IOT Based Prediction of Nutrients(N.P.K) In Soil

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Abstract- *Because it indicates how effectively the soil can sustain plant growth in agriculture, soil fertility is a crucial component in determining the quality of the soil. An Arduino board with a soil sensor can be used to swiftly ascertain the soil's nutrient level.*

Potassium, phosphorus, and nitrogen are all regarded as crucial components of nutrient sources. To find out how much more nutrient content needs to be supplied to the soil in order to boost crop fertility, these components should be measured.NPK sensors can be used to detect soil fertility. We can ascertain if the soil utilized to support plant production is rich in nutrients or deficient in them by looking at data on soil nutrient concentrations.A mass spectrogram or sensing element can be used in a number of ways to determine the nutrient content of the soil samples. Nevertheless, the spectrum analysis approach is cumbersome, with records that are only 60–70% accurate. Due to a lack of data, it is necessary to thoroughly determine the accuracy of the products by comparing the spectrum analysis approach with traditional wet chemistry methods. Therefore, a soil NPK sensor should be employed to measure soil nitrogen, phosphorous, and potassium. with the use of a soil NPK sensor, which is portable, quick, simple, raised, and inexpensive. Its benefit over a conventional detection method is that precise data is obtained in incredibly short observations. This research uses machine learning and the kernel density estimation algorithm to examine and compare various soil nutrient levels. The Internet of Things (IOT) is a reassuring technology that offers methodical and sensible answers to the transformation occurring in many fields. Many studies and analyses have been done, and a wide range of techniques have been adopted to use IoT technology in agronomical domains. IoT can be quite helpful in promptly identifying failing plant health so that the necessary action can be performed. This is a major advancement in smart agriculture. In this paper, we present a model to develop an automated framework that can identify crop degradation at its early stage, which is invisible to the unaided sight. In addition to saving a ton of time and labor, this technique aids in the prevention of significant losses. The suggested approach uses soil-based sensors such as plant-derived phosphorus, potassium, and nitrogen to create a recognition framework. Sensor data is transmitted to Arduino Cloud, which analyzes it and provides assistance in determining plant deterioration. The internet of things will play a critical role in the smart farming system in the years to come.

Keywords- Precision Agriculture , Npk Sensor , Kernel Density Estimation .

I. INTRODUCTION

Arduino NPK Analyzer for Soil. NPK Soil Sensor and Arduino make it simple to measure the nutrient content of the soil.The amount of additional nutrient content that needs to be applied to the soil in order to boost crop fertility must be determined by measuring the content of N (nitrogen), P (phosphorus), and K (potassium) in the soil.NPK sensors are used to determine the fertility of the soil.

The three main elements of soil fertilizer are potassium, phosphorus, and nitrogen. Understanding the concentration of nutrients in the soil can help us understand if the soils utilized to support plant production are deficient or abundant in nutrients.

The nutrient content of soil can be measured in a number of ways, such as with a spectrometer or some optical sensors.However, the spectrum analysis method has a problem in that the data are only 60–70% correct. It is also not very convenient.Given the lack of information in that area, the accuracy of the products when comparing the spectrum analysis method with conventional wet chemistry procedures remains unresolved.Thus, in order to determine the amount of soil nitrogen, phosphorus, and potassium, we will employ a soil NPK sensor.The Modbus RS485-compatible Soil NPK sensor is an inexpensive, highly precise, rapidly responsive, and portable sensor. This sensor has an advantage over more conventional detection techniques in that it provides extremely accurate and rapid measurements. All you have to do is place the probe into the ground and use an Arduino to acquire the data. Now let's take a closer look at how the Soil NPK Sensor interfaces with Arduino.

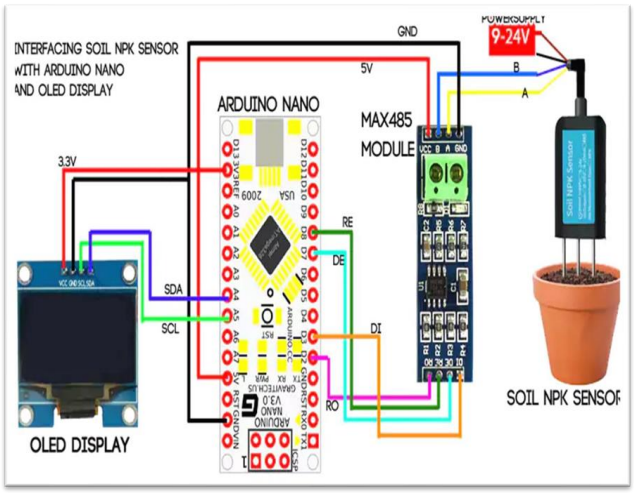
II. IDENTIFY, RESEARCH AND COLLECT IDEA

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 fertilizers will be utilized. The sensor will provide data regarding the amount of nutrients present in the soil.

The information gathered can be utilized to supply the field with the appropriate nutrients. 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.

Sensor analog data is converted to digital form using an analog to digital converter. This data is then transferred to Arduino, which uses the Internet of Things to transmit the data to the distant device. This data can beenteredinto a database, which can be retrieved as needed.



III. WRITE DOWN YOUR STUDIES AND FINDINGS

[1] Identification of the light colour that a nutrient absorbs :-

The most accurate colour is determined by comparing the usual range of wavelengths absorbed by a particular nutrient with the wavelengths of different colours. This wavelength is roughly equal to the light captured by nutrition.The photodiode filter in question is then turned on for the purpose of measuring nutrients. The table displays the different nutrition absorption wavelengths along with the wavelength of the matching colour.

[2] Measuring the distance between a soil sample and a sensor:-

To determine the ideal distance, adjust the length between the sample and the reflector. Next, choose the distance that provides the most precise readings for the angle of incidence and reflection of particular colour beams. The most precise distance is 3 cm, and this path length is maintained between the sensor and the soil sample.

[3] Determining the nutrients in the soil :-

Table III displays the NPK soil levels in three distinct samples as high, medium, or low.

Soil Sample	Nitrogen(N)	Phosphorus(P)	Potassium(K)
Sample 1	High	Normal	Low
Sample 2	Low	High	Normal
Sample 3	Normal	Low	High

Fig1 :- The nutrient content levels in samples.

Figure 2's bar charts show how the soil sample comparisons are displayed. Sample 1 has the highest amount of nitrogen because its wavelength is longer than 485. Sample 2 has less nitrogen and more phosphorus. Sample 3 had the greatest potassium content. Consequently, NPK levels in soil samples are measured in this manner.

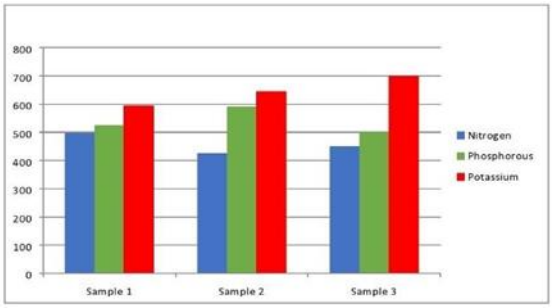


Fig2 :-Comparison of nutrient content in sample.

IV. CONCLUSION

The Plant Deficiency Detector Driven by IoT An all-encompassing answer to the problems involved in the prompt and precise identification of plant deficits is offered by the Arduino project.

The project intends to provide farmers with real-time insights into plant health through the integration of IoT technologies, sensor networks, and data analysis algorithms, resulting in more effective and sustainable farming operations. In summary, the system that we are developing will have the capability to identify the nutrients present in the soil.It will be

able to provide us with the values for various nutrients found in the soil sample, such as potassium, phosphorus, and nitrogen. It will be beneficial for creating programs for nutrient control at the agricultural level as well.It is possible to increase both the number and quality of the crops.

It is possible to significantly lower the costs incurred by the farmer when cultivating a specific crop on a given type of soil. There will be a maximum proportion of profit in the economy since it will assist farmers in planning their harvests ahead of time.

V. UPCOMING ADVANCEMENTS

By cultivating the crop at the ideal soil moisture content and free from infection, the smart farm assists the farmer in making large profits.

Owing to the automated procedure, less human labour is required, and crop growth is monitored via a smartphone. The cost of implementation is lowered by wireless communication. Eventually, this is applied to a sizable land region. For farmers to receive the data, there must always be internet access. The farmer can cultivate the crop according to the weather conditions thanks to the predetermined weather prediction.

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