Analyzing Soil Parameters using IoT Device

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***Abstract*—Agriculture is one of the most important sectors for any country. Putting efforts for new innovation in agriculture sector can lead to very bright side and can do wonders. Smart/ Intelligent Farming can be the solution to face the issues that our agriculture sector is currently going through. This could be tackled through usage of cellphones and through IoT gadgets. Farmers can monitor their fields and can get real-time soil parameters values through IoT based soil monitoring device integrated with sensors. The readings from different sensors embedded in the soil will be sent to Arduino UNO micro-controller for further analysis. With the analyzed information we will be able to know which particular crop is best suitable according to the received soil parameters. We can see the actual readings and crop suggestion information on the LCD display connected to the Arduino board. This effort will make the soil monitoring/ testing procedure a lot convenient and faster to the farmers.**

I. Introduction

One of the major essential needs for human life existence is agriculture and with the help of IoT we can achieve smart innovative farming. It is considered to be the backbone for any developing country and for a country like India agri-culture plays a very vital role in the country's growth and establishment. As the population is increasing rapidly, crop production need to be increased. For efficient production of more crops, a better soil monitoring system is required that should be more reliable and accurate in the details of soil parameters like soil moisture, temperature and humidity, which are the base for any crop growth. Hence, we can say that these parameters need to be monitored frequently, which at present are not possible through our existing manual approaches. To overcome this drawback, we propose IoT based system that could assist farmers in effective soil management and decide on the suitable crop to be cultivated in the land.

II. Related Work

* Mr. Sukhesh Kothari successfully monitored the soil and the environment properties continuously and sent report to the farmers periodically. There proposed model has increased in agricultural production. [1]

* Mr. Fan TongKe realized that the approach for new innovation in the agriculture sector is really effective and sole the issues with their cloud technology approach. [2]

* Dr. G.H.Agrawal's method deals with the planning development of a sensible resolution for application to the agricultural watching and management. [3]

III. Objectives

- To replace the manual evaluation of soil for better crop production, this provides benefits to the farmers.
- Focus on encouraging innovation in agriculture sector.
- It provides readily available information. A farmer can see the relevant detailed information within seconds, rather than waiting for days or weeks.
- More reach to rural areas, no geographic limitations.
- Low operational costs and better quality results.

IV. Hardware Requirements & System Architecture

The device consists of Temperature sensor, Humidity sensor, Moisture sensor, LCD display, Arduino UNO Microcontroller, Breadboard, connecting cables and regular power supply.

- **Arduino UNO Microcontroller:**

It is open source computer hardware, used for basically designing and manufacturing the base kits for building devices.

Fig. 1. Arduino UNO Micro-Controller

- **Moisture Sensor**

This sensor is used to detect the moisture present in the soil. It is very easy to use and handy, just inserting it in the soil starts to give the values. It can be ideal for indoor plants and garden.

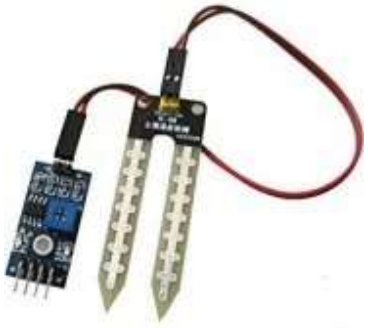

Fig. 2. Moisture Sensor

- **Temperature and Humidity Sensor**

The DHT11, temperature and humidity sensor is an ultra-low cost and basic digital sensor. It senses temperature and humidity through its surrounding air, easy to use but requires some time to grab and initialize the data.

Fig. 3. Temperature & Humidity Sensor

• A ***Breadboard*** is a solder less device for temporary prototype with electronics and test circuit designs.

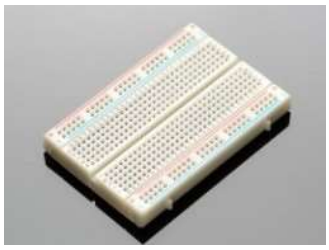

Fig. 4. Breadboard

• ***Liquid Crystal Display (LCD)***

LCDs are commonly used to display data in electronic devices such as calculators, microwave ovens, and many other electronic devices.

Fig. 5. Liquid Crystal Display (LCD)

V. HARDWARE BLOCK DIAGRAM

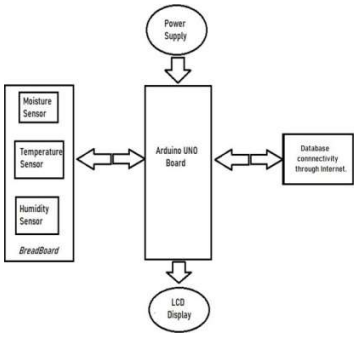

Fig. 6. Hardware Architecture

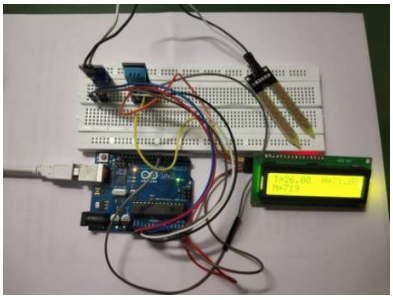

Fig. 7. Our System Architecture

VI. WORKING

The working process is presented as an algorithm.

Algorithm-

• Step1: Powering the device.

• Step 2: Fit the sensors in soil.

• Step 3: Digitally converted values are sent to the Arduino Uno Board

• Step 4: Arduino communicates with database server through internet and sends the data of all sensors.

• Step 5: Suitable crop and parameters values are displayed on LCD connected to Arduino.

• Step 6: Success.

A. FlowChart-

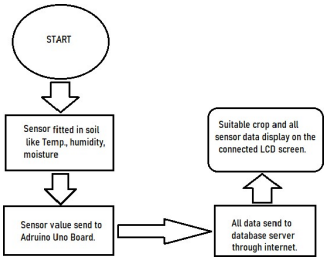

Fig. 8. System Flow

VII. RESULT

From the above approach, farmers can get the idea about their farms. Unawareness among farmers regarding water requirement for plants/crops in summers will no longer be an issue. Proper water supply time to time in order to maintain particular level of parameters for a particular crop can be achieved, resulting in good and better yield.

Result 1) when sensor are inserted in the soil

Fig. 9. Sensors inserted into the soil.

Result 2) When Sensors are free (without inserted in the soil)

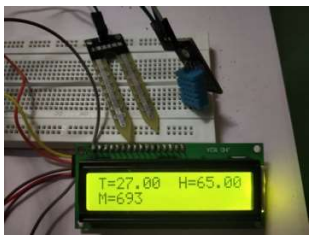

Fig. 10. Sensors reading at room temperature

Here we can the clearly see the difference as result 2 image shows the room temperature, humidity and moisture.

Whereas the result 1 shows the soil's parameters i.e. temperature, humidity and moisture along with the crop prediction.

- ***Table for Comparison***

Crop	Temperature (C)	Humidity	Moisture
Wheat	12-25	61-74	400-560
Rice	24-30	71-87	360-500
Orange	12-37	60-90	600-760
Sugarcane	20-27	55-76	600-700
Tomato	15-32	75-98	500-700
Apple	21-24	78-87	700-750

Fig. 11. Comparison Table

VIII. Conclusion

Our approach for monitoring the soil parameters for agri-cultural/plants purpose is cost effective and reliable as well. The analysis done and the result obtained shows that our system performance is quite accurate. The basic and important parameters like temperature and humidity, moisture as well are being checked here by the respective sensors.

The sensors value and the crop prediction according to the values are being displayed on the respected 16x2 LCD connected to the Arduino UNO Micro-controller

IX. References

[1] "Multidisciplinary Model for Smart Agriculture using Internet-Of- Things(IoT), Sensors, Cloud-Computing," (Hemalata channe, sukhesh Kothari, Dipalikadam et al,.2014)

[2] " Smart Agriculture Based on Cloud Computing and IoT "(Fan TongKe, 2013)

[3] "Automatic Parameter Monitoring and Analysis of Irrigation System in Agriculture "(Prof. S.G.Galande, Dr. G.H.Agrawal, Mr. S.P.Bangal, September 2015)

[4] https://www.arduino.cc/en/main/arduinoboarduno.

[5] Real Time soil fertility analyzer using IOT" (P.Sukumar, Dr.T.Kavitha2 A.Deepika, V.Jashnavi), ISSN: 2395-1303, Is-sue 4 Year-2018