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Upliftment of Indian Agriculture through Precision Farming

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Abstract:

Farming is becoming a more difficult area to work in due to a lack of manpower needed to crop production. Precise agriculture is built on information technology, which allows farmers to acquire information and data to help them make better decisions. With the advent of artificial intelligence and machine learning (AI/ML), predictive and prescriptive analysis of even huge amounts of data is now possible .Sensors can be placed in the field to collect various data and based on the values collected, corresponding action can be taken remotely like spraying water and fertilizers etc .GIS and GPS can also be used to collect the data directly from the field.

Keywords: precision agriculture, sensors, GIS, GPS

I.Introduction

Precise agriculture has the potential to increase output while lowering production costs and reducing environmental impact. Smart farming conjures up visions of farmers battling the conditions with computerised machinery controlled by satellite and regional sensors, as well as crop marketing automation that perfectly anticipates crop growth. Our region's foundation is farming [1-2]. Farmers are facing major dangers such as natural disasters, a scarcity of folks who understand how to do agricultural, and the prudent use of environmental resources in the context of climate problems and westernization. WSN can be used to combat the threats. Wireless sensor networks (WSNs) are made up of multiple sensors that can be connected to one another over Wi-Fi. Sensors have always been utilised to retrieve legitimate field data, which is then transferred to the sensor utilizing some of the available communication channels [3-5]. Depending on the info saved in the server, the sensor could activate the robotics.

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II. Background Study (Literature)

Describes the automation of supplying of water remotely using Raspberry board and Grove sensors. Raspberry board is used for collecting data from the sensors and controlling them. Grove is used for connecting the sensors to the Raspberry board. For the software part, HTTP is used as GUI. Based on the information collected from the temperature and the soil moisture sensors, automatically the water will be supplied to the plants in the farm Describes various methods and technologies used for precision farming. [6] How will activities be performed by sensors placed at various points across the field, how will all data be gathered, and what will the automatic work for plant management be performed? Because RFID is employed, the data collected is not completely reliable. [7] The topic of load balancing in the data centre for documentation purpose only was addressed[8]. This chapter provides an overview of wireless devices that are used to connect various devices in a network. In IoT systems, wireless technologies for communicating devices have their own set of uses. The properties of wireless technologies varies in terms of range, data transmission, and application. This [9] system uses a 16/32 bit microprocessor to monitor moisture, warmth, and soil moisture, which may then be presented on an LCD and stored in a database for more analysis. The technique is only suitable for rice seedlings but not for other crops.

III. Methodology

The precision farming can be done by using following tools and the equipments. They are as follows:

a) **Sensors**
Humid, plant, heat, textures, architecture, physical feature, moisture, nutrition content, condensation, air, and other variables are measured using various technologies like electromagnetism, conductance, solar electricity, and ultra sound. Sensors allow for the capture of massive amounts of data without the need for laboratory examination [10-12]. In farming, monitors such as sensing applications, water sensors, and pressure sensors could be used to evaluate crop distress, soil qualities, and pests, among other things. As the tractor goes through the field, an on-the-go sensor assesses the plant & soil parameters. Field properties can be instantly mapped using remote devices. Vegetative indicators, which represent plant health, can be found in both aerial and satellite photography. The temperature change is measured by a temperature probe and then given to the other device in a legible format. Pumping sensors determine how much water is pumped to the fields based on the amount of liquid in the sample. The moisture content of the soil is measured using a water level sensor.

b) **Bluetooth**
Bluetooth is indeed a chip-based device that allows data to be transferred wirelessly over small periods. Bluetooth is a reduced radio communication technology. Within such a ten-meter radius, Bluetooth was designed to replace wires and infrared communications. Because of its inexpensive cost and long battery life, Bluetooth can be utilised for communications.

c) **GPS**
The Global Positioning System (GPS) is a space-based satellite communication network that gives location and timing data in all extreme weather, anyplace on it or near the Ground surface wherever 4 or more GPS satellites are visible. When we try to put satellite throughout the field, we will squander a lot of money [13-14].

d) **GIS**
This method consists of hardware, software, and methods for compiling, storing, retrieving, and analysing network profiles and location information in order to create maps [15-18]. Field topography, plant species, surface drainage, subsurface drainage, soil tests, watering, chemical rate of application, and crop production can all be found in an agricultural GIS database. After being analysed, the data is utilised to deduce the correlations between the numerous factors that affect a crop at a certain location [19].

e) **Variable Rate Technology**
Variable Rate Technologies (VRT) are fully automated and could be used in a variety of farming situations [20]. VRT technologies determine the speed at which farm feeds are delivered based on your soil type identified on a soil map. Seeding, fertilizer and pesticide administration, herbicide selections and framework at a variable interest rate in the appropriate right time and place can all be controlled using knowledge inferred from the GIS. [21-25].

f) **Rate Controllers**
Pace controllers were systems that regulate the rates at which fluid or granular pharmaceutical inputs like fertilisers and insecticides are delivered [26-27]. These framework employs keep track of the tractor/speed sprayer's as it travels over the field, including the object's flow rate and pressure (if liquid), and make real-time modifications to apply an inflation target [28].

g) **Yield Monitoring**

Yield tracking is by far the most straightforward way to analyse field productivity and determine how it might be improved. The crop is measured as it is picked using a yield monitoring. Crop weight, impact forces, or the duration an array of beams of light is disrupted are all examples of YMs. Yield tracking can be employed in this report by the end, after the crop has been cultivated [29].

h) **WI-FI**

WI-FI is a wireless network that combines various electronic equipment such as desktop computers, mobile phones, PDAs, digital cameras, and other devices to build a cellular connection that operates on the 2.4 GHz UHF and 5 GHz ISM radio bands. The cost of entering the system can be reduced by employing hotspots. However, when compared to Ethernet (wired connection), the safety is significantly lower [30-34].

IV. Results & Discussion

By comparing the various methods and technologies used for the precision farming, low energy consuming devices found to be effective [35]. Fig 1 describes the comparison between the Bluetooth and BLE (Bluetooth Low Energy). Since BLE sustains a very good range and good data rate in transferring bits in a minimum number of time, it is used in Raspberry board instead of Bluetooth. BLE has very good security with less power consumption when compared to the Bluetooth [36-41].

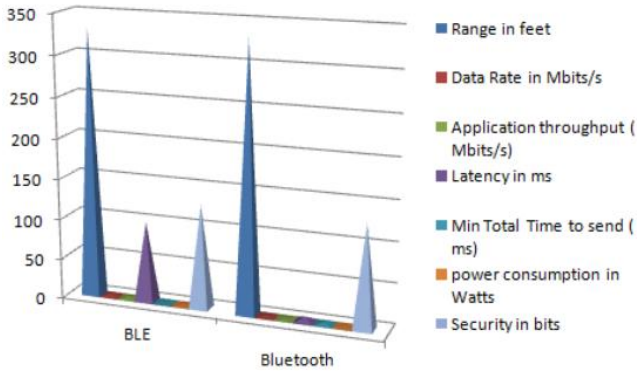

Fig1: Comparison between BLE and Bluetooth

Fig 2 describes about the characteristics of different types of soil when soil moisture sensor is placed in them. The data collected from different types of soil from soil moisture sensor is seems to be pretty good and suitable for taking into account for automation of supplying water to the plants [42].

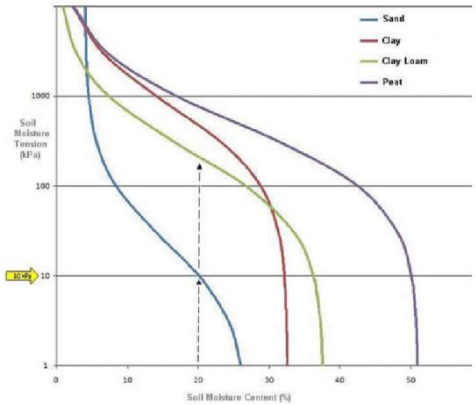

Fig2: Characteristics of soil moisture for different types of soil

V. Conclusion

This paper talks about why precision agriculture is important? and the shortcomings of man-power and other related real time impossibilities of the agriculture to be carried out [43]. Instead of treating all plants equally, the methodologies and technology outlined in this study depict the automatic administration each and every plant throughout the farm without human involvement. The related works described in this paper deals with, automated system which includes pumping of water, sprinkling fertilizers for variety of plants separately. The production of crops will be improved by focusing or every plant individually as according their satisfactory strength of water and fertiliser content using image analysis [44-46]. Added to this MQTT (Message Queuing Telemetry Transport) can be used for transporting messages between devices for the future expansion.

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