Editorial

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Smart device enabled sensor networks: Theory and practice

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Because of recent advancement in sensor technologies such as smart meters, smart phones, and wearable sensors, and the proliferation of smart devices, an exciting new research field of smart device enabled sensor networks has caught lots of attention in recent years. Advances in smart device enabled sensor networks will drive innovation in important sectors such as healthcare, transportation, energy, city/building design, agriculture, and manufacturing.

These networks are complex engineered systems whose functions are dependent upon tight integration of the underlying physical, computation, and communication processes. In this Special Issue, there are six papers covering various topics within the scope of smart device–enabled sensor networks with complementary focuses. They span from wearable sensors to detect falls of elderly people, smart homes, to indoor positioning system.

"A smart device enabled system for autonomous fall detection and alert" is an interesting application of wearable sensors to detect falls of elderly people in order for immediate medical attention. The system consists of a custom-made vest with a motion sensor and a smart phone connected to it with Bluetooth. The sensor readings are streamed to the phone for it to classify whether the detected motion belongs to an accidental fall with a high precision.

"An activity recognition-assistance algorithm based on hybrid semantic model in smart home" is another very interesting application of networked sensors to induce activities in a smart-home environment. The intelligence of the Smart Gateway framework stems from an algorithm built on a Hidden Markov Model and semantic association. With continued activity data fed to the framework for training, the framework becomes more intelligent and familiar with the user's routine to be able to provide life assistance advice as time goes on.

Indoor localization based on passive infrared (PIR) sensors is considered in "PIR sensors deployment with the accessible priority in smart home using genetic algorithm." The authors proposed an implementation of Genetic Algorithm–based approach for the PIR sensors deployment based on the priority of zones by accessible frequency in a smart home. Extensive simulations are carried out to evaluate the performance for different number of PIR sensors, the accessible map heat score rank, and overlap rate of different PIR sensors.

A novel scheduling algorithm is proposed in "A gradient-assisted energy-efficient backpressure scheduling algorithm for wireless sensor networks" to enable practical backpressure-based scheduling in a wireless sensor network. Although backpressure-based scheduling and routing in computer and wireless ad hoc networks has made a lot of progress, how to implement it in wireless sensor network remains an open problem. The proposed gradient-assisted energy-efficient backpressure scheduling algorithm (GRAPE) introduces a new link-weight assignment method, and it is proved throughput-optimal theoretically. Simulation results demonstrate that GRAPE can yield significant performance improvements in terms of energy use efficiency, network throughput, and packet delivery ratio.

In "Signal processing for tracking of moving object in multi-impulse radar network system," an iterative extended Kalman filter (IEKF)-based object tracking method is proposed for using two impulse radio ultra wideband (IR-UWB) radars for indoor target tracking. It is demonstrated that the proposed method outperforms the conventional filters with enhanced tracking accuracy. The relation between position of the IR-UWB radars and distance measurement is discussed. This study is performed in two-dimensional (2D) and may be extended to three-dimensional (3D) indoor tracking with the lessons learned.

A mobile Internet measurement probe called QMON is proposed in "Deploying and managing a network of autonomous Internet measurement probes: lessons learned." The proposed probe can be either statically deployed or used in drive measurements, and it is able to collect hundreds of key performance indicators on physical, network, and application layers of the network stack, acting at the same time as an event-driven real-time sensor network and a batch-mode detailed data collection device. This study provides valuable experience for practical deployment of mobile

Internet in a city and potential realization of future smart city.

As smart device–enabled sensor networks become more ubiquitous, we envision they will be one of the driving forces for future evolutions of smart home, smart city, and contribute to a smart society.

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