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Design and implementation of environment monitoring and controlling station with data collection network based wireless sensor network

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ABSTRACT

In modern generation of wireless sensor network, this proposed system gives a frame work for wireless sensor networks (WSN) is designed to see impacts of climate change in crop fields. we design a system architecture for observing and monitoring automatically and continuously in real time .This proposed system includes two base stations and many sensor nodes which are powered, designed, and implemented. Climate changes from sensor nodes are sent through WSN to the base station, then the base station communicates with remote data server center through GPRS or 3G network. We can also communicate in the areas where GPRS is not present, by using different methods of communication. As this system has many advantages and low cost continuously monitoring, the system can be applied widely in agriculture developing countries like Vietnam. Proteus simulation and power consumption results prove the energy efficient of environment stations and data collection network.

INTRODUCTION

In the context of ubiquitous wireless sensor network, this paper presents a complete frame work for wireless sensor networks (WSN) which is designed to observe impacts of climate change in crop fields. We design system architecture for observing and monitoring automatically and continuously in real time. This prototype system includes two base stations and several sensor nodes which are powered by solar cells are designed and implemented. Climatic parameters from sensor nodes are sent via WSN to the base stations, while the base station communicate with the remote data server center via GPRS Coverage. Power consumption estimation and NS-2 simulation results prove the energy efficient of environment stations and data collection networks. All the existing systems are connected to the PC. But here we transmit all sensors data to GPS server which is located at remote place. In proposed system sensors data transfer from base station to another base station and then transmit to remote server. Here server is optional.

LITERATURE SURVEY

Ubiquitous sensor networking for development: An Application to pollution monitoring (2009): The author explains that all over India the rapid development of

national economy, this prototype presents a new ubiquitous sensor network (USN) Architecture to be used in developing countries and reveals its usefulness by highlighting some of its key futures. In compliment to a previous ITU proposal, our architecture referred to as "ubiquitous sensor network for development (USN4D)" integrates in its layers features such as opportunistic data dissemination, long distance deployment and localization of information to meet the requirements of the developing world. Many important requirements for the sensor equipment to be used in USN4D settings are described. We present the main features and experiments conducted using the "Wasp Net" platform, we present an application to air pollution monitoring in the city cape town, in south Africa as one of the best step towards building community wireless sensor networks (CSN) in the developing world by using off the shelf sensor equipment.

Climate change scenario swith wireless sensor network: preliminary observation

A preliminary study was carried out under shed-net condition to observe climate change scenarios on tomato crop. Wireless sensor network (WSN) technology was used in the studies to monitor climate parameters (temperature, humidity, and co2 concentration) continuously under micro climate conditions. WSN devices used for the studies DSSAT (Decision support for agro technology transfer) simulation software tool were used to determine scenarios of crop yield under different co2 and temperature changes. In addition, coping strategies to combat the changes of the scenarios. Communication and information techniques tool were used for sensor web and for dissemination to rural community.

EXISTING SYSTEM

All the existing systems are connected to the PC. But here we transmit all sensors data to GPS server which is located at remote place.

PROPOSED SYSTEM

In proposed system sensors data transfer from base station to another base station and then transmit to remote server. Here server is optional.

In this proposed system, ARM7 micro controller is used for controlling all the hardware components that are connected to it. Here we use different types of sensors like humidity sensor, rain level sensor, temperature sensor etc. if any fire accidents occurs then immediately fire sensor is activated, with the help of signal conditioning unit, information is sent to micro controller. Then alarm is activated and message is sent to base station 2 using zigbee modem and the information related to fire accident is displayed on LCD. Now base station 2 sends the information remote locations. In the same way, when the sensor is activated then information is sent using GSM modem.

The changes in the climate leads to global temperate rise, flood increasing, salinity intrusion, lack of water can effect negatively to crop yields. In order to research all climate changes on natural and human activities, and for finding a solution to human adapt with climate change, we require an automatic and continuously monitoring of climate change.

In early years we have used wireless sensor networks to improve the agriculture decision making system ant apply this to coping strategies to overcome the threats from climatic changes by using sensor nodes, in which one node can observe many climatic parameters from a particular field in real time. In recent years, researchers have proposed automatic environment monitoring system based on the wireless sensor network. But the network formed by wireless sensors is a local area network because it uses only one wireless transceiver that supports just one communication interface and could not inter connect with other networks. Due to this, difficulty occurs for monitoring the areas which are far from the data centers. to overcome this we require inter-networking with different communication technologies. As climatic change occurs in all areas, we need to send the information of all the areas to the data center. By combing WSN technology with GPRS network, the problem of network management is solved, such that climate change monitoring can be done anywhere any time. The best solution can be achieved by integrating WSN with GPRS network by using a gateway, which offers many set of measurements as well as telecommunication.

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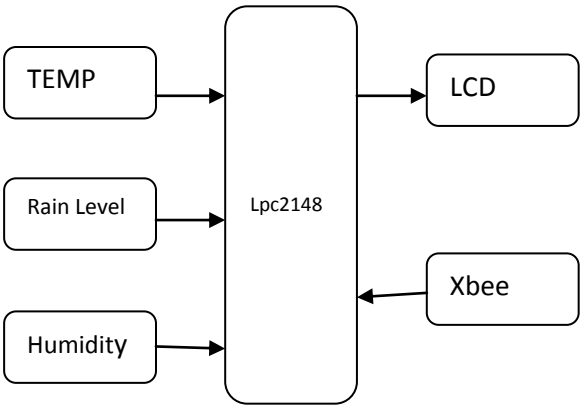
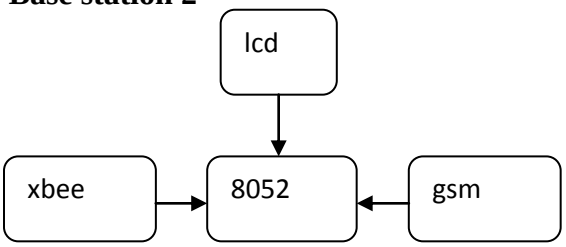
BLOCK DIAGRAM

Base station 1:



Base station 2



HARDWRE DESIGN OF THE SYSTEM

Sensor Network:

Proposed system contains system normal environmental system converted into some smart environmental monitoring system. It can give right decisions for copping different crops in different seasons. To increase the cultivation.In broadcast definition, a sensor is an object whose purpose is to detect changes in the environment. and then provides a corresponding output.

TEMPERATURE SENSOR LM35

The LM35 temperature sensor is an integrated circuit sensor that can be used to measure temperature with an electrical output that is proportional to the temperature. The LM35 sensor generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 series are precision integrated-circuit, temperature devices with an output voltage linearly- proportional to the Centigrade temperature. The LM35 device has an advantage over linear Temperature sensors calibrated in Kelvin scale, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scale. The LM35 device does not require any external calibration to provide typical accuracies.

HUMIDITY SENSOR

Humidity is the presence of water in air or atmosphere. The amount of water vapor in air can affect many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Controlling or monitoring humidity is importante in many industries & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled and monitored during wafer processing in semi conducting materials.

The aim of the project is smart environment monitoring system and easy monitoring the traffic signals . All the devices such as 16X2 LCD, Zigbee, lpc2148,temperature sensor, humidity sensor, rain level sensor, GSM are being interfacing to microcontroller which forms the control unit of the project. The uniqueness of this project is, it sends a caution SMS to mobile number as well as it post the values in by using zigbee and GSM technology. This project implementing smart environment monitoring is used whenever the Rechargeable Battery and solar system can be connected to this system to enable it to work in power failure conditions also.

ZIGBEE MODULE

The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, this consists of a start bit, 8 data bits, and one stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

Microcontroller

The NXP (founded by Philips) LPC2148 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with Thumb extensions 512KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP), 32KB RAM, Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, USB 2.0 Full Speed Device Controller, Two UARTs, Two

I2C serial interfaces, Two SPI serial interfaces Two 32-bit timers, Watchdog Timer, PWM unit, Real Time Clock with optional battery backup, Brown out detect circuit General purpose I/O pins.

GSM

The GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and time division multiple access transmission methods. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots; GSM supports data transfer speeds of up to 9.6 Kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service). Another major benefit is its international roaming capability, allowing users to access the same services when traveling abroad as at home. This gives consumers seamless and same number. connectivity in more than 210 countries. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

PROPOSED ALGORITHM

Algorithm for the proposed system is divided in two parts as

Algorithm for system consists sensors, ARM7:

1. Initialize SPI (Serial Peripheral Interface).
2. Initialize LCD.
3. Initialize GSM,GPS
4. Initialize all sensors.
5. Display sensors current status.
6. If any sensor status changes then message is displayed on LCD.
7. Operations in the field will be send SMS to farmer, alerting system on.
8. Then farmer will choose particular crop to cultivate depending on status of sensors.

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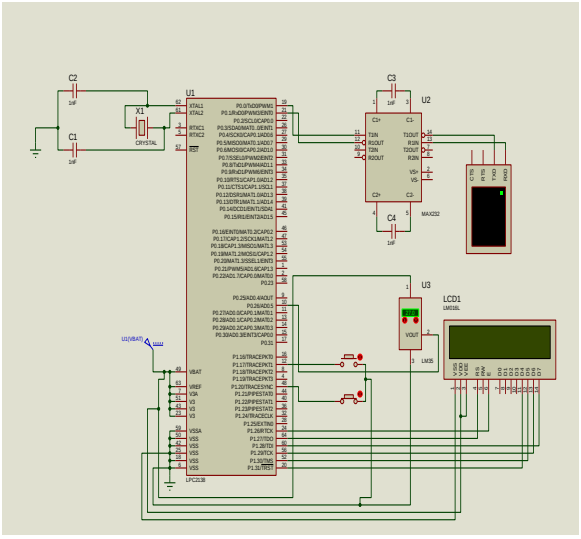
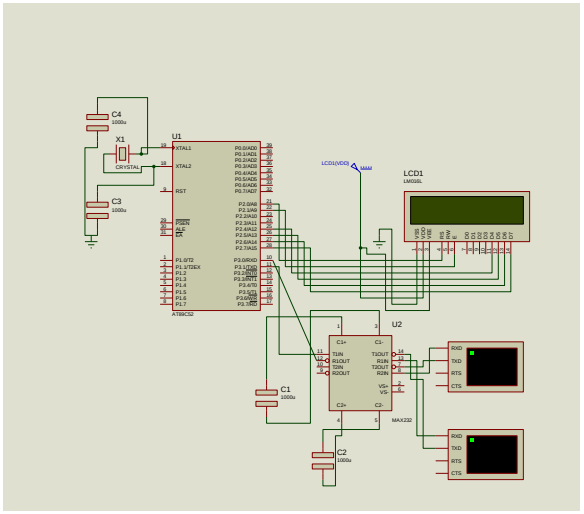
Working model and test design

Circuit diagram

Base station 1



Base station 2



CONCLUTION

In this paper, the energy efficient design of climate monitoring system based on ubiquitous WSN using solar cell is proposed and implemented. Working climate sensor station have successfully collected all the climatic parameters from environment using sensors such as wind speed, wind direction, temperature etc. In this system we have used low power consumption hardware and for long term purpose solar power supply is used. By applying advanced GSM and GPRS technology for data collection and transmission, the system has become more efficient. Many problems of real time monitoring and coverage areas can be solved by using solar power with high capacity lead acid batteries.

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