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Popular Article

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IOT Based Smart Farming in Agriculture

S. Sowmiya [1], J. Bhuvaneswari[2], M. Hemalatha[3] and M. Joseph[4]

[1]Ph.D Scholar, VOC AC&RI, Killikulam - 628252

[2]Assistant Professor, VOC AC&RI, Killikulam – 628252

[3]Professor and Head, VOC AC&RI, Killikulam - 628252

[4]Professor, VOC AC&RI, Killikulam - 628252

Introduction

An Internet of Things (IOT) ecosystem is one in which humans, animals, and things are outfitted with individual IDs that allow them to transmit data over an internet network without requiring human-to-human or human-to-computer interaction. "Just as the Internet changed the world, so too may the Internet of Things [IOT]. Possibly even more so. Kevin Ashton coined the word "IOT" in 1999. It stands for "internet of things," which refers to the connection of everything to the internet and the relationship between people, things, and people. The network of physical items, or "things," embedded with electronics, software, sensors, and network connectivity that allows these objects to gather and share data is known as the Internet of Things (IOT). IOT devices have distinct identities and are able to sense, act, and monitor certain types of data in real time from a distance. "Smart farming" is a new term for farm management that maximises the amount of human labour needed for production while increasing the number and quality of products produced. Technologies like IOT, robotics, drones, and AI are used in this process.

IOT in Smart Farming

"Smart farming" aims to give the agricultural sector the infrastructure it needs to apply cutting-edge technologies for tracking, monitoring, automating, and analysing processes. These technologies include big data, the cloud, and the internet of things (IOT).

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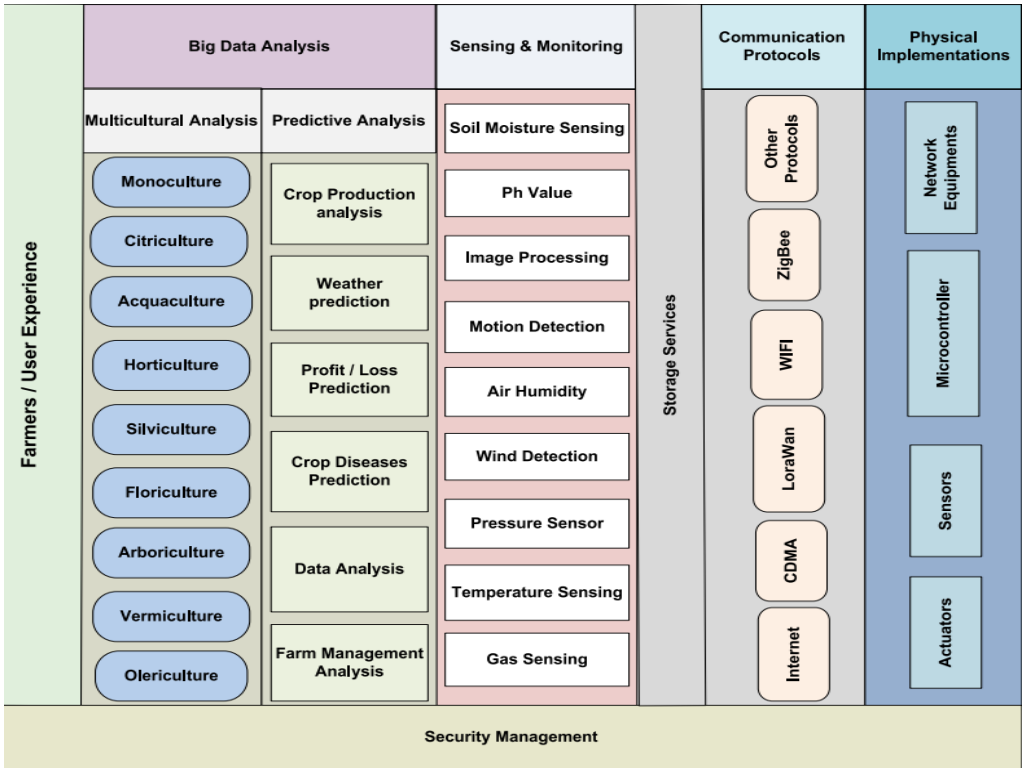

Predictive analysis: The application of data, statistical algorithms, and machine learning approaches to forecast future results based on past data is known as predictive analytics. Beyond only understanding what has occurred, the objective is to offer the best prediction of what will occur in the future.

Sensing and monitoring: When developing IOT systems, sensors are crucial. Sensors are devices that take in information from the outside world and convert it into a signal that both computers and people can understand.

Physical implementations: Various actuators, microcontrollers, and sensors are physically implemented to monitor various agricultural applications. In addition to handling networking-related tasks and other functionality handled by sensors and actuators, microcontrollers also serve as supervisors.

Storage services: Farmers save data on their crops so they can analyse it more effectively later on and use it over several growing seasons to increase yield.

IOT enabling technologies: The foundation of the Internet of Things is made up of numerous enabling technologies. Nonetheless, low-energy Bluetooth, low-energy wireless, low-energy radio protocols, LTE, RFID, NFC, and low-energy wireless are the main IOT enabling technologies and protocols.

Wireless Sensor Network (WSN): In order to increase farming's quality and production, wireless sensor networks, or WSNs, are frequently employed in agriculture monitoring. This programme uses sensors to collect several kinds of data in real-time scenarios, such as temperature, humidity, and carbon dioxide level.

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Cloud Computing: It can gather data on every crop that has been cultivated recently, which will assist farmers in choosing what to plant next. Regional meteorological data and weather forecasts for particular timeframes can be stored in the cloud in a variety of formats, including SaaS, PaaS, Iaas, and others.

Big data analysis: Farmers can access detailed information from big data about water cycles, rainfall patterns, fertiliser needs, and other topics. They may now decide when to harvest and what crops to grow for maximum revenue thanks to this ability to make informed judgements. Farm yields are ultimately improved by wise judgements.

Communication Protocols: These protocols enable data exchange formats, data encoding, and data addressing, and they serve as the foundation for Internet of Things systems, enabling connectivity and coupling to applications.

APPLICATION	DESCRIPTION
Crop water management	**Agriculture IoT is integrated with Web Map Service [WMS] and Sensor Observation Service [SOS].** **Water management can be efficiently managed by IOT Technology to avoid the wastage of water by using different types of sensors. To solve the problem, smart irrigation system using IOT helps farmers to avoid wastages of water, improve quality of crops by irrigating at correct time.**
Precision agriculture	**Agriculture IOT system ensure timely delivery of real time data in terms of weather forecasting, quality of soil, cost of labor and much more to the farmer**
Integrated pest management or control [IPM/C]	**Use of IOT for integrated pest management is unavoidable as it involves various tools from biological, chemical, mechanical and cultural field. Information about pests and all these tools needs to be maintained**
Food production and safety	**Agriculture IOT system accurately monitors various parameters like warehouse temperature ,shipping transportation management system and also integrates cloud based recording system**

IOT in Agriculture

IOT technologies for agriculture include software, IT services, wireless networking, and specialised equipment. IOT-based smart farming solutions are systems designed to use sensors (light, humidity, temperature, soil moisture, crop health, etc.) to monitor an agricultural field. IOT

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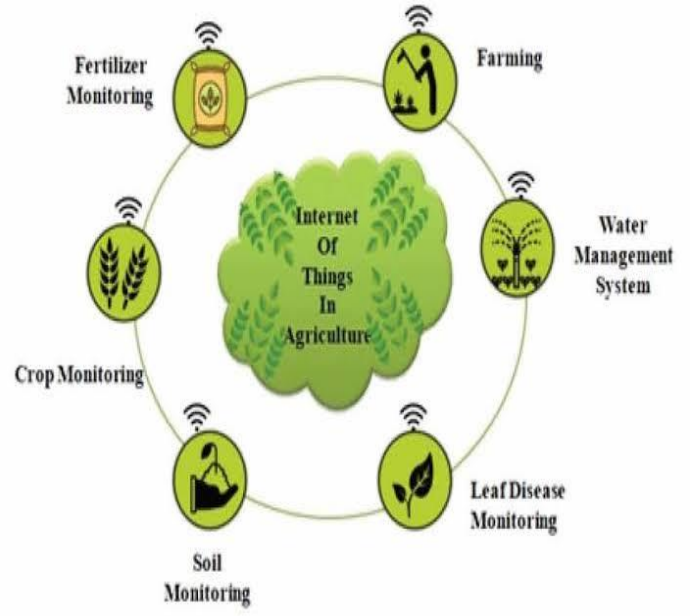
enables devices located across a farm to remotely measure any kind of data and instantly transmit this information to the user or farmer. Information on soil moisture, chemical application, dam levels, and livestock health can be collected by IOT devices.



Climate conditions monitoring: The most widely used technology in agriculture for tracking various climatic conditions is the weather station. Temperature, humidity, wind direction, air pressure, and other weather factors are being tracked. The meteorological information gathered is utilised to map the climate and offer fresh perspectives for implementing necessary measures to raise agricultural output. Climate Smart Agriculture (CSA) is a weather-related technique that has been outlined by the US Food and Agriculture Organisation (FAO). A number of factors, including temperature, carbon dioxide, oxygen content, and ventilation, are combined to generate and maintain an optimal environment for plants within very tight bounds.

IMD – Automatic Weather Station (AMS)

An integrated system of parts, or AMS, is used to measure, log, and frequently transmit meteorological parameters. They consume little power and offer frequent, accurate readings. Either to reduce the need for human labour or to allow measurements from far-off places.

Major parts of AWS

- Anemometer for measuring wind speed.
- Wind vane for measuring wind direction.
- Hygrometer for measuring humidity.
- Barometer for measuring atmospheric pressure
- Thermometer for measuring temperature.

Irrigation Monitoring System: IOT technology uses four methods to monitor irrigation systems: WiFi, Ethernet connections, weather prediction data, and field management and monitoring from any location. A low-cost irrigation system built on the Internet of Things has been developed, and

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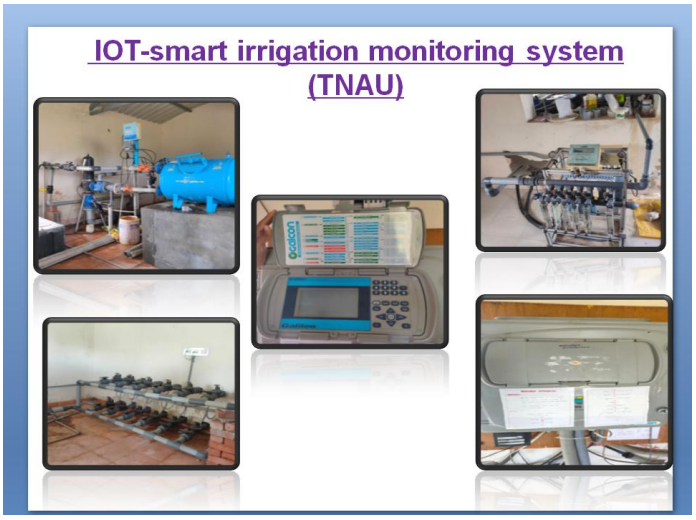
it informs the user via HTTP protocols. Wirelessly communicative sensor nodes keep an eye on the quality of the water.

Smart Irrigation System for the reduction of water losses in agriculture through this Innovative system.

To prevent excessive water use, smart sensors are deployed and operated using numerous Internet of Things protocols. Water management in greenhouses is accomplished using automatic drip irrigation, which operates by monitoring a specified soil moisture threshold.

The sensors used are Temperature and humidity sensor, Light sensor, Carbon dioxide sensor, Soil moisture sensor, Wind speed and direction sensors, Water pH levels and Air circulation monitoring.



Smart irrigation monitoring system

Farm Management System:

Every sensor and gadget on the farm have an identity that provides accurate information about fertilisation, meteorological information, automatic monitoring of the buffer zone width, and the generation of automatic detail records based on the daily operations of the farm. The term FMS

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refers to the collection of management techniques and strategies used to maintain a farm's profitability and productivity.

Soil Patterns Monitoring:

In the agricultural sector, soil monitoring has emerged as one of the most demanding tasks for farmers as well as companies. Many environmental problems that have an impact on crop productivity are encountered in soil monitoring. Additionally, field protection against overfertilization and crop loss is provided by the use of IOT technology to identify polluted soil. By routinely checking on the condition of the plants and sending out an alarm if any issues are identified, IOT sensors and cameras help to create the perfect habitat for plants.

Pest and Crop disease monitoring:

A proposed IOT-based monitoring system keeps an eye on illnesses, weeds, and pests. Early crop disease detection helps farmers increase crop yield by protecting crops from pest damage.

Determine the optimal time to Plant and Harvest:

To precisely identify when to weed and seed, Internet of Things (IOT) combines a number of current technologies, including radio frequency identification (RFID), wireless sensor networks (WSNs), end user apps, and cloud computing applications. In order to accomplish tasks like SMS and MMS, GPS offers an interface to communicate with ARM (an intelligent monitoring system). When unwelcome changes occur, GPS alerts the farm manager and assists the farmers in taking corrective action.

GPS based monitoring:

Utilising a wireless sensor network, the GPS system gathers farm specifications and transmits the parameters under observation to the central monitoring station.

Benefits of IOT in Agriculture:

1. IOT makes it simple to gather and manage massive amounts of data from sensors and integrates cloud computing services like maps of agricultural fields and cloud storage.
2. IOT productions can achieve remarkably low costs, which will boost sustainability and profitability.
3. The level of efficiency in the use of pesticides, fertilisers, water, soil, and other resources would rise with IOT.
4. The internet of things makes it possible to prevent problems and get rid of any problems that can arise when farming.

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