Survey on Artificial Intelligence Based Smart Farming

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Abstract: ***Nowadays farmers are facing financial issues because of abrupt changes in environmental parameter and many more things. So, in this paper there is overall study of different challenges faced in traditional farming, how traditional techniques are solving it and what are the limitations are faced in those traditional techniques. Traditional machine learning and deep learning techniques are used for solving single task at one time. Those traditional problems even can be solved by large language models and agentic AI models which are recent evolution of generative AI. In the proposed research paper different author study is gathered for comparison and future solutions are discussed.***

Keywords: Smart Farming, Conventional methods, AI (Artificial Intelligence), Agentic AI, Generative AI, Disease Prediction, Smart Farming, Precision Farming.

I. INTRODUCTION

Modern technology is assisting farming in changing rapidly. Smart farming employs tools such as sensors, data analysis, and smart systems instead of relying solely on traditional techniques and manual labor to ensure agriculture is more efficient and sustainable. This change has been necessitated by factors like climate change, unpredictable weather, increasing the world population, and production of more food with less input (Ramena , Chandrawat, & D., 2021) (Kumari , Nafchi , Mirzaee , & Abdalla, 2023). Through the use of smart solutions, farmers will be able to enjoy better quality of crops, decrease wastes, and manage their farms in a better way.

As recent research indicates, machine learning is an important part of this transformation. Crop yields, early detection of plant diseases and optimizing water or fertilizer utilization are being predicted using various algorithms like decision trees, support vectors machine and neural networks. (Mohyuddin, Khan, Haseeb, Mahpara, & Waseem,, 2024) Commentated on the accuracy and reliability of farming decisions supported by such algorithms. In creating sustainable farming, (Patrizi, Bartolini, Ciani, Gallo, & Sommella , 2022)developed a deep learning-enabled virtual soil moisture sensor to retrieve accurate soil information at minimal costs without the use of costly equipment. These strategies demonstrate that farmers can make smarter and faster decisions when the data provided by sensors is joined with smart models.

Another aspect that is taking shape in agriculture is automation. Robots, drones and automated vehicles can now perform tasks such as planting, weeding and harvesting with high precision. Not only does this minimize the labor requirements, but it also maximizes the output (Author). (Wang, Xu, Wang, Kang, & Hua, 2024) presented a smart system, planned to distribute crops and assist sustainable farming with machine learning and reinforcement learning. These systems demonstrate that technology is the answer to solving economic and environmental issues in agriculture.

The use of AI agents and conversational systems is another potentially promising development. It has been demonstrated by (Obeidat, Abdallah, Hamadneh, & Qawaqneh, 2024) that smart farms can enhance communication and coordination through AI-driven agents and, thus, make better decisions. (Kansal, Singh , Srivastava, & Chaurasia , 2023)showed how conversational AI tools can assist farmers by providing language-based advice. (Swadimath, Chandrakant, & Acharya, 2025) emphasized how a big language model (LLM) can facilitate sustainable agriculture by analyzing data about agricultural systems, and (Mujtaba, Abdulmajid, 2025) investigated the benefits of AI chatbots in enhancing food security by exchanging information more quickly. All these works portray how smart communication systems can help bring advanced technology closer to farmers.

To provide farmers with decision support in real-time, at a personalized scale, and in an easy-to-understand format, we present a smart farming framework that integrates agentic AI with large language models in this paper. In contrast to a fixed traditional system, our solution means that the AI agents can interpret data provided by sensors, analyze it, and communicate with farmers in natural

languages. This assists the seasoned and new farmers in better decisions regarding crops, irrigation, and the utilization of resources. We want to develop a system which makes farming more sustainable and productive and more farmer-friendly.

II. LITERATURE SURVEY

The paper compares various machine learning strategies to be used in more advanced technology in improving precision farming in smart agriculture systems. Algorithms studied involve decision trees, support vector machines, and neural networks, and their level of performance by outcomes when dealing with tasks such as crop yield prediction, disease detection, and resource optimization is compared. This paper has highlighted the capabilities and weaknesses of both approaches with a focus on precision, extensiveness, and versatility in the field of production. The authors suggest that the introduction of machine learning models into smart farming systems can enhance efficiency, sustainability, and decision-making to enhance contemporary agriculture. [1]

The paper is devoted to the increasing role of smart technologies in precision farming, with the special focus on the importance of incorporating IoT into Agriculture 4.0 using smart devices, smart meters, and wireless sensors of networks (WSNs). The research paper outlines a photovoltaic-based WSN whose sensor nodes are low-cost and low-power to provide monitoring services on the environment as well as soil conditions. There is a special emphasis on soil moisture measurement which is still difficult as it has problems of the costs, calibration, and in reliability. In order to address these weaknesses, the authors propose a deep learning that addresses long short-term-memory (LSTM) networks to develop a virtual soil moisture sensor. This model forecasts the soil moisture data using other sensor inputs to minimize the need of using hardware which is costly. The comparative analysis of population of other machine learning methods indicates that the proposed LSTM-based framework possesses excellent performance as it can be efficiently adopted in promoting sustainable precision farming activities. [2]

This paper will discuss how robotics is transforming the agriculture sector, which has resulted in labor problems, resource inefficiency, and sustainability. It discusses a vast selection of agricultural robots that are able to perform accurate planting, weeding, and harvesting, and explains that through automation, a company can cut down on man hours and increase its output. The paper gives a detailed observation of technical frameworks and structures of robots in agriculture as well as articulated robotic arms and autonomous flying vehicles. Using technologies combined, the efficiency of farming operations is increased, operating costs are decreased, and only have a minimum impact on the environment. The results confirm the paramount importance of robot innovation in the development of precise farming and re-invent traditional ways of cultivation with a sustainable future. [3]

There are increasing risks and uncertainties in the global food market thereby presenting the difficulties of balancing national food supply and demand. Planting areas should be effectively distributed and crop planning should be implemented in order to have food security. Current practices are mostly not accurate in predictions of prices, lack of flexibility and incentives among farmers. In this research, these are used by making a combination of the model of prediction of crop prices and a multifarmer allocation model. A long short-term memory (LSTM) model predicts the price of soybean, wheat, and maize, with the linear programming being optimal in the optimization of areas planted with crop plants with considerations of sustainability. Also, a multifarmer crop allocation lets the double deep Q-network (DDQN) algorithm make sure that there will be fairness and rotational gains. Efforts of the proposed approach are effective as evidenced by the results of the experiment that justify the economically and ecologically sound agricultural planning. [4]

Smart farming represents a new technology, where agriculture becomes more efficient with the help of highly advanced tools and less manual labor. Rather than merely applying conventional practices, it takes data and technology to make superior farm choices. Over the last few years, machine learning has gained relevance in the agriculture sector to analyze soil and weather conditions to select the appropriate farm crops as well as specific farming methods. The project applies the important parameters such as soil pH, nutrient content, temperature, rainfall, and humidity in order to make the proper recommendations.

Application of algorithms like the Logistic Regression and Support Vector Machines (SVM) enhances decision making and classification of crops by the system. The findings indicate that this technique is approximately 20 percent more precise than current methods. In general, the project is supposed to help even novice farmers with smart, data-driven advice to become more productive and profitable. [5]

III. PROPOSED METHOD

Proposed solution includes GenAI models such LLMs (Large Language Models) and Agentic AI for precision or smart farming giving multiple access to farmers with their smart phone.

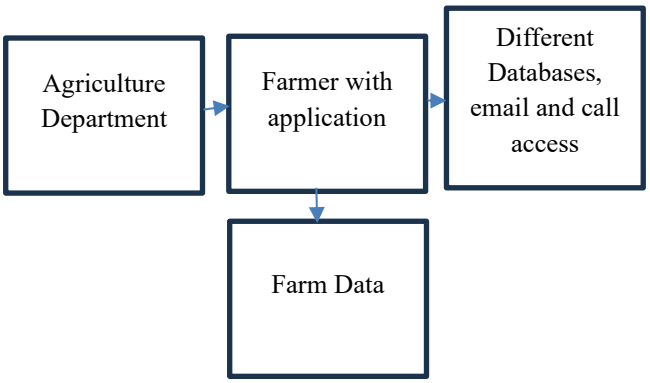

Fig.3.1 Proposed Method Architecture

Proposed architecture may give us the perfect solution for smart farming.

IV. CONCLUSION

Multiple traditional techniques are used in last few decades for smart and precision farming but those almost all traditional techniques have few limitations. Many limitations of traditional techniques are mentioned in the paper and their limitations. Recent technology, genAI how it helps the farmers with recent problems are discussed in this paper. There is need of recent technology for farmers for precision farming and to get more yield than previous low yield.

Future scope

The future of intelligence-driven smart farming promises a lot to transform agriculture to be smarter and greener. The development of deep learning, IoT, and language models can help systems to present more precise predictions and real-time assistance. These solutions can be made more accessible and effective to farmers through the integration of drone and satellite data, the enhancement of learning practices, and conversational AI. The research can be conducted in the future where transparency, low-cost technology, and data security can help to enhance smarter and more sustainable ways of farming in the world.

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