# Soil Monitoring System For Crop Recommendation

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***Abstract-*** *Soils have important direct and indirect impacts on agricultural productivity, water quality, and the global climate. By soil it's possible for plants to grow by mediating the biological, chemical, and different physical processes that supply plants with different nutrients, water, and other required elements. This paper provides a brief overview of the soil monitoring system using sensors. Various soil sensors are used to measure temperature, moisture and humidity. The information from the sensors in the soil is display on android app. This information is very helpful to crop recommendation to farmer for better agriculture.*

***Keywords***- Linear Regression, Soil Moisture, Machine Learning, IOT Based System.

## I. INTRODUCTION

Development of agriculture using technology will be very much useful in cultivation. For a new agricultural area, without knowing or monitoring the important parameters of the soil, cultivation will be difficult and so the farmers suffer financial losses. This project thesis provides a brief overview of the soil monitoring system using sensors. Various soil sensors are used to measure temperature, moisture and light. The information from the sensors in the soil is sent to the Bluetooth module through Arduino microcontroller. This information received from the Bluetooth is viewed in the application of the Android mobile phone. Thus this advanced technology helps the farmers to know the accurate parameters of the soil thus making the soil testing procedure easier.

### I.1 Objectives:

1) The primary objective monitoring the soil moisture, temperature and humidity for better agriculture.

2) When soil is get tested then the soil test report is generated and send it on Android app.

3) Recommendation for crops based on soil health.

4) Provide baseline dataset for assessing soil quality change and yields of representative farming systems.

5) Monitoring agricultural environment for many factors such as soil moisture, temperature and humidity along with other factors can be of significance.

6) To achieve maximum plant growth and yield quickly.

### I.2. Problem Statement:

The various parameter of soil like temperature, humidity and moisture are directly displayed to the user and depending on those parameter the crop is predicted by the system. It uses temperature, moisture and humidity sensor and for prediction of crops it uses linear regression algorithm.

### I.3. Existing System:

In the existing system the soil can be tested just to check out the fertility and the moisture level. It has to be given to the lab for testing the soil. It will take some days to fetch the result. For a new agricultural area, without knowing or monitoring the important things(parameters) of the soil, cultivation will be difficult and so the farmers suffer financial losses.

## II. LITERATURE SURVEY

The paper [1] have presented the research possibilities for the classification of soil by using well-known classification algorithms as J48, BF Tree, and OneR and Naïve Bayes; in data mining. The experiment was conducted on data instances from Kasur district, Pakistan. The comparative analysis of these algorithms have the different level of accuracy to determine the effectiveness and efficiency of predictions.

The paper [2] A specialized approach is being used to design the soil monitoring system for measurement and control of the plant growth parameter, i.e. soil moisture

The paper [3] has a recommendation system to help farmers in choosing appropriate crops. From the experimental evaluation the developed system can recommend appropriate crops to a satisfactory level

The paper [4] presented a case study of wireless sensor network system for monitoring the surrounding humidity, temperature and water content level of crops. The system offers remote monitoring access and alert function to users with less human intervention..

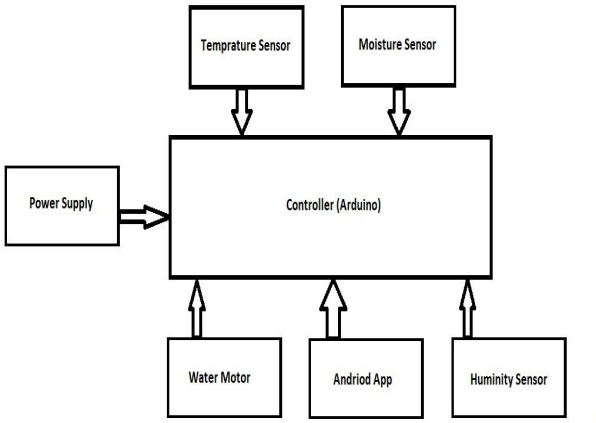
The paper [5] helps farmers to sowing the right seed based 2016 IEEE Eighth International Conference on Advanced Computing (ICoAC) 36 on soil requirements to increase productivity and profit by this technique. Thus the farmer's can plant the right crop as per requirement increasing his yield and also increasing the overall productivity of the nation.

## III. Proposed System:

The system propose monitoring of various soil parameters using sensor networks and information display on android app. Various soil sensors are used to measure temperature, moisture and humidity. The proposed system is capable of determining Soil moisture, temperature, humidity. The system is to design an integrated circuit to automatically measure the soil moisture, environmental temperature and humidity. The outcome of this project is monitoring soil and crop recommendation based on the processing of different parameters of soil and result is display on android app. This project replaces the primitive method of soil testing and so, the farmers get to know about their soil quickly. The result provides by this project helps the farmers to take up the decision.

1. Show Humidity
2 .Show moisture
3. Show Temperature
4. Crop recommendation

**Proposed System Architecture Diagram**




We will be using Arduino Nano Microcontroller for the implementation of our project. As shown in System Architecture all the components will be connected to the Arduino board. The android Application will also be connected to the microcontroller using Bluetooth. The kit will be given to the farmer so that he can get the test result of farm directly on this mobile phone. Also the system will be using Linear Regression Algorithm to predict the crop from the given dataset and it will display the list of predicted crops to the farmer, so that the farmer can decide the correct crop to cultivate.

## IV TYPES OF SENSOR USED:

• **Humidity Sensor**:

Humidity Sensor is the one of the most important devices that has been widely in consumer, industrial, biomedical, and environmental etc. This is used for measuring and monitoring Humidity. Humidity is defined as the amount of water present in the surrounding air(Environment). This water content in the air is a important factor in the wellness of mankind. For example, we will feel comfortable even if the temperature is 00C with less


. Fig. Humidity Sensor

humidity that is the air is dry . But if the temperature is 100C and the humidity is high that is the water content of air is high, then we will feel quite uncomfortable/unwell. Humidity is a major factor for operating sensitive equipment ex.- electronics, industrial equipment, electrostatic sensitive devices and high voltage devices or many more etc. Such sensitive equipment must be operated in a humidity environment that is suitable for the device project.

• **Temperature Sensor.**

Fig. Temperature sensor

This sensor simplifies the temperature sensing and has three pins they are ground, data line and power supply. Here communication is done through data line. Power supply is 3V to 5.5V. Temperature range from -55˚C to +125˚C can be sensed. Resolution is from 9 bits to 12 bits. Scratch card memory is available where the converted data is stored from the sensor.

• **Soil moisture sensor.**

Fig. Soil moisture sensor

The Moisture sensor is used to measure the water content that is moisture of soil. when the soil is having less water, the module output is at high level, else the output is at low level. This sensor reminds the user to water their plants and also check the moisture content of soil. It has been widely used in agriculture for checking soil moisture , land irrigation and botanical gardening.

## V. ALGORITHM USED

Linear regression is a simple approach to supervised learning. It assumes that the dependence of Y on X1,X2,...Xp is linear.True regression functions are never linear!
although it may seem overly simplisti, linear regression is extremely useful both conceptually and practically.

• **assume a model**

where β0 and β1 are two unknown constants that represent the intercept and slope, also known as coefficients or parameters, and is the error term.

• Given some estimates βˆ0 and βˆ1 for the model coefficients, we predict future sales using yˆ =βˆ0+βˆ1x

where ˆy indicates a prediction of Y on the basis of X = x. The hat symbol denotes an estimated value.

• We define the residual sum of squares (RSS) as RSS = or equivalently as RSS=(y1−βˆ0−βˆ1x1)2+(y2−βˆ0−βˆ1x2)2...+(yn−βˆ0−βˆ1xn)2
.
• The least squares approach chooses βˆ0 and βˆ1 to minimize the RSS. The minimizing values can be shown to be

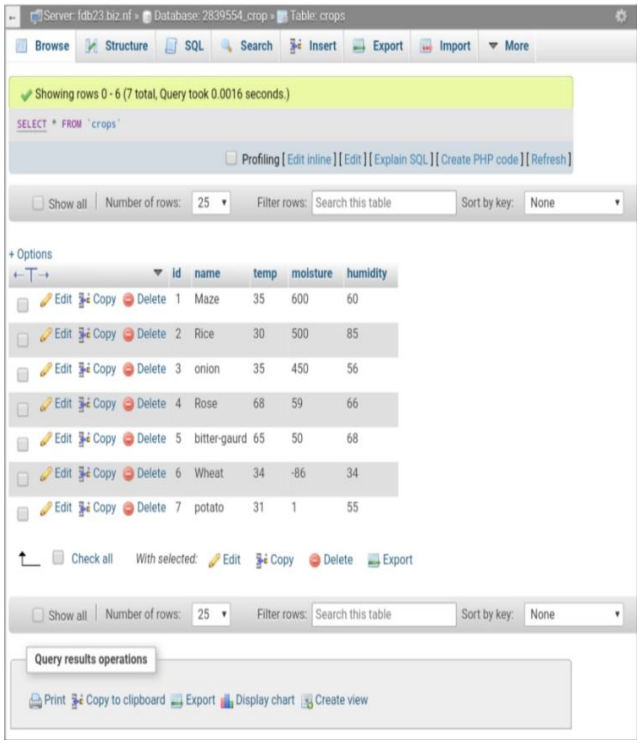
$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$$, \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x},$$

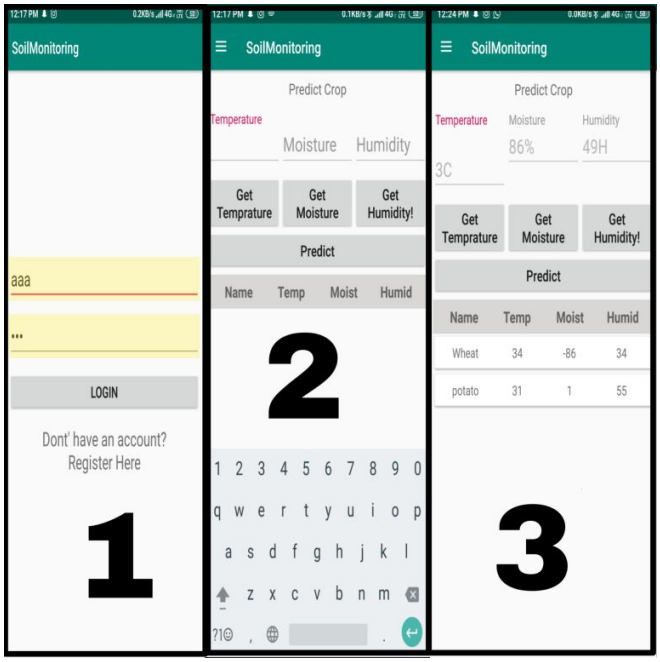
where $- \ y \equiv \frac{1}{n}\sum_{i=1}^{n} y_i$ and $\bar{x} \equiv \frac{1}{n}\sum_{i=1}^{n} x_i$ are the sample mean.

## VI. Result

**Predicted Crop Table**




Application-Screenshot




## VII. ADVANTAGES AND LIMITATIONS

**Advantages**

- Well established
- Fast
- It is beneficial for the farmers to increase their crops
- It is user friendly
- Reduces the farmers workload
- Provide alerts on soil resources to the predefined number
- Works anywhere in the world

**Limitations**

Soil moisture samples had to be taken from distances of about 1-2 meter away from the installed probes and were different from the soils that are directly in contact with the sensing volume of the probe.

**Scope:**

In future the system can be included with more number of sensors like metal and sound sensors in order to make the agricultural field intrusion free.

In future the same system can also be developed to sense the amount of nutrients required and to supply the same in correct quantities.

## VIII. CONCLUSION

Recommendation system for crops and soil based. This application beneficial to the farmers in terms of crop production. This application is user friendly so everyone can use it easily. We have developed a movable kit that can be used by the farmers easily in their farms.

Also the Android Application designed is user friendly and give clear and crisp information to farmer.

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