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The Digital Earth: AI's Impact on Soil Studies

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SUMMARY

Agriculture is the cornerstone of our country's economy, playing a pivotal role in sustaining livelihoods and ensuring food security. However, excessive use of fertilizers can compromise crop quality and soil health, necessitating accurate measurement and management of soil nutrients. The Internet of Things (IoT) enabled soil testing systems offer a solution by leveraging sensors to monitor soil moisture, temperature, and humidity, providing real-time data accessible remotely. This technology facilitates informed decision-making and enhances agricultural productivity. IoT is transforming agriculture by enabling remote monitoring of soil conditions, crop growth, and livestock feed levels. IoT platforms like Sensors offer scalability and security to handle large volumes of data, facilitating rapid development of innovative solutions. Remote monitoring of soil pH and temperature rates enhances agricultural efficiency and sustainability, providing farmers with vital information for optimal crop growth. Moreover, artificial intelligence (AI) technologies aid in identifying nutrient deficiencies in plants, thereby improving soil quality and crop yield. Machine learning algorithms analyse data from sensors and images, providing insights into soil health and recommending appropriate interventions. Technologies like Farm Beats utilize AI to diagnose soil issues and propose corrective measures, empowering farmers to optimize agricultural practices and enhance crop productivity.

INTRODUCTION

Agriculture is the main occupation of our country and it plays a vital role in our country. Using too much of fertilizers may lead to the inferior quality of the crop production. So, the measurement of soil nutrients is greatly required for better plant growth. Determining the amount of nutrients in the soil is the key function. pH value is also one of the most important and informative soil parameters to detect the soil fertility and it is measured to identify the soil fertility. In “IoT Enabled Soil Testing” system, takes readings from soil moisture sensor and humidity sensor and store it in a cloud server and graph is drawn as per the variations in soil moisture, temperature and humidity level of the soil. The sensors and microcontroller are successfully interfaced with the cloud. The data is stored successfully and can be accessed remotely. All observations and experimental set up prove that this is a complete solution to test the soil health parameter. User can have access to the data and can know if there are any deviations with respect to pH value and soil moisture.

Internet of things: The Internet of Things (IoT) is playing vital role in present world specially, IoT is transforming the agriculture industry and enabling farmers to contend with the enormous challenges they face. Today's large and local farms can, for example, leverage IoT to remotely monitor sensors that can detect soil moisture, crop growth and livestock feed levels, remotely manage and control their smart connected harvesters and irrigation equipment, and utilize artificial intelligence-based analytics to quickly analyse operational data combined with 3rd party information, such as weather services, to provide new insights and improve decision making. Sensors provide the first purpose built IoT platform designed to meet the unique needs of today's connected world. As the leading IoT platform, it delivers the security and scalability to handle millions of daily transactions. With Sensors you can deliver powerful, new smart agriculture IoT solutions in a fraction of the time of other approaches.

The Sensors can help you:

- Easily collect and manage the explosion of data from sensors, cloud services such as weather or maps, connected equipment and existing systems.
- Quickly build and bring to market new innovative IoT applications at 10 times the speed of other approaches with our rapid application development environment and drag and drop mash up builder.
- Leverage big data and analytics to provide new insights and recommendations to aid in better decision-making. Enable farmers to easily visualize data and take action on insights and recommendations.

The remote monitoring of the soil pH rate and its temperature rate has been done with the very minimal cost. The values can be viewed by the farmer's anywhere in the world at any time. Hence this system gives more accurate pH rate and temperature rate of the soil which play vital role in the agriculture. The temperature sensor, Humidity sensor and soil moisture sensor can be interfaced to the microcontroller to assess any further data.

Identification of nutrient deficiency in plants by artificial intelligence:

The deficiency of macro (N, P, S, Ca, Mg and K) and micro (Zn, Cu, B, Mo, Cl, Mn and Fe) minerals has a major effect on plant development. The lack of some nutrient minerals especially of nitrogen, potassium, calcium, phosphorus and iron is a huge problem for agriculture and early warning and prevention of the problem will be very useful for agro-industry. Currently, the methods used to determine nutritional deficiency in plants are soil analysis, plant tissue analysis or combined methods between the two a fore mentioned ones; however, these methods are time-consuming and costly. Deficiency of all analysed elements changed the physiological state of bean plants that was displayed in modifications of the chlorophyll fluorescence transients. The effects of the lack of these elements included the impairments in electron transport chain in both donor and acceptor sides of PSII and of PSI. The ANN with backpropagation was applied to recognize nutrient deficiency on the basis of chlorophyll fluorescence data. The ANN approach for early recognition of nutrient deficiency based on chlorophyll fluorescence data is a very useful and powerful tool.

Artificial intelligence and machine learning (ML) technologies that monitor soil quality and fertility utilize different algorithms for agriculture analysis. Machine learning applications use supervised and unsupervised methods to support data analysis procedures, generating sufficient elements to provide a statistical solution to the problems requiring these techniques. With the help of artificial intelligence technologies, particularly electronic applications for deep learning, farmers can find potential nutrient deficiencies in soil quality. Different agricultural technologies like Farm Beats have been built where farmers only need to take a picture with their smartphone and then upload the image to an AI development system. After assessing the problem, farmers are provided with restoration techniques and other solutions that will help improve the soil quality and quantity of the crop.

CONCLUSION

The integration of AI technologies in agriculture, particularly in crop sowing and soil health analysis, promises to revolutionize modern farming practices. By leveraging AI, farmers can increase crop output per acre while reducing input costs, bolstering profitability and sustainability. Real-time monitoring of soil health through IoT devices optimizes resource allocation, saving farmers time and labor. Remote sensing technologies, such as drones, offer crucial insights into land use changes and crop yield predictions, aiding in informed decision-making. Autonomous tractors further enhance efficiency by performing various farming tasks with precision and minimal human intervention. Overall, AI serves as a game-changing tool in modern agriculture, empowering farmers with actionable insights to maximize productivity and minimize environmental impact. As we continue to harness AI's potential, the future of agriculture looks promising, with increased efficiency, sustainability, and food security on the horizon.

REFERENCES

Aleksandrov V, 2022, Identification of nutrient deficiency in plants by artificial intelligence, *Acta Physiologiae Plantarum*, 44:29.

Sowmiya E and Sivaranjani S, 2017, Smart system monitoring on soil using internet of things (IoT), International Research Journal of Engineering and Technology, 04(2): 1070-1072.

Sindhu P and Indirani G, 2018, IoT enabled soil testing, Asian Journal of Computer Science and Technology, 7(1):54-57.