

IoT Based Soil Health Monitoring and Recommendation System

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Abstract— In India economy is mainly based on agriculture still we are not make it profitable and make sustainable use of our land resources. Main reason is lack of knowledge regarding soil. There are many types of soil and each soil has different characteristics .so it is important to test soil characteristics. There are many tools available for soil analysis but in some times these tools doesn't work and farmer need to take tension of visiting laboratory for soil analysis but it's very difficult to test different types of soil type in time from laboratory also tools which are in existing form are not in a common language. The main point of our work is to develop a soil based fertilizer recommendation system which can be made available to the farmer which helps to the farmer to produce proper crop. And tool will be in easy language so farmer can easily understand.

Keywords: IoT, Soil Health

I. INTRODUCTION

India is a land of versatile soils. In India economy is mainly based on agriculture and agricultural productivity is depends upon soil type. But the major problem pertaining to the Indian farmers is lack of sufficient knowledge about their soil. Each soil type has different characteristics i.e. there are various nutrients present in the soil. Deficiency of the nutrients to decrease in productivity. So, there is need of soil analysis. The alarming situation of farmer's suicide and the silent on the same; to lead the idea to put the efforts in the design and development of a sophisticated soil testing and fertilizer recommendation system. Our system will be used for soil analysis in order to increase crop yield. Soil analysis is done through the sensors. Based on soil analysis report fertilizer will be recommended to the user. Fertilizer will be recommended using nutrient status table stored in the database. By comparing Val- use of nutrients with table classification will be done. And accordingly fertilizer will be recommended to the user. Our system will help farm financial status of farmers. Our system also trying to fulfill the vision of our honourable prime minister that every farmer should have soil health reporters for better crop yield which in turn maximizes profit. This increase the financial status of farmers. Our system also trying to fulfill the vision of our honourable prime minister that every farmer should have soil health report.

II. LITERATURE REVIEW:

The two sensors are used efficiently those are temperature and moisture sensor. Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. This soil moisture sensore can be used to detect the moisture of soil or judge id there is water around the sensor, let the planets in your garden reach out for human help. Insert this module into the soil and them adjust the on-board potentiometer to adjust the sensitivity. The sensor

would output logic HIGH/LOW when the moisture is higher/lower than the threshold set by the potentiometer. Soil analyze is used to analyze various soil nutrients with the help of ph value, Ph sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. when the ph value dips below seven, the water starts to become more acidic, any number above seven equates to more alkaline .each type of ph sensor works differently to measure the quality of the water. This project presents the work on the development of a smart agriculture system using sensors. The crop water requirement and temperature, humidity values are measured by using the sensors. The irrigation system completely automated also provides real-time information about the lands and crops. The average value of temperature and humidity of the surrounding and the soil moisture measured is sent to the arduino. All observations and experimental tests proves that proposed is a complete solution to field activities, irrigation problems.

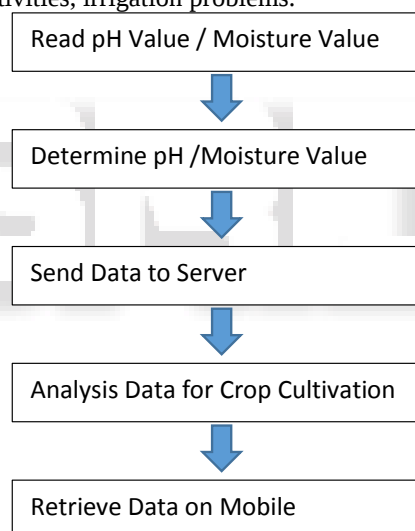


Fig. 1: System Data Flowchart

III. PROBLEM DEFINITION

Soil fertility changes with every harvest and changing weathercondition and also effects 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 basic 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 states of fertility. On basic of calculated fertility, system will determine the suitable crops for the tested land also farmer will get an idea of what fertilizer is required.

IV. HARDWARE IMPLEMENTATION

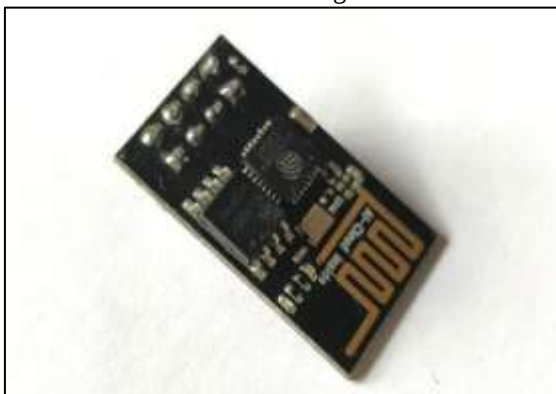
A. Atmega328 Microcontroller:

The most popular microcontroller produced by Atmel is known as Atmega328. It is quite well known as microcontroller that is compatible with Arduino Duemilanove board. It is a 8 bit microcontroller that has 32k flash memory, 1k of EEPROM with internal 2k SRAM. The Arduino board comes with two options either Atmega168 or the Atmega328. But the more updated and advanced is Atmega328 chip with 16k of flash 16k of flash program memory and 512 bytes of internal SRAM. It consists of total 28 pins. It contains 14 digital input output pins, of which 6 can be used as analog input pins and remaining 6 can be used as PWM outputs.



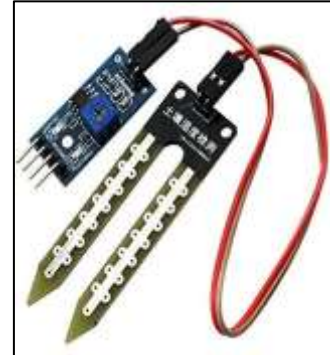
B. ESP8266 Wi-Fi Module:

The company named Espressif System, a semiconductor company operating from China has produced ESP8266 Chips. Basically it is the series or family of Wi-Fi Chips. It also includes the presently Wi-Fi series like ESP8266EX and ESP8285 chips. ESP8266 is small package which includes 32-bit Tensilica microcontroller, standard digital peripheral interfaces, antenna switches, power amplifier and filter and power management modules. It provides 2.4 GHz Wi-Fi capabilities and also supported to (WPA/WPA2), inter-integrated Circuit, analog to digital conversion. It has 64kb boot Ram and instruction Ram along with 96kb of Data Ram.



C. Soil moisture sensor:

The water content in soil is mainly measured by the Moisture Sector. The soil moisture sensor that has been used in system is having two probes which can be inserted into the soil. The Output coming from Moisture sensor is in the analog form which is converted into digital form. Percentage of water level in soil will determine us the final output. It is used in various many fields like irrigation and agriculture systems.



D. Ph Sensor:

PH is mainly used for water measurements, to measure the water whether it is acidic or alkaline, or caustic or base present. An Electrochemical PH sensor is most common method to detect the pH value of water. Combination PH sensors include both measuring electrodes and reference electrodes.



V. WORKING

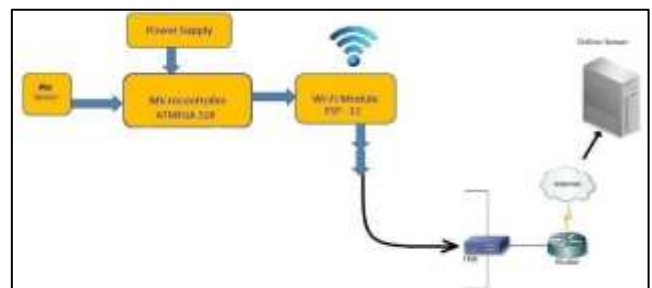


Fig. 2: system remote control

A. Sampling:

First we have to take soil sample which has been taken in such a way that it must represent area being sampled. But our System Required only Moist Soil. We get moist soil by adding water in it, because the sensor which is attached to our System can sense only wet Soil. When our Sampled Soil is ready for testing we will begin the further process.

B. Sensing Units:

Sensing Units in our Proposed System contains various agricultural Sensor to determine PH value, Moisture value of Soil Sample. PH sensor will sense the PH value of soil. It will absorb the liquid solution and gives us the voltage value. It is completely Analog Device and did required power supply to function. Output from PH sensor will further goes to our Microcontroller, which acts as processor of this System. On other hand Moisture Sensor measures the volumetric contain in soil. Data from Moisture sensor will also goes to processor.

C. Processing:

In our System, Microcontroller Atmega328 performs the most vital role, brain of the system. It is responsible for controlling the sensing and communication blocks of device and determine soil parameters such as PH, Moisture. Total Atmega328 Microcontroller has 28 pins and some pins are connected to LCD screen. To Display the result LCD screen is used that is attached to our hardware system. To display the result LCD has 2 register, Command and Data. When the command register is selected then it will treat it as Command and if the Data register then it will consider as data.

Remaining pins are data pins. In our system we are using 4-bit mode. Then this data will store to by wifi module. Here we have used ESP8266 Wi-Fi Module. So basically Wi-Fi Module receives the value and create get request, that get request is sent to the server and data goes directly to the server. Further processing is done in server and it goes to the database for recommendation purpose. By using internet the scanned data from sensor will retrieve in our mobile application which we have developed on software called android studios. It is very user friendly and efficient. Our proposed system already consist pre-defined data of crops and fertilizers from legitimate government sources. By calculating and processing with this data, our system will give you the prediction for fertilizer and crop recommendation.

VI. CONCLUSION

In this world each and every sector is undergoing a dramatic change due to IT field. But, in agriculture field, till date not much work has been done. We have proposed a model for advanced farming using multiple techniques: IOT Cloud-Computing and Data Mining through this model farmer will able to get details regarding required fertilizers from his soil sample. This is used to improved crop production with reduction in cost of fertilizer and thus improves the agriculture sector in India. Data is collected in the database regarding crop details and soil conditions which provides total fertilizer requirements. 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 sector. The reading of Ph meter gives the approximate ratio of various nutrient content present in soil in what proportion. The 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.

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