

ABSTRACT

Panta, Rajesh K. Ph.D., Purdue University, May 2010. Remote Reprogramming of Wireless Sensor Networks. Major Professor: Saurabh Bagchi.

In recent years, advances in hardware and software tools have led to many real-world sensor network deployments. Management of already deployed sensor networks is a very important issue. One of the crucial management tasks is that of software reconfiguration. During the lifetime of a sensor network, software running on the sensor nodes may need to be changed for various reasons like correcting software bugs, modifying the application to meet the changing environmental conditions in which the network is deployed, adapting to evolving user requirements, etc. The frequency of software updates is very high in sensor networks due to various reasons — harsh and unpredictable environments in which the sensor nodes are deployed, time-varying nature of the wireless channel, lack of robust tools for developing software, interference in the unlicensed ISM band, topology change caused by node mobility, battery outages, etc. Since a sensor network may consist of hundreds or even thousands of nodes which may be situated at places which are difficult or, sometimes, impossible to access physically, remote reprogramming of sensor networks is essential. This thesis presents energy efficient and fast reprogramming services for wireless sensor networks. Sensor networks are often battery-powered and need to be operated unattended for long periods of time. Radio transmission is often the most energy-expensive operation in sensor networks. Since energy is a very scarce resource, this thesis focuses on conserving energy during reprogramming. Also, since the performance of the network may be degraded, or even reduced to zero, during software update process, the reprogramming techniques proposed here minimize reprogramming time significantly compared to existing reprogramming protocols.