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Soil Fertility Detection and Crop prediction using ML and IOT

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ABSTRACT: This project is a low-cost soil and weather observation system that analyses the different soil properties and the weather to create high-tech, intelligent farming equipment for farmers. Since the current system is not very cost-effective, the goal of the proposed project is to create a smart irrigation system that is. The soil and weather monitoring module, where the smart irrigation system and machine learning module can be implemented, make up the two core modules of this system. The first module includes the characterization of different soil sensors and circuit connections. A soil moisture sensor is used to find moisture in the soil. DHT 11 can be used to determine both the temperature and humidity (Digital Humidity Temperature). The task of retrieving information from all of the aforementioned sensor data values falls under the purview of the second module, machine learning. An online application is created to give farmers appropriate knowledge and direction on growing crops that they prefer. Therefore, our solution is the ideal fusion of web application, machine learning, and IoT. Low-income home farmers can also benefit from intensifying their usage of smart climate farming techniques.

KEYWORDS: Crop Prediction, DHT 11, IOT, ML, Soil Moisture Sensor.

I. INTRODUCTION

The global economy greatly depends on the agricultural sector. With an increasing global population, the agriculture sector will face greater challenges. Data is used in two new scientific fields: agri-technology and precision farming, also known as "digital agriculture" by some. A key function for agriculture plays in the world economy. In order to address concerns about food security and lessen the effects of climate change, it is more crucial than ever to comprehend global agricultural productivity. One of the main problems in agriculture is projecting crop yields. A number of weather-related factors, including temperature variations, pesticide use, and heavy rainfall, have a big influence on agricultural productivity.

One major factor influencing agricultural productivity is the weather forecast. As a result, planting decisions are made in accordance with the weather forecast, which is predicted. Weather forecasting is the application of science and technology to predict future atmospheric conditions for a certain area and period of time. Informal weather forecasting has been practiced for thousands of years, especially since the nineteenth century. Weather forecasts are created by gathering information about the atmosphere's current condition at a certain area and then utilizing the weather to forecast future changes to the atmosphere. Finding the finest predictive model for forecasting still requires individual involvement.

Improved weather forecasting for agriculture has clear advantages, and farms are one of the main clients of private weather forecasting companies. The weather determines when crops are best planted, fertilized, watered, and harvested. Farm productivity can be increased by farmers with access to accurate meteorological data for every area of the farm. Crops can be grown and exported more quickly when weather forecasts are used. Around the world, there are a lot of dirt rural roads. Farmers need to know whether it's safe to use them. In order to help farmers choose the right crops and irrigation techniques in response to shifting weather conditions, we employ data from a particular place to forecast future weather.

II. RELATED WORK

"Smart Agro Farm Solar Powered Soil and Weather Monitoring System for Farmers" Devi Devapal (2020) Proceedings 24 (2020) 1843–1854, DIRECT SCIENCE A low-cost solar-powered soil and weather monitoring system that analyzes the various soil qualities and climates to create a high-tech smart farm for farmers might be referred to as a smart agro farm. The three primary modules of this approach are the web application module, machine learning module, and Internet of Things module. The IoT module has circuit connections and a range of soil sensors for characterizing moisture or wetness in the soil. It also automatically or self-sufficiently uses alternative energy to operate, making it very affordable for farmers. due to the possibility that the vector division methodology used as the input for the K-means cluster originated from.

Renuka and Sujata Terdal, "Evaluation of Machine Learning Algorithms for Crop Prediction," Volume 177, October 2020, SCIENCE DIRECT, 105709, The expansion of the national economy is significantly influenced by agriculture. It depends on various environmental factors and the weather. Many of the elements that make agriculture possible are soil, temperature, precipitation, flooding, fertilizers, crops, pesticides, and herbs. Because it depends on many variables, the crop output is difficult to forecast. In this work, we often use various machine learning approaches to conduct descriptive studies on agricultural data in order to gain an understanding of crop production status. Crop yield estimates include the estimation of crop yields based on historical crop yields, soil data, and precipitation information that is readily available.

J. C. Augusto, M. Quinde, J. G. Giménez Manuel, S. M. M. Ali, C. L. Oguego, and C. James Reynolds, "The SEArch Smart Environments Architecture," in the 15th International Conference on Intelligent Environments (IE), Rabat, Morocco, 2019. One important catalyst for innovation in ICT, computing, and technology with social impact is now sensing technology [1, 2]. Recently, the company and world have created a wide range of systems that support the concept of "smart technologies," implying the possibility to gather exact conversational information through sensing and supporting more useful decision-making. several of those advancements

III. METHODOLOGY

The Internet of Things, or IoT, is nothing more than cutting-edge technology that allows devices to be controlled and monitored in real time from anywhere in the globe. Our goal is to create a technology that can assist with an automated watering system by determining the ground's moisture content. The technique of predicting crops involves combining historical and current data from multiple IoT-connected sensors. One way to automate a given model is to analyze data using machine learning. Crop forecast within the historical data was computed by an analysis of farmers' past experience with climate conditions. Lastly, a web application is created to give farmers the necessary knowledge and direction on growing preferred crops. Thus, our technology is the ideal fusion of machine learning and IoT.

Block Diagram:

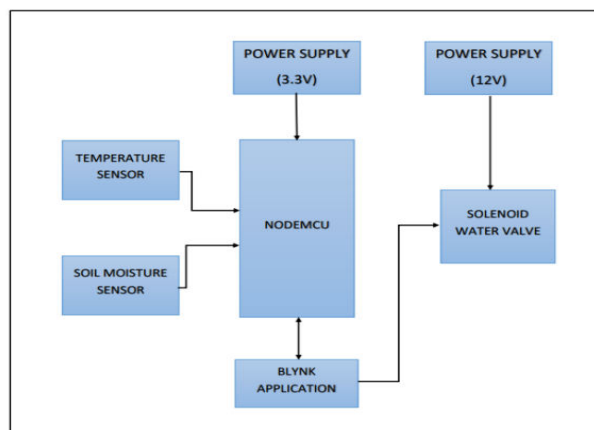


Fig 1 Block Diagram of Proposed System

The planned system is NODE MCU primarily based automation for optimizing utilization of water resources and reducing labour value in agricultural applications. System consists of NODE MCU platform and useful elements like moisture device & motor load and proposed block diagram shown in the figure . NODE MCU could be a single board elements hardware and IDE code interface for playing automation operations. moisture device detects the humidness level of soil. Soil moisture and temperature planned vary is about significantly for specific plants demand, and in keeping with that system is being operated. Motor load includes water pumps and concerned accessories for provision water to plants. Atmega328 Microcontroller automates water cycle supported data collected from humidness and temperature device. If soil moisture level is a smaller amount than minimum outlined threshold price, microcontroller acts to automatically trigger pump to work until device meets most threshold.

A threshold value is about at the start of the procedure .The steps before fixing the threshold price are as follows :

- The soil moisture device is buried within the soil and also the flow of water is opened a minimum of one inch of water is allowed to face on the soil.
- The soil is left beneath the sun for twenty four hours. If it rains during this interval the procedure needs to be started from the start.
- The moisture reading is noted at the tip of twenty four hours and with fifth deviation from the wetness reading, the threshold values are set.

The data is gathered and compared o the threshold reading. after the comparison, If the wetness content is higher than the threshold value then once a delay of a predefined time the value is scan once more and compared. If the wetness content is a smaller amount than the threshold reading, then the system bypasses one circle of reading the values. Signal is shipped to the pump to give notice a few phase change (From LOW to HIGH) Valve for the actual strip during which the wetness content is a smaller amount than the threshold reading is opened and water from the pump is allowed to flow.

IV. EXPERIMENTAL RESULTS

The soil moisture sensors is used and they are allowed to read the moisture content of the soil in every fixed interval of time. The data is gathered and compared o the threshold value. After the comparison, If the moisture content is more than the threshold value then after a delay of a fixed time the value is read again and compared. The monitored data compared with threshold value. After the comparison, if the moisture content is more than the threshold values then, the NODE MCU sends a signal to stop the motor. In another case if the moisture content is less than the threshold values then, the NODE MCU sends a signal to start the motor.

The proposed system is also having a web application to monitor the particular agricultural environment and here we can see the various sensor output and weather conditions and these values are taken for crop prediction.

Proteus Simulation:

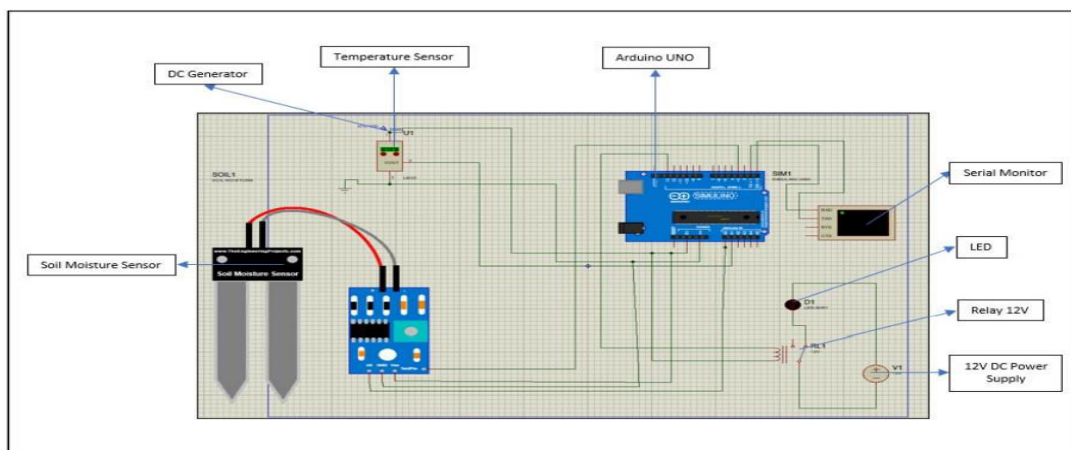


Fig 2 Proteus Simulation

Supposed in this system, the microcontroller used is the NodeMCU ESP8266. But for the simulation, Arduino UNO is used as the microcontroller instead of the NodeMCU because the library for simulation of component NodeMCU in Proteus did not exist. As for the solenoid valve, LED is used to replace the component because also the library for solenoid valve did not exist. The main reason to perform this simulation in the beginning is to make sure that the sensors will display its values through serial monitor and the LED will turn ON or OFF based on simulation that will be performed. Hence through this process, if the sensors not displaying the reading or LED not turning ON and OFF the during the simulation, those errors can be fixed directly at that time so that it did not happen on the real prototype.

V. CONCLUSION

This system is mainly designed for developing a low cost soil and weather monitoring system which analyses the different soil properties and weather conditions and thereby developing a hi-tech smart farm set up for farmers. This project proposes an IoT based smart irrigation with soil and weather monitoring architecture along with a hybrid machine learning based approach to predict the suitable crop. The proposed algorithm uses sensors data of recent, past and the weather forecasted data for prediction of suitable crop using machine learning. This proposed system is used Random Forest algorithm for crop prediction.

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