Editorial

Advanced Sensor Technology and Applications in Industrial Control System

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On behalf of the Science and Engineering Research Support society (SERSC), it is an honor for us to introduce you to this special issue, which includes articles that cover topics of particular interest to researchers in the field of sensor technology and applications in industrial control system.

This issue contains 18 articles that come from various countries, among which we mention Turkey, USA, Macau, Taiwan, Republic of Korea, Spain, China, and Italy. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the External Reviewers. We take this opportunity to thank them for their great support and cooperation.

In “Continuous monitoring of water quality using portable and low-cost approaches,” the authors proposed two different approaches for autonomous monitoring of water quality. In the first system, the boats receive trajectories set by the operator before a mission and follow the trajectories to visit predefined sampling points. In the second system, a group of portable water quality probes mounted on buoys at fixed positions regularly analyze water quality and send the data to the control center.

Authors proposed a method for correction of frequency-sweep nonlinearity in a signal processor instead of linearization of the VCO frequency sweep. For linearization, an additional fixed delay structure was adopted, and the frequency-sweep nonlinearity was extracted and used for compensation in “Correction of nonlinear frequency sweep in frequency-modulated continuous-wave laser range sensor.” The authors validated their linearization method with numerical analysis and computer simulation.

The main contribution of the paper “Target localization in wireless sensor networks for industrial control with selected sensors” was a novel energy-based target localization method in WSNs with selected sensors. In this method, sensors used turbo product code (TPC) to transmit decisions to the fusion center. Moreover, the thresholds used in authors’ target localization method were determined using a new heuristic method specifically designed for sensor position following uniform distributions and target position following a Gaussian distribution.

In “Fisher information of mine collapse hole detection based on sensor nodes connectivity,” the authors presented the possibility of detecting the collapse hole using WSN. By establishing a 2D model of the collapse hole in coal mine, the authors described a class of algorithms for detecting the collapse hole in coal mine. Based on log-normal shadowing channel model, the authors analyzed the accuracy of detecting the collapse hole in coal mine using Fisher information and made numerical calculation.

An integrated system for the monitoring of the patient’s history must be capable of real-time behavior. Moreover, immediately needed Tag information for monitoring requires a fast-booting system, and one of the essential requirements for mobile conversion is a low-power mobile system. In “The display system of a patient’s history using the RFID and Linux,” to monitor RFID data in real time, the RFID system used a 125 kHz carrier wave with the EM4095 and an embedded Linux operating system with a 400 MHz PXA255 ARM RISC chip, a 512 Kbyte Boot Flash, and a 64 Mbyte SDRAM. Moreover, the system was configured to use a NAND Flash.
In "Multiple odor recognition and source direction estimation with an electronic nose system," the authors proposed a mobile olfaction system that was composed of multiple odor recognition and odor source direction estimation abilities for extensive use in mobile environments. Also, authors suggested a recognition algorithm capable of detecting two odors simultaneously using a hierarchical elimination method.

In "Novel MAC protocol and middleware designs for wearable sensor-based systems for health monitoring," authors proposed a middleware platform built on WUSB (Wireless USB) over WBAN (Wireless Body Area Networks) hierarchical protocol for wearable health-monitoring systems (WHMS). The proposed middleware platform is composed of time synchronization and localization solutions. And it is executed on the basis of WUSB over WBAN protocol at each sensor node comprising the WHMS.

In "Optimizing classification decision trees by using weighted naive bayes predictors to reduce the imbalanced class problem in wireless sensor network," authors devised a new scheme that extends a popular stream classification algorithm to the analysis of WSNs for reducing the adverse effects of the imbalanced class in the data. This new scheme was resource-light at the algorithm level and does not require any data preprocessing. Experiments showed that authors' modified algorithm outperforms the original stream classification algorithm.

In "On the impact of local processing for motor monitoring systems in industrial environments using wireless sensor networks," authors presented a theoretical study for verifying the performance of motor monitoring systems in industry employing WSN. First, a discussion was performed about the standards and protocols already proposed for WSN, and about some implementation aspects, which can impact the quality of service in WSN based applications in industrial environments. Finally, mathematical models were developed for verifying the performance of an IEEE 802.15.4 based WSN for applications of torque and efficiency monitoring in induction motors, which are widely used in industries.

In "Robust people tracking using an adaptive sensor fusion between a laser scanner and video camera," authors presented an adaptive sensor fusion method between the laser scanner and video camera. In this proposed approach, authors' system does not need a checkerboard. To evaluate the performance of the proposed system, authors showed error analysis and two applications.

In "Multiple Interface Parallel Approach of Bioinspired Routing Protocol for Mobile Ad Hoc Networks," authors presented a new bioinspired routing protocol for mobile ad hoc networks obtained thanks to new parallelization techniques of a base protocol called AntOR which has two versions: the so-called disjoint-link (AntOR-DLR) and disjoint-node (AntOR-DNR). The new parallel approach (PAntOR-MI) used the disjoint-node version of AntOR (AntOR-DNR) as the main protocol, as well as the existing (PAntOR).

Presented in "A PEM fuel cell diagnostic system using the extension theory" was a fault diagnostic system for a fuel cell, an easy to implement system made up of multiple Modbus modules. On top of that, a user friendly human machine interface was constructed for easy monitoring of the cell system operation. Integrated with a ZigBee wireless communication module, this system can be in the future applied to a distant monitoring system, such as an alter system for a fuel cell powered vehicle.

Because the existing storage scheme for one-dimensional is not suitable for the multi-dimensional data or costs too much energy, in "Data storage scheme supporting for multidimensional query," authors proposed a kind of data storage scheme supporting multidimensional query inspired by K-D tree. The scheme can effectively store the high-dimensional similar data to the same piece of two-dimensional area. It can quickly fix the storage area of the event by analyzing the query condition and then fetch back the query result.

The main purpose of "Deadline-aware scheduling perspectives in industrial wireless networks: a comparison between IEEE 802.15.4 and Bluetooth," authors presented a new bioinspired routing protocol which works in roaming for Bluetooth multisystems technology in their paper "Sensor protocol for roaming bluetooth multiagent systems." The advantage of designing a roaming protocol is to ensure that the Bluetooth-enabled roaming devices can freely move inside the network coverage without losing their connection or break of service in case of changing the base stations.

In "Wireless virtual multiple antenna networks for critical process control: protocol design and experiments," the author evaluated experimentally the impact of fading channels on the controllability of the closed-loop wireless system. In particular, it is envisaged here that the incorporation of the cooperative network paradigm into future wireless system standardization will allow cable replacing in tight closed-loop control applications with cycle-time below 100 ms.

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