

## Arduino Controller based Smart Portable Soil Monitoring System

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### Abstract

*The Arduino UNO microcontroller based smart portable soil testing system is developed to determine the values like pH content and moisture level. This can be done using the sensor respectively to check the values. The GSM Module which uses the mobile communication to communicate the value to the given mobile. The communication method used here to retrieve the values whenever it is necessary and after getting the values it would be displayed in LCD. Then when the button is pressed, the GSM starts to work, search for the signal and after responding to the signal the values are sent to the registered mobile. This method would be easier to check the value of soil so that it will be viewed whenever the values are needed. It describes that the values are available at our doorstep because it is smart portable monitoring system. This project helps us to create a new idea to do further additional functions that can be done.*

**Key-words:** Mobile Communication, GSM Module, LCD, Soil Tester, pH.

### 1. Introduction

Agriculture is commonly known as backbone of India. It plays a vital role in food crops. Agriculture also depends on processing, promotion and distribution of agricultural products but the important role is planting a food crops in the field. It also plays an important role in economy [1]. Normally the farmer needs to work hard for harvest. They even need to check the basic requirement for the crops to be grown. First they need to test the soil so the need to collect it and given in the

agricultural university for the result. The result is obtained after a week. Since it is a long process the farmer need to wait for some days [2-4].

To make easier and to obtain the result a portable device is made to check the value of the moisture content and pH level at the instant time. Since there are some devices to do these things we make it as portable so that we will be very glad to share with the farmers [5]. We feel happy when a device invented related to agriculture. This portable device can be used to identify the value of any kind of soil under certain surroundings [6]. These instant values can also be stored in mobile using device named, GSM Module. The mobile communication plays an important role in day to day life and hence this helps the device to store and retrieve the values measured [7-9].

The device is made with less number of components and portable, it is also cost efficient. So this device may find a good place in a market level. So that many farmers find to get the device and use it so that they no need to wait for several days to obtain the result. To assess the value of the moisture content and pH value, we must ensure,

- i. The correct setup of the device.
- ii. Check the environmental condition.
- iii. Soil sample to be tested etc.

By these requirements we will find the value that need to be measured.

## **2. Methods**

### **A. Soil Sample Collection**

Five soil samples were collected for the purpose. Samples were collected from different fields that vary in color, slope, drainage, and the type of agricultural practices used. It was ensured that samples collected in the standing crop were collected at the depth of 15 cm for shallow rooted crops and at the depth of 30 cm for deep rooted crops.

### **B. Soil Sensing**

The basic component of any soil needed to be tested is moisture and pH. Knowing the moisture level and pH value of any soil can help in determining the crop to be planted and also the fertilizer up to an extent. For this purpose, soil moisture sensor and pH sensor is used. The pH

measured can be used to determine the acidity of the soil. The output from the soil sensor helps us to know how moist the soil is.

### C. Processing and Interpretation of Results

Arduino UNO is used to integrate the sensors, LCD Display and the GSM. Here the GSM is used send the output as a message to mobile number of the user. The output from the sensors is given to the two input pins of the Arduino UNO board. The software used is Embedded C. The Arduino board is programmed such that as soon as the sensors are in contact with the soil surface the detected values are simultaneously displayed on the LCD display without any delay. Since it takes a few seconds to get a stable value, the output keeps oscillating since the sensor detects an accurate value. When a stable output is seen, the output can be sent to the mobile number of the user. This is made possible with the help of a button integrated with the Arduino UNO board and the GSM module. On pressing the button after the attainment of a stable output, the output is sent as a message to the user.

### 3. Components

The block diagram of the Soil tester is shown in figure. 1. This portable device contains simple components like Arduino, LCD display, GSM Module, sensors namely moisture level sensor and pH sensor and a key. All the components are connected as per the block diagram and so it works correctly.

When the components are connected and the power supply is given the device starts to work their respective functions and intimate us the value that is needed. As soon as the result is obtained it is also send to registered mobile. Since it is a simple device we no need to spend a huge expenses on it.

The prototype shown in figure.2 describes the perfect connection of the device.

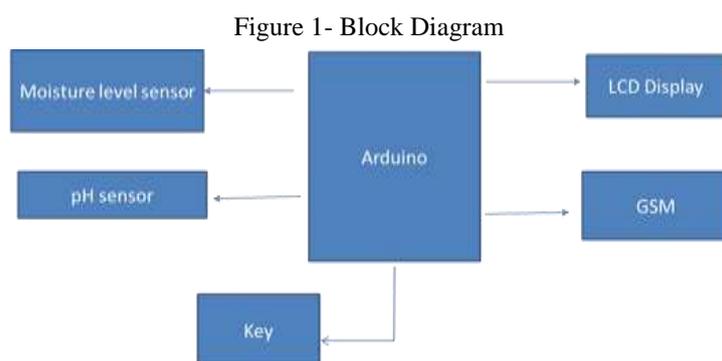


Figure 2- Prototype of Soil Tester



#### 4. Result and Discussion

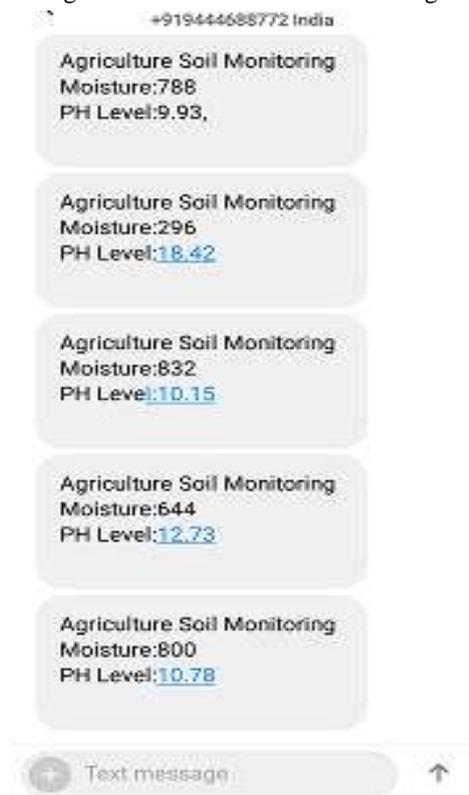
The portable soil tester works perfectly, when the power supply is given. The Arduino is the major element in this project. Arduino controls other components based on the program dumped inside it using embedded c. As soon the power supply is given, Arduino sends signal to sensors and the moisture content and pH value is measured using moisture level sensor and pH sensor respectively. Then Arduino helps to display the output in LCD display as shown in figure.3. It also controls GSM to send the message to the respective mobile when the key is pressed.

Figure 3- LCD Display



When the key is pressed we can see in the LCD as sending message and at last the message is sent to the mobile that we have registered. We use embedded c to program the Arduino and so it works and per the comments we give. The message received in the device us shown in figure. 4. In the program we should give the mobile number to store the values and retrieve it whenever we want.

Figure 4- Result Received in Message



## 5. Conclusion

The portable soil tester is an efficient method of instant soil testing with the use of sensors. The use of GSM makes the project more useful by sending the message as output to the user. Since this device is cost efficient every farmer will be able to buy. Though the device has both advantages and disadvantages, while comparing the advantages are more and so it has a unique place in market.

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