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An Analysis on IoT-based Smart Irrigation Technology

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ABSTRACT: ***When India's population reaches above 1.2 billion and continues to grow at its current pace, there will be a significant food crisis in 25 to 30 years, necessitating the expansion of agriculture. Implementing the proper operational choice at the right time is essential for production farming profitability based on the circumstances at hand and past performance. Precision agriculture is a systematic procedure created to increase agricultural output by precisely adjusting crop and soil management to each field's unique needs while maintaining ecological integrity. In order to electronically assess the external factors in an agricultural field, this present review focuses on the construction of an automated or Internet of Things (IoT) based irrigation system using portable wireless sensor systems as well as decision analysis techniques. The primary objective of this review is to create a microcontroller system that continuously waters plants and communicates that data to the farmers. Irrigation is a traditional method that uses a larger proportion of laborers than other everyday agricultural practices. Sensors and microcontrollers may be used to autonomously water plants by detecting when they need to be irrigated. Automation entails accelerating production, cutting costs, and making efficient use of resources in coming days. The greatest way to prevent water problems in agriculture will be to use smart irrigation.***

KEYWORDS: ***Agriculture, Irrigation System, Moisture, Microcontroller, Smart Irrigation.***

1. INTRODUCTION

A growing problem is the scarcity of freshwater resources, especially in Mediterranean nations or southern Asian nations like India. The Mediterranean nations are the most susceptible to drought among those in Europe. Policies relating to climate change and water management have been linked. The demands for water from various industries or the effects of varying degrees of global warming on hydrologic supplies are only two examples of the many factors that might have an impact on water management. In research articles on water resources and agriculture, global warming and its implications often come up [1]. The potential effects of climate change have prompted scientists to think about developing water adaptation strategies to guarantee that there is enough water for both human consumption and agricultural production, as well as to preserve ecosystems [2].

In addition, it is necessary to guarantee the water's safety for human consumption and environmental reuse. The potential dangers of climate change include an increase in water scarcity, a decrease in water quality, an increase in soil salinity, a loss of biodiversity, an increase in the need for watering, and the potential expense of emergency and remediation measures. These factors have caused an upsurge in research looking at ways to utilize less water in irrigation systems. Several of these investigations recommend using social, economic, as well as environmental implement policies as well as technology advancements to enhance water management. One of the most significant economic sectors in these nations is the agricultural one, making good water resource management even more crucial to the survival of this industry. Ten

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Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 4, April 2022

percent of India's land is covered in rice farms. In addition, 15% of Indians experience food insecurity and 20% live in poverty [3], [4].

As a result, inadequate food production has an impact on both the economy and the people. The summer monsoon of 2002 had the least quantity of precipitation in the previous 130 years. Due to the shortage of fresh water, this led to a decrease in rice output. Extensive land use and profit maximization are the goals of farming. Farming techniques need to be improved in the agriculture industry. Precision farming methods, for example, are modern agricultural innovations that address these issues [5]–[7]. Utilizing computer technology, precision agriculture is a farm management approach which ensures the soil and crops get the precise nutrients they need at the ideal moment for improved health and yield. Internet of Things (IoT) is defined as a network of autonomous items that connect and exchange data remotely over the Internet as shown in Figure 1.

In recent years, researchers have attempted to construct automated control irrigation methods for irrigation scheduling. As the difference among demand and availability widens, it creates new difficulties and puts further strain on the agricultural supply chain. The conventional irrigation methods include drip irrigation, ditch water management, sprinklers, as well as terraced structures. Increased production demands, water shortages, and subpar agricultural practice are used to categories the typical irrigation techniques.

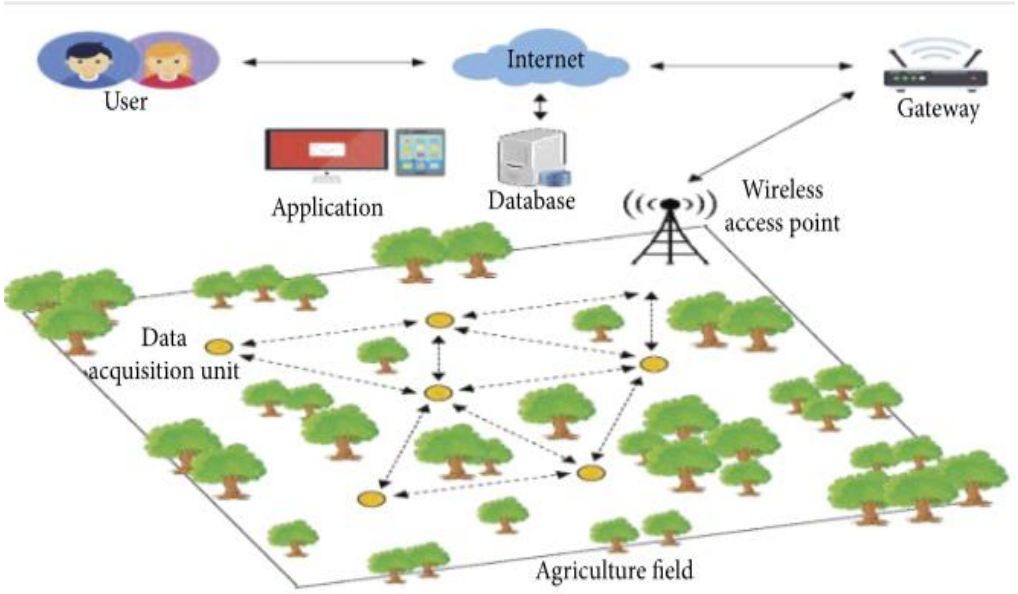

Figure 1: Representing the Wireless Sensor Network Layout for the Automated Irrigation System.

2. DISCUSSION

India's economy is largely based on agriculture, and the country ranks second globally in terms of agricultural production. As of 2018, 17% to 18% of the Gross Domestic Product (GDP) of India comes from agriculture, which employs 50% of the labor force. The majority of the irrigation system in India is run manually. Our nation is in a position to save every drop as water becomes scarcer. Therefore, by using modern technology, the conventional way of watering may be replaced with automated irrigation. The soil moisture sensor is placed close to the plant roots in

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this method, where it detects moisture and sends the information to the microcontroller, which regulates the water supply to the plants. When a farmer uses a manual operation but forgets to shut off the engine, water and power are wasted. The Smart Irrigation System has the ability to automatically switch ON and OFF the motor to fix these issues. The atmosphere, the state of the soil, and the moisture level are the key factors affecting this motor's performance. Different sensors, including soil moisture sensors, temperature sensors, and humidity sensors, are utilized to calculate the aforementioned values. In addition, by regularly checking the field's moisture level for a better cropping strategy, soil conditions are updated. The cultivation will be enhanced by this.

To water the plants, additional laborers are needed in our traditional farming approach. Numerous sensors, including temperature and soil moisture sensors, are employed, and the output of these sensors is linked to the microcontroller in order to decrease the amount of farmer interaction and make this process automated. The complexity and risks associated with the procedure are decreasing as technology advances on a daily basis. Many issues can be solved using embedded and microcontroller systems. A sensor-based microcontroller system is used in this system to autonomously regulate the irrigation water system. This may be accomplished by installing sensors on agricultural land to monitor soil temperature and soil moisture sensor, which sends data to the microcontroller. The soil moisture sensor is used by this system to automatically provide the water flow. In this research, a sensor-based irrigation system that employs renewable energy as a source is applied via wireless sensor networks.

In this review, the plants are watered via wireless sensor networks. The goal of this smart irrigation system is to create a fully automated irrigation system that automatically switches on and off the motor by sensing the moisture content of the agricultural field using a soil moisture sensor without the need of any human work. The authors present a survey intended to summarize the current state of the art with regard to smart irrigation systems in light of the recent developments in sensors for the implementation of irrigation systems for agriculture and the evolution of WSN and IoT technologies that can be applied in the development of these systems. We will provide a summary of the current status of irrigation system research in this survey. The criteria for soil properties, weather, fertilizer use, and water quantity and quality that are monitored in irrigation systems will be determined by the authors [8]–[10]. The most popular wireless technologies and nodes used to create WSN and IoT based smart irrigation systems will be described by the researchers. Finally, researchers will talk about the difficulties and the best methods for putting sensor-based irrigation systems into reality. Studies with an emphasis on irrigation systems, water management, or precision agricultural systems have been carried out by other writers.

The other studies that were accessible on smart irrigation systems, however, examined a large number of publications. They do not provide a thorough examination of the state of the art for irrigation systems. Others concentrate on certain irrigation-related topics, such as pivot-center-specific irrigation systems, irrigation systems for greenhouses, or software for irrigation systems. Last but not least, research on irrigated agriculture may be found in studies on precision farming, crop monitoring, and the agro-industrial and environmental sectors of agriculture. We provide a brief summary of the most recent developments in irrigation systems in this study, along with the sensors and actuators that are being used. We also go through the most popular nodes and wireless technologies used for data transfer and communication amongst the sensors' collected information. In this approach, our study fills a current vacuum in the literature by offering an overview of IoT-based smart irrigation systems.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 4, April 2022

Agriculture serves as both the backbone of the economy and a significant industry. All nations have serious concerns about the developing problem of agriculture automation. The need for food rises as the world's population rises, which is happening quickly. It has been incredibly challenging for the agricultural business to find methods and procedures that would enable them to completely meet the expanding wants and requirements due to the growing population and the shifting expectations of consumers. Agriculture is one of the most important societal sectors since it supports advancements. In order to enhance the industry's overall outcomes and results, it is crucial to make sure that improvements are done. Technology used in food production should encourage significant innovation and development to meet changing consumer demands. Since the majority of nations depend on the agricultural sector, it is essential to utilize the agricultural resources. Smart irrigation is a growing field of science that use data-intensive techniques to boost agricultural output while lessening its effect on the environment.

A deeper knowledge of the operation environment and the operation activities is made possible by the data that modern agricultural operations collect from a number of sensors. Decision-making becomes more precise and effective as a result. Additionally, this enables resource optimization and accomplishing the sector's desired goals. When these technologies are used in irrigation systems, water is saved to such an extent that it contributes significantly to Goal 6 and Target 6.4 of the Sustainable Development Goals (SDGs) set out by the United Nations. Implementing intelligent irrigation systems may help achieve sustained benefit and a better world for everyone SDGs connected to water and the environment. However, the improper use of agricultural components might have a harmful impact on the ecosystem.

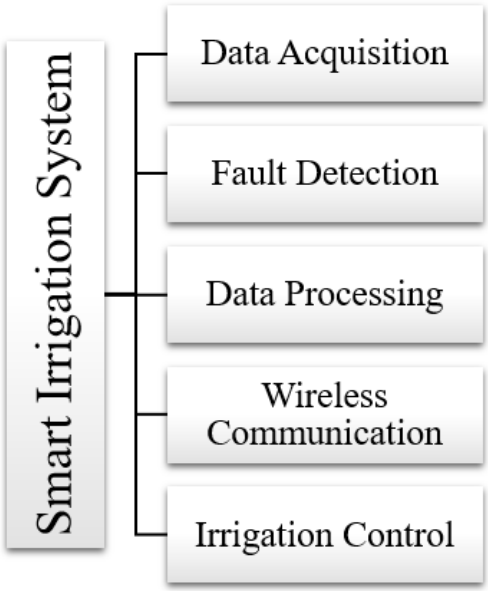

Figure 2: Demonstrates That the Smart Irrigation System Which Comprises Several Equipment's that Plays an Important Role in Agricultural System.

Lack of field competence and a lack of land reservoirs might be two of the main causes. The frequent removal of water from the soil has caused the water levels to drop, which has assisted in the growth of areas of unirrigated land. As a result, strengthening agricultural systems has become

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essential, and nations are now striving to put in place efficient frameworks where systems might be operated effectively. Artificial intelligence (AI) technologies and solutions are being used in contemporary agriculture and sustainable farming methods. The multifaceted area of sustainability has drawn a lot of attention from academics in recent years across a variety of disciplines. Due to its interdisciplinary character, sustainability includes a wide variety of themes, including climate, ecology, the green economy, food safety, sustainable agriculture, clean technology, etc. Therefore, the application of AI in agriculture has received increased attention recently. A developing method that automates irrigation systems and reduces water use, the smart irrigation system improves performance. This method helps farmers to satisfy their demand using a newly accepted strategy that conserves water for the irrigation process by adjusting irrigation depending on real soil and weather conditions. Figure 2 demonstrates that the smart irrigation system has data collection (sensor), watering management, Wi-Fi connection, data management, as well as problem detection. IoT devices may use any of these parts.

3. CONCLUSION

The goal of this evaluation study was to draw attention to the improvement of agricultural monitoring systems that address issues with current plans, such as cost, availability, and outside usability. A straightforward, affordable, environmentally friendly agricultural management system that is highly adaptable, dependable for exterior use, self-powered to eliminate the need for long power distribution connectors, and also has greater performance to reduce the strain on agriculture and increase crop yields as well as income has been evolved. The smart irrigation system may be utilized extensively to decrease water waste and to supply farmers with healthy plants. In our project, a relay that regulates this process allows the motor to be automatically switched ON and OFF. The water tank or water storage that is attached to the motor provides the plants with the necessary quantity of water. This project effectively monitors the water level for the plants. When required, it gives plants the right quantity of water. The plants' development and vitality may be preserved. As farmers are not obliged to regularly examine the irrigation operation, men work and labor costs are decreased. Water wastage has decreased, which has numerous positive economic effects; as a result, this project has positive economic effects as well. The greatest way to prevent water problems in agriculture will be to use smart irrigation.

REFERENCES:

[1] S. Rawal, “IOT based Smart Irrigation System,” *Int. J. Comput. Appl.*, 2017, doi: 10.5120/ijca2017913001.

[2] S. B. Saraf and D. H. Gawali, “IoT based smart irrigation monitoring and controlling system,” in *RTEICT 2017 - 2nd IEEE International Conference on Recent Trends in Electronics, Information and Communication Technology, Proceedings*, 2017. doi: 10.1109/RTEICT.2017.8256711.

[3] A. J. Rau, J. Sankar, A. R. Mohan, D. Das Krishna, and J. Mathew, “IoT based smart irrigation system and nutrient detection with disease analysis,” in *TENSYMP 2017 - IEEE International Symposium on Technologies for Smart Cities*, 2017. doi: 10.1109/TENCONSpring.2017.8070100.

[4] G. Natarajan and L. Ashok Kumar, “Implementation of IoT based smart village for the rural development,” *Int. J. Mech. Eng. Technol.*, 2017.

[5] P. P. Jayaraman, A. Yavari, D. Georgakopoulos, A. Morshed, and A. Zaslavsky, “Internet of things platform for smart farming: Experiences and lessons learnt,” *Sensors (Switzerland)*, 2016, doi: 10.3390/s16111884.

[6] W. Difallah, K. Benahmed, B. Draoui, and F. Bounaama, “Implementing wireless sensor networks for smart irrigation,” *Taiwan Water Conserv.*, 2017.

[7] N. Suma, S. R. Samson, S. Saranya, G. Shanmugapriya, and R. Subhashri, “International Journal on Recent and Innovation Trends in Computing and Communication IOT Based Smart Agriculture Monitoring System,” *Academia*, 2017.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 4, April 2022

[8] A. D. Wilson, "Diverse applications of electronic-nose technologies in agriculture and forestry," *Sensors (Switzerland)*. 2013. doi: 10.3390/s130202295.

[9] A. King, "Technology: The Future of Agriculture," *Nature*, 2017, doi: 10.1038/544S21a.

[10] S. De Wilde, "The future of technology in Agriculture," *Hague Sticht. Toekomstbeeld der Tech.*, 2016.