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Role of Artificial Intellienge in Agriculture Production

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The global population has now reached 8 billion and it is projected to rise to 9.7 billion by 2050. This means that the demand for food production will increase significantly. To tackle this challenge, it is essential to use artificial intelligence (AI) technologies that can optimize resources and improve productivity. This is especially important in an environment with supply chain tensions and unpredictable weather patterns. A systematic review of the literature was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology to analyze how AI technologies have been applied to agriculture. The review retrieved 906 relevant studies from five electronic databases and selected 176 studies for bibliometric analysis. The quality appraisal step selected 17 studies for the analysis of the benefits, challenges, and trends of AI technologies used in agriculture.

The application of AI in agriculture has been widely considered as one of the most viable solutions to address food inadequacy and to adapt to the needs of a growing population.

This review provides an overview of AI's applications in agronomy, specifically in soil management and weed control, as well as the promising development of Internet of Things (IoT) technology. Agricultural robots have been developed and improved greatly in recent years, to target diverse areas of the agricultural industry. The pivotal role of technology in modern agriculture. (1) However, three main challenges must be addressed for widespread adoption of AI-based technology in the market: uneven distribution of mechanization, the ability of algorithms to quickly and accurately process large data sets, and security and privacy concerns surrounding data and devices. Although the review acknowledges the difficulty of applying machines and algorithms tested in experimental environments to real-world scenarios, it highlights the already prosperous development and the promising future of agricultural applications.

Sowing : In the recent trend of Smart Agriculture making use of Robots plays a very important role. Scarcity of skilled laborers and environmental changes have made man to replace with machines. The automation in forming process is mainly for time saving, energy efficiency of repeated work in farming fields and increased productivity of crop and market trends. The main prerequisite for a good crop yielding is its seeding procedure. In this paper a Robotic vehicle is designed for Seeding in the form using an Arduino controlled by Bluetooth/RF. Certain types of sensors are also used. Agriculture purpose Robot is designed by considering certain climatic conditions and the type of land available for sowing the seed. This Robot is unique of its kind in prototype design. This method can also have extended high end application in Agriculture yielding and other level designs for optimization of time, work and efficiency in order to increase the productivity of crops.

Fertilizer Application : Smart Farming Systems emphasize the need for modern technologies like the Internet of Things (IoT), Cloud and Artificial Intelligence (AI) in the agricultural process. The digital transformation accelerates conventional farming practices to increase crop production with quality. Earlier works failed to integrate AI with sensor technology, guiding agricultural practitioners in a successful direction. Therefore, we propose an architectural model with four layers, including sensor, network, service, and application, aid in deploying a smart farming system with limited energy consumption. Moreover, focusing on the application layer, we implement a deep learning approach to build a fertilizer recommendation system that matches the expert's opinion. Finally, the whole system outcomes are presented as a single mobile application for farmers' ease of use.

Irrigation : The agriculture sector consumes 85% of the available freshwater resources across the world. And this percentage is increasing rapidly with the population growth and with the increase in food demand. This leaves us with the need to come up with more efficient technologies in order to ensure proper use of water resources in irrigation. The manual irrigation which was based on soil water measurement was replaced by automatic irrigation scheduling techniques. The plant evapotranspiration which was dependent on various atmospheric parameters such as humidity, the wind speed, solar radiations and even the crop factors such as the stage of growth, plant density, the soil properties, and pest was taken into consideration while implementing autonomous irrigation machines.

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The technology of smart irrigation is developed to increase the production without the involvement of large number of man power by detecting the level of water, temperature of the soil, nutrient content and weather forecasting. The actuation is performed according to the microcontroller by turning ON/OF the irrigator pump. The M2M that is, Machine to Machine technology is been developed to ease the communication and data sharing among each other and to the server or the cloud through the main network between all the nodes of the agricultural field (2). The automated robotic model for the detection of the moisture content and temperature of the Arduino and Raspberry pi3. The data is sensed at regular intervals and is sent to the microcontroller of Arduino (which has an edge level hardware connected to it), it further converts the input analog to digital. The signal is sent to the Raspberry pi3 (embedded with KNN algorithm) and it sends the signal to Arduino to start the water source for irrigation. The water will be supplied by the resource according to the requirement and it will also update and store the sensor values.

The context of AI-enabled weed management, field information serves as the foundational bedrock upon which precise, effective, and sustainable weed control strategies are constructed. Field information encompasses critical criteria such as the country of operation, the weed species at hand, and the crop type under cultivation. Each of these criteria carries profound significance in shaping AI-driven weed management practices.

The geographical context of weed management is of paramount importance, as different regions and countries are characterized by unique agroclimatic conditions, weed species prevalence, and agricultural practices. AI models, specifically those developed for the purpose of identifying and managing weeds, necessitate meticulous calibration to effectively address the specific challenges and conditions within a given country. The selection of appropriate AI algorithms, the design of training datasets, and the calibration of weed detection models are influenced by the country factor. Moreover, it facilitates the incorporation of AI models into specific agricultural settings, ensuring that weed management approaches are in accordance with local limitations and preferences

Weeds are unwanted plants that grow on farmland and compete with crops for nutrients, space, and sunlight. If not removed, they obstruct crop growth, causing a reduction in crop yield and consequently, a reduction in profit for farmers . Therefore, weed control is an important means to improve crop productivity. Currently, large-scale spraying of pesticides is the most widely used weed control method, but this wastes resources and causes environmental pollution. Therefore, the design of a weeding system that reduces pesticide use is urgently needed. Currently, weed robots are designed based on real-time image detection as the early identification and control of weeds is paramount.

Harvesting : Harvesting is a challenging task in agriculture because harvesters strongly correlate to crop detection, quality cuts, damage, picking and packaging. The labour assets utilize for harvesting is one of the main cost components in agriculture production. To overcome the high labour cost component, the prior studies pay wider attention to exploit commercially doable AI applications for harvesting. Using a robotic system would enable certain advantages such as minimum wastage, picking efficiency, high picking rate and flexible work force and nighttime operation. Development of timely, efficient, and careful robotic harvesting solutions lead to complete the harvesting process while generating high quality yields at minimum time consuming and at minimum unrecuperative damages in the harvesting process. Particularly, there have been significant developments of AI towards the sustainability agriculture objective of ensuring production of an adequate food supply. Besides research projects have been performed, very few have developed into the commercial world (Kiwi fruit; Tomato; Cotton; Apple; Rice).

Conclusions

Artificial Intelligence (AI) is the most Sophisticated technology that can be adopted in adopted in Agriculture sector. From sowing to till harvesting the crop, AI helps the farmers to grow the crops in the Land.

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