Design and Implementation of wireless sensor Node using Programmable system on chip 4 (PSOC 4200)

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***Abstract*- The hardware reconfiguration is an important property of PSoC that allows the programming of different configurations in the same design, which are in less time, and change them while the device is running. Currently embedded system development is a huge market where less time to market period is demanded from system developers. In order to address this, different International companies have come up with different system development methodologies. Among these, Cypress Semiconductors have introduced a programmable system on chip (PSoC). The aim of this work is to explore the programmable PSoC 4200 family . The sensor node communication is growing very rapidly now days, the basic architecture of wireless sensor node for coastal monitoring is used here to system design here use CC2520 is TI's second generation ZigBee / IEEE 802.15.4 RF transceiver for the 2.4 GHz unlicensed ISM band. A wireless sensor node (WSN) has important applications such as remote environmental monitoring and target tracking.**

***Index Terms*– PSoC 4200 , Node, Zigbee**

I. INTRODUCTION

PSoC 4 is a scalable and reconfigurable platform architecture for a family of programmable embedded system controllers with an ARM® Cortex™-M0 CPU [6]. It combines programmable and reconfigurable analog and digital blocks with flexible automatic routing. The PSoC 4200 product family, based on this platform, is a combination of a microcontroller with digital programmable logic, high-performance analog-to-digital conversion. The

monitoring of physical parameters present at the coastline we measure its chemical properties it contain the temp, PH contain, turbidity of this material. For that, a low cost wireless sensor node is being developed in order to deploy nodes over the coastline for measuring physical parameters, providing a large coverage area using Zigbee. The use of PSoC devices allow to easily interface with sensors and communication devices by using a single chip and, on the other hand, to reprogram the hardware while the system is running allowing to perform different functions or being Sensor networks have found widespread use in a variety of applications such as structure monitoring, environment monitoring, home automation monitoring, military operations etc. Commercially available sensor nodes are often used to design and deploy sensor networks [1]

II. RELATED WORK

The method suggested by De Marziani, Alcoleas, Colombo, Costa, Pujana, Colombo, Aparicio, Alvarez, Jimenez, Urena , Hernandez, for the low cost reconfigurable sensor network for coastal monitoring. The hardware reconfiguration is an important property of PSoC that allows the programming of different configurations in the same design, which are mutually exclusive in time, and then dynamically change them while the device is running [1]

The work presented by Rakhee Mohiddin, Manoj Kumar, Shashi Kumar Palakurty, Surabhi Bothra, Sai Phaneendra P, M.B. Srinivas Birla Institute of Technology and Science-Pilani, Hyderabad Campus, Hyderabad, India Narayana Pidugu, Karthikeyan Mahalingam Cypress Semiconductor Technology (India) Pvt. Ltd., Bangalore, India Patrick Kane Cypress Semiconductor Corporation, San Jose, California, USA on Building a Sensor Network with PSoC**,** the resulting designs are inexpensive and compact, but at a price: You have to select a processor that has the features you need. Depending on the microcontroller family, PSOC (1, 3 or 5) have 4–16 digital blocks and 3–12 analog programmable blocks [2]

The proceeding of "Sensor Networks: Evolution, Opportunities, and Challenges," by Chee-yee Chong, member, IEEE and Srikanta P. K Kumar, senior member, IEEE, this work presents the node hardware architecture for a wireless sensor node designed for monitoring physical parameters. This performs the conditioning of sensor signals and their processing Additionally, the interface with RF module is implemented in the same integrated circuit The sensor nodes send the data collected to a central system by means of low cost RF modules based on Zigbee standard [3]

III. METHODOLOGY

Basically operation is divided into four part one is sensing, role of PSoC, transmitter section, receiver section

Hardware requirements: PSOC 4, Temp sensor, Ph sensor, Turbidity, Zigbee

Software requirements: Psoc creator

PSoC CY8C4245:

PSoC 4 is a scalable and reconfigurable platform architecture for a family of mixed-signal programmable embedded system controllers with an ARM® Cortex™-M0 CPU. It combines programmable and reconfigurable analog and digital blocks with flexible automatic routing. The PSoC 4200 product family, based on this platform, is a combination of a microcontroller with digital programmable logic, high-performance analog-to-digital conversion, opamps with Comparator mode, and standard communication and timing peripherals[6].

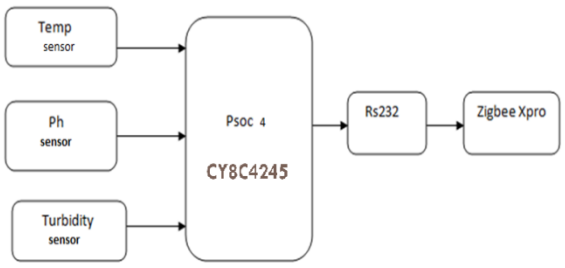


fig 1 - Block diagram of Transmitter section of wireless sensor node

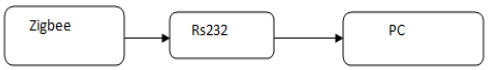


fig 2- Block diagram of Receiver section of wireless sensor node.

ZigBee Module :

ZigBee is a protocol that uses the 802.15.4 standard as a baseline and adds additional routing and networking functionality. The ZigBee protocol was developed by the ZigBee Alliance. Here ZigBee module forms a node to transmit as well as receive the data. ZigBee Module has 2.4GHz frequency and transmitting range indoor 100m and outdoor 300m.[3]

Sensor :

The monitoring of physical parameters present at the coastline we measure its chemical properties it contain the temp, PH contain, turbidity of this material. Analog Sensor Interface The analog sensor interface has been designed to measure single-ended sensor outputs. In order to select the corresponding single sensor output, an 8-input analog multiplexer has been implemented in the PSOC, controlled by the 8 bit microcontroller core (M8C).[1]

1.Temp sensor - LM 35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature. Key features is Calibrated directly in ° Celsius (Centigrade).

2.PH Sensor –

The pH scale measures how acidic or basic a substance is. It ranges from 0 to 14. A pH of 7 is neutral, pH less than 7 is acidic, and a pH greater than 7 is basic

3.Turbidity –

Turbidity as measured using photometric techniques is defined as «reduction of transparency of a liquid caused by the presence of un dissolved matter». Reduction of transparency can be measured to a certain extent using scattering and/or transmission of light. Here we use the basic principle of LDR as sensor input, A Light Dependent Resistor LDR is a device which has a resistance which varies according

to the amount of light falling on its surface, when light falls upon it then the resistance changes.

RECEIVER SECTION

Base station receives detected and monitor signal using ZigBee module. Using computer and VB 6.0.

IV. SOFTWARE DESIGN

PSoC Creator -

PSoC Creator is a free Windows-based Integrated Design Environment (IDE). It enables concurrent hardware and firmware design of systems based on PSoC 4.

Steps to use the PSoC 4 creator –

1. Drag and drop Components to build your hardware system design in the main design workspace.
2. Code sign your application firmware with the PSoC hardware.
3.Configure Components using configuration tools.
4. Explore the library of 100+ Components
5. Review Component datasheets

fig – Final design of sensor based system using PSoC 4 in creator

Next step is communication of UART to our system it contain PC or laptop .

Methodology to communicate UART with PC Host

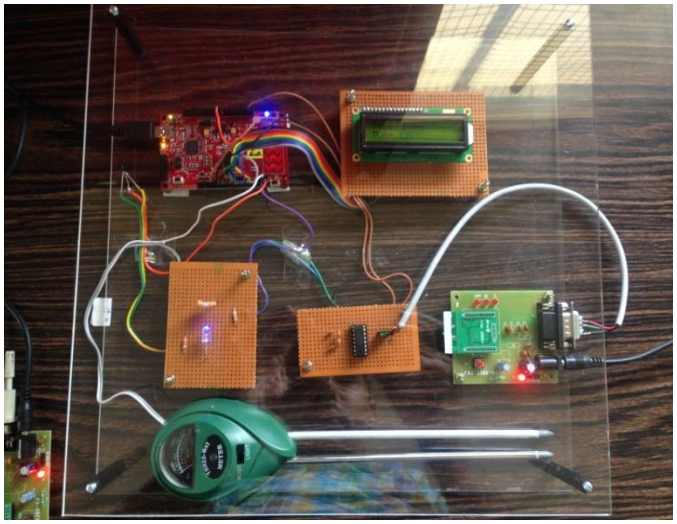
1. Connect the USB cable between the PC and PSoC 4 module.
2. Open the device manager program in your PC, find the COM port in which the PSoC 4 is connected, and note the port number.
3. Open the HyperTerminal program and select the COM port in which the PSoC 4 is connected.
4. Configure Baud rate, Parity, Stop bits and Flow control information in the HyperTerminal configuration window. These settings should match the configuration of the PSoC Creator UART component in the project
5. Start communicating with the device as explained in the project description[6]

V.APPLICATION OF THIS SYSTEM

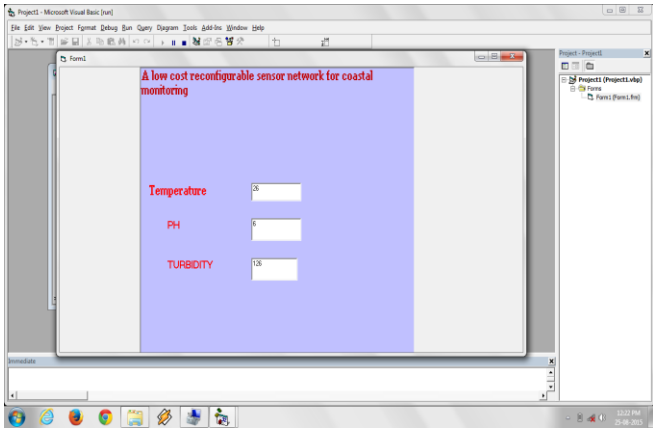
- Coastal Monitoring and Measurement.
- Earthquake Monitoring and Measurement,
- Industrial applications,
- Military Appliances.
- Automotive Applications
- Monitoring device applications
- Remote control applications
- Low Cost
- Power Consumption
- Accuracy
- Fastest Process

VI. RESULT

Implemented System -



The user interface has been designed in Visual basic and allows to visualize the sensor variables.



1. First template shows the Temperature sensed by LM 35 (Room temp.)
2.Second template shows the PH contain sensed by PH meter (lemon juice)
3. Third template shows the Turbidity of solution sensed by LDR module

VII. CONCLUSION

This work is for monitoring of coastline parameter contain Temp, PH, Turbidity measuring different parameters using physical sensors and PSoC. Sensor networks have experienced a fast development and extended their fields of application.

The experimental tests show that the use of reconfigurable analog-digital systems from PSoC can reduce cost and design time in data acquisition systems for monitoring physical variables. This device replaces the traditional components of a MCU based system by a low cost single-chip with programmable component.

The use of these devices allow, on the one hand, to easily interface with sensors and communication devices by using a single chip and, on the other hand, to reprogram the hardware while the system is running allowing to perform different functions or being able to improve their performance in a remote way.

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