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An Innovative Micro-Controller Based Crop Recommender Using Soil Analysis and Weather Forecasting Technique

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ABSTRACT- India is a vast country where agriculture is a source of living for the majority of the population. Due to technical barriers, the output percentage in the agriculture sector is not up to the mark as and when compared to the effort that is being put in by our farmers. In this project, we have proposed an idea of a crop-recommender that will take the soil details and weather forecast of the area through API call and based on that input will recommend crops that can be grown in the area. In our proposal, we have developed a microcontroller based device to test the soil sample and a web-portal for analyzing and displaying the result. The entire process has been developed keeping the literacy percentage of the farmers in mind, thereby making the process quite simple and user friendly. Our proposed work is to enable the farmers to cultivate in their fields with more efficiency and reduce the crop damage percentage. This will enable to bring back "Green-Revolution" in India.
Keywords- crop-recommender, API, microcontroller, web-portal, Green-Revolution.

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I. INTRODUCTION

Agriculture has played a very important role in the civilization of human mankind. Without the introduction of agriculture, it would not have been possible to reach this height of civilization by the mankind. Due to a lack of technical resources, the output of the agricultural sector is not up to the mark. The devices that are available at present are not much user-friendly due to certain factors like portability, economic stability and literacy percentage of the mass population associated with farming. To overcome the mentioned problems, we have proposed to develop a method that will take the soil details and weather forecast of the area as input and recommend a list of crops that can be cultivated in the given conditions. In our project, we have used microcontroller and sensors along with certain software components to analyze and recommend the list of suitable crops for the given area.

II. OUR PROPOSED WORKING PROCEDURE

In this project, we have used certain hardware as well as software components to obtain the required results. In this project, we have used a microcontroller along with an array of sensors to obtain the details of the soil such as pH value, moisture content and temperature. These data are pulled into a web portal by a python script. The weather details are fed into the web portal by means of an API call. These input details, after being analyzed put forward a list of recommended crops on the web portal. The user can record the soil details by logging into the web portal by their own login details. The user can also access the result of the soil analysis from the web portal. The web portal has been added to provide ease of use to the users.

A. Hardware Components

The hardware components used along with their functionalities are provided below:

i. Arduino UNO:

It is a microcontroller that is being used to connect other sensors and provide the output of the sensors via Serial Communication.

This Arduino UNO microcontroller board has multiple pins, such as PWM pins areused for Analog output, Analog Input Pins (A0 –A7) are used for Analog inputs and the remaining pins can be used as Digital input output pins.

Figure 1. Arduino Uno Microcontroller.

ii. **pH Sensor:** A pH sensor has been used to measure the pH value of the sample soil.

Figure 2. pH sensor probe with transmitter.

iii. **Soil Moisture Sensor:** The soil moisture sensor has been used to record the content of moisture in the soil.

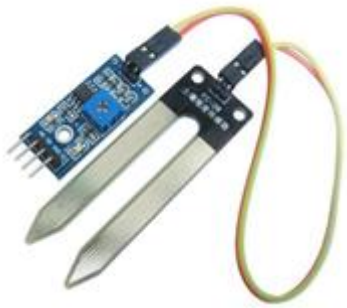

Figure 3. Soil Moisture sensing probe with transmitter.

iv. **Soil Temperature Probe Sensor:** This probe sensor has been used to record the temperature of the sample soil.

Figure 4. Soil Temperature Probe Sensor.

B. Application Programming Interface

This is a weather forecast service Application Programming Interface (API) call. In this API call we request a server to provide the weather report, with the API Key and the location ID for getting the report for that specific location's weather report. After requesting the server via an URL Link the weather report is returned in the form of JSON file format. Then, the JSON text is parsed to find out the required rainfall amount and duration of rainfall. Then we calculate the average of the amount of rainfall for the period of 5 days and conclude the type of rainfall i.e. heavy or medium or light rainfall.

C. Block Diagram

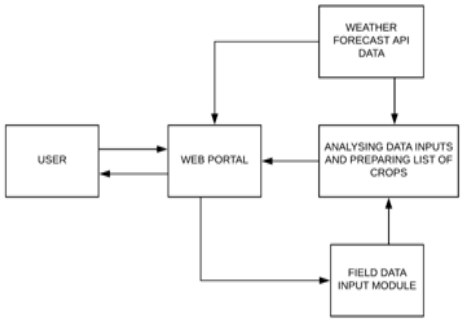

Figure 5. Block Diagram of the proposed idea.

C. Circuit Diagram

Figure 6. Circuit diagram of the proposed idea of soil testing unit.

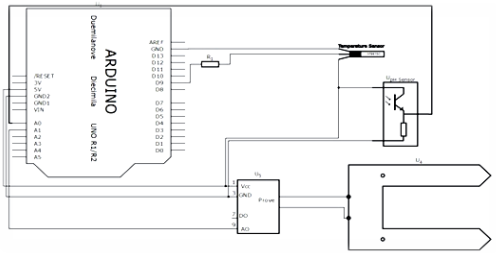

TABLE 1: Pin connections of various sensor modules with the microcontroller

Components	Microcontroller Pin
pH Sensor	A0
	VCC(5V)
	GND
Soil Moisture Sensor	A1
	VCC(5V)
	GND
Temperature Probe	D9
	VCC(5V)
	GND

D. Operational Procedure

In our proposed work, we have designed a web portal where the user first needs to register themselves and then login using the login details.

On logging into the web portal, the user gets an option of testing the soil. On availing this option, the user will be prompted to connect the hardware module and record the details of the soil sample; the weather details will be directly fed into the system by means of an API call. Gathering all these input details, the system generates a list of recommended crops that can be irrigated on that soil sample and this list is being shown on the web portal to the user.

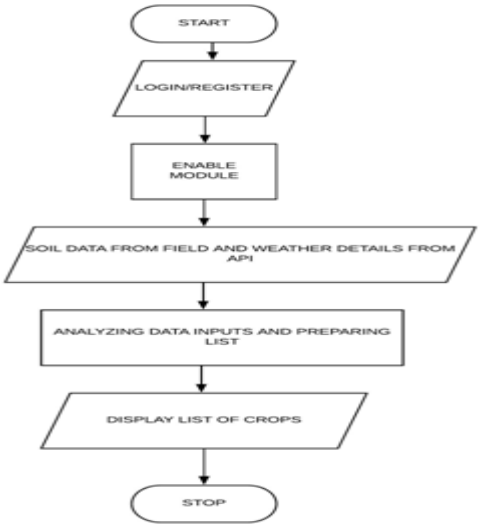

Figure 7. Flowchart of the operational procedure.

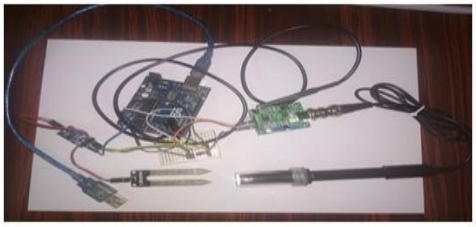

Figure 8. *Complete working model of our proposed work.*

III. RESULT AND ANALYSIS

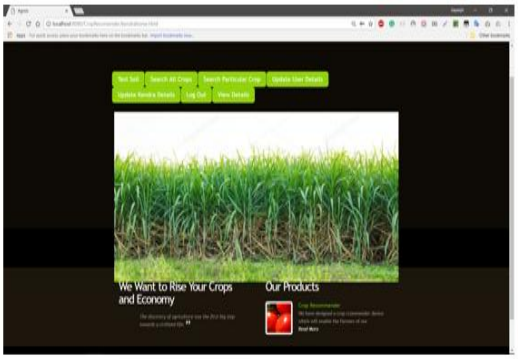

Figure 9. Homepage of our proposed web-portal.

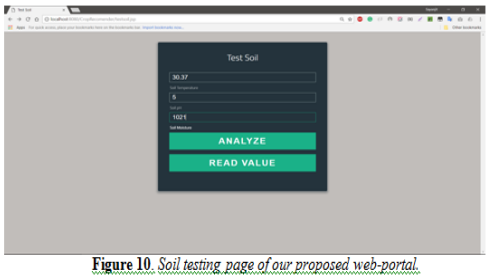

Figure 10. *Soil testing page of our proposed web-portal.*

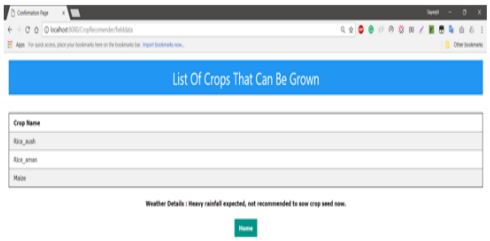

Figure 11. *Output of our proposed web-portal.*

Here after analyzing the soil sample our proposed work provides us the list of suitable crops that can be cultivated in that soil. We are also providing the weather forecast detail, i.e. when it is good condition to sow the seeds.

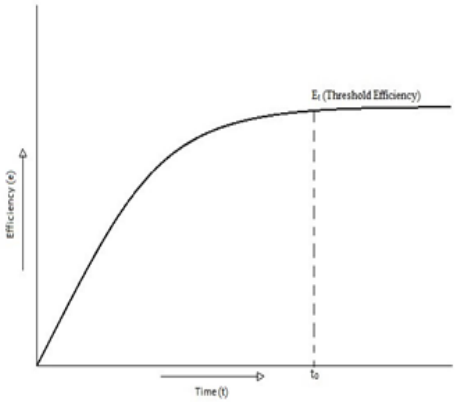

Figure 12. Time(t)-Efficiency(e) comparison graph for our proposed work.

According to our proposed work, when time domain(t) increases then also efficiency(e) of our proposed work also gradually increases, so, $t \alpha e$ for $t_0 > t$ after getting a threshold efficiency E_t thus the graph will be stable and there is no change according to time.

IV. CONCLUSION

The crop recommender overcomes the problem of portability and economic barrier. By using this crop recommender the output percentage of the agricultural sector is expected to rise and the percentage of crop damage will decline. The crop

recommender will also find its applications in certain other fields like home gardens and organic parks. In future, we have also thought to implement the regional languages in the system thereby making it more user-friendly. Storing of the testing results in a database for later access by the users will also add to the security and reliability of the system.

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