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IoT Based Intelligent Agriculture Field Monitoring and Controlling System

Mrs. R. Ponni[1], K. Akash [2], R. Kirubanidhi[3], S. Praveen [4], M. Viknesh[5]

[1] *Asst. Prof Department of ECE and Krishnasamy College of Engineering and Technology*
[2,3,4,5] *Department of ECE and Krishnasamy College of Engineering and Technology*

ABSTRACT:

Our project's goal is to guarantee the health of agricultural land by offering fertilisers. There is a need for numerous automated systems nowadays since, in the age of improved electronics and technology, life should be easier and more convenient for humans. These systems should be able to replace or significantly reduce the amount of human effort required for daily tasks and employment. In order to help millions of people, one such system was created, called the IOT Based Intelligent Agriculture Field Monitoring & Controlling System. It is a model for controlling irrigation facilities that uses sensors to sense soil moisture and humidity with a microcontroller to create a smart switching device. As inconsistent watering causes the soil to lose minerals and can cause the plants to decay. The fundamental idea behind this system is to link the Arduino microcontroller, which is also connected to other electronic parts, to the soil moisture sensor and nutrient sensor (N, P, K) that were previously embedded into the plant. The sensors that measure the soil moisture and nutrient content transmit the data and parameters of the soil moisture and nutrient level to the microcontroller, which then operates the pump. The microcontroller transmits a signal to the relay module, which in turn activates a pump to give a specific amount of water and fertiliser to the plant, if the level of soil moisture and nutrient content falls below a predetermined value. The pump stops operating when it has delivered enough water and fertiliser.

Keyword: Agriculture land, Internet of things, Modern Agriculture.

1. INTRODUCTION:

Soil monitoring is a basic procedure which is required for farming. 26% of the Earth's surface is uncovered as land. All mankind lives on the earthbound, strong Earth included bedrock and the weathered bedrock called soil. Soil is a blend of inorganic mineral particles and natural matter of differing size and arrangement. The particles make up around 50 % of the dirt's volume. Pores containing air and water involve the rest of the volume. The vital parameters should have been measured in the dirt are temperature, dampness, mugginess and light.

Nowadays, an agricultural industry is one part that is an imperative wellspring of economic growth. Horticulture is viewed as the nation's best field that productive. Soil reflects both natural and human activities. It changes in its properties with respect to environmental issues. In order to know the soil properties in the particular location, it was decided to study the nutrient contents, microbial analysis of the soil.

The pH, organic carbon, NPK, minor nutrients was assessed. The pH was found to be alkaline. The NPK level was moderate in amount, and all the minor minerals were higher in amount except boron which was absent. The total mineral content of the soil was 266.19kg/acre.

Among the microbes tested, the bacteria were found in higher concentration, followed by fungi and very less of actionmycetes was present. From the results it is concluded, that the soil contains sufficient organic carbon, nutrients, microbes essential for growth of the plant. Precision farming is very important to help the farmer to realize the high quality productivity. Sensor technologies are the best solutions to do this. Soil nutrient monitoring system is to master the nutrient status of the bare ground, and quickly extract the information of farmland nutrient. Because of having a significant impact on the crop, the soil nutrient monitoring is important. Lack of monitoring soil nutrient because people suffer from various disease due to chemical fertilizers. The benefits of optimizing irrigation scheduling with soil moisture sensors includes increasing crop yields, saving water, protecting local water resources from runoff, saving on energy costs, saving on fertilizer costs and increasing the farm’s profitability.

2. LITERATURE SURVEY

Soil and Water Testing using Raspberry pi

Authors: A. A. Revankar and K. U. Nayak

The presented an experimental research which determine the primary nutrients of the soil by applying ultraviolet spectroscopy. Finding shows that by using a series of test and through the analysis of the wavelength, the concentration of primary soil nutrients can be determined.

Vision System for Soil Nutrient Detection Using Fuzzy Logic

Authors: J. C. V Puno

The presented the paper that can detect the NPK of the soil by using fiber optic sensor. This paper identified measurement of nutrient contents in order to determine the amount of additional nutrient content should be applied to soil in order to upsurge plant productiveness. This increases soil value, resulting in a good quality of crops in exchange. In the present work, a colour sensor based on optic fiber was established to determine values of nitrogen, phosphorous and potassium. Colour analysis of the liquified soil solution was conducted here.

Smart Crop and Fertilizer Prediction System

Authors: C. P. Wickramasinghe, P. L. N. Lakshitha, H. P. H. S. Hemapriya, Anuradha Jayakody and P. G. N. S. Ranasinghe

The paper presents a tool with embedded sensors that measure soil fertility and developed a cross- platform mobile application to suggest the best crops according to available soil fertility. Further, a fertilizer plan will be suggested to optimize fertilizer usage in order to increase profitability and avoid soil degradation. To evaluate the final product, the same soil sample was tested in the lab and using sensors embedded tool. Results obtained by those tests proven that both generate approximately equal Nitrogen (N), Phosphorus (P) and Potassium (K) values.

Data Warehouse Design for Soil Nutrients with IOT Based Data Sources

Authors: Abdul Rahman, Ermatita and Dedik Budianta

Plant fertility is very dependent on the levels of nutrients present in the soil. Measurement of soil nutrients can be done through laboratory tests and can also be done using IOT technology. IOT equipment is supported by sensors that can be used to measure soil nutrients and the location of the soil is measured. Data from land measurements made through IOT technology can be stored and displayed in real-time through the cloud. This paper designs data sources derived from IOT-based nutrient measurement data to build data warehouse locations and soil nutrients. A data warehouse that is formed later can be done for analysis of the types of plants and fertilizers needed at a soil location.

Automated Soil Macro-Nutrient Analyzer using Embedded Systems

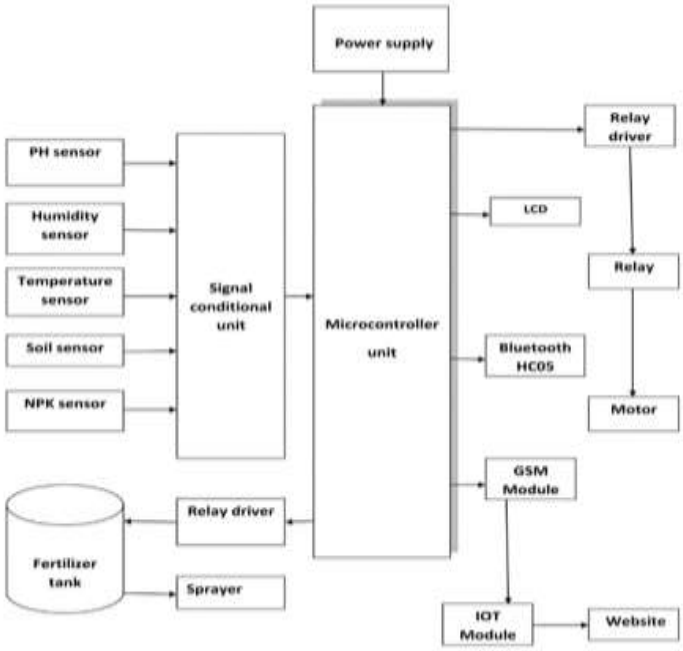
Authors: Khairnar, H. M., & Kulkarni

Nutrient is a substance which provides essential nourishment for the growth of plant. Nutrients are classified as Micronutrients & Macronutrients. Nutrients those are needed in small amount are known Micronutrient while those are needed in large amount for growth of plant is known as Macronutrients. NPK are Primary Macronutrients. In this Paper, Soil Macro Nutrient analyzer is designed which measures amount of NPK available in soil sample using color sensor, also soil pH using pH Sensor. Microcontroller controls the operation and displays the contents. This method will reduce human efforts, time and reduces errors in measurement.

3. PROPOSED SYSTEM

The specific land's soil nutrients and soil moisture level can be measured using IOT technology. the sensors that can immediately read the moisture and nutrient content of the soil. The collected data, which includes the location of the measured land, can be manually entered into the database system or sent immediately to cloud storage. Based on wireless sensor network technology, sensors are utilised in the agricultural sector to analyse nutrient factors. The sensor will gather information about the soil's characteristics and moisture content, which will then be saved in a cloud database. . In order to create a database of data measurement results for soil nutrient data and soil moisture level in a place, a data acquisition technique was used. A website or mobile application can be used to view the data. This information can be entered to display the soil moisture level and land nutrient level. It is possible to gather the cloud-stored data. The obtained information can be compared to the average value of soil moisture and N, P, and K nutrients. The website or mobile application will provide advice if the farming ground lacks sufficient nutrients. The nutrition analyser is connected to the autonomous fertiliser spraying system. These sprayers that pump fertiliser into the ground do it without human assistance. The microcontroller transmits a signal to the relay module, which in turn activates a pump to give a specific amount of water and fertiliser to the plant, if the level of soil moisture and nutrient content falls below a predetermined value. The pump stops operating when it has delivered enough water and fertiliser.

BLOCK DIAGRAM:



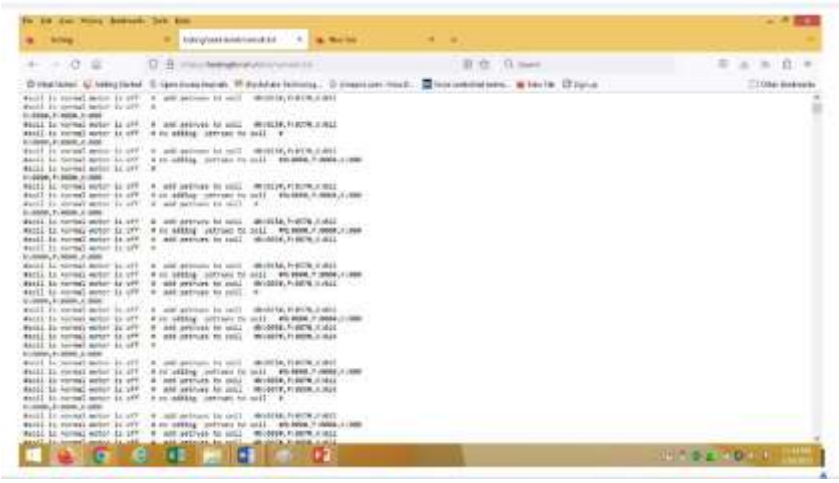
4. WORKING:

The main working principle behind this system is in connecting the soil moisture sensor, nutrient sensor (N, P, K) which was previously embedded into the plant, to the Arduino microcontroller, which is also connected to other electronic components. Measurement of soil moisture and nutrient content is done by the sensors which forwards the information and parameters regarding the soil moisture and nutrient level to the microcontroller, which controls the pump. If the level of soil moisture and nutrient level drops below a certain value, the microcontroller sends the signal to the relay module which then runs a pump and certain amount of water and fertilizer is delivered to the plant. Once the enough water and fertilizer is delivered, the pump stops doing its work. This Arduino module sends the information to the cloud then the user can see the soil and NPK parameter information on the mobile phone as well as server using web browser. The mobile application is developed in android. The mobile application helps to monitor and control the field from anywhere. The mobile application uses PHP script to fetch data from MySQL database. In MySQL database all the sensor data are stored. The android fetches the data and encode it in JSON format to be displayed in android device. The user interface for the application is designed in a way that enables both the monitoring and control of field from the device. The internet connection should be provided to monitor and control the field.

5. RESULT:

In this section, the experimental tests were performed to determine the various components

of the proposed agricultural field monitoring and control system. It use sensors to sense the soil nutrients and soil moisture.



6. CONCLUSION

Time is the critical factor for soil nutrient detection since the variability of soil nutrient levels may be quiet high over time. Due to complex soil pretreatment and chemical analysis, standard testing time for NPK is time consuming. This approach for measuring the soil parameters is used for the efficient plant growth. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The important parameters of the soil such as temperature, moisture, humidity and pH value are checked by the respective sensors. The measured parameters are transmitted to the cloud through the Arduino. Finally we can see the graph of soil parameter and suitable crop for this parameter on mobile phone as well as laptop through browser.

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