International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Implementation of Smart Sensor Interface for Industrial WSN in IOT Environment

K. Purshotham[1], S. Venkata Kiran[2]

[1]M.Tech Scholar, Department of ECE. Sri Venkatesa Perumal College of Engineering & Technology,Puttur-India

[2]Associate Professor, Department of ECE. Sri Venkatesa Perumal College of Engineering & Technology,Puttur-India

Abstract: ***The proposal of system is to develop a sensor interface device is essential for sensor data collection of industrial Wireless Sensor Networks (WSN) in Internet of Things (IoT) environment. It is planned to style a re-configurable sensible device interface for industrial WSN in IoT atmosphere, during which ARM is adopted as the core controller. Thus, it will scan information in parallel and in real time with high speed on multiple completely different device information. Intelligent device interface specification is adopted for this style. The device is combined with the most recent ARM programmable technology and intelligent device specification. By detecting the values of sensors it can easily find out the Temperature, Vibration, Gas present in the industrial environment. So that critical situation can be avoided and preventive measures are successfully implemented.***

Keywords: CPLD, IEEE1415 protocol, Internet of Things(IoT), sensor data acquisition

1. 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… 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.. 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. We have distance comparison between the neighbour nodes and also local level connected from the nearest edges in wireless sensor networks.

2. 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. 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 readers with 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. In the existing work, the developed system was not efficient in the view of task scheduling, as the system was used was a non Linux device and also external Ethernet was used for the communication purpose.

3. Proposed System

On a Raspberry Pi (Single-Board Computer) board of ARM 11 architecture will be ported with an Embedded Linux operating system and using Ethernet protocol for IOT applications, we will acquire the data from the Wireless Sensor Network (WSN), post the data over the web such that it can be viewed over internet on any browser as well also in advancement will operate the appliance from the web.

Using ARM controller we can connect all types of sensors and we can connect 8 bit microcontroller based sensor network to ARM controller using different wired or wireless technology. Many open source libraries and tools are available for ARM-linux wireless sensor network development and controlling. We can monitor and control the wireless sensor network remotely using internet and web server. The system describes the development of a wireless industrial environment measuring temperature, humidity, atmospheric pressure, soil moisture; water level and light detection. Where the wireless connection is implemented to acquire data from the various sensors, in addition to allow set up difficulty to be as reduced. By using Wi-Fi technology we send the sensors data to authorized person.

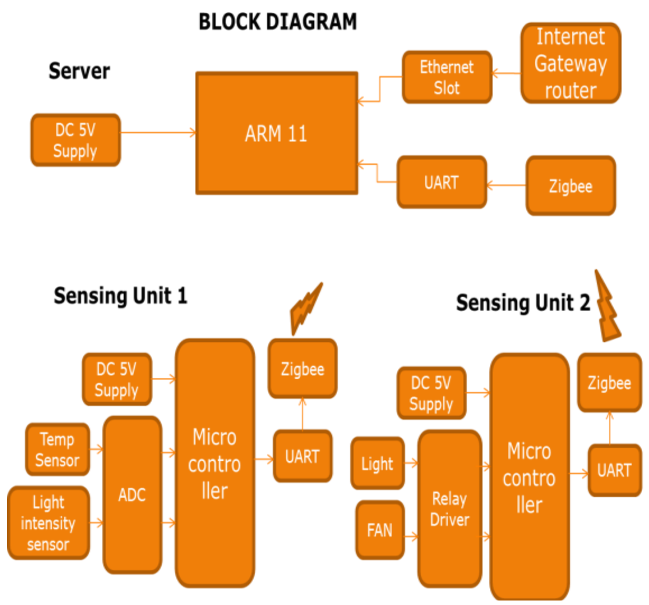

Figure 1: Block Diagram of the proposed system.

To design a reconfigurable smart sensor interface device that integrates data collection, data processing, and wired or wireless transmission together. The device can be widely used in many application areas of the IoT and WSN to collect various kinds of sensor data in real time. To program IP core module in its ARM. Therefore, our interface device can automatically discover sensors connected to it, and to collect multiple sets of sensor data intelligently, and parallel with high-speed.ARM is the core controller of the interface device. It is used to control data acquisition, processing, and transmission intelligently, and make some preprocessing work for the collected data. The driver of chips on the interface device is also programmed inside the ARM. Multiple scalable interfaces are designed on the equipment. It can be extended to 8-channel analog signal interface and 24-channel digital signal interface. This ensures that our device can connect with a number of sensors among the application of industrial IoT or WSN and guarantees the diverse collection of the information. In terms of data transmission, our design can achieve communication through Universal Serial Bus interface. Therefore, we can choose different transmission mode of the device in different industrial application environments. The designed device collects analog signal transmitted from color sensors, light intensity sensors, and other similar sensors through an analog signal interface. It can also collect digital signal transmitted from the digital sensors, such as temperature sensors, digital humidity sensors, and so on, through a digital signal interface .

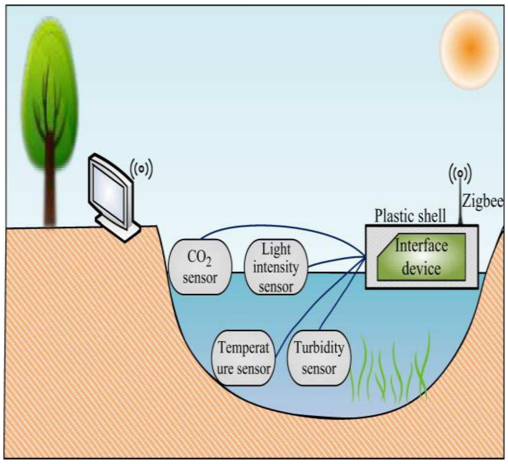

Figure: Schematic diagram of monitoring equipment installation

The ADC module and signal interface on the interface device are controlled by the ARM, which makes it possible to collect the 8-channel analog signals and 24-channel digital signals circularly, and sets these collected data into the integrated Static Random Access Memory on the interface device. The collected data can be transmitted to the host computer side by way of USB serial communication so that the user can analyze and process the data.

A. Temperature sensor

Temperature sensors are vital to a variety of everyday products. For example, household ovens, refrigerators and thermostats all rely on temperature maintenance and control in order to function properly. Temperature control also has applications in chemical engineering. Examples of this include maintaining the temperature of a chemical reactor at the ideal set-point, monitoring the temperature of a possible runaway reaction to ensure the safety of employees and maintaining the temperature of streams released to the environment to minimize harmful environmental impact.

B. Light intensity sensor

A Light sensor generates an output signal indicating the intensity of light by measuring the radiant energy that exists in a very narrow range of frequencies basically called “light” and which ranges in frequency from “infra-red” to “visible ” up to “ultraviolet” light spectrum. The light sensor is a passive devices that convert this “ light energy” whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly known as “Photoelectric Devices” or “PhotoSensors”.

C. Humidity sensor

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical and biological process. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for indus trial processes and human comfort.

D. ADC

The analog-to-digital conversion involves quantization of the input, so it necessarily introduces a small amount of error. Instead of doing a single conversion, an ADC often performs the conversions ("samples" the input) periodically. The result is a sequence of digital values that have been converted from a continues-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal. Typically the digital output will be a two's complement binary number that is proportional to the input, but there are other possibilities. An encoder, for example, might output a Gray code.

E. ZigBee wireless module

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power consumption limits transmission distances, ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure

networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) Zigbee has a defined 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 (WPANs), such as Bluetooth or WiFi.

4. Results and Discussions

A.ADC

An analog-to-digital converter (ADC, A/D. or A to D) is a device that converts a continuous physical quantity (usually voltage) to a digital number that represents that quantity's amplitude. The input to the ADC is a voltage. ADC is designed for voltages from 1 to 10v, from -5 to +5v, etc., but they almost always take a voltage input. In any event, the input is an analog voltage signal for most cases. The output of the A/D converter is a binary signal, and the binary signal encoders the analog input voltage. So, the output is some sort of digital number.

- The input can range from 0 to 100 v.
- When the input voltage goes above 50v, the output is a binary one (1).
- When the input voltage is below 50v, the output is a binary zero (0).

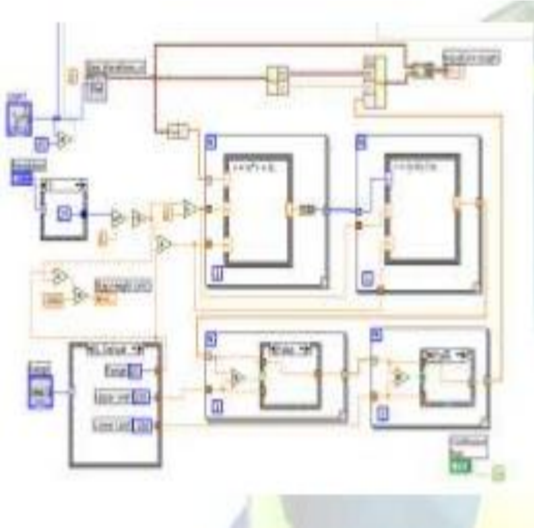

Figure 2: Implementation of ADC

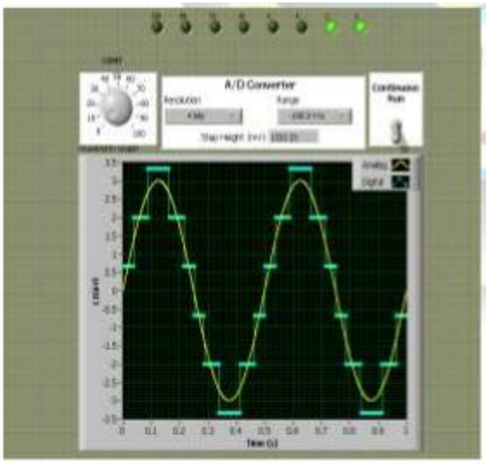

Figure 3: Front panel of ADC

B. Binary Conversion

Given analog value is converted to equivalent binary numbers. Analog value is divide by 2 and compare the remainder with constant value 1. The output of this value is given to the led indicator. In this project we have converted for 8 bits.

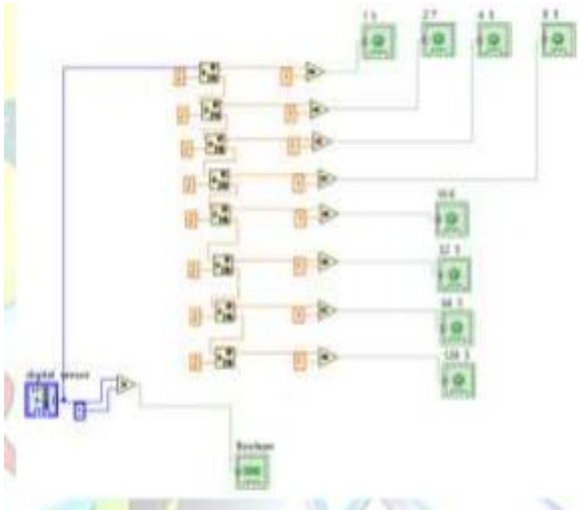

Figure 4: Logic diagram for binary conversion

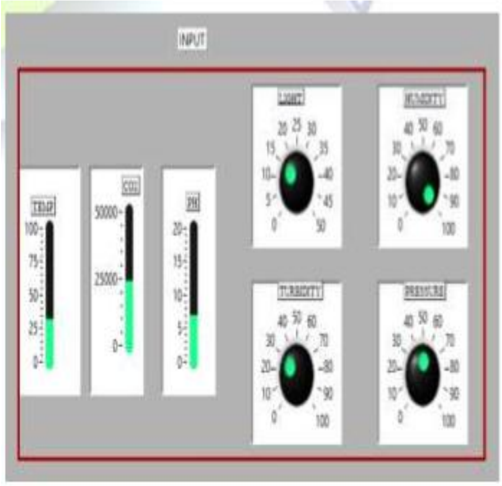

Figure 5: input

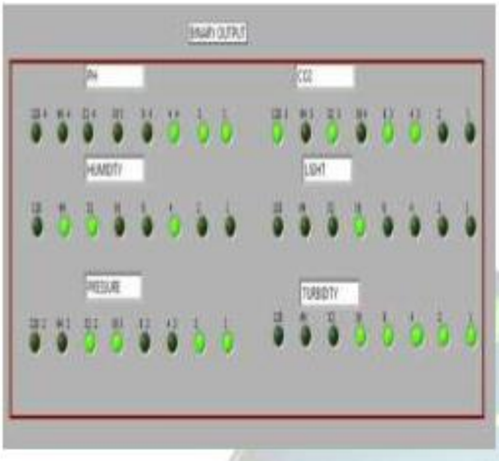

Figure 6: Equivalent binary output

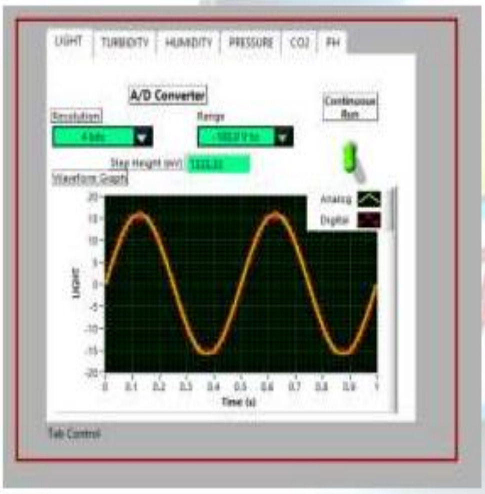

Figure 7: Output waveform

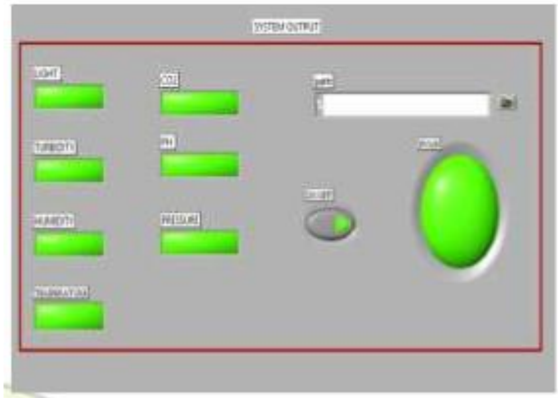

Figure 8: Output of the system when all sensors meet threshold

5. Conclusion and Future Work

This describes a reconfigurable smart sensor interface for industrial WSN in IOT environment. The system can collect sensor data intelligently. It was designed in LabVIEW. Various analog and digital sensors are implemented in LabVIEW. Various sensors like digital temperature sensor, turbidity sensor, ph sensor, CO2sensor, light sensor, humidity are implemented in LabVIEW and graphs are plotted for each sensor. Digital value of each sensor is obtained. Each sensor has certain threshold limit. If any one of the sensor does not satisfy threshold limit an alarm sound is played indicating which sensor is not satisfying the limit. Web publishing tool is used to control inputs over web page. But hosting is done within the internal server. We have to use arduino board completely implementing these sensor values over internet.

References

[1] S. Li, L. Xu, X. Wang, and J. Wang, “Integration of hybrid wireless networks in cloud services oriented enterprise information systems,” Enterp. Inf. Syst., vol. 6, no. 2, pp. 165–187, 2012.

[2] Q. Li, Z. Wang, W. Li, J. Li, C. Wang, and R. Du, “Applications integration in a hybrid cloud computing environment: Modelling and platform,”Enterp. Inf. Syst., vol. 7, no. 3, pp. 237–271, 2013.

[3] 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.

[4] 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, 2014.

[5] 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.

[6] 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. 2013.

[7] L. Xu, “Introduction: Systems science in industrial sectors,” Syst. Res. Behav. Sci., vol. 30, no. 3, pp. 211–213, 2013.

[8] Z. Pang et al., “Ecosystem analysis in the design of open platformbasedin-home healthcare terminals

towards the internet-of-things," in Proc. IEEE 15th Int. Conf. Adv. Commun. Technol. (ICACT), 2013,pp. 529–534.

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

[10] Y. Chen and V. Dinavahi, "Multi-FPGA digital hardware design for detailed large-scale real-time electromagnetic transient simulation of power systems," IET Gener. Transmiss. Distrib., vol. 7, no. 5,pp. 451–463, 2013.