

Case Study on Agriculture Soil Testing Using Wireless Sensor Networks

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Abstract- In country like India majority of work is mainly based on agriculture, still farmers are not able to use the resources available for yielding the right crops at right time. The one of the reason behind this is the lack of study regarding the crop and soil analysis for the growth of crops. By the time soil test reports are generated, crops are yielded and harvesting is the average of completion hence there is need for soil analysis to be made available to the former.

Farming can be done using various new technologies to yield crops and their more production. In this paper i am going to check Rain sensing, temperature, moisture and humidity. This study is all about study of soil features and an automated control features with latest electronic technology using arduino and transducer. The case study works automatically and hence reduces man power.

The main objective of my work is to develop a testing system which can be used for soil analysis, which intern helps the formers to cultivate and produce the proper crop. The wireless communication system has been in cooperated to interact with the experts.

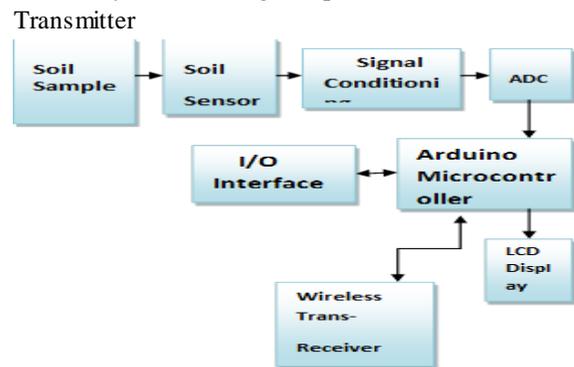
Index Terms- Arduino Uno, DHT11 sensor, Max232, soil moisture sensor, Zigbee LM35

1. INTRODUCTION

Automated soil testing is a device which can be used to measure moisture, humidity, temperature and pH values to ensure the fertility of soil in the field of agriculture to select the suitable crop and also the type of fertilizer to be used. Agriculture soil sample are sensed by various sensor and the output of sensor is processed by signal conditioning circuit. The microcontroller is used to transmit the sensed data over a wireless channel and sensed values displayed on LCD and transmits the data to a remote location or designated authority in the agriculture department for further analysis and suggestions.

The device or setup used in Automated Agriculture soil testing is a small and portable, which can be used either in labs or on the identified spot on the field selected for yielding the crops. With this setup farmer now can test the nutrient contents of soil at regular basis and he now need not depends on others for checking the soil properties. Automated soil testing device is a simple and user friendly device so that any person can test the soil without the presence of an operator, it is an economical device and thus a common man can easily afford it.

However, awareness about implementing various techniques in agriculture for improving the yielding techniques and harvesting methods. Earlier these data collection are done Manually data collected can be sporadic, not continuous and produce variations from incorrect measurement taking. This manual method of study can be difficult and to control environmental important factors. So this manual study should be replaced with automated testing by implementing a wireless sensor nodes, each node now will sense the change in physical enviornment and report to the user when ever required and user can collect the data and study those collected data and make a decision accordingly. This automated testing of soil can be studied by the following setup as shown



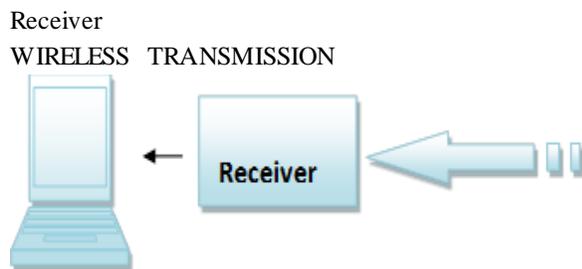


Figure 1. Schematic Of Arduino Based System For Automated Soil Testing

2. PROBLEM STATEMENT

Large tracts of fertile land suffer from soil erosion by wind and water (SOIL EROSION). Lack of technology leads to improper usage of manures, fertilizers and biocides which directly effects yielding and also effects agriculture marketing.

3. LITERATURE SURVEY

This paper summarizes the overall scope of agriculture as well research and development taken place in agriculture expert system. An overview is also presented on the research endeavors to apply on field sensor development, wireless sensor network (WSN), remote sensing application and internet technology for agriculture expert system.

[1]. This paper emphasizes on the low cost data acquisition, supervisory control and data logging aspect of a greenhouse process. The agriculture areas are of prime importance for computer control process. The green house process parameters which are under consideration here whose process data temperature, humidity, soil Moisture and light intensity should be acquired from the field, logged in a database and the data is further used for supervisory control. The GUI is made in virtual instrumentation domain Lab View. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment^[1].

[2] The paper proposes the use of data mining techniques to provide recommendations to farmers for crops, crop rotation and identification of appropriate fertilizer. The results from the recommendation system are optimized with respect

to parameter consideration. In future work we will be focusing to go in more micro level of parameter consideration for recommendation which will result in increase in efficiency of the system for e.g. consideration of micronutrients in fertilizer recommendation etc. Also we have planned to turn this web application into portal where all information about agriculture will be available in one single place^[2].

[3]. In this paper, Agriculture refers to the production of food and goods through farming. In India has a very long history dating back to ten thousand years. Presently, about two-third of the Indian population depends directly on agriculture for its livelihood. Agriculture productivity mainly depends on quality of soil which is dependent on the plentiful factors like soil texture, soil water holding capacity, soil pH value, soil conductivity and soil mineral contents. Soil pH, Fertilizer and conductivity give a lot of information about the physical and chemical properties of soil. In this work, a microcontroller based system is developed to measure these three properties of soil (soil pH and Fertilizer and Conductivity/ Salinity) which in turn effect the plant's growth. The signals from the sensors are conditioned with the help signal conditioning cards and interfaced to microcontroller through inbuilt ADC. Digital readout is used to display the computed results in LCD^[3].

[4]. Although various on-the-go soil sensors are under development, only electrical and electromagnetic sensors have been widely used in precision agriculture. Producers prefer sensors that provide direct inputs for existing prescription algorithms. Instead, commercially available sensors provide measurements, such as electrical resistivity/conductivity that cannot be used directly since the absolute value depends on a number of physical and chemical soil properties, such as texture, organic matter, salinity, moisture content, etc^[4].

4. HARDWARE USED

- Soil sensor:
Sensors are hardware devices that produce a measurable response to a change in a physical condition like temperature, pressure, humidity and pH.
- Microcontroller:

Arduino Uno is a microcontroller board based on the ATmega328(datasheet). It has 14 digital input/output pins, 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header and reset button.

- ADC:

Microcontroller requires input in digital form for this Purpose analog to digital converter is used to convert the output of signal conditioning, which is in analog to digital signal.

- LCD:

A Liquid Crystal Display is a low cost, low power device capable of displaying text. The LCD controller receives control words from the microcontroller; it decodes the control words and performs the corresponding actions on LCD. Once the initialization sequence is done, it displays the soil parameters.

- Timer:

A timer is a specialized type of clock for measuring time intervals.

- Relay:

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low power signal, or where several circuits must be controlled by one signal.

- Zigbee transducer:

Zigbee is a wireless networking standard that is aimed at remote control and sensor applications. It operates in industrial, scientific and agricultural radio bands- 2.4GHz in worldwide.

5. WORKING PRINCIPLE

Whenever farmer wants to analyze the soil fertility, he leads to take the soil sample of about 150 gm and 60 ml of water should be added to the soil sample and allow the sample to settle down the sensor will be placed in the sample. Here copper electrodes are used as sensor which measure the ionic particles present in the soil and converts it into electrical signal. the electrical signal is amplified using signal conditioning and this amplified signal is send to microcontroller in the form of digital signal from ADC the microcontroller place a key role in processing data received from sensor, where it compare the data already pre-stored with the sensor output signal. The microcontroller after comparison

gives the output and the values are displayed on the LCD display. The output not only provides the information on fertility present in the soil but also suggest crops to be grown on that soil. The wireless trans-receiver transmits the data to a remote location or designated authority in the agriculture department for further analysis and suggestions. This is as shown in fig 2

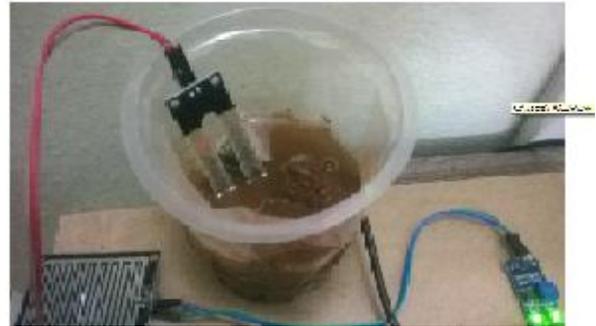


Fig 2. Sample of soil under test

6. POSSIBLE OUTCOME

- Grouping of soil into classes relative to the nutrient level.
- Predicting the probability of getting a profitable response to fertilizers.
- To provide the basis for fertilizer recommendation.

This is as shown in fig 3 and fig 4

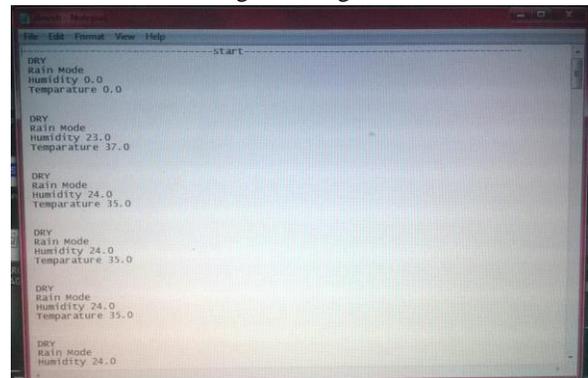


Fig 3: Possible outcome of sensor data



Fig 4 :- LCD display at Transmitter side

7. FUTURE SCOPE

- Flood control
- Water usage audit of house hold, industrial sector and agriculture.
- Drying
- Weighing and sieving
- Best irrigation facility

8. CONCLUSION

“Case Study on Agriculture Soil Testing Using Wireless Sensor Networks” has been developed for soil testing of agricultural farm. The moisture content, humidity, temperature and pH values vary from one type of soil to others .the parameters of the soil are compared with pre-stored values received from agricultural department .the system also provides the information about the crops that can be grown in respective soils. Wireless communication system has been incorporated for interacting with the experts.

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