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IOT Based Soil Tester

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ABSTRACT

Indian economy is mainly based on agriculture, still we are not able to make most favourable, commercial and sustainable use of our land resources. The main reason is the lack of knowledge regarding the soil analysis for the growth of crops. Agriculture is based on two important aspects *i.e.* weather and soil, as weather cannot be controlled, quality of soil can be analysed by soil testing. In every state, around 9 to 10 lakh soil samples have been received in labs and it is very difficult to test all the soil samples at a time by the labs. It takes more time to generate test reports. Hence there is need of soil analysis to be made available to the farmer. According to agriculture university survey, problem like infertility of soil increasing day by day because of excess use of chemical fertilizers. Farmers have inadequate knowledge of quality fertilizers to be used for soil.

Keywords: Soil, IOT, Analysis, Farmer.

I. INTRODUCTION

Agriculture is the most important sector of Indian Economy. Indian agriculture contributes 18 per cent of India's gross domestic product (GDP) and provides employment to 50% of the countries employment. India is an agriculture based country, where more than 50% of population is depend on agriculture. This structures the main source of income. In agriculture, soil monitoring and analysis commonly refers to the analysis and verification of a soil sample to determine nutrient content, composition, yield and other characteristics such as pH level, nitrogen and moisture. Soil analysis is an essential process which is needed for efficient crop growth. 26% of the Earth's surface is exposed as land. Soil analysis and testing is often performed by commercial labs that offer a variety of tests, targeting groups of compounds and minerals. The advantages associated with local lab is, they are familiar with the chemistry of the soil in the area where the sample was taken. This enables experts to recommend the tests that are most likely to reveal useful information. Soil testing is used to facilitate fertilizer composition and dosage selection for land employed in agricultural sectors. Lab tests are more accurate, In addition, lab tests frequently include professional interpretation of results and recommendations which are used for proper cultivation of crops. Crop production and cultivation requires adequate use of fertilizers and nutrients. Soil testing enables us to find proper contents of soil due to which we get information regarding how much fertilizers are needed for that specific soil, but the problem is soil test results takes couple of days sometimes even weeks to arrive back from the lab, soil testing labs are generally situated in cities, farmers from rural areas find it difficult to visit these labs as they are situated far away. A portable system is required to test the soil in rural areas which will be available at gram panchayat level. It will be easy to access to the farmer in deep rural areas. Lab reports reveal that the infertility of soil is increasing day by day because of excess use of chemical fertilizers. Development of agriculture using latest technology

will be very much useful in cultivation of crops. For a new agricultural area, without knowing or monitoring the important parameters of the soil, cultivation will be difficult and so the farmers might suffer financial losses.

II. METHODS AND MATERIAL

A. Overview of the system:

To develop a system for farmers which can test various soil parameters and according to that farmers can maintain their farm.

B. IOT In agriculture:

The agricultural sector relies on innovative ideas and technological development to help increase yield and better allocation of resources. In earlier days innovation such as tractors and irrigation had a positive impact on farming architecture . Today, a driving force behind increased agricultural production at a lower cost is the Internet of Things which leaves the door wide open for engineers looking to bring a smart farming solution. The objective of IOT in agriculture is:

- Monitoring for soil moisture and nutrients.
- Reducing overuse of fertilizers.
- Fast and accurate results.
- Farmers can no longer depend on soil testing labs for getting results.
- Make room for smart farming.
- Efficiency in crop growth.

C. Proposed System:

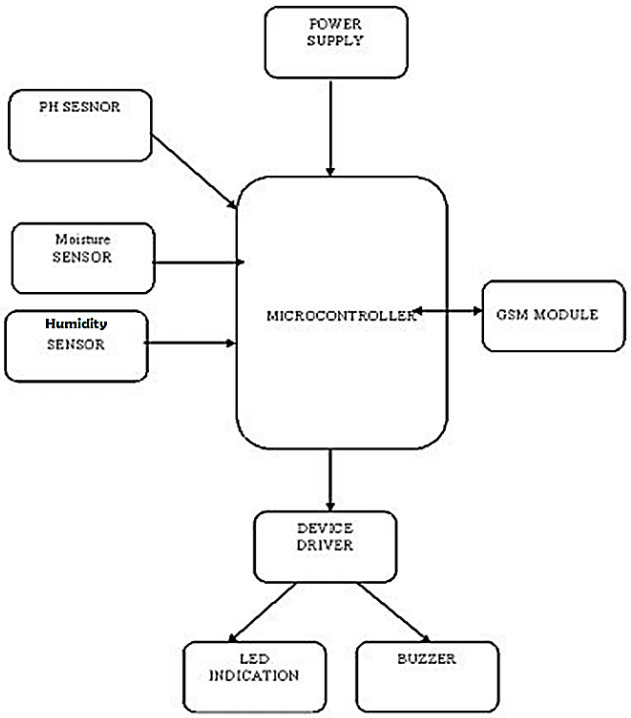


Figure 1

III. HARDWARE REQUIREMENTS

A. Ph Electrode:

The idea of this project is to interface common inexpensive pH probe that are very common these days to measure pH value. HR202 is basically an advanced humidity detector resistor which is made from organic materials, it can be used in various commercial applications like, hospitals, storage, workshop, textile industry, pharmaceutical field and meteorology.

Specification:

- Sealed, gel-filled epoxy body
- Response Time: 90% of final reading in 1 second.
- Temperature Range: 5 to 80 degree Celsius.
- pH range: 0 to 14
- Resolution: 13 bit sensor DAQ

B. Moisture Sensor

Soil moisture module is most effective way to measure the moisture contents of soil, when the soil humidity exceeds a set threshold value, the module D0 output low. The digital signal output D0 can be directly coupled with the microcontroller To detect or verify high and low control signal by the microcontroller. This in turn detects the moisture contents of the soil. The digital outputs DO signal module can directly activate the buzzer module, which can form soil moisture alarm equipment. AD and AO of analog output module is directly coupled with AD converter to get accurate and précised values of soil moisture contents.

Specification

- Battery Life: 3 years
- Moisture : 0-100%
- Temperature Range: -40 to 85 degree Celsius.
- Battery Type: CR2450 X1

C. GSM MODULE

GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface. The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having inbuilt TCP/IP stack to enable us to connect with internet via GPRS. It is beneficial for services such as SMS, Voice as well as DATA transfer application. The internal Regulated Power supply allows you to connect wide range unregulated power supply. With the help of this modem, you can read text messages, use data via internet, accept and attend the incoming and outgoing calls through basic AT protocols.

Specification:

- Sealed, gel-filled epoxy body
- Response Time: 90% of final reading in 1 second.
- Temperature Range: 5 to 80 degree Celsius.
- pH range: 0 to 14
- Resolution: 13 bit sensor DAQ

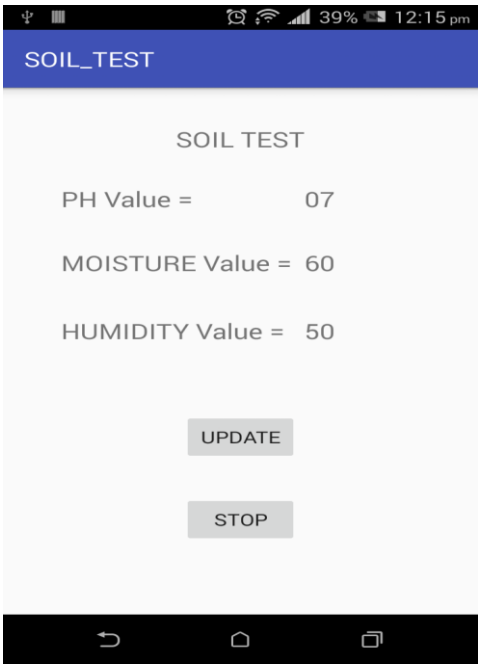
D. Microcontroller:

The sensors which we are using are interfaced with PIC18F452. Electrodes are interfaced with I2C protocol. LCD is used to denote measured output. This controller has master controller synchronous module.

Specification:

- Flash memory of 512kb
- Allows execution of RAM
- 8/16/32 bit timers
- USB, Ethernet, CAN interfacing support
- General purpose input output pins
- External memory interface

IV. RESULTS AND CONCLUSION



Results are compared with soil testing lab, following table shows that results which are tested in labs and results recorded from pH electrode and moisture sensor.

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