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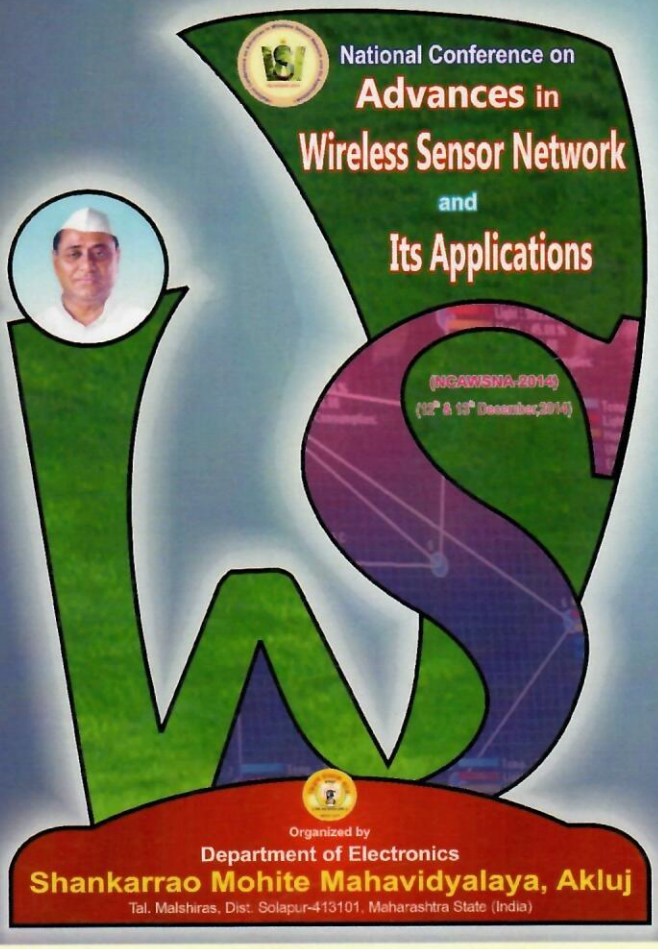

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Establishing Low Cost Wireless Star Sensor Network for Soil Moisture Monitoring and Control with Arduino Controller

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ABSTRACT: Wireless Sensor Networks(WSN) have attracted the attention of many researchers and have becomes interesting area of research.WSN playing a vital role in development of smart electronic technology and are widely used for various applications like health monitoring control, environment monitoring, smart space monitoring and control, agriculture and irrigation, military and security. A WSN consist of coordinator (base station) communicate with different wireless sensor nodes (routers). The Arduino low cost controller is used to Measuring and Monitoring the sensor node data.

In this work, efforts are made to design and developed soilmoisture sensor and its interfacing to a Microcontroller. The Arduino controller is connected to a Zigbee communicator and forming a low cost Wireless Star Sensor Network for decision support on the field.The controller has capabilities of processing, sensing and storing data. In this paper the effort are made to communicate four sensor nodes with coordinator using Star sensor network topology. This paper explains the efficient management of water resource and is expected to improve crop yield.

Index Terms: Arduino Controller, Star Network, Soil Moisture Sensor, WSN, Zigbee.

I. INTRODUCTION

Agriculture in India is important for the people living in rural area because it is the main source of income. In past few years, new trends have been developed to improve the different areas of agricultural sectorusing the latest technologies[1]. Monitoring different climatic conditions, soil parameters like temperature, humidity, soil moisture, soil pH, soil conductivity, etc. in real time isimportant for better management and maintenance ofagricultural production[2]. By monitoring this condition it will help the farmer to take the necessary action during the degradation of crops even when the disaster occurs.A wireless sensor networkprovides us platformfor monitoring environmental conditions affectingagricultural practices[3].Many sensors connected to controller and processing station directly, an increasing number of sensors communicate the collected data wirelessly to a centralized processing station. This is important since many network applications require hundreds or thousands of sensor nodes, often deployed in remote and inaccessible areas. Therefore, a wireless sensor has not only a sensing component, but also on board processing, communication and storage capabilities. 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. There are various topology of wireless sensor network this includes star, star-mesh hybrid technology [6]. In star topology, all the components of network are connected to the central device called hub.

II. SYSTEM UNDER STUDY

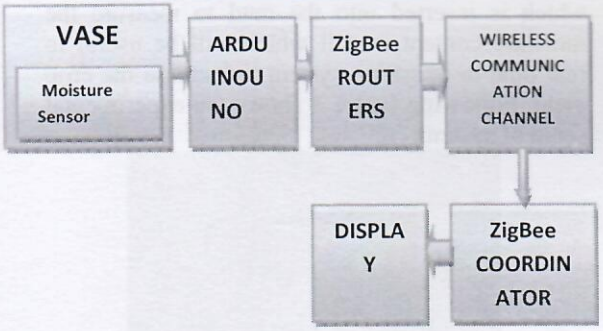

Figure 1:Block diagram of Wireless Star Network for soil moisture sensor

In designing and development low costwireless star sensor network for soil moisture monitoringrequire soil moisture sensor which sense data and transmit to corresponding destination. The soil moisture sensor (SMS) is a sensor connected in POT that measures soil moisture content in the active root zone before each schedule POTevent. 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. The effort is to monitor the agriculture field using low cost method and transmitting information wirelessly. 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 wire.

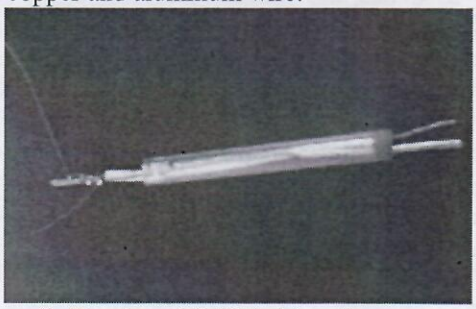

Figure2: Developed Soil Moisture Sensor

The advanced microcontroller like Arduino is used to take the data from soil moisture sensor and send to Zigbee.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.

III. EXPERIMENTATION

In this research work taking soil moisture sensor which is inserted into the mud to measure the moisture content in soil which will be useful in real time in irrigation system to increase the crop yield. Following figure 3 shows the experimental setup of system.

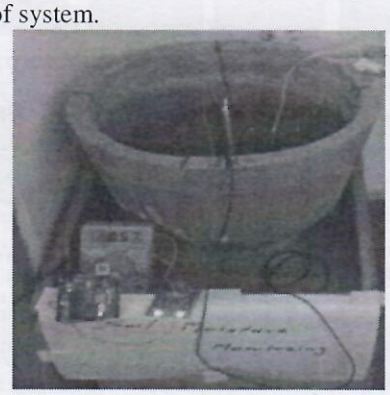

Figure 3: Typical setup of experimentation

Before starting the reading we have kept the temperature at room temperature and the pot was not exposed to sunlight, for sensor the length of copper is 17.7cm and aluminum is18cm. By adding different quantity of water for few days and jotted down the reading with different timing. We obtain the changes in voltages before added water and after adding the water and observed voltage to be in mV. After obtaining readings manually the system is design for wireless communication.

IV. 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.

Table 1: Variation of Voltage

Sr.No	Time(Min)	Voltage(mV)
1	0	320
2	15	334
3	55	346
4	65	369
5	75	367
6	85	367
7	135	367
8	195	367
9	215	367
10	235	367

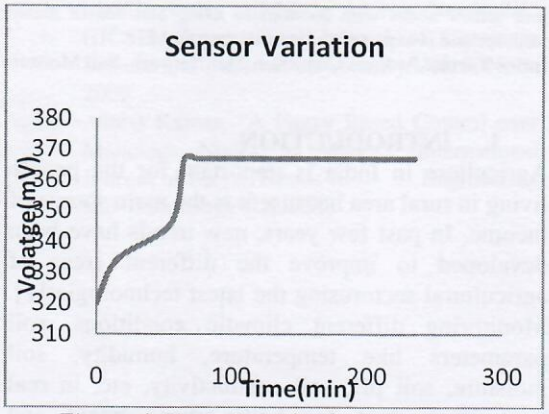

Figure 4: Variation of voltage w.r.t Time

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.

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.

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