Industrial Monitoring and Predictive Maintenance System Based On FPGA

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Abstract— The FPGA (Field programmable gate array) provide flexibility with the system. Where sensors are more flexible using the FPGA and the communication of data and control statements are using zigbee Standard Protocols. Smart sensor trend towards increased quality and reliabiltiy from production processes with minimal operator supervision depends very much upon the development and application of reliable and accurate sensors. Various sensors are being used for measuring the temperature, humidity gas etc. These sensor values must be in real time and accurate in order to avoid faults. In the proposed system reconfigurable sensors are interfaced with the FPGA(field programmable gate array). The sensors output normally in the form of analog.so here ADC using for convert the analog value to Digital value. Then the measured values are compared with the threshold value.so easily the admin will be informed to take corrective measure. The communication protocol is zigbee used, it has high speed and accurate.

Key words: FPGA, Zigbee, Sensors

I. INTRODUCTION

Now a days, technology is growing rapidly with new innovative ideas. In this project we are about to design an VLSI reconfigurable wireless sensor network system for industrial monitoring system. In all aspects of control and monitoring in industries development is done in all fields. mostly all developments are done in wired means. But this project includes wireless protocol zigbee with FPGA used for industrial monitoring. So the reconfigurable smart sensor interface to reduce the manual work of an admin for monitoring the temperature, humidity, gas, human intrusion. For point to point communication everyone used wired links. Currently, the wired links are replaced by the wireless module. In this project FPGA is used in the processing unit instead of microcontroller, because of limited processing and input-output capabilities.

Three units operation is used in any system. This three units structure is continued used in industry for many applications. The three units are sensing unit, processing unit and communication unit. The communication unit, which directly communicate the data between processer like PC and FPGA.

II. LITERATURE REVIEW

Wireless sensor networks (WSN) sometimes called wireless sensor and actuator network (WSAN), are spatially distributed, autonomous sensors to monitor physical environmental conditions. such as temperature, sound, pressure, etc…and to cooperatively pass their data through the network to a main location.

A. Wireless Sensor Networks

Wireless sensor networks (WSN), sometimes called wireless sensor and actuator networks (WSAN), are spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location.

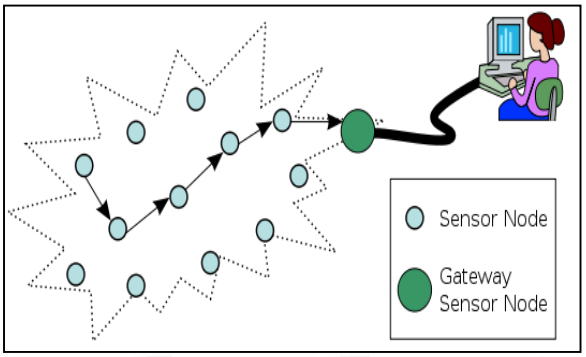

Fig. 1: Multihop wireless sensor architecture

The more modern networks are bi-directional, 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.

The main characteristics of a WSN include:

- Power consumption constraints for nodes using batteries or energy harvesting
- Ability to cope with node failures (resilience)
- Some mobility of nodes (for highly mobile nodes see MWSNs)
- Heterogeneity of nodes
- Scalability to large scale of deployment
- Ability to withstand harsh environmental conditions
- Ease of use
- Cross-layer design

B. Reconfigurable Smart Sensor Interface for Industrial Wsn

In this project sensor interface device is essential for sensor data collection of industrial WSN in IOT environment. In this system using CPLD (Complex Programmable Logic Device) which can read data in parallel and high speed. For this design IEEE 1451.2 sensor interface specification is adopted. This system consist of CPLD programmable technology and standard of IEEE 1451.2 intelligent sensor specification. In this paper the proposed system performance is verified and good effects are achieved in practical application of IOT to water environment monitoring.

C. Industrial Monitoring Using RTOS

A periodic transmission to measure accurately and reliable for the operation of nuclear power plants s and large scale industries .sensors are used in RTOS. So that the sensors value should be real and accurate to avoid faults. Hence, RTOS read data in real time with maximum speed in parallel sequence .The measured values are sent to the monitoring station via zigbee. Then the measured values are compared with the threshold value. In case of mismatch the workers will be informed to take corrective measures. This is a new approach using RTOS in order to avoid serious disasters in nuclear power plants and large scale industries.

D. Smart Sensor System

Smart sensor system provide safety, security and surveillance as well as monitoring of our healthy and environment. The smart sensor definition is vary but typically sensing element with processing capabilities is known as minimum a smart sensor provided by a microprocessor. In this paper future application is industrial monitoring, health monitoring smart sensor systems potentially represent a new generation of sensing capability and self-awareness that are essential components of future intelligent system. It will have a profound impact on applications such as food safety and biological hazard detection, safety hazard detection and warning environmental monitoring both locally and on a global scale health monitoring and media diagnostics and industrial and aerospace application.

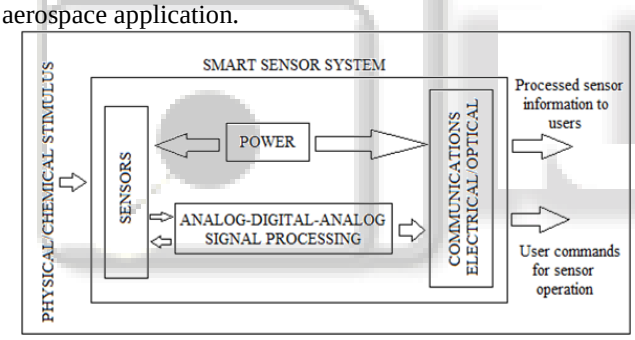

Fig. 2: Smart sensor system

E. Smart Transducer Interface

A digital interface for connecting multiple physically separated transducers to a single processor over a single pair of wires. The interface can support both asynchronous and isochronous data transfers. Several Transducer Electronic Data Sheets (TEDS) and their data formats are described. An electrical interface, channel identification protocols, time synchronization protocols, read and write logic functions to access the TEDS, and transducers with a wide variety of attributes are defined. This standard does not specify signal conditioning, signal conversion, or how an application uses the TEDS data.

III. PROCESS DESCRIPTION

The block diagram represent the overall structure of the system. The smart sensor device is interact with the environment in this module. The module consists of temperature, gas, humidity and human intrusion. In Industry, manage the temperature of machinery is very important for the better performance of the machinery, here LM35 sensor is used.

It is low cost and the operating range from 4V to 30V. Humidity is the presence of water in air. The amount of water in air can be affect human comfort as well as many manufacturing processes in industries Humidity measurement in industry is critical because it may affect the business cost of the product. SY-HS-220 humidity sensor having linear DC output voltage, ranging from 0 to 60C.

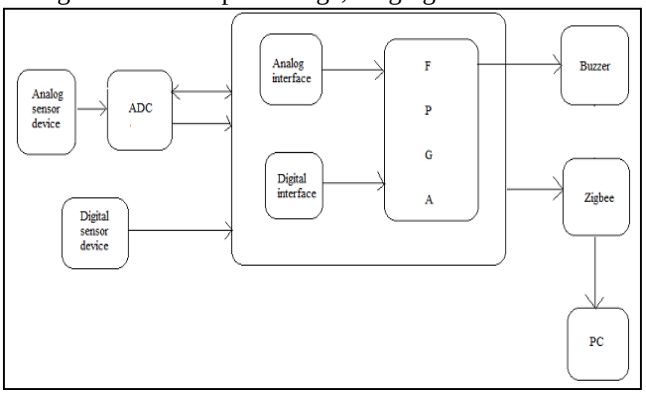

Fig. 3: Block diagram

The human intrusion can be sensed using the IR sensor connected to the FPGA system. Human intrusion can lead to misguidance of the system and even physical accidents. Normally sensor output is in analog form, here this signals are converted into digital form by using ADC. The ADC0808 having high speed, high accuracy, minimal temperature dependence, repeatability, and minimum power consumption. FPGA allows to processes the most complex signals in fast way.

The FPGA work on three different power voltages, i.e. 1.2V, 2.5V and 3.3V. In the communication unit, a zigbee module is chosen. Because of zigbee characteristics is low power consumption and enough data rate for the application. This technology is widely used and worked in 2.4 GHz. The FPGA can communicate with zigbee module through UART port; The FPGA can solve any problem because of flexibility in the device.

IV. OUTPUT ANALYSIS

Given an I/O function, develop a procedure to manufacture a device using known materials and processes. Predictive analysis to ensure that the synthesized design, when manufactured, will perform the given I/O function. A manufacturing step that ensures that the physical device, manufactured from the synthesized design, has no manufacturing defect.

Proposed model is designed using VHDL code in ISE tool for testing purpose various test benches are prepared, according to the parameters to be observed. The output is obtained by buzzer indications or message alerts.

V. ADVANTAGES

- The wireless sensor network reduces the manual work of an admin like monitoring and controlling process.
- And more number of sensors can be included as per the industrial need and it is easy to reconfigure.
- It can be done manually by controlling all devices together.

VI. APPLICATIONS

- The wireless sensor network has focus on industrial applications, military, environment monitoring and household security applications.
- The processes in Industry are very well automated and developed. This project is mainly used for monitoring and control them via wireless means. But Control and monitoring processes of each machine are still manual.
- There are no single controls for all devices, it can be done manually. In this Project, for the controlling process, indication will be provided to perform the controlling action.

VII. CONCLUSION

In wireless sensor networks, energy efficient routing constitutes the challenging research area. Now a-days many more energy saving methods are developed hence, in many field wireless application can be extended. When this project is commercially implemented, we will get efficient result in monitoring and control. This carried out test results ,use to determine system performance for the instrumentation and maintenance application and this result is quite satisfactory. This experimental result shows that real-time system can be setup with the smart sensor nodes. zigbee is having excellent low power capability. In terms of power and performance, it provides an excellent alternative for Bluetooth and RFID. This project gives attention on account of better power management, easy in maintenance, reduced costs, and less effort in development in remote and hard-to-reach areas.

In future, we can change type of sensor and number of sensor nodes as per requirement of industry. For the further development, it may lead to use the commercial products.

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