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A Review of Smart Agriculture System Using IOT

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Abstract: Automation in agriculture has great potential worldwide. The global population is growing very quickly, and as a result, there is a significant increase in the need for food. The productivity produced by traditional farming practices is not meeting the populations growing needs and is not meeting expectations. Thus, farmers apply hazardous pesticides more heavily, which has an impact on the soil. This approach has a significant impact on agriculture, and ultimately, the land remains barren and devoid of fertility. These problems and the effects of the environment on agricultural practices need to be resolved today.
We all understand that agriculture is an especially vital industry for rural residents, with 70% of Indians relying on it for their livelihood. The main challenges affecting the agriculture industry due to urbanization are a spike in environmental pollution, climate change, and deterioration of soil and water quality. In addition, all of these factors will immediately reduce farming industry revenue, which will be the main reason for the extensive relocation of rural residents to urban areas. We can track machinery, monitor the efficacy of fertilizer, track the efficacy of the soil, monitor the temperature and humidity, remotely monitor the storehouse, and more with IOT-based sensor technologies. Wireless sensor networks (WSN) and the internet of Things (IOT) working together will develop agriculture at a lower cost. Sensors based on IOT, such as humidity, temperature, monitoring, and moisture sensors, will have applications in intelligent farming.

Keywords: Smart Agriculture tools, IOT, Sensors, Irrigation, Agriculture, Soil, and Temperature.

I. INTRODUCTION

In the current digital era, farmers can handle agricultural data by employing farm IOT devices that can transmit and receive real-time, ground-level agricultural information. The environment has recently shifted because of concentrated advancements in artificial intelligence and machine learning research on farming contexts, irrigation, livestock, and agriculture. Improving water conservation and output has been the goal of irrigation monitoring, control, and decision-making solutions [1, 2, 3, 4, 5,].Because 60%–70% of India's economy is based on agriculture, agriculture is important to the country's development in terms of food production. Groundwater is being used without planning, which is causing it to disappear daily. Another significant advancement in technology is the Internet of Things (IOT). IOT is crucial to many industries, including agriculture, where technology can feed billions of people worldwide in the future. Because the entire system is microcontroller based and can be controlled wirelessly from a distance, timing watering according to crop and soil conditions need not be a worry. All around the nation is a sizable region used for agriculture. Therefore, a predetermined, dispersed number of sensor nodes is required. IOT-based smart agriculture uses sensors to monitor the agricultural field and automate irrigation using data from light, humidity, temperature, and soil moisture, among other sensors. IOT can be used in both manual and automatic modes. It should be able to measure changes in the water table and soil moisture content.

II. Applications of IOT in Agriculture

IOT supports a wide range of applications in digital agriculture, including supply chain monitoring, precision agriculture, irrigation assessment support, crop growth observation and selection, soil and plant monitoring, and greenhouse environment monitoring and control systems. The established technologies listed below are employed in IOT applications in agriculture:

Agriculture and Sensor Technology: A wide range of sensors are used in agricultural products, including heavy metal detection sensors, biosensors (which detect an analytic), gas sensors (which detect the presence of gas), soil moisture sensors, water-level sensors, and equipment that samples the state of the atmosphere from meteorological sensors (monitors).

RFID Technology: Animal tracking and identification make extensive use of RFID technology. It facilitates the intelligent tracking, identification, and traceability of animals and their management.

Radio Transmission Technology in Agriculture: ZigBee Wireless Sensor Networks Enable Self-Organizing Wireless Data Transmission This technology has been extensively used for data transmission in large-scale farming.

Technical Quality Safety of Agricultural Products: Recording and monitoring of the chain can comprehend the entire regulatory process in the agricultural industrial chain (production–circulation–sales).

Precision Seeding and Spraying Techniques: This method can accomplish the same results for planting, spraying, and fine-tuning the use of pesticides, seeds, and other materials by combining technology with Global Positioning System (GPS) navigation, seeding technology, and fertilization at a variable rate.

III. LITERATURE REVIEW

(Mohapatra et al., 2022) conclude that an agri-environmental monitoring system is possible through a small prototype design model. Even if the model has a lot of advantages, but many big challenges like hardware cost, software cost, energy optimization, storage and reliability of data, data accessibility and connectivity and fast real time development. Modern agriculture practices not only help to improve the farm output but also contribute to the overall welfare of farmers.

(Namani & Gonen, 2020) study focuses on introduction of a Smart Drone for crop management where the real-time Drone data coupled with IoT and Cloud Computing technologies help in building a sustainable Smart Agriculture. Several features could be added to improve the functionality of Smart Drones. Additional features include extending the drone capability by introducing a pluggable scheduler, an intelligent analyzer in the drone which help in less human intervention when there is an odd detection in the crop. Security and risk features are to be added. Drones has to be embedded with reprogrammable software which helps to divert the drone, come home and land etc.

(Srivastava et al., 2020) includes development of a system which can monitor temperature, level of water, moisture and even the movement if any happens in the field which may destroy the crops in agricultural field through sensors using Arduino UNO board. Also, aims at making use of evolving technology i.e. IOT and smart agriculture using automation. Once hardware has been developed depending on the change in requirements and technology the software needs the updating. The updated hardware is called new version of the software. This new version is required to be tested in order to ensure changes that are made in the old version work correctly and it will not bring bugs in other part of the software. This is necessary because updating in one part of the hardware may bring some undesirable effects in other part of the hardware.

(Devanand et al., 2019) proposed system for agriculture is very good it checks the moisture level in the soil according to which motor is turned ON or OFF. Also, the information about water level in the water tank is given to the user on the LCD display as well as by using IoT also. The system gives information about humidity and atmospheric temperature. According to which we can take action. Because of PIR sensor animals' entry is also detected. The advantages included low cost, low power consumption and less time analysis.

(Gade et al., 2019) is monitoring temperature, PH, moisture in agriculture field and using smoke sensor detection of fire in farm field is done. Through WIFI module the measured value was sended toward the farmers mobile through virtuino app. Benefits for the farmers and gardeners who do not have enough time to water their crops. It also controls the wastage of water during irrigation. As water supplies become insufficient and polluted, there is a need to irrigate more efficiently in order to minimize water use and chemical leaching. Recent advances in soil water sensing make the commercial use of this technology possible to automate irrigation management for crop production.

(Naresh & Munaswamy, 2019) proposes a thought of consolidating the most recent innovation into the agricultural field to turn the customary techniques for water system to current strategies in this way making simple profitable and temperate trimming. Some degree of mechanization is presented empowering the idea of observing the field and the product conditions inside some long-separate extents utilizing cloud administrations. The points of interest like water sparing and work sparing are started utilizing sensors that work consequently as they are modified. This idea of modernization of farming is straightforward, reasonable and operable. As relying upon these parameter esteems rancher can without much of a stretch choose which fungicides and pesticides are utilized for enhancing crop creation.

(G. Sushanth & S. Sujatha., 2018) includes development of a system which can monitor temperature, humidity, moisture and even the movement of animals which may destroy the crops in agricultural field through sensors using Arduino board and in case of any discrepancy send a SMS notification as well as a notification on the application developed for the same to the farmer's smartphone using Wi-Fi/3G/4G. The system has a duplex communication link based on a cellular- Internet interface that allows for data inspection and irrigation scheduling to be programmed through an android application. The system also senses the invasion of animals which is a primary reason for reduction in crops. This system generates irrigation schedule based on the sensed real time data from field and data from the weather repository. This system can recommend farmer whether or not, is there a need for irrigation. And, because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

(Anushree M., Layak Ali & Pruthiviraj U., 2018) objects to irrigate the plants using the smart drip irrigation system. And to achieve this objective, a central controller of the system was developed using open-source platform. Also, various sensors have been employed which continuously provide the existing parameters of factors governing the healthiness of plants. The entire irrigation system can be monitored and managed by the webpage. This web page has a facility for controlling the irrigation of plants both manually and automatically. Further, weather prediction is also done, so as to regulate the quantity of water being administered thus making it more reliable and efficient. The system is scalable to less modification to the core.

(Patil et al., 2017) embrace the savvy agribusiness framework in light of IOT witch help farming administration and development of products including less utilization of water, compost and pesticide. Also, presents Agro-logger system which is capable to send and receive the data from the sensors and also get the updated and precise data from the cloud. This data is further analyzed for the best selection criteria depending on the reviews given by the farmers and Agro-logger.

(Windhuk et al., n.d., 2015) investigate the potential contributions of internet of things technologies (IoT) towards poverty reduction in rural areas, in line with the needs identified in communities and with emphasis on agriculture. It also shows the benefits in business from IoT in various domains of agriculture which includes water management, weather forecasting, wildlife management, finance, forestry, plant and animal disease management, extension services, etc. The study also be utilized by developers of new IoT technologies to build country-specific technologies based on the identified.

V. CONCLUSION

The proposed review paper provides information on various IOT applications for soil parameters, including soil temperature, soil moisture, and atmospheric temperature, to predict water availability. This process will help identify poor soils with a good water ratio for agriculture. The data collected by the sensors are designed to learn using machine learning techniques to ensure a high-performance system. Adopting IOT-based smart farming helps to obtain a good harvest and reduces human involvement in farming. The project provides a comprehensive solution to field operations, irrigation issues, and the need for a smart warehouse management system and smart irrigation system, as demonstrated by all observations and experimental tests. Putting such a system into practice in the field will undoubtedly increase crop yields and overall production.

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