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Modern-Day Solution for Traditional Farming Methods Using Artificial Intelligence

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ABSTRACT
In the upcoming generation, the world's population will continue to grow. In order to feed the 9.3 billion people on the planet by the year 2050, 60% more food must be produced, which can't be done using conventional farming methods because they require more land and resources. In order to deliver greater insights and advice, it is necessary to enhance the current methods for harnessing data in new ways. Anyone interested in farming would be able to develop solutions based on data-driven decisions with the correct recommendations, insights, and Artificial Intelligence (AI) - powered precision agriculture solutions. Therefore, it's essential to develop a better and more efficient strategy to address this problem. The difficulties farmers experience when employing traditional agricultural techniques are explored in this paper, along with how artificial intelligence is revolutionizing the farming sector by replacing traditional techniques with effective alternatives and making the world a better place.

Keywords—Artificial Intelligence, Traditional Farming, Precision Agriculture, Agrobot, Machine Learning, Agriculture.

I. INTRODUCTION

Farming has been a crucial aspect of human civilization for many centuries. Nevertheless, conventional farming techniques are subject to constraints such as resource scarcity, inclement weather, and labor shortages. Over the past few years, technology has become increasingly important for improving farming methods and increasing crop productivity. Since ancient times, farming has been a vital human activity, but it is currently constrained by a number of factors, such as unpredictable weather patterns, a lack of resources, and a labor shortage. Technology has recently played a crucia l role in enhancing farming methods and raising crop yields.
The technology of artificial intelligence (AI) has the potentia l to transform agriculture. Farming solutions powered by AI can help farmers make data -driven decisions, use resources more efficiently, and produce more crops. AI integration in agriculture can boost farm productivity and efficiency, improving food security, sustainability, and economic growth.
By analyzing massive datasets gathered from multiple sources, such as soil sensors, weather stations, and drone photography, AI can assist farmers in making informed decisions. Machine learning algorithms can be used to process this data to produce actionable insights that can aid farmers in maximizing resource efficiency and

minimizing waste. AI can assist farmers in spotting possible crop hazards like pests and diseases, allowing them to take preventative action to safeguard their harvests.

Additionally, AI-driven automation can help farmers streamline various farm tasks like planting, harvesting, and irrigation. This might lower labor costs and boost productivity, boosting fa rmers' profitability. Additionally, AI can support the development of more susta inable farming and assist in market demand prediction.

The application of AI to modern farming can also be advantageous to the environment. Farmers should minimize waste and maximize resource use to improve sustainability and their ecological footprint. AI can enable the development of more climate-resilient farming practices and cut greenhouse gas emissions.

Finally, integrating AI into conventional farming practices can be advantageous for farmers, the agriculture industry, and the environment. AI-based farming solutions can increase production, profitability, sustainability, and efficiency, which will help create a more reliable and secure food system.

II. LITERATURE SURVEY

The research [1], provides an overview of the challenges faced by farmers and the potential of AI in addressing them. One promising application of AI in farming is in the development of more precise fertilization methods, enabled by real-time insights about crop needs. By reducing waste and improving quality, AI can also facilitate faster and more profitable market access for farmers.

According to the research [2], the critical parameters for predicting both crop yields and irrigation requirements in a systematic way are examined. This also acknowledges the previous advancements and the new emerging techniques in Artificial Intelligence (AI) for precision farming, which have been developed specifically for predicting yields and implementing smart irrigation. These AI-based systems offer ample information regarding crop yields in the early stages and also provide smart irrigation management, systems.

According to the study [3], the review investigated the application of different machine learning (ML) techniques in crop management and selection. Support Vector Machines, k-Nearest Neighbor, Fuzzy networks, ARIMA, Decision trees, Ensemble learning, and Random forests are some of the commonly used ML methods. The review also delves into various time series algorithms and proposes the use of the machine and deep learning to suggest suitable crop recommendations based on yield estimation. This approach, using time series analysis, has the potential to address food insufficiency issues in the future.

The study [4] aims to explore the integration of Artificial Intelligence and the Internet of Things in agriculture by examining various agricultural applications. Researchers' efforts in using sensor technology, agricultural robots, and drones, and AI-driven solutions to enhance productivity in farming are discussed. The study also sheds light on the constraints and hurdles faced in implementing smart agriculture, along with potential future opportunities in this field.

The study [5] presents Al-powered Interconnected system applications used in the agricultural sector. It discusses the India n government's efforts to promote smart agriculture, which aims to increase farmers' income and decrease their reliance on soil and climate conditions. Additionally, it highlights the increasing use of hybrid systems combining image processing with trainable ANNs, integrated with Mobile IT and Sensor networks in smart agriculture over the past decade.

The study [6], introduces the agrobot that relies on sowing seeds and is monitored by an Arm processor and cloud-based IoT agriculture. The main objective of this agrobot is to reduce the workload of farmers by performing basic functions such as sowing seeds and covering them with soil, while continuously monitoring environmental factors like temperature, humidity, moisture, and animal movement that may impact crop yields. Additionally, this agrobot utilizes solar technology as an alternative to an external power source.

In conclusion, the studies reviewed highlight the immense potential of Artificial Intelligence in revolutionizing the agricultural sector. AI-based precision farming techniques have the potential to significantly increase productivity, reduce waste, and enhance market access for farmers. The use of machine learning and time-series analysis can also enable accurate crop yield predictions and suggest suitable crop recommendations. Additionally, the integration of AI with the Internet of Things, sensor technology, agricultural robots, and drones can help overcome challenges and constraints faced in implementing smart agriculture. These advancements have the potentia l to transform farming practices and address food insufficiency issues in the future.

III. TRADITIONAL FARMING

The process of Agriculture is divided into different parts [7] as shown in Fig.1:

Preparation of soil: Farmers prepare the soil for seeding in this earliest stage of farming. Large soil clumps must be broken up and debris, such as sticks, pebbles, and roots, are removed during this procedure. Additionally, depending on the type of crop, fertilizers, and organic matter are added to the environment to make it perfect for crops.

Sowing of Seeds: At this stage, attention is paid to the spacing and planting depth of seeds. Climate factors like temperature, humidity, and rainfall have an impact at this stage.

Adding Fertilizers: For farmers to grow healthy and robust crops, it is important for them to maintain soil fertility. Fertilizers are used by farmers because they provide pla nt nutrients including nitrogen, phosphorus, and potassium. Fertilizers are merely nutrients that are planted and added to agricultural areas to enhance the necessary minerals already present in the soil. This stage affects the crop's quality as well.

Irrigation: This stage aids in maintaining humidity and soil moisture. Crop growth can be hampered by under- or overwatering, and if done improperly, can result in damaged crops.

Weed Prediction: Unwanted plants known as weeds commonly appear next to crops or at the edge of farms. Weed control is essential since it may reduce crop quality, decrease yields, and increase production costs.

Harvesting: Harvesting involves collecting mature crops from their growing sites in the fields. This activity is labor- intensive because it calls for numerous workers. Post-harvest processing operations like cleaning, sorting, packing, and cooling are also included in this stage.

Storage: The products are stored at this stage of the post- harvest system so that food security is ensured outside of agricultural seasons. Crop transportation and packing are also included.

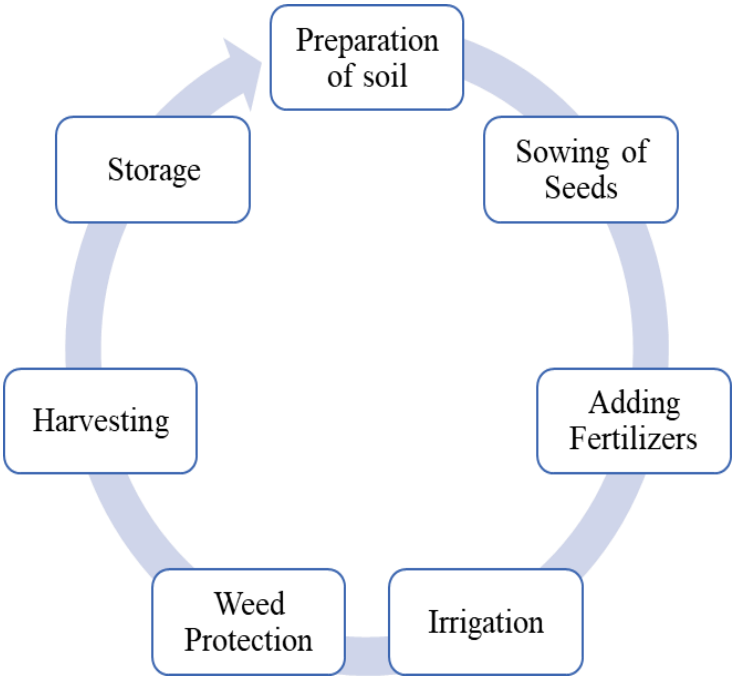

Fig. 1: Traditional Farming Process

IV. CHALLENGES FACED BY FARMERS IN TRADITIONAL FARMING

Weather conditions including rainfall, temperature, and humidity are crucial to the agriculture lifecycle. Due to increasing deforestation and pollution, farmers find it difficult to make decisions on how to prepare the soil, plant seeds, and harvest.

Every crop requires a certain kind of soil nutrients. Specifically, soil requires three nutrients: nitrogen (N), phosphorus (P), and potassium (K). Poor crop quality may result from nutritional insufficiency.

Weed control is crucial, as is frequently seen in the life cycle of agriculture. Unless it is monitored, it can raise production costs and deplete the soil of nutrients by absorbing nutrients from the soil.

Absence of contemporary farming technology and equipment, which restricts productivity and efficiency.

Traditional farmers have limited access to educational and training opportunities, which may impede their ability to adjust to shifting market demands and technological advancements.

V. ROLE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

The agricultural sector is relying on a rtificial intelligence (AI) technologies to help produce healthier crops, control pests, monitor soil and growing conditions, organize data for farmers, lessen workloads [9], and improve a variety of agriculture-related operations along the entire food supply chain.

Use of Weather Forecasting: The determination of the optimal time to sow seeds has become a difficult task for farmers owing to the effects of climate change and increasing pollution. However, artificial intelligence can assist farmers in analyzing weather conditions through the utilization of weather forecasting, thereby enabling them to plan the type of crops suitable for cultivation and the appropriate time to sow seeds.

Soil and Crop Health Monitoring: The kind of crop planted and how well it grows depends significantly on the type of soil and its nutrients. The quality of the soil is deteriorating as a result of rising deforestation, making it challenging to evaluate.

Diagnosing Plant Disea ses: AI is used to dia gnose pla nt diseases, farmers can identify problems early on, prevent the spread of disease, and reduce crop losses. This can ultimately lead to higher yields and greater profitability for farmers.

Analyzing Crop Health by Drones: [8] Crop health is tracked using Drone-based Ariel imaging technology. In this method, a drone collects field data that is analyzed by computers. The images are examined, and a thorough report outlining the farm's present state of health is given. It aids in the identification of pests and germs, enabling farmers to use pest management and other measures to take the necessary action in a timely manner.

Precision Farming: Precision farming is the practice of using technology and data to optimize crop production and reduce waste. AI plays a critical role in precision farming by analyzing large amounts of data on factors such as soil quality, weather patterns, and crop health to provide farmers with insights into how to maximize their yields and reduce inputs such as fertilizer and water.

Predictive Analytics: In smart farming, predictive analytics can be used to forecast crop yields, detect diseases and pests, and identify optimal planting and harvesting times.

Intelligent Spraying: Intelligent spraying is an AI-powered technology that optimizes the application of pesticides and herbicides in agricultural fields. It uses sensors and machine learning algorithms to detect plant characteristics, analyze environmental factors, and reduce waste and environmental impact.

Agricultural Robotics: Startups in the field of artificial intelligence are creating robots that are capable of multitasking on farming fields. Such robots are designed to efficiently manage and eliminate unwa nted weeds while also harvesting crops at a faster pace and with higher volumes as compared to human labor.

AI-enabled system to detect pests: [7] AI systems use satellite images and AI algorithms to detect the presence of pests, such as locusts or grasshoppers, in real-time. Upon detection, alerts are sent to farmers via their smartphones, allowing them to take necessary precautions and apply appropriate pest control measures. AI assists farmers in combatting pest infestations efficiently.

VI. AI STARTUPS IN FARMING

Agrosmart: This startup uses AI and IoT to provide farmers with real-time data and insights about their crops and soil, allowing them to make data-driven decisions.

Prospera: uses AI, computer vision, and machine learning to help farmers optimize their crop yields and reduce waste through the use of precision agriculture.

Trace Genomics: An American startup that uses AI and machine learning to provide farmers with insights about their soil health, allowing them to optimize their crop yields and reduce costs.

Intello Labs: A Bengaluru-based startup that uses AI and machine learning to provide farmers with real-time data and insights about their crops, soil, and weather conditions, allowing them to make data -driven decisions.

Fasal: A Bengaluru-based startup that uses AI and machine learning to provide farmers with real-time data and insights about their crops, soil, and weather conditions, allowing them to make data-driven decisions.

VII. FUTURE OF FARMING USING ARTIFICIAL INTELLIGENCE

The future of farming using artificial intelligence (AI) is promising as it has the potential to revolutionize the agriculture industry. AI can provide farmers with real-time data and insights to make data -driven decisions about crop management, disease and pest control, irrigation, and more. With AI-powered precision agriculture, farmers can optimize crop yields, reduce waste, and increase profits.

In the future, AI-powered agricultural robots and drones can perform tasks such as planting, spraying, and harvesting crops more efficiently and accurately than humans. AI can also help with crop breeding by analyzing genetic data to identify the most desirable traits for specific environmental conditions.

Furthermore, AI can aid in environmental sustainability efforts by reducing the use of pesticides and fertilizers and promoting more sustainable farming practices. AI can also help address food security challenges by increasing crop yields and improving the efficiency of food distribution systems.

VIII. CONCLUSION

Traditional farming methods will not be feasible for meeting the demands of the future. This paper has highlighted the potential of artificial intelligence to modernize traditional farming methods. By using AI-powered technologies, farmers can improve their crop yields, reduce waste, and optimize their operations. There are many AI-ba sed solutions already available for precision agriculture, including crop monitoring, yield prediction, smart irrigation, and crop selection. However, there are still challenges to be addressed, such as the need for more data and the high cost of implementation. Despite these challenges, the future of farming looks promising with the integration of artificial intelligence, and it is essential for farmers to embrace these technologies to stay competitive and sustainable in the long run.

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