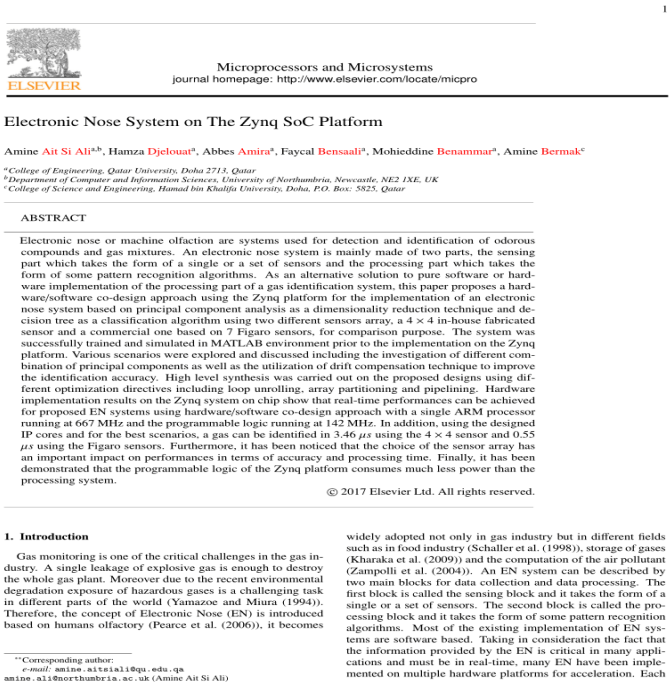
Handbook of Machine Olfaction: Electronic Nose Technology



Microprocessors and Microsystems
journal homepage: http://www.elsevier.com/locate/micpro

Electronic Nose System on The Zynq SoC Platform

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ABSTRACT

Electronic nose or machine olfaction are systems used for detection and identification of odorous compounds and gas mixtures. An electronic nose system is mainly made of two parts, the sensing part which takes the form of a single or a set of sensors and the processing part which takes the form of some pattern recognition algorithms. As an alternative solution to pure software or hardware implementation of the processing part of a gas identification system, this paper proposes a hardware/software co-design approach using the Zynq platform for the implementation of an electronic nose system based on principal component analysis as a dimensionality reduction technique and decision tree as a classification algorithm using two different sensors array, a 4×4 in-house fabricated sensor and a commercial one based on 7 Figaro sensors, for comparison purpose. The system was successfully trained and simulated in MATLAB environment prior to the implementation on the Zynq platform. Various scenarios were explored and discussed including the investigation of different combination of principal components as well as the utilization of drift compensation technique to improve the identification accuracy. High level synthesis was carried out on the proposed designs using different optimization directives including loop unrolling, array partitioning and pipelining. Hardware implementation results on the Zynq system on chip show that real-time performances can be achieved for proposed EN systems using hardware/software co-design approach with a single ARM processor running at 667 MHz and the programmable logic running at 142 MHz. In addition, using the designed IP cores and for the best scenarios, a gas can be identified in 3.46 μs using the 4×4 sensor and 0.55 μs using the Figaro sensors. Furthermore, it has been noticed that the choice of the sensor array has an important impact on performances in terms of accuracy and processing time. Finally, it has been demonstrated that the programmable logic of the Zynq platform consumes much less power than the processing system.

1. Introduction

Gas monitoring is one of the critical challenges in the gas industry. A single leakage of explosive gas is enough to destroy the whole gas plant. Moreover due to the recent environmental degradation exposure of hazardous gases is a challenging task in different parts of the world (Yamazoe and Miura (1994)). Therefore, the concept of Electronic Nose (EN) is introduced based on humans olfactory (Pearce et al. (2006)), it becomes widely adopted not only in gas industry but in different fields such as in food industry (Schaller et al. (1998)), storage of gases (Kharaka et al. (2009)) and the computation of the air pollutant (Zampolli et al. (2004)). An EN system can be described by two main blocks for data collection and data processing. The first block is called the sensing block and it takes the form of a single or a set of sensors. The second block is called the processing block and it takes the form of some pattern recognition algorithms. Most of the existing implementation of EN systems are software based. Taking in consideration the fact that the information provided by the EN is critical in many applications and must be in real-time, many EN have been implemented on multiple hardware platforms for acceleration. Each

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"Electronic noses" are instruments which mimic the sense of smell. Consisting of olfactory sensors and a suitable signal processing unit, they.Handbook of Machine Olfaction: Electronic Nose Technology. Tim C. Pearce (Editor), Susan S. Schiffman (Editor), H. Troy Nagle (Editor), Julian W. Gardner.Request PDF on ResearchGate Handbook of Machine Olfaction: Electronic Nose Technology "Electronic noses" are instruments which mimic the sense of.The handbook covers the scientific principles and technologies that are electronic nose technology, from the biological olfactory system which has inspired the."Electronic noses" are instruments which mimic the sense of smell. Consisting of olfactory sensors and a suitable signal processing unit, they are able to detect.Title: Handbook of Machine Olfaction: Electronic Nose Technology. Authors: Pearce, Tim C.; Schiffman, Susan S.; Nagle, H. Troy; Gardner, Julian W. Publication.Handbook of Machine Olfaction: Electronic Nose Technology [Tim C. Pearce, Susan S. Schiffman, H. Troy Nagle, Julian W. Gardner] on cassiewerber.com *FREE* .Handbook of machine olfaction: electronic nose technology / [edited by] T.C. Pearce [et al.]. Also Titled. Electronic nose technology. Other Authors. Pearce.Handbook of Machine Olfaction. Handbook of Machine Olfaction: Electronic Nose Technology. Edited by T.C. Pearce, S.S. Schiffman, H.T. Nagle, J.W. Gardner.Handbook of machine olfaction: electronic nose technology. Responsibility: [edited by] T.C. Pearce [et al.] Imprint: Weinheim [Germany]: Wiley-VCH, cMachine olfaction is the automated simulation of the sense of smell. It is an emerging application of modern engineering where robots or other automated systems are needed to measure the existence of a particular chemical concentration in air. Such an apparatus is often called an electronic nose or e- nose. the typical applications for electronic nose technology many are backed by.10, 5977 () Llobet, E., Brezmes, J., Vilanova, X., Sueiras, J.E., Correig, X.: Qualitative In: Handbook of Machine Olfaction: Electronic Nose Technology.intro. Wat zijn de 3 fases van innovatie ontwikkeling efficiency, effectiveness, disruption why is the middle segment difficult to compete.Handbook of Research on Power and Energy System Optimization Electronic Nose Technologies and Advances in Machine Olfaction Machine odor detection has developed into an important aspect of our lives with various applications of.A self-made electronic nose consisting in a sensor array of six commercial tin .. Handbook of Machine Olfaction: Electronic Nose Technology, Wiley-VCH.Not all the sensors of the e-nose were reactive to manure digestates, but four Handbook of machine olfaction: electronic nose technology.Get this from a library! Handbook of machine olfaction: electronic nose technology. [T C Pearce;].To appear in Handbook of Machine Olfaction: Electronic Nose Technology, concluded that the e-nose has promise in wastewater monitoring applications.An electronic nose based on coated piezoelectric quartz crystals to certify ewes' cheese and to Handbook of Machine Olfaction, Electronic Nose Technology.Searching handbook of machine olfaction electronic nose technology by pearce. Your favorite shops now help provide education to children without access.CAREER: Computational Models

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