Abstract of research

A wireless sensor network (WSN) consists of thousands of tiny, inexpensive, low-power wireless devices and is characterized by being self-organizating and self-healing, and having very low power consumption, very low cost deployment, and a very simple network topology. WSNs face key issues on how to reduce power consumptions of the network. The IEEE 802.15.4 standard has specified the physical and MAC layers for such low cost WSNs, and the ZigBee Alliance is established for building upper layer protocols and promoting industrial applications.

The project aims to explore the design issues of WSNs related to network formation and time synchronization, and to design a cluster-mesh network scheme for low duty cycle, low data rate, and low power WSNs based on the IEEE 802.15.4 standard. The project involves in providing a cluster-based mesh style network topology that works in the low rate wireless personal area network environment. Also, the time synchronization issue will be investigated through simulations and theoretical analysis, especially under the low duty cycle mode. We propose to use a two-level time synchronization scheme to achieve the time synchronization locally and globally within different network regions. Further more, we plan to establish an experimental WSN according with the proposed schemes to evaluate the performance of our schemes and to explore its application potentiality.

The project result will make important contributions to the development of the network layer specification of the ZigBee Alliance such as proposing new protocols to the ZigBee Alliance. Implementation and evaluation of the proposed algorithms can benefit the design of routing protocols, the optimization of network structure, the mechanism of the data fusion and diffusion, etc. The technology and experimental platform developed in this project can apply to practical applications. At the same time, this project can contribute to the educational aspects that it provides topics for graduate/undergraduate courses related to wireless personal area network and opportunities for students to use simulation software and experimental platform.