IJARSCT
Impact Factor: 6.252
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 1, November 2022

Monitoring of Soil Moisture using Cloud IoT and Android System

Prof. Ravishankar Bhaganagare[1], Pornima Khobragade[2], Sneha Godbharle[3], Harsh Kulthe[4], Sandesh Rathod[5]
Professor, Department of Computer Engineering[1]
Students, Department of Computer Engineering[2,3,4,5]
SKN Sinhgad Institute of Technology and Science, Kusgaon (BK), Pune, Maharashtra, India

Abstract: *A certain level of soil moisture is a requirement for good plant growth. Additionally, as water is a necessary component for life support, it is necessary to avoid using it excessively. Water is most frequently used for irrigation. This necessitates the regulation of water supply for agriculture. It's best to not over- or under-irrigate pasture. One tool for providing information about the soil is soil monitoring. Systems have been used over time to approach register this goal, with computerized procedures being the most popular because they allow data to be acquired with high persistence and minimal labour demand. The existing structure's size makes microprocessor-based technologies necessary. These systems offer significant technological advances, but they are expensive, bulky, difficult to maintain, and unwelcome by the pastoral scheme's technologically untrained operators. The goal of this project is to lay out a controllable, simple-to-implement method for detecting and specifying the level of soil moisture that is continuously regulated in order to achieve the best plant development and correspondingly increase the available irrigation resources. In this project, the data collected from the input sensors is processed by the neural network algorithm and monitoring correction factors. Soil monitoring is a set of evaluations demonstrating how soil characteristics or conditions change over time. The manufacturing and maintenance expenses are reduced by using readily available, straightforward components. As a result, this system is more practical, suitable, and low-maintenance for applications, particularly in rural and small scale\agriculturists.*

Keywords: Arduino, Wifi Shield, Power Supply, Soil Moisture Sensor, Ph Sensor, Salinity Sensor, And Neural Networks

I. INTRODUCTION

A novel technique for evaluating soil moisture, salinity, and PH value has been developed called the Soil Monitoring System for Precision Agriculture. This setup will consist of two components: a mobile application that alerts or makes recommendations to farmers (users) when soil moisture, salinity, or pH values are low or high compared to normal values and another application that monitors the data about the entire process. The mobile app will require communication with a wifi shield. The application will incorporate the wifi shield's serviceability to make it easier for users to use its features without experiencing any problems. Given that this system is data-centric, it must store a data. A database will be used for that.

The goal of a soil nutrient monitoring system is to quickly and accurately determine the nutrient condition of farmland by understanding the nutritional state of bare ground. The monitoring of soil nutrients is crucial due to its major influence on the crop. Lack of soil nutrient monitoring because chemical fertilisers induce a variety of diseases in humans. The advantages of using soil moisture sensors to optimise irrigation schedule include higher crop yields, water savings, runoff protection for nearby water resources, cost savings on electricity and fertiliser, and higher farm profitability.

1.1 Objectives

There are primarily four aims that sum up how this project will function in its whole.

- To create an automated model that is both affordable and capable of controlling the moisture content of a soil sample, primarily to meet the needs of rural farmers who lack access to technology.

- To determine how fertilisers and soil nutrients affect agriculture.
- Improving the efficacy of soil protection methods; and Raising public awareness about soil degradation.
- To test the viability of indigenous sensors (resistance blocks) as opposed to utilising ones that are commercially available.

II. SYSTEM INFORMATION

2.1 Literature Review

We'll start by looking at the many soil varieties according to pH levels. pH-based classifications of soil

- Extremely acidic soil less than 4.5
- Very strongly acid 4.5 to 5.0
- Strongly acid 5.1 to 5.5
- Medium acid 5.6 to 6.0
- Slightly acid 6.1 to 6.5
- Neutral soil 6.6 to 7.3
- Alkaline 7.4 to 8.0
- Strongly alkaline 8.1 to 9.0
- Very strongly alkaline greater than 9.0

Second, we will look at the different types of soil based on the salt content in them. The Soil salinity classes are

- up to 0.2 ds/m- Normal soil
- 2-3 ds/m- Critical to sensitive crops
- -4 ds/m- Very critical to tolerant crops
- greater than 4 ds/m- Injurious to crops

2.2 Existing Systems and their Advantages or Disadvantages

1. The feel-and-appearance method, which uses a shovel or dirt auger, is instinctive but necessitates skilled observation. It is also ambiguous.
2. Electronic India 1160 soil and water testing analysis kit: This kit is considerably more expensive than our product (around 35,000).
3. Several approaches that use comparable principles have already been developed to determine the levels of moisture and salinity [2] [1].

None of the systems currently in use preprocess data using neural networks. The goal of our project is to eliminate input variations brought on by broken sensors and microclimate activities. Additionally, an effort is made to comprehend historical data in order to forecast future rain.

Although the majority of farmers are able to specify and understand the basic criteria for planning irrigation on different crops, determining the actual amount of water needed is frequently a difficult task because of a number of unknowns related to crop characteristics, soil characteristics, and the dynamics of water flow through the soil and uptake by the crop. Regardless of the irrigation techniques employed, farmers frequently struggle to irrigate crops adequately and efficiently due to a variety of crop-related problems characteristics (depth of root systems, indeterminate growth, periodic cutting and re-growth cycles), soil hydraulic properties, and farming practises (harvesting schedules) that when combined with uncertainties of soil-water relations frequently result in improper irrigation management and subpar yields.

2.3 Proposed System

When a moisture sensor is embedded in soil, the soil moisture sensor uses the soil as its input and outputs a moisture content measurement. An arduino with an attached soil moisture sensor communicates with an android application via wifi shield. The sensor continuously measures soil moisture, and the output values are saved in a database. The same is processed using a neural network method and correction factors. The output values are displayed in the android application after being fetched from the database.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Impact Factor: 6.252
Volume 2, Issue 1, November 2022

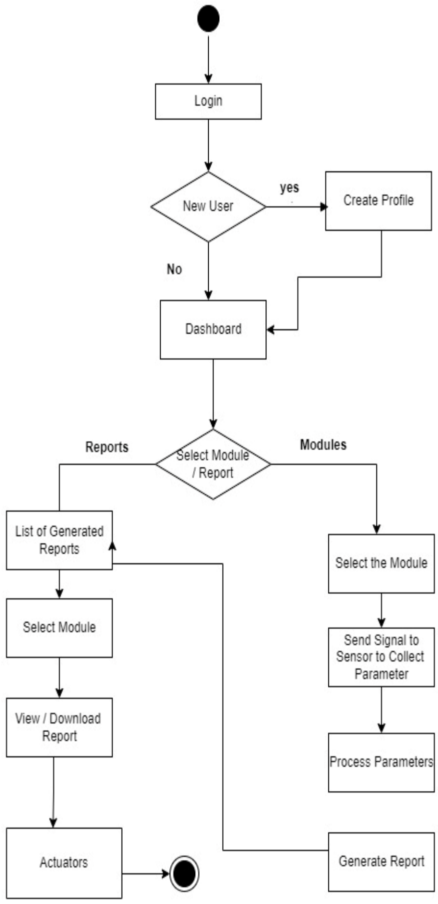
III. IMPLEMENTATION OF PROPOSED SYSTEM

3.1 System Model

The filter and pipe Architecture is a method of organising a system's data processing so that each processing component (filter) is unique and carries a specific type of data transformation. It creates a pipeline-like movement of data from one component to another for processing. The model mentioned above is described as follows:

- Soil parameters are provided as input, and sensors are used to validate this input.
- Standard soil parameters that are kept in the database are compared with the test findings.
- A correction factor will be generated as a result of the x comparison.
- The neural network algorithm receives data from the database and uses that data to analyse it while also applying a correction factor. However, the same can be utilised for input data pre-processing. This enables comparison with prior data and produces quicker, more precise findings.

The farmers' recommended production is based on this adjustment factor.



3.2 System Functionalities

Each filter has a relatively straightforward interface that allows it to take inputs such as soil parameters from the inbound pipe, process those parameters, and publish the results to the outbound pipe.

The pipe carries output from one filter to the next by connecting them together.

Section 1:

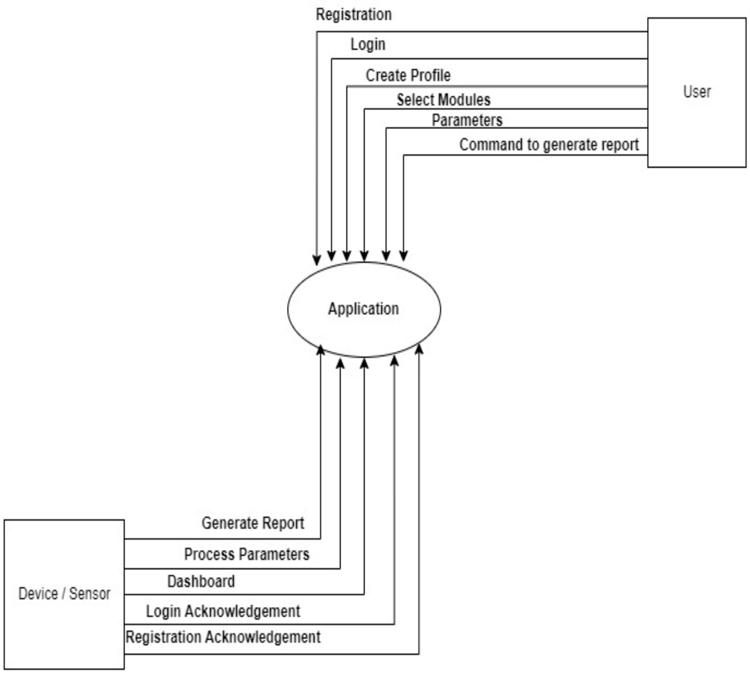
- Input: A sample of soil.
- Processing: The system will use the soil sample's inputs as inputs. It will use the appropriate sensors to monitor the salinity, pH, and moisture contents.
- Sensor data will be used to measure soil characteristics.

Section 2:

- Input: Typical soil properties saved in the database.
- Processing:
  - The soil moisture measurements are compared with criteria for a dry, ideal, and wet condition.
  - The soil salinity characteristics are also compared to benchmarks for the minimum, ideal, and excess salt concentration in soil.
  - The soil pH characteristics are compared with standards for acid, basic, and neutral environments using the comparator.
- Output: The comparator produces the correction factor.

Section 3:

- Input: Correction factor
- Processing:
- Output: The output will be shown as a recommendation or alert in the mobile application.



3.3 Comparing the Input Soil Parameters with Standard Values

Algorithm 1 shows the implementation details for comparing moisture parameters.

Algorithm 1 - Comparing with standard moisture parameters

- Start
- Input: Soil Parameters in voltage
- if (Input > 700)
- Excess wet

  if (Input > 3300 && Input < 700)

  Optimally wet or optimally dry

  if (Input < 300)

  Dry

  if(Input>0 && Input < 100)

  Sensor is in air

  End

Algorithm 2 shows the implementation details for comparing Ph parameters.

Algorithm 2 - Comparing with standard pH parameters

- Start
- Input : Soil Parameters in voltage
  if (Input > 5.1 && Input < 5.5)
  Acidic
  if (Input > 5.6 && Input < 6.0)
  Basic
  if (Input >6.0 && Input < 6.5)
  Neutral
- End

Algorithm 3 shows the implementation details for comparing salinity parameters.

Algorithm 3 - Comparing with standard salinity parameters

- Start
- Input : Soil Parameters in voltage
  if (Input >3 && Input < 4)
  Excess salt content
  if (Input > 0 && Input < 2)
  Optimal salt content
  if (Input >2 && Input < 3)
  Less salt content
- End

IV. RESULTS DISCUSSION

An arduino with an attached soil moisture sensor communicates with an android application through wifi shield. The sensor continually measures soil moisture, and the output results are saved in a database. The values for the output are pulled from a database. We will show the moisture measurements with the timestamp and moisture content after retrieving them from the database using a look-up table. If it falls between 0 and 100, the sensor is in the air; if it falls between 100 and 300, it is dry; if it falls between 300 and 700, it is humid or ideal; and if it falls between 700 and 1000, it is excessive.

V. CONCLUSION

The soil monitoring system, which measures and regulates soil moisture, a key factor in plant development, was designed using a sophisticated methodology. The results from the measurement has demonstrated that the system performance is highly accurate and trustworthy. In order to detect the necessary changes and adjust irrigation operations, soil moisture sensors are employed. These small adjustments to irrigation techniques assist to increase production while using less water. Disciplined monitoring of the sensors to identify the soil moisture level when the data acquired is within the specified range for the particular soil type is the key to successful irrigation management utilising soil moisture sensors. We can use the same neural networks to anticipate seasonal fluctuations and precipitation can aid farmers in planning their upcoming crop, which may lead to more work on this subject. However, the drawback of the existing setups indicated in the preceding section is eliminated by our solution. It is proven to be affordable, adaptable, and easy to use. In the Indian area of North Karnataka, where rainfall patterns have been unpredictable during the previous four years, there has been no attempt to automate the process of managing the soil.

REFERENCES

[1]. Monitoring moisture of soil using low cost homemade Soil moisture sensor and Arduino UNO, Matti Satish Kumar ; T Ritesh Chandra ; D Pradeep Kumar ; M. Sabarimalai Manikandan, 2016 3rd International Conference on Advanced Computing and Communication Systems (ICACCS)

[2]. Smart farming using Arduino and data mining, Ankita Patil ; Mayur Beldar ; Akshay Naik ; Sachin Deshpande, 2016 3rd International Conference on Computing for Sustainable Global Development

(INDIACom)

[3]. Estimation of Vegetation Parameters of Water Cloud Model for Global Soil Moisture Retrieval Using Time-Series L-Band Aquarius Observations, Chenzhou Liu ; Jiancheng Shi, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, Volume: 9 Issue: 12

[4]. The SMOS Soil Moisture Retrieval Algorithm, Yann H. Kerr and others, IEEE Transactions on Geoscience and Remote Sensing , Volume: 50 Issue: 5

[5]. The arduino website, [Online] available: https://www.arduino.cc/

[6]. Soil moisture retrieval from space: the Soil Moisture and Ocean Salinity (SMOS) mission, Y.H. Kerr ; P. Waldteufel ; J.-P. Wigneron ; J. Martinuzzi ; J. Font ; M. Berger, IEEE Transactions on Geoscience and Remote Sensing , Volume: 39 Issue: 8

[7]. J. L. Aznarte and N. Siebert, "Dynamic Line Rating Using Numerical Weather Predictions and Machine Learning: A Case Study," in IEEE Transactions on Power Delivery, vol. 32, no. 1, pp. 335-343, Feb. 2017.doi: 10.1109/TPWRD.2016.2543818 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7442844&isnumber=7828064

[8]. R. Hanni, M. M. Patil and P. M. Patil, "Summarization of customer reviews for a product on a website using natural language processing," 2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI), Jaipur, 2016, pp. 2280-2285. doi: 10.1109/ICACCI.2016.7732392 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7732392&isnumber=7732013

[9]. AT. R. V. Anandharajan, G. A. Hariharan, K. K. Vignajeth, R. Jijendiran and Kushmita, "Weather Monitoring Using Artificial Intelligence," 2016 2nd International Conference on Computational Intelligence and Networks (CINE), Bhubaneswar, 2016, pp. 106-111.doi: 10.1109/CINE.2016.26 URL:http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7556813&isnumber=7556626