Volume: 12 Issue: IV Month of publication: April 2024

DOI: https://doi.org/10.22214/ijraset.2024.59848

Smart Agriculture Automation System using ML

Prof. D. A. Nikam[1], Mr. Harshad M. Bujare[2], Mr. Sujay P. Gavali[3], Mr. Akash M. Patil[4], Mr. Prajwal T. Konuri[5], Miss. Shrawani B. Desai[6]
Dr. J.J. Magdum College of Engineering, Jaysingpur.

Abstract: The "Smart Agriculture Automation System using Machine Learning" project envisages a future where farming transcends manual labor and embraces data-driven automation. In response to the escalating demand for food amidst a burgeoning global population, traditional farming methods are rendered insufficient. However, Smart Agriculture Automation Systems offer a transformative solution by enhancing crop production efficiency and maintaining yield quality. Climate change-induced challenges such as erratic weather patterns and heightened pest attacks further underscore the necessity for innovation in agriculture.

At the heart of this system lies real-time sensor data, enabling precision farming practices that optimize resource utilization while fostering environmental sustainability. Leveraging Machine Learning algorithms, the system not only predicts and mitigates agricultural challenges but also detects early signs of crop diseases and nutrient deficiencies. This proactive approach ensures higher yields minimizes manual tasks and minimizes wastage.

The integration of IoT technology enables remote monitoring and seamless data exchange, unlocking capabilities such as precise crop prediction, weather forecasting, and fertilizer recommendations. By analyzing historical data alongside current environmental factors, these systems accurately forecast crop yields and offer insights for informed decision-making in planting and harvesting cycles. Smart Agriculture Automation Systems embody adaptability, sustainability, and accessibility, heralding a new era of intelligent and efficient modern farming.

This project integrates the Internet of Things (IoT) sensors and an innovative marketplace to revolutionize the agricultural landscape. Through this system, we aim to empower farmers with data-driven insights,

Keywords: Random Forest, Machine learning, IOT, Prediction, Recommendation.

I. INTRODUCTION

The "Smart Agriculture Automation System with ML" project integrates various advanced technologies to revolutionize farming practices. It utilizes IoT sensors to collect real-time data on environmental conditions such as temperature, humidity, and soil moisture. This data is then processed using machine learning algorithms, particularly in image analysis, to detect early signs of crop diseases, nutrient deficiencies, and pest infestations. By providing farmers with timely insights into their crop health, the system enables proactive decision-making, leading to improved yields, crops, and soil fertility without reducing losses.

Furthermore, the project includes the development of an innovative marketplace platform that connects farmers directly with consumers. This platform ensures fair pricing and transparency in agricultural transactions, fostering trust and accountability within the agricultural supply chain. One of the key findings of the project is the significant enhancement in farming efficiency achieved through the integration of IoT and ML technologies. By accurately predicting and mitigating challenges such as adverse weather conditions and pest outbreaks, farmers can optimize resource allocation and minimize crop losses. Additionally, the marketplace component promotes sustainability by encouraging local consumption and reducing the carbon footprint associated with long-distance crop transportation and enhanced sustainability. Overall, the "Smart Agriculture Automation System with ML" project demonstrates the transformative potential of modern technologies in addressing the challenges faced by the agricultural sector while fostering sustainability and resilience in food production dataset. The which is entered by the user is passed through the model and crop which is appropriate for the soil and environmental conditions entered by the user. In the second module, the user needs to upload a picture of the pest on the plant.

II. LITERATURE REVIEW

The literature review of the project reveals a critical need for advanced agrarian decision support systems to address the limitations of husbandry practices. Current husbandry opinions, frequently grounded on suspicion and profitable pressures, can lead to significant fiscal pitfalls and indeed woeful consequences similar to planter self-murders, particularly in countries like India where husbandry plays a central part in frugality.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

The analysis underscores the necessity of using ultramodern technologies similar to machine literacy (ML) and to develop intelligent crop and fungicide recommendation systems. Research highlights the significance of considering colorful factors, including climate, soil quality, and literal rainfall patterns, in crop selection and operation. By integrating data on geographical rainfall distributions specific to each state or region in India, growers can make further informed opinions regarding crop selection, resource allocation, and threat operation.   Proposed approaches, similar to Formalized Greedy Forest, offer promising styles for determining optimal crop sequences and minimizing agrarian pitfalls. likewise, using literal rainfall data enables the vaticination of seasonal rainfall patterns, furnishing precious perceptivity for crop planning and operation. By exercising ML and AI algorithms, growers can optimize resource operation, alleviate pitfalls associated with climate variability, and promote sustainable agrarian practices. Overall, the literature review emphasizes the transformative eventuality of intelligent crop and fungicide recommendation systems in enhancing agrarian productivity, sustainability, and adaptability in regions like India.

Random Forest and **Decision tree** are used to train the dataset with each algorithm. By using a voting classifier, a highly accurate model is generated In this library, we get the CNN algorithm which we used to train the model by taking the different pest images. The image uploaded by the user is passed through the model classified and compared with the dataset and recognized as the pest.

Paper title	Project work	Dataset used	Backend technologies	Results
Soil analysis and crop fertility prediction	Soil analysis through nutrients and ph level	USDA-NRCS soil data mart	Naïve bayes and random forest	Crop fertility , data of soil
Soil analysis and crop prediction	Soil analysis and crop prediction with temperature & soil moisture	Rainfall dataset and data set of crop macro nutrients	Naïve bayes, logistics algo, C4.5 algorithm	Crop yield prediction by 50% through soil reports
Intelligent crop & pesticide recommendation portal using ml	Soil quality assessment and pesticide recommendation	Weather data soil test results	Random forest , deep learning, SVM, SVC	Improved crop yields, reduced pesticide use
Soil analysis & crop prediction	Developed ml model to predict crop yeilds	USDA-NRCS, Data mart, weather data	Random forest, deep learning	Improved predictions by 15%
Crop fertilizer prediction	Recommend optimal fertilizers	Soil tests results weather data	Decision tree	Increased fertlizers by 15%
Crop disease detection	**Model to detect crop disease**	**Image data set**	**Convolutional neural dataset**	**Predict disease by 90% indetification**

Table No.: 1: Reference's

If a farmer had access to such data, he or she could decide how much water and fertilizer would be required for each crop type being planted. This would garner enormous profits for the entire region of India because not only would it guarantee sustainability but also promote overall growth distribution of weather conditions specific for every state or region in India. If a farmer had access to such data, he or she could decide how much water and fertilizer would be required for each crop type being planted.

To apply perfection husbandry(An ultramodern husbandry fashion that uses exploration data on soil characteristics, soil types, and crop yield data collection and suggests the growers the right crop grounded on their point-specific parameters to reduce the wrong choice on a crop and increase productivity). To break the problem by proposing

Algorithms and technology enforced in the design A model is developed using a voting classifier. In the voting classifier machine literacy algorithms, Random Forest and decision tree are used to train the dataset with each algorithm. By using a voting classifier, a largely accurate model is generated on the dataset. The which is entered by the stoner is passed through the model and crop which applies to the soil and environmental conditions entered by the stoner. In the alternate module, the stoner needs to upload a picture of the pest in the factory. An RGB(Red, Green, Blue) image is suitable for this design. After acquiring the picture from the stoner, we developed a model using CNN,

III. METHODOLOGY

The methodology for developing the Smart Agriculture Automation System begins with a comprehensive requirement analysis to understand the project objectives, focusing on crop prediction, fertilizer recommendation, and yield forecasting. Following this, a hardware setup is established by integrating essential components such as NPK sensors, humidity and temperature sensors, soil moisture sensors, water level sensors, gas sensors, ESP32, and Arduino boards. Data collection ensues, capturing real-time environmental and soil data, which is then preprocessed to ensure accuracy and reliability.

Machine learning models, employing algorithms like Random Forest and Decision Tree, are developed and trained using historical data to predict suitable crops, recommend fertilizers based on NPK values and soil conditions, and forecast crop yields. The models are fine-tuned through hyperparameter optimization and performance evaluation. Concurrently, a user-friendly web application is designed and implemented, offering interfaces for inputting sensor data and presenting prediction outcomes and recommendations. Extensive testing is conducted across various levels to validate system functionality and accuracy. Deployment on a secure platform follows, accompanied by continuous monitoring for performance metrics and user interactions. Maintenance and improvement strategies are implemented to incorporate feedback, enhance model accuracy, and refine system usability over time, ensuring the Smart Agriculture Automation System's effectiveness and reliability in agricultural decision-making processes.

Parameters information:

N- rate of Nitrogen content in soil

P- rate of Phosphorous content in soil

K- rate of Potassium content in soil

Temperature- temperature in degree Celsius moisture-relative moisture in pH value of the soil downfall- downfall in mm

The platform is engineered to accommodate diverse farming practices and support multi-crop patterns. By integrating NPK sensor data into the system, farmers can tailor their cultivation strategies based on specific nutrient requirements for different crops,

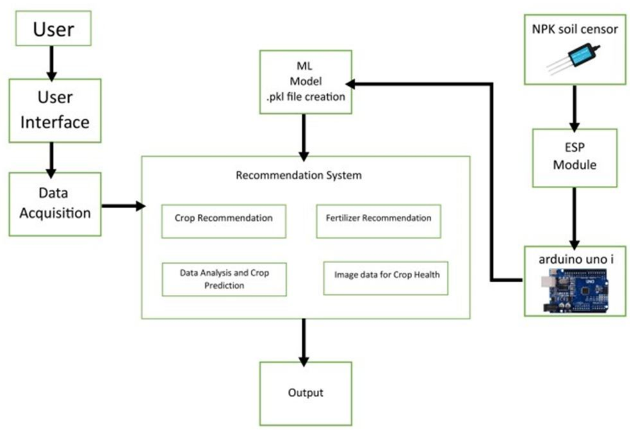


Fig: 2 : System architecture diagram

IV. PROPOSED SYSTEM

The project will commence with a thorough initiation phase, defining clear objectives, and scope. A teamwork comprising data analysis, planning, and agriculture things will be assembled. A comprehensive project plan will be developed, encompassing key timelines, milestones, and resource allocation, ensuring a strong foundation for the project. Data Collection and Integration. A network of sensors and IoT devices will be deployed in the agricultural fields to collect real-time data on soil conditions, and crop health. Data integration processes will be put in place to enable the seamless transfer and storage of data in a centralized database. Data pipelines will be established to ensure data consistency and quality, enabling accurate analysis. Data Pre-processing and Cleaning Following data collection, the project will focus on pre-processing and cleaning to eliminate noise and inconsistencies. Strategies for handling missing data and outliers will be employed to ensure the quality and integrity of the data used in subsequent analyses. Data Analysis and Machine Learning Model Development Machine learning algorithms will be leveraged to analyze the historical data and identify meaningful patterns. Predictive models will be developed for disease and pest detection, and yield forecasting.

V. FUTURE SCOPE

1) Direct Communication with Researchers: Farmers will have a platform to connect odirectly with researchers to discuss crop diseases, future farming techniques, and profitability.
2) Multilingual Support: The application will be upgraded to support multiple languages, breaking down language barriers and ensuring accessibility for farmers of different linguistic backgrounds.
3) Government Schemes and Financial Support: The application will provide easy access to government schemes and financial assistance, simplifying the process for farmers to avail themselves of benefits.

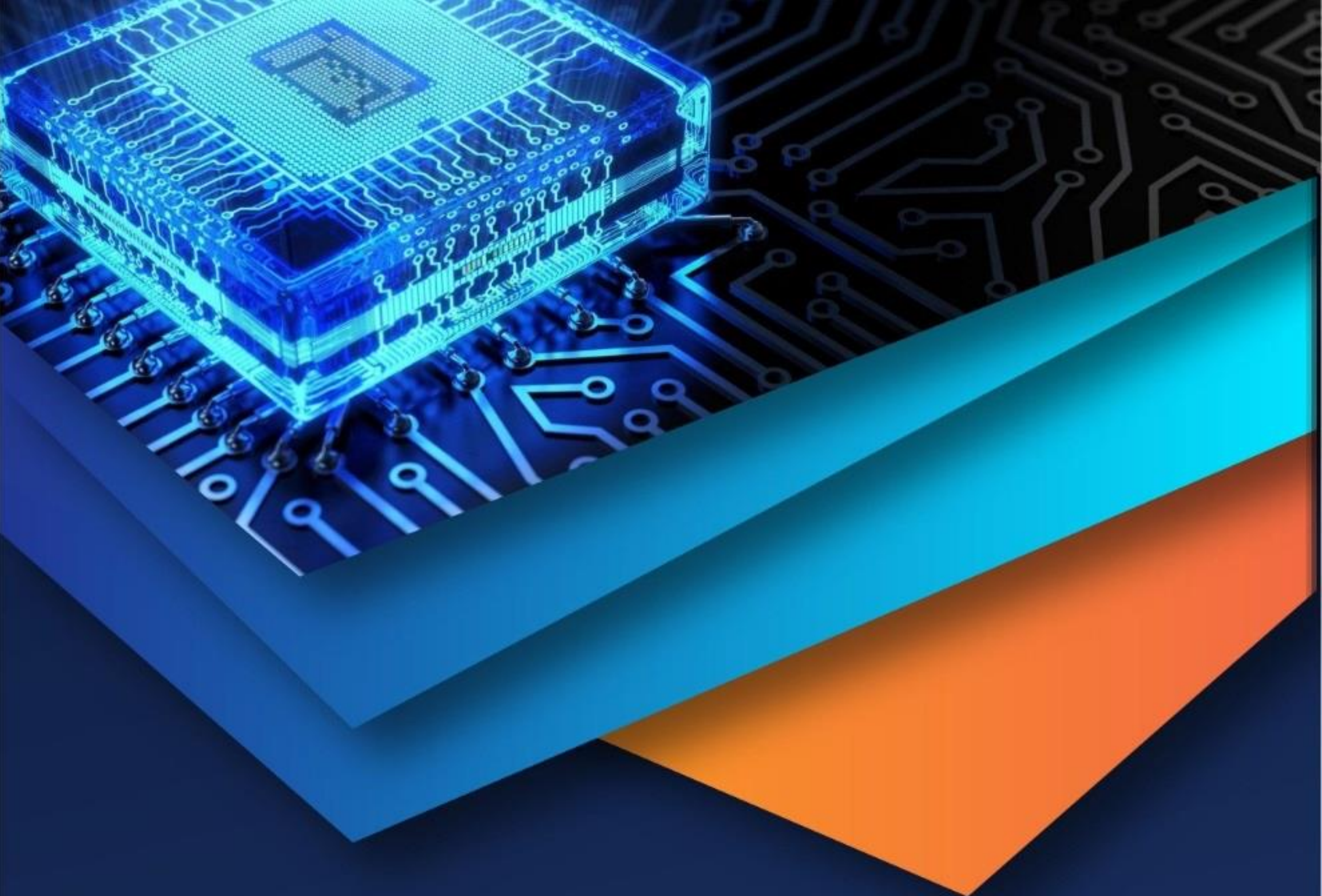
4) Home Delivery: Farmers will be able to directly deliver their products to consumers through the platform, enhancing profitability and fostering direct communication.
5) Advanced IoT Devices: Integration of advanced IoT devices will automate farm equipment operations, reducing manual labor and increasing efficiency, especially during natural calamities

VI. CONCLUSION

To enhance the efficiency and sustainable farming of crop production by optimizing resource allocation, monitoring crop health, automating various agricultural tasks, and making farmers profitable

REFERENCES

[1] Deepali Nikam : "Intelligent crop and pesticide recommendation portal using ML and AI, International research journal of modernization in engineering technology & science, vol-04/issue-06/June-2022, ISSN-2582-5208
[2] Author Name, "IoT-Based Smart Agriculture: Towards Making Agriculture Smart," Journal of Agricultural Science and Technology, Vol. 5, Issue 2, (2020).
[3] Author Name, "Machine Learning Applications in Agriculture," Agricultural Journal, Vol. 12,Issue 3, (2019).
[4] Author Name, "Digital Marketplace in Agriculture: A Comprehensive Review," International Journal of Agricultural Management, Vol. 8, Issue 1, (2021)
[5] Author Name, "IoT-Based Smart Agriculture: Towards Making Agriculture Smart," Journal of Agricultural Science and Technology, Vol. 5, Issue 2, (2020).
[6] Author Name, "Machine Learning Applications in Agriculture," Agricultural Journal, Vol. 12, Issue 3, (2019).
[7] Author Name, "Digital Marketplace in Agriculture: A Comprehensive Review," International Journal of Agricultural Management, Vol. 8, Issue 1, (2021)



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)