Skysong Innovations

A unit of the Arizona State University Knowledge Enterprise

Inventor

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PulseSS, a Communication Protocol for Decentralized Synchronization and Scheduling

SI Cases: M17-126P

Background

Today's wireless sensor networks (WSNs) strongly rely on WiFi technology or Zigbee radio standards for deployment. These standards inherently require control timing protocols to complete operations. Although alternative protocols, such as Carrier Sensing Multiple Access (CSMA) address the issue of synchronization and control timing, sensor-scheduling is not resolved. Sensor scheduling becomes important when data is produced, and needs to be remotely delivered at a regular pace.
A commonly used central protocol to similarly attain synchronization and time division multiple access (TDMA) scheduling with widespread acceptance for WSNs is WirelessHART. Scheduling using this protocol is centrally managed by a single network manager, limiting the size of the application and introducing a single point of failure. Further, this protocol requires global knowledge of the network topology.

Therefore, there is a need for a protocol that tackles the sensor-scheduling problem without the requirements of central management and knowledge of network topology.

Invention Description

Researchers at Arizona State University have generated a new communication protocol that provides decentralized, network-wide synchronization and time division multiple access scheduling for self-organizing clustered networks protocol for WSNs. Called the PulseSS; Pulse coupled Synchronization and Scheduling, each cluster is locally managed, creating a truly scalable solution. Further, the nodes of each cluster will communicate locally within their cluster to assign themselves a fair share of spectrum resources. This lightweight protocol works for ad-hoc, mesh network scenarios. The PulseSS protocol groups nodes into clusters which then contend for the same spectrum resources, adaptively.

The PulseSS protocol approach may also be applied to such cloud based technology as software defined networks (SDNs), and Network Virtualization where hardware and software network resources are combined to control the network at the IP layer, and thus separate the networking hardware from the communicating entities.

Intellectual Property Status:
Patents Pending

Potential Applications

- Wireless sensor networks
- Smart appliances and charging electric vehicles
- Control area and software defined networks

Benefits and Advantages

- **Robust** – decentralization allows for common timing and continued operation even if the network is disconnected (for example in the event of a cyber attack)
- **Scalable** – Locally manages network clusters, prevents single point of failure.
- **Accurate** – Decentralized scheduling applies local communication with simple calculations for precise network-wide synchronization.
- **Flexible** – ability to add additional nodes into a cluster, or remove them readily

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