Real Time soil fertility analyzer and crop prediction

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Abstract - *With evolution in technology various agricultural practices have shifted from traditional techniques to automated techniques like field irrigation system. Many such agricultural parameters are being monitored remotely to improve quality of farming. One of the most important parameter in farming is soil fertility i.e. ratio in which various nutrient essential for crop is present in soil. To monitor soil fertility, pH of the soil is most commonly measured. It is also one of the most useful and informative soil parameters because of its relationship to many aspects of soil fertility and plant growth. Despite its importance, the implications of inadequate soil pH on forage response, particularly nutrient use efficiency, are often overlooked. In the proposed system we determine the average percentage of basic soil nutrients Nitrogen, Phosphorous and Potassium and determine the suitable crops for the particular soil type. The system will analyze soil nutrient content at real time and make crop prediction. System will be built on Arduino. System will also suggest the crops on basis determined PH of soil.*

***Key Words*: PH, Real time detection, Soil fertility, PH meter, Crop prediction system.**

1. INTRODUCTION

In India Conventional farming practice involves human labors for performing all types of farming activities like watering fields, cultivating crops with required fertilizers etc. Soil analysis is a valuable tool for farmers; it determines the inputs required for efficient and economical production. A proper soil test will help to ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil. It will also allow you to determine lime requirements and can be used to diagnose problem areas. Sampling technique is correct; as the results are only as good as the sample you take. Soil testing is also a requirement for farms that must complete a nutrient management plan. Major nutrients: Nitrogen (N), Phosphorus (P) and Potassium (K) Soil pH is the most commonly measured soil properties. It is also one of the most useful and informative soil parameters because of its relationship to many aspects of soil fertility and plant growth. Despite its importance, the implications of inadequate soil pH on forage response, particularly nutrient use efficiency, are often overlooked.

In Automated farming practice we intend to reduce human errors by monitoring the soil quality using various soil sensor via smartphones and webserver. The key feature of our system is to determine suitable crops for current state of soil. By calculating nutrient content in soil.

2. LITERATURE REVIEW

Paper1: S.Sivachandran, K.Balakrishnan, K.Navin [1]

In this paper Embedded Based Soil Analyzer is used to analyze various soil nutrients with the help of pH value. As per the availability of nutrients, recommendations of cultivating the particular crop will be given. This project uses microcontroller which determines PH of diluted soil sample using Glass ph electrode. PH is defined as the negative logarithm (base 10) of the activity of hydronium ions (H+or, more precisely, H3O+aq) in a solution. It ranges from 0 to 14, with 7 being neutral. A pH below 7 is acidic and above 7 is basic. The optimum pH range for most plants is between 5.5 and 7.0. The system includes Microcontroller Unit, Signal conditioning, Sensors, Display, Thermal Printer and Power supply. Output from pH sensors and EC sensor are analog in nature to process these analog signals to the system A/D converters are used. PIC18F458 Microcontroller has the inbuilt analog to digital converter and no need to connect the external A/D converter for the system. In this system, keypad is used to connect the user and the system.

Paper 2: Apurva C. Pusatkar, Vijay S. Gulhane [2]

In this paper, the advanced development in wireless sensor networks was used in monitoring various parameters in agriculture. In this context, due to the advancements in small-scale sensor devices with wireless technologies, one is able to remotely monitor humidity, temperature and moisture. In this paper it was proposed to implement a wireless sensor network connected with centralized basic node using ZigBee, which was connected to a Central Monitoring Station (CMS) through Global System for Mobile (GSM) technologies or General Packet Radio Service (GPRS). The system acquires Global Positioning System (GPS) parameters related to the field then transfers them to a central monitoring station. This system was presumed to evaluate soil conditions and act accordingly in order to help farmers. This system implies

monitoring various factors such as humidity, soil moisture and provide remote monitoring using ZigBee which sends data wirelessly to a central server which collects data store it and allow it to be displayed as needed and also be sent to the client mobile.

3. SYSTEM ANALYSIS

A. Problem Definition

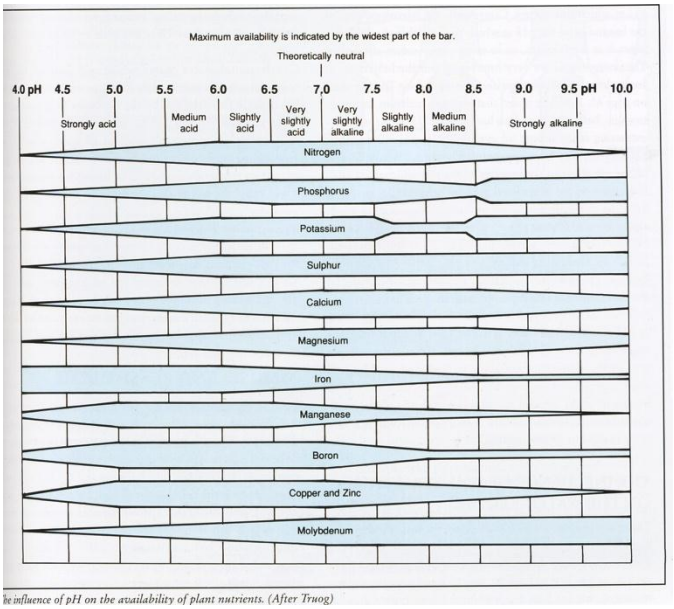
Soil fertility changes with every harvest and changing weather condition and also affects the nutrient content of soil. Also fertility of soil varies at different part of field and it requires to be monitored for healthy crop production. To determine soil fertility PH of soil is determined using PH electrodes, PH electrodes sense the soil alkalinity and electrical conductivity. On basis of this sensed parameter we determine the approximate percentage of basic NPK (Nitrogen, Phosphorous, Potassium) nutrient contents present in soil. Multiple observations will be taken from various parts of land. The average of all the observation taken from multiple part of land will give the soils state of fertility. On basis of calculated fertility, system will determine the suitable crops for the tested land and also farmer will get an idea of what fertilizer is required.

B. Scope

Proposed system will determine the fertility of soil by measuring basic parameter effecting soil fertility like PH and electrical conductivity. This will help the farmer in deciding, what crop to bow in the soil, based on the measured nutrient contents present in soil at current state. It will also help in determining what fertilizer to use for the crop. And amount of fertilizer required. Throughout the cultivation process of crop, farmer can test soil fertility n no. of times and take necessary steps to get a good yield. Farmer can maintain the record of his land fertility over the span of time and can access it remotely from anywhere using a mobile device.

C. Proposed System

The objective of proposed system is to replace the traditional farming technique of testing soil fertility by the automated remotely monitored fertility monitoring technique. In this system the farmer gets current status of soil fertility in his land at real time. The soil quality is determined by using the sensors to calculate the soil nutrient contents i.e. nitrogen, phosphorus and potassium (NPK). The farmer tests multiple sample of soil in his land using a portable device. Result of each test is averaged to determine the approximate fertility of total land. Result of all the tests will be displayed on dsplay screen. The farmer phisically enters the diplayed value in his mobile application to get a digitally generated soil fertility e-report. A digital report generated on the basis of all the tests, which will include the averaged result of all the tests, reflecting the ratio in which various nutrients i.e. Nitrogen, Phosphorous, Potassium are present in the soil. And will also contain the list of suitable crop and the required fertilizer for the land.



he influence of pH on the availability of plant nutrients. (After Truog)

Fig -1: Chart representing nutrient content in soil for various PH readings

D. Soil Quality Analyzer And Crop Prediction System Working:

Arduino board along with analog to digital convertor is used to process analog reading PH metal electrode. Arduino UNO R3, power requirement is 9v [4], which will be powered using 9-volt adapter. The Ph electrode and EC sensor will be connected to Arduino digital GPIO pins. Both sensor work in range of 3.3v – 5v power supply. Analog-Digital converter is used to convert anolog data captured from PH electrode to digital value.

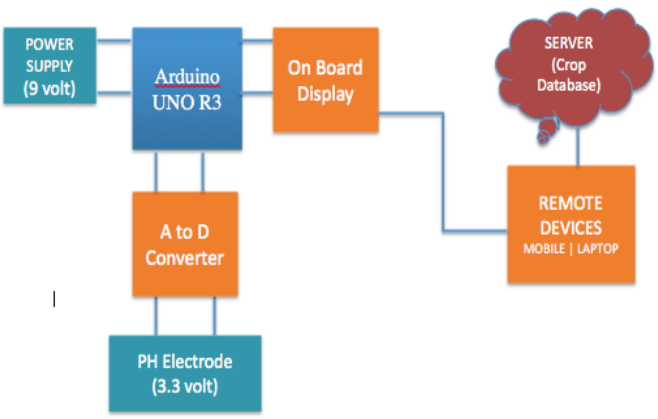


Fig -2: Block diagram of Soil Quality Analyzer And Crop Prediction System

Ph electrode used to measure the Ph value is a solid metal electrode which works on principal of, current flowing between two semiconductor electrodes (drain and source) which is controlled by the electrostatic field generated by the protonated third electrode (gate), which is placed between drain and source. Ion Selective Field Effect Transistors [7] are used measure current flow.

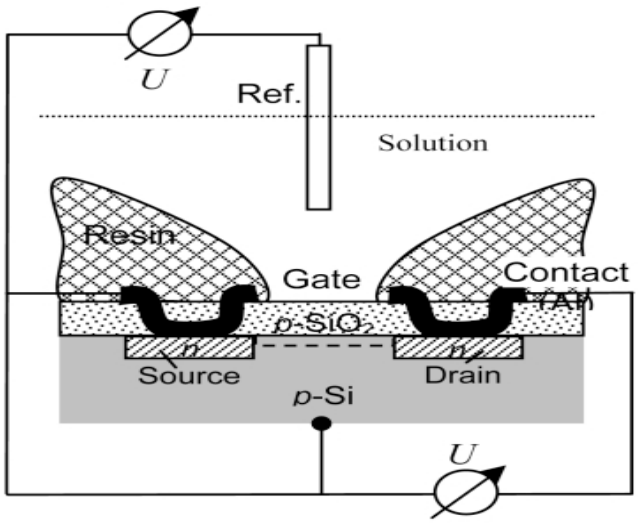


Fig -3: Working of PH metal electrode

Electrical conductivity is measured using an EC sensor. The sensor consists of two metal electrodes and a constant voltage is applied across the electrodes resulting in an electrical current flowing through the sample. Since the current flowing through the soil is proportional to the concentration of ions in the soil. The higher the ion concentration, more conductive the sample will be and hence the higher the conductivity reading. The unit of measurement for Electrical Conductivity is microSiemens per centimeter (µS/cm)[6]. 1000 microsiemans is equal to 1 millisieman (1MS/cm). Arduino UNO R3 will process the data sensed by the sensor and convert it into user understandable reading. This processed data will calculate the fertility of soil. The farmer can view digital report generated basis on test reading on his mobile devices and will also be able to view the list of all suitable crops for his land.

4. CONCLUSIONS

In this project, a method for determining soil fertility by considering Ph and electrical conductivity parameter is presented. Ph is measured using Ph meter and electrical conductivity is measured using EC sensor. The reading of Ph meter gives the approximate ratio of various nutrient content present in soil and in what proportion. This approximation of soil nutrient will determine the suitable crop for the land. The advantage of this project is it skips lab-testing process and determines soil fertility in real time. The proposed model for testing soil fertility is cheap and easy to use and maintain.

REFERENCES

[1] Real Time Embedded Based Soil Analyzer. International Research Journal of Engineering and Technology (IRJET). Volume: 3 Issue 3 | March 2014
[2] Implementation of Wireless Sensor Network for Real Time Monitoring of Agriculture. International research journal of engineering and technology (IRJET). Volume: 03 issue: 05 | may-2016
[3] Automated Soil Testing Device. ITSI Transactions on Electrical and Electronics Engineering (ITSI-TEEE). 2320 – 8945, Volume: 1 Issue -5 | 2013
[4] https://www.arduino.cc/en/Main/ArduinoBoardUno
[5] https://en.wikipedia.org/wiki/ESP8266
[6] https://www.agriculturesolutions.com/resources/92-the-why-and-how-to-testing-the-electrical-conductivity-of-soils
[7]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3291948/
[8]https://www.teachengineering.org/activities/view/nyu_probe_activity1
[9] http://soilquality.org