International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249 – 8958, Volume-6, Issue-ICDSIP17, March 2017

Synthesis of AMS Based System-on-Chip for Measurement of Physicochemical Parameters of Water

S. K. Tilekar, S. C. Pathan, P. V. Mane-Deshmukh, S. V. Chavan, B. P. Ladgaonkar

Abstract*— An innovative technology, Analog Mixed Signal (AMS) based VLSI design, is realizing commendable dynamic reconfigurability of on-chip resources, analog as well as digital, which furnishes needs ubiquitous System-on-Chip (SoC) design. It reveals wide spectrum of applicability, particularly in the field of precision measurements and controlling of various parameters such as pH, Electrical Conductivity (EC), concentration of Dissolved Oxygen (DO), etc., of liquid. Further, the deployment of AMS based Programmable SoC (PSoC) overcomes constraints in the configurability and has ultra-low power consumption, which is otherwise exhibited by traditional VLSI. Therefore, deploying PSoC5 device the SoC for temperature compensated EC and pH measurement of water is synthesised and presented in this paper.

The AD590, standard EC electrode and standard pH electrode are wired off the chip for the synthesis of this SoC. Deploying the on-chip resources of the CY8C55 series PSoC device and ensuring co-development process, the necessary DAS is configured and routed in PSoC device by PSoC Creator2.1 environment. Configuring 10-bit ΣΔADC, the preciseness of parameter measurement is achieved. The SoC is calibrated to the standard units by employing scientific method and standardize with sophisticated instrument from standard Hanna make meter and results are interpreted in this paper.

***Index Terms*— Analog Mixed Signal, PGA, Conductivity, pH, PSoC..**

I. INTRODUCTION

Indeed, advances in the VLSI domain emerges an innovative technology, Analog and Mixed Signal (AMS) based system design, wherein reconfigurability, scalability, portability, ultra-low power consumption, etc. are significantly emphasized while synthesis of an ubiquitous Programmable System-on-Chip (PSoC) [1]. Therefore, AMS design technology exhibits wide spectrum of applications in various domains from simple domestic to critical industrial applications. Moreover, the designing of the SoC for precision measurement of physicochemical parameters such as dissolved oxygen, conductivity, turbidity, pH, etc.is novel field of research [2]. These physicochemical parameter measurements has meritorious application domain.

Presently, many investigators are designing an embedded system to measure these parameters by employing microcontrollers and microprocessors of promising features [3-6]. But these embedded systems realize concept of System-on-Board (SoB), because analog design is always off the chip. Furthermore, conventional operational amplifiers low input impedance, limited input bias current, has interfacing constraints. It is due the fact that the physicochemical sensors, have input impedance in the range of GΩ. Therefore, to surmount the designing constraints of the microcontroller based embedded system the investigators are switching towards the VLSI based configurable devices. The VLSI devices, CPLD and FPGA, have the poor reconfigurability and analog data acquisition is off the chip. The field of Programmable System-on-Chip (PSoC) of the AMS technology ensures better integrability and commendable reconfigurability of analog as well as digital resources and ultra-low power consumption. Hence, to configured dedicated embedded system on a chip the PSoC devices are highly suitable. The vendors, Cypress Semiconductors, Altera, Actel, etc., are providing AMS based PSoC chips of their own features, wherein single chip is facilitate with both analog as well as digital cores of high reconfigurability along with the cores of computing devices.

It is found that, the investigators [7-9] have designed the PSoC based SoC for physical parameters measurement employing the PSoC1 device. However, the reports designing of system for the precision physicochemical parameters measurement, employing AMS technology, is rather rare. Therefore, employing an AMS based VLSI technology the SoC is designed for measurement of pH and electrical conductivity of the water under investigation. The designing issues and results of its implementation are interpreted in this paper.

Revised Version Manuscript Received on March 08, 2017.

S. K. Tilekar, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India - 413101

S. C. Pathan, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India - 413101

P. V. Mane-Deshmukh, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India - 413101

S. N. Patil, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India - 413101

S. V. Chavan, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India - 413101

B. P. Ladgaonkar, VLSI Design and Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj, Dist. Solapur (Maharashtra), India – 413101

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.