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Engineering

IOT BASED AGROMETER FOR ENHANCING CROP PRODUCTION

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ABSTRACT In conventional methodology of farming, human laborers are required to visit the farm, at certain specific times to monitor the soil properties manually. This process will be time consuming and they should travel to the soil testing centers for the getting accurate data. In case of agricultural students also, they have to travel to different fields for collecting data for their studies. As new technologies has been introduced and utilized in modern world there is a need of 'technology revolution' in the field of agriculture also. The objective of this paper is to propose a novel Smart IoT based Agro meter assisting farmers in getting Live Data (Soil Temperature, Ph value of value soil, humidity, Soil Moisture, rain fall) for efficient environment monitoring which will enable them to increase their yield of efficient crops. In this paper, sensor technology and wireless networks integration of IoT technology has been studied and reviewed based on the actual situation of agricultural system. The collected data by the system provided for agricultural research facilities.

KEYWORDS : IoT, sensor, arduino, agrometer

I. INTRODUCTION

Agriculture contributes to nearly one third of the GDP of India. It provides livelihood for a major portion of Indian population. India generates huge revenue by the export of agricultural products to International markets. However the biggest challenges faced by Indian agriculture are unpredicted climate change and change in soil properties. The farmers are still using traditional methods for agriculture, which results in low yielding of crops and fruits. So the crop yield can be improved by using automatic machineries. There is need to implement modern science and technology in the agriculture for increasing the yield. By using IoT the increase in production with low cost by monitoring the efficiency of the soil, temperature and humidity monitoring, rain fall monitoring and pH value monitoring.

The loT (Internet of Things) is a network of Internet enabled objects, together with web services that interact with these objects. Internet connection is made available for all physical devices which are not necessarily personal computers through various sources. The prime objective is to provide a useful and an error free system to the end user.

Soil testing is widely used by farmers. The potential for increased yields and profits has been the obvious motivator for the keen interest in soil testing. The report will generally provide you with appropriate fertilizer application recommendation. Therefore, soil testing using the proposed model not only reduces the operating cost but it also improves the crop quality and increased growth. A brief outline of the paper is as follows. Section II explains about the architecture of proposed model. Section III describes about socio economic relevance of this project. Finally the paper is concluded in section IV.

II. PROPOSED SYSTEM

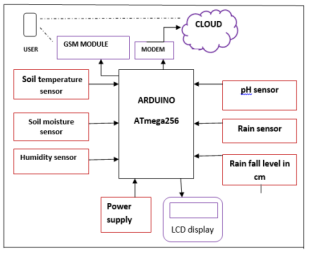

Figure 1 : block diagram of proposed system

Figure 1 shows the block diagram of an agrometer. Sensors namely soil temperature sensor, soil moisture sensor, humidity sensor, pH sensor, rain sensor are used for collection of data. Rainfall level in cm can be entered with the help of a keypad. All these collected data is processed by the arduino and send it to the GSM module. The message again transmitted to the corresponding IP address.

A. HARDWARE USED

1. SOIL TEMPERATURE SENSOR (DSB1820)

DSB1820 is a water proof one wire digital temperature sensor used to measure temperature in the range of -55℃ to 125℃ and can given a precision up to 12bits.It is usable with 3.0-5.0V system. The main advantages of these sensors are, they work great with any microcontroller and also multiple sensors can share one pin.

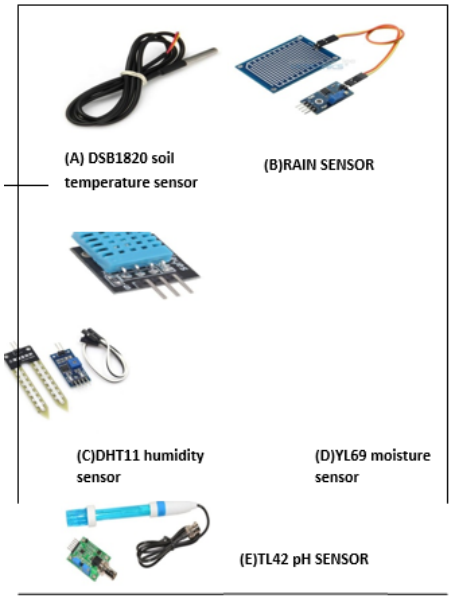

Figure 2: sensors used in agrometer

2. RAIN SENSOR

It is also called a rain switch, that is, a switch device activated by rainfall (figure 2(B)). The sensor employs hygroscopic disks that swells in the presence of rain and shrink back down again as they dry. An electrical switch is in turn depressed or released by the hygroscopic disk stack.

3. HUMIDITY SENSOR (DHT11)

The DHT11 is a low cost digital temperature and humidity sensor. It uses a thermistor and capacitive humidity sensor to measure the surrounding air. The sensor is good for 20-80% humidity readings with 5% accuracy, and it is good for 0-500c temperature readings with 20c accuracy. The picture is shown in figure 2©.

4. SOIL MOISTURE SENSOR (YL-69)

The soil moisture sensor or hygrometer is usually used to detect the humidity of the soil. The sensor has two parts, an electronic board on the right side of figure 2 (D), and the probe with two pads on the left side. According to water content of soil, the output voltage changes.

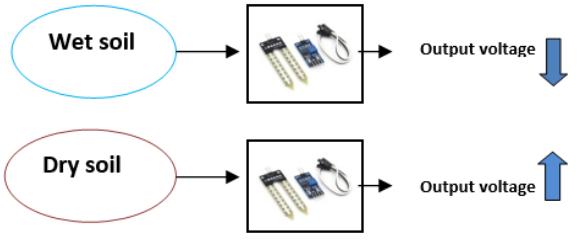

Figure 3: working of moisture sensor

The output can be a digital signal low or high depending upon the soil. If the soil humidity exceeds a certain predefined value the output will be low, otherwise it will be high. The threshold value can be set with the help of potentiometer. The output can be a analog signal and it is in the range of 0-1023. The sensor uses two probes to pass current through the soil and then it reads the resistance to get the moisture level. If the value of resistance is low it means conductivity is high (more water content), while dry soil conducts electricity purely.

5. TL42 pH SENSOR

The combined electrode consists pH glass & reference electrode in a single entity. It has a cable length of 1mtr or 5mtr. A pH meter relies on a voltage test to determine the hydrogen ions level and thus pH. The more hydrogen ions the more will be the conduction. So conductivity increases with increase in acidic nature. In order for a electricity to flow, the circuit must be complete. The circuit is completed by the sample (soil). The sample soil comes into contact with two electrodes which are found on the probe. pH meters have two electrodes a glass electrode and a reference electrode. The glass electrode has a permeable membrane made from specialized glass, which houses a chemical solution and silver based wire. The reference electrode is also made up of a wire in a chemical solution. The glass electrode attracts the hydrogen ions; this then creates a small voltage which can be compared with the reference electrode. The voltage difference is sent to the indicator, which is translated into a pH reading.

6. ATmega 2560 MICROCONTROLLER

The ATmega2560 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega2560 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The device is manufactured using the Atmel high-density nonvolatile memory technology. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega2560 is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

ATMEGA2560-16AU Features:

- High Performance, Low Power Atmel AVR 8-Bit microcontroller.
- Advanced RISC Architecture
- 135 Powerful Instructions – Most Single Clock Cycle Execution
- 32 × 8 General Purpose Working Registers
- Fully Static Operation
- Up to 16 MIPS Throughput at 16MHz
- On-Chip 2-cycle Multiplier

7. GSM MODULE (SIM800L)



Figure 4: SIM800L GSM module

SIM800L is a miniature cellular module which allows for GPRS transmission and receiving SMS and making and receiving voice calls. Its supply voltage is in the range of 3.8V-4.2V. The module has two antennas. First is made of wire, very useful in narrow places. Second PCB antenna with double sided tape and attached pigtail cable. This one has better performance. It work on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz

8. LCD DISPLAY (JHD162A)



Figure 5: 16*2 LCD display

A 16*2 display is used in the farmer side. The purpose of this is, display of messages entered by the farmer such as rain fall level in cm.

B. SOFTWARE USED

1. ARDUINO

Arduino board design uses a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

III. EXECUTION PROCEDURE

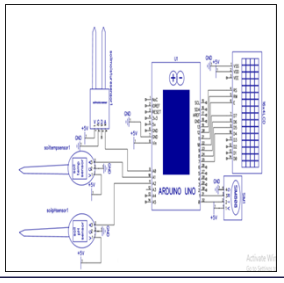

Figure 6: circuit diagram

Figure 5 clearly explain how the hardware equipments are connected to arduino.

(A)The soil moisture sensor (YL-69) consists of three pins namely A0, D0, VCC and SGND. The A0 pin of soil moisture sensor (YL-69) is connected to the analog input pin A0 of arduino UNO. Connect VCC of YL-69 to 5V power supply pin of arduino UNO. Connect the ground pins of YL-69 and arduino UNO.
(B) The A0 pin of soil temperature sensor DSB1820 is connected to the analog input pin A1 of arduino UNO. Connect VCC of DSB1820 to 5V power supply pin of arduino UNO. Connect the ground pins of DSB1820 and arduino UNO.
(C)The A0 pin of soil pH is connected to the analog input pin A2 of arduino UNO. Connect VCC of YL-69 to 5V power supply pin of arduino UNO. Connect the ground pins of YL-69 and arduino UNO.
(D)The D0-D4 pins of LCD display are connected digital pins of arduino. Connect VCC of LCD to 5V power supply pin of arduino UNO.

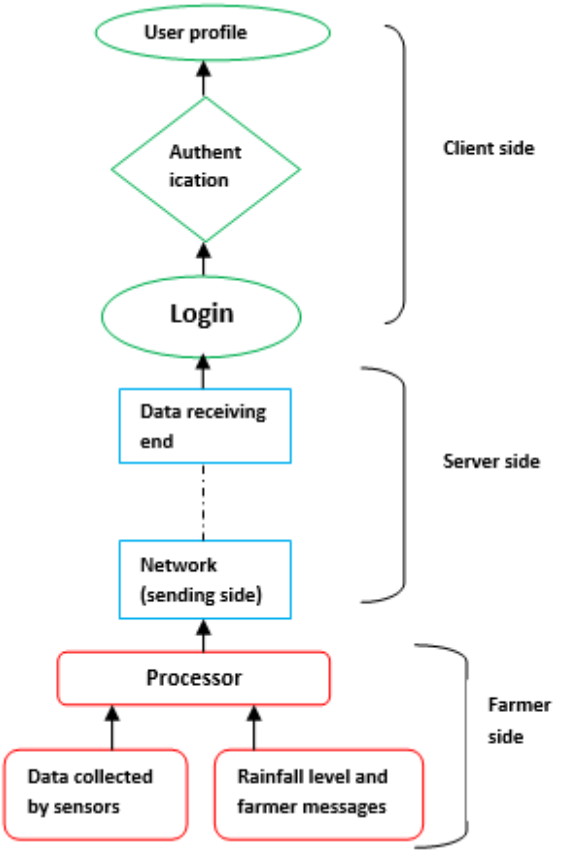

Figure 7: flowchart explaining the working of agrometer.

All sensors except humidity and rain sensors are inserted into the soil, where the property of soil is to be monitored. Rain sensor will give output if rain is detected. Then the farmer has to enter the rain fall level in cm measured using a rain gauge. The collected data by these sensors are processed by the arduino and it is sent to corresponding IP address with the help of IoT. All these process happens at farmer side and sever side. Agrometer has client side also. In client side the user can login to the IP address and check the monitored value. From the data analysis they are able to recognize the soil type and can advice to the farmers about fertilizers, pesticides, amount of water to be poured etc. This will be very helpful for farmers especially incase of uneducated ones.

So without the help of any soil testing centers, without any travelling, with minimum effort and with minimum cost the accurate data regarding the soil is obtained with help of this proposed model.

I. CONCLUSION AND FUTURE WORK

In this paper, we proposed a method for efficient crop monitoring for agricultural field. With the application of IOT the datas can be stored and retrieved from anywhere. The embedded technology helps in obtaining the nature of the soil using different sensors. This system reduces the farmer's difficulty in finding the right crop for the field. It provides the suggestion for the farmer to cultivate suitable crops for that particular land.

In this proposed work, the sensor part is limited only for monitoring of crops. Hence in future it can be automated for irrigation and the system can be enhanced with security of farmland under video surveillance which prevents it from obtrude intrusion.

Also rain sensor can be modified into automatic detection of rain fall level in cm.

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