

List of BioSense09 Papers

Title	Authors	Abstract
On On Field Monitoring using Wireless Sensor Networks: the FP6 GoodFood Project Approach	F. Chiti, R. Fantacci, G. Manes,D. Di Palma, G. Collodi, A. Manes, L. Bencini	The Ambient Intelligence vision relies upon the integration of distributed networks, embedded computational units and intelligent user interfaces. The Internet of Things vision introduces the capability of connecting smart sensor/actuators to locally available networks in order allow the interaction with the real world. The two visions are, thus, perfectly integrated and ideally suited to perform the task of collecting simple information from the surrounding environment using smart sensors, fusing and mining data to allow the final user to have an effective view of changing phenomena and to let end-user to take decisions and control the actuators, simply connecting to the Web, wherever in the world. This talk describes a successful application of the above concept in a challenging environmental monitoring context, concerning with the remote management of a vineyard and a cellar, in the frame of the 6th FW European Integrated Project "GoodFood". The paper reports a real case study concerning the deployment of four pilot sites in different vineyards located in Italy, in the Chianti region. The deployed systems, active for more than two years, exhibit unprecedented stand-alone and continuous operation capability, with millions data stored, thus representing the state-of-the-art in the application of WSN technology to wine production management.
SAR speckle removal by neural networks trained on artificially generated data	F.M.B. Van Coillie, H. Lievens, I. Joos, A. Pizurica, L.P.C. Verbeke, R.R. De Wulf and N.E.C. Verhoest	We propose a neural network-based method for speckle removal in SAR images. The method main idea is to train a neural network learning machine on artificially generated input-target couples that are representative of features of interest in this type of imagery. By generating the training data artificially we avoid the problems such as (un)availability of real data, data quality, and cost price. We show that the proposed approach can yield case specific, high performing despeckling filters. A comparative study with three classical denoising techniques (Enhanced Frost, Enhanced Lee and Gamma MAP) and a wavelet filter demonstrated a superior speckle removal performance of the proposed method in terms of both quantitative and qualitative performance measures.
Pre-filtering of multichannel remote sensing data for agricultural bare soil field parameter estimation	N. Ponomarenko, V. Lukin, I. Djurović, M. Simeunović	The paper addresses practical aspects of multichannel radar and hyperspectral image pre-filtering. Such images are shown to be often corrupted by spatially correlated noise which is quite difficult to remove. Special modifications of DCT based filter intended for this purpose are proposed and tested on artificial and real life images that can be further used for remote sensing data classification and extraction of useful information like bare soil erosion of agricultural fields.
Data Mining Approach for Predictive Modeling of Agricultural Yield Data	B. Marinković, J. Crnobarac, S. Brdar, B. Antić, G. Jaćimović, V. Crnojević	Prediction of agricultural yields is a challenging task that demands fusion of knowledge from different areas such as data mining, statistics and agriculture. This paper shows that data mining techniques can be successfully applied to agricultural data analysis. Results that we present are gained on the data set that contains monthly measurements of different environmental parameters and annual yields for maize, soybean and sugar beet. Obtained results are in compliance with previous results on plant production modeling that are at the core of agricultural science.
MetaSense Project - Miniature Metamaterial-Based Soil Moisture Sensors	Vesna Crnojević-Bengin, Ferran Martin Srđan Petrović, Goran Kitić, Vasa Radonić	In this paper, developed within EUREKA! MetaSense project, novel miniature metamaterial-based soil moisture sensors are developed. The influence of soil moisture on proposed configurations is analyzed. Small dimensions, fine sensitivity and compatibility with standard planar fabrication technologies make these sensors suitable for application in wireless sensors networks.
On Remote Sensing Techniques in Agriculture	K. Alič, A. Švigelj, M. Smolnikar,	Abstract—Observation of the earth surface is increasingly important for the sustainable development of countries, for environmental monitoring, and for balanced utilisation of the earth resources. Remote sensing techniques are playing the key role in provision of required geo-information. In this paper we examine remote sensing principles that are mainly used for

	M. Mohorčič, D. Škrabl, T. Javornik, G. Kandus	agricultural applications. Special attention is given to alternative approaches to remote sensing, including the hybrid use of remote sensing and wireless sensor networks (WSN).
An Efficient UAV Based Remote Sensing Solution for Precision Farming	B. Antić, D. Čulibrk, V. Crnojević and V. Minić	Modern agriculture heavily relies on the use of information technology in almost every aspect of the agrarian production. An integrated agricultural management system with remote sensing as one of its main parts constitutes the foundation of precision agriculture. Prevalent use of satellite imaging sensors for crop management considerably limits the spatial and spectral resolution of acquired images and has a prohibitively long crop revisit time. Multispectral image sensors placed on unmanned aerial vehicles (UAV) prove to be a cost-effective solution for obtaining high-quality aerial images of crops. This paper presents the main elements of an efficient UAV-based remote sensing system used in precision farming. The data obtained from the Tetracam multispectral cameras, carried by the unmanned aerial vehicle Pixy, can be used to calculate various vegetation indices, such as NDVI, GNDVI etc. Based on these indices, we can estimate the levels of different biophysical crop parameters, like the leaf area index (LAI) or total nitrogen uptake (QN).
Micro Force Sensor Fabricated in the LTCC Technology	G. Radosavljević, L. Živanov, A. Marić, G. Stojanović, W. Smetana, M. Unger	This paper presents the resonant force sensor designed for the operation in the MHz range and for 0 up to 6 N load. The LTCC technology is implemented for the sensor fabrication and readout of the measured data is realised wirelessly. Usage of the LTCC technology, adequate LTCC materials and wireless readout makes possible exploitation of this sensor in the harsh operating environments.
Body Communications: End User Experience	D. Bajic, T. Loncar-Turukalo	Data transmitted over the classical communication systems are well defined. The end user might not know the technical details, but he/she is perfectly aware of what is the expected delivery: speech, music, images, video, files etc. Wireless transmission of medical records is comparatively new domain, where the standardization procedures have not been completely finalized yet. The communications society has devoted a lot of efforts to create the proper channel model, to improve the antennas (usually textile), to enhance the modulation technique, with an ultimate aim of making the data transmission as good as possible. This implies that the transmission starts at the transmitter and ends with the receiver, regardless of what the input signal really is, and what the final user actually requires. This paper addresses some of the problems considering the transmission of cardiovascular records (blood pressure waves and electrocardiogram (ECG) from multiple leads, as well as the usual data derived from it (RR interval, pulse interval PI, heart rate variability HRV, QT interval, systolic, diastolic and middle blood pressure - SBP, DBP and MBP etc). It is concerned with the pre-processing before the transmission that might (or might not!), if taken into the account, increase the system throughput. It also deals with the ambiguities at the receiving end, initiated by different recording objectives. The final aim is not to give the answer, but to raise the question whether some of these aspects should be incorporated within the transmission optimization.
Distributed Rateless Packet Coding Scheme for Wireless Sensor Networks	D. Vukobratović, Č. Stefanović, T. Karabenč, M. Rovčanin, V. Crnojević	Distributed encoding of WSN generated data based on network and fountain coding principles has attracted considerable attention lately. The proposed solutions simplify the process of data gathering, increase the data robustness to node failures and offer low-complexity distributed data storage in WSN. Rateless packet approach is recently proposed distributed rateless coding solution which performs closely to centralized rateless codes and is simple for implementation. However, rateless packet solution is based on random walks of rateless packets on WSN graph, which may require significant communication and energy resources for the distributed encoding process. In this paper, we explore this problem further, comparing the rateless packet approach with the “dummy” centralized approach to perform the same task. While investigating and evaluating the two approaches, we point out the benefits and possible improvements of the rateless packet scheme, focusing in this paper on communication/energy requirements, rather than the overall coding efficiency.
Two-tiered Wireless Sensor	G. Berke,	The need for increased food production, environmental protection and health care demands the use of new technologies in

Network for Monitoring in Agriculture	M. Smolnikar, M. Mohorčič, T. Javornik, G. Kandus	agriculture. In this respect, wireless sensor networks (WSNs) have recently emerged as an attractive solution for remote monitoring and control. This paper presents the implementation of a two-tiered WSN, capable of interconnecting facilities scattered over a large geographical region. It is based on ZigBee and GPRS communication technologies, where ZigBee is used for local sensorial data collection and GPRS for the aggregation of the data and its transmission to the control centre. The system is composed of two types of nodes, i.e. sensor and central nodes, and a control centre application running on a web server. Sensor nodes are ZigBee-based, battery powered and for the purposes of the test application equipped with a temperature and humidity sensor. The central node of each local WSN serves as a gateway between ZigBee and GPRS technologies and is permanently available to execute commands received from the control centre. The latter enables remote control of the WSN on the level of individual node. Data collected in a control centre can be displayed or exported for further analyses in various formats. We tested the system for several weeks, and it proved to perform well and sufficiently robust to return to a working state after any possible disturbance.
Adaptive Local Extrapolation in Event Driven Wireless Sensor Networks	G. Ollos, R. Vida	Energy-efficient operation is an issue of paramount importance in wireless sensor networks, as it leads to an extended network lifetime. Sleep scheduling solutions proved to be exceptionally effective strategies to achieve this goal. Numerous such algorithms have been proposed and examined, but virtually without any considerable support for dynamic eventdriven systems. Dynamically occurring events, the constantly changing environment or the presence of mobile elements in the architecture make existing sleep scheduling techniques far too rigid. In such environments dynamic adaptation can be obtained through learning. In this paper we address the problem of energy efficient sensing by adaptively predicting the measured samples within a user specified error bound, without external assistance (other nodes or base station); this enables scalable distributed sleep scheduling, even in a dynamically changing environment. The adaptation and extrapolation error tracking is continuous, and does not need offline pre computations or dedicated phases. We compare our technique to the well known ZOH model, we provide system order sensitivity analysis and discuss simulations and results.
End User Oriented Solution for Remote Crop Monitoring	B. Antić, V. Minić, Č. Stefanović	Application of wireless sensor networks (WSN) in precision agriculture still requires significant customization of the existing hardware in order to step out from the controlled environments such as laboratories and green houses. In this paper we present one such customized solution which relies on the existing technology but offers a significant hardware upgrade and ensures a complete end-user-oriented solution providing an access to measurement information collected from open crop fields by means of WSN. The solution comprises hardware supplements for each individual WSN and a centralized data administration system capable of servicing a large number of WSNs and their users through a web interface. The system is at a great extent independent on the deployed technology and has been fully tested in practice where it has exhibited a high reliability.
Design and fabrication of a wireless, passive sensor for environmental monitoring	M. Maksimović, G. Stojanović, G. Radosavljević, M. Radovanović	A wireless, passive sensor platform capable of monitoring the complex permittivity of a surrounding medium is presented. The sensor is fabricated using LTCC technology and consists of a planar inductor–capacitor resonant circuit. The passive sensor is placed within the medium of interest and remotely detected using a loop antenna. By tracking the resonant frequency of the sensor the complex permittivity of the coating material can be determined. Since gas concentrations change the complex permittivity of a medium, the LC sensor can be used to determine the concentration. The sensor does not require an internal power source. Using this sensor gas levels can be measured in a variable humidity and temperature environment. The paper describes the operational principles, fabrication process and possible applications.
Driver Architecture Proposal for Contiki Operating System	M. Nikolić, M. Oklobdžija, V. Kovačević	Demands for fast development of wireless sensor network systems, with requirement for low power consumption and high flexibility, led to the creation of the Contiki operating system. Its fully optimized, lightweight, event-driven structure defines almost all major aspects of WSN operating systems, such as: processes (proto-threads), process interactions, communication stack and file system. Interface with peripheral drivers is one of the things left to be defined by user applications. This paper proposes general driver architecture for Contiki OS, with focus on serial port driver.
Bluetooth-based Wireless	M. Pesko,	This paper investigates the use of Bluetooth technology in the context of wireless sensor networks (WSNs) for the

Sensor Node for Environmental Data Monitoring	M. Mohorčič, M. Smolnikar, Gorazd Kandus	environmental data monitoring. The reference application scenario assumes distributed access to local environmental data via a mobile user device. Additionally, remote imaging using a camera on a sensor node is also considered as sensorial data. In order to demonstrate the suitability of Bluetooth for WSN applications that require high data throughputs, we designed and implemented a Bluetooth-based wireless sensor node and developed an accompanying Java application for storing and displaying the measured data on a mobile user device.
Quality of Service Provisioning in WSN Overview of Medium Access Control- and Physical-Layer Issues	N. Zogović, G. Dimić, D. Bajić	Research on wireless sensor networks (WSN) has mostly focused on providing energy-efficient operation of each node that provides as long lifetime of WSN as possible. We argue that it is important to include consideration of quality-of-service (QoS) provisioning in addition to considering energy-efficiency. An overview of QoS metrics and parameters in WSN is presented. Having in mind that throughput, average delay and jitter (delay variance) are the most important QoS parameters at medium access control (MAC) layer, fundamental energy-efficiency vs. delay trade-off, and throughput vs. capacity in wireless communications are reviewed. Existing energy-efficient MAC protocols for WSN, with some of the QoS-aware features are described. Finally, a review of MAC schedulers based on fundamental results on delay-constrained communications over wireless medium is given.

As far as the technical program is concerned, we received about 20 regular papers for a total of 17 selected papers. Every paper was evaluated by two reviewers (or more when the evaluation outcome was not sharp).

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