WIRELESS SENSING NETWORK FOR AGRICULTURE MONITORING

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ABSTRACT: *The emerging field of Wireless Sensor Networks (WSN) combines sensing, computation, and communication executed with tiny devices. Through advanced mesh networking protocols, these devices can form a sea of connectivity that extends the reach of cyberspace out into the physical world Besides, agricultural practices are not optimized and remain traditional with scarcity of skilled labor, commitment to traditional knowledge, reluctance to innovation, few personal initiatives, and lack of research on the field. All these challenges make it necessary to think of building decision support systems for agriculture.*

In modern agriculture, a Wireless Sensing Network (WSN) provides a simple cost-effective solution to monitor and control the plants. The important parameter to be monitored includes humidity and temperature. A smart low cost WSN for precision agriculture for monitoring and control using ZigBee technology.

KEYWORDS: AVR Microcontroller, LCD, Sensors, ZigBee, Precise monitoring.

INTRODUCTION:

In India, agriculture plays a key role and contributes to GDP. The agriculture industry is drastically changing and the is a need to develop automated system to monitor and control growing plants. Monitoring and controlling the remotely and distantly located plants is highly laborious and challenging. A wireless Sensor Network (WSN) provides a simple cost-effective solution to monitor and control the factors and environmental parameters that influencing the growth of plants. The role of WSN is to sense the remote data from the desired location and transmit the same through the wireless network which can be viewed by the receiver. WSN is a collection of various sensors that are deployed at location where the parameters are to be sensed, monitored and controlled. The sensed parameters are then transmitted to the observing station through wireless network.

Today, Ethernet network, RF module 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.

WIRELESS SENSOR NETWORKS (WSN):

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 there are two standard technologies available for WSN: ZigBee and Bluetooth. In general, as frequency increases, bandwidth increases allowing for higher data rates but power requirements are also higher and transmission distance is considerably shorter. It is also possible to create a WSN using Wi-Fi 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 of power supply still remains an important disadvantage.

ZIGBEE:

ZigBee is a system of high-level, including the network layer (NWK), application layer (APL) and security services specification. Each layer is responsible for completion of the task, and provides services to upper layer, the interface between the layers communicate by the defined logical link, of which application layer also provides many other services to enhance the properties of the network self-organization, dynamic management features and security. ZigBee's frequency bands are 2.4GHZ, Europe (868MHZ) and the United States (915MHZ) are free to apply band. ZigBee can establish reliable, open and global standards. As the duty cycle is very short, send and receive messages with lower power consumption, so under normal circumstances, two 1.5V batteries can be support to six months to two years. It achieves energy-saving effect and provides a rich application space. 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.

PROPESED SETUP:

The proposed hardware of this system includes 8-bit AVR, Blue tooth module, Temperature sensor, humidity sensor and 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.

COMPONENTS:

A. LM35-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: LM35 TEMPERATURE SENSOR

B. HUMIDITY SENSOR DHT11

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. The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

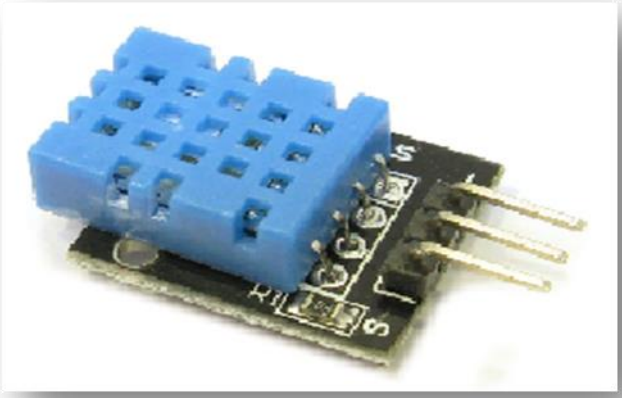

FIGURE 2: HUMIDITY SENSOR **DHT11**

C. SOIL MOISTURE SENSOR YL38:

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

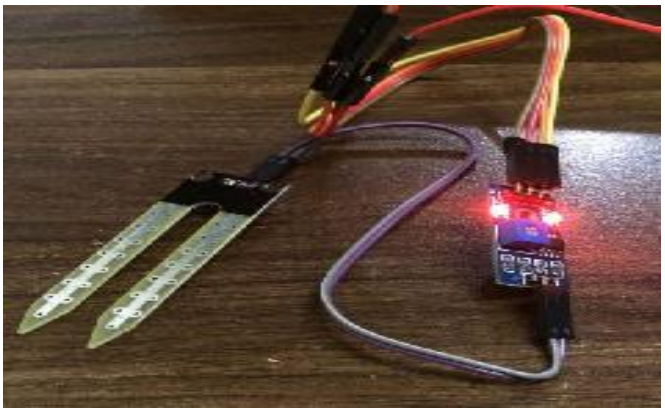

FIGURE 3: SOIL MOISTURE SENSOR **YL38**

WORKING OF THE DESIGN:

The two Transceivers are designed. Here System works in two parts namely:

1) Transmitter 2) Receiver

1. 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.

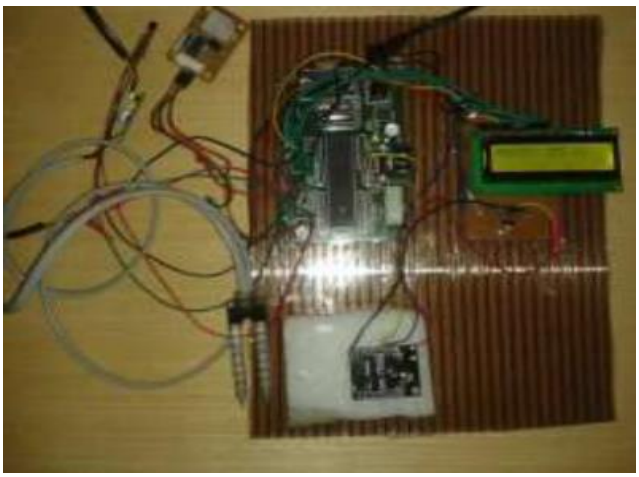

FIGURE4: TRANSMITTER SIDE PROTOTYPE

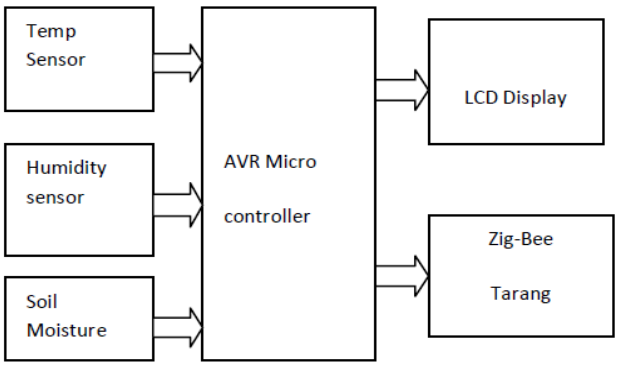

FIGURE5: BLOCK DIAGRAM OF TRANSMITTER SIDE

FIGURE6: RECIVER SIDE PROTOTYPE

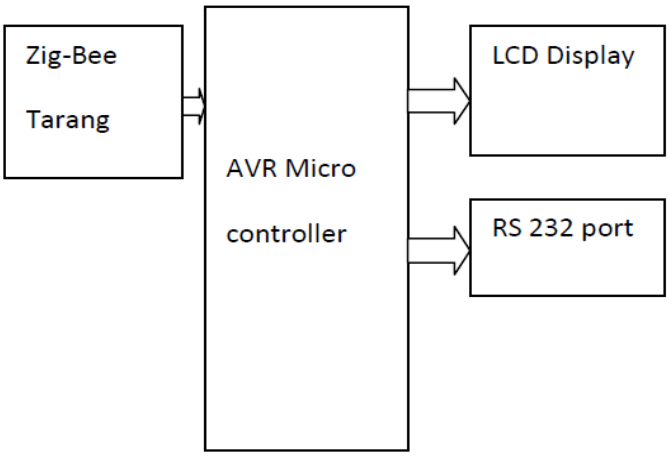

FIGURE6: RECIVER SIDE BLOCK DIAGRAM

RECIEVER:

At receiver side ZigBee 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 farming the 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.

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

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) All the parameters in the field play a vital role in the growth of the plant, thus it is required that all the parameters are kept at optimum rate hence violation in any may affect the plants growth severely.

Automatic irrigation scheduling consistently has shown to be valuable in water use efficiency with respect to manual irrigation based on direct soil water measurements. The aim of the implementation is to demonstrate that the automatic irrigation can be used to reduce water use. The implementation is an automated irrigation system that consists of a distributed wireless network of soil moisture and temperature sensor

OBSERVATIONS:

The following observations are obtained by 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 is plotted in the graph.

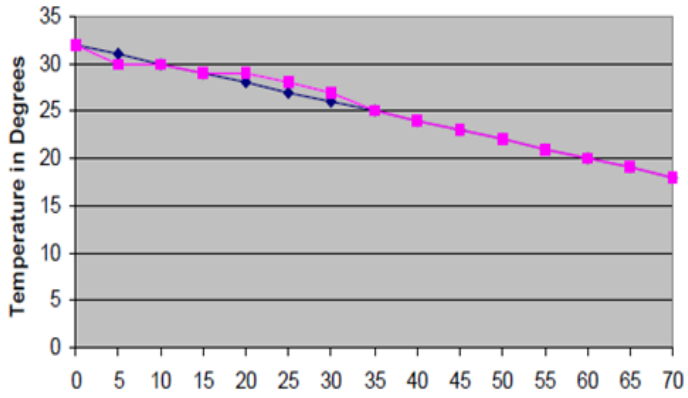

FIGURE 7: TEMPERATURE VS TIME

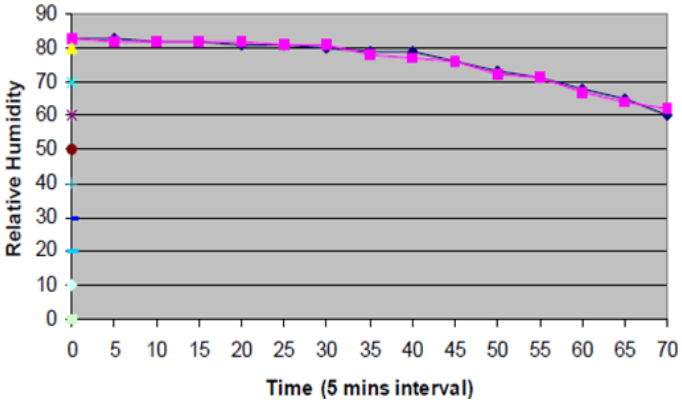

FIGURE 8: RELATIVE HUMIDITY VS TIME

CONCLUSIONS:

Zigbee-based agriculture monitoring system serves as a reliable and efficient system for monitoring agricultural parameters. The corrective action can be taken. 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 cheaper in cost and consumes less power. The GDP per capita in agriculture sector can be increased. This project can be extended for cattle monitoring. Overall with the help this project an automatic irrigation system can be designed based upon the instantaneous output of sensors.

REFERENCES:

[1] Stoianov L., Nachman S., Madden Pipenet (207) IEEE Inter-National Conference on Information Processing in Sensor Networks.

[2] Design & Implementation of Wireless Transceiver for Data Acquisition in Wireless Sensor Network Dr. R. K. Prasad, Mr. S. Madkar
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[3] Brenetxea G., Ingelrest F., Schaefer G., Vetterli M., Couach O., Parlange M. (2008) SensorScope: Out-of-the-Box Environmental Monitoring, In The 7th International Conference on Information Processing in Sensor Networks (IPSN).

[4] Lemos S.G., Noguera A.R., Torre-Neto A., Parra A., Alonso J. (2007) Journal of Agricultural and Food Chemistry, 55 4658-4663.

[5] Burri N., von Rickenbach P. and Wattenhofer R. Dozer (2007) ultra-low power data gathering in sensor networks, ACM, 450-459.