MANTECH Publications

Journal of Computational Intelligence Theory and Its Applications
Volume 3 Issue 2

A Survey on Smart Agriculture with Cloud Computing Storage Using Internet of Things

Ajith Jerom B[1], Rajamohana Sp[2]

PG Scholar[1], Assistant Professor[2]

Department of Information Technology

PSG College of Technology Coimbatore, Tamil Nadu.

Corresponding Authors Email Id:-ajith.jerom.95@gmail.com, monamohanasp@gmail.com

Abstract

Agriculture plays vital role in the development of agricultural country and agriculture is the back bone of India. In India about 70% of population depends upon framing and one third of the nation's capital comes from framing. Issues about the agriculture have been always hindering the development of the country. The perception of smart agriculture is flattering a truth as it involves different models for the development of crop at different stages. In traditional agriculture, cultivation of plants, vegetables, fruits will be used to sustain and enhance human life. In our nation cultivation is much reduced due to lack of interest, scarcity of agriculture land water and some framers with their own interest still cultivating the land at present. But that was also yields to very less production due to lack of awareness about the dry lands, no usage of pesticide timely and suitable crops for the land. Hence now days the smart agriculture has come into the depiction globally that helps in increasing and the productivity and solving issues caused due to the critical environment factors. This paper surveys about the using of IoT sensors with the cloud environment for testing and monitoring the soil. Testing the soil type and quality consists of many tests, such as bulk density test, respiration test, moisture test and also it is important to check the water quality. In viewing of the results obtained by the above tests the device suggests the crop for the framer and it also helps him for the maintenance of the crop.

Keywords: *Internet of Things (IoT), Cloud Computing, Sensors, Smart Monitoring.*

INTRODUCTION

Agriculture is considered as the basic necessity for the human life and it is the main source for food grains and other raw materials. It had the least exposure to technology but through the technology reaching every nook and corner of the globe, the agricultural landscape is also moving towards the modernization [1]. Technologies [2] like cloud, Internet of Things(IoT), and Big Data are revolutionizing the global agricultural industry leading to an increase in crop productivity. In such a scenario, Internet of Things (IoT) based system for agriculture is proving to be latest technology trend within the industry. Indian agriculture sector is in a difficult phase due to the lack of mechanization and death of technological advances. Smart agriculture is a technique of implementing Internet of Things (IoT) in agriculture to solve many issues. Internet of Things is the integration of sensors and other devices connected to the internet through a wired or wireless medium for communication. IoT consists of things that are connected anytime, anywhere which enables remote access of resources [3]. Climate change affects agriculture in a number of ways, including changes like average temperature, rainfall, carbon dioxide, humidity, soil moisture and ground level zone concentrations. Hence it is necessary to implementing Internet of Things (IoT) which increases the productivity [3]. So experts says IoT could play a crucial role in meeting this need when it is combined with big data and cloud, it can done for improving the efficient uses of input like fertilizers, soil and pesticides, monitoring the livestock, predicting diseases, scanning storage capacities like water tanks and making sure that crops are fed and watered well [1]. Framers need a wide variety of data and services to improve the crop production based on crop, water, climate, availability, conditions, irrigation and finance facilities etc., Cloud computing [4] has been for storing the agriculture data that is sensed by the sensors. Cloud supports various services for farmers that are to interact with the cloud by using any cheaper ways like sensors, mobile devices, pc, laptop etc. The data are stored in methodological form [5] and they are collected by sensor, GPS. The data also defines some of the parameters like soil texture, humidity, wind speed, rain amount. The user can obtain the detail information about the crop which is required to increase the production. Cloud in agriculture helps the framers to increase our economic level. In this paper we described how the sensed data will be processed and stored in cloud. This will be

very helpful to framer who are away from the land and improves the crop cultivation.

LITERATURE SURVEY

IoT [7] is a kind of intelligent technology, including identification, sensor and intelligence. IoT defines as the time changes of cloud computing. It is now defined as IoT with the combination of cloud computing + ubiquitous network + intelligent sensing network. In another name Cloud computing management platform is the "brain" of cloud computing. Through IoT, it develops an enormous number of smart tags interacting with outside world or sensors and transmitting information to each other with decentralized and central systems.

Ubiquitous network includes various number of features like 3/4G, GSM, WLAN, LTE, RFID, ZigBee, NFC, blue tooth and other wireless communication. Other than the above features it also includes optical cable and other wire communication protocol and technology. Cloud computing is related with new pattern for the establishment of computinginfrastructure and big data processing method for various resources. The determination of cloud computing is to access large amounts of computing power, through the aggregation of resources and to provide a single system view. Cloud computing is becoming a powerful architecture to perform large-scale and complex figuring, and has transfigured the way that computing infrastructure is vague and used. In addition to that, an important goal of these technologies is to deliver feasible solution for tackling big data, such as large-scale, multi-media and high dimensional data sets [6].

THE STUDY AND APPLICATION OF IoT TECHNOLOGY IN AGRICULTURE

The authors aim at developing software for monitoring the fields. The critical temperature, humidity and soil signals gathered from sensors are transmitted by a wireless network through M2M (Machine to Machine) platform. The software design includes user interface module, network communication module, data collection module and data processing module[8].The temperature sensor directly turns the temperature signal to digital signal which is read by the MCU (Micro Control Unit). Humidity sensor gathers the analog signal from the fields but MCU cannot read analog signal hence AD convertors are used to convert the analog signals to digital signals. These processed data are moved to cloud storage. The advantage of this

technique gives high performance and it user friendly [3].

SMART AGRICULTURE BASED ON CLOUD COMPUTING AND INTERNT OF THINGS

Smart Farming [7] IoT interconnects the information sensing devices such as RFID, sensors, GPS system, and two dimensional codes according to pre-determined protocol. It exchanges the information through wired or wireless network. Cloud computing, visualization and SOA technology helps to monitor the plant factory for agriculture modernization and enhance the productivity of crops through Internet of Things (IoT).

Cloud computing is based on internet enabled computer and other resources to access the hardware and software. The cloud platform involves four layers namely physical layer, resource pool layer, management and middleware layer and SOA construction layer. One of the biggest advantages in cloud is that the end user does not need to have a professional knowledge about cloud. Internet of Things enables to remote access of resources. It consists of three layers namely sensing layer, delivery layer and control layer [2].

The sensor layer is responsible for numerical sensor of physical values in agriculture production. The cloud storage is responsible to store the data that is being sensed from the sensors. Gateway can be an essential component of an IoT system. Gateway is considered as a physical device or software program that works as the connection point between the cloud and controllers. All the sensor data's are moving to cloud, or vice versa, goes through the gateway, which can be either a dedicated hardware appliance or software program. The sensors can generate tens of thousands of a data points per second. A gateway provides a place to preprocess the sensed data locally at the edge before sending it on to the cloud. Hardware resources are integrated by visualizing technology to achieve dynamic distribution of resources and load balancing. This technology includes tracing and controlling farm security. It takes record of quality and security related information in logistic process.

SMART MONITORING SYSTEM ON SOIL

Monitoring the soil is very much important due to climate change. Monitoring the soil using sensors [5] with IoT technology, the parameters like pH rate, temperature, water level can be monitored using wireless

sensors network. The pH rate, temperature can be monitored regularly and the information can be accessed from the mobiles via wireless network. If the user notices any abnormalities, they can immediately notice their land and use pesticides to overcome the abnormalities. The remote monitoring of oil pH rate and its temperature has been done with minimal cost. The data can be viewed by the framer from anywhere in the world at any time. Hence this system gives more accurate pH rate and temperature value of the soil which plays vital role in the agriculture. The sensors like temperature, Humidity, soil moisture can be interfaced with microcontroller to assess any further data.

A reliable and targeted for continuously monitoring system towards the framers land can be successfully built with these components. The resulting system was also low in cost and in power. After the data sensed by the sensors the data can be further moved to cloud using a Wi-Fi connection to any database as per the user's wish. On the cloud, sever side application will then crunch the stored values to provide a customized feedback tailored to each user via a web.

Soil Testing

In paper [4] there are three different methods has been carried to test the soil, they are moisture test, respiration test and bulk density test. Soil moisture test is to be performed first because it plays a key role in exchange of water and heat energy between the land surface and the atmosphere, through evaporation and plant transpiration.

Figure 1: IoT in Smart Farming

By considering the soil moisture test results we can perform further tests too like soil respiration. During the growth of the crop at different stages we need to give the pesticides according to its level of growth so that healthy crop can be maintained. The pesticides which we give to the crop should be given at minimum level because if wegive a high level of the pesticide the crop may damage and it also affects the soil nutrients in the land. By using the Soil Quality Testing using Sensors in Smart Agriculture for Crop Production and Maintenance we can have an effective growth of the crop and the crop health can also be maintained. As we use less quantity of the pesticides the soil will not be affected and this also lowers cost in the crop production.

SENSORS

Temperature Sensor

The DS18B20 temperature sensor offers 9-bit to 12-bit Celsius temperature measurements and has alarm function with non-volatile user-programmable upper and lower trigger points. The DS18B20 has 64-bit serial code which allows multiple DS18B20's to function on same 1-wire bus [12].

Technical Specifications: Unique 1-wire Interface; Measures Temperature from -55^0C to +125^0 C; Converts temperature to 12-bit digital word in 750ms.

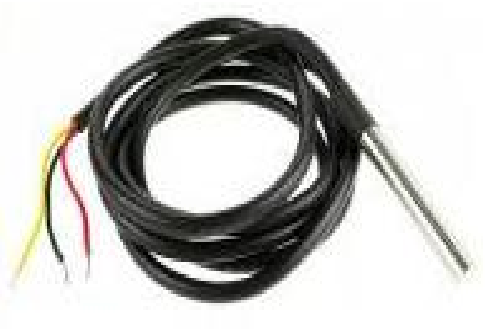

Figure 1: DS18B20 Waterproof Temperature Sensor

Soil Moisture Sensor

The working principle of Soil Moisture Sensor is to measure the moisture in soil and similar materials. The sensor has been designed with two large exposed pads which work as probes for the sensor, together acting as a variable resistor. The moisture level in the soil would be detected by this sensor. Whenever the water level became low in the soil the analog voltage will be low and this analog voltage keeps increasing as the conductivity between the electrodes in the soil changes [12]. The sensor can be used for watering a flower plant or any other plants require automation.

Technical Specification: 3.3V to 5V; ***Analog Output***; VCC external 3.3V to 5V.

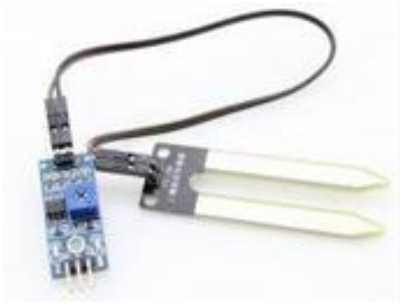

Figure 2: Soil Moisture Sensor

DHT11 Humidity Sensor

DHT11 is a Humidity and Temperature Sensor, which provides calibrated digital output. DHT11 can be interfaced with any microcontroller or core controllers like Arduino, Raspberry Pi, etc. and get instantaneous results. The cost of the sensor is a low which provides high reliability and long term stability. It is a part of DHTXX series of Humidity sensors. The other sensor in this series is DHT22. Both these sensors are Relative Humidity (RH) Sensor. As a result, the sensor will able to measure both the humidity and temperature. Although DHT11 Humidity Sensors are cheap and slow, they are very popular among hobbyists and beginners [10].

Technical Specification: Measurement Range from 20-90%RH 0-50 ℃; Humidity Accuracy from ±5%RH; Temperature Accuracy from ±2℃.

Figure 3: Humidity Sensor

Analog pH sensor

Analog pH meter is specially designed for Arduino controllers and has built-in simple convenient and practical connection and features. The sensor has an LED which works as a Power Indicator, a BNC connector and PH2.0 sensor interface. It is simple to use, just connect the pH sensor with BND connector, and plug the PH2.0 interface into the analog input port of any Arduino controller. If pre-programmed, you will get the pH value easily [11].

Technical Specification: Module Power from 5.00V; Module Size from43mmx32mm; Measurement Range from 0-14PH; Measuring Temperature from 0-60^0 C; Accuracy from 0.1pH.

Figure 4: pH Analog Sensor

CONCLUSION

In this paper we obtained a survey about the IoT applications, the sensors that are being used to monitor the agriculture in real time [1]. In addition to that modern agriculture becomes more reliable with the help of the Internet of Things (IoT). Through IoT, the soil, water, plants can be monitored in real time and brings more productivity in the agriculture. With the cloud storage the sensed data's are stored and used for predictive analysis in future.

REFERENCES

I. R. sujatha, R.AnithaNithya"A Survey on soil Monitoring and Testing In Smart Farming Using IoT and Cloud Platform", International Journal of Engineering Research and Application ISSN: 2248-9622, vol. 7, Issue 11, (Part-6) November 2017, pp.55-59.

II. TongKe F. "Smart Agriculture Based on Cloud Computing and IoT"[J]. Journal of Convergence Information Technology, 2013, 8(2).

III. Ramya.B, Tamilarasi.T, Tharani.J, E.A. Mary Anita "A Survey on Smart Agriculture using Internet of Things" International Journal of Engineering Research and Technology(IJERT) ISSN:2278-0181 NCICCT-2018.

IV. PaleDivyavani,RaghavendraRao,"Measurement and Monitoring of Soil Moisture using Cloud IoT and Android System",Indian Journal ofScience and Technology Vol 9(31),(31):1-8 · August 2016.

V. K.Spandana 1 , SaiSupriya KPL," A Survey on Soil Quality Testing using Sensors in Smart Agriculture for Crop Production andMaintenance using Internet Of Things", International Journal of Engineering Trends and Technology (IJETT) – Special Issue – April 2017, ISSN: 2231-5381,165-169.

VI. Kiran R. Biduaa, Dr. Chhaya N. Patela,"Internet of Things and Cloud Computing for Agriculture in India",International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 12, 2015.

VII. Ms. G. Rekha , S. MuthuSelvi,"Android Arduino Interface with Smart

FarmingSystem",InternationalJournal Of Engineering And Computer Science ISSN:2319-7242,Volume 6 Issue 3 March 2017, Page No. 20521-20526.

VIII. Zhao, Ji-chun, Jun-feng Zhang, Yu Feng, and Jian-xinGuo. "Thestudy and application of the IOT technology in agriculture." InComputer Science and Information Technology ICCSIT, 2010 3rdIEEE International Conference on, vol. 2, pp. 462-465. IEEE, 2010.

IX. What is IoT gateway? –Definition from Whatlss.com, https://whatis.techtarget.com/definition/IoT-gateway.

X. DHT11 Humidity and Temperature Sensor on Arduino with LCD, https://www.electronicshub.org/dht11-humidity-sensor-arduino/.

XI. Analog pH Meter Kit- SGBotic, https://www.sgbotic.com/index.php?dispatch=products.view&product_id=1454.

XII. AnandNayyar, VikramPuri "Smart farming: IoT based sensors agriculture stick for live temperature and moisture monitoring using Arduino, cloud computing and solar technology" In Research Gate Publications Conference Paper: November 2016.