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Analyzing Smart Agriculture in Terms of IoT

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ABSTRACT

Agriculture is the major income source in India. Many farmers in India use the traditional way for crop production. Weather conditions in India has changed a lot nowadays. Agriculture in India depends upon weather conditions. There are many traditional ways to increase crop production like Irrigation, greenhouse, fertilizers, etc., but keeping in mind about the current weather conditions we need a smarter way to monitor the weather conditions. Now smart farming is possible because of the Internet of Things (IoT).

IoT uses different enabling technologies like cloud computing, big data analytics, wireless sensor network, embedded systems. Using IoT, we can track live data like weather conditions, soil moisture, temperature, humidity, soil PH, soil nutrition levels, water level from any place. The motive of this paper is to know about smart farming techniques and technologies in terms of the Internet of Things.

KEYWORDS: *IoT; Smart Agriculture; Smart Farming; Smart Greenhouse; Smart Irrigation; IoT enabling technologies*

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I. INTRODUCTION

The Agricultural economy is the main income for India. India's agriculture is dependent upon traditional methods. Around 55 percent of people in India do farming and it constitutes only 15 percent of GDP (Gross Domestic Product)[1]. Food and vegetables prices are rapidly changing and increasing because crop production rate is decreasing. Smart agriculture needs software for management and sensors for monitoring the data. The importance of Smart farming is growing due to sudden climate change and a huge population and it results in more requirements of food.

Many farmers have faced issues in traditional methods of agriculture sector like excessive use of fertilizers, insecticides, and pesticides, soil salinity, different plants require different amounts of temperature, humidity, and moisture[1]. Adding smart practices in farming will help the Indian economy by increasing crop production rates.

Recent technologies like the Internet of Things, Big data analytics, Wireless sensor network, Embedded Systems, Cloud Computing put change over worldwide. These technologies have also changed the traditional farming techniques. Smart farming practices are not yet much familiar in India. Using these technologies in farming farmers can monitor their fields from any place.

II. INTERNET OF THINGS (IoT)

Internet of Things (IoT) refers to the "Things" which are numbers of devices or sensors connected to the Internet. IoT allows device to device communication. These "Things" collect and share live data. IoT is a giant network that connects things to people and allows collecting as well as sharing sensed data[2]. In agriculture, a wide range of data is needed to be sensed like humidity or moisture. Using IoT in agriculture we can keep track of soil moisture, soil water level, temperature and humidity and other necessary information which needed to collect for better crop production.

III. ENABLING TECHNOLOGIES USED IN IoT

A. BIG DATA

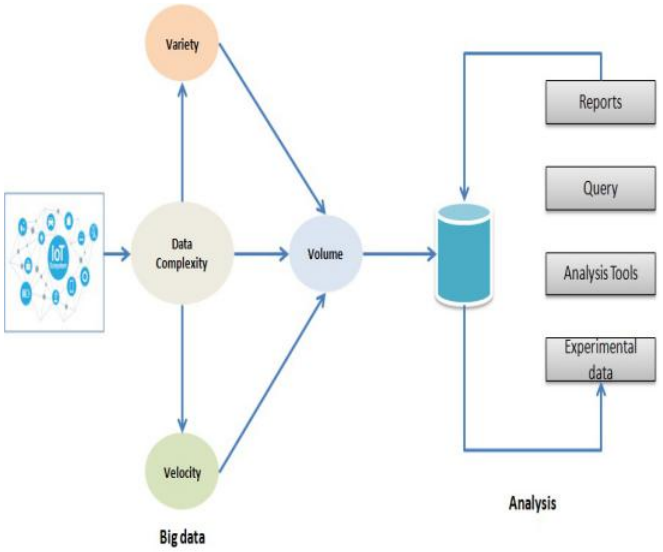
The data which was sensed earlier from any sensor is stored using big data technology. As we know now IoT allows devices to sense live data, the sensed data is huge in amount. As the name suggests the big amount of data is stored and analyzed, processed using big data analytics technology.

Big data analytics does four types of analytics: 1) Descriptive 2) Diagnostic 3) Predictive 4) Prescriptive. In smart agriculture Predictive analytic is used for doing soil data mining. For doing soil data mining it uses classification or clustering algorithms. Better crop sequence is analyzed using soil data mining[3].

In big data, the data is characterized by volume, velocity, veracity and variety.

1. Volume: volume refers to the size of the data is to be analyzed or to be processed. In smart agriculture big volume of data gets produced every day
2. Velocity: velocity refers to the data generation speed. In smart agriculture for each minute huge number of data needs to be analyzed.
3. Variety: In big data, the data has different types like structured, unstructured and semi-structured.

4. Veracity: veracity refers to the quality of the data. How much valuable is the data is found using veracity characteristic.



B. CLOUD COMPUTING

For storing sensed data on the server the cloud computing technology is used. Cloud computing is famous for the pay-as-you-use model which allows you to pay the cheaper cost. The cloud service provider offers three primary services as below:
Infrastructure as a service(IaaS): In IaaS service provider offers infrastructure, virtual environment, storage, and operating systems Software as a Service(SaaS): In SaaS service provider offers a method for delivering software applications over the internet.

Platform as a service(PaaS): In PaaS service provider offers an environment for debugging, testing and managing softwares[5].

Cloud computing is used in smart agriculture to send data in terms of the report over the internet.

C. WIRELESS SENSOR NETWORK

Wireless Sensor Network (WSN) is nothing but a collection of numerous sensor nodes.

These sensor nodes communicate among themselves by using radio signals. Each node in WSN has limited bandwidth, processing speed, and storage capacity[6].

WSN is used for collecting live data of parameters like temperature, humidity, pressure, wind direction and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, pollutant levels. In smart agriculture, WSN is used for sensing live data which is necessary for better crop production.

IV. APPLICATION AREAS IN SMART AGRICULTURE

The term smart agriculture uses the Internet of Things for improving the quality and quantity of crop production. Data like soil scanning, water level, humidity, temperature, etc., are collected from WSN. Softwares and applications are also used for monitoring temperature, moisture and water levels. Softwares or applications provide the user interface for farmers to easily monitor collected data from sensors. The Global Positioning System also used for tracking the location of fields.

As sensors collect live data every minute, huge storage is required. Big data analytics is useful in this case. Big data analytics stores the unstructured data and also allows doing analytics on required data.

This is how agriculture adopted modern techniques for betterment in crops.

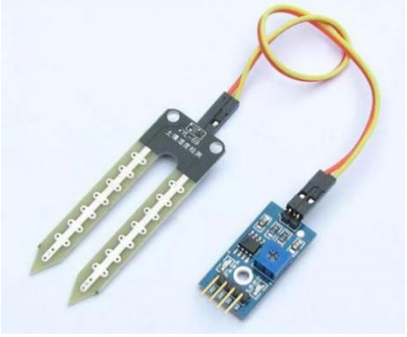
Following are some application areas in a smart agriculture that actually uses IoT and IoT enabling technologies in farming:

A. Smart Greenhouse

Traditional greenhouses control theenvironmental parameters manually by some proportional control mechanisms. InSmart greenhouses, manual intervention is reduced by intelligently monitoring, and controlling climate. In smart greenhouse to monitoring 'things' DHT11 sensor, LDR sensor, soil moisture sensor, pH sensor is used. Also, for controlling 'things' cooling fan, exhaust fan, water pump, artificial light, and the motor pump is used. The Microcontroller is an essential part of IoT. Microcontroller works as a CPU for this system[7].

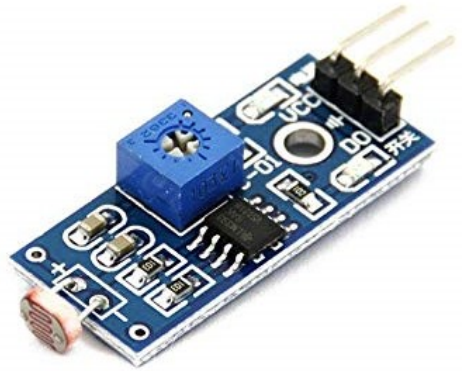
DH11 sensor: DH11 sensor is used for measuring temperatu re and humidity. DH11 sensor collects readings of the temperature and humidity and forwards it to the Microcontroller. According to those readings, Microcontroller gives appropriate commands.

Soil Moisture sensor: Soil moisture sensor measures moisture levels in soil. It contains two metal rods. If the soil moisture is less the resistance will be high and if the soil moisture is more resistance will be low.



LDR sensor: LDR(Light dependent resistor) is used for monitoring light intensity.

If the intensity of light increases, the resistance of LDR will be decreased. If the intensity of light decreases, the resistance of LDR will be increase.



pH sensor: pH sensor is used for measuring the pH of soil. The pH denotes a solution's acidity or alkalinity. pH sensor has a pH probe and a pH sensor module. pH sensor helps to retrieve the pH of the soil and based on that farmers can use fertilizers in proper proportion on crops.

Microcontroller-Arduino: Arduino board is Microcontroller which is the heart of the system. Arduino IDE is an open source and provides an easy interface so that you can easily handle your system.

B. Smart Irrigation

The smart irrigation system is mainly used to avoid the wastage of water. Each plant requires a different amount of water. A smart irrigation system not only calculates the moisture of the soil but also the soil parameters. The moisture, temperature level is calculated and appropriate irrigation is done.

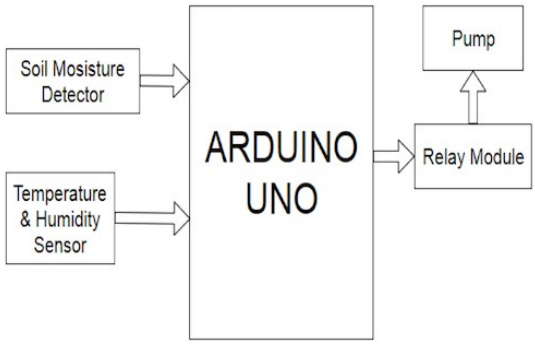


Fig : block diagram of smart irrigation system[9]

1. Soil moisture sensor

Soil moisture sensor is used to measure water level in soil.

2. Temperature and Humidity Sensor

The temperature and humidity sensor is used to reduce the watering frequency in the field. When the weather gets cooler, less water is provided to the field and vice versa in the other case.

3. RelayModule

The relay module is a switch that allows you to turn ON or OFF a circuit.

4. Peristaltic Pump

The peristaltic pump is used for pumping the water which is required for the field. The water is stored within a flexible tube which is fitted inside a circular pump.[9].

C. Agriculture Drones

Agricultural Drone is an innovative idea for live tracking of crops or fields. Crop health assessment, irrigation, crop monitoring, crop spraying, planting, soil, and field analysis is possible using agricultural drones[8].

Drones collect multispectral, visual data. Farmers can view whole fields by sitting at home or any corner of the field. Yield prediction, crop health, counting, chlorophyll measurement, any small problems can be seen easily. Agricultural drones are faster way to retrieving crop details. Mostly ground-based and aerial drones are used in smart agriculture.

D. Livestock Monitoring

With the help of wireless IoT devices, farmers can keep track of location and health status of their animals. Using these devices farmer can identify a sick animal. The sensors in livestock monitoring device helps in monitoring blood pressure, temperature, digestion system, immune system, and other important health characteristics.

V. Challenges in smart agriculture

A. Cost

As smart agriculture is possible using IoT and enabling technologies it obvious that the costs of systems will be expensive. In India, many farmers do not have a good economic background. Making an effective tool within less cost is challenge smart agriculture.

B. Awareness of smart farming in rural areas

In rural areas of India, farmers do not have knowledge about smart farming techniques. Farmers should know these smart practices to increase their income.

C. Proper Technical knowledge

To handle systems made up of IoT technology we need some technical knowledge. To handle the system some softwares and mobile applications are available through which we can interact with the system. To handle these applications farmers must need some basic technical knowledge.

D. Security

The IoT devices used for smart agriculture captures the live data and stores it in huge storage. As the data comes in the picture, the security of data becomes essential. The system should prevent attacks.

E. Authentication

For using the system for a particular field or someone's field, proper authentication must be done. The only authorized person should access the details of the farm. Authentication secures the data.

F. Platform Independence

The software or application used for running the system must be platform independent. That application or software must run on any operating system and different devices too.

VI. Advantages of smart agriculture

Following are some advantages of acquiring Smart agriculture practices:

- Using smart practices in agriculture results in increased crop production.
- Using smart irrigation wastage of water is avoided
- Not only the quantity of production is increased but also the quantity also increased.
- Detailed farm and field evaluation is possible.
- Real-time remote monitoring of fields has made it easier.
- Livestock monitoring helps in monitoring health of animals.
- Drones are useful in capturing crop growth from initial stage.

VII. Conclusion

The IoT has made farming easier. IoT uses different enabling technologies. One of them is a wireless sensor network (WSN) which is used in smart agriculture to collect the live data of fields like humidity, weather conditions, temperature, water levels, fog, etc. This collected live data is huge in amount. Here the need for Big data analytics helps to store and do analysis on data. Big data analytics uses some clustering and classification methods which allow to do data mining on stored data. By using this technique farmers can calculate the need for fertilizers. Collecting and sharing data over the server is also possible using Cloud computing. Cloud computing is also useful in smart farming. To improve the economy of India farmers should adopt these modern practices of farming.

References

[1] Kodali, Ravi Kishore, Vishal Jain, and Sumit Karagwal. "IoT based smart greenhouse." *2016 IEEE Region 10 Humanitarian Technology Conference (R10-HTC)*. IEEE, 2016.

[2] https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/

[3] Rajeswari, S., K. Suthendran, and K. Rajakumar. "A smart agricultural model by integrating IoT, mobile and cloud-based big data analytics." *2017 International Conference on Intelligent Computing and Control (I2C2)*. IEEE, 2017.

[4] https://www.bigdataframework.org/four-vs-of-big-data/

[5] https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/#cloud-computing-models

[6] Matin, Mohammad Abdul, and M. M. Islam. "Overview of wireless sensor network." *Wireless Sensor Networks-Technology and Protocols* (2012): 1-3.

[7] Agnal, Sharmila, et al. "Automated Smart Greenhouse Environment Using IoT." (2018).

[8] https://medium.com/sciforce/smart-farming-or-the-future-of-agriculture-359f0089df69

[9] https://www.electronicsforu.com/electronics-projects/prototypes/smart-irrigation-system