

Open Issues on Intelligent Sensor Networks

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In this paper, we address some open issues on intelligent sensor networks research. Recent advancement in wireless communications and electronics has enabled the development of low-cost sensor networks, which is one of the most important technologies for 21st century. The sensor networks can be used in various application areas, such as security and surveillance applications, smart classroom, monitoring of natural habitats and ecosystems, medical monitoring etc. Although there have been great improvements in research on sensor networks, there still lie some open issues need to be solved to make the whole system works well. First is sensor node platform. The key issue is about how to design and implement a kind of cheaper node than the Berkeley Motes and iPaq-based Sensor Node that are two famous platforms. Second is energy awareness. Energy efficiency is the crucial problem in sensor networks. There are various sources of energy consumption in sensor networks, such as Processing Unit, Radio, Sensors, Actuators. Some results show that the actuation energy is the highest and the communication energy is the next. Node-level techniques and Network-level techniques are employed for various efficient energy management methods. Third are the time and space issues. Time synchronization is a critical piece of infrastructure of sensor network. Almost all forms of sensor data fusion and coordinated actuation require synchronized physical time for reasoning about events in the physical world. The clock accuracy and precision requirements are often more crucial in sensor networks than in traditional distributed systems. The space issues comprise the node localization and sensor coverage problems. They are both essential to support services and applications in sensor networks. Fourth are the protocols of sensor networks. The protocol stack consists of the physical layer, data link layer, network layer, transport layer and application layer. The physical layer addresses the needs of simple but robust modulation, transmission, and receiving techniques. Since the environment is noisy and sensor nodes can be mobile, the medium access control (MAC) protocol must be power-aware and able to minimize collision with neighbors' broadcasts. The network layer takes care of routing the data supplied by the transport layer. The transport layer helps to maintain the flow of data if a sensor networks application requires it. Depending on different sensing tasks, different types of application software can be built and used on the application layer. The last issue is the collaborative signal processing. The nodes in sensor network must collaborate to collect and process data to generate useful information. Important technical issues include the degree of information sharing between nodes and how nodes fuse the information from other nodes. Also one needs to consider the tradeoffs between the better system performance and the resource limitation in collaborative signal and information processing. The above all will make the system more intelligent.