MOISTURE MONITORING SYSTEM OF SOIL BASED ON WIRELESS SENSOR NETWORK USING ARDUINO

Guided by: Prof. J. Kathirvelan

Manjunath R (14MSS0047), V S Rajakrishnan (14MSS0055), Nishad Nazar (14MSS0056)

School of Electronics Engineering, VIT University, Vellore - 632014, Tamil Nadu, India.

Abstract :- The main objective of the present paper is to develop a smart wireless sensor network (WSN) for an agricultural environment. Monitoring agricultural environment for soil moisture factor is of great significance to the agriculture sector. The soil moisture measurement enables effective agriculture and also enables proper water management in the agriculture sector. This paper incorporates soil moisture sensor and displaying the sensor data to the LCD.

Keywords : Atmel AVR microcontroller, LCD, Sensor.

I. INTRODUCTION

Wireless sensor system (WSN) is presently utilized in a wide range of uses, for example, industrial monitoring, medicinal services application, home automation and movement control. The usage of Wireless sensor system does not just focus on the applications specified. Farmers can exploit the advancement of engineering through the WSN concept. Precision farming is presently actualized to screen the status of the field environment. Many factors like humidity, temperature, light intensity etc are monitored in the wide extents.

One factor that influences the nature of yields is the substance of water in the soil, likewise called soil moisture. It is a very important segment of the soil in respect to plant growth .If the soil moisture content is nominal for the plant growth, then plants can promptly retain water. Soil dampness can be classified taking into account the volumetric water content. This will focus the immersion level of the soil. Precision farming utilizes remote transmission to monitor other parameters in the greenhouse, for example, temperature, moistness and furthermore other ecological data.

One essential concern on wireless transmission is the power utilization. The issue with different remote transceiver like Zigbee and Bluetooth is the power utilization. As the scope of the transmission gets to be longer, the module needs more power to transmit the information. An alternate thought likewise is the expense of the framework. In this paper, our gathering actualizes a low power 2.4 GHz remote transceiver for soil dampness checking and monitoring. This paper utilises the existing technologies of ZigBee based remote control and monitoring system for wireless control and monitoring of the soil moisture.

A. Wireless Sensor Network

A WSN is a framework containing power sources, sensors, radio frequency (RF) transceivers, and microcontrollers. Late advances in wireless sensor organizing innovation have prompted the advancement of ease, low power, multi-functional sensor hubs. Sensor nodes empower environment sensing together with information processing. WSN are utilized for an wide range of applications, including remote data acquisition, smart structures and expressways, ecological monitoring, site security, wireless on-tracking of materials, security administration. A general WSN convention comprises of the network layer, application layer, physical layer, transport layer, data-link layer, power management

plane, mobile management plane and the task management plane. As of now two standard innovations are accessible for WSN: Zigbee and Bluetooth. Both work inside the Industrial Scientific and Medical (ISM) band of 2.4GHz, which gives easy operations, large spectrum allocation. In general, as frequency increments, bandwidth expands considering higher information rates anyhow power requirements are likewise higher and transmission distance is shorter. It is also possible to create a WSN using Wi-Fi (IEEE 802.11).

II. SYSTEM ARCHITECTURE

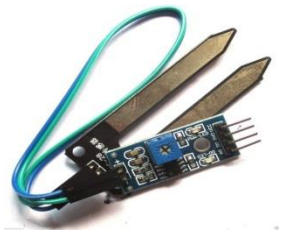
The proposed system incorporates Arduino UNO of Atmel 8 bit AVR, soil moisture sensor, Zigbee module and LCD. The framework is made in economical manner & low power consumption so that anyone can afford the cost of it. The data observed is gathered at the server. It can be utilized as a part of precision farming.

The primary objective of the developed of such a system is aimed to make the farming more precise, water conservation and moreover the project aims in reaching out to the basic farmers. Amid irrigation period they need to monitor their pump house all throughout the night as the power supply is not steady. The system can be introduced at the pump house found remotely from the town, it is interfaced with the pump starter & sensors are installed at diverse location in the field for data monitoring. Using the system they can control the pump from their home at whatever point they need.

A. Arduino UNO

Arduino is a single-board microcontroller, intended to make it easier to build interactive objects or environments. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The **AVR** is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996. The AVR was the first of microcontroller families to use an on-chip flash memory for program storage, as opposed to one-time programmable EPROM, ROM, or EEPROM used by microcontrollers at the time. It has 6 analog inputs, a 16 MHz ceramic resonator, an ICSP header, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB connection, a power jack, and a reset button. It is equipped with everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

A. Soil Moisture sensor



The soil moisture used is a resistive type. This type is a simple soil sensor. It's made of two electrodes which are exposed, and works on the principle that the more water the soil contains, the lower the resistance between the two electrodes. The resistance can be measured using a simple voltage divider and an analog pin. While it's very simple to construct, resistive sensors are not extremely reliable, because they get oxidised over time and thus degrade.

B. ZigBee

ZigBee is a specification for a set of high-level communication protocols used to create personal area networks made from low-power digital radios. ZigBee is based on an IEEE 802.15.4 standard. The IEEE standard defines the physical layer and MAC(Medium Access Control) Layer. Though its low power consumption limits

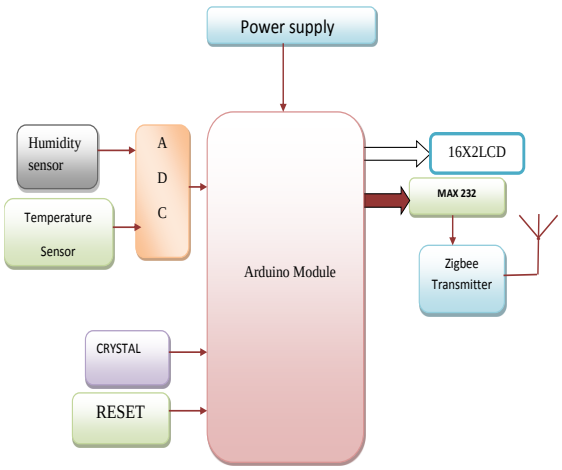
transmission distances to 10–100 meters of line-of-sight, ZigBee devices are capable of transmitting data over distant distances by passing data through a mesh network of intermediate devices to reach more distant ones. The line-of-sight of the ZigBee devices depends on power output and environmental characteristics. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys). ZigBee has a defined rate of 250kbit/sec, best suited for intermittent data transmissions from a sensor or input device. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless technology such as Bluetooth or Wi-Fi.

III. WORKING

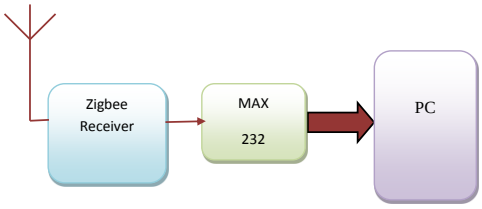
Measurements, covering the different moisture conditions for the two types of soil (Red and Black soil) are taken. The output from the sensor is analog in nature, is fed to the microcontroller, which is programmed to display the soil moisture in percentage, the output is then displayed in the LCD panel.

IV. BLOCK DIAGRAM

Transmitter Section:



Receiver Section:



V. RESULTS

SOIL	SENSOR OUPUT (Ω)	SOIL MOISTURE (%)
Red loam	985	0
	785	25
	593	50
	396	75
	200	100
Black	970	0
	799	25
	627	50
	456	75
	285	100

VI. CONCLUSION

Thus a soil moisture sensor monitoring system has been developed using Arduino and the result has been tabulated. The relationship between sensor output (resistance) and moisture (in percentage) for representation is inversely proportional. The values for soil types of red loam and black for dry and fully moist states are taken as references of 0% and 100% respectively.

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VIII. REFERENCES

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