

IoT based System to Carry out the Soil Tests to Determine various Parameters of the Farm

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Abstract - In India agriculture is unquestionably the largest livelihood. With rising population, there is need for increased agriculture production. The perception of Smart Agriculture is flattering a truth as it evolves from intangible models for the development of crop at different stages. In traditional agriculture, cultivation of the plants will be used to sustain and enhance human life. Hence now a days the Smart Agriculture has come into the depiction globally. It provides the key by means of placing the sensor in the cultivation land to determine the soil effectiveness. The soil is tested using various sensors such as pH sensor, temperature sensor, and humidity sensor. Based on the result, the farmers can cultivate the appropriate crop that suits the soil. The obtained sensor values are sent to the field manager through the Wi-Fi router and the crop suggestion is made through the mobile application. Main approach is to make it portable to identify crops at the farm.

Key Words: IOT, Soil, pH scale, Agriculture, Temperature, Humidity.

1. INTRODUCTION

Internet of things (IoT), which is the ability for technology in everyday objects to send and receive data, will revolutionize how we do everything from transportation to communication. Agriculture also stands to benefit greatly from integrating this technology into simple electronics.

IBM estimates that IoT will enable farmers to increase food production by 70 percent by the year 2050. In addition to better pest management and weather forecasting, IoT could save up to 50 billion gallons of water annually, as sensors can better help farmers optimize water usage. Being able to better optimize crop management will have a transformative effect on agriculture in the following years. Farmers need variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities etc. Cloud computing has been used for storage of agriculture data by Government and private agencies. Cloud support various services to farmers to interact with cloud by using any cheaper ways like sensors, mobile devices, scanners etc. The system was studied and developed to configure of the wireless sensor network to assess the temperature, humidity and water level adjustment, and of the sensor node necessary for the optimal farming environment, and of the monitoring management devices to collect and analyse such collected data from sensor node and to store them in the management server and to alert emergency. The collected data provide the information about the various Environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity to a greater extent. By using IoT and databased decisions and by predicting the implications of each and every decision, a farmer can reap high profits and use his field more efficiently. This is a means of assisting farmers in optimizing yield, minimizing input costs and reducing environmental impact on crop growth. Monitoring of soil moisture in different areas of a farm can help in overall irrigation management. Different crops require different irrigation strategies and using real time data of soil moisture a farmer can increase yield by maintaining an optimal soil moisture for a specific crop.

2. Working Nature of sensors

The Sensors can help you:

- Easily collect and manage the explosion of data from sensors, cloud services such as weather or maps, connected equipment and existing systems.
- Quickly build and bring to market new innovative IoT applications at 10 times the speed of other approaches with our rapid application development environment and drag and drop mash up builder.
- Leverage big data and analytics to provide new insights and recommendations to aid in better decision-making. Enable farmers to easily visualize.

3. Existing System

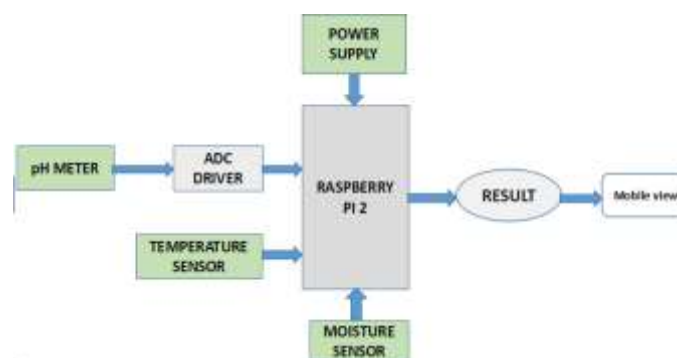
By Rudimentary, the farmer needs to send out the soil samples to the soil testing labs where the soil sample is tested and the results are sent back to the farmers which can take up to 15-20 days. Now there are many devices available in the market that allow customers to monitor the soil on a regular basis from their farms and homes. These devices are having a huge impact on crop production costs as they are reducing the time and resources of farmers and facilities required for farming. Now farmers can monitor the soil regularly and irrigate the soil by the required amount of water. They also can access this information from their mobiles via wireless network and can check the soil's moisture content and also other parameters. The project aims in designing a system which is capable of monitoring of pH, humidity, soil temperature and light intensity alerts in case of emergency through SMS to predefined database.

4. Proposed System

In proposed system is focused on determining and monitoring the soil, for nutrient qualities and predicting the crop to be planted on the soil. By using the existing method, the soils pH rate, temperature, light intensity, humidity, and atmospheric temperature can be monitored using the wireless sensors. System monitor the parameters and provides a report for the land, where the information can be transmitted via wireless connection. It helps in reducing farmers workload, also can have alerts on soil resources. The proposed system includes a micro controller which uses sensors which generate the values of the parameters about the soil which can be seen as an output using a web app. The soil tests profoundly give results for parameters.

5. System Design

The problem we have considered is to analyze the soil parameters such as soil pH, temperature and moisture values using Raspberry Pi and to send result to application. Using Raspberry Pi, we intend to determine the parameters of soil using sensors. The processor Raspberry Pi is used to give better performance using programming language Python to take necessary action. The parameter is monitored by the kit (using pH sensor, temperature sensor and moisture sensor) and sends real-time data to the owner to take necessary actions. The block diagram describes the working of the project model in a simple manner.



A) types of sensor:

1. pH - A pH meter provides a value as to how acidic or alkaline a liquid is. The basic principle of the pH meter is to measure the concentration of hydrogen ions. Acids dissolve in water forming positively charged hydrogen ions (H⁺).

The greater this concentration of hydrogen ions, the stronger the acid is. Similarly, alkali or bases dissolve in water forming negatively charged hydrogen ions (OH⁻).

The stronger a base is the higher the concentration of negatively charged hydrogen ions there are. The amount of these hydrogen ions present solution is dissolved in some amount of water determines the pH. A pH value of 7 indicates a neutral solution. Pure water should have a pH value of 7. Now pH values less than 7 indicate an acidic solution while a pH value greater than 7 will indicate an alkaline solution.

2. humidity sensor- A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor, when looking for comfort. Very low power consumption. No extra components needed. The HH10D relative humidity sensor module is comprised with a capacitive type humidity sensor, a CMOS capacitor to frequency converter and an EEPROM used to hold the calibration factor.

3. temperature sensor- temperature Sensors measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to “sense” or detect any physical change to that temperature producing either an analogue or digital output. The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large, constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of $\pm\frac{1}{4}^{\circ}\text{C}$ at room temperature and

$\pm\frac{3}{4}^{\circ}\text{C}$ over a full -55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the water level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy.

B) Micro controller- The MCP3008 is a low cost 8-channel 10-bit analog to digital converter. The precision of this ADC is similar to that of an Arduino Uno, and with 8 channels you can read quite a few analog signals from the Pi. This chip is a great option if you just need to read simple analog signals, like from a temperature or light sensor. The MCP3008 connects to the Raspberry Pi using a SPI serial connection. You can use either the hardware SPI bus, or any four GPIO pins and software SPI to talk to the MCP3008. Software SPI is a little more flexible since it can work with any pins on the Pi, whereas hardware SPI is slightly faster but less flexible because it only works with specific pins.

c) Raspberry pi 2, model B- The ultra-low-cost, deck-of-cards sized Linux computer has had yet another makeover, The Raspberry Pi 2 Model B is on a completely new level to its predecessors by being a staggering 6x faster than the Raspberry Pi Model B. This second-generation Raspberry Pi has an upgraded Broadcom BCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. The board also features an increase in memory capacity to 1Gbyte.

6. Experimental Results

By placing the sensor kit into the agriculture land. The sensor will measure the Temperature, pH rate, Water level of that particular soil and sends the information about the abnormalities or low pH rate of the soil. By sensing the soil frequently and suggest the type pesticides to be used. This reduce the farmers workload because the farmer gets the intimation about the crop yields and soil. By implementing 7 reduce the human workload. The gathered information sends and stored in the cloud environment from there the data will be sending to the registered user to their devices.



Fig: Working device in the farm land

7. CONCLUSION

The remote monitoring of the soil pH rate, humidity and its temperature rate has been done with the very minimal cost. The values can be viewed by the farmer's anywhere in the world at any time. Hence this system gives more accurate pH rate, humidity rate and temperature rate of the soil which play vital role in the agriculture. The temperature sensor, Humidity sensor and soil moisture sensor can be interfaced to the microcontroller to access data through Thing speak cloud platform. Graphs are plotted for better analysis. The crop to be planted is suggested by comparing the obtained values of soil parameters with the actual values. A reliable and continuous vital sign monitoring system targeted towards each farmer's land has been

successfully built. The resulting system was also low in power and cost, non - invasive and provisional real time monitoring on the agriculture. It is also easy to use and provide accurate measurements. Soil's most important parameter for cultivation is its mineral content. Since there is no specific sensor for measuring the mineral content of the soil, we are considering only the parameters such as pH, humidity and soil temperature. The future scope of our project is developing a system which measures the mineral content of the soil along with other parameters for suggesting the crop to be planted.

REFERENCES

- [1]. Xiaojing, Z., Yuangua, L., Zigbee implementation in intelligent agriculture based on internet of things, College of Electronics Information and engineering, Qiongzhou University, China, 2012
- [2]. Agarwal, R. and Karahanna, E. Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage, MIS Quarterly, vol. 24, no. 4, pp. 665-694, 2000.
- [3]. Agriculture, livestock and fisheries: sector profile, <http://www.zda.org.zm/content/agriculture>
- [4]. S. R. Nandurkar, V. R. Thool, R. C. Thool, –Design and Development of Precision Agriculture System Using Wireless Sensor Network||, IEEE International Conference on Automation, Control, Energy and Systems (ACES), 2014..
- [5]. Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta- Gándara, –Automated Irrigation System Using a Wireless Sensor Network and GPRS Module||, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, 0018- 9456, 2013
- [6]. Dr. V. Vidya Devi, G. Meena Kumari, –Real-Time Automation and Monitoring System for Modernized Agriculture||, International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE) Vol3 No.1. PP 7-12, 2013.
- [7]. Y. Kim, R. Evans and W. Iversen, –Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network||, IEEE Transactions on Instrumentation and Measurement, pp. 1379–1387, 2008..