International Journal of Modern Electronics and Communication Engineering (IJMECE) ISSN: 2321-2152
Volume No.-7, Issue No.-3, May, 2019

Smart Sensors Based Agriculture Monitoring System Using IOT And Cloud

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Abstract: The on-demand self service nature of internet technologies has dramatically changed the way of human livelihood as well as what and how information is managed. India is an agricultural country where 70% of the population's livelihood depends on agriculture and it has been practiced for ages. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic. India cannot achieve a sustained progress in agriculture unless the cropped area is brought under assured irrigation. Soil moisture plays a key role in the life of the plant. The aim of this project is to design a smart sensors based agricultural monitoring system. The proposed work is about having control over the irrigation and monitoring of the agricultural field using IoT. In this, a technique is developed to acquire the soil moisture and temperature values from the fields using sensors. Also, as per the values obtained from the sensors, the motor switches on/off automatically. The system connects physical sensing devices with the cloud through which the control mechanism is monitored using cloud. The farmers can also see the sensory data using their desktop or smart phones and decide the course of action. By using this system, it not only saves the water resource but also increases the quality of yield.

Keywords: Agriculture, Arduino UNO R3, Cloud, IoT, Soil moisture sensor.

I. INTRODUCTION

Agriculture is the science and art of cultivating plants and livestock. Agriculture is the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that enabled people to live in cities. It is the most important sector in the Indian Economy. Indian agriculture sector accounts for 18 per cent of India's gross domestic product (GDP). India is the world's largest producer of pulses, rice, wheat, spices and spice products. India has emerged as the second largest producer of fruits and vegetables in the world [1].

Indian agriculture is being plagued by various problems. These problems directly and indirectly affect the life of a farmer. Farming practices and other activities of agriculture consume time as well as the efforts of a farmer. The grains are stocked and used throughout the year. These food crops are cultivated to contribute to the overall growth in the sector of agriculture. Nevertheless, the problems faced by farmers go unnoticed in the entire process of extracting food and harvesting crops [2].

One of the most common problems is with farm irrigation systems. Starting an irrigation cycle too early and/or running an irrigation cycle too long is considered over watering. At the very least this practice wastes water and money. Another challenge faced by the farmers is the unpredictable climatic changes. No industry is more dependent on predictable weather and climate patterns than agriculture. Volatile climate changes create enormous challenges to meeting the needs of the world's growing population [3].

The growing and changing demands need to be met by an agriculture industry that is facing labour shortages and rising costs for farm work. Many farmers are facing a dilemma between wanting to produce more, higher-quality crops and finding the workers to plant, maintain, and harvest those crops. Technology will play a key role in helping the food and agriculture sectors adapt to these climatic changes. Modern communications infrastructure, especially insuring up to date broadband in rural areas, will help get better information to farmers and food producers. Also conservation measures are embedded into crop production practices, and provide weather forecasting infrastructure with modern communications technologies. Speedy and reliable weather information is crucial to producers facing climate change risks [4]. Figure 1 show about the automation done in agriculture using technology.

Figure 1 Automation in agriclture.

II. RELATED WORK

S. Darshna, Jianfa Xia et al [5], Zhenzhou Tang et al [8], Joaquín Gutiérrez et al [9], have proposed a design in developing a smart agriculture system that helps the farmers and others users to automate their land for better productivity and conservation of the resources such as water. The control over the irrigation and monitoring of the agricultural field are the main activities to be considered for automation. ESP8266 a Wi-Fi module [15] [17] is used for communicating the sensor data with the server. Weather Forecasting (temperature and humidity) [7] [10] and monitoring the water level[12] of the well are the water resource for the field are added advantages of the system. The data sensed from the fields are being stored and analysed in the cloud server (Thingspeak) [18]. The system gives the LCD display about the current temperature and humidity values in the form and can be checked any time. All these integrate into a system [11], [13], [14] and form a possible solution for the farmers to irrigate their fields automatically by switching on/off the motor based on the soil moisture content and also is aware of the climatic changes in the fields. SMS [6] can also be sent to the farmers their will improve the cultivation method and also reduce the human factor, energy and power. The system can be easily upgradable with any module to make it efficient.

III. PROPOSED SYSTEM

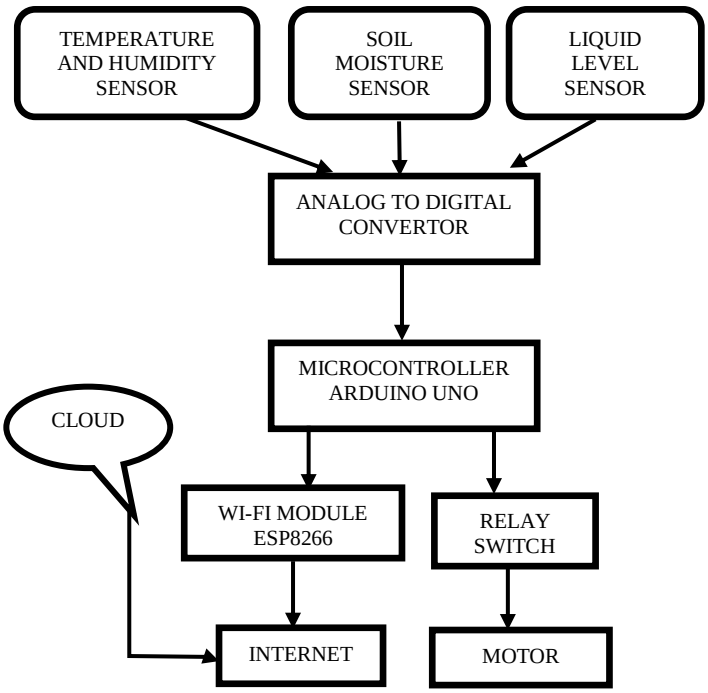

Figure 2: Block diagram of the agriculture monitoring system

In Figure 2, the basic proposal of the project to make farmers life easier is shown. Here the sensors are deployed in the field that continuously monitors the field parameters. The sensory data that is collected is being stored and analyzed in the cloud and also can be viewed around the globe. The system is a combination of wifi module (ESP8266) and cloud provider. Also sensors such as temperature and humidity sensor, water level sensor and soil moisture sensor are used.

An embedded system is proposed to design a low cost and smart agricultural monitoring device for the farmers. It helps the farmers to reduce the human factor, energy and power and improve the cultivation methods. The design proposes automation in irrigating the field, monitoring the climatic changes and to check the level of water resources being used. The hardware setup at the field consist of wi-fi module, sensors such as soil moisture sensor, temperature and humidity sensor and float sensor and a relay connected to the microcontroller arduino uno r3 board. Also cloud services are used for storage and analyzing the data. When the power supply is switched on, 230 V AC is stepped down to 5V AC current which is given as the power input for microcontroller board. The wi-fi module connects with the internet and starts transmission of the sensed data from the field and stores the values in the cloud storage. When the soil moisture value falls below the threshold value, the relay starts the motor to irrigate the field and stops until the value reaches above the maximum threshold value. And also a message is sent to the farmer about the field conditions. Using the cloud services data can be viewed from around the world. Thus this enhances better productivity and conservation of resources such as water.

Figure 3: The hardware setup of the agricultural monitoring system

The hardware implementation of the agriculture monitoring system is shown in the figure 3.This consist of the sensors that

is powered using a battery is connected to the microcontroller, relay and a wifi module.

IV. RESULTS

When the soil moisture value fall below 30%, then the arduino sends signal to start the motor using the relay (Figure 4). The water from its resource is used to irrigate the plant until the soil moisture reaches its maximum. When the threshold value is reached, the relay signals the motor to stop (Figure 5).

Figure 4: The relay signals the motor to start watering the plant when moisture level falls below the threshold.

Figure 5: The relay stops the motor when the maximum is reached.

All these data are updated to the cloud channel every minute simultaneously. The data can be viewed as numeric value or as a chart that records the data against time (Figure 6 and 7). Also the data can be viewed in their smart phones anywhere and anytime (Figure 8).

Figure 6: A view of the temperature and humidity values in the website.

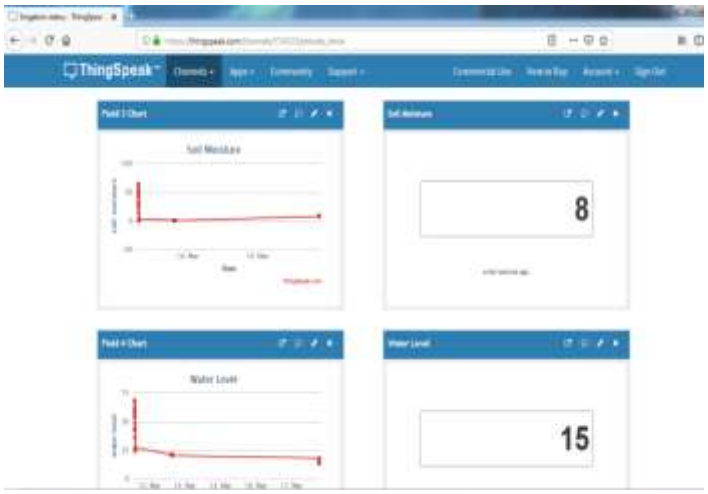

Figure 7: A view of the soil moisture and water level values in the website.

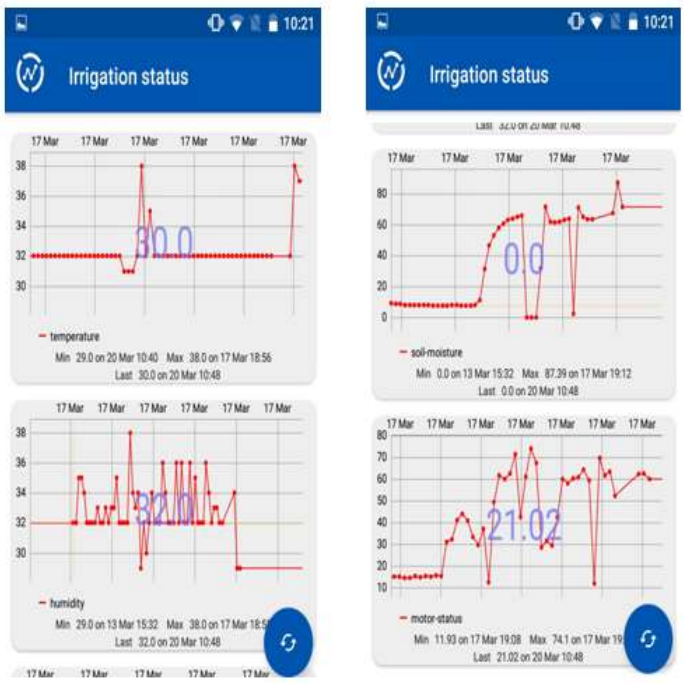

Figure 8: A view of the temperature, humidity value (Left), soil moisture and water level (Right) in the smart phone.

V. CONCLUSION

Thus with an advanced internet technology a smart agriculture monitoring system is designed by which the agricultural methods and practices are being replaced and enhanced by more sophisticated and accurate digital and electronic device. Internet of Things converge with cloud, has made the agriculture crop monitoring system easy and efficient. This enhances the productivity of the crop and also it increases the profits for the farmer. Sensors of different kinds are used to gather the information of crop conditions and environmental changes. This information is transmitted through network to the farmers' device that initiates corrective actions. Farmers are connected and aware of the conditions of the agricultural field at anytime and anywhere in the world. This will assist farmers in increasing the agriculture yield and take care of production as the kit will always provide helping hand to farmers for getting accurate live feed of environment temperature and soil moisture.

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