Wireless monitoring of Soil moisture& humidity using Zigbee in Agriculture

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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 various factors such as soil moisture, temperature and humidity along with other factors can be of significance. A traditional approach to measure these factors in an agricultural environment meant individuals manually taking measurements and checking them at various times. This paper investigates a remote monitoring system using Zigbee. These nodes send data wirelessly to a central server, which collects the data, stores it and will allow it to be analyzed then displayed as needed and can also be sent to the client mobile.*

Keywords: AVR Microcontroller,LCD,remote monitoring, Sensors, ZigBee.

I.INTRODUCTION

Wireless technology using various sensors for precision agriculture has become a popular research with the greenhouse effect. People are utilizing the merits of embedded system into monitoring and control system for agriculture parameter. Monitoring parameters of temperature and humidity is an important means for obtaining high-quality environment. Remote monitoring is an effective method in order to avoid interference environment and improve efficiency. Today, Ethernet network, RFmodule and ZigBee wireless network are used to transmit data in remote Monitoring System. This paper gives a review of remote control and monitoring systems based on existing technologies and a GSM-ZigBee based remote control and monitoring system with automatic irrigation system is proposed. The design presented has the advantage of ZigBee technology.

A.*Wireless Sensor Networks*
A WSN is a system comprised of radio frequency (RF) transceivers, sensors, microcontrollers and power sources. Recent advances in wireless sensor networking technology have led to the development of low cost, low power, multifunctional sensor nodes. Sensor nodes enable environment sensing together with data processing. Instrumented with a variety of sensors, such as temperature, humidity and volatile compound detection, allow monitoring of different environments. They are able to network with other sensor systems and exchange data with external users. Sensor networks are used for a variety of applications, including wireless data acquisition, machine monitoring and maintenance, smart buildings and highways, environmental monitoring, site security, automated on-site tracking of expensive materials, safety management, and in many other areas.A general WSN protocol consists of the application layer, transport layer, network layer, data link layer, physical layer, power management plane, mobility management plane and the task management plane. Currently two there standard technologies are available for WSN: ZigBee and Bluetooth. Both operate within the Industrial Scientific and Medical (ISM) band of 2.4 GHz, which provides license free operations, huge spectrum allocation and worldwide compatibility. In general, as frequency increases, bandwidth increases allowing for higher data rates but power requirements are also higher and transmission distance is considerably shorter. Multi-hop communication

over the ISM band might well be possible in WSN since it consumes less power than traditional single hop communication. It is also possible to create a WSN using Wi-Fi (IEEE 802.11), but this protocol is usually utilized in PC-based systems because it was developed to extend or substitute for a wired LAN . Its power consumption is rather high, and the short autonomy of a battery power supply still remains an important disadvantage.

A.ZigBee

The ZigBee standard is built on top of the IEEE 802.15.4 standard. The IEEE 802.15.4 standard defines the physical and MAC (Medium Access Control) layers for low-rate wireless personal area networks . The physical layer supports three frequency bands with different gross data rates:2,450 MHz (250 kbs-1), 915 MHz (40 kbs-1) and 868 MHz (20 kbs-1) It also supports functionalities for channel selection, link quality estimation, energy measurement and clear channel assessment. ZigBee standardizes both the network and the application layer. The network layer is in charge of organizing and providing routing over a multi-hop network, specifying different network topologies: star, tree, peer-to-peer mesh. The application layer provides a framework for distributed application development and communication. Aside from the agriculture and food industry, it is widely used in home building control, automation, security, consumer electronics, personal computer peripherals, medical monitoring and toys. These applications require a technology that offers long battery life, reliability, automatic or semiautomatic installation, the ability to easily add or remove network nodes, signals that can pass through walls and ceilings and a low system cost.

. II. SYSTEM ARCHITECTURE

The proposed hardware of this system includes 8 bit AVR, Blue tooth module, Temperature, humidity and soil moisture sensors, LCD. The system is low cost & low power consuming so that anybody can afford it. The data monitored is collected at the server. It can be used in precision farming.The system should be designed in such a way that even illiterate villagers can operate it. They themselves can check different parameters of the soil like salinity, acidity, moisture etc. from time to time. During irrigation period they have to monitor their distant pump house throughout the night as the electricity supply is not consistent. The system can be installed at the pump house located remotely from the village, it is interfaced

with the pump starter & sensors are plugged at different location in the field for data acquisition. Using this system they can switch on their pump from their home whenever they want.

A.Temperature sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It is low cost and small size sensor. Its temperature range is -55° to +150°C.
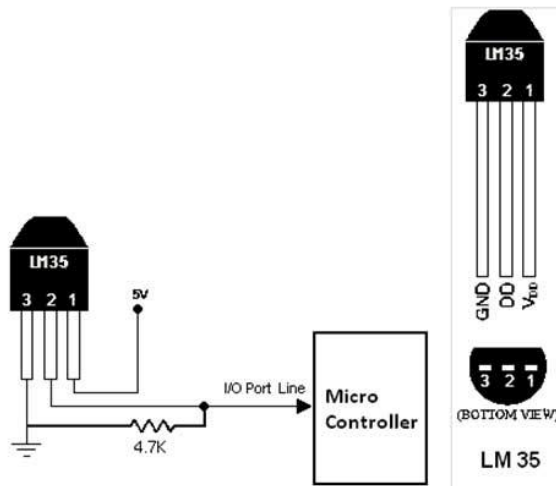

Figure.1 Temp Sensor

B.Humidity sensor

Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed. By calibration and calculation, these measured quantities can lead to a Measurement of humidity.
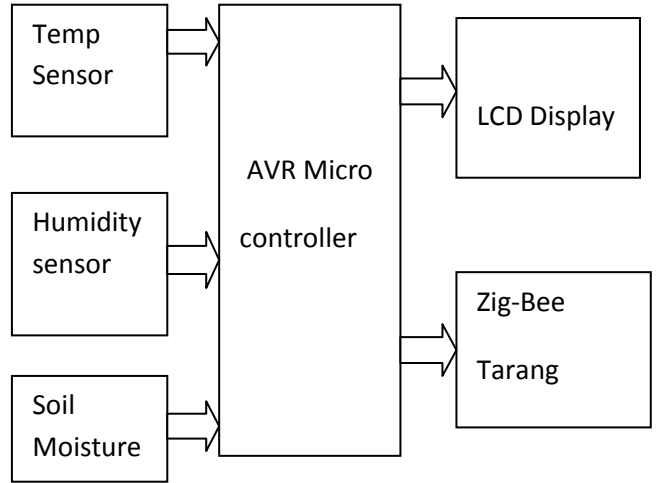

Figure.2 Humidity Sensor

C*Soil moisture sensor*

The soil moisture sensor used is capacitive type. The sensor gives analog output of zero volt when there is 100% moisture and 5V for 0% moisture

Figure.3 Soil Moisture Sensor

5. Block diagram of Transmitter

The block diagram of server side(receiver) is shown.

III.WORKING

The two Transceivers are designed. hereSystem works in two parts
1) Transmitter
2) Receiver
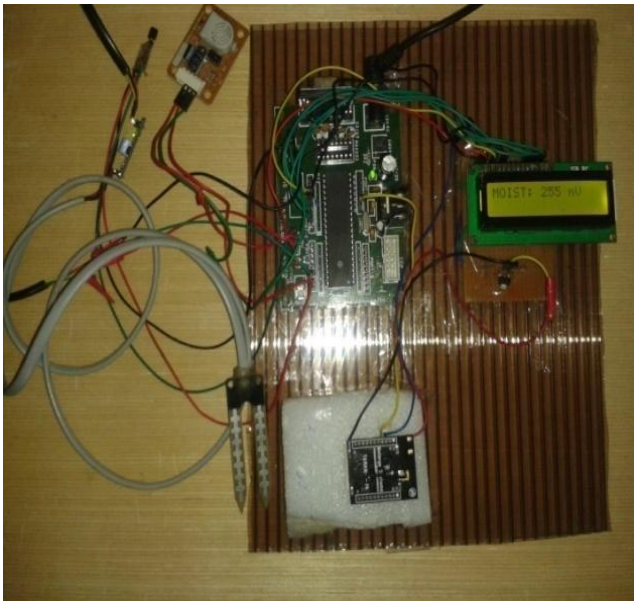
Figure4. Prototype of Transmitter.

The block diagram of Transmitter (field side) is shown
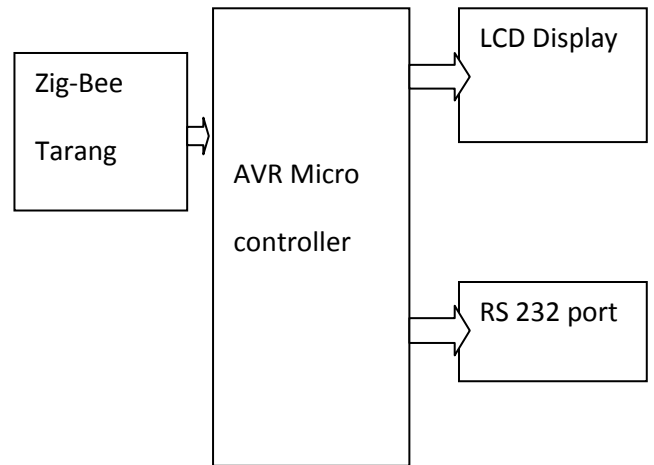
6. Block diagram of Receiver

Figure.7 Prototype of Receiver

A.Transmitter

Initially power is on. After this system is reset. Signals are read by different sensors and its output is given to microcontroller. Output to microcontroller from sensor is taken through 8 channel ADC pins. The output from microcontroller is given to Zigbee through Rx and Tx pins

B.Receiver:

At receiver sideZigBee come into picture. There is only one Tx and Rx pins Signal is send to microcontroller and parameters like temperature, soil moisture and humidity are monitored. These parameters are monitored on computer using RS-232 port.This data can be used for precision farmingThe actuators can be controlled using microcontroller data. This is how total working takes place of automation irrigation system. Different sensors like moisture and temperature sensor senses the moisture content and temperature required. Thus it helps to provide a proper environment to grow crops easily. A different technique of irrigation has been used to irrigate the field. First water is stored in tanks trough pipes then different sources like sprinklers and drip irrigation can been used as both are suitable to irrigate crops.

Advantages of the system

In crop field we have to irrigate the land fully. We have to irrigate depending upon the soil, ups and downs of the land and where it needs.

i) We have designed ZigBee wireless sensor network for monitoring the crop field area by deploying moisture sensors in the land to detect the places where the water level is low. From those results we can irrigate to that particular place only. So we can conserve water and minimize the problem of water logging in the land.

ii) We used humidity sensor to sense the weather. By this the farmer can get idea about the climate. If there is any chance for rainfall, the farmer need not irrigate the crop field. Due to this we can conserve water and also power since we dint turn on motors.

iii) Nowadays in the crops the fertilizer level is increasing, which affects people. By using pH sensors we get the information about the soil and analyze the acid level of the soil. By which we can apply fertilizer to the place where it needs, also we can avoid over fertilization of the crops. Temperature is a randomly varying quantity in the environment of paddy field. Temperature reading

gives information to the farmer. By using temperature sensors we can detect the temperature

IV.RESULTS

The following monitoring results are obtained using temperature, humidity and moisture sensor. These real times monitoring results are recorded on server. The graphs can be plotted. The monitoring of temperature,moisture humidity are plotted for the month of February 2014.
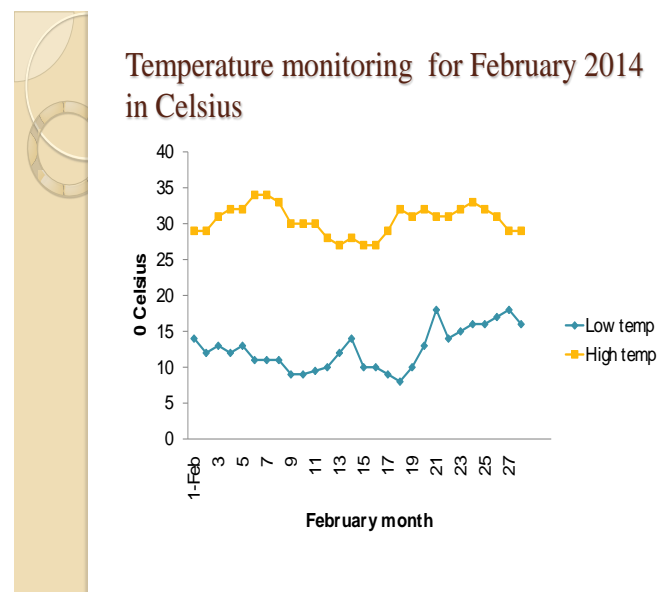
Figure 8Temp monitoring in Feb2014
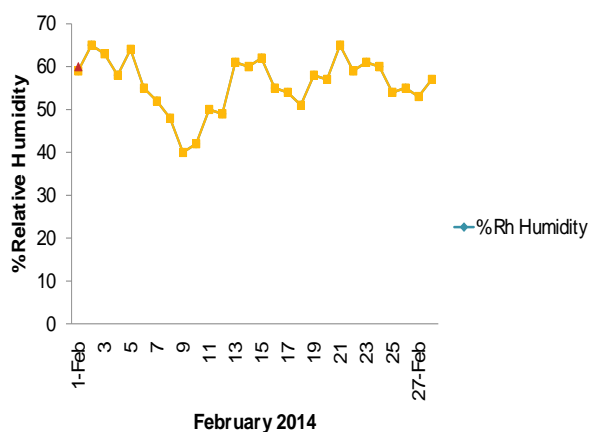
% Rh Humidity Monitoring For Feb 2014

Figure 9 Humidity monitoring in Feb2014
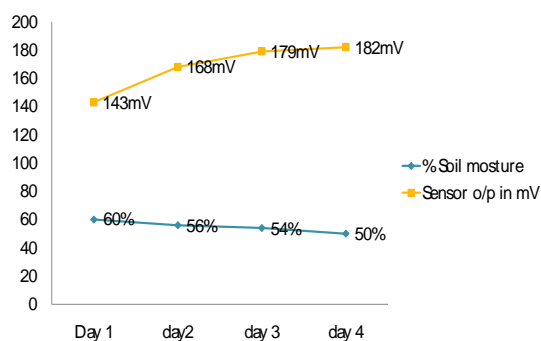
Soil Moisture monitoring

Figure 10 soil moisture monitoring in Feb2014

IV.CONCLUSION

Zigbee-based agriculture monitoring system serves as a reliable and efficient system for efficiently monitor the environmental parameters. Wireless monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes in it. It is much cheaper in cost, consumes less power and can control 254 devices, which in turn leads to the development of lots of new technologies like Home Automation, Health Care Automation.

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