

Remote Monitoring of Crop Field Using Wireless Sensor Network

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ABSTRACT: This paper presents the design and implementation of wireless sensor network that can monitor the air temperature, Humidity, light intensity in a crop field and from remote places also. The system consists of nodes, which are equipped with small size application specific sensors and radio frequency modules. The sensor data is transmitted via radio frequency link to the centrally localized computer terminal for data logging and analysis. This data can be monitor from the remote places by uploading the data into the internet, also the sensor nodes can additionally be programmed from the computer terminal itself according to the changing needs of farmers thus preventing the need for redeployment of the wireless sensor network every time some changes are to be made. Since the energy is the main operating constraint sleep mode of the core component is utilized.

I. INTRODUCTION

Wireless sensors will be spatially distributed with each node communicating with one another and the central unit would record the data received. The autonomous devices which use sensors to co-operatively monitor physical or environmental parameters such as temperature, light intensity, humidity, and moisture levels. Data collected from the sensors play a key role in crop field management [1]-[6] and this data can be monitor from any place by uploading this data to the remote pc's through rabbit processor. Another application of WSN in detection of forest fires and plant fires [7]-[9] forest fires can cause huge damage to the human and natural resources. Sensor nodes in WSN can determine and transmit the location of source of the fire to the fire preventing department before the fire expands to other regions. The crop growth depends upon the air temperature, humidity, light intensity and active radiation of light which plays an important role in the photosynthetic activity. Remote monitoring of crop field using WSN thus represents the class of network applications with more benefits to the end users.

II. SYSTEM ARCHITECTURE

The WSN for remote monitoring of crop field consists of set of wireless sensor nodes distributed in an area called end devices or sensor nodes. They have a stronger battery, a larger memory and more computation power, the sensor nodes collects the data from the field by using sensors and this data is send to the coordinator through routers ,the path between end devices, routers and coordinators is provided by ZIGBEE. The collected data is send to the internet and pc through Ethernet.

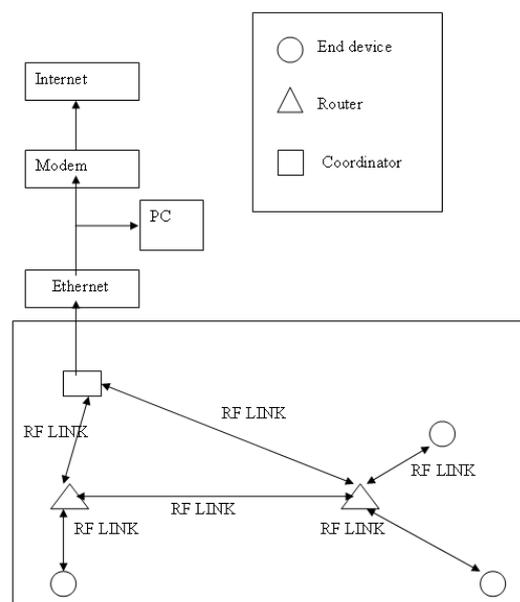


Figure 1. The structure of the WSN for remote monitoring of the crop field

III. WIRELESS SENSOR NETWORK

In the remote monitoring of parameters using WSN system consists of ZIGBEE based sensor nodes. The end devices and router are sensor part of the system, the coordinator is the controller of the system, and the topology of the WSN is shown in the figure 2.

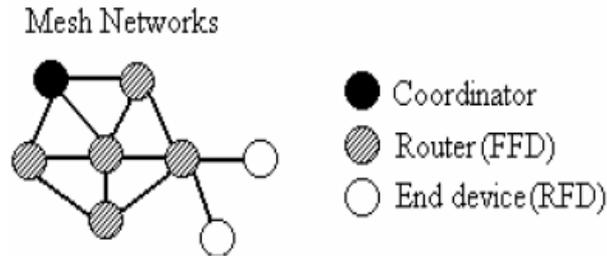


Figure 2. ZIGBEE network topology

The design of WSN system is as follows:

A. End devices

The end device is the sensor board, this board is embedded temperature sensor, humidity sensor, and light sensor when the ADC has transformed physiological signals into the digital signals which are sent to the 8 MHz 8 bit reduced instruction set computing cpu and then sent to 2.4 GHz IEEE 802.15.4 transceiver. The transceiver will send signals to the router. We can observe the field condition easily.

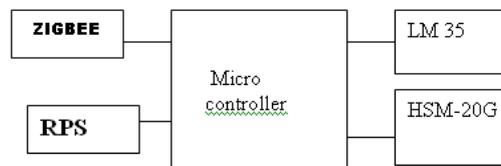


Figure 3. basic model of sensor node

(i) Sensors

Low power consumption, fast response time, tiny size, long term stability. The module HSM-20G is used as humidity sensor with measurement accuracy $\pm 5\%RH$. LM 35 is used as precision centigrade temperature sensor with directly calibrated in centigrade. Both the sensors do not require any external components for signal conditioning thereby saving valuable PCB area. Another key aspect for choosing these sensors is that the output from both the sensors is immune to noise and external disturbances due to its digital nature. The start up time in both the sensors is very low. Therefore current is not needed for a long time during initialization thereby reducing the power consumed. The power saved can be used to perform other computing tasks. Another advantage is that the sensors can be deployed quickly in the field since no calibration is needed prior to deployment.

(ii) Router

The router is used to transmit data between end device and the coordinator, when the router receives signals from the end device another router and the coordinator it will transmit signals to goals.

(iii) Coordinator

The coordinator is the controller board used to control the sensor network, the measured data of any end device appear on PC and internet via Ethernet. basic model of the coordinator is shown in Figure 4

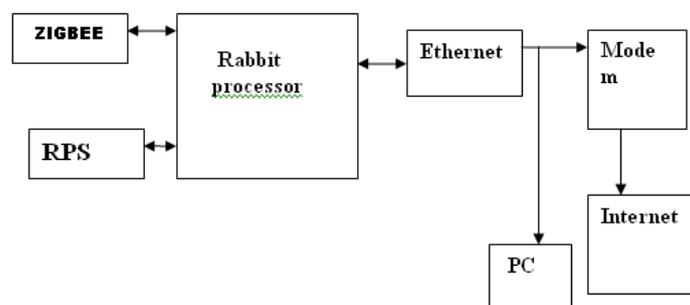


Figure 4. Basic model of coordinator

IV. RF COMMUNICATION

The ZIG BEE-PRO RF Modules [10] manufactured by Digi are used to provide the required wireless RF communication link amongst sensor nodes. The modules are engineered to meet IEEE 802.15.4 standards and provide reliable delivery of data between compatible devices. They operate within the ISM 2.4 GHz frequency band and provide a wireless communication range of 1500 m in open space. They require minimal power and support the unique needs of low-cost, low-power wireless sensor networks. The modules are programmed using dedicated programming kit to make them compatible for wireless communication.

V. RESULTS

The proposed WSN system consists of two sensor nodes which measures temperature and humidity. In order to save power and increase the life time of the nodes sleep and wake up modes are used. The collected data is displayed on web page

Wireless Sensor Network for Remote Monitoring of Crop Field

Name	Value	Description
Current Temp	36.5462000	Current temperature in °C
Humidity value	7.520000	Target Humidity (between 0 and 100)

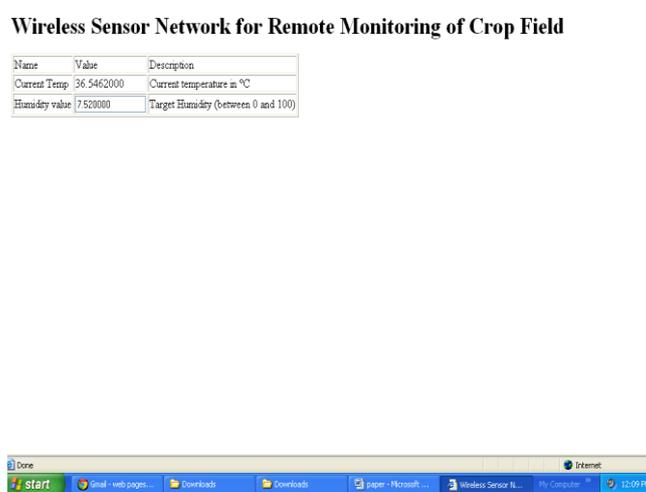


Figure 4 Web page contain results



Figure 6 Basic sensor node

VI. CONCLUSIONS

Crop field monitoring is useful class of sensor network applications with enormous potential benefits for the farmers and society as a whole. This paper presents the design and the implementation of a Wireless Sensor Network that monitors the air temperature, humidity and ambient light intensity in a crop field and from remote places. The sensor data is wirelessly transmitted to a centrally located computer terminal that logs the field data within seconds. The data collected can aid the farmers in achieving maximal crop productiveness. In case the computer terminal is switched OFF, data loss is prevented by the storage of the sensor data along with the time information in non-volatile memory. We have achieved a wireless communication range of more than 1 km, which can effectively monitor a normal crop field area. To make our sensor network energy efficient, sleep mode has been used for the sensors as well as the RF modules. Long network lifetime has been achieved by including a DC boost converter in the power supply design, which provides sensor nodes a stable power supply from degrading alkaline batteries. The converter can also detect low battery level indicating the need to charge the rechargeable batteries. Other special features of the design include detection of sensor node failure

In future, we plan to expand our network by adding more sensor nodes so that the coverage of an individual node decreases.

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