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Development of Low Cost Wireless Sensor Network for Automatic Field Monitoring With Arduino Controller

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Abstract-Wireless Sensor Networks (WSN) have attracted the attention of many researchers and has becomes interesting area of research.WSN playing a vital role in agricultural field. Wireless Sensor Networks consist of autonomous device which uses sensor to monitor physical and environmental parameter.

A WSN consist of coordinator communicate with different wireless sensor nodes. The sensor node can be reprogrammed by the programmer itself without being need of redeployment of sensor for any changes in WSN. The Arduino UNO controller is plays vital role to monitor the data obtains from all the different nodes.

In this paper, the main focus to design and development of a soil moisture sensor and its interfacing with advanced controller. An effort is made to communicate different parameters like soil moisture, Humidity, Temperature in soil. The Arduino controller is used as advanced controller which connected to a Zigbee to form a wireless Sensor Network in a field and have communication between them. The controller has capabilities of processing, sensing and storing data. In this paper, an effort taken for efficient management of agricultural field and is expected to improve crop yield.

Index Terms- *Arduino Controller, Star Network, Soil Moisture Sensor, Humidity Sensor, WSN etc*

1. INTRODUCTION

Agriculture in India is important because most people depend on it as it is major source of income for the farmer and the increasing demand of food due to increasing population. Using latest technology effort has been made for the development in crop yield production [1]. Monitoring different climatic conditions, soil parameters like humidity, temperature, soil pH, soil moisture, soil conductivity, etc. in real time is important for better management and maintenance of agricultural production [2]. Using this information it will help farmer to know about the condition of field even during disaster and will know whether to irrigate or not at set point. Many sensors connected to controller and processing station directly, an increasing number of sensors communicate the collected data wirelessly to a centralized processing station. When many sensors cooperatively monitor large physical environment, they form wireless sensor network. While there are many widespread application of wireless sensor network structural health monitoring, traffic control, health care and agricultural based uses. Now a day's drip irrigation system has been used because it is economical and efficient. In drip irrigation system water is supplied to root zone due to which lot of water is saved which water the field automatically to prevent draught. Our aim is to control the valve timing based on the pre programmed timing.

2. SYSTEM UNDER STUDY

In this experiment main focus on sense the moisture, humidity by using a soil moisture sensor, humidity sensor by establishing a cheap wireless sensor network its information will be sensed to base station. The following figure shows block diagram of Low cost wireless sensor network for automatic field monitoring with arduino controller

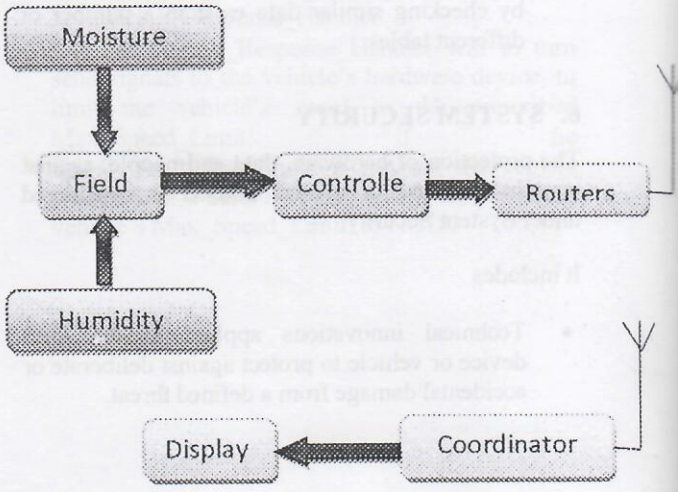

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Figure 1: Block diagram of Wireless Star Network for sensors

The soil moisture sensor is inserted in field that measures soil moisture content in the deep root of plant so it must be inserted little deep inside to obtain accurate reading. Soil moisture sensor plays a key role in monitoring the amount of moisture present in the soil and the time require to percolate through the soil depending upon the type of soil and plant grown. In this system it will monitor the field and apply water based on the readings obtain and efficiently manage the field. This system uses soil moisture sensors which produce a voltage through Volta effect. The following Figure 2 shows developed soil moisture sensor in research LAB.

In manufacturing low cost soil moisture sensor we use copper and aluminum metal. To prevent aluminum from oxidizing we will anodize it and for copper we will coat it with Everbrite. At the tip to the sensor we will use zinc and to fix it a Teflon.

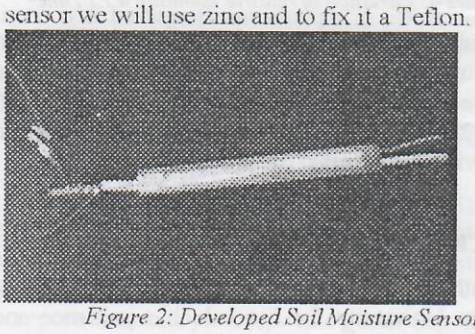

Figure 2: Developed Soil Moisture Sensor

A humidity sensor measure the relative humidity expressed as percentage (RH %). The sensor is composed of two metal plates with non-conductive polymer film between them. This film collects moisture from air and correspondingly produces an output voltage. The microcontroller is used to take the data from all sensors and send to coordinator. The Arduino is a family of single-board microcontroller, intended to make it easier to build interactive objects or environment. ZigBee is a specification for a suite of high level communication protocols used to create personal area network with upto 100 meter line of sight. The Zigbee router is used to transmit input data wirelessly. The coordinator of same network receives the data from router and transmits to Personal Computer. Then according to the values obtain from the sensor value necessary action will be taken. If the level of water goes down below or up a set point according to the sensor value obtain the motor will be turned on controlled by the Arduino. We will develop a drip irrigation system to make effective use of resources.

3. EXPERIMENTATION

In this research work taking soil moisture sensor, humidity sensor which is inserted into the field to measure the reading obtain. In a field, soil moisture sensor and humidity sensor are put in different places. The Zigbee on node is act as a router and send the information to coordinator through wireless communication. Depending upon the values obtain from the sensor the Arduino controller start instructing the base station and acting accordingly. Following figure 3 shows the experimental setup of system.

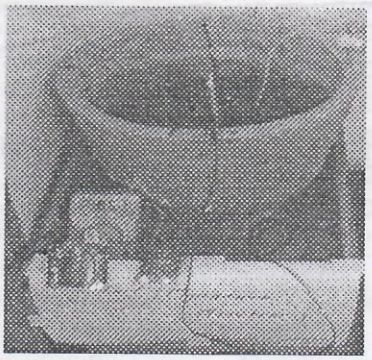

Figure 3: Typical setup of experimentation

If a moisture level goes down below a set point then the information send to Arduino and it inform base station and the flow of water start. After the motor start the water will flow to field according to drip irrigation system and water stop after a set point when sensor reading has given its maximum value. Similarly other sensor acting accordingly and farmer get informed about it through SMS.

I. RESULT AND DISCUSSION

The information that sensor transmit to ZigBee coordinator through wireless star sensor network is shown in table 1. The variation in voltage is obtained according to the amount of water added i.e 500ml at different interval of time.

Sr.No	Time(Min)	Voltage(mV)
1	0	320
2	15	334
3	55	346
4	65	369
5	75	367
6	85	367

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7	135	367
8	195	367
9	215	367
10	235	367

Table 1: Variation of Voltage

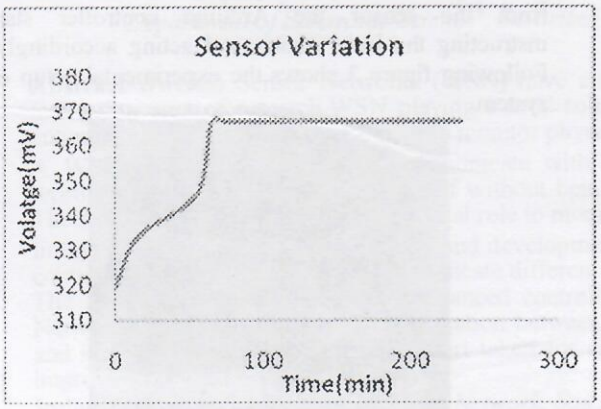

Figure 4: Variation of voltage w.r.t Time

The variation of voltage signal with respect to time is shown in Figure 4. It indicates that while entering water in mud soil moisture sensor sense data and shows with respect to time. After 65 min the output of sensor remains constant. This system can be used for water consumption in agriculture field.

The data that sensor transmit to ZigBee coordinator through wireless network is shown in table 1. The fluctuation in Voltage is obtained according to the humidity in air and as humidity changes especially during amount of water increase in air.

Sr. No.	Time(Min)	Relative Humidity
1	0	55.27
2	20	41.17
3	40	38.51
4	60	41.17
5	80	41.77
6	100	40.73
7	120	39.25
8	140	38.06
9	160	41.17
10	180	38.66
11	200	39.10
12	220	37.62

Table 2: Table 1: Variation of Relative Humidity

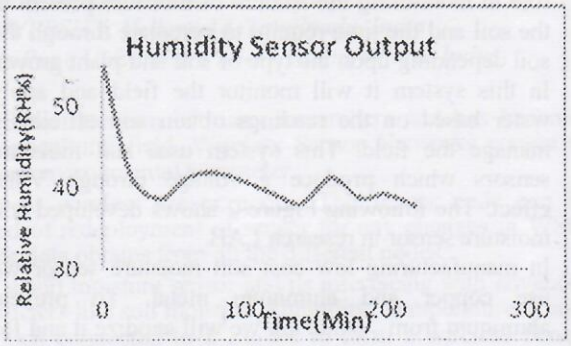

Figure 4: Variation of relative humidity w.r.t Time

In future the deployment of this system in agricultural field should be done which is a cost effective method. In this system NPK sensors and PH sensor should also be used to increase the crop yield which will be controlled by Arduino.

4. ACKNOWLEDGMENTS

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REFERENCE

[1] Ning Wang, Naiqian Zhang, Maohua Wang, "Wireless sensors in agriculture and food industry—Recent development and future perspective", published in Computers and Electronics in Agriculture 50 (2006) 1–14

[2] Anurag D, Siuli Roy and Somprakash Bandyopadhyay,"Agro-Sense:Precision Agriculture using Sensor-based Wireless Mesh Networks", ITU-T "Innovation in NGN", Kaleidoscope Conference, Geneva 12-13 May 2008