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Smart Organic Farming: Integrating Ai with Paramparagat Krishi Vikas Yojana (PKVY) for Sustainable Growth

Mr. Chethan R, Mrs. Sumitha C,
Assistant Professor
Anushree M, Archana D D, Chethan kumar K S, Pavan Kumar Y M
B.E. Student,
Department of Electrical & Electronics Engineering,
G Madegowda Institute of Technology, Bharathinagara, Mandya

Abstract - This project centers on leveraging advanced machine learning techniques to predict crop yields under the Paramparagat Krishi Vikas Yojana (PKVY), a national initiative promoting organic farming. By developing robust machine learning models that integrate diverse datasets encompassing soil characteristics, weather patterns, and crop-specific parameters, the study aims to enhance the sustainability and productivity of organic farming practices. The research employs a case study approach focused on Mandya district, targeting key crops such as Ragi, Coconut, Banana, and Sugarcane. Through predictive analytics, the project seeks to provide actionable insights to optimize agricultural outcomes, supporting the adoption of sustainable farming methods under the PKVY framework.

I. INTRODUCTION:

Agriculture is the backbone of the Indian economy, providing livelihood to a significant portion of the population and ensuring food security for the nation. However, conventional agricultural practices heavily dependent on chemical fertilizers, pesticides, and intensive resource use have led to serious environmental challenges such as soil degradation, water pollution, loss of biodiversity, and declining soil fertility. In response to these issues, organic farming has emerged as a sustainable alternative that promotes ecological balance improves soil health, and produces chemical-free food. To further strengthen organic farming practices, the Government of India launched the

Paramparagat Krishi Vikas Yojana (PKVY) with the objective of promoting cluster-based organic farming through participatory guarantee systems.

Agriculture has historically played a central role in shaping economic development, food security, social stability, and environmental sustainability, particularly in agrarian economies such as India. Despite significant advancements in agricultural technologies during the Green Revolution, the long-term consequences of intensive chemical-based farming have raised serious concerns related to soil degradation, groundwater contamination, biodiversity loss, and declining farm profitability. The growing dependence on synthetic fertilizers, pesticides, and monocropping practices has resulted in diminishing soil fertility, increased pest resistance, and adverse impacts on human health and ecosystems. In this context, the need for a transition toward sustainable and environmentally responsible agricultural systems has become increasingly urgent. Organic farming has emerged as a viable alternative that emphasizes ecological balance, soil health, and the use of natural inputs, offering a pathway to sustainable agricultural growth while addressing the limitations of conventional farming methods.

Indian agriculture is facing serious challenges due to unpredictable weather patterns, declining soil fertility, excessive use of chemical fertilizers, and inefficient water usage. Farmers often rely on traditional knowledge or trial-and-error methods, which may not always produce optimal results. Moreover, lack of access to real-time data and scientific recommendations results in low productivity and economic losses.

Organic farming is rooted in traditional agricultural knowledge systems that promote harmony between farming practices and natural ecosystems. It relies on biological processes, crop diversification, composting, green manuring, and biological pest control to maintain productivity without the use of synthetic chemicals. In India, organic farming aligns closely with indigenous practices that have been followed for centuries, making it culturally acceptable and environmentally suitable. However, despite its advantages, organic farming faces several challenges related to productivity, risk management, certification processes, market access, and knowledge dissemination. Farmers transitioning to organic methods often experience initial yield reductions, lack of technical guidance, and uncertainties related to pest management and climate variability. These challenges highlight the need for institutional support and policy interventions to enable farmers to adopt organic farming practices in a sustainable and economically viable manner.

Recognizing the importance of promoting organic agriculture, the Government of India launched the Paramparagat Krishi Vikas Yojana (PKVY) as a key initiative At the same time, the global agricultural sector is witnessing a rapid transformation driven by advancements in digital technologies. The emergence of smart farming, also known as precision agriculture, has introduced data-driven approaches to agricultural management. Smart farming integrates technologies such as artificial intelligence, machine learning, remote sensing, Internet of Things (IoT), drones, and big data analytics to optimize farming operations and improve decision-making. These technologies enable farmers and policymakers to monitor soil conditions, weather patterns, crop health, and pest infestations in real time, allowing for timely interventions and efficient resource utilization. The application of artificial intelligence in agriculture has shown significant potential in enhancing productivity, reducing input costs, and mitigating risks associated with climate change and market fluctuations.

II. LITERATURE SURVEY

- Kamilaris and Prenafeta-Boldú (2018) provide a comprehensive survey on deep learning applications in agriculture, highlighting its potential for crop monitoring, disease detection, and yield prediction, which are critical for enhancing organic farming practices through AI integration.
- Wolfert et al. (2017) review the role of big data in smart farming, emphasizing how data-driven approaches can optimize resource use and improve decision-making, aligning well with the goals of PKVY to promote sustainable organic farming clusters.
- Khanna and Kaur (2019) discuss the evolution of the Internet of Things (IoT) in precision agriculture, underscoring the significance of sensor networks and real-time data collection for precision organic farming.

under the National Mission on Sustainable Agriculture. PKVY was designed to encourage farmers to adopt organic farming practices through a cluster-based approach, reducing dependency on chemical inputs while enhancing soil fertility and environmental health. The scheme emphasizes participatory guarantee systems for certification, capacity building, and financial assistance for organic inputs. PKVY represents a significant policy commitment toward promoting sustainable agriculture, farmer empowerment, and ecological conservation. Since its inception, the scheme has contributed to an increase in organically cultivated areas and awareness among farmers regarding the benefits of organic practices. However, the implementation of PKVY has also revealed several operational challenges, including limited access to real-time agronomic information, difficulties in monitoring crop health, variability in yields, and constraints in supply chain integration.

- Singh et al. (2020) review the role of artificial intelligence in sustainable agriculture, noting AI's capacity to support environmental sustainability and resource efficiency, which complements PKVY's organic farming objectives.
- Reddy and Reddy (2019) analyze the status and challenges of organic farming in India, providing context on the socio-economic and infrastructural barriers that PKVY aims to address.
- The Ministry of Agriculture and Farmers Welfare (2015) outlines the operational guidelines of PKVY, establishing the framework for cluster-based organic farming promotion in India.
- Sharma et al. (2021) explore smart farming technologies tailored for organic agriculture, advocating for sustainable approaches that integrate AI and IoT for enhanced productivity.
- Liakos et al. (2018) review machine learning applications in agriculture, highlighting models that can be adapted for pest detection, yield forecasting, and soil health monitoring within organic farming systems.
- Kumar and Gupta (2020) discuss AI-based decision support systems designed for precision and organic farming, emphasizing the importance of tailored AI tools for farmer-centric applications.

III. PROBLEM STATEMENT AND OBJECTIVES:

Problem statement :

Despite initiatives like the Paramparagat Krishi Vikas Yojana (PKVY), the adoption of organic farming remains limited due to continued dependence on chemical fertilizers and pesticides, resulting in soil degradation, declining soil fertility, and long-term environmental imbalance. Traditional organic farming practices lack scientific, data-driven decision

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support systems to effectively assess soil health, predict crop yield, and guide sustainable crop planning. Additionally, organic farmers often operate in isolation without a digital platform to connect farmers cultivating similar crops (such as ragi or paddy), leading to inefficient multicropping decisions, poor market coordination, uneven production, and reduced income. The absence of an integrated system that combines soil health analysis, crop yield prediction, farmer networking, and market linkage limits the potential of organic farming for sustainable growth. Therefore, there is a critical need for an AI-enabled intelligent farming and farmerconnectivity platform that promotes chemical-free agriculture, improves soil health, supports sustainable farming practices, enhances crop-wise farmer collaboration, and increases overall crop yield and profitability in alignment with PKVY objectives.

Objectives

- Analyse , Design and Develop an AI-integrated web platform for organic farming.
- Integrate ML models for soil health and yield prediction
- Support sustainable agriculture through data-driven insights and Reduce chemical dependency through ML-based organic farming guidance.

IV. METHODOLOGY:

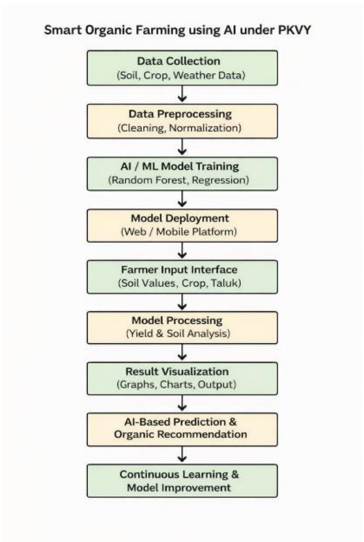

Fig 1: Block diagram to train the model.

The proposed AI-enabled organic farming support system operates through a structured and systematic workflow designed to collect, analyze, and process agricultural data to provide accurate yield predictions and organic farming recommendations. Initially, relevant agricultural data such as soil parameters including pH and NPK values, crop details, historical yield records, and weather information are collected from government agricultural datasets, PKVY farmer records, and field surveys. This collected data serves as the primary dataset for training the machine learning models.

Once the data is collected, it undergoes a preprocessing stage to ensure quality and reliability. During this phase, missing, noisy, and inconsistent values are removed. Data normalization and feature selection techniques are applied to standardize the dataset and retain only the most influential parameters required for effective machine learning model training.

After preprocessing, machine learning models such as Random Forest and regression algorithms are trained using historical agricultural data. These models learn complex relationships between soil conditions, crop types, climatic factors, and yield performance. Based on this learning, the system is capable of predicting crop yield and identifying suitable organic farming practices for different taluks.

The trained model is then deployed on a web-based application, making the system accessible to farmers, agricultural officers, and other stakeholders. This platform acts as an interactive interface between the AI system and end users. Through this interface, farmers can provide inputs such as soil test values, selected crop type, and taluk location, enabling the system to generate location-specific and crop-specific predictions.

Upon receiving farmer inputs, the AI model processes the data to analyze expected crop yield, assess soil health conditions, and identify appropriate organic farming practices. The results are presented to users through intuitive visualizations such as graphs, bar charts, and analytical dashboards. These visual outputs illustrate multicropping patterns across taluks, comparative yield performance, and soil condition analysis, making the insights easy to understand.

Based on the processed data, the system generates AI-driven predictions and organic farming recommendations. These include optimal crop combinations, organic nutrient management strategies, and eco-friendly pest control measures, thereby reducing farmers' dependency on chemical fertilizers and pesticides. Furthermore, the system incorporates a continuous learning mechanism, where new farmer inputs and seasonal outcomes are used to update and refine the model, ensuring improved accuracy and adaptability over time.

V. WORKING PRINCIPLE:

Fig 5: Block diagram of Working principle of model

The working principle of the proposed AI-enabled organic farming support system begins with secure user authentication, where farmers access the web-based application through a login module to ensure authorized and protected interaction with the system. Once authenticated, the system allows farmers to input essential agricultural details such as soil parameters, selected crop type, taluk location, and cultivation-related information. In addition to user-provided data, the system integrates historical datasets related to soil characteristics, weather conditions, and past crop yield performance to enhance prediction accuracy.

After data acquisition, the collected information undergoes processing and feature extraction. This stage involves data cleaning, normalization, and transformation of raw inputs into meaningful features suitable for machine learning model execution. The processed data is then fed into trained machine learning models, including Random Forest and regression algorithms, which analyze crop suitability, expected yield patterns, and soil health conditions based on learned relationships.

The outputs generated by the machine learning models are further evaluated using decision logic and rule-based mapping. These outputs are aligned with predefined organic farming guidelines and water management rules to generate practical and actionable recommendations for farmers. The system then presents the predicted results and recommendations through the web interface using both graphical and textual visualizations, enabling easy interpretation.

Finally, the system supports continuous user interaction by allowing farmers to review the outputs, raise queries through integrated support modules, and provide feedback. This feedback mechanism helps refine system performance and improves the accuracy and usability of the AI-enabled organic farming support system over time.

VI. SOFTWARE DESIGN:

The proposed system titled “Smart Organic Farming Integrating with AI for Sustainable Growth” is designed as a web-based intelligent agricultural support system. The software architecture follows a modular and layered design approach to ensure scalability, reliability, and ease of use. The system integrates frontend web technologies, backend server processing, database management, and artificial intelligence models to assist farmers in decision-making related to organic farming, multi-cropping, water conservation, and crop yield prediction.

The frontend of the system serves as the user interaction layer and is developed using HTML, CSS, and JavaScript/TypeScript. This layer provides a simple and intuitive interface through which farmers can register, log in, and input agricultural details such as crop type, soil condition, rainfall, and season. The frontend design focuses on accessibility so that farmers with minimal technical knowledge can easily navigate the application using a web browser like Google Chrome.

The backend of the system is implemented using the Django framework, which acts as the core controller of the application. Django handles HTTP requests, URL routing, form submissions, and authentication processes. It ensures secure communication between the frontend and the database while managing business logic efficiently. When a farmer submits input data, the backend processes the request and forwards the data to the appropriate machine learning model for analysis.

The database layer is responsible for storing farmer registration details, crop information, historical yield data, and prediction results. SQLite is used as the database for its simplicity and reliability in academic projects. Storing historical data allows the system to improve prediction accuracy and maintain records for future analysis.

The intelligence of the system lies in the artificial intelligence and machine learning module. The project uses Linear Regression and Random Forest Regressor algorithms to analyze agricultural data and predict crop yield. Linear Regression identifies relationships between environmental factors and yield, while Random Forest improves prediction accuracy by combining multiple decision trees. These models are trained using real agricultural datasets obtained from trusted sources such as government agricultural portals and research datasets. After prediction, the system processes the

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results through an analysis and visualization module. This module converts numerical outputs into meaningful insights such as yield estimates, crop suitability suggestions, and multi-cropping recommendations. Additionally, the system provides guidance on organic farming practices, hydroponic farming methods, and water conservation techniques like drip irrigation and rainwater harvesting. These recommendations help farmers adopt sustainable agricultural practices while improving productivity.

Finally, the processed results are displayed to the user through the web application in a clear and understandable format using charts, graphs, and text-based recommendations. This complete flow ensures that the farmer receives accurate, actionable, and eco-friendly guidance, making the system a practical solution for sustainable agricultural development.

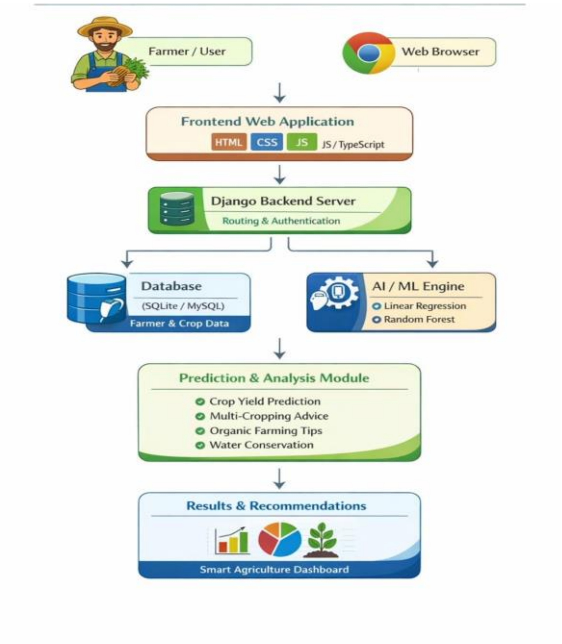

Fig 6: Block diagram of model discription

The block diagram of the Smart Agriculture system represents the complete flow of data and operations. The process begins with farmer registration through the web application, where farmers enter crop and soil-related information. This data is stored securely in the database.

The stored data is then sent to the machine learning module, where preprocessing and analysis are performed. Crop yield prediction is generated using trained models. The prediction results and farming guidance such as organic farming methods, multi-cropping suggestions, water conservation practices, and hydroponic farming information are displayed to the farmer through the web interface. This integrated flow ensures intelligent decision-making and sustainable agricultural practices.

VII. ADVANTAGES AND APPLICATIONS:

Advantages:

- AI-Driven Decision Support

Provides data-driven recommendations for crop selection, organic nutrient management, and water conservation using machine learning models.

- Reduced Chemical Dependency

Encourages organic farming by minimizing the use of chemical fertilizers and pesticides through intelligent organic practice guidance.

- Improved Soil Health and Yield Stability

Supports soil sustainability and multicropping strategies, leading to better long-term productivity and reduced crop failure risk.

- Taluk-Wise Crop Analysis

Enables region-specific insights by analyzing crop performance across different taluks, improving localized decision-making.

Applications:

- Organic Farming Guidance: System Can be used to guide farmers in adopting organic practices such as natural fertilizers, crop rotation, and eco-friendly pest control.
- Crop Yield Prediction: Helps farmers estimate crop yield in advance, enabling better planning and risk management.
- Water Conservation Advisory: Assists in optimizing irrigation practices and promoting efficient water usage based on crop and soil conditions.
- Farmer Cluster Collaboration (PKVY): Supports coordination among PKVY farmer clusters by identifying similar crop patterns and promoting shared knowledge.
- Government and Agricultural Planning: Useful for agricultural departments to analyze regional crop trends and support policy decisions.
- Educational and Research: Use Can be utilized by students and researchers for studying AI applications in sustainable agriculture.

VIII. RESULT:

The results of the Smart Organic Farming Integrating with AI for Sustainable Growth project demonstrate the successful development of a web-based application that supports farmers in decision-making. The system provides features such as user registration, crop yield prediction, organic farming guidance, multi-cropping information, market

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access, and water conservation practices. These results indicate that the application effectively enhances productivity, improves soil and crop health, and encourages sustainable farming methods

Fig 8.1: Home Page of the Smart Agriculture Web Application

The home page of the Smart Agriculture Web Application serves as the primary interface for users and provides an overview of the system. It is designed to be simple and user-friendly so that farmers and students can easily understand and navigate the platform. The home page introduces the concept of smart agriculture by highlighting the use of artificial intelligence for crop yield prediction, organic farming guidance, and sustainable farming practices. It also provides easy access to different modules such as crop yield prediction, crop information, multi-cropping guidance, market rates, hydroponic farming, and farmer registration. By acting as the central entry point, the home page helps users quickly understand the purpose of the project and smoothly move to other functional pages of the application.

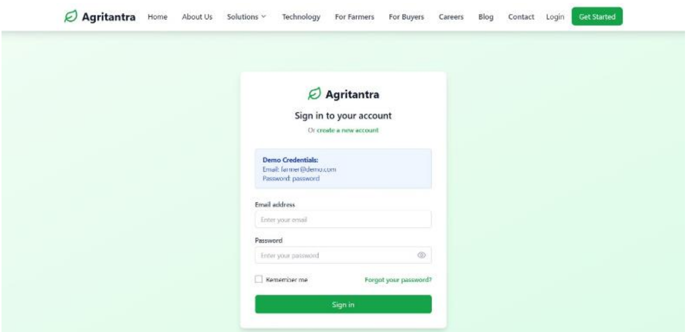

Fig 8.2: User Registration Page

This page allows new users to create an account by entering basic details. Farmer registration helps store user information securely and enables access to personalized farming guidance, crop prediction features, and other services provided by the application.

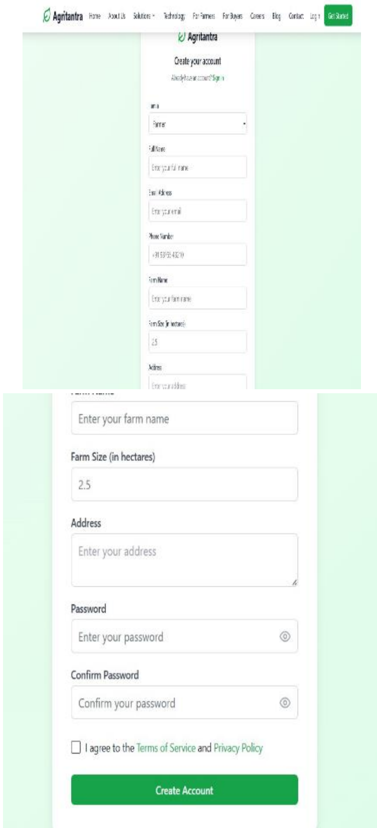

Fig 8.3: User Login Page

The login page allows registered users to securely access their accounts using valid credentials. After successful login, users can use features such as crop yield prediction, organic farming guidance, multi-cropping information, market rates, and water conservation support.

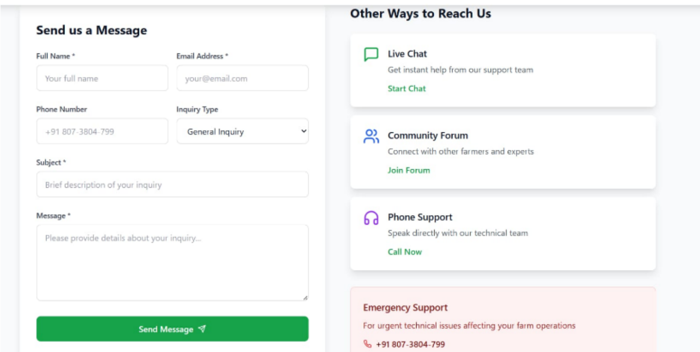

Fig 8.4: Contact Us Page – User Communication and Support

The Contact Us Page provides users with an easy way to communicate with the Smart Agriculture system administrators and support team. Through the "Send Us a Message" option, users such as farmers or stakeholders can submit their queries, feedback, or issues directly via the web application. In addition to the message form, alternative contact methods like email address, phone number, or office location are displayed to ensure accessibility for users who

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prefer other communication channels. This page improves user interaction, builds trust, and ensures timely support, thereby enhancing the overall usability and effectiveness of the Smart Agriculture platform.

Fig 8.5: Core Benefits of Smart Agriculture System for Farmers

The Core Benefits for Farmers section highlights how the Smart Agriculture system directly supports farmers in improving productivity and sustainability. By using AI-based crop yield prediction and data-driven recommendations, farmers can make better decisions about crop selection, multi-cropping, and organic farming practices. The system helps reduce dependency on chemical fertilizers by promoting organic inputs, efficient water usage, and eco-friendly farming techniques. It also assists farmers in understanding market trends, expected yields, and resource optimization, which leads to reduced costs, improved income, and long-term soil health. Overall, this system empowers farmers with technology-driven insights, making agriculture more efficient, profitable, and sustainable.

ix. CONCLUSION:

Integrating AI with the Paramparagat Krishi Vikas Yojana represents a significant step toward sustainable agricultural development in India. By leveraging technology to support traditional organic practices, this approach can address existing challenges and unlock new opportunities for farmers. The proposed smart organic farming model not only enhances productivity but also contributes to environmental conservation and rural empowerment. As India continues to innovate in agriculture, the fusion of AI and PKVY offers a compelling vision for the future of farming.

X. REFERENCE:

[1] R. Kamilaris and F. X. Prenafeta-Boldú, “Deep learning in agriculture: A survey,” Computers and Electronics in Agriculture, vol. 147, pp. 70–90, Apr. 2018.

[2] S. Wolfert, L. Ge, C. Verdouw, and M. J. Bogaardt, “Big data in smart farming – A review,” Agricultural Systems, vol. 153, pp. 69–80, May 2017.

[3] A. Khanna and S. Kaur, “Evolution of Internet of Things (IoT) and its significant impact in the field of precision agriculture,” Computers and Electronics in Agriculture, vol. 157, pp. 218–231, Feb. 2019.

[4] P. K. Singh, R. Pramanik, and A. K. Singh, “Role of artificial intelligence in sustainable agriculture: A review,” International Journal of Agricultural Science and Technology, vol. 12, no. 3, pp. 45–52, 2020.

[5] M. S. Reddy and K. K. Reddy, “Organic farming in India: Status, challenges and prospects,” Journal of Organic Agriculture, vol. 8, no. 2, pp. 123–131, 2019.

[6] Ministry of Agriculture and Farmers Welfare, Government of India, “Paramparagat Krishi Vikas Yojana (PKVY): Operational Guidelines,” New Delhi, India, 2015.

[7] N. Sharma, R. Kumar, and S. B. Singh, “Smart farming technologies for organic agriculture: A sustainable approach,” International Journal of Engineering Research in Agriculture, vol. 6, no. 4, pp. 89–95, 2021.

[8] J. Liakos, P. Busato, D. Moshou, S. Pearson, and D. Bochtis, “Machine learning in agriculture: A review,” Sensors, vol. 18, no. 8, pp. 1–29, Aug. 2018.

[9] A. Kumar and V. Gupta, “Artificial intelligence based decision support systems for precision and organic farming,” IEEE International Conference on Smart Agriculture, pp. 112–117, 2020.

[10] S. Patel, A. Mehta, and R. Desai, “Integrating government schemes with smart farming technologies for sustainable agriculture in India,” International Journal of Rural Development Studies, vol. 9, no. 1, pp. 34–41, 2022.