Soil Health Diagnostics for Agriculture Using Internet of Things

[1]Prajakta Chandwadkar, [2]Anuja Gunjal, [3]Shruti Khedlekar, [4]Sukanya Anap, [5]Prof. N. L. Bhale

[1,2,3,4]Student, [5]Head of Department
Department of Information Technology,
Matoshri College of Engineering and Research Centre,Maharashtra,India

Abstract: In recent Years, agriculture has become increasingly Data-Driven and Data – Enabled due to the use of different technologies such as greenhouse and aquaculture technologies. With the development of agriculture, new technology is required, and the focus is facing towards the smartest technological investment. The increasing demand for the quality and the quantity in the food sector raised the need to intensify and industrialize the agriculture sector. Current work provides empirical measurement results from an Internet of Things (IoT) platform based on remote telemetry applications for agriculture. This article highlights the potential of wireless sensors and IoT in agriculture, as well as the challenges expected to be faced when integrating this technology with the traditional farming practices.

Keywords: Smart Agriculture, IoT, Sensor, Cloud, Nutrients, temperature.

1. INTRODUCTION

Agriculture is considered as the basis of life for the human species as it is main source of food grains and other raw materials. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. The proposed system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility.

Internet of Things (IoT) is widely used in connecting devices and collecting data information. Internet of things is used with IoT frameworks to handle and interact with data and information. In the system users can register their sensors, create streams of data and process information. 'Internet of Things' is based on device which is capable of analyzing the sensed information and then transmitting it to the user.

Current work provides empirical measurement results from an IoT platform based on remote telemetry applications for agriculture. Smart farming based on IoT technologies will enable growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made. Smart Farming is a capital-intensive and hi-tech systems of growing food cleanly and sustainable for the masses. It is the application of modern ICT into agriculture. In this paper, the hardware and software of the IoT for smart farming will be presented besides sharing the successful results.

IoT sensors capable of providing farmers with information about crop yields, rainfall, pest Infestation, and soil nutrition are invaluable to production and offer precise data which can be used to improve farming techniques over time. Many researches are done in the field of agriculture. Most projects signify the use of wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about various environmental factors. Monitoring the environment factors is not the complete solution to increase the yield of crops. There are number of other factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity to a greater extent. Hence Automation must be implemented in agriculture to overcome these problems. So in order to provide solution to all such problems, it is necessary to develop an integrated system which will take care of all factors affecting the productivity in every stage.

Our aims to demonstrate how the processing of Big Data and the concept of Decentralized cloud operation can answer the demands of IoT applications in agriculture and how smart farming will help farmers operate more efficiently and more secured.

2. LITERATURE SURVEY

Paper 1: A Model for Smart Agriculture using IOT.

A Model for Smart Agriculture Using IOT technique can achieve convenient wireless connections only within a short distance. It was published in the year 2016. Resulted in ZigBee with Wings. Complete realtime historical environment information efficient management and utilization of resources.

Paper 2: Automatic Control of Agricultural Pumps Based on Soil Moisture Sensing.

For testing NI MULTISM simulation software Automatic Control of Agricultural Pumps based on Soil Moisture

Sensing. It was published in year 2015. DIAC and TRIAC technique is used. Achieving proper management, saves human power and enhances crop or does not support several water levels and uses old techniques.

Paper 3: Multidisciplinary Model for Smart Agriculture using Internet-of-Things (IoT), Sensors, Sensors, Cloud-Computing, Mobile-Computing Big-Data Analysis.

A model was beneficial for increase in agricultural production and for cost control of Agro Products. Different soil nutrient sensors are not used. It was published in the year 2015.

Paper 4: Automated Irrigation System Using a Wireless Sensor Network and GPRS Module.

A system based on microcontroller, ZigBee and GPRS technologies. It was published in the year 2013. Feasible and cost effective for optimizing water resources for agricultural production. The investment in electric power supply is expensive.

Paper 5: Real –Time Automation and Monitoring System for Modernized Agriculture.

A Bus concept, ZigBee Protocols based on IEEE 802.15.4, Hybrid Network. Monitoring and control of greenhouse parameter in precision agriculture. Not energy saving and data fusion, directions are left for future research.

Paper 6: Smart Drip Irrigation System using Raspberry pi and Arduino

A system automates and regulates the watering without any manual intervention. Sending the emails to the system. It is of year 2013. Failures of any particular part or device is not informed and has to be tested manually. Modules include Raspberry pi, arduino, micro controllers, xbee modules.

Paper 7: An Effective Method for Crop Monitoring Using Wireless Sensor Network.

Methodology WSN with GSM technology.It assures collecting data from various locations previously inaccessible on a Micro-measurement scale. It is of year 2013 providing only precision values that is not accurate and is not cost efficient.

3. ARCHITECTURE

3.1 Problem Statement / Definition

Design and develop a portable affordable instrument to measure soil health parameters- Secondary-nutrients(S), Macro-nutrients (Zn, Fe) along with moisture and temperature.

Nutrient Status of Soils

In India, intensive agriculture has resulted in impressive growth in food grain production powered by improved varieties of seeds, application of fertilizers and assured irrigation. The existing NPK consumption ratio in the country is skewed at 8.2:3.2:1 (2012-2013) against the preferred ratio of 4:2:1.A great variability is observed in fertilizer consumption among States from 250 Kg / ha in Punjab, 212 kg / ha in Bihar, 207 kg / ha in Haryana to 4.8 kg / ha in Nagaland and 2 Kg/ ha in Arunachal Pradesh in nutrient form during 2012-13.

However, imbalanced applications of fertilizers have caused deficiency of primary nutrients (i.e NPK), Secondary nutrients (such as sulphur), and micronutrients (boron, Zinc, Copper etc), in most parts of country.

3.2 Part of Hardware and Software work

Hardware Part:

- The sensor is sending data to the device and both are physically not connected.
- The device is decoding the sensor input to actual values and include timestamp and location details and send the data to cloud IoT hub in JSON format.
- The frequency to send data from the device to the cloud is configurable.
- The number of sensors are configurable – viz: there are multiple sensors.

Software part:

- The data is stored in the cloud database.
- The UI client support 2 kinds of user viz. admin and read only user
- The admin is able to register, update, delete new devices, and sensors using the UI client. Only values from registered devices are displayed.
- The UI is showing the values over period of time in a single graph from multiple devices.
- The graph displayed is filterable based on soil parameter, time interval and location.
- There is option to export data to excel file based on filters soil parameter, time interval and location

Depending on soil health, recommend the favorable crops that can be grown.

3.3 Proposed Architecture

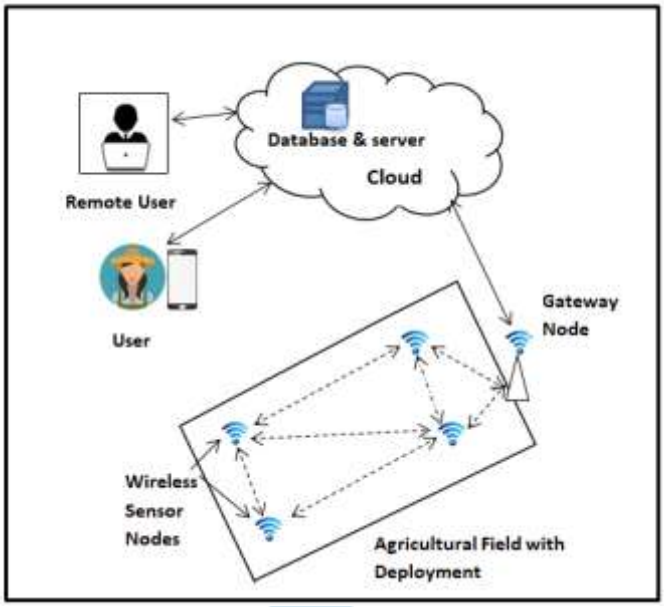

Figure.1. Proposed System Architecture

Cloud: The architectural design to monitor the crops is shown in figure.In this implementation model we used Arduino UNO board, Sensors and ESP8266 Wi-Fi module as an embedded device for sensing and storing the data in to cloud.

ESP8266: The Wi-Fi connection has to be established to transfer sensors data to end user and also send it to the cloud storage for future usage. ESP8266EX has been designed for mobile, wearable electronics and Internet of Things applications. With the aim of achieving the lowest power consumption with a combination of several proprietary techniques. In order to satisfy the power demand of mobile and wearable electronics. All the sensor devices are connected to internet through Wi-Fi module.

Figure.2.ESP8266 WiFi Module

Temperature and Humidity Sensor: We used DHT11 for temperature and humidity sensor. It is suitable for remote applications. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability.

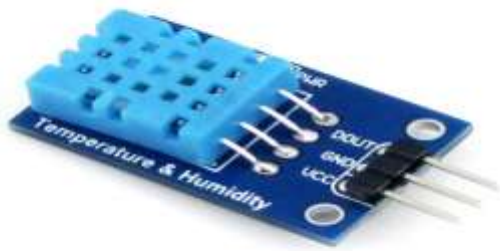

Figure.2. Temperature and Humidity Sensor DHT11

Working on establishing Zinc and Sulphur Sensor: We are developing the Zn and Se sensor by applying the programs on it. This sensor are used as Zinc is an important component of various enzymes that are responsible for driving many metabolic.
Sulphur in agriculture is used for Formation of chlorophyll that permits photosynthesis through which plants produce starch, sugars, oils, fats, vitamins and other compounds Protein production.Sulphur is a constituent of three S-containing amino acids (cysteine, cysteine and methionine), which are the building blocks of protein.

CONCLUSION AND FUTURE WORK

An attempt has been made on the farming domain and its need for the latest technologies in smart farming. Using fixed and mobile sensors, together with mobile devices such as smartphones and tablets, farmers gather data in various formats regarding mainly the crops, soil, and weather allowing them to effortlessly access their data and monitor their crops. The collected data are sent to a core cloud platform where they are processed and analyzed using specific algorithms. The results are sent back to the farmers to improve the agricultural process.

IOT based smart agriculture system can proved be very helpful for farmers since over as well as less nutrients in soil is not good agriculture. Threshold values for climatic conditions like humidity, temperature, moisture can be used based on the environmental conditions of that particular region.By further enhancement of this project farmers can bring large areas of land under cultivation. Only the exact amount of fungicide and pesticide can be used. The system can further been improved by incorporating new self-learning techniques which could deployed in the cloud to understand the behavior of the sensing data and can take autonomous decisions. So the future work include the design of the new more nutrients sensors with also prediction of diseases and pesticides for that particular crop with more accurate result system.

REFERENCES

[1] N. Ahmed, D. De and I.Hussain, "Internet of things (IoT) for Smart Precision Agriculture and Farming in Rural Areas", IEEE Internet of things Journal, vol. 5, no.6,pp.48904899,2018.Available:10.1109/jiot.201828 79579.

[2] Hemlata Channel, Sukesh Kothari2, Dipali kadam3, "Multidisciplinary Model For Smart Agriculture using Internet-of-Things (IoT), Sensors, Cloud- Computing, Mobile- Computing Big-Data Analysis", International Journal of Int. J. Computer Technology Applications, Vol 6, May-June 2015.

[3] Joaquin Gutierrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay and Miguel AngelPortaGandara, "Automated Irrigation System Using a Wireless Sensor Network and GRPS Module", IEEE Transaction on Instrumentation and Measurement, Vol.63, No.1, January 2014.

[4] Meena Kumari G, Dr. V. Vidya Devi, "Real- Time Automation and Monitoring System for Modernized Agriculture", International Journal of Review and Research in Applied Sciences And Engineering (IJRRASE) Vol3 No.1. PP 7-12 March 2013.

[5] Patil K.A, N. R. kale, " A Model for Smart Agriculture Using IoT", International Conference on Global Trends in signal Processing, Information Computing and Communication, IEEE 2016.

[6] N. Shakthipriya, "An Effective Method for Crop Monitoring Using Wireless Sensor Network", MiddleEast Journal of Scienctific Research 2014.

[7] K.lakshmisudha, swathi hegde, neha cole, shruti iyer, " good particularity most stationed cultivation spinning sensors", state-of-theart weekly going from microcomputer applications (0975-8887), number 146-no.11, july 2011

[8] Nikesh gondchawar, dr. r.complexion.kawitkar, "iot based agriculture", all-embracing almanac consisting of contemporary analysis smart minicomputer additionally conversation planning (ijarcce), vol.5, affair 6, june 2016. Overall Journal on Recent and Innovation Trends in Computing and Communication ISSN: 23218169 Volume: 5 Issue: 2 177 – 181

[9] M.K.Gayatri, J.Jayasakthi, Dr.G.S.Anandhamala, "Giving Smart Agriculture Solutions to Farmers for Better Yielding Using IoT", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural.