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# STUDY OF SOIL MONITORING

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**Abstract-** Soil sensors can be used to measure the soil temperature, humidity and soil water content in different positions. The soil humidity, representing soil moisture content expressed as relative value, can be computed by the quantity of water per unit mass of the dry solid soil. The soil water content is expressed as the quantity of water per unit mass of the whole wet solid soil. Remote monitoring of soil parameters is an emerging trend which has the potential to transform agricultural practices and increase productivity. pH value, temperature and moisture content of soil are the basic parameters which help in characterizing the soil and therefore in taking proper decisions regarding fertilizer application and choice of crops sown. In this work, antimony electrode is used for pH measurement. For soil moisture content estimation, the inverse relation between soil resistance and soil moisture has been utilized and corresponding circuitry has been developed. The determination of soil temperature is done using the DS18B20 sensor working on the Dallas one wire protocol. The system is integrated with Bluetooth for the transfer of data to a nearby cell phone. The entire system is developed on STM32 Nucleo platform. The main function of a data logger is an endless loop while the data measured and stored at scanning interval is saved in the data tables. The interval could be modified to change data collection frequency. The sensing and automatic monitoring technologies in completely unknown environments have been explored and achieved great success, such as the environmental adapt ability of robotic control systems.

**Key Words:** Soil sensors, soil humidity, soil temperature, STM32 Nucleo platform

## 1. INTRODUCTION

In a country like India, agriculture is the most prominent sector where the country's major income depends on these fields. About 60% of the land in the country is used for the agriculture and more than 50% of population depends on agriculture. Agricultural Automation especially in developing countries can help on effective yield and reduce human intervention. Now-a-days Internet of Things (IOT) was being used in various sectors. India being an agricultural country it needs some innovations in the field of agriculture. For Remote Monitoring of the soil properties we need an IOT based system. Internet of things sometimes referred to as the Internet Of Everything(IOE) which consists of all the web enabled devices that collect, send and act on data they acquire from their surrounding environments with embedded sensors, processors and communication hardware. Various sensors are embedded in the farm to know the soil information. Basically the soil parameters are Soil pH, soil Moisture, Temperature and Humidity. These basic parameters of the soil will help in characterizing the soil and therefore in taking proper decisions. Machine Learning is an emerging technology which is a subfield of computer science and Artificial Intelligence that focuses on the design of systems that can learn from and make decisions and predictions based on the data. Based on the Machine Learning algorithms the crop has been predicted which gives the better yield. This paper is an attempt to study the various Machine Learning as well as IOT techniques applied to the agriculture sector to predict soil moisture, soil PH, and other factors affecting agriculture.

### 1.1 Problem Statement

Over the past few decades, soil monitoring has become increasingly important. Environmental factors such as climate change, dwindling water resources, and threatened habitats are driving the need to monitor the environment and implement better policies to protect it. Many natural processes in the environment are driven by or in some ways related to soil hydrological processes. Monitoring soil moisture conditions provides important information for the protection of, and in the understanding of local and regional water resources.

### 1.2 Objective Of Research

I. To monitor soil moisture, temperature and humidity of surrounding as well as PH of soil.

II. To study and identify above parameters.

III. Attempt to evaluate and formulate probable methods to improve the fertility.

## 2. LITERATURE REVIEW

**1. Baihaqi Siregar, AB Azmi Nasution, Lukman Adlin, (June 14,2018)**The input of the system are the data taken from sensors grown in soil by the soil moisture sensor which then the data will be sent to Wasp mote, after which the data will be stored on the micro-sd card, and the data will be sent to in the monitoring application system with the help of 3G board. The process of collecting and transmitting data starts from the ground-implanted sensors detecting the frequency of soil moisture; then the data will be obtained by Waspmote's main board via digital pin 3. On the Waspmote main board, the system uploads a program that serves to store data into micro-sd. The soil moisture data stored inside the micro-sd can be seen by the user by removing the

micro-sd from the Waspmote board first, then to see the data contained in the micro-sd. Then the system also upload a program that serves to send data from Waspmote board to internet. The data obtained was sent to the monitoring application system via the 3G board, and then from this 3G board the data was sent to the nearest base transceiver station (BTS) to connect to the internet and from internet communication data is sent to the database server (mysql) using POST method. Data sent from Waspmote board is not only the soil moisture data, but also data from room temperature, ground temperature, and battery capacity. However, in this study we focused on analysis and data processing only on soil moisture alone.

**2. Rabelo, S. L, Jucá, S. C. S, Gonçalves , D. L.(Augest 31,2018)** This article describes a project developed using principles of Project Based Learning (PBL) and aims to use an embedded system for soil monitoring, thus measuring soil moisture and implementing automatic irrigation, as well as, the temperature and humidity of the environment. The configuration data for irrigation time control and the lower and upper limits of soil moisture percentage can be adjusted through a PHP page, where also the monitoring of the variation of soil moisture through a graph can be done in real time. The proposed project is divided into two steps using PBL. Phase one focuses on developing a circuit with sensors capable of doing measurement of ambient parameters and soil moisture, and phase two, on developing an irrigation system to control soil moisture, both using Internet of Things (IoT) concepts.

**3. G.sushanth and s.sujitha(April 4,2019)** The presented the work on the development of a smart agriculture system using sensors, microcontroller within an IOT system. The aim of the implementation is to demonstrate the smart and intelligent capabilities of the microcontroller to allow the decisions to be taken on watering the plants based on the continuous monitoring of the environmental conditions in the field. It also aims at a predefined irrigation schedule as per the farmers convenience, uploaded into the application developed for the same. The implementation is a photovoltaic powered automated irrigation system that consists of a distributed wireless network of soil moisture and temperature sensors deployed in plant root zones. These sensors continuously monitor the parameters and send it to the Arduino board for further processing which acts as an IOT gateway. This gateway has been given the wireless capability by installing a WiFi module which will be updating the data to the cloud. The IOT gateway also has the GSM capability through the module connected. This receiver unit also has a duplex communication link based on a cellular-Internet interface, using general packet radio service (GPRS) protocol, which is a packet oriented mobile data service used in 2G and 4G cellular global system for mobile communications (GSM). The data being uploaded to the cloud allows the user to continuously view the parameters from home.R.nageswara rao and b.sridhar developed a paper based on agriculture irrigation system is with low complex circuitry. A two sensors are used efficiently those are temperature and moisture of soil in the circuit to get the calibrated information to the system. Two sensors and Raspberry pi microcontrollers of all three Nodes are successfully interfaced various Nodes. All observations and experimental tests proves that proposed is a complete solution to field activities, irrigation problems, Implementation of such a system in the field can definitely help to improve the field of the crops and overall production. The irrigation system completely automated also provides real-time information about the lands and crops that will help farmers make right decisions.

**4. Sonali Kesarwania, Devesh Mishrab, Anshuka Srivastvaa, K.K. Agrawal (Feb 26,2019)** In this paper, we are considering the soil moisture, presents in the crop field by using the soil moisture sensor, also sending the real-time data to the mobile through Blynk application and proposed to get information through the internet for the advancement of agriculture, using the Internet of Things (IoT) structure. Here, the motor is used, which gets turned on and off according to the threshold limit settings of the soil moisture sensor. The analog data from the sensor is collected then converted.

## 3. NEED OF STUDY

Monitoring soil moisture in the root zone of crops will optimize irrigation. The benefits of optimizing irrigation scheduling with soil moisture sensors includes increasing crop yields, saving water, protecting local water resources from runoff, saving on energy costs, saving on fertilizer costs and increasing the farmer profitability. Irrigation plays an increasingly important role in agriculture. Irrigation is essential but so is the proper management of the irrigation. Soil moisture monitoring is the key to ensuring good irrigation management decisions are made to maximize the benefit of irrigation.

## 4. PROPOSED METHODOLOGY

Soil is for the farmer what the pulse is for the doctor. It helps them take decisions about when to irrigate, when and what to sow, use nutrients and so on. While, some farmers have indigenous knowledge of detecting soil moisture and health, such knowledge is confined to only a few. Taking farming decisions on the basis of soil moisture and health have become even more difficult in the age of climate change. Receiving accurate and instantaneous information on soil moisture content, salinity, temperature, and other parameters, soil sensors are an important tool for anyone involved with soil. Fig shows the block diagram of the proposed system. It consists of sensing unit such as Soil Moisture Sensor, temperature sensor, colour sensor and PH sensor to measure water content of soil, the atmosphere temperature, colour of soil and pH respectively and LCD interfaced with Node Arduino displays all this values.

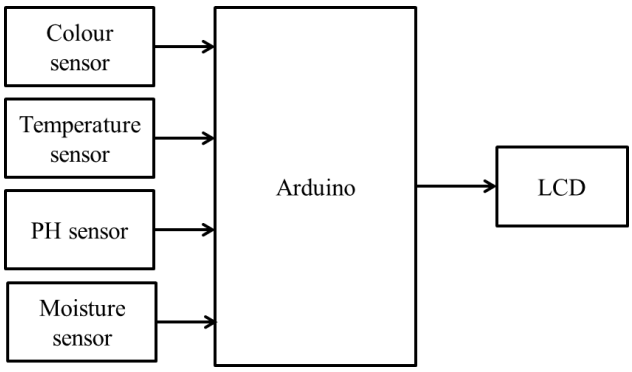


Fig block diagram of proposed system

## 5. CONCLUSION

The back bone of human civilization has been irrigation since man has started agriculture. As the years passed by many methods of irrigation to the land has been introduced by the humans. Over the past few decades, soil monitoring has become increasingly important. Environmental factors such as climate change, dwindling water resources, and threatened habitats are driving the need to monitor the environment and implement better policies to protect it. Many natural processes in the environment are driven by or in some ways related to soil hydrological processes. Monitoring soil moisture conditions provides important information for the protection of, and in the understanding of local and regional water resources. Proposed system consists of sensing unit such as Soil Moisture Sensor, temperature sensor, colour sensor and PH sensor to measure water content of soil, the atmosphere temperature, colour of soil and PH respectively and LCD interfaced with Node Arduino displays all this values.

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