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IoT based Smart Agriculture 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 IoT based Smart Agriculture system assisting farmers in getting live data(Temperature & Humidity, Soil moisture, Rainfall, Gas) to do smart agriculture. The proposed system is integrated with Node MCU with various sensors and live information can be obtained via online from ThingSpeak.com. The device being proposed is tested on Live agricultural fields.***

Keywords—Internet of things(IoT), Smart Agriculture, Temperature & Humidity sensor, Soil moisture sensor, raindrops detection sensor, Gas sensor, NodeMCU, Cloud Computing.

1. 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. Hence, automation must be implemented to develop an integrated system which will improve productivity. But, complete automation in agriculture is not achieved in every stage. Though, it is implemented in the research level, it is not given to the farmers as a product to get benefitted from the resources. This paper deals about Smart agriculture, the data's are stored and can be easily visualized and analyzed by the end user.

2. LITERATURE SURVEY

In this paper, [1] 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.[2]Conducted a survey on Smart Agriculture irrigation systems to get better understand about the IOT-based development in agriculture with cloud computing.[3] 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 [4] 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. A Smartphone Irrigation Sensor [5] 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 [6] 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. . [7] In this paper author proposed a low maintenance and high gain Agriculture using novel Ecofriendly 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 [8] 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. Various sensors are used to monitor the environmental conditions. [9][10] 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.

3. PROPOSED SYSTEM

The implemented framework comprises of different sensors, actuators, ADC converter, decoders and microcontrollers. The sensor data has been sent and received from the client end utilizing internet connectivity which is enabled in the nodemcu.the system is used to maintain the optimal condition of the irrigation system effectively. The data can be viewed on the thingspeak app or web page and also a sms service of a sensed data provided (incase if lack of the internet facility) to the user.

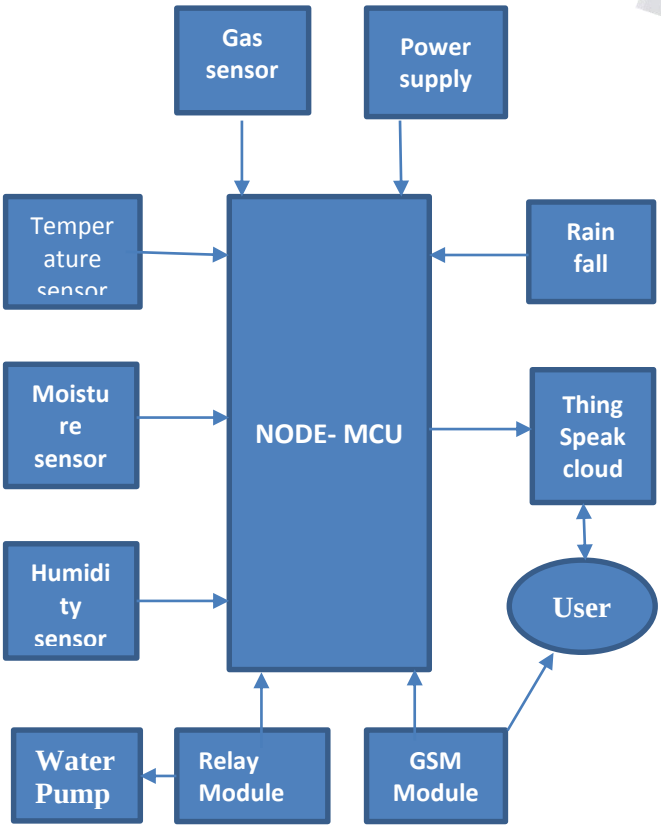

Fig:Block diagram of proposed system

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4. HARDWARE SPECIFICATION

A. NodeMCU(ESP8266)

The Node MCU is a bit-sized Wi-fi enabled microcontroller-ESP8266, it can monitor and control things from anywhere in the world. It is integrated with all the sensors. It takes necessary decision/action and also informs about the sensor values to the farmer's web page using the cloud. And also, message them with the help of GSM.

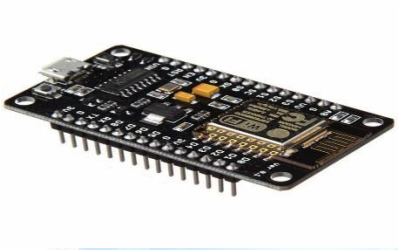

Fig:NodeMCU(ESP8266)

B. GSM

It is a chip that will be used to establish communication between a microcontroller and smart phone. A GSM modem can be a dedicated modem device with a serial, USB, Bluetooth or it can be a mobile phone.

Fig:GSM

C.Temperature and Humidity Sensor

It is a low-cost digital sensor used for measuring temperature and humidity. It can be easily interfaced with any microcontroller. If the sensor value is beyond the threshold level, LED starts blinking and the values appears on the web page.

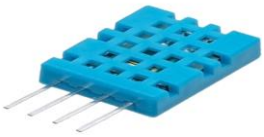

Fig:Temperature and Humidity Sensor

D.Soil moisture sensor

It measures the volumetric water content in soil. The working can be done by inserting the sensor into the soil. When the soil is dry, there will be no flow of current (open circuit).The flow of current exists, if it is wet (closed circuit).

Fig:Soil moisture sensor

E.Rain drops detection sensor

The sensor contains a sensing pad with series of exposed copper traces that is placed out in the open. It act as a variable resistor (potentiometer) Whose resistance varies according to the amount of water in its surface.

Fig:Rain drops detection sensor

F.Gas sensor

It detects the presence or concentration of the gases in the atmosphere. When the concentration of the gas exceeds the threshold value, the digital pin goes high. The analog pin can be used to measure the concentration of the gas.

Fig: Gas sensor

G.Relay

It is a switch that opens or closes the contacts to cause the operation. Relays are used where it is necessary to control a circuit by an independent low-power signal.

Fig:Relay

H.Water pump

The soil moisture sense the water level in the soil, if it is low, the NodeMCU turns on the water pump to provide the water. The water pump automatically shuts off when there is sufficient amount of water.

5. SOFTWARE SPECIFICATION

A. Arduino IDE

The Arduino Integrated Development Environment(IDE) or Arduino software consists of a word processor for developing codes, a tool bar for board and port selection, menu bar, Serial monitor, an upload section to feed the code into the microcontroller and the data from the embedded system can be viewed by using serial monitor.

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Fig:Arduino IDE

B. The Cloud Server

ThingSpeak is an cloud based application platform for the "Internet of Things", that enables you to build an application based on the information gathered by the sensors. It offers the capabilities of real-time data collection, visualizing the collected data in the graphical representation.

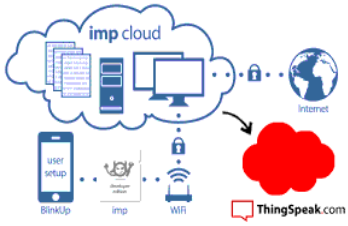

Fig:Thingspeak cloud server

6. EXPERIMENTAL RESULT

The following resultant output is to carry two processes: Initially Web server link will be provided to the user for Thingspeak server. By clicking the login page will be displayed, in that we must give the username and password to proceed to the next page. The output(Temperature, Humidity, Soil moisture, Gas and rain drops)is displayed in the graph format. Another process is that the field's live data can be sent as a to the user message by using GSM Technology

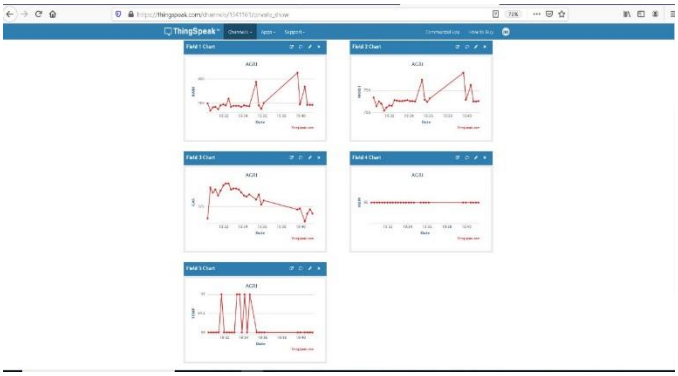

Fig:Live data of sensors(Temperature and humidity, Soil moisture, Rain drops detection ,Gas)from Thing speak

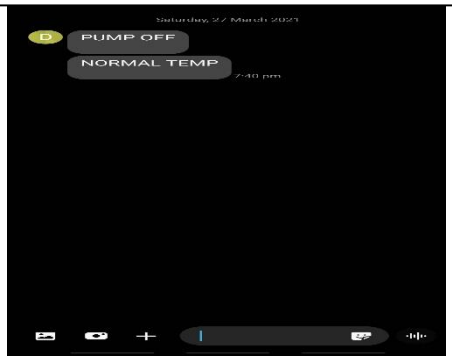

Fig:SMS service of sensed data sended to the user

7. CONCLUSION

Hence, an IoT enabled Smart farming device for live monitoring of the environmental parameters has been proposed by using sensors, actuators, NodeMCU, Arduino IDE and Cloud. The device has high efficiency and accuracy in fetching live data. This will assist farmers in increasing the agricultural yield and take efficient care of food production.

8. FUTURE ENHANCEMENT

Future work would be focused more on increasing sensors to this device to fetch more data especially with regard to pest control and by also integrating the farm map in this system to locate the position of the plantings.

9.ACKNOWLEDGMENT

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