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Analysis of Soil Moisture Data using IOT & KNN Algorithm

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***Abstract*— Soil moisture is a key variable in dominant the exchange of water and heat energy between the land surface and additionally the atmosphere through evaporation and plant transpiration. Hence, it plays an important role in the development of weather patterns and the production of precipitation. Agriculture productivity mainly depends on the quality of soil, which is dependent on factors like soil moisture and pH values.**

In this research paper, we determine the quality of soil by using pH values (a measure of acidity or alkalinity of water-soluble substances), where we are using a sensor which is connected to a microcontroller. Now, this sensor is inserted into the soil for retrieving the values which are stored in different devices which are connected to the Wi-Fi modem around it. Then these values are compared with the different pH values and analysis is done using KNN. After this analysis, we conclude which type of crops can be harvested in that particular soil. Doing this, we could help farmers to pre-estimate which land can be used for what purpose.

Keywords: Soil moisture, Crop prediction, KNN, IOT.

I. INTRODUCTION

Nowadays, we are surrounded by a large amount of "smart" sensors and intelligent systems that are always inter-connected through Internet and cloud platforms; this is the Internet of Things (IoT) paradigm that introduces advanced technologies altogether social and productive sectors of the society. Considering the worldwide market, corporations contend to extend their profit and economy by optimizing prices, time, and resources and, at an equivalent time, attempting to boost the services quality and the variety of the products offered to customers.[1][2] The attention towards efficiency and productivity improvements is coveted also in the agricultural sector, where the production dynamics and the resource management affect crop types, irrigations, and disinfestations amount; keeping such production rhythms with none automatic management is probably going to bring resource waste, rotten or abandoned crops, and polluted and impoverished soils.[2]

Agriculture is the major backbone of Indian Economy. Most of the available freshwater resources are used in Agriculture. In India, most of the irrigation systems area unit operated manually that isn't machine-driven. In recent years automated and semi-automated technologies been deployed for irrigating the field which has replaced the traditional Agricultural mechanism.[3] The available traditional methods of irrigation are drip irrigation, ditch irrigation, sprinkler system. This downside will be simply corrected by creating use of the machine-driven system instead of the normal systems. The current irrigation methodology adopted use uniform water distribution which is not optimal. [3][4]
So, consequently technologies being applied towards agricultural monitoring that is needed by farmers. [4]

II. SYSTEM ARCHITECTURE

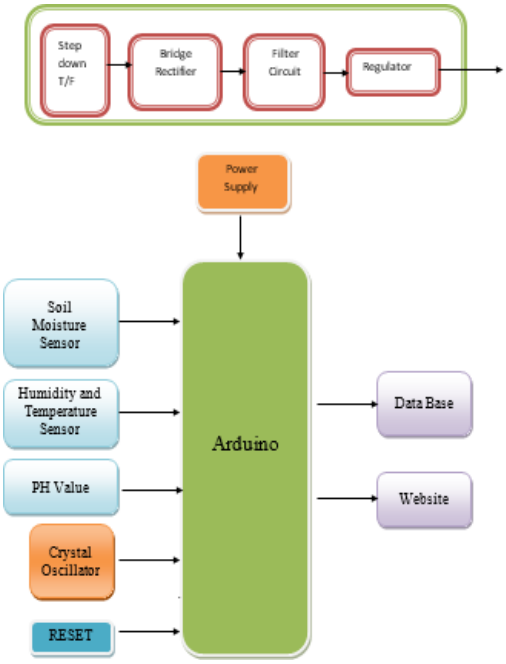


Fig.1. Block Diagram

The above block diagram shows the outlay of the entire paper which has been discussed above the hardware requirements are quite limited & easily available as well as less feasible. [5] The various sensors such as soil moisture sensor, DHT11 sensor, PH sensor are placed in the soil for collecting the live values from the soil and sends them to the microcontroller for further process. In Analysis of soil

moisture data using IOT and KNN, The live values are collected from the soil are compared with preexisting data and analysis is carried out to determine which crop can be harvested in that soil so as to yield the maximum result. [5][6]

III. LITERATURE SURVEY

The paper "Generalized software tools for crop area estimation and yield forecast" by Roberto Benedetti

Describes the procedure that results in the estimates of the variables of interest, such as land use and crop yield and another sampling standard deviation, is rather tedious and complex, till to make necessary for a statistician to have a stable and generalized computational system available. This paper focuses on the use of this system in different steps of the survey: sample design, data editing, and estimation. The information made is, however, obtainable for one user solely, the manager of the survey. [5]

The paper "Risk in Agriculture: A study of crop yield distribution and crop insurance" by Narsi Reddy Gayam

In his analysis study examines the idea of normality of crop yields using data collected from Republic of India involving sugarcane and Soybean. The null hypothesis (Crop yield are ordinarily distributed) was tested using the Lilliefore technique combined with an intensive analysis of the data. The result shows that in all cases considered in this thesis, crop yield is not normally distributed. [6]

The paper "Applying data mining techniques within the field of agriculture and allied sciences"

An attempt has been made to review the research studies on the application of data mining techniques in the field of agriculture. Some of the techniques, like ID3 algorithms, the k-means, and the k nearest neighbor, artificial neural networks and support vector machines applied within the field of agriculture were conferred. Data mining in the application in agriculture is a relatively new approach for forecasting / predicting of agricultural crop/animal management. [6]

The paper "Analysis and prediction of crop yields for agricultural policy purposes" by Richard Kidd Perrin

Climate and alternative environmental changes within the developing world and also the African continent has become a serious threat to their agricultural economy. Traditional insurance for cash risk management is impractical in developing countries as a result of high dealings costs, adverse choice, info spatial property, poor distribution and different challenges that hinder the availability of protection. Area-based index insurance is viewed as a promising monetary risk management resolution for granger farmers in developing countries, like African country. However, estimating the yield (i.e., yield prediction) may be a vital a part of rating the premium for this insurance instrument. Because of the importance of predicting crop yield, the aim of this study is to use several forecasting strategies for evaluating crop yield estimates in an African country. Crop yield forecasting, that provides data for decision-makers, is vital in many ways to Ghana's economy. [7]

IV. HARDWARE DESCRIPTION

A. Arduino UNO:

The Arduino UNO is a microcontroller board based on the ATmega328.It uses an ATmega16U2 faster transfer rate and more memory. Arduino will be used to develop complete interactive objects or will be connected to computer code on your pc. It uses Arduino IDE (Integrated Development Environment) software which allows you to write programs and upload them to your board. A program written with the IDE for Arduino is called a sketch. [6][7]

Features:

a) Input voltage: 7-12V
b) 14 Digital I/O Pins (6 PWM outputs)
c) 6 Analog Inputs
d) 32k Flash Memory
e) 16 MHz Clock Speed

B. Soil moisture sensor:

This device is used to check the moisture of soil when the soil has a water shortage, the module output is at a high level, and else the output is at a low level. By using this device one can automatically water the flowering plant, or the other plants requiring automatic watering technique. Module triple o/p mode, the digital o/p is straightforward, analog o/p more accurate, serial o/p with precise readings. Soil moisture sensors measure the amount of water content in the soil.

A soil moisture probe is formed of multiple soil moisture sensors. One common variety of soil moisture sensors in industrial use could be a Frequency domain sensor such as a capacitance sensor. Another sensor, the neutron moisture gauge, utilize the moderator properties of water for neutrons. [6][7]

Features:

a) Sensitivity adjustable.
b) Has a fixed bolt hole, convenient installation.
c) The threshold level can be configured

C. Digital Temperature and Humidity Sensor:

DHT11 digital temperature and humidity sensor is a compound sensing element contain a graduated digital signal output of the temperature and humidity. Application of a dedicated digital modules assortment technology and therefore the temperature and humidity sensing technology, to make sure that the merchandise has high reliableness and wonderful long-run stability. The sensor includes a resistive sense of wet components and NTC temperature measurement devices and connected with a high-performance 8-bit microcontroller. [7]

Specification:
Supply Voltage: +5 V
Temperature range: 0 to 50 °C error of 2 °C
Humidity 20-90% RH ± 5% RH error
Interface: Digital

D. PH sensor:

A pH scale meter is an instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter". The distinction in electrical potential relates to the acidity or pH of the answer. The pH meter is used in many applications ranging from laboratory experimentation to quality control. [8][9]

Specification:
Power requirements: 230 V ac 10%, 50Hz
Range: 0.0 to 14.0 pH
Accuracy: 0.1 pH
Probe: pH electrode

E. Wi-Fi Module:

ESP8266EX (ESP- Espressif Systems Smart platform; EXrevised version) offers a complete and self-contained Wi-Fi networking resolution, it can be used to host the application or to offload wireless networking functions from another application to the processor.it hosts the application it takes up directly from an external flash; it's integrated cache to boost up the performance of the system in such applications.

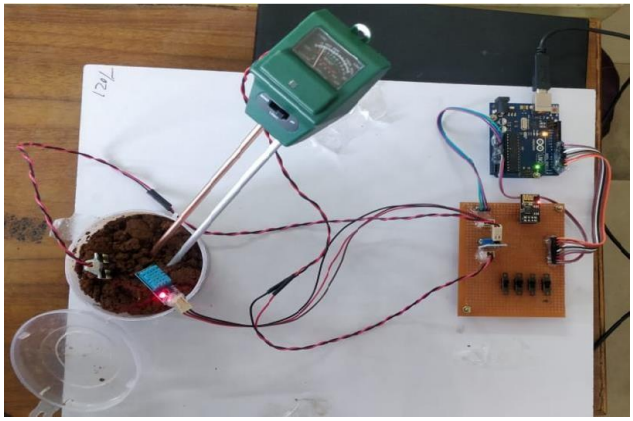
Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity (SPI/SDIO or I2C/UART interface). it integrates the antenna switch, RF module, power amplifier, low noise receive amplifier, filters, power management modules, and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266EX also integrates an enhanced version often silica's L 106 Diamond series 32-bit processor, with on-chip SRAM, besides the Wi-Fi modem properties. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs, so as it can be made to work as an entirely individual system even if required. [9][10]

V. WORKING PROCEDURE

- To run all the modules we need +5v DC power, to get the required voltage we need power supply circuit, so we converting 230v AC mains to +5V DC.
- Arduino controller is connected to all modules; each module is executed with respective commands given by Arduino.
- Consider four different types of soil samples such as Red soil, Desert soil, Black soil, Literal soil for this prototype.
- As soon as we give the power supply, all the modules get activated by the controller.
- Insert soil moisture sensor, DHT11 sensor, pH sensor into the soil for retrieving live values from the all the four soils and sent to the microcontroller (Arduino Atmega 328p) to store them in the MY SQL database/server with the help of WI-FI module which is connected to the mobile hotspot for further analysis purposes.
- In the Website page, Admin will upload the preexisting data and comparison is performed against live values by using K-Nearest Neighbor Algorithm.
- As a result, it predicts/determines the crop name based on the quality of the soil and environmental conditions as to yield maximum result.

VI. EXPERIMENTAL RESULTS

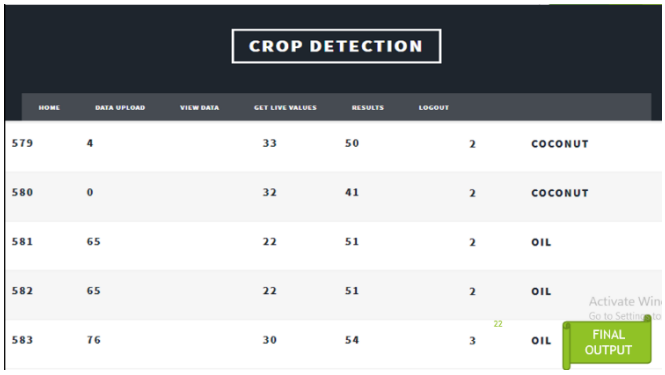
A. Hardware Kit:



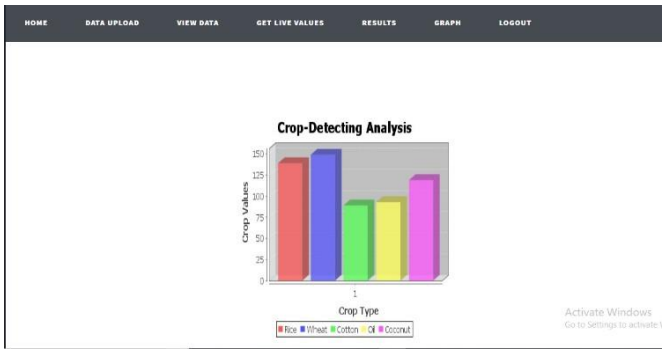
B. Initializing Page:

```
Select switch to test a soil type
 Switch1 = Red Soil
 Switch2 = Black Soil
 Switch3 = Laterite Soil
 Switch4 = Desert Soil

Red Soil is Selected

 Temperature : 30
 Humidity : 54
 Moisture : 76
 pH : 3
AT+CIPSTART="TCP","www.ctcorphyd.com",80
ALREADY CONNECTED

ERROR

busy s...

Recv 98 bytes

SEND OK

+IPD,168:HTTP/1.0 200 OK
X-Powered-By: PHP/5.5.38
Content-Type: text/html
Content-Length: 4
Date: Mon, 08 Apr 2019 04:11:40 GMT
Server: LiteSpeed
Connection: close

doneCLOSED
```

C. Prediction Result:



D. Crop Detection Analysis:



VII. Conclusion

Hence, from the above discussion we can conclude that the paper (Analysis of soil moisture data using IOT and KNN) is a new and innovative agricultural production technology which takes into consideration the data related to soil, weather and past year production and suggests which are the best profitable crops which can be cultivated in the apropos environmental condition. As the system lists out all possible crops, it helps the farmer in the decision making of which crop to cultivate. Also, this system takes into consideration the past production of data which will help the farmer get insight into the demand and the cost of various crops in the market. As maximum types of crops will be covered under this system, the farmer may get to know about the crop which may never have been cultivated.

References

[1] Joaquin G, Juan F , Alejandra N.G, and Miguel Angel, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", IEEE Transactions On Instrumentation and Measurement, Vol.63, no.1, pp.166-176, 2013

[2] Snehal S, Sandeep V.R, "Agricultural Crop Yield Prediction Using Artificial Neural Network Approach". International Journal of Innovative Research in Electrical, Electronic, Instrumentation and Control Engineering, Vol. 2, Issue 1, January 2014.

[3] Kim Y., Evans R.G. and Iverson W.M., "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network," Instrumentation and Measurement, IEEE Transactions on, vol.57, no.7, pp.1379-1387,July2008.

[4] Monali Paul, Santosh K. Vishwakarma, Ashok Verma, "Analysis of Soil Behavior and Prediction of Crop Yield using Data Mining approach", 2015 International Conference on Computational Intelligence and Communication Networks.

[5] Abdullah Na, William Isaac, ShashankVarshney, Ekram Khan, "An IoT Based System for Remote Monitoring of Soil Characteristics", 2016 International Conference of Information Technology.

[6] Dr.N.Suma, Sandra Rhea Samson, S.Saranya, G.Shanmugapriya, R.Subhashri, "IOT Based Smart Agriculture Monitoring System", Feb 2017 IJRITCC.

[7] N.Heemageetha, "A survey on Application of Data Mining Techniques to Analyze the soil for agricultural purpose", 2016IEEE.

[8] Awanit Kumar, Shiv Kumar, "Prediction of production of crops using K-Means and Fuzzy Logic", IJCSMC, 2015.

[9] M.R. Bendre, R.C. Thool, V.R.Thool, "Big Data in Precision agriculture",Sept,2015 NGCT.

[10] Mucherino, A., Papajorgji, P., & Pardalos, P. (2009). Data mining in agriculture (Vol. 34). Springer.