

Preface

Sensors play a pivotal role in our everyday life. They gather data on environment, and information on weather, traffic congestion, air pollution, water pollution, etc. is obtained; they gather data on human body, and information on health, treatment or therapy outcomes is obtained; they gather data on objects, and information for monitoring and control of these objects is obtained; they gather data on subjects or objects functions, and information for better decisions, control and action is obtained. For instance, the weather information is used to choose adequate clothes, the battery level sensor permits smartphone power management optimization, and the level of blood glucose allows better healthcare management. Data collected through sensors enhance our lives and our connections to each other and with our environment, allow real-time monitoring of many phenomena around us, provide information about quality of products and services, improve the equipment control based on sensorized interfaces and contribute to increase knowledge on physical and chemical world.

The advances in electronics, embedded controller, technology for communication as well as the progress towards a better informed, knowledge based society increase the demand for small size, affordable sensors that allow accurate and reliable data recording, processing, storing and communication. The work contains invited chapters from renowned experts, working in sensors' field, and it is split into two books that present several technologies and applications of sensors in *Environmental and Food Engineering* (ISBN 978-3-319-47322-2) and for *Healthcare Settings* (ISBN 978-3-319-47319-2).

The book *Sensors for Everyday Life—Environmental and Food Engineering* describes novel sensors and sensing systems developed for environment monitoring and food production and quality assessment.

Environmental quality refers to characteristics from natural environment as well as from the built environment (i.e. city air and/or water pollution, concentration of nitrate from the soil in cultivated fields). Environmental quality plays an important role in health and well-being of the populations. Degraded environmental quality as produced by air and water pollution may affect our lives, directly or through the food we eat. In food engineering various sensors are used for assessment of

contaminants, adulterants, naturally occurring toxins or any other substance that may make food injurious to health on an acute or chronic basis as well as sensors that contribute for quality improvement of food. New developed sensors and technology trend related air, water, food quality monitoring as well as for modern agronomy and food production are presented in this book.

How This Book is Organized

In Chap. 1, a novel method for the simultaneous determination of NO_x and soot in the exhaust of diesel engines during the periodical technical inspection roadworthiness test is presented. A multi-wavelength light extinction measurement, in a setup similar to an opacimeter with high sensitivity, and a mathematical inversion algorithm are used to obtain the concentrations from the extinction readings.

Analytical technique of the fine particles using atomic emission spectroscopy system for an environmental pollution monitoring is presented in Chap. 2. Laser-induced breakdown spectroscopy (LIBS) system and the helium-microwave-induced plasma-atomic emission spectroscopy (He-MIP-AES) system are used for characterizations and real-time measurement of the air chemical compositions and particle size.

Chapter 3 presents sensors and method for automatic fault detection in heating ventilating and air conditioning (HVAC) systems. This is important mainly in smart buildings context as the indoor condition in these buildings is mainly related with the capabilities and reliability of HVAC systems.

New optical fiber humidity sensor is described in Chap. 4. Different humidity sensors that have been developed by now are presented focusing in the different optical structures and materials that have been used for improving sensitivity and resolutions of these sensors.

The measurement of air gas concentration represents an important field of application of sensing technologies. In Chap. 5 of the book, a review on the oxygen gas sensing technologies is presented with focus on potentiometric, amperometric, paramagnetic and tunable diode laser spectroscopy (TDLS) sensors. Theoretical aspects and operational basic of these technologies, system requirements as well as limitations of the methods are discussed in this chapter.

A low-cost sensor node based on interdigital capacitive sensor for nitrate and nitrite in surface and ground water concentration detection is presented in Chap. 6. This sensor is important for agronomy as well as for water pollution assessment. Nitrates may be present in high concentration in ground and surface water as a result of intensive agriculture, disposal of human and animal sewage and industrial wastes.

In Chap. 7 an intelligent wireless sensor network system designed to monitor various parameter in palm oil plantation for improvement in the controlled pollination process is presented. The system helps in making decision related to best time for pollination process. The inaccuracy in determining pollination readiness

of the oil palm flower could potentially cause a detrimental effect on the palm oil industry in the long run.

The following two chapters present sensors for determination of quality and quantity of water for drinking purpose. In Chap. 8, a reflectometer and a Doppler radar systems for detection of water level in septic tank is described. A novel S3 (Small Sensor System) nanowire device for the detection of complex mixtures of bacteria in potable water is presented in Chap. 9.

Next three chapters describe sensors used in food productions and quality assessment. A novel approach to monitor the quality of milk products, based on electromagnetic wave spectroscopy is presented in Chap. 10. The system use vector network analyser to capture spectral signatures in the form of scattering parameters from electromagnetic wave sensors. Data on reliability testing is presented. A new, rapid, portable, easy-to-use, economic and non-destructive fouling based on nanowire technology device to control the presence of false grated Parmigiano Reggiano cheese is described in Chap. 11. A review on the conventional techniques and dielectric spectroscopy for analyzing food products is presented in Chap. 12, focusing on the application of dielectric spectroscopy in fats and oils adulteration detection.

Different wireless sensor network architecture is implemented nowadays to perform distributed measurement tasks for environment monitoring with increase in space resolution. Big challenge in these implementations continues to be wireless interference and radio-frequency (RF) spectrum crowding. Chapter 13 focuses on a technique for optical-based RF interference cancellation. In this chapter several system architectures are presented and a sample of their experimental performance and the key characteristics of this technique and the future prospects for this technology, focusing specifically on photonic integrated circuits are discussed. A scheme is proposed in Chap. 14 that can reduce the performance difference between cluster heads (CHs) involved in inter-cluster communication on IEEE 802.15.4 cluster-based wireless sensor networks (WSNs) under spatial non-uniform traffic condition where the CHs have various amount of traffic. This reduced the energy consumption and simplified processing mechanism to achieve long WSNs lifetime under limited network resource condition.

We do sincerely hope that the readers will find this special issue interesting and useful in their research on sensors and wireless sensor networks for environment monitoring, food production and quality assessment.

We want to acknowledge all the authors for their contribution and for sharing of their knowledge. We hope that the works presented in this book will stimulate further research related to sensors for everyday life.

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