Abstract

Recently, applications requirements are growing at a rapid rate. They are constantly being developed, altered, and improved upon. Achievement of these applications requirements depends on the design of the protocols of Medium Access Control (MAC) layer. Therefore, one of these reliable protocols is IEEE802.15.4 beacon-enabled mode that is considered as a de facto protocol, and it is widely implemented in the monitoring field. The protocol is designed to Low-Rate Wireless Personal Area Networks (LR-WPANs) with limited power. In addition, IEEE802.15.4 MAC uses a superframe that is divided into two periods, Contention Access Period (CAP) and Contention Free Period (CFP). Generally, within the monitoring field, the exchange of sensitive data between two nodes occurs during the CFP because it offers real-time guarantees through the Guaranteed Time Slot (GTS) mechanism. However, the 802.15.4 standard has three issues. First, lack of scalability, which is caused by the maximum possible devices that the GTS can allocate which is only seven. Second, in CFP, all timeslots have fixed-length, which leads to a slot size-induced bandwidth waste problem. Third, its duty cycle is not efficient, especially under very high duty cycle. In our thesis, we have proposed an efficient GTS allocation scheme to eliminate the GTS bandwidth underutilization problem and allows to allocate more than seven devices in same superframe. Our scheme uses variable-length timeslots that are allocated to devices based on their actual bandwidth. Also, we proposed an enhanced standard protocol's sleeping schedule, aims to conserve sensor energy without compromising the low latency. The underlying idea of our scheme is based on the B-MAC duty cycle with additional modifications. The proposed schemes were evaluated through OMNet++ simulator and the results evidenced that our proposed GTS allocation schemes and sleeping schedule scheme are outperforming the IEEE 802.15.4 standard.

Keywords: Wireless personal sensor network, IEEE802.15.4, GTS, sleep cycle, Throughput.