A SURVEY ON "RECONFIGURABLE SMART SENSOR INTERFACE FOR WATER MONITORING IN IoT ENVIRONMENT"

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ABSTRACT

Automatic monitoring of industrial applications involves many kinds of sensors, these sensor are connected to the device is required to write complex data collection program code. To solve these problems this paper proposed a new method to design a reconfiguration smart sensor interface for industrial application in IoT environment in which FPGA is used as core controller. It can read data in parallel, & offers real time monitoring with high speed. A portable STIM block is obtained using a Verilog model of IEEE1451.2.It is low cost, powerful technique. Performance of proposed system is verified & good results are achieved in practical application of IoT to water environment monitoring.

Keyword: - *FPGA, Internet of things, Sensor data acquisition, IEEE1451 protocol etc.*

1. INTRODUCTION

Now days, IoT (Internet of Things) is a new creation of the Internet which gives a stage for communication between objects and it can organize and manage it. IoT gives daily life things to connect with user and operate wireless from anywhere. IoT means when the objects or things connected with each other using standard protocols and standard architecture so that they can communicate between each other and all these objects/things can be monitored and controlled by anywhere and anytime using internet. With rapid development of IoT, major manufacturers are dedicated to the research of multi-sensor acquisition interface equipment .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. 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 utilizing as the core controller in mainstream data acquisition interface device. MCU has the advantage of low cost 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, which enable it to achieve parallel acquisition of multi-sensor data and greatly improve real-time performance of the system. FPGA has currently becomes more popular than MCU in multisensory data acquisition in IoT environment. However, in IoT environment, different industrial WSNs involve a lot of complex and diverse sensors. During that same time, each sensor need its identity or prerequisites to readout and diverse clients bring their provisions that require different sorts for sensors. It prompts the need for composing intricate. Also bulky sensor driver code Also information gathering methods to each sensor recently associated with interface device, which acquires A large number tests of the researches. Sensor information procurement surface device is those key and only ponder looking into streamlined WSN requisition.

2. OBJECTIVE

The objective of the proposed system is given below

- To study the IOT system and WSN working.
- To develop a verilog module for WSN standard.

- To interface a smart sensor interface device to integrates data collection, data processing, and wired or wireless transmission together.
- To develop a water monitoring application.

3. LITERATURE SUREVY

Qingping Chi et al. [1], proposed a new method to design a reconfigurable smart sensor interface for industrial WSN in IoT environment. In this method complex programmable logic (CPLD) device is adopted as the main controller. CPLD provides the reading of sensor data in parallel and in real time with high speed on multiple different sensor data. CPLD also solves all previous problems like interrupt handling, current connect number, sampling rate etc. In traditional microcontroller based system, signal types of sensors are generally restricted by the device; this means each sensor connected to the device is required to write complicated and inconvenient data collection program code. In this new system IEEE1451.2 standard intelligent sensor interface specifications are used so that system can collect sensor data intelligently. Fig.1 shows the Systems functional block design.

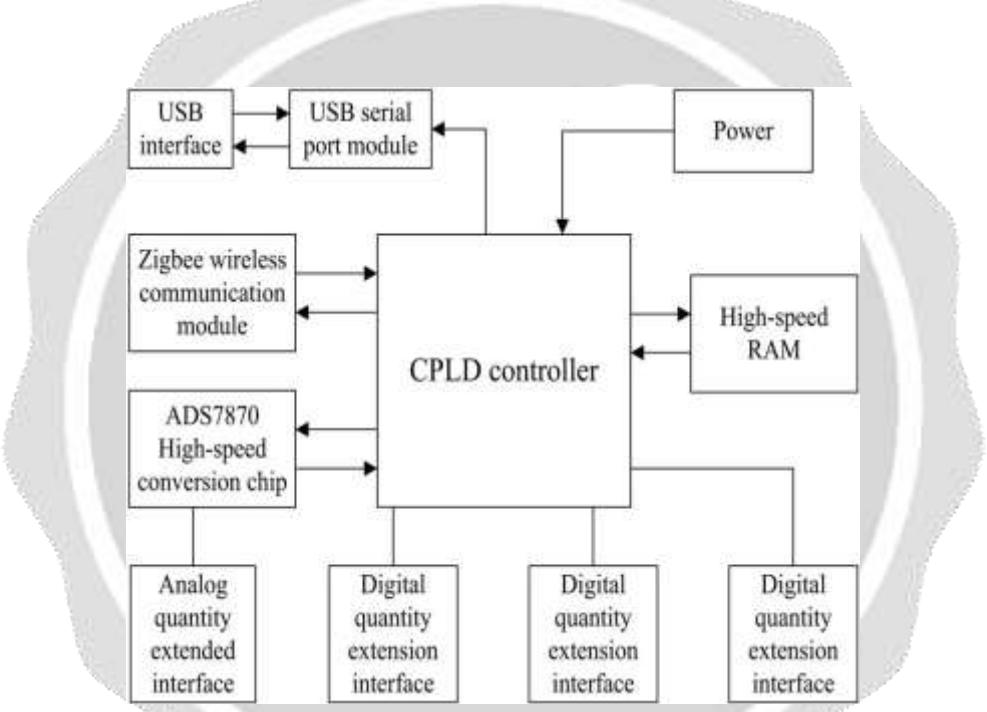

Fig.1 CPLD hardware block diagram.

This system is based on IEEE1451 protocol and combining with CPLD and the application of wireless communication; it is very suitable for the real time and high speed data acquisition system in IoT environment. The system achieved good results in practical application in taking real time monitoring of water environment in IoT environment.

Mihai T. Lazarescu, et al [2] proposed **t**he Internet of Things (IoT) provides a virtual view, via the Internet Protocol, to a huge variety of real life objects, ranging from a car, to a teacup, to a building, to trees in a forest. Its appeal is the ubiquitous generalized access to the status and location of any "thing" we may be interested in. Wireless sensor networks (WSN) are well suited for long-term environmental data acquisition for IoT representation. This paper presents the functional design and implementation of a complete WSN platform that can be used for a range of long-term environmental monitoring IoT applications. The application requirements for low cost, high number of sensors, fast deployment, long lifetime, low maintenance, and high quality of service are considered in the specification and design of the platform and of all its components. Low-effort platform reuse is also considered starting from the specifications and at all design levels for a wide array of related monitoring applications.

Shifeng Fang et al. [3], presents water resource management based on geo-informatics including multiple technologies such as cloud services, Enterprise Information Systems (EIS), Geographical Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing (RS). This paper also introduces a prototype IIS called Water Resource Management Enterprise Information System (WRMEIS) that combines data acquisition, data management and sharing, modelling, and knowledge management. The system provides best results for water and flood security. The system combines Snowmelt Flood Forecasting Enterprise Information System i.e. SFFEIS, based on the Water Resource Management Enterprise Information System. The system contains operational database, Extraction Transformation Loading (ETL), information warehouse. In which it contains management of information which allows participant to play the role as sensor and a contributor, to the information warehouse, temporal and distributed analysis, prediction models to predict the atmospheric condition, knowledge management is useful for the decision taking; which is provided by both users and public play the role of providing knowledge and data, and other several functions. This system is a prototype water resource management IIS which integrates geo-informatics, EIS, and cloud service. This system provides the crucial importance of a systematic approach toward IISs for efficient resource and environment management.

A remote sensing and control irrigation system using distributed wireless sensor network aiming for variable rate irrigation, real time in field sensing, controlling of a site specific precision linear move irrigation system to maximize the productivity with minimal use of water was developed by Y. Kim et al.. The system described details about the design and instrumentation of variable rate irrigation, wireless sensor network and real time in field sensing and control by using appropriate software. The whole system was developed using five in field sensor stations which collects the data and send it to the base station using global positioning system (GPS) where necessary action was taken for controlling irrigation according to the database available with the system. The system provides a promising low cost wireless solution as well as remote controlling for precision irrigation. [4]

In one of the studies related to wireless sensor network, researchers measured soil related parameters such as temperature and humidity. Sensors were placed below the soil which communicates with relay nodes by the use of effective communication protocol providing very low duty cycle and hence increasing the life time of soil monitoring system. The system was developed using microcontroller, universal asynchronous receiver transmitter (UART) interface and sensors while the transmission was done by hourly sampling and buffering the data, transmit it and then checking the status messages. The drawbacks of the system were its cost and deployment of sensor under the soil which causes attenuation of radio frequency (RF) signals. [5]

Yepeng Ni and Sun Yi et al. [6] introduced lightweight Wi- Fi–ZigBee wireless home gateway to access smart home devices. ZigBee technology used to transmit the data collected from the node network to the embedded gateway, and then communicates with the monitoring PC by Wi-Fi network. Wi-Fi module used to send commands from monitoring PC to ZigBee network, and then control home device.

Kelly, S.D.T et al. [7] proposed the framework of the monitoring regular domestic conditions by means of low cost ubiquitous sensing system using IoT. It is based on a combination of pervasive distributed sensing units, information system for data aggregation, and reasoning and context awareness.

Xufeng Ding [8] design a distributed heterogeneous wireless sensor network for agriculture environmental monitoring and early warning system based on Internet of Things technologies. The system includes a ZigBee coordinator node, multiple ZigBee sensor nodes, multiple ZigBee routing nodes, a GSM SMS module, and the management software based on SQL running on the remote control center PC.

M. Haefke *et al.* developed a ZigBee based smart sensing platform for monitoring environmental parameters such as temperature, relative humidity, pressure and sunlight with the use of microcontroller
which serve as a smart weather station. The research was based on characteristics such as use of low cost equipment, accurate sensors and flexibility in data handling. Use of XBee module provided the wider range and reduced the current consumption of the circuit. The analysis was done by fabricating six prototype weather stations tasting for more than 24 hours. For better results and analysis system has to be reviewed for more time period. [9]

4. PROPOSED METHODOLOGY

The block diagram of the proposed system is given below.

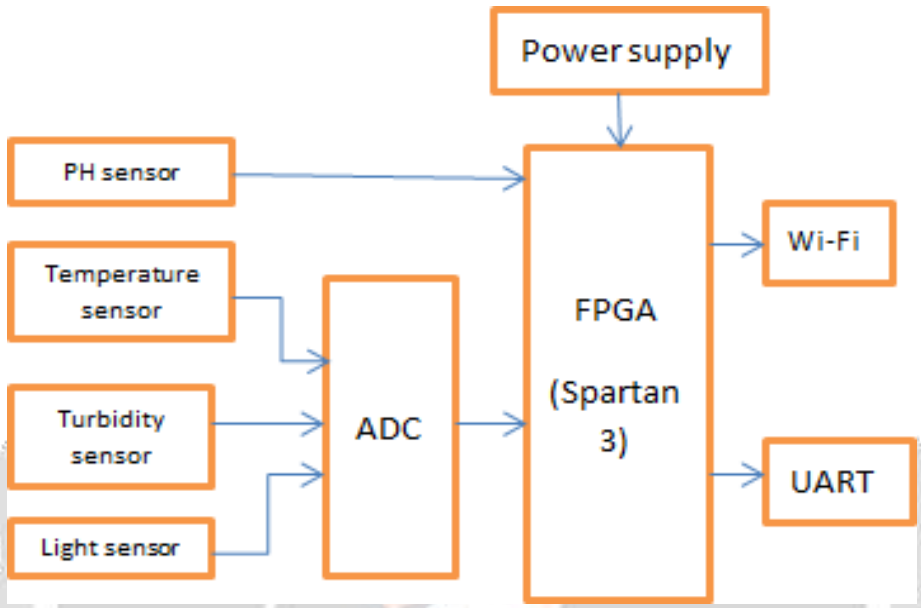

Fig -2: System block Diagram.

In information transmission, our design can achieve wired communication through Universal Serial Bus (USB) interface and wireless communication through Wi-Fi module. Therefore, we choose different transmission mode of the device in different industrial application environments. Fig. 1 is the application and working diagram of the reconfigurable smart sensor interface device. The device collects analog signal transmitted from Light sensors, Turbidity sensors, and temperature sensors through an analog signal interface. It can collect digital signal transmitted from the digital sensors, PH sensors and so on, through a digital signal interface. The Analog to Digital Converter (ADC) module and signal interface on the interface device are controlled by the FPGA, which makes it possible to collect the 8channel analog signals and 24-channel digital signals circularly, and sets these collected data into the integrated Static Random Access Memory (SRAM) on the interface device. The collected data can be transmitted to the host computer side by way of USB serial wired communication or Wi-Fi wireless communication, so that the user can analyse and process the data. The core module of this system is FPGA-based reconfigurable smart sensor interface device designed by ourselves It might great meet the necessities specified previously. Here are the primary solutions: Firstly, we recommended that water turbidity sensor, temperature sensor, PH sensor, Also light force sensor ought to be used to gather required data; Secondly, Wi-Fi module associated with the gadget may be embraced to sending and getting information.

5. CONCLUSION

This paper describes a reconfigurable smart sensor interface for industrial WSN in IoT environment. The system can collect sensor data intelligently. It was designed based on IEEE1451 protocol by combining with FPGA and the application of wireless communication. It is very suitable for real-time and effective requirements of the high-speed data acquisition system in IoT environment. The use of FPGA simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible. Application of IEEE1451 protocol enables the system to collect sensor data intelligently. Different types of sensors can be used as long as they are connected to the system. Main design method of the reconfigurable smart sensor interface device is described in this paper.

6. REFERENCES

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