IOT Based Smart Farming using Cloud Computing

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***Abstract*—Internet of Things (IOT) technology has brought revolution to many field of common man's life by making everything smart and intelligent. This paper, propose a Smart Farming IOT based Agriculture System assisting farmers in getting Live Data (Temperature, Humidity, Soil Moisture, Electrical conductivity, pH) for efficient environment monitoring which will enable them to do smart farming and improve their overall yield and quality of products. The Agriculture system proposed in this paper is integrated with Arduino Technology with various sensors and live information feed can be obtained online from thingspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy in data feeds.**

Keywords*— *Internet of Things (IOT), Smart Farming, Soil moisture sensor, Temperature & Humidity sensor, pH sensor, Soil electrical conductivity sensor, Arduino Uno, Cloud computing.

I. INTRODUCTION

THE WORLD IS TRENDING TOWARDS NEW TECHNOLOGIES AND IMPLEMENTATIONS IT IS A NECESSARY GOAL TO TREND UP IN AGRICULTURE TOO. MANY RESEARCHES ARE DONE IN THE FIELD OF AGRICULTURE AND MOST OF THEM SIGNIFY UTILIZATION OF WIRELESS SENSOR NETWORK THAT COLLECT DATA FROM DIFFERENT SENSORS DEPLOYED AT VARIOUS NODES AND SEND IT THROUGH THE WIRELESS PROTOCOL. THE COLLECTED DATA GIVE THE INFORMATION ABOUT THE VARIOUS ENVIRONMENTAL FACTORS. MONITORING THE ENVIRONMENTAL FACTORS IS NOT THE COMPLETE SOLUTION TO INCREASE THE YIELD OF CROPS. THERE ARE NUMBER OF OTHER FACTORS THAT REDUCE THE PRODUCTIVITY. HENCE, AUTOMATION MUST BE IMPLEMENTED IN AGRICULTURE TO OVERCOME THESE PROBLEMS. IN ORDER TO PROVIDE SOLUTION TO SUCH PROBLEMS, IT IS NECESSARY TO DEVELOP AN INTEGRATED SYSTEM WHICH WILL IMPROVE PRODUCTIVITY IN EVERY STAGE. BUT, COMPLETE AUTOMATION IN AGRICULTURE IS NOT ACHIEVED DUE TO SEVERAL ISSUES. THOUGH IT IS IMPLEMENTED IN THE RESEARCH LEVEL, IT IS NOT GIVEN TO THE FARMERS AS A PRODUCT TO GET BENEFITTED FROM THE RESOURCES. HENCE, THIS PAPER DEALS ABOUT DEVELOPING SMART AGRICULTURE USING IOT AND GIVEN TO THE FARMERS.

II. LITERATURE REVIEW

In this paper [1] explain an IOT based crop-field monitoring and irrigation automation system. In this, to monitor crop-field a system is developed by using sensors and according to the decision from a server based on sensed data, the irrigation system automated. With the help of wireless transmission the sensed data forwarded towards to web server database. The irrigation is automated, if the moisture and temperature fields fall below of the potential range. The user can monitor and control the system with the help of application which provides a web interface to the user. In [2] proposed a smart drip irrigation system. Here, an Android mobile application is used to minimize the involvement of human and it used to control, monitor the crop area remotely. Water wastage can minimize with Drip Irrigation System and it works based on information from water level sensors. Various sensors are used to monitor the environmental conditions. [3][4][5] Proposed smart irrigation systems using Internet of Things. To calculate humidity and water levels of soil some wireless sensors area unit required. The collected data are sent to a smart gateway through a network, using a gateway called Generic IOT Border Router Wireless Br 1000. From the gateway, the information is then sending to a web service through a network. A Smartphone Irrigation Sensor [6] is proposed. Here, they designed and implemented an automated irrigation sensor with the utilization of Smartphone we can capture and according to with that digital images can able to find out and monitor the crop field and easy to measure water levels. Smart agriculture monitoring system used for controlling and can increase the yield production value [10]. Paper [7] proposed a Greenhouse Monitoring System based on Agriculture IOT with a Cloud. In a greenhouse, management can monitor different environmental parameters effectively using sensor devices such as light sensor, temperature sensor, relative humidity sensors and soil moisture sensor. Periodically the sensors are collecting information of agriculture field area and are being logged and stored online using cloud computing and Internet of Things. [8] In this paper author proposed a low maintenance and high gain Agriculture using novel Eco-friendly and energy efficient sensor technology. This paper clearly explains about automated farm monitoring and irrigation techniques which includes wide range of sensors to remotely sense and monitor various parameters of the soil like temperature, moisture and fertility and controls the supply of water and fertilizer to the land. In paper [9] proposed a Smart Beehive for Environmental, Agriculture and Honey Bee Health Monitoring. Within and outside a living beehive for monitoring the multidimensional conditions such as oxygen, carbon dioxide, pollutant levels, temperature and humidity. A sensor network data acquisition and task management for decision support of smart farming [11]. In order to perform necessary tasks required for farmers using internet of things, this paper presents a conceptual

model and system design for decision support of smart farming with network sensor applications. In papers [12][13][14] proposed an agricultural application of wireless sensor network for crop field monitoring. These systems fully equipped with two type sensor nodes to measure humidity, temperature and an image sensing node to compare information by taking images of crops. By following these methods can achieve high stability of sensors with low consumption of power. With it's a long period of monitoring the agriculture field area. [15] Conducted a survey on Smart Agriculture irrigation systems to get better understand about the IOT-based development in agriculture with cloud computing.

III. PROPOSED SYSTEM

The implemented framework comprises of different sensors and devices and they are interconnected by means of remote correspondence modules. The sensor data is been sent and received from client end utilizing Internet connectivity which was enabled in the ARDUINO module-an open source IOT platform. This system is used to maintain the optimal conditions of the irrigation system effectively. The data can be viewed on the Thing Speak app or web page. The farmer can go through each and every information regarding the levels, at what time it's been functioning, any fluctuation appearing or not, whether the operations are been performed in time.

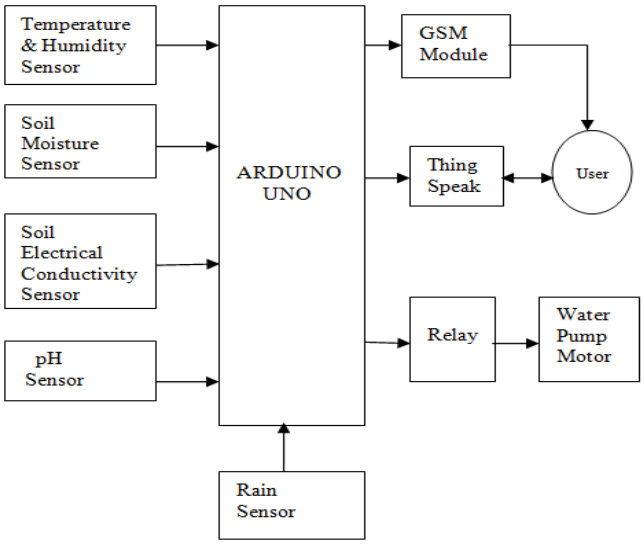

Fig: Block diagram of proposed system

IV. HARDWARE REQUIREMENT

A. ARDUINO UNO

The Arduino Uno is a microcontroller board supported the ATmega328. All the sensors are integrated with Arduino Uno. These sensors provide the information about the environmental condition to the Arduino Uno. Arduino Uno takes necessary decision/action and also informs about the sensor values and its necessary actions to farmer's web page using cloud computing. And also, message them with the help of GSM.

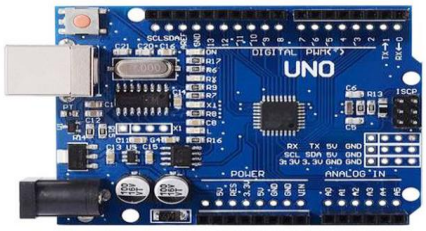

Fig: Arduino Uno

B. SOIL MOISTURE SENSOR

It senses the moisture content of the soil. The sensor has both analog and the digital output and works on the principle of open short circuit. In this system, the output is high or low showed by the LED. At the point when the soil is dry, there will no passage of current and act as an open circuit. When soil is wet, the passage of current exists and circuit is said to be short and the output will be zero. Sensor information is appeared by the levels. It is hostile to rust so the sensor has long time which will manage the cost of the farmer at the very least cost.

Fig: Soil moisture sensor

C. TEMPERATURE AND HUMIDITY SENSOR

It is used for measuring temperature and humidity. In this system, it shows the information at which level it was functioning. Suppose, it is beyond the threshold level, LED will starts blinking and instantly the values appears on the webpage and the farmer gets to know.

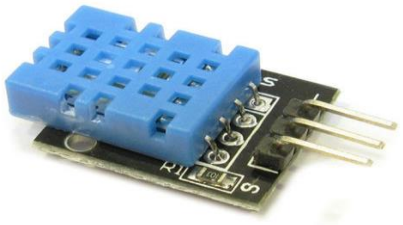

Fig: Temperature & Humidity sensor

D. ELECTRICAL CONDUCTIVITY SENSOR

It measures the amount of salt present in the soil. Salt content is too high it affects the crop yield. The optimal range of soil electrical conductivity range from 1.1-5.7 ds/m Suppose, it is beyond the threshold level, the LED will starts blinking and instantly the values appears on the webpage and the farmer gets to know.

Fig: Electrical conductivity sensor

E. pH SENSOR

It measures the acidity and alkalinity of the soil. The optimal pH range for plants is between 5.5 and 7.0.Suppose, it is beyond the level, then the LED will start blinking and the values appears on the webpage.

Fig: pH sensor

F.RELAY

It is a switch which is electrically operated switch. For control-ling purpose the relay is used. It has the particular low-power signal.

Fig: Relay

V. SOFTWARE REQUIREMENT

A. Arduino IDE

The Arduino Integrated Development Environment-or Arduino Software (IDE) consists a word processor for creating code, a message zone, a substance console, a toolbar with gets for typical limits and a movement of menus. It partners with the Arduino and Genuino hardware to exchange programs and talk with them. Undertakings made using Arduino Software (IDE) is called diagrams. These portrayals are formed in the word processor and are saved with the report extension.ino. The editor has features for cutting/staying and for looking/supplanting content. The message zone gives input while saving and exchanging and moreover indicates botches. The solace indicates content output by the Arduino Software (IDE).

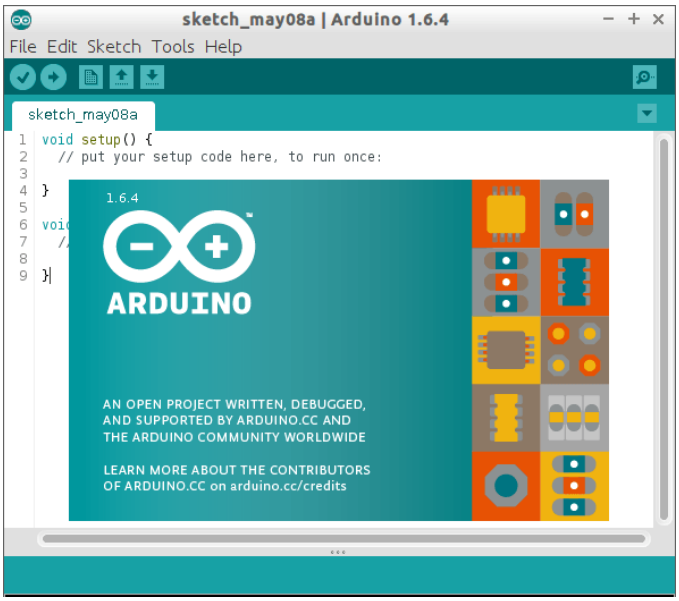

Fig: Arduino IDE

B. Thing Speak

Thing Speak is an application stage for the Internet of Things that enables you to construct an application around information gathered by sensors. It includes constant information gathering information handling, perceptions, applications and modules.

VI. EXPERIMENTAL RESULT

The hardware is interfaced with all the sensors within the board. The sensors provide input to the controller and farmer receives the information on the cloud platform in detail. Test results shows that the hardware can be controlled remotely with the help of wireless network technology. The following are the results viewed on the web page(also can be seen in Thing Speak Cloud Platform).It clearly gives us the information regarding the sensor level, at what time crop conditions is been changing and date too. By this data, it becomes easy for a common man to understand.

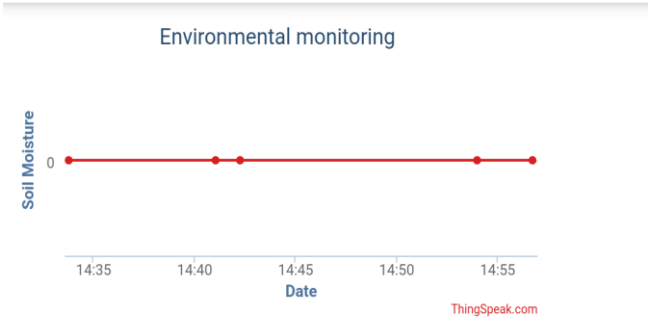

Fig: Live data of Soil moisture from Thing speak

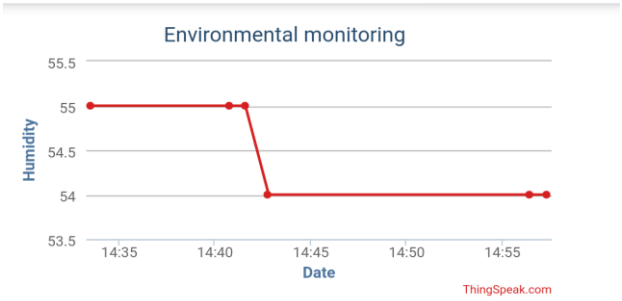

Fig: Live data of Humidity from Thing speak

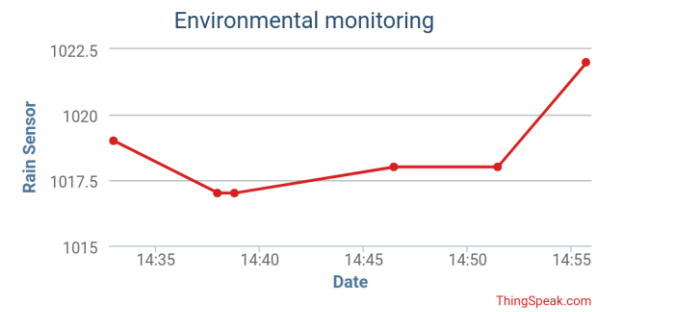

Fig: Live data of Rain from Thing speak

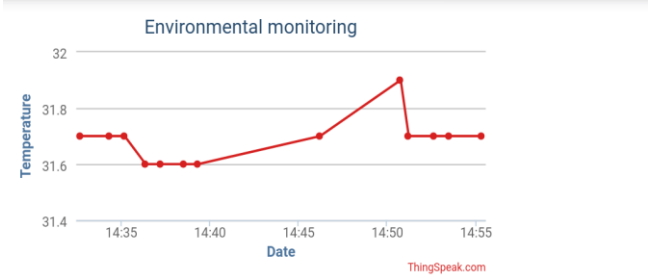

Fig: Live data of Temperature from Thing speak

VII. CONCLUSION

Here, a Smart Farming Enabled: IOT based agriculture stick for live monitoring of temperature, humidity, soil moisture, electrical conductivity and rain condition has been proposed using Arduino and Cloud computing. The stick has high efficiency and accuracy in fetching these live data. The agriculture stick being proposed via this paper will assist farmers in increasing the agriculture yield and take efficient care of food production as the stick will always provide helping hand to farmers for getting accurate live feed of environmental results.

VIII. FUTURE SCOPE

Future work would be focused more on increasing sensors on this stick to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this agriculture IOT technology to full-fledged Agriculture Precision ready product.

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