Design and implementation of WSN for Precision Agriculture using cloud

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Abstract

Precision agriculture(PA) is an approach to manage farm by using the information technology (IT) to ensured that the crops and soil level are received exactly what they are needed for optimum healthy and productivity. The goals of the PA is to ensured that they are profitability, sustainability and the protection of the environment. It is also known as the satellite agriculture, and site-specific cropping management (SSCM).It relies upon the specialized equipment, software and IT services. This approach includes the accessing real-time data about the condition of the crops, soil and the air, along with their other relevant information such as hyper-local weather predictions. This project covered the development and the application of wireless sensor network techniques in PA . Remote sensing, field data collections, environmental monitoring and variable rate technologies in agriculture. The current status and future needs and potentials of using the wireless sensor networks in the precision agriculture are implemented. This project proposed the development of the sensor node are capable of measuring all the parameters and creating the actuation signal for all the actuator and sending the data to the cloud. When any critical changes appeared an automatic message is sending to the farmers mobile using the message API.

Keywords: precisionagriculture(PA),wirelesssensornetwork,remotesensing,sitespecificcroppingmanagement.

I . Introduction

Precision agriculture is an approach in which the agricultural crops are fed with the optimum amount of resources required by the crop for exact duration of time. Traditional irrigation process has a typical time based watering(irrigation) practice in which farmer used to irrigate the crop after certain amount of time .But problem with this approach is that sometimes that crop doesn't need water so early so ultimately that leads to wastage of water and sometimes crop needs water a bit early .So to overcome such issues this paper presents a soil moisture detection sensor to get soil moisture content so that crop can be irrigated accordingly. Soil moisture is important for the physical structural strength of plant while temperature , humidity and the light is required for photosynthesis process.This paper proposed the development of sensor node which is capable of generating control signal for any actuator and simultaneously sending data to the cloud .All data from sensor node is sent to the cloud storage. A mobile application ha been developed to visualize the data in a smart phone.

Traditional irrigation process has a typical time based watering (irrigation) practice in which farmer used to irrigate the crop after certain amount of time (typically few days). But problem with this approach is that sometimes that crop doesn't need water so early so ultimately that leads to wastage of water and sometimes crops needs water a bit early. So to overcome such issue this paper presents a soil moisture detection sensor to get soil moisture content so that crop can be irrigated accordingly. This also helps in preventing the over irrigation because apart from water wastage over irrigation can sometimes leads to diseases in crop. Like soil moisture, Temperature and Relative humidity along with light illumination around the plant is also key parameter to control.

II. LITERATURE SURVEY

Kiruthika M et al.,(2015) the need of wireless sensor network in the agricultural field so as to increase the productivity. Author also explains the need of precision agriculture in current scenario of agriculture particularly in India. The paper shows the architecture for analyzing and monitoring of the environment parameters.

J. Shenoy et al.,(2016) possible solution in reduction of transport cost for agricultural products, also predicts the prices of crop based on past information and present market scenario. It also gives a solution of reducing middle mans who normally tends to get more profit share than producers and consumers. This solution helps to bridge a communication gap between farmers and agricultural product buyer.

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Sheetal V et al.,(2016) try to solve the problem in the crops due to unequal rain distribution by controlling the environment parameter i.e. soil ph and moisture. An Arduino is used as a controlling unit. It controls the process along with communication process as well.

Brewster C et al.,(2017) the technological constraint and challenges which have to cater while deployment of IoT based low scale pilot project in agriculture domain . This paper states a conceptual idea for all the stages of agricultural products namely food production, processing, distribution and the retail market.

Prem P Jayaraman et al.,(2015) presented semantically improved digital farming with the help of use case Phenonet with IoT platform which is an open platform in paper [10]. They have also developed and demonstrated interoperability of this platform in addressing the technological challenges faced by application.

Tanmay B et al.,(2016)system capable of identifying rodents in grains stores is designed in paper [6]. The system in this paper is also capable of acquiring data and analyzing data. The PIR sensor, ultrasonic ranging device, web camera and ultra sound repeller are used as the sources of data. Along with it, it also used Raspberry pie as data gateway in the system.

Suraj P T et al.,(2017) present a system termed PATRIOT which depicts the gradual and feasible development and implementation of Internet of the thing in the domain of Agriculture. It emphasis on the concept accessing data in anytime and from anywhere using IoT.

III . PROBLEM DEFINITION

No proper data analysis manually.No steps taken in the absence of farmer.No improvement in the field during the farmers absence.Manual monitoring and manual control which leads to delay in field management. Climatic factors such as temperature, solar radiation, relative humidity, soil moisture, wind, etc. influence the performance of seasonal crops, as they affect plant growth and physiological processes related to the formation of grain. These factors also affect performance indirectly increasing damage caused by pests and diseases. The recommended Quantity of irrigation or soil moisture level is essential to maintain proper nutrient management, of weeds, pests and diseases. Transient crops grow in damp, warm environments where insects and pests also thrive and damage the crops.

ADVANTAGES: Fast data communication.Complete Website development for wireless monitoring.Alert to the farmers number using message API.Enhancing agricultural field in the farmers absence .Growth in the cultivation .Maintains soil fertility in farmers absence .Proper measurement and use of fertilizers.

IV . PROPOSED SYSTEM

This project proposes the development of the sensor node capable of measuring all the environmental parameters andcreating the actuation signal for all the actuator and sends data to the cloud where the data can be monitored using the website that is developed completely for this application. And also, when any critical changes appear an automatic message is sent to the farmers mobile using the message API. We have also focused on transmitting of data at the faster rate with the help of advanced techniques using cloud computing and website designing techniques. Animal farms require healthy stock to provide maximum profits. Many detectors have been developed to monitor the individual health of animals. These wearable sensors monitor various health indicators to identify disease and infection.

The success of crop farming relies on proper irrigation. Under-watering reduces nutrient uptake while over-watering causes leaching which poisons ground waterAdvantages of the system are low power consumption, reasonable cost, long power life due to the solar cells and efficient water management. The study showed that a wireless sensor based irrigation system is an effective solution to cut water use.The Fundamental concept of work is expressed in which consists of various components namely humidity & temperature sensor ,Soil Moisture sensor, Microcontroller unit (MCU) along with WiFi module wifi router , thingspeak cloud and finally the mobile app.soil moisture measurement is done by using YL – 69 electrode. There are two terminal in electrode between which the

resistance is measured. with change in the soil moisture the resistance between this two point changes .so this change in moisture the measure of amount of moisture in the soil YL-38 is a chip which is used in the proposed work to convert change in resistance into analog voltage .It is fed with the 3.3v supply so it gives output from 0 to 3.3 v. output of this chip is fed to MCU unit as shown in figure.

It has also got a Digital output pin using which actuator signal can be generated locally. Set point is adjusted using on chip potentiometer. DHT 11 is used to sense relative humidity and temperature of surrounding atmosphere.DHT 11 is a single device with having both humidity sensor and temperature. It sense humidity using capacitive sensing technology and senses temperature using thermistor embedded inside the small cabinet. It gives output in digital pulse form so it is connected to the digital input of MCU. As this sensor gives data in pulse form, data gets updated every 2 sec, but the targeted process in the proposed paper is very slow so it is not an issue for us. NodeMCU is a microcontroller unit which is used as an MCU in the proposed system. It is a development prototyping kit based on ESP8266.

Apart from GPIOs, it also comes with PWM capability, an ADC for the analog input all in the single board. It is actually an open source platform for development of IoT application. It also has firmware which help in running the WiFi SOC based on ESP8266.NodeMCU basically collects the data from all above mentioned sensor at its GPIO pins. Data from DHT11 is given at GPIO 0 of NodeMCU while analog data from soil moisture is given at analog input of NodeMCU which got 10 bit inbuilt ADC. It converts 0 to 3.3v analog signal to 0 to 1023 count. Soil moisture data is mapped into the percent value so that it can be interpreted well. Arduino IDE software is used to do programming of the MCU. It is again a platform which is utilize to program such prototype board. For testing purpose wifi hotspot tethering of the cell phone is used as a wifi router. SSID and passwords are used while coding the board so that board can connect to the internet using hotspot tethering of cell phone.

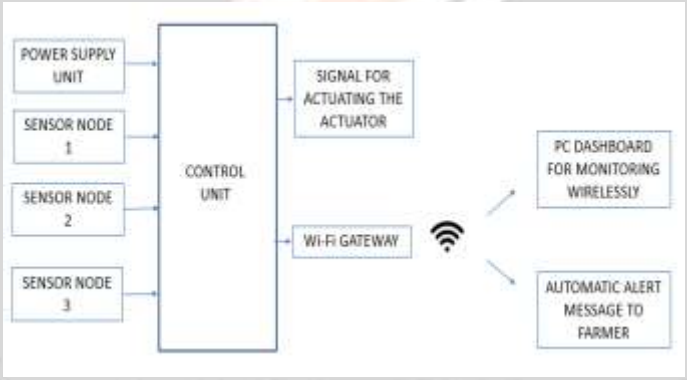


Fig 1 Block diagram of proposed system

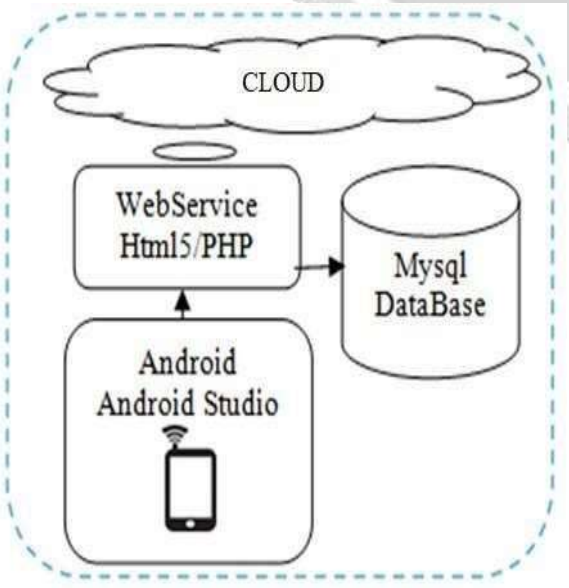


Fig 2 Movil Architecture and Data Cloud

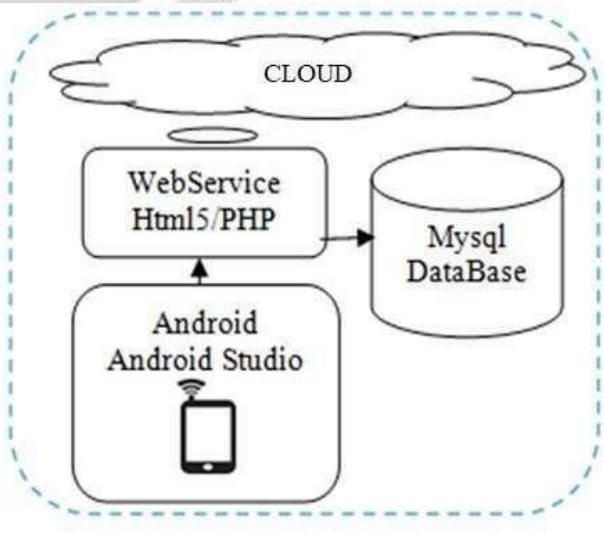


Fig 2 Movil Architecture and Data Cloud

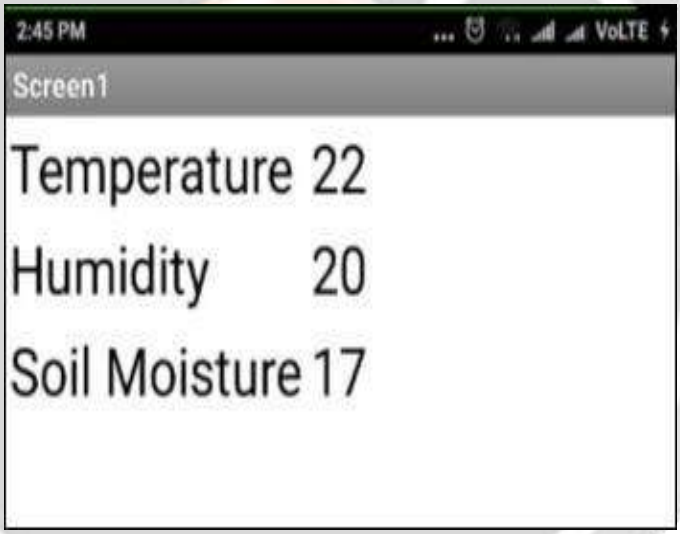
An API key is generated with the channel which is also used while coding the board. Three analog value has been sent to that field where we have graphical presentation of the information. The very basic mobile application is developed for the prototype. App inventor tool is used to develop the mobile app. It is a cloud based tool which allows us to build app in the web browser itself.

ALGORITHM:

MQTT(Message Queuing Telemetery Transport) protocol algorithm .This is broker between user and cloud.

V . RESULTS AND DISCUSSIONS

In the proposed work the output of the proposed work is actually visualized in the thingspeak platform. The graphical representation of the data sense at the agricultural field is given in the Charts. The temperature of the surrounding environment obtained at thingspeak , similarly Relative humidity and the soil moisture sensor data . As discussed earlier the mobile application has been created to visualize the data in the cell phone. The data from thingspeak cloud has been exported using the api key and URL for feed status is used for each field of particular channel. Field 1, Field 2 and field 3 shows the graphical representation of surrounding air temperature, Humidity and soil moisture sensor readings. All the data are exported to mobile application as shown in Fig. 3



Screen shot of mobile application

VI . CONCLUSION

An electronics system has been proposed that includes a sensor node along with the IOT application in the domain of agriculture. The proposed system is capable of sensing data and controlling the parameter locally, simultaneously it sends data to the thingspeak cloud which further is accesed by the user in the mobile phone. In future this work can be carried out by improving the usage of mobile app like adding alarms if particular parameter is not controlled properly. In the proposed system set point for relative humidity, soil moisture and surrounding temperature is mention during coding of the MCU now to make this prototype more practical these control of setting the set point can be given to the mobile app itself.

VII . REFERENCES

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