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Prediction Of Nutrients (N.P.K) In Soil Using IOT

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Abstract :-

Soil fertility is an important factor in assessing the quality of the soil since it shows how well the soil can support plant growth in agriculture.The quantity of nutrients in the soil can be quickly determined by using an Arduino board equipped with a soil sensor. The nutrient content of the soil can be quickly determined with an ESP32 equipped with a soil sensor. It is widely accepted that nitrogen, phosphorous, and potassium are essential constituents of nutrient sources.These elements should be measured to determine how much more nutrient content needs to be added to the soil to increase crop fertility.Soil fertility can be established through NPK sensors. By examining data on soil nutrient concentrations, we may determine whether the soil used to support plant production is rich in nutrients or lacking in them. There are several approaches to use a mass spectrogram or sensing element to find out how many nutrients are in the soil samples.However, with data only 60–70% genuine, the spectrum analysis approach is laborious.Due to a scarcity of data, a detailed comparison between the spectrum analysis approach and conventional wet chemistry procedures is required to ascertain the accuracy of the products. To detect soil nitrogen, phosphorus, and potassium, a soil NPK sensor should be used. Along with the application of a cheap, quick, straightforward, elevated, and portable soil NPK sensor. The plus side over a traditional detection method is the extremely short observation times required to gather exact data.This study compares and utilises different soil nutrient levels using machine learning and the kernel density estimation algorithm. One advising technological advancement that provides rational and sensible answers to the transformation taking place in many industries is the Internet of Things (IOT).Numerous research surveys and evaluations have been conducted, and a variety of methods have been used to apply IOT technology in agronomical fields.When it comes to quickly detecting plant health issues so that appropriate action may be taken, IOT can be very useful. It’s a significant development in smart agriculture.Within this manuscript, we introduce a methodology for creating an automated framework capable of detecting crop damage in its early stages, which remain undetectable to the unaided eye. This method helps to prevent large losses in addition to saving a tonne of time and labour.The proposed method builds a recognition framework using soil-based detection devices, such as nitrogen, potassium, and phosphorus derived from plants. Sensor data is sent to the Arduino Cloud, which evaluates it and helps identify plant damage. In the years to come, the smart farming system will rely heavily on the internet of things.

Keyword - KERNEL DENSITY ESTIMATION, NPK SENSOR, PRECISION FARMING.

I. INTRODUCTION :-

A soil-based Arduino NPK analyzer. Measuring the nutrient level of the soil is made easy with the NPK Soil Sensor and Arduino. Measuring the amount of N (nitrogen), P (phosphorus), and K (potassium) in the soil is necessary to calculate how much extra nutrient content needs to be added to the soil in order to increase crop fertility.The soil's fertility is assessed using NPK sensors.Soil fertiliser consists of three basic components: nitrogen, phosphorus, and potassium. We can tell if the soils used to promote plant production have enough or too many nutrients by looking at the concentration of nutrients in the soil.

There are several methods for determining the nutrient content of soil, including spectrometers and some optical sensors. The data are only 60–70% accurate, which is a concern for the spectrum analysis method. Furthermore, it is not particularly practical. The accuracy of the products when comparing the spectrum analysis method with traditional wet chemistry procedures is stillunclear due to the paucity of knowledge in that field. Therefore, we will use a soil NPK sensor to measure the amount of nitrogen,phosphorous, and potassium in the soil.

The Soil NPK sensor is a low-cost, extremely accurate, quick-responding, and portable sensor that is compatible with Modbus
RS485. This sensor offers very accurate and quick measurements, which gives it an advantage over more traditional detecting methods. To gather the data, all you need to do is bury the probe in the ground and utilise an Arduino. Let's now examine the Soil NPK Sensor's interface with the ESP32 in more detail.

II. IDENTIFY, RESEARCH AND COLLECT IDEA :-

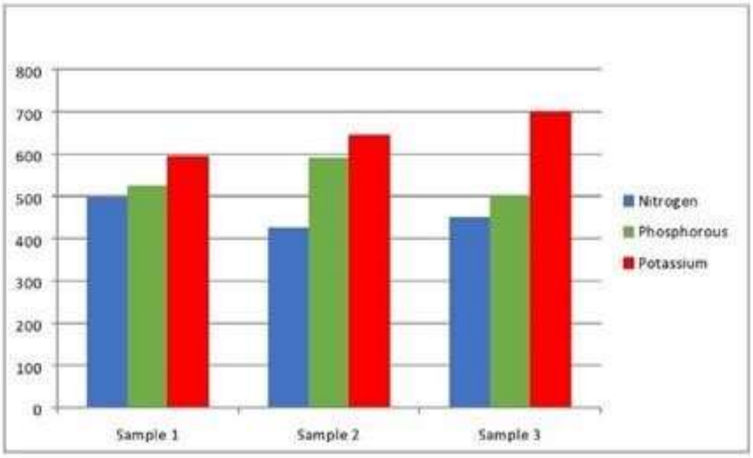
The purpose of the proposed system is to replace the traditional soil testing method with a device that can quickly yield information on the composition of the soil. This method will nevertheless yield good enough data to predict which fertilisers will be used, even if it won't be as accurate as the existing methods. Data on the level of nutrients in the soil will be provided by the sensor.

It is possible to use the information acquired to provide the field with the right nutrients. Sensors assess the pH, electrical conductivity, and soil nutrient levels (potassium, phosphorus, and nitrogen) and send data into the system.

An analogue to digital converter is used to transform analogue sensor data into digital format. After that, the data is sent to Arduino, which sends it to the remote device via the Internet of Things. This information can be added to a database and retrieved as needed.

[4] Demonstrate the comparison of the soil sample presentation :-

Since Sample 1's wavelength is longer than 485,it contains the most nitrogen. Sample 2 contains more phosphorus and less nitrogen. Sample 3 contains the highest amount of potassium. Thus, this is how NPK levels in soil samples are determined



IV. Existing System approach :-

Taking soil samples and sending them to labs for additional testing is the antiquated method of determining the soil composition. The nutritional content of the samples is then determined by testing them against substances. This is a laborious and time-consuming operation. After it is received, the entire procedure takes roughly five business days. The meteorological variables that affect the soil have changed by the time the sample gets to the labs, thus the results are not as precise as they would be if testing had taken place on the actual field.

V. Current System approach :-

The goal of the suggested system is to swap out the conventional method of soil testing with a tool that can provide information about the contents of the soil in a very short amount of time. Although the results from this method won't be as precise as those from the current methods, they will still be good enough to forecast which fertilisers will be required. The sensor will provide data regarding the amount of nutrients present in the soil. The information gathered can be utilised to supply the field with the appropriate fertilisers. The pH, electrical conductivity, and nutrient content (nitrogen, phosphorus, and potassium) of the soil are all measured by sensors that feed data into the system. Analogue data is converted using an analogue to digital converter.

VI. System Implementation Plan

- **Sensor Calibration :**- To guarantee precise measurements, calibrate the NPK sensors.
- **Programming Arduino** :- Write code to enable the Arduino Nano to read sensor data and Forward it to the online programme.

- **Online application development :-** Provide a user-friendly online application with a responsive interface so that users may get crop suggestions and soil data.
- **Database Integration :-** Set up a database so that past soil nutrient data may be stored and retrieved for trend analysis.
- **Algorithm Development :-** Create an algorithm to evaluate data on soil nutrients and produce crop suggestions. Personalised data access and suggestions can be achieved by implementing user authentication.
- **Testing and Optimisation :**- Give the system a thorough test and make any required modifications to ensure peak performance.
- **Deployment :-** Make sure the system is accessible and reliable before making it available for actual use.

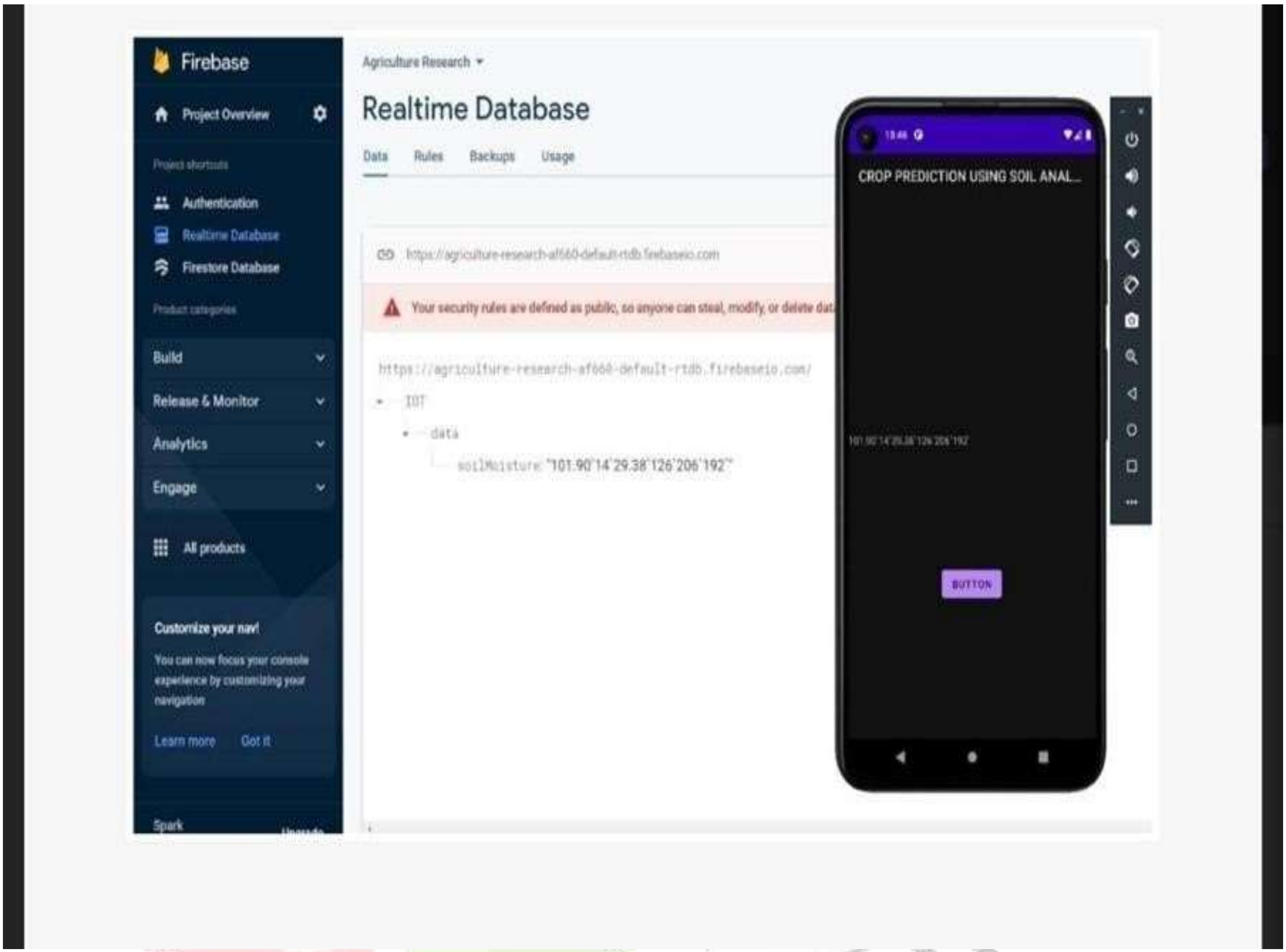
VII. Scope of the Project :-

Numerous sensors, including the Arduino Uno, NPK sensor, GSM module, OLED display, Modbus module, and power supply, are used in the IOT-Based Soil Analysis and NPK Detection. The microcontroller used by the several sensors to transmit and receive data is the Arduino Uno. The amount of potassium, phosphorus, and nitrogen in the soil can be measured with the NPK sensor. The GSM module can communicate by SMS after determining the nutrients in the soil, and an OLED display can be used in placeof an LCD display. A de facto standard communication protocol is connected to the Modbus module, a serial communication standard.

VIII. LITERATURE SURVEY :-

Sr.no	Name	Author	Published	Methodology	Findings
1.	IOT based Modern Agriculture Soil Nutrient Monitoring	Prof. Gophane Pruthiviraj, Prof. Dhygude Nitin	6 June 2022	Ability to measure current soil nutrients – Nitrogen, Phosphorus, and Potassium (NPK) values using sensor at the field eliminating the need to carry the soil to the lab.	The soil NPK Sensor can detect the levels of Nitrogen, Phosphorous, and Potassium in the soil
2.	Prediction of Nutrients (N, P, K) in soil using Color Sensor (TCS3200)	Akriti Jain, Abizer Saify, Vandana Kate	3 January 2020	Database consisting of soil nutrients (NPK) for various crops including vegetables, fruits, etc	The soil NPK sensor for detecting the content of nitrogen, phosphorous, and potassium in the soil. It helps in determining the fertility of the soil.

IX Firebase real-time cloud database connected with Android application.:-



Data Pre-Processing :-

We conducted data pre-processing, which helped to increase the efficiency of the machine learning model. We collected the data with variables such as longitude, latitude, date, time, temperature, moisture, water level, pH value, and nitrogen, phosphorous, and potassium values using a sensory device. These data are stored in a Firebase cloud service. We pre-processed these collected data. During the data preprocessing, we performed data cleaning and the transforming and normalising of the data to prepare them for analysis.

X User Classes and Characteristics :-

[1] Farmers Characteristics: Basic knowledge of farming, access to a computer or smartphone.Interactions: Input soil samples into the Arduino system, view nutrient analysis results on the web application.

[2] Researchers Characteristics: Background in agriculture or soil science, may require detailed data.Interactions: Access and download comprehensive soil nutrient data from the web application for research purposes.

[3] System Administrators Characteristics: Technical expertise, responsible for system maintenance.Interactions: Monitor system performance, troubleshoot issues, update software.

XI CONCLUSION :-

The IoT-Powered Plant Deficiency Detector The Arduino project provides a comprehensive solution to the issues associated with the timely and accurate identification of plant deficiencies.
By integrating IoT technologies, sensor networks, and data analysis algorithms, the project aims to give farmers real -time insights into plant health, leading to more efficient and sustainable agricultural operations. In conclusion, the system we are creaing will be able to determine which nutrients are in the soil. It will be able to provide us the amounts of potassium and other differentnutrients that were present in the soil sample. Thus, this is how NPK levels in soil samples are determined.

XII UPCOMING ADVANCEMENTS :-

The smart farm helps the farmer make significant earnings by producing the crop at the appropriate soil moisture content and free from infection. The automated process reduces the need for human labour, and a smartphone is used to track crop development.Wireless communication reduces the deployment cost. In the end, this Is utilised across a wide land area. Farmers need constant internet access in order to obtain the data. Thanks to the predetermined weather prediction, the farmer can cultivate the crop in accordance with the weather.

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