ISSN 2395-1621

Interfacing of reconfigurable sensors Using FPGA for Industrial WSN in IoT

#1Ravi Humane, #2Prof. A. R. Askhedkar

[1]rvhumane@gmail.com
[2]anjali.askhedkar@mitcoe.edu.in

[1]M.E Student, Dept. of Electronics and Telecommunication
[2]Assistant Prof, Dept. of Electronics and Telecommunication
MIT College of Engineering
Pune, India.

ABSTRACT

This paper discusses the ongoing research being carried out on an autonomic Smart sensor interface device which is essential for sensor data collection of industrial wireless sensor networks in IoT environments. The current connect number, sampling rate, and signal types of sensors are generally restricted by the device. While, in the Internet of Things environment, every sensor connected to the device is required to write complicated and cumbersome data collection programming code. In this paper, to solve above these problems, a new method is proposed to design a functional smart sensor interface for industrial WSN in IoT environment, in this field programmable gate array device is adopted as a core-controller. The performance of the proposed system is verified and good effects are achieved in practical application of IoT to industrials environment monitoring.

ARTICLE INFO

Article History

Received: 20th June 2016

Received in revised form : 20th June 2016

Accepted: 23rd June 2016

Published online : 23rd June 2016

Keywords: FPGA, Sensors, ZigBee, IoT.

I. INTRODUCTION

Wireless sensor networks (WSNs) have become a hot research topic in recent years clustering is considered as an effective approach to reduce network overhead and improve scalability. Wireless sensor network is one of the pervasive networks which sense our environment through various parameters like heat, temperature, pressure, etc. [1], Since sensor networks are based on the dense deployment of disposable and low-cost sensor nodes, destruction of some nodes by hostile action does not affect a military operation as much as the destruction of a traditional sensor, which makes the sensor network concept a better approach for battlefields [2]. The transmission between the two nodes will minimize the other nodes to show the improve throughput and greater than spatial reuse than wireless networks to lack the power controls. Adaptive Transmission Power technique to improve the Network Life Time in Wireless Sensor Networks using graph theory [3].We have distance comparison between the neighbour nodes and also local level connected from the nearest edges in wireless sensor networks.

II. RELATED WORK

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

III. LITERATURE SURVEY

WIRELESS SENSOR NETWORKS (WSN) has been employed to collect data about physical phenomena in various applications such as habitat monitoring, and ocean monitoring, and surveillance [1]-[3]. As an emerging technology brought about rapid advances in modern wireless telecommunication, Internet of Things (IoT) has attracted a lot of attention and is expected to bring benefits to numerous application areas including industrial WSN systems, and healthcare systems manufacturing [4]-[5]. WSN systems are well-suited for long-term industrial environmental data acquisition for IoT representation [6]. Sensor interface device is essential for detecting various kinds of sensor data of industrial WSN in IoT environments [7]. It enables us to acquire sensor data. Thus, we can better understand the outside environment information. However, in order to meet the requirements of long -term industrial environmental data acquisition in the IoT, the acquisition interface device can collect multiple sensor data at the same time, so that more accurate and diverse data information can be collected from industrial WSN. With rapid development of IoT, major manufacturers are dedicated to the research of multi-sensor acquisition interface equipment [8]. There is a lot of data acquisition multiple interface equipment's with mature technologies on the market. But these interface devices are very specialized in working style, so they are not individually adaptable to the changing IoT environment [9]. Meanwhile, these universal data acquisition interfaces are often restricted in physical properties of sensors (the connect number, sampling rate, and signal types). Now, micro control unit (MCU) is used as the core controller in mainstream data acquisition interface device. MCU has the advantage of low price and low power consumption, which makes it relatively easy to implement. But, it performs a task by way of interrupt, which makes these multi-sensor acquisition interfaces not really parallel in collecting multi-sensor data. On the other hand, FPGA has unique hardware logic control, real-time performance, and synchronicity [10], [11], which enable it to achieve parallel acquisition of multi-sensor data and greatly improve real-time performance of the system [12]. FPGA has currently becomes more popular than MCU in multi-sensor data acquisition in IoT environment. However, in IoT environment, different industrial WSNs involve a lot of complex and diverse sensors. At the same time, each sensor has its own requirements for readout and different users have their own applications that require different types of sensors [13]. It leads to the necessity of writing complex a nd cumbersome sensor driver code and data collection procedures for every sensor newly connected to interface device, which brings many challenges to the researches [14] –[16]. Sensor data acquisition surface device is the key part of study on industrial WS N application [17]. In order to standardize a wide range of intelligent sensor interfaces in the market and solve the compatibility problem of intelligent sensor, the IEEE Electronic Engineering Association has also launched IEEE1451 smart transducer (STIM) interface standard protocol suite for the future development of sensors [18]. The protocol stipulates a series of specifications from sensor interface definition to the data acquisition [19]. The STIM interface standard IEEE1451 enables sensors to automatically search network, and the STIM promotes the improvement of industrial WSN [20].

IV. PROPOSED SYSTEM

An embedded system based monitoring and control system for Nuclear Power Plants and large scale industries is designed. In the existing system, Complex Programmable Logic Device is used as a core controller and sensors are interfaced to it. But CPLD is limited in function and logic density compared with a FPGA. FPGA's are more versatile than a CPLD and also denser logic functions may be performed in it while comparing a CPLD. Hence in the proposed system microcontroller is used as a core controller. The programming module is implemented using VHDL coding. The system mainly consists of two units and they are monitoring and control unit. The monitoring unit is placed near the plant the control unit is far away from the plant. The monitoring unit consists of sensors, FPGA and Zigbee. The measured sensor values of the plant or industry are sent to the controller and they are transmitted to the control unit via Zigbee. The control unit consists of the Zigbee and computer. The transmitted values from the monitoring unit are received via Zigbee and they are compared with the threshold values in the controller and they are displayed in the computer and then sent via WAN to the Internet if needed. In case of mismatch the workers will be informed to take corrective measures.

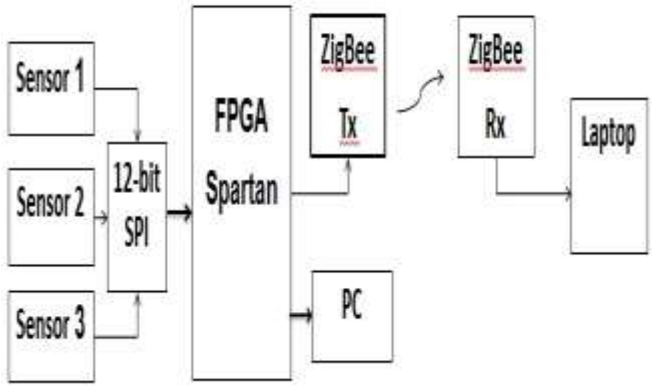


Fig. 1 Block Diagram

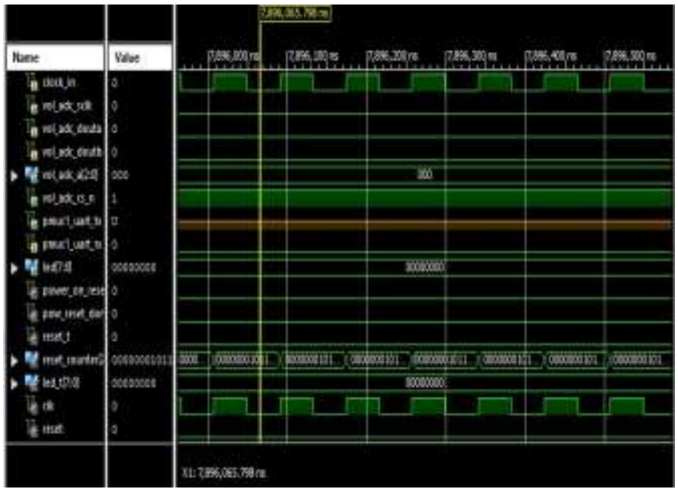
A. Sensor

A sensor is a device used for the detection of changes in quantities and it provides a corresponding output, generally as an electrical or optical signal. In everyday, sensors are used in objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. With advances in micro machinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the more traditional fields of temperature, pressure or flow measurement. A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. Making the sensor smaller often improves its performance of measuring and it can be designed to have a small effect and also introduces many advantages. The smallest change it can detect in the quantity that it is measuring is the resolution of a sensor. Various sensors used here are for measuring temperature, gas, humidity, light intensity and pressure.

B. ZigBee

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is used in applications that require low data rate, long battery life and secure networking. ZigBee has a data rate of 250kbit/s, best suited for intermittent data transmissions from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that require short-range low-rate wireless data transfer. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks such as Bluetooth or Wi-Fi. ZigBee protocols are intended for embedded applications requiring low data rates and low power consumption.

V. SIMULATION RESULT



V. CONCLUSION

In this system, all the measurement is sent to the analog channel of the Spartan3 microcontroller and displayed. The performances of the channels are distinguished on the basis of its accuracy. The accuracy indicates how closely the sensor can measure the actual or real world parameter value. The more accurate a sensor is, better it will perform. This system is time saving, portable, affordable, consumes less power and can be made easily available so that the user can use this system whenever and wherever.

REFERENCES

[1] Qingping Chi, Hairong Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu, "A Reconfigurable Smart Sensor Interface for Industrial WSN in IoT Environment," IEEE Trans. Ind. Informat., vol. 10, no. 2, may 2014.

[2] L. Benini, "Designing next-generation smart sensor hubs for the Internet of Things," in Proc. 5th IEEE Int. Workshop Adv. Sensors Interfaces (IWASI), 2013, p. 113

[3] M. T. Lazarescu, "Design of a WSN platform for long-term environmental monitoring for IoT applications " IEEE J.Emerg. Sel. Topics Circuits Syst.,vol. 3, no. 1, pp. 45–54, Mar. 201.

[4] S. Li, L. Da Xu, and X. Wang, "Compressed sensing signal and data acquisition in wireless sensor networks and internet of things," IEEE Trans. Ind. Informat., vol. 9, no. 4, pp. 2177–2186, Nov. 2013.

[5] M. Rizzelloet al., "A standard interface for multisensor systems," Sensor Environ. Control, pp. 224–228, 2003.

[6] F. Salvadori et al., "Monitoring in industrial systems using wireless sensor network with dynamic power management," IEEE Trans. Instrum. Meas., vol. 58, no. 9, pp. 3104–3111, Sep. 2009.

[7] Goswami, A., Bezboruah, T. and Sarma, K. C., "Design of an embedded system for monitoring and controlling temperature," Porc. Of International conference on emerging technologies and applications in engineering, technology and science during January, 2008, Rajkot, Gujarat, India, Vol.1, pp.105 -110.

[8] Goswami, A., Bezboruah, T. and Sarma, K. C., "Design and implementation of an embedded system for monitoring and controlling the intensity of light," Porc. Of The 2008 International conference on embedded systems and application during July 14-17, 2008 at Las Vegas Neveda, USA, Vol-ESA 2008, pp.117-123

[9] Introduction to LCD programming tutorial by Craig Steiner Copyright 1997 -2005 by Vault information services LLC (http://8052.com/tutlcd.phtml).

[10] L. Wang, L. D. Xu, Z. Bi, and Y. Xu, "Data cleaning for RFID and WSN integration,"IEEE Trans. Ind. Informat., vol. 10, no. 1, pp. 408–418,Feb. 2014.

[11] Y. Fan, Y. Yin, L. Xu, Y. Zeng, and F. Wu, "IoT based smart rehabilitation system,"IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1568–1577, 2 may2014.

[12] W. He, G. Yan, and L. Xu, "Developing vehicular data cloud services in the IoT environment,"IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1587–1595, 2014.

[13] W. Viriyasitavat, L. Xu, and W. Viriyasitavat, ―A new approach for compliance checking in service workflows, IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1452 – 1460, 2014.

[14] L. Xu and W. Viriyasitavat, ―A novel architecture for requirement-oriented participation decision in service workflows, IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1478 – 1485, 2014.

[15] S. Fang, L. Xu, H. Pei, and Y. Liu, ―An integrated approach to snowmelt flood forecasting in water resource management, IEEE Trans. Ind. Informat., vol. 10, no. 1, pp. 548 – 558, Feb. 2014.

[16] Z. Bi, L. Xu, and C. Wang, ―Internet of Things for enterprise systems of modern manufacturing, ‖ IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1537–1546, 2014.

[17] W. Viriyasitavat and L. Xu, ―Compliance checking for requirement-oriented service workflow interoperations,IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1469 – 1477, 2014.

[18] R. Dafali, J. Diguet, and J. Creput, ―Self-adaptive network-on-chip interface, IEEE Embedded Syst. Lett., vol. 5, no. 4, pp. 73–76,Dec. 2013

[19] Basma M. Mohammad El-Basioni, & Sherine M. Abd El-kader ―Smart Home

[20] Design using Wireless Sensor Network and Biometric Technologie, International Journal of Application or Innovation in Engineering & Management (IJAIEM),Volume 2, Issue 3, March 2013.

