SmartFarmer – IoT Enabled Smart Farming Application

Literature Survey

Abstract:

An IoT-based farming system is referred to as smart agriculture. A greater variety and higher quality of agricultural goods are produced under this new approach. IoT devices offer details about the characteristics of farming fields and then act in response to input from the farmer. An sophisticated IoT-based method for tracking the atmosphere and soil conditions for productive crop growth is given in this study. Using Node MCU and a number of sensors attached to it, the built system is capable of monitoring temperature, humidity, and soil moisture level. Additionally, an SMS message regarding the field's environmental state will be transmitted to the farmer's phone over Wi-Fi.

Introduction:

The objective of this outline is to present an IoT-based smart farming system that will give farmers access to real-time information about soil moisture and environmental temperature at a very low cost, allowing for real-time monitoring. Following the investigation, it was discovered that each crop field has unique qualities that can be assessed independently in terms of both quality and quantity. Important elements that determine a soil's appropriateness and capacity for a particular crop include soil type, nutritional content, irrigation flow, pest resistance, etc. In light of conventional farming practices, farmers must frequently compute the agriculture plots

during the crop life to have a better understanding of the crop circumstances.

As a result, smart agriculture is required because farmers spend 70% of their time monitoring and comprehending crop conditions rather than working in the fields. Wireless sensors make it easier to continuously monitor crops with greater accuracy and, most crucially, allow for the early detection of unfavourable states.

This is why modern agriculture uses sophisticated equipment throughout the process, from planting to crop harvesting to storage and transportation.

The process is made smarter and more cost-effective by timely reporting using sensors, which have accurate monitoring capabilities. Agriculture equipment is currently supplemented by a variety of autonomous tractors, harvesters, robotic weeders, drones, and satellites.

Sensors may be deployed and begin gathering data quickly. This data is then almost immediately available online for additional investigations. Sensor allows accurate data gathering for each site, which is essential for the application of scientific crop and site-specific agriculture.

EXISTING WORKS:

1. Monitoring the state of the climate.

The weather stations that incorporate numerous smart farming sensors are arguably the most well-liked smart agricultural technology. They are spread out around the area and gather various environmental data before sending it to the cloud. The measurements offered can be used to map the climate conditions, select the suitable crops, and implement the necessary improvements (i.e. precision farming).

AllMETEO, Smart Elements, and Pycno are a few instances of these agricultural IoT devices.

2. Automation in greenhouses.

In order to manage the greenhouse environment, farmers frequently require manual intervention. They can obtain precise real-time information on greenhouse parameters including illumination, temperature, soil quality, and humidity thanks to the usage of IoT sensors.

Weather stations can autonomously change the conditions to reflect the specified parameters in addition to sourcing environmental data. In particular, automation systems for greenhouses operate on a similar concept. Examples of IoT agriculture products that offer such features are Farmapp and Growlink.

Another intriguing device that makes use of smart agriculture sensors is GreenIQ. You can remotely control your irrigation and lighting systems with this intelligent sprinkler controller.

3. Crop administration

Crop management tools are an additional IoT product category in agriculture and a component of precision farming. They should be set up in the field to gather information pertaining to crop farming, such as temperature and precipitation as well as leaf water potential and general crop health, just as weather stations.

So you can successfully stop any diseases or pests that could reduce your crop's output, you can keep an eye on your crop's growth and any irregularities. Arable and Semios are excellent examples of how this use case might be put to use in practise.

4. Precision agriculture

Precision farming, also referred to as precision agriculture, is all about effectiveness and making precise data-driven decisions. It's also one of the most popular and successful IoT uses in agriculture.

Farmers may gather a wide range of metrics on every aspect of the field ecosystem and microclimate with IoT sensors, including illumination, temperature, soil quality, humidity, CO2 levels, and pest infestations. With the aid of this information, farmers can more accurately predict the water, fertiliser, and pesticide requirements of their crops, cut costs, and produce better, healthier crops.

For instance, CropX creates Internet of Things (IoT) soil sensors that assess soil moisture, temperature, and electric conductivity, allowing farmers to tailor their practises to the particular requirements of each crop. When combined with GIS information, this technology aids in producing accurate soil maps for each fields.

Similar services are provided by Mothive, which assists farmers in reducing waste, increasing yields, and improving farm sustainability.

5. Drones used in agriculture

The use of agricultural drones in smart farming is arguably one of the most exciting developments in agritech. Drones, also referred to as unmanned aerial vehicles or UAVs, are more effective in gathering agricultural data than satellites and aircraft. Aside from surveillance, drones are also capable of carrying out a wide range of jobs that formerly needed human labour, such as planting crops, eradicating pests and diseases, spraying for agriculture, monitoring crops, etc.

For instance, DroneSeed creates drones to plant trees in sparsely wooded areas. Such drone use is six times more productive than using human labour. A Sense Fly eBee SQ agriculture drone, which is

reasonably priced, employs multispectral image analysis to gauge the health of crops.

6. Predictive analytics for intelligent agriculture

Predictive data analytics and precision agriculture go hand in hand. Despite the fact that IoT and smart sensor technology are a gold mine for extremely relevant real-time data, using data analytics enables farmers to make sense of it and make key forecasts, such as when to harvest crops, the likelihood of illnesses and pests, yield volume, etc. Farming, which is fundamentally very dependent on weather, is made more controlled and predictable with the aid of data analytics tools. For instance, the Crop Performance platform enables farmers to access crop volume and quality as well as their susceptibility to adverse weather circumstances like floods and drought in advance. Additionally, it enables farmers to choose the ideal amount of nutrients and water for each crop.

Solutions like SoilScout, when utilised in agriculture, help farmers save up to 50% on irrigation water, lessen the loss of nutrients due to overwatering, and provide actionable information regardless of the time of year or weather.

7. Total farm management programmes

The so-called agricultural productivity management systems might be seen as an example of a more advanced approach to IoT products in agriculture. They often comprise numerous on-site sensors and IoT devices for agriculture, as well as a robust dashboard with analytical tools and built-in accounting and reporting functions.

This enables remote farm monitoring and streamlines the majority of commercial processes. FarmLogs and Cropio both offer related solutions.

Other notable prospects include vehicle tracking (or even automation), storage management, logistics, etc., in addition to the IoT agriculture use cases that have been described.

8. Comprehensive farm management programmes

The so-called agricultural production management systems can be viewed as a more intricate method of utilising IoT devices in agriculture. A comprehensive dashboard with analytical capabilities and built-in accounting/reporting functions is typically included together with a variety of farm IoT devices and sensors that are deployed on the premises.

By streamlining the majority of corporate procedures, this provides remote farm monitoring capabilities. FarmLogs and Cropio are examples of comparable solutions. In addition to the IoT agriculture use cases mentioned, other significant prospects include logistics, storage management, vehicle tracking (or even automation), and so on.

Reference	architecture	Protocol	Technology	Benefits	Limits
Debauche (2022)	Short Supply Circuit Internet of Things (SSCIoT)	5G-MEC LoRa WSN Wi-Fi 3GPP	Edge, Fog &Cloud computing	Efficient data processing. ultra-low latency. limit exchange with cloud.	Complex architecture
Dahane (2021)	Edge-Fog-IoTCloud based architecture	nRF24L01 Http	Edge, fog,cloud computing and AI	Real time processing Interoperability and Accessibility The Edge Computing paradigm reduces congestion due to the need for computing	Complex architecture
Nguyen (2020)	5layer sensor edge fog cloud terminal system architecture	LoRa nRF Wifi AVR	Edge and fog computing LPWAN	Distributed local storage. Interoperability.security. The Edge Computing paradigm reduces congestion due to the need for computing	Complex architecture

				Reduce the size of data up 67%	
Perez-Pons (2020)	SmartDairyTracer platform based on Global Edge Computing Architecture (GECA)	ZigBee Wifi Http MQTT CoAP	Edge, Fog Computing AI Blockchain	The Edge Computing paradigm reduces congestion due to the need for computing. Network or cloud storage resources reduce data traffic by more than 46%. Blockchain technologies guarantee the security data integrity and traceability. Low-cost	Complex architecture

Components:

Based on data from many sensors, including temperature, humidity, soil moisture and soil nutrients, this gadget monitors the farm or greenhouse and informs the farmer of the current circumstances in order for him to act quickly. The farmers' prompt actions will enable them to boost their farming production and make proper use of natural resources, which will also make our product environmentally friendly. By carefully monitoring the various current conditions, our product will improve the crops' quantity and quality. It is an Internet of Things device that uses the "Plug and Sense" idea. On a laptop or a smartphone, you can view real-time data for many metrics.

Different Components:

Breadboard

DHT11 Temperature and Humidity Sensor

Soil Moisture Sensor

LEDs

Passive buzzer

Power Supply-Power Bank

IBM Cloud

Watson IoT Platform

Node-Red

IBM CloudantDB

Conclusion:

The technology and materials we employed to produce our porotype allowed us to create an effective and accurate solution for farmers that was also affordable, as evidenced by our results and a literature review of other studies. which was affordable and simple for farmers to install. With the user-friendly app and various alarm mechanisms, we can therefore draw the conclusion that this prototype will undoubtedly assist farmers on tiny acreage to successfully monitor their crops.

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