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Using IoT for Fertilizer Monitoring and Spraying Agricultural Robots

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Abstract: ***The main goal of this effort is to modernize the conventional agricultural system and enhance present agricultural practices by utilizing contemporary technologies. The Internet of Things, or IoT, is the key component of smart agriculture. In terms of agriculture, the project will assist small - scale farmers in using intelligent irrigation. which offer better services with the least amount of labor and irrigation costs. Because Internet of Things (IoT) sensors can manage irrigation and provide information about agricultural fields, smart irrigation is an empirical notion. This paper's feature is the use of sensors to monitor water level, pH, temperature, and humidity in agricultural fields. Wireless transmission is used to transfer sensor data to a Web server database. Any remote smart device or computer with an internet connection will be used to control all of these operations, and the operations will also be affected by the rain. Wi - Fi, the IFTT app, the smart agriculture app, and sensor interfaces will all be used to carry it out.***

Keywords: Smart Agriculture, Internet of Things, Interfacing, IFTT app

1. Introduction

The necessary fertilizers must be considered in order to meet the ever - increasing demands of food production over time. Determining the additional amounts of nitrogen (N), phosphorus (P), and potassium (K) needed is crucial for increasing crop fertility. Finding the soil's pH value is another crucial consideration. As a result, the soil will be of higher quality and produce higher - quality crops. Since the need for labor grows along with crop production, we employ the fruit plucking technique, which is both more labor - and money - efficient, to lessen labor demand. Our IOT - based agribot, which revolutionizes farming operations with cutting - edge technology, introduces a novel solution in precision agriculture. by the incorporation of automated fruit plucking capabilities, precision spraying mechanisms, and a fertilizer monitoring system. With the help of this agribot, a new age of productivity, resource optimization, and higher output in Use Internet of Things sensors to monitor vital signs in the soil, including as temperature, pH, moisture content, and nutrient levels. Data from these sensors ought to be wirelessly transmitted to a cloud platform or central hub. Data analytics methods or machine learning algorithms can be used to analyze the gathered data. This examination can shed light on the condition of the soil, nutrient shortages, and irrigation needs. Install intelligent sensors that gauge the soil's nutrient content. Farmers should be able to optimize fertilizer application based on the unique requirements of their crops thanks to the real - time nutrient content data that these sensors should offer. Provide an intuitive mobile application or web interface that will let farmers view the gathered data, get alerts, and decide on fertilization and soil management with knowledge. Create an autonomous agribot with sensors, GPS, and spraying mechanisms. The agribot should be able to precisely administer fertilizer or pesticides while navigating through fields along pre - planned paths. Combine the components for spraying agribots, monitoring fertilizer, and soil into a single, cohesive system. With this interface, data flow is guaranteed and farmers are empowered to make data - driven choices for the best possible crop development. It's crucial to remember that the suggested approach might be altered in accordance with particular needs and accessible technological capabilities. The objective is to provide a strong and effective solution that improves farming methods, increases crop output, and reduces resource waste in the agricultural industry.

2. Literature Survey

Smart farming using Agri - bot (K. Gowthami, K. Greeshma, N. Supraja, IJAER, 2019)
This paper offers a system which performs the seeding process in the agricultural field. The main idea behind this development is to perform agricultural tasks without human intervention and to implement a prototype of an effective low cost agribot. This project is based on a wireless communication by making use of Arduino and Bluetooth**.**

Automatic weed detection and smart herbicide spray robot for corn fields (G. Sowmya, J. Srikanth, IJSETR, 2017)
This paper designs and develops a robot to detect weed in corn crop, by making use of image processing. The advantages of this project are time saving as it detects the beets with the help of a camera and the herbicides are sprayed on the infected crop, saves the farmers from tedious work**.**

Designing of an Autonomous Soil: Monitoring Robot (Patrick M. Piper and Jacob Vogel, IEEE, 2015)
This paper designs and develops a robot for monitoring of soil. this robot is capable of sensing the moisture the temperature of the soil through stevens hydra probe II and it consists of GPS to navigate.

IoT Based Smart Agriculture - towards making the fields talk (Muhammad Ayaz, Mohammad Ammad - Uddin, Zubair Sharif, Ali Mansour, and El Hadi M. Aggoune, IEEE, 2019)
This paper proposed a multitasking iot based technology in the agricultural field. the idea of this structure is to help farmers produce high quality yields to meet the rising demand of food with the increased population, by making use of wireless sensors, uavs, cloud computing, and communication technologies. the system proposes a

complete technology - based farming from the start till the harvesting which includes very less human interaction.

Image processing - based intelligent robotic system for assistance of agricultural crops (Nikhil Paliwal, Pankhuri Vanjan, Jing - Wei Liu, Sandeep Saini and Abhishek Sharma, IJSHC, 2019)

This paper determines a prototype model of image processing based IOT robot which helps in identification of the leaf infection. This consists of UGV and UAV usage which helps in detecting the disease, soil data connection and in the classification of the field to provide solutions for mixed cropping. The main purpose of this paper is to help farmers with early detection of disease**.**

Agricultural Automation System with Field Assisting Robot - Agribot (C. Jeeva, Saher Miraj, Archit keshav Gangal and Farheen, IJPAM, 2018)

This system consists of Arduino UNO which acts as the hearth of the system. This system consists of a camera, to detect the obstacles falling in its path which will help in taking the required actions and it proposes three main functions: Ploughing seed dispensing and harvesting. The main idea behind this is to design a multitasking robot which in turn reduces the working hours, cuts down on labor expenses and helps in the correct way of seeding

Design and Implementation of Agribot with Automatic Sun Tracking (V. Radhika, B. Sharmila, R. Ramya, M. Gopisri, IJEAT, 2019)

This proposed agribot consists of Arduino, solar panel, GSM module and sensors. solar panels are used to charge the robot. the ultrasonic sensors detect the hurdles and also helps in digging of holes for sowing seeds at a predefined distance. pH sensors help in the computation of the moisture content in the soil. Electrochemical sensor helps in identifying the fertility of soil and the optical sensor helps in the movement of the robot. The main aim behind this system is to reduce farmers burden and help obtain good number of yields.

3. Methodology

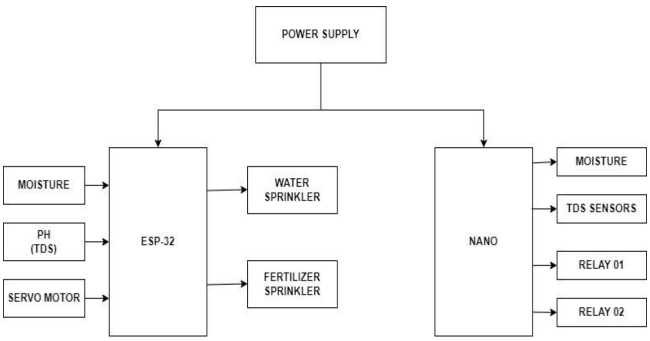

Figure 3.1: Methodology of Fertilizer Sprinkling

1) **TDS Sensor:** To ascertain the levels of total dissolved solids (TDS), the TDS sensor monitors the conductivity of the water. Two electrodes are immersed in the water to form its composition. The conductivity of the water is measured by the sensor when an electric current is run through it; this conductivity is directly proportional to the TDS levels.
2) **Moisture Sensor:** This device gauges the soil's moisture content. Usually, it has two probes that are submerged in the ground. A higher conductivity rating indicates that the soil is more effectively conducting electricity when it is damp. The moisture content of the soil is ascertained from this reading.
3) **Microcontroller:** The system's brain is the microcontroller. It gets the data from the moisture sensor as well as the TDS sensor. It analyses the information and runs any required computations or comparisons.
4) **Actuators:** Actuators are gadgets that the microcontroller controls by interpreting data from the moisture and TDS sensors. Based on the needs of the system, these actuators are capable of carrying out a variety of jobs or activities. For instance, the microcontroller can turn on a solenoid valve to stop the flow of water if the TDS levels are too high. Insufficient soil moisture can cause a water pump to start irrigating the plants.
5) **Communication Module:** With the help of this module, the system may send and receive commands from outside sources. It can be a Wi - Fi - like wireless module that enables the system to establish a connection with a computer, smartphone, or other gadgets. This makes it possible to monitor and regulate the TDS and moisture levels remotely.
6) **Power Supply:** The power supply gives the system as a whole the electrical power it needs. A battery or a direct power supply can be used, based on the setup and application.

The system can continually monitor the TDS levels in water and the soil moisture levels by integrating all these components. Based on the data, it may take the necessary steps to ensure ideal soil moisture and water quality for a variety of uses, including hydroponics, gardening, and agricultural.

4. Results Screenshots

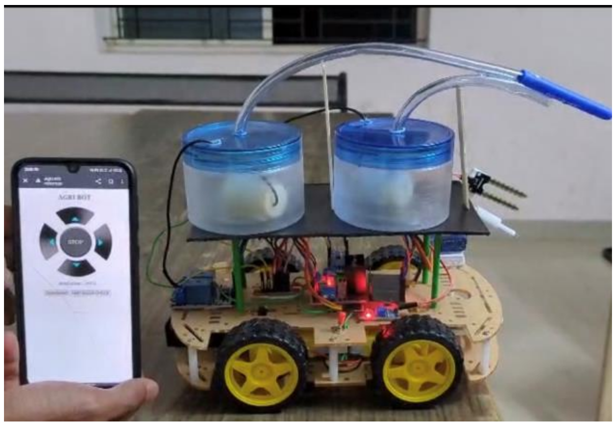

Figure 1: Agribot connected through web application

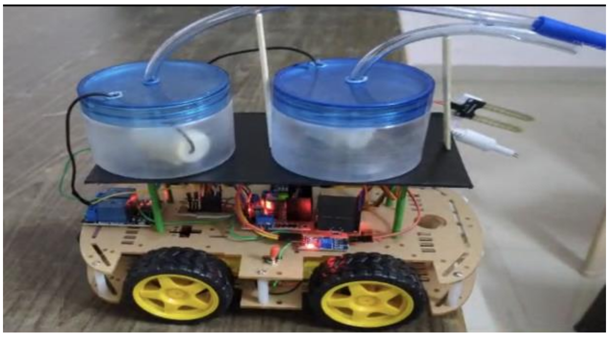

Figure 2: Agribot when power is supplied

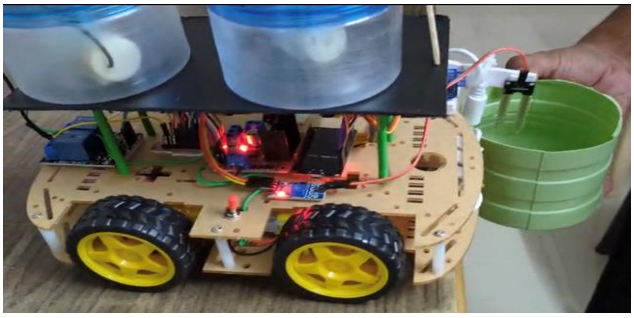

Figure 3: Agribot when Ph and moisture is tested FROM solvent water

5. Conclusion

We came to the conclusion that Agribot, an Internet of Things - based soil, fertilizer, and spraying device, represents a major advancement in precision agriculture. Agribot gives farmers unmatched control and insights into their farming methods by seamlessly combining cutting - edge technologies including sensors, data analytics, and automated spraying systems. Agribots soil monitoring feature gives farmers access to real - time information on the health, moisture content, and nutrient content of their soil, enabling them to make educated decisions.

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