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ORIGINAL RESEARCH

An Analysis of Different Smart Agricultural System Using IoT

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Abstract – From centuries the main occupation of human is Agriculture as it has been emerging as the most important practice. There is a lot of traditional methods that are being used in the farming process and cultivation. The methods result in lot of wastage of water and due to excess moisture in the soil may harm the crop. For conservation of the natural resources like water and the nutrients of the soil, IoT is an emerging area to assist agriculture using sensors and automation of farms. Around 85% of total available water resource across the globe are used for irrigation purpose. IoT is the best solution for agriculture to conserve the resources for the future generation. This paper presents the smart system of organizing and monitoring the weather forecast data, temperature, humidity, rain and sensing the ground parameters like water level and soil moisture via Internet. The main objective is to monitor and control the irrigation systems through a smartphone. A wireless sensor based networking and intelligent processors of IoT helps to achieve optimum utilization.

Index Terms – Traditional methods, automation, monitoring, wireless sensor, intelligent processors

I. INTRODUCTION

The Internet of Things (IoT) describes the network of physical objects – "things" that are provided with unique identifiers (UIDs) connecting and exchanging data over a network without requiring human-to-human or human-to-computer interaction. IoT is a network of physical devices, other objects embedded with sensors, software, and connectivity, enabling them to connect and exchange data with each other, with other devices over the internet. IoT allows for devices to collect data in real-time, analyse it, and make decisions based on that data. IoT has vast applications in industries such as healthcare, transportation, agriculture, manufacturing, and home automation. IoT can also make use of artificial intelligence (AI) and machine learning to aid in making data collecting processes easier and more dynamic.

Smart Farming

Smart Farming involves collecting data from various sources such as soil sensors, weather stations, crop monitoring systems, analysing the data in real-time and making decisions related to crop management, irrigation, pest control, and other factors that impact the crop health and productivity [1]. IoT helps to maximize yield, minimum waste and reduce the overall environmental impact of farming operations by using sensors, drones, and this helps to monitor the crops more effectively, efficiently and make data-driven decisions [2].

Smart Irrigation

Smart irrigation technology is a method that allows for accurate control of the water needs of large farm, thus saving both money and water in the long run. IoT devices collect the data and use this to automatically adjust the amount and timing of water applied to crops. This technology uses weather data or soil moisture data to determine the irrigation need for the landscape. It is optimized for the particular area that is being watered. Smart irrigation systems can also help farmers to better manage water resources and conserve water in regions where water is scarce or expensive.

Precision farming

A farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. Precision farming is also referred as Precision agriculture. It uses information technology (IT) to ensure that crops and soil receive exactly what they need for optimum health, productivity and profitability. It considers aspects such as soil type, terrain, weather, plant growth and yield data when managing crops. Independently of the data source, the most crucial objective of PF is to provide support to farmers in managing their business and to increase efficiency, accuracy of agricultural operations. Modern agricultural production relies on monitoring crop status by observing and measuring variables such as soil condition, plant health, fertilizer and pesticide effect, irrigation and crop yield and take action to optimize their operations.

Drip Irrigation

Drip irrigation is a type of irrigation system that delivers water directly to the roots of plants, drop by drop, through a network of pipes, tubes. It involves dripping water onto the soil at very low rates (2-20 litres/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers. Drip irrigation sometimes called Trickle irrigation. This irrigation is an efficient and economical way to water the fields. Used commonly in drier areas of the country, drip irrigation is becoming more popular in the Northeast. Unlike other forms of irrigation, such as sprinklers that are only 65-75% efficient, drip irrigation 90% efficient at allowing lands to use the water applied.

The emitters slowly drip water into the soul at the root zone. Because moisture levels are kept at an optimal range, plant productivity and quality improve. In addition, drip irrigation:

- Prevents disease by minimizing water contact with the leaves, stems, and fruit of plants
- Allows the rows between plants to remain dry, improving access and reducing weed growth
- Saves time, money, and water because the system is efficient
- Decreases labor
- Increases effectiveness on uneven ground
- Reduces leaching of water and nutrients below the root zone

Vertical Farming

Vertical farming is the practice of growing crops in vertically stacked layers. It often incorporates controlled-environment agriculture, which aims to optimize plant growth, and soilless farming techniques such as hydroponics, aquaponics, and aeroponics. It sometimes known as Indoor farming. Vertical Farming uses IoT has applications in a variety of industries, from urban agriculture to food production in remote or harsh environment. Software, robotics and data science are some of the technologies used in vertical farms to monitor crops and create optimum growing conditions. This includes controlling temperature, humidity, CO2 and light and eliminating the need for pesticides. These farms also aren't reliant on the weather, so fresh produce can be grown all year round. Drones can be used to monitor crop health and growth patterns, while automation systems can be used to manage the entire farming process, from planting to harvesting Vertical farms also tend to produce more than conventional farms.

Hydroponics

Hydroponics is a type of agriculture that involves growing plants in nutrient-rich water solutions instead of soil and can include an aggregate substrate, or growing media, such as vermiculite, coconut coir, or perlite. Hydroponic production systems are used by small farmers, hobbyists, and commercial enterprises. The agriculture industry is also developing new techniques to grow food in lesser space and by saving water. The hydroponic growing system is a step towards this. The liquid nutrient solution is a mixture of essential plant nutrients in the water. The plant root is suspended either in the static liquid solution or in a continuously flowing nutrient mixture. The hydroponic growing system requires continuous attention to the crops, unlike the traditional farming system.

Aeroponics

The process of growing plants in the air or mist environment without soil or an aggregate medium. This word is derived from Greek word aer ("air") and ponos ("labour"). It is a subset of hydroponics, since water is used in aeroponics to transmit nutrients. A nutrient-dense fluid is sprayed on the plant roots at predetermined intervals while the plant roots are suspended in a dark container in an aeroponic system. With this technique, nutrients are delivered extremely precisely, and since roots receive enough oxygen, growth may occur more quickly.

II. SYSTEM ARCHITECTURE

Smart Farming

The smart farming involves many components such as sensors, data processing, decision making these monitors the crop health, nutrient measurement, fertilizers and pesticides quantity, prediction of yield. The sensor captures the data is transmitted to local data storage using various communication protocols such as wi-fi, Zigbee allowing the farmers to monitor the field continuously. The automation includes robotics and autonomous vehicles that perform with higher efficiency.

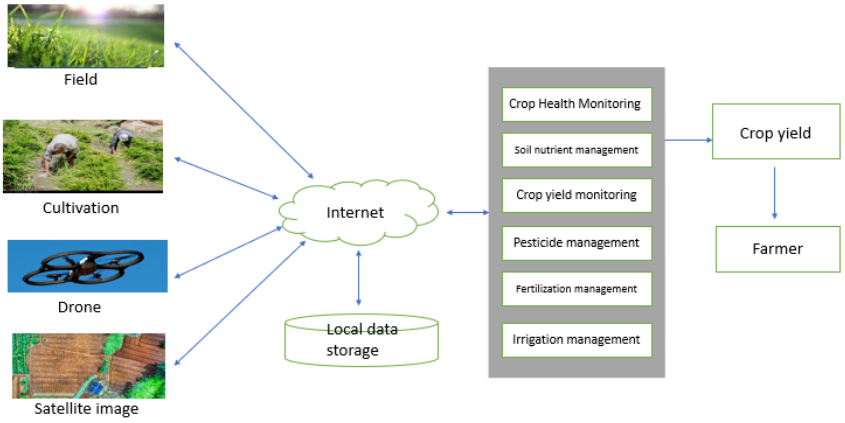

Fig.1: Architecture of Smart Farming

Smart Irrigation

The automated irrigation system allows users to track their status, start and finish the process with a single button and receive updates on moisture level, weather. The user downloads a

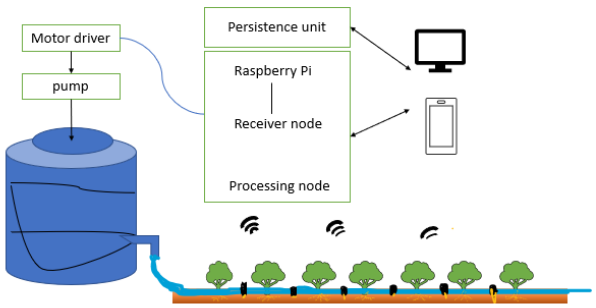

Fig.2: Architecture of Smart irrigation

mobile app that enters profile credentials and develop a physical device to control irrigation. Sensors are able to adjust the watering schedule which are set to basic timing for particular region. The receiver notifies the farmer immediately if it overflows or any error occurs.

Precision Farming

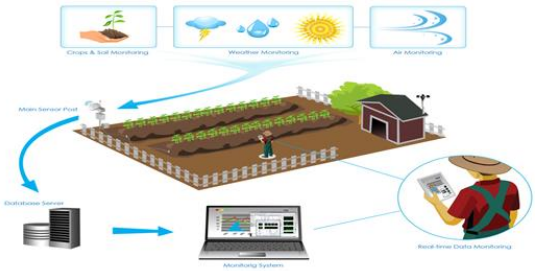

Fig.3: Architecture of precision farming

The user monitors the conditions of soil, crops, ambient air, and weather conditions through the sensor implanted at every corner of the field and the drones clicks the real-time images of individual plants. These data along with image is processed and guides the farmers which fields require treatment, optimal amount of water, pesticides.

Drip Irrigation

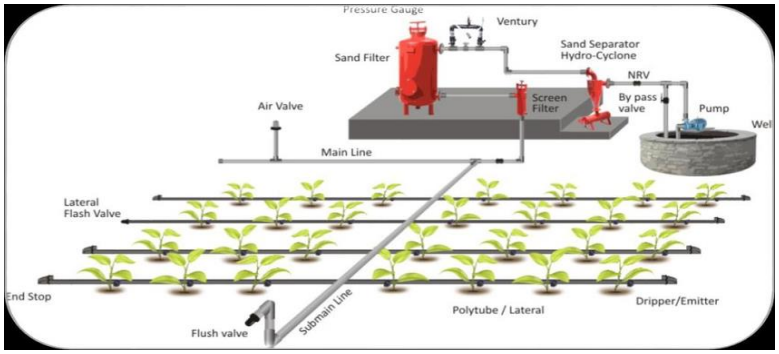

Fig.4: Architecture of Drip Irrigation

The pipes known as dripper lines are placed at every end of the field to deliver water and nutrients directly to the roots in right proportion. The water flow meter maintains the inlet flow from the overhead tank.

Vertical Farming

The stacks are placed vertically as multi-stored buildings and water, nutrients are passed and they are grown under their own light source for year-round photosynthesis through LED light, not bound to any geographical location. The actuators and sensors detect and control it.

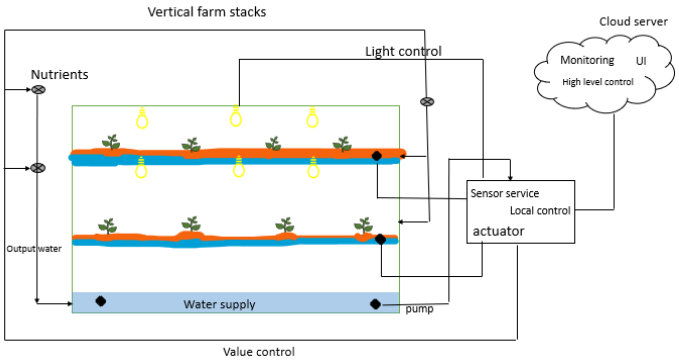

Fig.5: Architecture of Vertical farming

Hydroponics

This technology provides exactly what the plants need and when they need and allow you to control how much light the plants require and for how long. By controlling the environment of plant, many risk factors are reduced unlike plants grown outdoor may get infected to pests and fungus in soil. Due to ambient light, the seedlings can mature much faster.

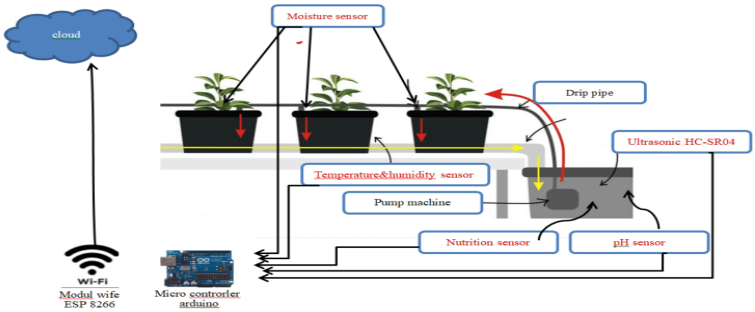

Fig.6: Architecture of Hydroponics

Aeroponics

This system may have clogging problems since relatively small holes are used for spraying. They receive more oxygen to carry out their food-producing activity and less vulnerable to pests and diseases, plants typically flourish in misty and airy environments. The plant's lower stem area is covered with biodegradable foams, which is then connected to or inserted into the aeroponics chamber apertures. For system to work well, it is crucial to maintain a proper temperature and make sure that the necessary amount of nutrient-rich mist is available.

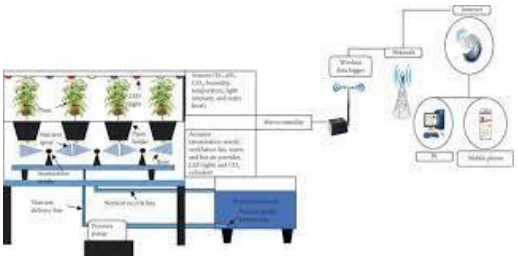

Fig.7: Architecture of Aeroponics

III. CONCLUSION

The farming techniques that introduced as to reduce the wastage of water and automate the irrigation mechanism. The main objective of using different methods is to automate and monitor the behaviour of soil moisture, temperature and humidity, rain, and water level and see how it contributes to evaluate the needs of water in a plant. The system uses Internet of things and compares actual values obtained from sensors with threshold values set for soil moisture and water level sensor. The farmer receives a notification on his smart phone and he can choose to turn on the water change in sensor readings throughout a time period. The entire process is automated using different technologies to reduce the usage of electricity and soil.

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