Anomaly Detection to Enhance Crop Productivity in Smart Farming

N.Jeba¹, Dr. S C Lingareddy², P.Kowsalya³, S.Manju Sree⁴, S.Swetha⁵

¹Assistant Professor, ³,⁴,⁵ UG Student, ²Professor, ¹,²,³,⁴,⁵ Department of Computer Science & Engineering, ²Sri Venkateshwara College of Engineering, Bangalore. ¹,³,⁴,⁵ Kumaraguru College of Technology, Coimbatore.

¹jeba.n.cse@kct.ac.in
²kowalya.14cs@kct.ac.in
³manju.14cs@kct.ac.in
⁴swetha.14cs@kct.ac.in

July 31, 2018

Abstract

Agriculture is a source of livelihood for majority Indians and has the great impact on the economy of the country. But now-a-days due to climatic changes, insufficiency of water and excessive use of fertilizers, crop production has been decreased. Our project majorly concentrates on increasing crop production. In smart farming by testing the soil, it helps to display the moisture content and pH value of the soil through the LCD display with the help of pH and moisture sensor. So with these values the crop rotation, fertilizer suggestion (either organic or synthetic fertilizer) for cultivation will be displayed. And so the farmer can utilize the whole nutrients in the soil to get higher crop production. With different pH value, it displays which crop can
be produced. And hence the crop suggestion, crop rotation and fertilizer suggestion to increase the yield of crop will be displayed for the respective values obtained in the soil.

1 Introduction

Smart Farming represents the application of modern technologies into agriculture. Offering high-precision crop control, useful data collection, and automated farming techniques, there are clearly many advantages a networked farm has to offer. Farming in India is done using the ancient techniques. The fact that most of our farmers lack proper knowledge makes it even more inconsistent. A large portion of farming and agricultural activities are based on the predictions, which at times fail. Farmers have to bear huge loses and at times they end up committing suicide. Since we know the benefits of the proper soil moisture, pH value and its quality, in the growth of crops, such parameters cannot be ignored. We, therefore, have come up with the new idea of smart farming using IoT. Our idea tries to digitalize farming and agricultural activities so that the farmers can check on the requirements of the crop and predict their growth. The implementation of our project largely depends upon the awareness among farmers, which, we believe will be easily created due to its numerous advantages. The aim of this project is to introduce the latest technology into the agriculture field and better crop production by collecting sample of soil and informing the farmers about it. IoT has the ability to innovate the landscape of current farming methods. IoT sensors capable of providing farmers with information about crop yields, fertilizer, moisture content in the soil, and soil nutrition to improve crop production. We collect information in order to both maximize crop yield and minimize waste.

2 Related Works:

We have gone through few studies to get a solution to our problem and referred few works designed by different authors. In paper [1] temperature monitoring and humidity in agricultural field is done through sensors using CC3200 single chip. Along with CC3200 a
camera is interfaced to capture images and send those captured pictures to farmers mobile through MMS using Wi-Fi. But this system has a major drawback of image clarity. The controller of the smart farming system using IoT [2], keeps monitoring the humidity, soil condition, temperature, and supplies water to the field according to the values acquired. A system is introduced to collect field data at regular interval and to reduce manual work by using Raspberry-Pi IoT based system for effective collection and data processing, transferring information, to make decisions, to provide automation and to control function for efficient and cost effective crop yielding [3]. In this paper [4], the growth parameters like temperature, humidity, soil water are used for optimization of plant growth, but this system does not include the pH parameter for better crop production. Relational database systems (e.g., mysql [5]) have been the historic choice for storing data from the sensors for later retrieval, analysis, and visualisation. However, the performance of these systems can be compromised by large streams of time-series data, and they do not address most of the challenges. To perform specific tasks like water irrigation automatically, based on the temperature, humidity and soil moisture, a threshold value is being fixed. If the obtained value from sensors is less than the threshold value, the water will automatically start to flow from the water tank to the agricultural field. Though this system concentrates on water irrigation it does not take the nutrient content to increase crop productivity.

3 METHODOLOGY:

This systems input is taken from the soil. The inputs are sensed through pH and soil moisture sensors. The ph value and moisture value of the sample soil is taken and sent to the LCD display through Arduino. Along with these values, the crop suggestion for the respective pH value will be displayed. Crop rotation and fertilizer suggestion for the suggested crop will also be displayed in the LCD. For the visualization of data, we use ThingSpeak. Through the Wi-Fi module (which is connected along with the Arduino), the data (pH value and moisture value) can be analyzed and visualized as graph in ThingSpeak. In Multi parameter plant growth monitoring system it proposes a wireless, multi-parameter plant growth
monitoring and control system for quality agriculture application. With the collection and analytics of one-week weather forecast information, the developed system can optimize the plant growth condition by adjusting major growth parameters including environmental temperature, humidity, soil water and illumination data and controlled actuators for proper irrigation rate, fan operation and ultra-sound water level monitoring. Automated fertilization unit, maintains proper soil pH level required for maintaining the quality of soil and that of the particular crop. A smart farming alternative for small Pomegranate farms of India - The proposed work aims at developing wireless sensor nodes for monitoring soil and atmospheric conditions. Only the automatic system for water irrigation exists. And information for the crop production is available only in agricultural university or lab or its up to the knowledge of farmers. No proper and accurate knowledge about the moisture content and hence this may lead to either crop decomposition or without insufficient water, the crops may destroy. Anomaly detection to enhance the crop productivity in smart farming majorly concentrates on increasing crop production. This is an IoT based project. In smart farming by testing the soil, it helps to display the moisture content and pH value of the soil through the LCD display. This project uses pH and soil moisture sensor to detect the pH value and the moisture content present in the soil. So with these values the crop rotation for cultivation will be displayed. The crop suggestion will be provided based on the obtained pH value, this suggestion will be displayed in the LCD display. Fertilizer suggestion (either organic or synthetic fertilizer) will also be provided for the respective suggested crop. We use IoT to test the soil and provide few details regarding the crops. With these details the farmers find an alternative crop for cultivation. To select the crops for rotation we use
factors like moisture, nutrient status in soil, and the inputs needed to increase crop production (like fertilizer). The consideration of these factors in crop rotation includes advantages like increase of soil fertility, -preventing depletion of selective nutrients and also to prevent the diseases and pests of particular crops and to improve the crop production. In this project, the data collected like pH and moisture values during each testing are generated as graph for analytics and visualization and displayed in ThingSpeak through a Wi-Fi module. This Thingspeak helps to analyze and visualize the datas obtained through sensors in MATLAB.

4 IMPLEMENTATION AND RESULT:

In this section we will discuss about modules which are implemented in proposed framework. Sensor does not need an extra pin to read the soil moisture. The soil moisture sensor data pin, which is directly connected with Arduino board pin number A0. It is an analog pin, the soil moisture sensor provides the output as an analog output voltage. The output voltage is converted to digital value. Arduino has the facility of Analog to Digital conversion (ADC). For power, it is connected with +5V of arduino. And is grounded by connecting with GND of arduino. In program, Arduino Uno performs all the task using analogRead() function and shows the analog value. Thus theArduino UNO and Soil Moisture Sensoris connected, with the above mentioned features. A1 pin of Arduino is connected to the pH Sensor, to read the values of pH Sensor. +5V of Arduino is connected through wire to the ph Sensor and is grounded by connecting it to GND. Receiver (Rx) and Transmitter (Tx) of Arduino is connected to Rx and Tx of Wi-Fi module respectively. And GND of Wi-Fi module is connected with GND of Arduino. The Digital Input/Output pins of Arduino D2,D3,D4,D5,D11,D12 are connected with LCD display.Data like pH and moisture of soil is received and collected in a Master Node. These data is shared on to the cloud, the clients can easily view it by logging in to the account on the cloud. We have used ThingSpeak cloud to update all the data that is received to Master. In our project we use sensors in every node. Most of the electronics devices in homes and vehicles such as automobiles, smart phones,
city infrastructure, industrial equipment, home automation etc are automated by sensors. These sensors will detect and measures the parameters like soil moisture and pH. The sensed data through sensors will be communicated to another end in form of electrical signal and numerical value. The sensor data collected from environment will act as input. In this project we use Thing Speak for storing, analyzing and visualizing the data in cloud. Thing Speak allows the instruments, sensors and websites to send and communicate the data in cloud to store in a separate channel. To access data easily, data must be stored in the cloud. With the presence of online analytical tools, the data can be monitored and can be analyzed at any time through internet. The open source interface API like ThingSpeak always listens to the incoming data, time stamps the incoming data and outputs the data for the users (which is via visual graphs) machines. ThingSpeak is very useful for hardware projects which are smaller, which needs the internet as a connectivity criteria, but in which dedicated common server maintenance is not practical. There are many other IoT services as alternative to this but due to requirement of their functionality to be paid, they are not open source consequently. By the above mentioned functionalities, this project provides crop suggestion for the sensed pH value. And other results like crop rotation and fertilizer suggestion to improve crop production. This improves yield of crop and is economically efficient.

5 CONCLUSION FUTURE WORK:

Thus the proposed and designed system accomplishes a better way to improve crop production. Through collected value from pH sensor and soil moisture sensor, the crop suggestion, crop rotation and fertilizer suggestion for the respective values will be displayed. And the obtained values will be displayed in ThingSpeak as graph. In future, image processing can be included to this system, to provide the information like soil type, to get more accurate crop suggestion for the respective soil type. And an automatic fertilization unit can be included to this system, to reduce the manual work by farmers.
References


[9] Rui Zhang, Ping Ji, Dinkar Mylaraswamy, Mani Srivastava, Sadaf Zahedi, Cooperative sensor anomaly detection using global information, Recent Advances in Electronics and Communication Technology (ICRAECT), 2017 International Conference.

[10] Felix Rembold, Michele Meroni, Ferdinando Urbano, Guido Lemoine, ASAP Anomaly hot Spots of Agricultural Production, a new early warning decision support system developed by the joint Research centre, (ICASI), 2015 International conference.