Soil Nutrients Monitoring and Analyzing System for Agriculture

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Abstract- Soil is the foundation of agriculture. Soil Provides nutrients that support crop growth. Some chemical and physical properties of the soil such as moisture, temperature, soil nitrogen, phosphorus and potassium content affect the yield of the crop. These features can be heard from open-source devices and are available in the field.

Keywords: Soil Analysis, NPK Sensor, Soil Moisture Sensor, Temperature Sensor, Thingspeak Server.

I. INTRODUCTION

Soil analysis is an important part of precision agriculture that can increase agricultural productivity. In addition to the time-consuming and expensive chemical analysis medicine, technological advancement, has opened many new ways to measure land. The principle of maximum optical absorption of visible light from the material in the frequency range due to the movement of electrons is used to obtain information about the NPK material, which is still panicked on the ground. Real Time Soil Parameter Monitoring System was developed with the help of Enhancement Sensor together with IoT. The cost effectiveness of determining land features increases as technology advances. Record of the information on soil nutrients (NPK) and other parameters (temperature, pH, percentage of soil cover, etc.). Analysis of information in graph and code models using Thingspeak Server.

II. LITERATURE SURVEY

Inspection and analysis of the soil is planned at, where farmers will be able to monitor soil moisture, soil temperature and soils such as nitrogen, phosphorus, and potassium. Farmers can monitor all parameters wirelessly from their mobile phones or PC systems. We will use Capacitive Soil Moisture Sensor to measure soil moisture. The temperature of soil can be measured using the DS18B20 Waterproof Temperature Sensor. Similarly, we will use the soil NPK sensor to measure the NPK value of the soil. All sensors can be easily interfaced with Arduino. We will use Thingspeak server to monitor the data in graphical and numerical format. We need a GSM or Wi-Fi network in area to send data to the server. But agriculture does not have access to these networks. To solve this problem, we will use NRF2401 wireless transceiver module to send data from, sensor node to gateway. Data from the transmitter can be sent wirelessly to the receiver at a distance of km. The receiver that makes up the uses the ESP32 Wi-Fi module, which can access the Wi-Fi network. Using this Wi-Fi network, data can be sent to Thingspeak server.

III. PROPOSED SYSTEM

The basis of agriculture is soil. Nutrients provided by the soil can support the growth of crops. Our goal is to improve crop growth by identifying nutrients. Our system will have an NPK sensor measuring the soil. The NPK sensor is designed to control the nitrogen, phosphorus, and potassium content in soil.

Helps determine soil fertility. The sensor can be buried in the ground for a long time. The sensor does not need medication.

NRF24L01 is a wireless transceiver module that is each module can send and receive data. It operates in the 2.4 GHz frequency range. When the works properly, the module can cover 100 meters. Transfers the file to the PC system. Data from the transmitter can be sent wirelessly up to the receiver over a mile away.

The receiver is a built using an ESP32 Wi-Fi module to access the Wi-Fi network. Using this Wi-Fi network, data can be sent to Thingspeak server. And Thing speak server will display the results of analysis in graphical display.

IV. DESIGN APPROACH

This model includes NPK sensor for good monitoring of soil, Arduino Nano, NR24L01 PA + LNA module, MAX485 Modbus module, ESP32 Wi-Fi module, humidity and humidity and temperature sensor.

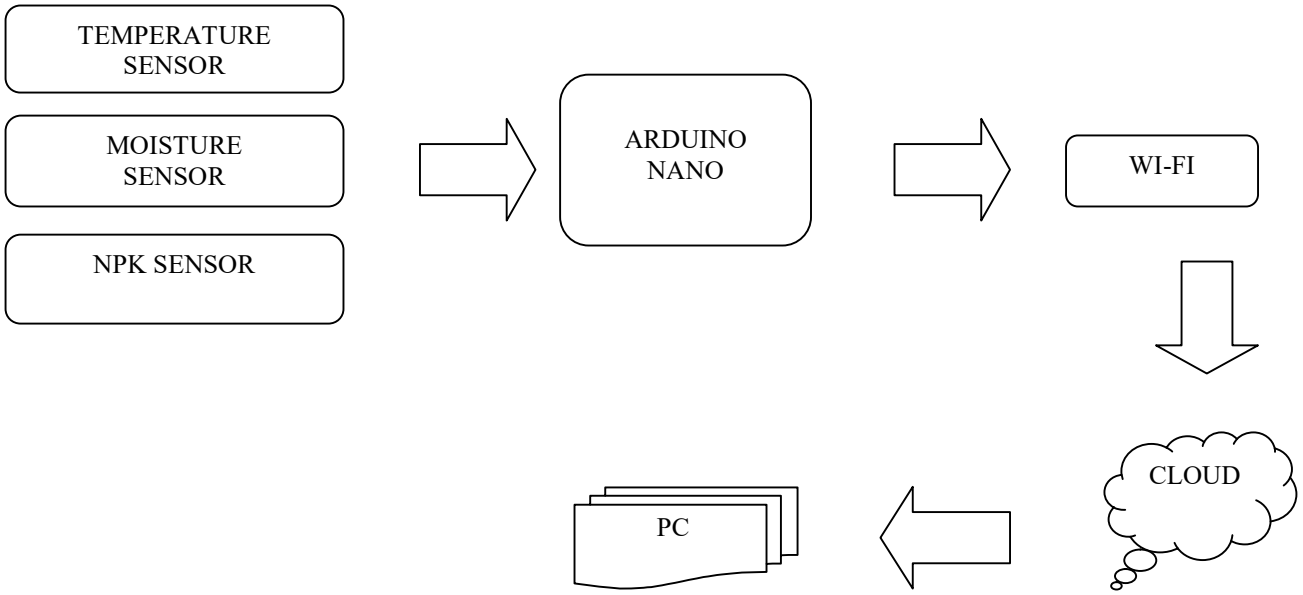

Fig 1. Data Flow Diagram

V. IMPLEMENTATIONS OF THE PROPOSED SYSTEM

SPRINT 1

Temperature and humidity values should be monitored during Sprint 1. In real time use this can be done using different devices such as NPK (Nitrogen Phosphorus Potassium) sensors for soil nutrient testing and DS18B20 sensors for temperature measurement.
In this project, a C code was created to obtain temperature, NPK and humidity values using random data. Nitrogen, Phosphorus and Potassium detection, excitation and monitoring on Thingspeak Server platform, electrical engineering using Arduino NANO, NPK Sensor and Wife and Wireless Transceiver Module.

SPRINT 2

In Sprint 2, cloud account is created and Thingspeak Server platform is started. A new channel is created on the Thingspeak Server platform. Based on source code from device certificate, it can broadcast to cloud and monitor status.
As part of this, the Node-Red stream editor was created to generate clipboard options and publish to the cloud using an API key, API authentication, and device credentials.
In real time use, when the NPK sensor detects NPK on the ground, the information to be monitored will be sent to the Radio module. In this project, cloud storage and Clouding DB were used to store the monitoring data. In

Thingspeak Server, we will adjust the display window as needed according to the individual view playing on the red button board.

SPRINT 3

In Sprint 3, the nRF24L01 is a wireless transceiver module, meaning each module can send and receive data. The module can cover 100 meters while operating effectively. LNA with SMA connector, duck antenna and special RFX2401C chip with combination of PA + LNA.
The multi-chip with duck antenna helps the module achieve about 1000 meters further transmission. NRF24L01 module works with the help of SPI communication, so we can use NRF24L01 with any microcontroller that has SPI pins like ESP32 Wi-Fi module.
The results and management of this process are general and separate links are created with the retrieved process and its associated URL (/sensor or / command).

SPRINT 4

Mobile or PC application must be developed in Sprint 4 via the app, users can view the latest temperature, NPK and soil moisture results on a PC or mobile phone. This project used Thingspeak which uses MATLAB to track data in graphical representation. It has two screens, public and private.
Here we have a serial monitor to check for data changes. The sensor node's serial monitors display data read by the sensor, such as humidity in percent, temperature in degrees Celsius, NPK content in mg/kg.
It depends on the red node where the events will appear in the debug window.

VI.RESULTS AND DISCUSSION

IoT smart agricultural products are designed to help monitor farmland using sensors and automatic irrigation systems. Thus, farmers and related brands can easily follow the field from anywhere without any interruption. Smart agriculture refers to the management of farms using modern information and communication technologies to increase the quantity and quality of products while improving human resources.
Among the technologies offered to farmers today, wireless sensors capture soil, water, light, humidity, and temperature in the fields. The IoT can determine the best time to irrigate crops and collect data from sensors that measure temperature, humidity, and water level.

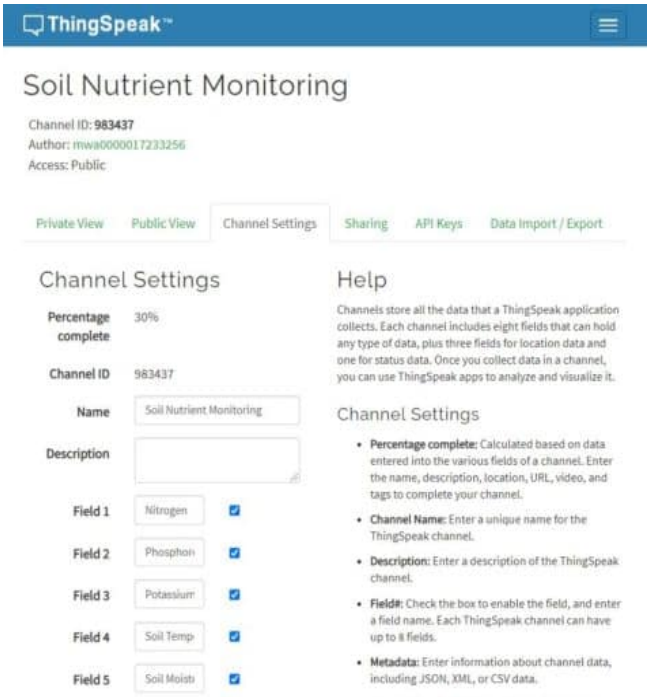

Fig. 2. Node Red and Web page Dashboard

Fig.3.serial monitoring

Fig.4.Results

VII CONCLUSION

IoT-based smart agricultural soil monitoring and analysis such as soil temperature, moisture and NPK analysis. It can use NPK soil moisture sensor and NPK sensor while monitoring temperature and humidity with Node-Red. The Performs well and accurately stores current temperature, NPK and soil moisture data. The paper will help farmers increase yields and monitor crop quality. Farmers will always check and monitor the soil and know the temperature and humidity in real time. Thanks to this system, many problems faced by farmers in their daily lives have been effectively solved. The main advantage of the is the ability to analyze the nutrients in the soil using NPK sensors, which will be informed by the Thingspeak server and displayed in a graphical image. Therefore, the process is cheaper and more effective than other types of tools. The preparation system can be used to switch the water spray on and off according to soil moisture, making the irrigation system one of the most time-consuming agricultural operations. Agriculture is one of the largest uses of water. Product damage and fire issues have become major issues today. As there is currently no good solution to this problem, it should be taken care of quickly. Therefore, this project has a social significance as it aims to solve this problem. This project will help farmers do business and agriculture by holding their lands, save them from significant financial losses and save them from holding their fields. This will also help them get better crops and hence their health.

REFERENCES

[1] Prof. Utkarsha Shinde, Neha Chalvade, Kalyani Chaudhari, Shradha Andhare, "Robotics for NPK Measurements, Automated Fertilization and Aeroponic Systems", International Journal of Engineering and Technology Research, Vol. 03, no. 05, p. 12. 1758-1760, March 2016.

[2] Gurudatta Warudkar, Dr. Sanjay Dorle, "Review of agricultural soil fertility characteristic determination", International Conference on Information and Communication Technologies (ICICES), 25 July 2016.

[3] Akshay Sankpal, Krishna K Warhade, "Study of Scientific Research on Land Surveying", International Journal of Advanced Computing and Electronic Technology (IJACET), Vol 2, Issue 2, 2015.

[4] Xu Lihua, Xie Deti, "Using Hyperspectral Data to Estimate Nitrogen and Phosphorus", International Conference on Remote Sensing, Environment, and Industry, 2012.

[5] Chen Hongyan, Zhao Gengxing, Wang Yinjuan, Sui Long, Hu Meng, " Remote sensing estimated soil Nutrient Content", International Remote Sensing Conference, Environmental and Traffic Engineering, 2011.

[6] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash “Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM” Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756

[7] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, “Performance Investigation of T-Source Inverter fed with Solar Cell” Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749

[8] C.Nagarajan and M.Madheswaran - ‘Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter’ - *Journal of ELECTRICAL ENGINEERING,* Vol.63 (6), pp.365-372, Dec.2012

[9] C.Nagarajan and M.Madheswaran - ‘Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis’- *Springer, Electrical Engineering*, Vol.93 (3), pp.167-178, September 2011.

[10] C.Nagarajan and M.Madheswaran - ‘Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques’- *Taylor & Francis, Electric Power Components and Systems*, Vol.39 (8), pp.780-793, May 2011.

[11] Nagarajan and M.Madheswaran - ‘Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis’- *Iranian Journal of Electrical & Electronic Engineering*, Vol.8 (3), pp.259-267, September 2012.