International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 07 | July-2017 www.irjet.net p-ISSN: 2395-0072

Analysis of Soil Parameters in Agriculture Field Using IoT

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Abstract – *IoT (Internet of Things) is an emerging Technology in present and in future. It interacts between objects and things as a shared network with internet connection provided. IoT helps in agriculture field to solve the major problems faced by farmers. In India, agriculture is the main occupation of farmers, due to over population and scarcity of rains. We are facing difficulties in maintaining our daily resources like water, food, crops and so on. To solve these problems we have an idea of this project using IoT with low cost system for analyzing of soil parameters in agriculture field such as soil status, temperature and humidity. This system uses ESP8266 Wi-Fi module, Arduino UNO microcontroller, GSM and sensors using Arduino platform. The system is integrated with GSM for the data transfer through sms to a user mobile phone.*

***Key Words*: Arduino UNO, GSM, LM35, DHT11, IoT.**

1. INTRODUCTION

Crop production takes about 40% of the earth's land and consumes 85% of fresh water available. To maintain this better irrigation system is necessary. It is possible by analyzing the soil status, which helps farmers to maintain and manage their field more effectively. IoT is the technology, which helps the farmers to give required attention to the farm located far away from their stay. The invention of IoT would create numerous ways that gives powerful potential of agriculture yield and prevent the difficulties that affect the crop productivity. In this project ,three sensors are used such as soil sensor for sensing the soil status whether it is dry or wet and supply water if in dry condition, Temperature sensor i.e., LM35 to sense the temperature of the field and DHT11sensor for sensing humidity. Data sensed by particular sensors are managed and stored at the cloud database. Data collected is transferred to user mobile phone through GSM via SMS.A GSM module having GPRS feature provides information over long distances [1].LCD display to display soil status, temperature and humidity values. Wi-Fi module has integrated TCP/IP protocol with self contained socket, which gives better network access to any microcontroller. Arduino UNO is open-source microcontroller and easy to use. To fulfill the farmers needs IoT plays important role as emerging technology in agriculture field. Information of Soil parameters using IoT is available in cloud instantly anytime or anywhere in the world [2].

The organization of this paper is as follows. Section 2 illustrates Related Work. Section 3 illustrates System Architecture, which includes block diagram and workflow. Section 4 includes the Results. Section 5 includes Conclusion.

2. RELATED WORK

Analysis of soil parameters by automatic ON/OFF condition of motor through IoT. It has used Real time implementation of environmental parameters on crops from growing till cutting it [1].Monitoring of weather forecast, soil temperature and humidity, soil moisture level, remote water valves, pest control using internet of things and collecting the information from the sensors[2].Used automated concept of irrigation for crop field to maintain the water level and replacing traditional technique with semi-automated and automated techniques[3].Using neural networks for improving and management of soil with prediction of seasonal rainfall for planning future crop harvest[4].Used Arduino Microcontroller for crop field monitoring and automated irrigation and sending the data to mobile application through GSM via IoT[5].Used IoT to optimize resource utilization and reduce human power in agriculture field. It had smart devices , WSN for automate maintaining agricultural processes[6].Used IoT based system for moisture measurement and soil pH on STM32 board with Bluetooth for communication with farmer's smart phone about the crop and field parameters[7].To predict the slope failures during heavy rainfall ultrasonic waves are used and WSN is used for optimal sensor placement strategy.[8].A novel IoT sensor network for monitoring physical parameters, display data and integrate it to cloud, generate alert and predict the future values with MATLAB analysis[9].Regulating the agriculture field with IoT and sending the collected data to user mobile through GSM without human- to- human or human-to-computer interaction[10].

3. SYSTEM ARCHITECTURE

The system is developed for Analysis of soil parameters in two ways: A. System Hardware B. System Software.

3.1 System Hardware

Fig 1.shows the block diagram of System with Internet of Things. System Hardware mainly includes an ATmega328 Arduino microcontroller chip, GSM module, sensors and Wi-Fi module.

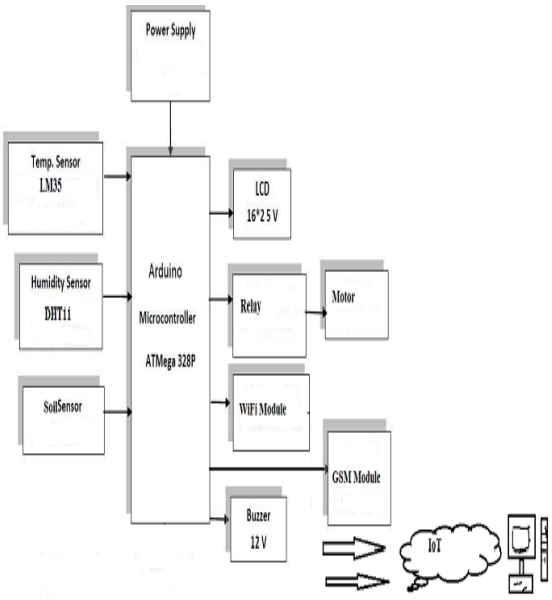

Fig 1.Block Diagram of the System.

3.1.1 Arduino Microcontroller

It is an open-source for both hardware drive and software drive with 8-bit ATmega328 a low power CMOS Controller based on RISC architecture. Arduino Uno has high performance with variety of choices, fully static operation, and self programmable flash program memory in system.

3.1.2 GSM Module

It operates over subscription to a user mobile with a sim card. It helps to transfer the soil status when dry and motor gets ON to the user mobile.

3.1.3 Sensors

Soil Sensor: It is used to measure the content of water in the soil. Water is the important source for plants growth. This detects the wet/dry condition of the soil according to the need of crops. The sensor has two probes which are used to pass current through soil while inserted the probes in the soil. When the soil is wet it has less resistance hence passes more current whereas in dry condition the soil has high resistance and passes less current through the soil. The detection of soil status is done with knowing the resistance valve.

Temperature Sensor: LM35 is used as temperature sensor which is integrated circuit rated to operate over -50 degree to +155 degree Celsius. The temperature and humidity reading value are sent to user through IoT so that user is able to know the field conditions from anywhere.

Humidity Sensor: DHT11 is used to measure the water vapor in air which defines the humidity. If there is change in temperature there will be change in humidity also, this occurs before and after irrigation.

3.1.4 Wi-Fi Module

ESP8266 Wi-Fi module is a self contained socket capable of hosting an application. It is integrated with TCP/IP protocol stack. Each module is pre-programmed with AT command set firmware.

3.2 System Software

Collecting and reading the data from the sensors and controlling the various devices. Sensed data is collected from each sensor and sent to IoT, each reading is processed and graph is plotted in the Thing speak cloud. Fig 2.Shows the work Flow;

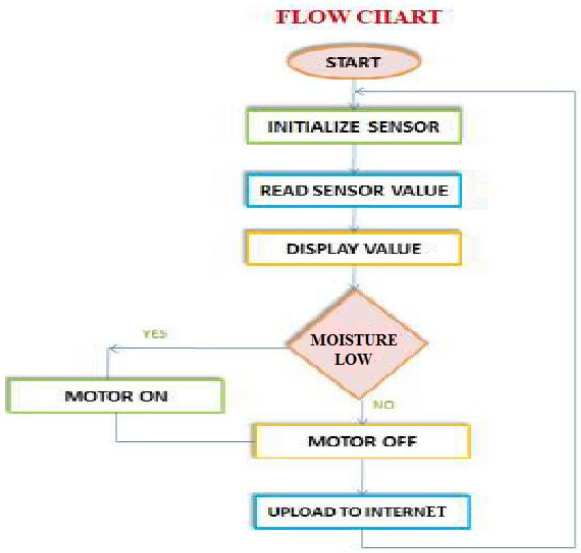

Fig 2. Work Flow of the System.

Step 1: Process started.
Step 2: All the sensors are initialized using IoT.
Step 3: Sensor values are checked. Soil sensor gives soil Status whether soil dry/wet. DHT11 sensor gives the Humidity available in the environment. LM35 sensor gives the temperature reading.
Step 4: If the soil status is up to required level, motor remains off.

Step 5: If the soil status is dry then motor gets ON automatically.
Step 6: Initialize all the sensor values after completion of step 5.Process is completed and moves to original state.

4. RESULTS

The output can be analysed in the Thingspeak cloud, which is an open source IoT application. Thingspeak gives the graphical notation of the values collected. Thingspeak gives the real time data visualization.

Fig 3.shows LCD displaying when soil is dry, corresponding graph for dry status of soil is plotted in chart 1a.

Fig 3.LCD Display Dry status of soil.

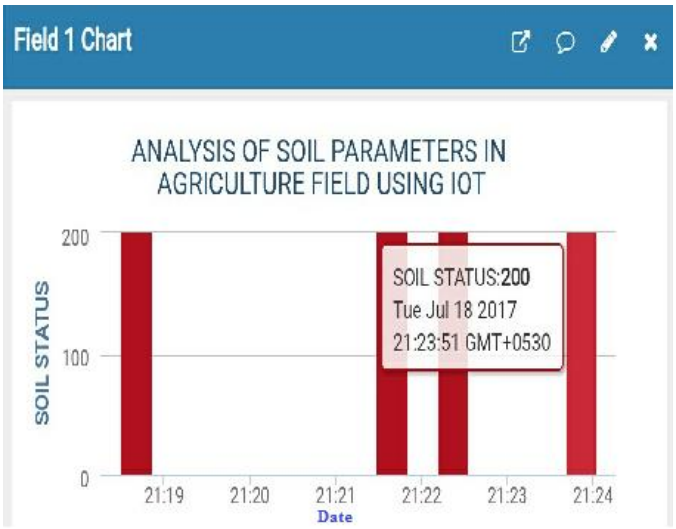

Chart 1a .Analysis of soil status, when dry.

The graph in chart 1a is plotted with soil status value v/s date by analyzing the soil status using IoT. It shows fixed value 200 when dry state.

Fig 4.shows LCD displaying when soil is wet, corresponding graph for wet status of soil is plotted in chart 1b.

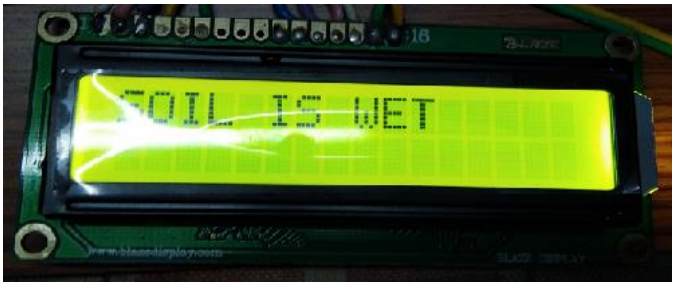

Fig 4. LCD Display Wet status of soil.

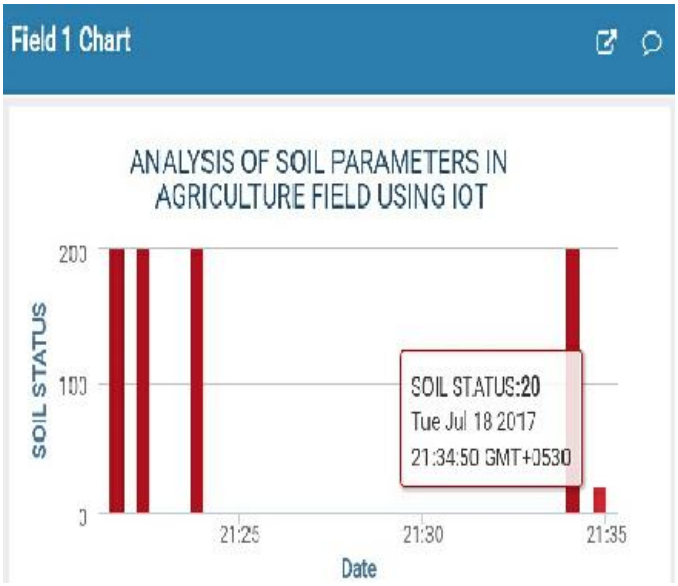

Chart 1b .Analysis of soil status, when wet.

The graph in chart 1b is plotted with soil status value v/s date by analyzing the soil status using IoT. It shows fixed value 20 when wet state.

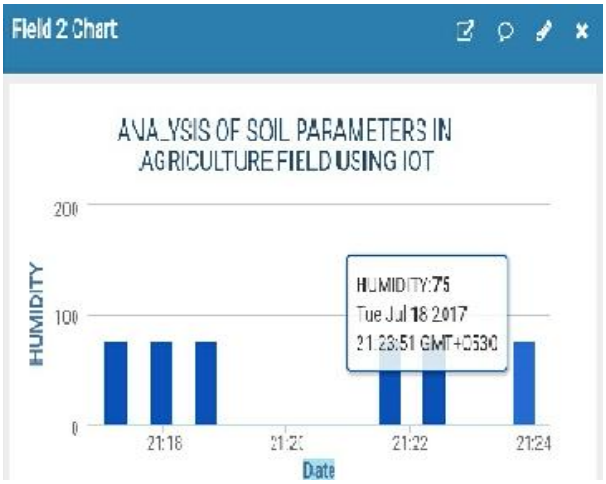

Chart 2 .Analysis of Humidity Value.

The graph in chart 2 is plotted with humidity value v/s date by analyzing the humidity value using IoT.

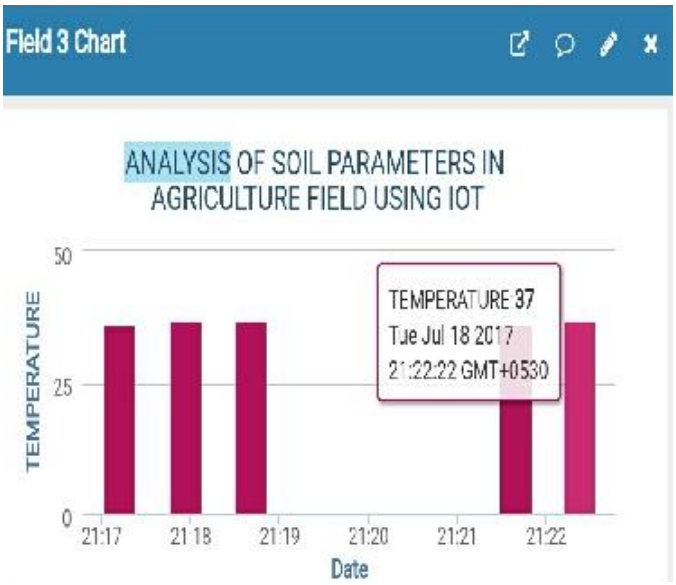

Chart 3 .Analysis of Temperature Value.

The graph in chart 3 is plotted with temperature value v/s date by analyzing the temperature value using IoT.

Fig 5 .shows The Display of soil status when dry and motor started is sent to user mobile as message through GSM.

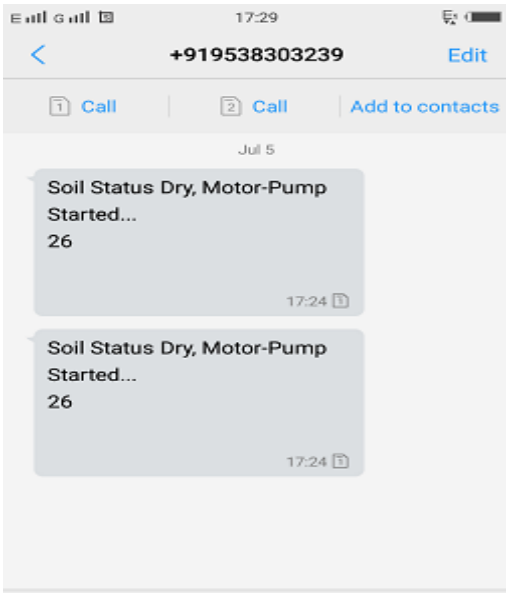

Fig 5 .Message display in user mobile.

5. CONCLUSION

To increase the crop productivity in countries like India, it is necessary to improve the technological knowledge. Here, it is proposed with IoT technology to make the crop yield better and make user convenient to know the field status wherever he is, by analyzing the soil parameters. The data is collected from the sensors and stored in cloud with time, date and month. Results here shows the system is optimal and accuracy for controlling and maintaining the collected data and processing it to user.

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