

Preface

Sensors are the most important component in any system and understanding the fundamentals of operation, integration into a system and the selection are very useful. There is a continuous advancement of sensing technology, embedded system, wireless communication technology, nano-technology and miniaturization which make it possible to develop smart wireless electronic systems to monitor many phenomenon around us continuously.

This Special Issue titled “Next Generation Sensors and Systems” in the book series of “Smart Sensors, Measurement and Instrumentation” contains the invited papers from renowned experts working in the field. A total of 14 chapters have described the advancement in the area of Sensors and Sensing Technologies, Signal processing, Wireless Sensors and Sensor Networks, Protocols, Topologies, Instrumentation architectures, Measurement Techniques, Energy Harvesting and Scavenging, Design and Prototyping in recent times.

The first chapter by Mohamed Serry describes the new nanostructured Schottky junctions based on graphene/platinum grown on different substrates which are fabricated and investigated for sensing applications. The uniqueness of the research is based on the process for growing the graphene layer on the M-S junction.

The design of a planar interdigital micro-sensor for the characterization of biological mediums by impedance spectroscopy is presented in “[Design and Realization of a Planar Interdigital Microsensor for Biological Medium Characterization](#)” by T.-T. Ngo, A. Bourjilat, J. Claudel, D. Kourtiche and M. Nadi. A theoretical optimization of the geometrical parameters of the sensor is proposed allowing the extension of the measurement frequency range by reducing the polarization effect manifested by a double layer.

In “[Molecularly Imprinted Impedimetric Sensing of Phthalates: A Real-Time Assay Technique](#)”, a real-time, non-invasive detection of phthalates was performed employing electrochemical impedance spectroscopy technique incorporating an enhanced penetration depth interdigital capacitive transducer by A.I. Zia, Apeksha Rao and S.C. Mukhopadhyay. The research was conducted to investigate the application of pre-concentration extraction polymer with molecular imprinted

recognition sites as an analyte sensitive coating for the sensor to introduce molecular selectivity for di (2-ethylhexyl) phthalate molecules.

A. Zhukov, M. Ipatov, J.J. del Val, M. Ilyn, A. Granovsky and V. Zhukova have developed a novel functional materials exhibiting giant magnetoresistance (GMR) and reported on magnetic, transport and structural properties of $\text{Co}_x\text{-Cu}_{100-x}$ ($5 \leq x \leq 30$) and $\text{Fe}_{37}\text{Cu}_{63}$ glass-coated microwires prepared by the Taylor-Ulitovsky method in “[Magnetic and Transport Properties of M-Cu \(M = Co, Fe\) Microwires](#)”. In the next chapter the correlation of “[Giant Magnetoimpedance Effect of Amorphous and Nanocrystalline Glass-Coated Microwires](#)” by A. Zhukov, A. Talaat, M. Ipatov, J.J. del Val, L. Gonzalez-Legarreta, B. Hernando and V. Zhukova. The outcomes of the research lead to the development of magnetically soft thin wires for applications in magnetic field sensors.

Non-Faradaic Electrochemical Modification of Catalytic Activity (NEMCA) was investigated for the first time for the activation and reactivation of the industrial potentiometric oxygen sensor based on stabilized zirconia solid electrolyte, which was reported in “[Aged Zirconia Electrochemical Oxygen Sensor Activation and Re-activation Using NEMCA](#)” by P. Shuk and R. Jantz. The NEMCA has improved the sensor response, impedance and stability.

In “[A New Scheme for Determination of Respiration Rate in Human Being Using MEMS Based Capacitive Pressure Sensor](#)”, the development of a MEMS-based capacitive nasal sensor system for measuring Respiration Rate (RR) of humans has been reported by Madhurima Chattopadhyay and Deborshi Chakraborty. Two identical arrays of diaphragms based MEMS capacitive nasal sensors have been designed and fabricated. In the proposed scheme, the two identical sensor arrays are mounted below Right Nostril (RN) and Left Nostril (LN), in such a way that the nasal airflow during inspiration and expiration impinge on the sensor diaphragms. A Finite Element Method based simulation study for monitoring the condition of lungs and heart of acute respiratory distress syndrome (ARDS) patients for monitoring their conditions ranging from dynamic shifting of body fluids to lung aeration has been reported in “[Monitoring of the Lung Fluid Movement and Estimation of Lung Area Using Electrical Impedance Tomography](#)” by Deborshi Chakraborty and Madhurima Chattopadhyay. The chapter has presented a brief overview on application of EIT for monitoring of the lung fluid movement and estimation of lung area in a human being along with physical and mathematical aspect with a goal to achieve a system having higher potential to cater medical challenges in lung oriented diseases.

A smart home’s monitoring system incorporating wellness’s context based on daily activities of human beings will be very useful to predict future’s event for pro-active medical treatment. The “[Activity and Anomaly Detection in Smart Home: A Survey](#)” by U.A.B.U.A. Bakar, H. Ghayvat, S.F. Hasan and S.C. Mukhopadhyay have reviewed the state-of-the-art dense sensing paradigm and anomaly detection approaches including sensors, data, analysis, algorithms and comparison of techniques.

In “[Real-Time Monitoring of Meat Drying Process Using Electromagnetic Wave Sensors](#)”, Magomed Muradov, Jeff Cullen and Alex Mason have investigated use an electromagnetic (EM) wave sensor to monitor the meat drying process and determine its suitability as a non-destructive and non-contact technique. The sensor has been modelled using High Frequency Structure Simulation Software (HFSS) and then constructed. Experimental work was conducted involving measurement of meat weight and EM signature (namely the S11 parameter in the frequency range 1–6 GHz) over a period of approximately one week, with measurements recorded every hour. The change in EM signature and weight loss has been analysed and correlations drawn from the resultant data.

Arijit Chowdhury, Avik Ghose, Tapas Chakravarty and P. Balamuralidhar have investigated the noise performance of a few smartphone based accelerometers in “[An Improved Fusion Algorithm For Estimating Speed From Smartphone’s Ins/Gps Sensors](#)”. The noise analysis has been used for improving the estimation of the speed of moving vehicle, as captured by GPS. A number of experiments were carried out to capture the vehicle’s position and speed from On Board Diagnosis V2 (OBD2), GPS as well as 3-axes accelerometer. The authors have also demonstrated a method by which the phone’s orientation is compensated for while calculating speed from the measured acceleration. A new method of INS/GPS fusion has been proposed to enhance the accuracy of speed estimation. It is envisaged that with increasing estimation accuracy, the application of multi-sensor fusion in autonomous vehicles will be greatly enhanced.

The “[Monitoring Water in Treatment and Distribution System](#)” by Joyanta Kumar Roy and Subhas Chandra Mukhopadhyay has reviewed and explained the importance of water quality monitoring and its technology from generation to the distribution. They have reported a SCADA-based intelligence sensing system which is utilising the Internet of Things to improve easy access to monitor water quality, treatment process and plant health in real time. Internet of Things is a new era of computing technology and a smart connect, machine to machine, machine to infrastructure, machine to environment intelligent system, which can talk to each other and make operational functions in universal network in the cloud.

A novel way for the recognition and classification of objects inside a scene, inspired by the well-known frame theory is described in “[An Application of the Frame Theory for Signature Extraction in the Analysis of 3D Point Clouds](#)” by F. Martino, C. Patruno, R. Marani and E. Stella. Three-dimensional (3D) point clouds have been obtained using a laser triangulation system of high resolution to achieve low noise datasets for the validation.

The last chapter by K. Tashiro, A. Ikegami, S. Shimada, H. Kojima and H. Wakiwaka presents the design of self-generating component powered by magnetic energy harvesting. A magnetic field alarm has been developed to demonstrate the devices. It consists of an energy harvesting module, Cockcroft-Walton circuit and piezo buzzer. The energy harvesting module is composed of coil and magnetic flux concentration core. It can generate 200 μW from an environmental magnetic field of 200 μT at 60 Hz.

I do sincerely hope that the readers will find this special issue interesting and useful in their research as well as in practical engineering systems. We are very happy to be able to offer the readers such a diverse special issue, both in terms of its topical coverage and geographic representation.

Finally, I would like to wholeheartedly thank all the authors for their contribution to this special issue.

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