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Design of Reconfiguring Smart Sensor Interface for Industrial WSN Using GSM

Talakokkula Sandya
P.G.(M. Tech),
Siddhartha Institute of Technology & Sciences.

V. Vijaya Bhasker
Associate Professor,
Siddhartha Institute of Technology & Sciences.

ABSTRACT:

A sensor interface device is essential for sensor data collection of industrial wireless sensor networks (WSN). Manual status monitoring and health check of industrial machineries are not possible for machineries like boilers and chemical tanks, containers etc. Hence to check the status of these industrial machineries, there is requirement of intelligent system with wireless networking. Lot of complication is involved in industrial automation across various sites located far away from each other especially it is complicated to consolidate status and control each unit by manual operation over wired network. Hence to simplify the operation there is requirement of intelligent system with wireless networking. In this work, to solve these problems, a new method is proposed to design a reconfigurable smart sensor interface for industrial WSN, in which microcontroller is adopted as the core controller. Performance of the proposed system is verified and good effects are achieved in practical application of remote environment monitoring.

Keywords:

ARM Controller, High speed, Sensor Interface Device, WSN.

1.Introduction:

A wireless sensor network (WSN) is a distributed autonomous sensors to monitor physical and also environmental/industrial conditions, such as temperature, smoke, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bidirectional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Provide a bridge between the real physical and virtual worlds Allow the ability to observe the previously unobservable at a fine resolution over large spatiotemporal scales Have a wide range of potential applications to industry, science, transportation, civil infrastructure, and security. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. The topology of the WSNs can vary from a simple star network to an advanced multi hop wireless .mesh network.

The propagation technique between the hops of the network can be routing or flooding. First of all, microcontroller is used as the core controller to release the restriction on the universal data acquisition interface, and realize truly parallel acquisition of sensor data. It has not only improved the sensor data collection efficiency of industrial WSN, but also extended the application range of the data acquisition. Secondly, a new design method is proposed in this paper is that the multi sensors are controlled using the single system. The smart sensors are used in the proposed system is the great advantage. A smart transducer is a transducer that provides functions beyond those necessary for generating a correct representation of a sensed or controlled quantity. This functionality typically simplifies the integration of the transducer into applications in a networked environment.

1.1 RELATED WORK:

A wireless smart sensor platform targeted for instrumentation and predictive maintenance systems is presented. Thegeneric smart sensor platform with „plug-and-play" capability supports hardware interface, payload and communications needs of multiple inertial and position

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sensors, and actuators, using a RF link for communications,in a point-to-point topology. The design also provides means to update operating and monitoring parameters as well as sensor/RF link specific firmware modules „over-the-air". Sample implementations for industrial applications and system performance are discussed. In this project has used on Zigbee. This cost is too high and the WSN are controlled by remote access.Radio Frequency Identification and Wireless Sensor Network are two important wireless technologies that have wide variety of applications and provide limitless future potentials. However, RFID and sensor networks almost are under development in parallel way. Integration of RFID and wireless sensor networks attracts little attention from research community. This paper first presents a brief introduction on RFID, and then investigates recent research works, new products/patents and applications that integrate RFID with sensor networks. Four types of integration are discussed. They are integrating tags with sensors, integrating tags with wireless sensor nodes, integrating readerswith wireless sensor nodes and wireless devices, and mix of RFID and sensors. New challenges and future works are discussed in the end. RFID readers have relatively low range and are quite expensive, we envision that the first applications will not have RFID readers deployed ubiquitously. The applications which allow mobile readers to be attached to person"s hands, cars or robots will be good candidates.

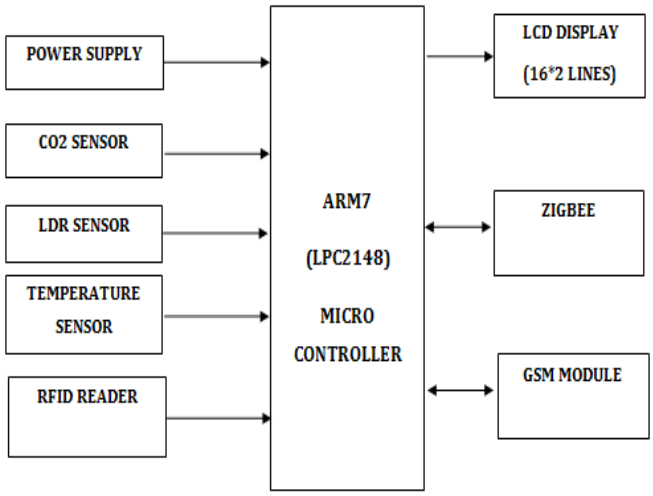
2.PROPOSED METHOD :

The proposed work includes the collection of data from various sensors of Industry like temperature sensor, CO2 sensor and light sensor. The signals of the sensors undergo signal conditioning to convert the signals from analog to digital. The microcontroller used belongs to ARM7 family. It processes the data and displays the parameters on the LCD as well as provides it to the ZIGBEE module and then to coordinator node for further analysis of sensor information and the system provides the instant alerts to remote users in the form of SMS. The system also providing the option to reconfiguring the sensor system with the help of RFID technology.

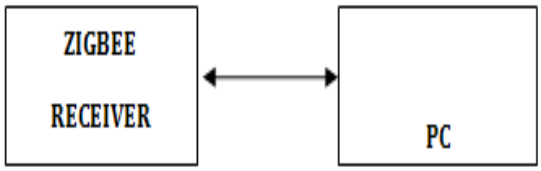
2.1 BLOCK DIAGRAM DESCRIPTION:

The proposed system is divided into two sections. First is a hardware circuit contains different sensors like temperature, LDR and CO2 . This may be preferably places at required locations of industry. The circuit has a sensor module consisting of some sensors that measures real-time industrial parameters like temperature, LDR, and CO2 etc. In this sensor node the ARM7(LPC2148) microcontroller collects the sensor data from sensors and get the node ID number form RFID and process them and fed to the zigbee wireless transmitter which will send the information to the coordinator node. And also the system sends the SMS alerts ON exceed of sensor threshold levels.The coordinator node consists of zigbee receiver and PC which will collects the sensor information form different nodes and display them for further proceedings.

SENSOR NODE:



Coordinatornode:



HARDWARE DESCRIPTION:

wireless sensor nodes mainly consist the sensor unit, signal conditioning circuitry, microcontroller (MCU), Zigbee module, timers, memory and power management module and other components shown in block diagram of proposed system.

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Microcontroller :

In this work the micro-controller is playing a major role. Micro-controller is responsible for collecting environmental information (such as temperature,LDR, CO2, etc.) and do some data conversion, responsible for controlling and managing the entire nodes. Micro-controllers were originally used as components in complicated process-control systems. However, because of their small size and low price, Micro-controllers are now also being used in regulators for individual control loops. The purpose of this work is to present control theory that is relevant to the analysis and design of Micro-controller system with an emphasis on basic concept and ideas. It is assumed that a Microcontroller with reasonable software is available for computations and simulations so that many tedious details can be left to the Microcontroller. The control system design is also carried out up to the stage of implementation in the form of controller programs in assembly language OR in C-Language.

Max232:

The data which we are entering in to the hyper terminal editor is available at the COM1 port. Then the data enters in to the MAX232 voltage converter via the RS232 cable. [5]The MAX232 converts the voltage levels of the RS232 to the TTL level and then sends to the UART of the microcontroller. So the main duty of the max232 is for the voltage conversions.

LCD Display Section:

This section is basically meant to show up the status of the work. This work makes use of Liquid Crystal Display to display prompt for necessary information.

Zigbee Module :

Zigbee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. WPAN Low Rate or ZigBee provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. Fig 2, ZigBee makes possible completely networked homes where all devices are able to communicate and be controlled by a single unit. Two Zigbee modules are used for the transmitter and the receiver.

The experiment is done as per the IEEE 802.15.4a channel models i.e. for R (LOS and NLOS) and IO (LOS and NLOS). Prior to doing the experiment each Zigbee module is connected to each PC and the X-CTU software is installed in those PC's.

LDR Sensor:

The Light Dependent Resistor(LDR) are used in places where there is need to control the Intensity and level of light especially for protecting photo films and frames. An LDR is made of semiconductor material. It has a high resistance because the vast majority of the electrons are locked into the crystal lattice and unable to move. Therefore in this state there is a high LDR resistance.

As light falls on the semiconductor, the light photons are absorbed by the semiconductor lattice and some of their energy is transferred to the electrons. This gives some of them sufficient energy to break free from the crystal lattice so that they can then conduct electricity. This results in a lowering of the resistance of the semiconductor and hence the overall LDR resistance. This data is given to microcontroller.

CO2 sensor:

Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

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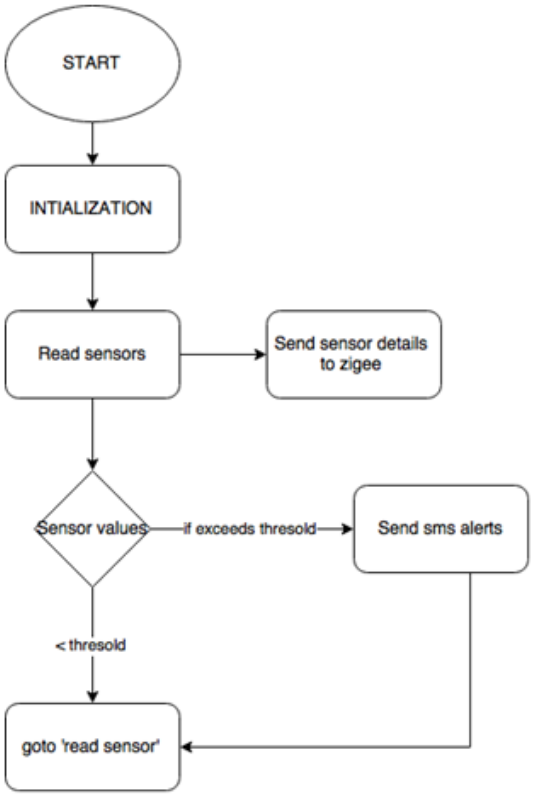
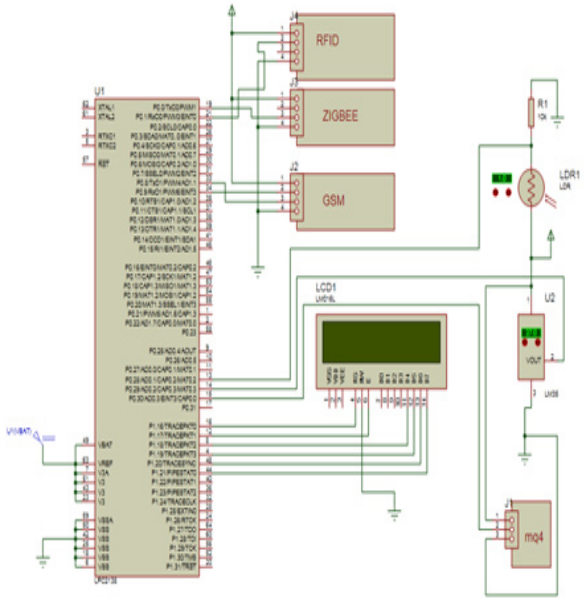
FLOWCHART:



SCHEMATIC DIAGRAM:



APPLICATIONS:

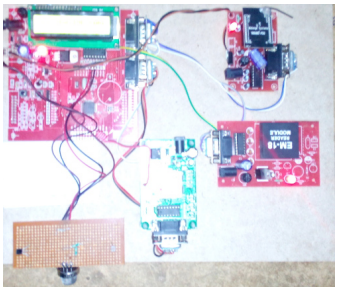
» Green house
» Industries
» hospitals

ADVANTAGES:

» Smart meters
» Crop management
» Automatic alert system in the nuclear industries

3. RESULT AND CONCLUSION:

The proposed system was fully developed and tested to demonstrate its feasibility and effectiveness. The screen-shots of the smart home app developed has been presented in Figure bellow.



CONCLUSION:

The "WSN BASED REMOTE INDUSTRIAL MONITORING SYSTEM" can collect sensor data intelligently. It was designed based on ARM and the application of wireless communication. It is very suitable for real-time and effective requirements of the high-speed data acquisition system in industrial environment. The ARM greatly simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible. Different types of sensors can be used as long as they are connected to the system. On setting the values of each sensors then the Temperature, Gas, ldr values are known. Here the values of sensors is measured By this the critical situation can be avoided. We can monitor the sensors through GSM.

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