Achieving Collision Freedom without Modifying Communication Protocols in Wireless Rechargeable Sensor Networks

Yuanchao Shu[1], Yuelong Tian[1], Yu Gu[2] and Jiming Chen[1]
[1]State Key Laboratory of Industrial Control Technology, Zhejiang University, China
{ycshu, yuelongtian1988}@zju.edu.cn, jmchen@iipc.zju.edu.cn
[2]Singapore University of Technology and Design, Singapore
jasongu@sutd.edu.sg

ABSTRACT

A wireless rechargeable sensor network (WRSN) is an emerging type of sensor network that is capable of harvesting wireless energy from the ambient environment. For example, the Wireless Identification Sensing Platform (WISP) [1] can harvest ambient Ultra High Frequency (UHF) Radio Frequency (RF) energy from commercial RFID readers to power its computation, sensing and communication components. Since multiple nodes in a WRSN need to communicate with the RFID readers simultaneously, collisions are common. Various protocols are designed at the MAC layer to reduce collisions in the network [2, 3].

However in a WRSN, we observe that node activities such as communication are highly dependent on the energy harvested. Therefore in this work we propose a completely new approach, purely based on the energy charging patterns at individual nodes. By doing so, we can avoid communication collisions while minimizing total charging time. Specifically, we design the moving patterns of RFID readers in the network such that the time duration of each node being charged above its working threshold value is differed by a minimal time interval δ. In this way, the nodes in a WRSN become functional at different time intervals, naturally avoiding communication collisions with the RFID readers. Through extensive simulations and experiments, we observe that this new collision avoidance scheme is able to significantly reduce the communication delays in WRSN.

BODY

Control charging patterns to wake up nodes at different time intervals. Now your wireless rechargeable sensor network is collision-free!

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Volume 1 of Tiny Transactions on Computer Science