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Real Time Plant Health Data Monitoring with Digital Twin with Augmented Vision for the Screening of Plant Growth Disease

Tmt.S.D.Gayathri, Tmt. A. Rajakumari

Lecturer, Department of Electrical and Electronics Engineering, I R T Polytechnic College, Bargur, Tamilnadu, India
Lecturer, Department of Electrical and Electronics Engineering, I R T Polytechnic College, Chennai, Tamilnadu, India

ABSTRACT: The Project proposes real-time plant health data monitoring with Digital Twin with Augmented Vision for the screening of plant growth disease, suggesting that this symptom could be used as screening tool to help identify plants with potential high-risk cases who could be recommended to treat immediately.

For faster action in agriculture in a land, it generates a scannable Augmented Vision (AV) code print. Also, the agricultural sensor data's also uploading to server system by IoT. By our proposed system, every land is being addressed by their unique DT based AV code with them.

The agriculture sensors will be deployed, and the values will be sent to the IOT with their unique code. In among the many lands in the different cultivation areas, the critical disease affecting lands being addressed as to inspect for the treatment in emergency manner to treat those faster and save plants in deadly affection.

The owner of the land will scan the AV code with all different lands AV code using android app scanner available, immediately the DT vision Software System fetch the respective lands sensor values from the server also according to the sensor values and database data's the DT vision Software System will show us the details in real-time images as shown in fig(1) and fig(2) for normal and disease datasets i.e. green DT leaf images for normal stage of and Red DT images the leaf severe affected plants land with the IOT data sets respectively .

By screening with this the owner can identify the immediate treatment needed priority lands in order, i.e. RED leaf as immediate next for the orange leaf DT **images** plant lands and then can check for the green leaf DT images plants. Such that owner can save the life of the disease affecting lands in a sequence treatment order one by one.

I. INTRODUCTION

1.1 GENERAL VIEW

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.

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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 actinomycetes 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 waterresources from runoff, saving on energy costs, saving on fertilizer costs and increasing the farm's profitability.

1.2 METHOD

This section explains the details of the nutrition analyser and suggesting system. The concept of development starts with the overall precision detection system. The overall system of the IoT based on soil nutrition level detection.

II. LITEATURE SURVEY

2.1 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.

2.2 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.

2.3 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.

2.4 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

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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.

2.5 Automated Soil Macro-Nutrient Analyzer using Embedded Systems

Author: 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 MacroNutrient 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.

III. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

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. And the automatic irrigated system is also attached with analyzer.

3.1.1 DISADVANTAGES OF EXISTING SYSTEM

- No database-based system available to compare or to analyse a plant's history of tracking and agri data.
- No updated technology for scanning like AR, VR and MR.
- No image-based output in current method.

3.2 PROPOSED SYSTEM

The Project proposes real-time plant health data monitoring with Digital Twin with Augmented Vision for the screening of plant growth disease, suggesting that this symptom could be used as screening tool to help identify plants with potential high-risk cases who could be recommended to treat immediately.

For faster action in agriculture in a land, it generates a scannable Augmented Vision (AV) code print. Also, the agricultural sensor data's also uploading to server system by IoT. By our proposed system, every land is being addressed by their unique DT based AV code with them.

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3.2.1 ADVANTAGES OF PROPOSED SYSTEM

- No need to sampling the soil in laboratories.
- To minimize the chemical fertilizer.
- No need to spray the fertilizer in the land with help of human.
- First time in Technology **DT Vision** system utilizes for the real-time update and screening the plant disease in emergency in agriculture land.
- The Images based output and tracking with DT vision system.

IV. SYSTEM SPECIFICATION

4.1. HARDWARE REQUIREMENTS

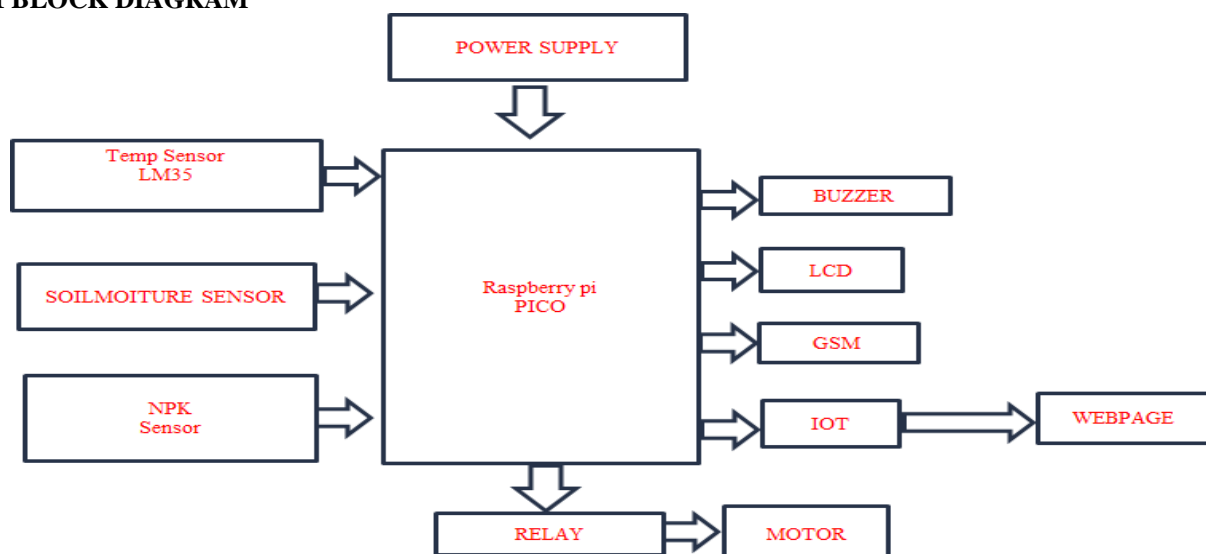
- Raspberry Pi Pico
- Power Supply
- Temperature Sensor
- Soil Moisture Sensor
- Npk Sensor
- Relay
- Lcd
- Dc wate pump

4.2. SOFTWARE REQUIREMENTS

- Python
- ML

V. BLOCK DIAGRAM & CIRCUIT DIAGRAM

5.1 BLOCK DIAGRAM



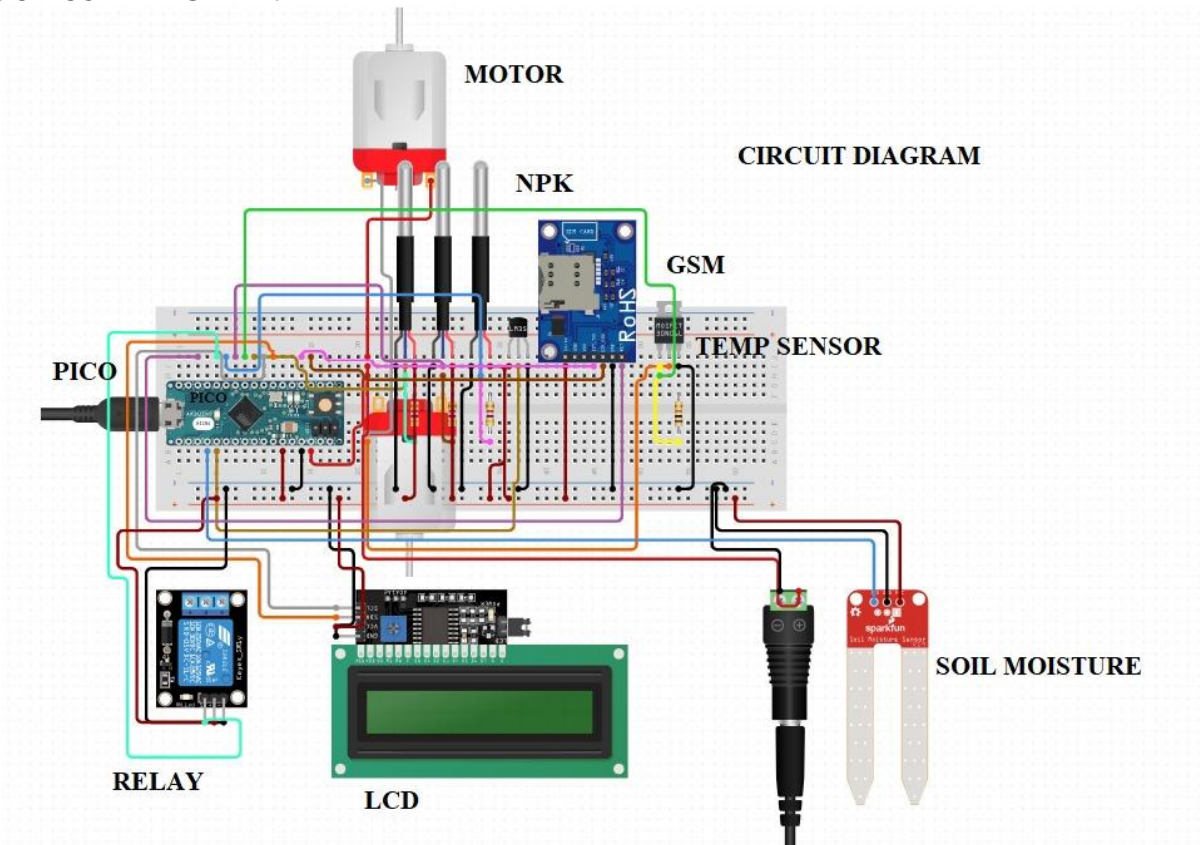
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5.2. CIRCUIT DIAGRAM :



5.3 WORKING

Nowadays, in the age of advanced electronics and technology, the life of human being should be simpler and more convenient, there is a need for many automated systems that are capable of replacing or reducing human effort in their daily activities and jobs. Hence developing one such system, named as IoT Based Intelligent Agriculture Field Monitoring & Controlling System. which is actually a model of controlling irrigation facilities that uses sensors to sense soil moisture and humidity with a Raspberry PICO in order to make a smart switching device to help millions of people. Since irregular watering leads to the mineral loss in the soil and may end up with rotting the plants. The main working principle behind this system is in connecting the soil moisture sensor, nutrient sensor (N, P, K) which was previously python ML into the plant, to the Raspberry PICO processor, 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 microprocessor, which controls the pump. If the level of soil moisture and nutrient level drops below a certain value, the microprocessor 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 Raspberry PICO 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

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5.4.SCREEN SHOTS



VI. CONCLUSION & FUTURE ENCHANCEMENT

6.1 CONCLUSION

Time is the critical factor for soil nutrient detection since the variability of soil nutrient levels may be quite 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 Raspberry PICO. Finally we can see the graph of soil parameter and suitable crop for this parameter on mobile phone as well as laptop through browser.

6.2 FUTURE ENHANCEMENTS

In the future, enhancing your digital twin-based real-time augmented vision system for agriculture lands to detect disease screening could involve several key advancements. Firstly, integrating more sophisticated sensor technologies, such as multispectral or hyperspectral cameras, could provide a more detailed and accurate analysis of crop health. Additionally, implementing advanced machine learning algorithms, like deep learning models, could improve the system's ability to detect subtle signs of disease early on. Furthermore, enhancing the system's connectivity and interoperability with other agricultural machinery and systems, such as automated irrigation or robotic harvesting,

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could enable more efficient and targeted disease management practices. Finally, incorporating real-time data analytics and decision support systems could help farmers make informed decisions quickly, ultimately improving crop yield and reducing the impact of diseases on agricultural productivity

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BIOGRAPHY



S.D. Gayathri
Lecturer, Department of Electrical and Electronics Engineering, I R T Polytechnic College-
Bargur
gayathrivenkatesh2013@gmail.com



A. Rajakumari
Lecturer, Department Of Electrical And Electronics Engineering, I R T Polytechnic College ,
Chennai-44.
rajakumari1996@gmail.com