Development Of An AI-ML-Based Crop And Soil Management Application For Farmers

Ramya J, Rakshitha N, Tharun Kumar K S, Yogesh P

Assistant Professor, Student, Student, Student, Student,
Dept. of Computer Science and Engineering,
ATME College of Engineering, Mysuru, India

Abstract: Agriculture is a essential region that faces demanding situations consisting of unpredictable climate

situations, soil degradation, and inefficient useful resource control. The Crop and Soil control device is a web-primarily based application designed to assist farmers by means of integrating artificial Intelligence (AI) and gadget getting to know (ML) for precision farming. This gadget presents crop yield prediction, fertilizer pointers, and soil health evaluation to assist farmers make records-pushed selections and improve productivity.

Key Terms–Agriculture portal, AI-based crop prediction, Machine

INTRODUCTION

Agriculture plays a crucial role in global food security and economic stability. Traditional farming methods often rely on experience and generalized knowledge, leading to inefficiencies in resource use and crop selection. The advent of AI and ML in agriculture presents a transformative approach to farm management, providing data-driven insights for precision farming. This paper discusses the development of an AI-ML-based crop and soil management application, highlighting its features, methodologies, and benefits for farmers. AI-ML techniques have transformed agricultural practices by enabling automated soil analysis, pest detection, and yield predictions. These advancements facilitate decision-making, reduce labor costs, and optimize farm resources. Research indicates that integrating AI in agriculture can increase crop productivity by up to 25% while minimizing resource wastage. Traditional farming knowledge. However, challenges such as soil degradation, unpredictable climate conditions, and inefficient use of fertilizers and pesticides contribute to decreased productivity. AI-ML-based solutions aim to mitigate these issues by offering precise recommendations and predictive analytics to assist farmers. Several studies have explored the application of AI and ML in agriculture. Research by Sharma & Gupta (2021) highlights the role of machine learning in crop yield prediction, while Zhang et al. (2022) examine deep learning techniques for plant disease detection. Additionally, Khan & Abbas (2023) discuss data-driven fertilizer recommendation systems, emphasizing the importance of soil nutrient analysis. These studies underscore the potential of AI-ML in enhancing agricultural productivity and decision-making. Overall, the agriculture portal serves as an essential tool for agricultural

management, promoting efficiency, transparency and improved communication among stakeholders in the agricultural sector. Its designed and functionality aim to support the growing needs of the agricultural community, making it a vital resource for administrators. Intelligence (AI) and device gaining knowledge of (ML) into modern farming practices. This gadget enables farmers to make facts-pushed selections by using offering actual-time insights into soil health, recommending appropriate plants, and suggesting top-rated fertilizers primarily based on soil nutrient levels. additionally, the system predicts crop yields and rainfall to help farmers plan their cultivation cycles efficiently. The mission is constructed using Python for ML models, personal home page for backend improvement, and MySQL for statistics storage. It functions an intuitive interface that lets in farmers, customers, and administrators to engage efficiently. The device additionally consists of question management, consumer authentication, and crop stock management to ensure a seamless enjoy for all stakeholders. by using

leveraging facts analytics, AI-pushed predictions, and secure net technology, this undertaking ambitions to revolutionize conventional farming strategies. The last intention is to sell precision farming, reduce aid wastage, and increase agricultural efficiency, making farming extra sustainable and profitable.

I. METHODOLOGY

The proposed system comprises three main modules:

Soil Analysis: Uses AI algorithms to analyze soil composition and predict fertility levels. Which will help the farmers to analyze their soil type and better crop and for more yield.

Crop Recommendation: Recommends optimal crops based on soil quality, weather conditions, and historical yield data. And the chances of crop failure due to the above reason will be minimal.

Yield Prediction: Employs ML models such as Decision Trees, Random Forest, and Neural Networks to forecast crop yield.

The Crop and Soil management device follows a structured technique to make certain efficient design, implementation, and capability. The device structure is primarily based on a three-tier model which include a presentation layer (frontend the use of HTML, CSS, and JavaScript), an application layer (backend the usage of Hypertext Preprocessor), and a records layer (MySQL database for storing user and agricultural facts). The improvement begins with information series and preprocessing, in which relevant datasets on soil houses, crop yields, and fertilizer utilization are amassed, cleaned, and formatted the use of Pandas and NumPy. characteristic engineering is achieved to extract critical attributes which includes soil pH, nitrogen, phosphorus, potassium tiers, and climatic elements to beautify device gaining knowledge of model accuracy. For system learning implementation, Random wooded area and decision timber are used for crop prediction, while KNN and support Vector Machines (SVM) analyze soil nutrient tiers to provide fertilizer suggestions. additionally, Neural Networks are employed to are expecting crop yield primarily based on environmental conditions. The gadget consists of consumer authentication for cozy get right of entry to, permitting farmers, clients, and administrators to manipulate agricultural facts effectively. Key features including enter validation, session control, and password hashing make certain information integrity and protection towards cyber threats.

PROPOSED SYSTEM

The proposed system for the Agriculture Portal is designed to enhance the administrative functionalities and overall user experience significantly. This system will incorporate a modern, responsive user interface that allows administrators to manage customer and farmer data more efficiently. Key features will include advanced data management capabilities, such as bulk actions for record modifications and deletions, as well as enhanced search and filter options to quickly locate specific records. Additionally, the system will implement robust security measures, including prepared statements for database queries to prevent SQL injection attacks and improved session management to safeguard user data. The proposed system will also introduce a user feedback mechanism, enabling customers and farmers to provide insights and suggestions, which will help in continuously improving the platform. Furthermore, an analytics dashboard will be integrated to provide valuable insights into user data, allowing for informed decision-making and custom reporting capabilities. Overall, the proposed system aims to create a more efficient, secure, and user- friendly environment for managing agricultural data. The proposed Crop and Soil control gadget is designed to enhance agricultural productiveness by way of integrating synthetic Intelligence (AI) and system studying (ML) for statistics-driven decision-making. This net-based software presents crop yield prediction, fertilizer guidelines, and soil health analysis, permitting farmers to make informed selections for higher farming results. not like conventional techniques, this device leverages statistics analytics and predictive modeling to signify the excellent crops based on soil composition, weather situations, and nutrient degrees. The system is built using Python for ML fashions, Hypertext Preprocessor for backend processing, and MySQL for records garage. It includes an intuitive person authentication system that lets in farmers, clients, and directors to safely get admission to and control agricultural records. Key functionalities encompass farmer and client management, query coping with, crop stock monitoring, and an AI-driven recommendation engine for fertilizers and crop choice. to improve data visualization and usability, statistics Tables are

incorporated, permitting users to type, seek, and analyze agricultural facts effectively. security features which includes password hashing, enter validation, and session control make certain facts integrity and safety in opposition to unauthorized get entry to. moreover, an admin panel allows seamless gadget tracking and selection-making. The proposed gadget goals to modernize farming by way of presenting actual-time insights, reducing useful resource wastage, and selling precision agriculture. destiny upgrades can also

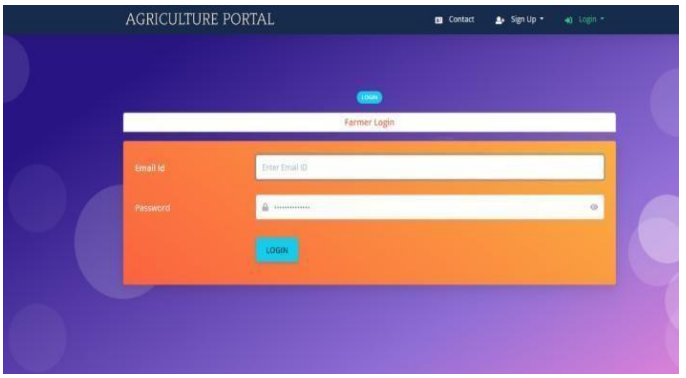
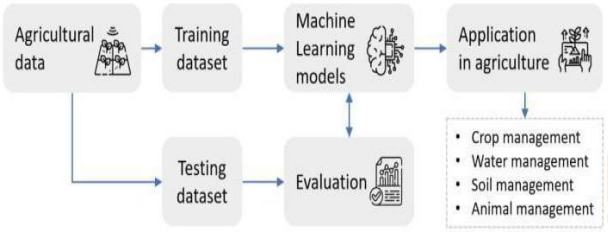


Fig 3: Farmer Login



Flow chart

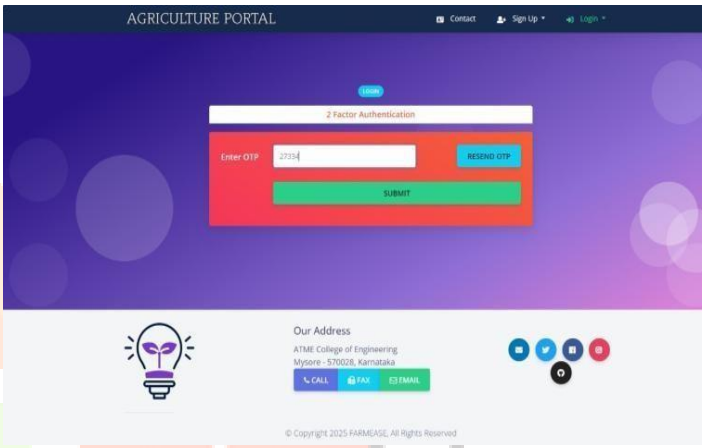


Fig 4: Factor Authentication

V.RESULTS

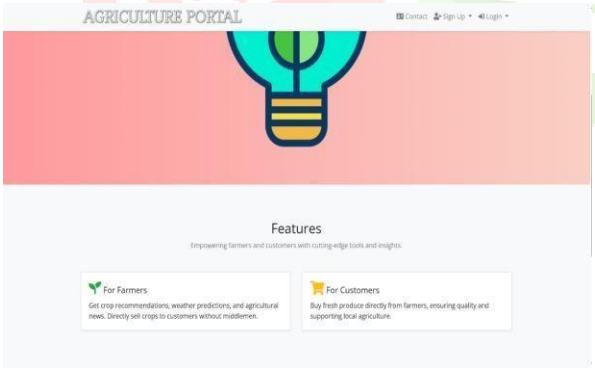


Fig 1:Home page

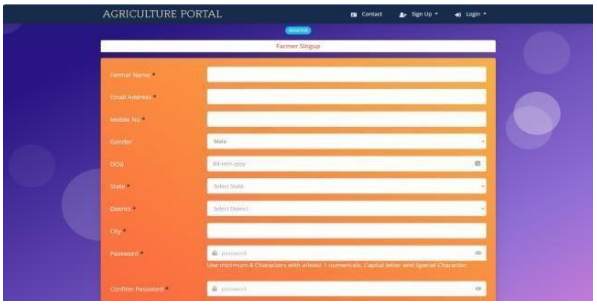


Fig 2: Farmer singup

CONCLUSION

The Agriculture Portal project has been meticulously designed to address the pressing need for efficient management of agricultural data and operations, ultimately enhancing productivity and decision-making within the sector. By employing a multi-tier architecture, the system effectively separates the user interface, business logic, and data access layers, ensuring a robust and scalable solution. The user-centric design of the portal prioritizes usability, allowing administrators, farmers, and customers to navigate the system with ease and access essential functionalities without unnecessary complexity. Key features such as comprehensive data management capabilities enable users to add, update, and delete records seamlessly, while advanced search and filter options facilitate quick data retrieval. Moreover, the integration of predictive analytics through machine learning models empowers users to make informed decisions based on data- driven insights, forecasting crop yields, customer behavior, and market trends. This capability not only optimizes operational efficiency but also fosters a proactive approach to agricultural management. The system's effective query management

feature enhances communication between customers and administrators, ensuring timely responses to inquiries and improving overall customer satisfaction. The Agriculture Portal is designed with scalability in mind, allowing for future enhancements and the incorporation of new features as user needs evolve. To maximize the portal's effectiveness, it is recommended that user training programs be implemented, regular updates be scheduled, and a feedback mechanism be established to gather user input for continuous improvement. In conclusion, the Agriculture Portal represents a significant advancement in agricultural management, poised to transform data handling and operational practices. Its successful implementation will not only benefit individual users but also contribute to the overall growth and sustainability of the agricultural sector, making it a vital tool for modern agriculture practice.

Future Areas

The future scope of the agricultural portal is promising and ther e are many opportunities for improvement and expansion to me et the developing needs of the agricultural sector. While techno logy is ongoing, the portal can integrate more complex data ana lysis and machine learning capabilities, allowing for deeper ins ights into agricultural trends and patterns. Future developments could include the implementation of advanced forecasting mod els that not only use big data analyses to predict crop yields, but also predict market requirement ,epidemics, outbreaks and climate impact. This allows farmer to make positive decision This improves user commitment, makes it easier to enter time, and allows farmer and managers to manage operations efficiently. Integration of internet of things(IOT) technology can also be considered enabling the integration of device with intelligent sensors to monitor ground conditions , weather pattern and harvests.

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