	60	55	44	23.00446	82.32076	7.840207	263.9642	rice
5	74	35	40	26.4911	80.15836	6.980401	242.864	rice
6	78	42	42	20.13017	81.60487	7.628473	262.7173	rice
7	69	37	42	23.05805	83.37012	7.073454	251.055	rice
8	69	55	38	22.70884	82.63941	5.700806	271.3249	rice
9	94	53	40	20.27774	82.89409	5.718627	241.9742	rice
10	89	54	38	24.51588	83.53522	6.685346	230.4462	rice
11	68	58	38	23.22397	83.03323	6.336254	221.2092	rice
12	91	53	40	26.52724	81.41754	5.386168	264.6149	rice
13	90	46	42	23.97898	81.45062	7.502834	250.0832	rice
14	78	58	44	26.8008	80.88685	5.108682	284.4365	rice
15	93	56	36	24.01498	82.05687	6.984354	185.2773	rice
16	94	50	37	25.66585	80.66385	6.94802	209.587	rice
17	60	48	39	24.28209	80.30026	7.042299	231.0863	rice
18	85	38	41	21.58712	82.78837	6.249051	276.6552	rice
19	91	35	39	23.79392	80.41818	6.97086	206.2612	rice
20	77	38	36	21.86525	80.1923	5.953933	224.555	rice
21	88	35	40	23.57944	83.5876	5.853932	291.2987	rice
22	89	45	36	21.32504	80.47476	6.442475	185.4975	rice
23	76	40	43	25.15746	83.11713	5.070176	231.3843	rice
24	67	59	41	21.94767	80.97384	6.012633	213.3561	rice
25	83	41	43	21.05254	82.6784	6.254028	233.1076	rice
26	98	47	37	23.48381	81.33265	7.375483	224.0581	rice
27	66	53	41	25.07564	80.52389	7.778915	257.0039	rice
28	97	59	43	26.35927	84.04404	6.2865	271.3586	rice

Fig: Input dataset

Fig : Dataset connector

Code Generation :

The generation of source code by using different libraries such as stremlit, Numpy, Image, pickle, requests, st_lottie. Here we connect the above dataset and write the programe which display frontend of the web.

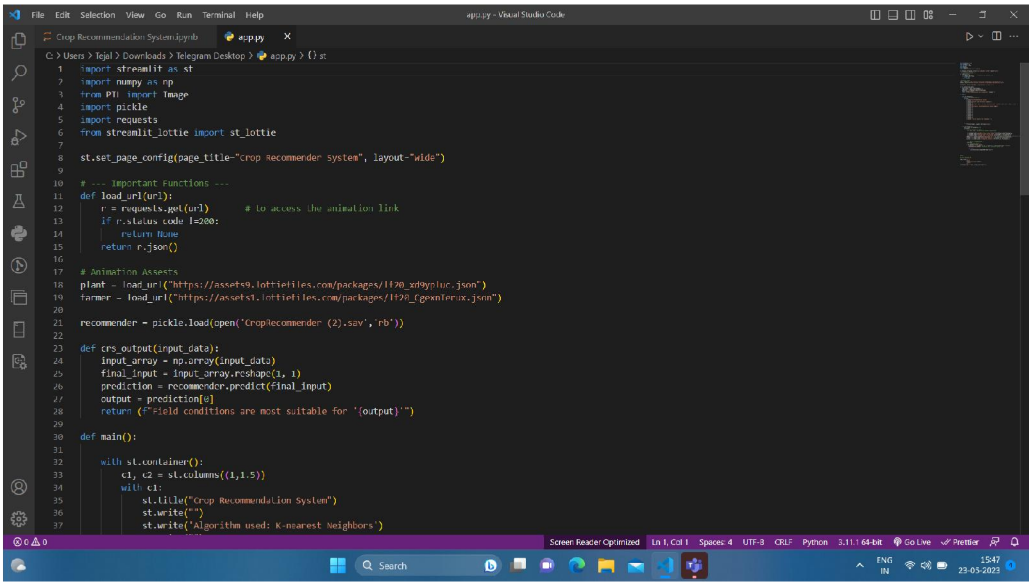


Fig: Source code

DOI: 10.48175/IJARSCT-10585

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 11, May 2023

Web Front View :

After running source code we will get webpage as :

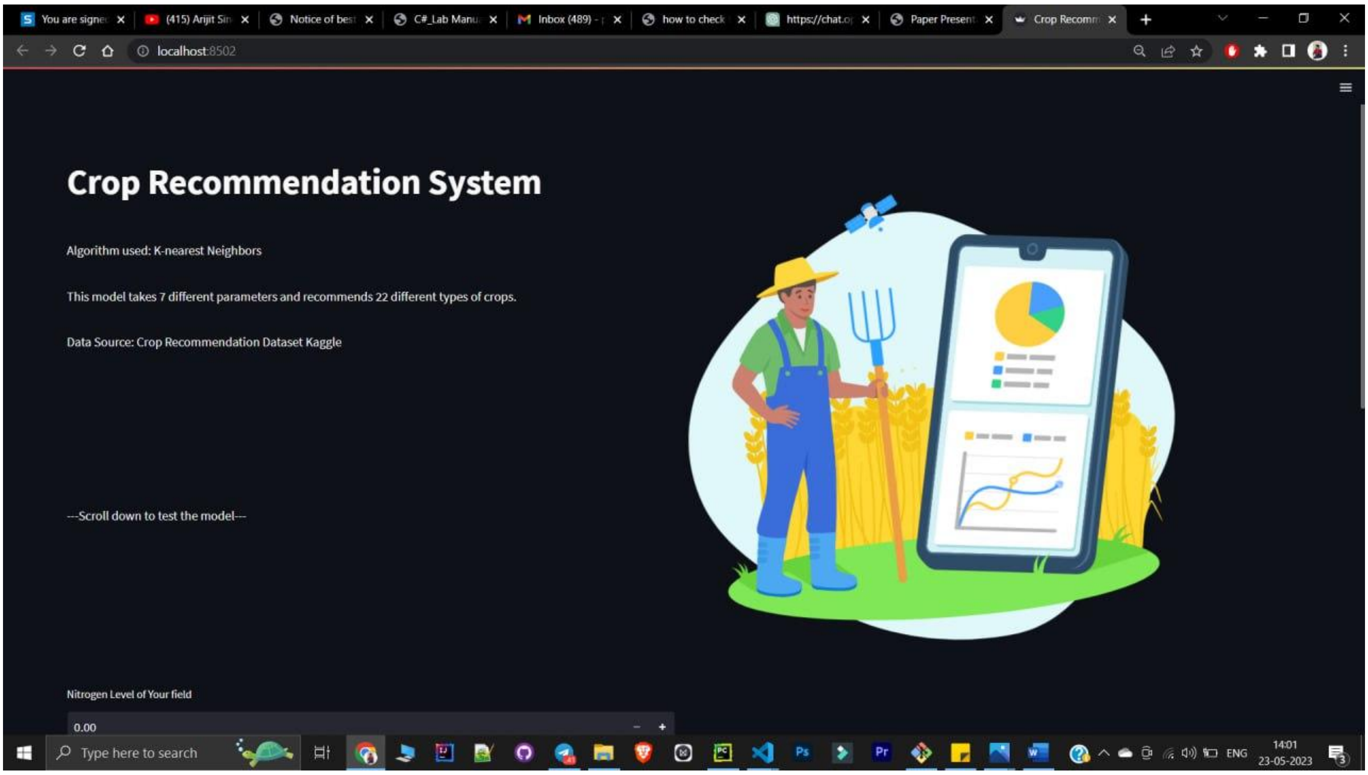


Fig : WebView

Final Output :

It shows final output that is the recommended crop .

Web FrontView :

After running source code we will get webpage as :

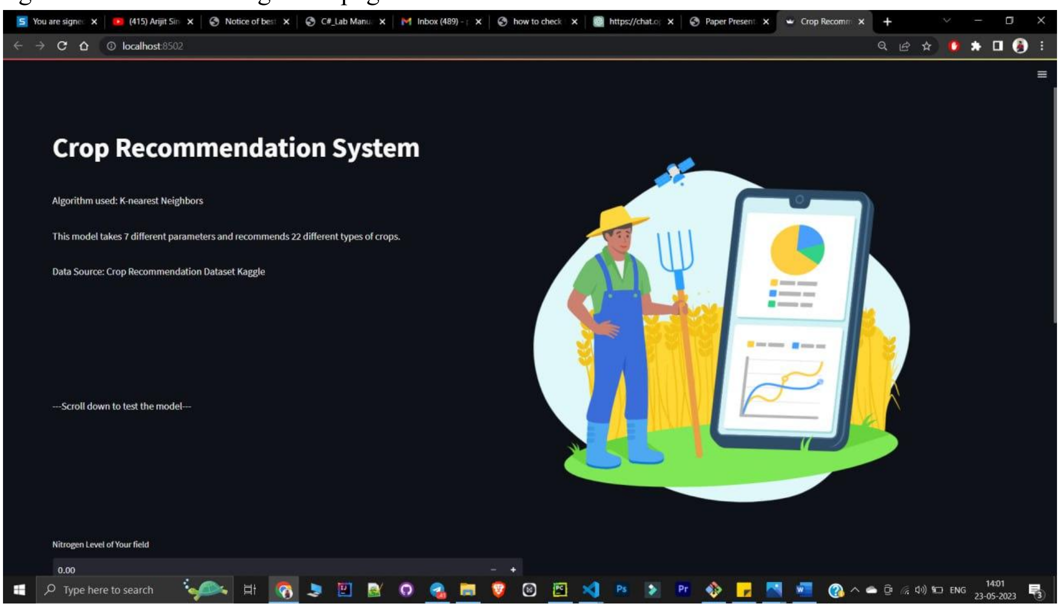


Fig : WebView

IJARSCT ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 11, May 2023

Final Output :

It shows final output that is the recommended crop .

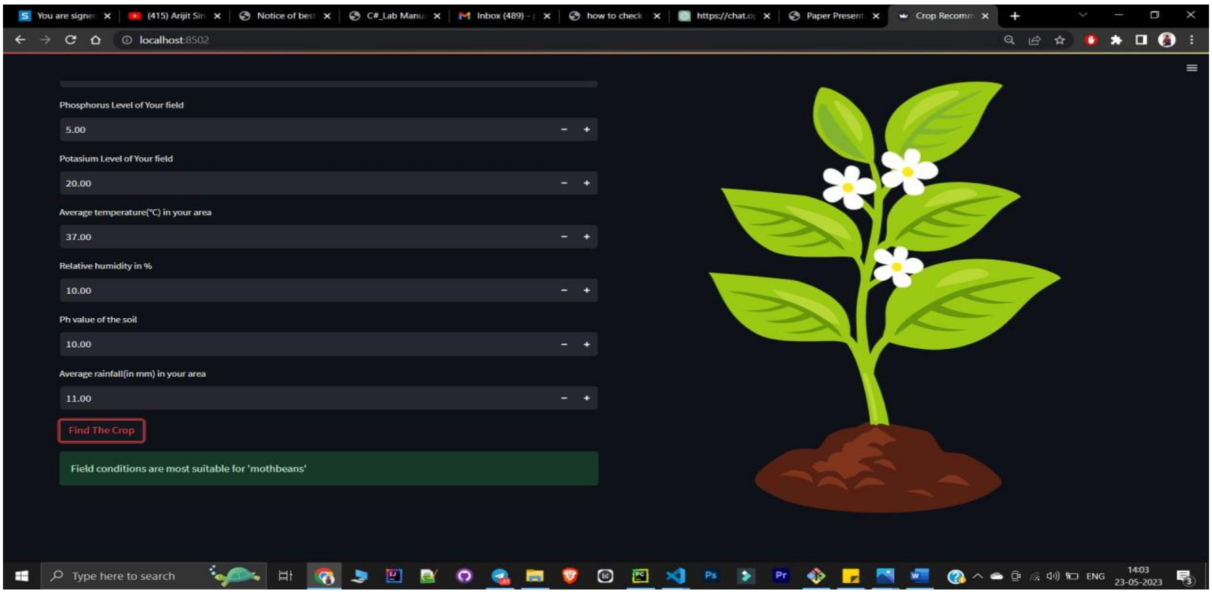


fig: Final output

V. TOOLS AND TECHNOLOGIES USED

- Python: Python is an abundance of powerful tools ready for scientific computing Packages. Thepackages like NumPy, Pandas and SciPy, Streamlite-lottie, Pillow. Pickle_mixing.
- NUMPY: NumPy is a powerful Python library which provides a fundamental infrastructure for numerical computing. It stands for "Numerical Python" and provides efficient data structures, mathematical functions, and tools for working with large arrays and matrices. NumPy forms the foundation for many scientific and data analysis libraries in Python.
- SCIKIT-LEARN : It features numerous classification, clustering and regression algorithms like random forests, SVM and it furthermore supports Python scientific and numerical libraries like SciPy and NumPy.
- TENSORFLOW: In the TensorFlow [22] has an open source software library for numerical computation using data flow graphs.
- IDE used: Jupyter Notebook, PyCharm
- Dataset used: Kaggle Crop Dataset

VI. FUTURE SCOPE

The future scope of intelligent crop recommendation systems includes:

- Integration of IoT and sensor technologies for real-time data collection.
- Harnessing big data and advanced analytics techniques for improved recommendations.
- Utilizing remote sensing and satellite imagery for precise and proactive decision-making.
- Incorporating crop genetics and genomics to recommend resilient and high-yielding crop varieties.
- Developing user-friendly mobile applications and decision support tools for accessibility.
- Promoting collaboration and knowledge sharing among farmers and experts.

These advancements aim to enhance the accuracy, efficiency, and sustainability of crop recommendations, contributing to improved agricultural practices and global food security

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 11, May 2023

VII. CONCLUSION

The proposed system framework for an intelligent crop recommendation system harnesses emerging technologies, and advanced machine learning algorithms, including ensemble methods and deep learning, enhance the accuracy and robustness of the recommendations by capturing complex patterns and relationships in the data. the proposed system framework represents a significant step forward in intelligent crop recommendation systems, offering a comprehensive and technologically advanced approach to assist farmers in making optimal crop decisions. By leveraging the power of data, analytics, and user-friendly interfaces, the system has the potential to revolutionize agriculture and drive sustainable farming practices in the future.

REFERENCES

[1]. Shilpa Mangesh Pande, Prem Kumar Ramesh, Anmol, B R Aishwarya, Karuna Rohilla and Kumar Shaurya, Crop Recommendation using Machine Learning Approach, Proceedings of the Fifth International Conference on Computing Methodologies and Communication (ICCMC 2021).

[2]. https://www.researchgate.net/publication/331426761_Crop_Recommendation_System_to_Maximize_Crop_Yield_in_Ramtek_region_using_Machine_Learning

[3]. Haedong Lee and Aekyung Moon, “Development of Yield Prediction System Based on Real-time Agricultural Meteorological Information”, 16th International Conference on Advanced Communication Technology, 2014

[4]. Pudumalar, S., E. Ramanujam, R. Harine Rajashree, C. Kavya, T. Kiruthika, and J. Nisha. "Crop recommendation system for precision agriculture." In 2016 Eighth International Conference on Advanced Computing (ICoAC), pp. 32-36. IEEE, 2017.

[5]. T.R. Lekhaa, “Efficient Crop Yield and Pesticide Prediction forImproving Agricultural Economy using Data Mining Techniques”,International Journal of Modern Trends in Engineering and Science(IJMTES), 2016, Volume 03, Issue 10

[6]. https://www.researchgate.net/publication/335799151_Crop_Recommendation_System_for_Precision_Agriculture