Maximizing Sensor Lifetime with the Minimal Service Cost of a Mobile Charger in Wireless Sensor Networks

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Abstract

Wireless energy transfer technology based on captivating resounding coupling has emerged as a hopeful technology for wireless sensor networks, by on condition that controllable yet frequent energy to sensors. The use of a mobile charger to wirelessly charge sensors in a rechargeable sensor network so that the sum of sensor lifetimes is maximize even as the take a trip distance of the mobile charger is minimize. contrasting existing studies that unspoken a mobile charger must charge a sensor to its full energy capability before moving to charge the next sensor, we here assume that each sensor can be partially charged so that more sensors can be charged before their energy depletions. Under this new energy charging model, we first formulate two novel optimization problems of scheduling a mobile charger to charge a set of sensors, with the objectives to maximize the sum of sensor lifetimes and to minimize the travel distance of the mobile charger while achieving the maximum sum of sensor lifetimes, respectively. We then propose efficient algorithms for the problems. We finally estimate the presentation of the proposed algorithms through investigational simulations. Reproduction results make obvious that the proposed algorithms are very promise. Especially, the average energy expiration duration per sensor by the proposed algorithm for maximizing the sum of sensor lifetimes is only 9% of that by the state-of-the-art algorithm while the travel distance of the mobile charger by the second proposed algorithm is only about from 1% to 15% longer than that by the state-of-the-art benchmark.

Keywords: Rechargeable sensor networks; sensor charging scheduling; partial charging; sensor lifetime maximization; service cost minimization; mobile chargers; wireless energy transfer.

INTRODUCTION

Wireless sensor networks play an important role in many monitoring and surveillance applications including environmental sensing, target tracking, structural health monitoring, etc. As conventional sensors are powered by batteries, the limited battery capacity obstructs the large-scale deployment of wsns. The wireless energy transfer based on magnetic resonant coupling revolutionizes energy supplies to wireless sensor networks. Unlike sensor energy replenishments through energy harvesting that only provide temporally and spatially varying energy sources (e.g., solar energy and wind energy) the deployment of mobile chargers (mobile charging vehicles) to charge sensors wirelessly has been a new promising technology that ensures sensors can be charged with high yet stable charging rates, thereby they can operate continually. It is however very challenging to design efficient charging scheduling algorithms for mobile chargers, due to following three inherent constraints on wsns. The first constraint is that the energy consumption rates of different sensors are significantly different. Sensors near to the base station have to relay data for the other remote sensors, and thus consume much more energy than others. In addition, the energy consumption rate of each sensor may change over time as its sensing data rate usually depends on the specific application of the WSN. The second one is that the battery technology has not been much improved in the past decades. It still takes a long time (e.g., 30- 80 minutes) to fully charge a commercial off-the-shelf sensor battery. The final constraint is that a mobile charger consumes its energy not only on sensor charging but also on its mechanical movement, thereby incurring high charging costs. Several recent studies have been conducted to address the mentioned challenges. For example, Xu et al. Studied the problem of scheduling k mobile chargers to charge a set of sensors wirelessly so that all the sensors in the set can be fully charged as quickly as possible, while Ren et al. Investigated the problem of dispatching a mobile charger to charge as many sensors as possible within a given time period. Shi et al. Employed a mobile charger to charge all sensors periodically such that the network can operate continually. Given a set of to-becharged sensors with different residual lifetimes, Wang et al. Devised an adaptive algorithm to schedule a mobile charger to charge a proportion of sensors with an objective to maximize the amount of energy charged to sensors minus the amount of energy consumed on the mobile charger's traveling, while ensuring that each chosen sensor will be charged prior to its energy expiration. Although the mentioned studies strive for the finest trade-off between charging as many sensors as possible before their energy depletions and minimizing the travel cost of the mobile charger, there is still one major limit in these studies. That is, they all assumed that a mobile charger must charge a sensor to its full energy capacity. Since it takes a while (e.g., 30-80 minutes) to fully charge a commercial off-the-shelf sensor battery (e.g., Lithium battery), this full-charging model will prevent the mobile charger from charging more sensors before these sensors expire their energy completely, especially when there are many lifetime critical sensors to be charged at some moment. We here use an example to illustrate such a scenario. Assume that a WSN consists of two sensors u and v only, the residual lifetime of each of them is 10 minutes, and it takes an hour to fully charge either of them, as illustrated in If one mobile charger is deployed to charge the sensors by adopting the full-charging model, then one of them will be charged before its energy depletion, while the other must be dead for a period of 60-10=50 minutes before it can be recharged, assuming that the travel time of the mobile charger between the two sensors is ignored, see It can be seen that in the full-charging model, some sensors can continue their operations without energy depletions, while the others may have been dead for a long time before they can be recharged again. However, the energy expirations of sensors for a long period may lead to severe consequences to the WSN. For example, in a WSN for early forest fire detections, the energy depletions of some sensors for several hours may delay the detection of a forest fire. Such a detection delay may result in the fire becoming uncontrollable, eventually incurring significant damages and casualties, since the forest fire can quickly spread by strong wind in a very short time. Distance is worthy since the continuing operation of sensors is a fundamental requirement for most WSN applications. Otherwise, no sensing data will be generated by the dead sensors or "fresh" sensing data generated by other live sensors cannot be forwarded to the base station due to the energy expirations of relay sensors.

RELATED WORK

A Framework of Joint Mobile Energy Replenishment and Data Gathering in Wireless Rechargeable Sensor Networks, Miao Zhao, Ji Li, and Yuanyuan Yang-2014

Recent years have witnessed the rapid development and proliferation of techniques on improving energy efficiency for wireless sensor networks. Although these techniques can relieve the energy constraint on wireless sensors to some extent, the lifetime of wireless sensor networks is still limited by sensor batteries. Recent studies have shown that energy rechargeable sensors have the potential to provide perpetual network operations by capturing renewable energy from external environments. However, the low output of energy capturing devices can only provide intermittent recharging opportunities to support low-rate data services due to spatial-temporal, geographical or environmental factors. To provide steady and high recharging rates and achieve energy efficient data gathering from sensors, in this paper, we propose to utilize mobility for joint energy replenishment and data gathering. In particular, a multi-functional mobile entity, called SenCar in this paper, is employed, which serves not only as a mobile data collector that roams over the field to gather data via short-range communication but also as an energy transporter that charges static sensors on its migration tour via wireless energy transmissions. Taking advantages of SenCar's controlled mobility; we focus on the joint optimization of effective energy charging and high-performance data collections.

A Hybrid Framework Combining Solar Energy Harvesting and Wireless Charging for Wireless Sensor Networks, Cong Wang, Ji Li, Yuanyuan Yang and Fan Ye-2016

Power wireless sensor networks (WSNs) by wireless charging technology. Although previous studies indicate that wireless charging can deliver energy reliably, it still faces regulatory challenges to provide high power density without incurring health risks. In particular, in clustered WSNs there exists a mismatch between the high energy demands from cluster heads and the relatively low energy supplies that wireless charging can provide. Fortunately, solar energy harvesting can provide high power density which is also risk-free. However, it is subject to weather dynamics. Therefore, in this paper, we propose a hybrid framework that combines the two technologies - cluster heads are equipped with solar panels to scavenge solar energy and the rest of nodes are powered by wireless charging.

NETWRAP: An NDN Based Real Time Wireless Recharging Framework for Wireless Sensor Networks, Ji Li, Cong Wang, Fan Ye, and Yuanyuan Yang-2013

A mobile vehicle equipped with wireless energy transmission technology can move around a wireless sensor network and recharge nodes over the air, leading to potentially perpetual operation if nodes can always be recharged before energy depletion. When to recharge which nodes, and in what order, critically impact the outcome. So far only a few works have studied this problem and relatively static recharging policies were proposed. However, dynamic changes such as unpredictable energy consumption variations in nodes, and practical issues like scalable and efficient gathering of energy information, are not yet addressed. In this paper, we propose NETWRAP, an NDN based Real Time Wireless Recharging Protocol for dynamic recharging in wireless sensor networks. We leverage concepts and mechanisms from NDN (Named Data Networking) to design a set of protocols that continuously gather and deliver energy information to the mobile vehicle, including unpredictable emergencies, in a scalable and efficient manner. We derive analytic results on energy neutral conditions that give rise to perpetual operation. We also discover that optimal recharging of multiple emergencies is an Orienteering problem with Knapsack approximation. Our extensive simulations demonstrate the effectiveness and efficiency of the proposed framework and validate the theoretical analysis.

Quality-Aware Target Coverage in Energy Harvesting Sensor Networks, XIAOJIANG REN, WEIFA LIANG, AND WENZHENG XU-2015

Sensing coverage is a fundamental problem in wireless sensor networks for event detection, environment monitoring, and surveillance purposes. In this paper, we study the sensing coverage problem in an energy harvesting sensor network deployed for monitoring a set of targets for a given monitoring period, where sensors are powered by renewable energy sources and operate in duty-cycle mode, for which we first introduce a new coverage quality metric to measure the coverage quality within two different time scales. We then formulate a novel coverage quality maximization problem that considers both sensing coverage quality and network connectivity that consists of active sensors and the base station. Due to the NP-hardness of the problem, we instead devise efficient centralized and distributed algorithms for the problem, assuming that the harvesting energy prediction at each sensor is accurate during the entire monitoring period. Otherwise, we propose an adaptive framework to deal with energy prediction fluctuations, under which we show that the proposed centralized and distributed algorithms are still applicable. We finally evaluate the performance of the proposed algorithms through experimental simulations. Experimental results demonstrate that the proposed solutions are promising.

EXISTING PROCESS

Wireless sensor networks (WSNs) play an important role in many monitoring and surveillance applications including environmental sensing, target tracking, structural health monitoring. As conventional sensors are powered by batteries, the limited battery capacity obstructs the large-scale deployment of WSNs. The wireless energy transfer based on magnetic resonant coupling revolutionizes energy supplies to wireless sensor networks. The first constraint is that the energy consumption rates of different sensors are significantly different. Sensors near to the base station have to relay data for the other remote sensors, and thus consume much more energy than other. In addition, the energy consumption rate of each sensor may change over time as its sensing data rate usually depends on the specific application of the WSN.

DISADVANTAGE

- Optimization problem
- Scheduling of mobile charger problem

PROPOSED PROCESS

The first constraint is that the energy consumption rates of different sensors are significantly different. Sensors near to the base station have to relay data for the other remote sensors, and thus consume much more energy than others. In addition, the energy consumption rate of each sensor may change over time as its sensing data rate usually depends on the specific application of the WSN. Each sensor can be charged only once per charging tour, while we here allow each sensor to be charged multiple times and the amount of energy charged at each charging can be different. Also, existing work only focused on charging as many sensors as possible in time while we aim to maximize the sum of sensor lifetimes.

ADVANTAGE

- Less complexity
- Better communication

PROCESS

- Search Techniques
- Distance Search
- Network analysis
- Attack detection
- Localization

NETWORK ANALYSIS

We initiate a fixed-length walk from the node. This walk should be long enough to ensure that the visited peers represent a close sample from the underlying stationary distribution. We then retrieve certain information from the visited peers, such as the system details and process details. It acting as source for the network .In sender used to create sends the request and received the response and destination used to received the request and send the response for the source.

SEARCH TECHNIQUES

In the distance of the subsequent hotel from the subsequent source place by using spatial expanse of Google map Search Techniques: Here we are using two techniques for searching the certificate 1)Restaurant Search,2)Key Search. Key Search: It means that the user can give the key in which dish that the eating place is legendary.

DISTANCE SEARCH

The User can measure the distance and compute time that takes them to reach the destination by giving speed. Chart will be prepared by using these values. These are done by the use of Google Maps.

ATTACK DETECTION

In the attack detection instead of relying on cryptographic-based approaches. Furthermore, our work is novel because none of the exiting work can determine the number of attackers when there are multiple adversaries masquerading as the same identity. Furthermore, our approach can straightforwardly localize multiple adversaries even when the attackers untrustworthy their transmission power levels to deception the system of their true locations.

LOCALIZATION

Localization estimation errors using RSS which are about 15 feet. When the nodes are less than 15 feet separately, they have a high likelihood of generate similar RSS readings, and thus the spoofing recognition rate falls below 90 percent, but still greater than 70 percent. However, when moves closer to the attacker also increases the probability to expose itself. The uncovering price goes to 100 percent when the spoofing node is about 45-50 feet away from the original node.

ARCHITECTURE DIAGRAM

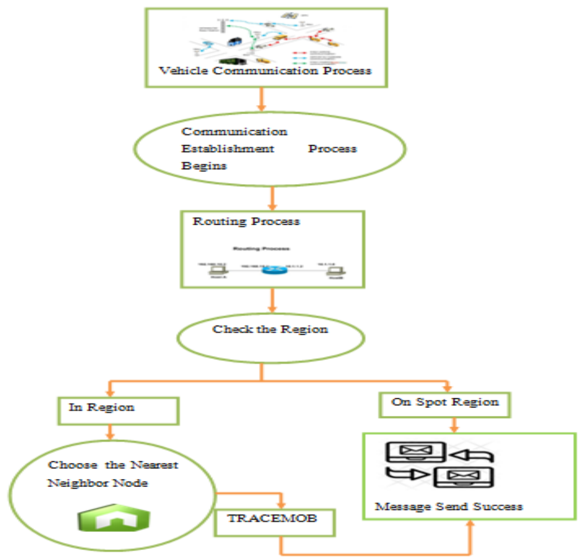

Fig 1 Architecture Diagram

CONCLUSION

The use of a mobile charger to wirelessly charge sensors in a rechargeable sensor network so that the sum of sensor survival times can be maximized while keeping the travel distance of the mobile charger minimized. Unlike existing studies that assumed a mobile charger must charge a sensor to its full energy capacity before charging the next one, we are the first to propose a partial energy charging model for sensor charging to shorten sensor dead durations, under which we first formulate two novel optimization problems of dispatching a mobile charger to charge a set of sensors, which are to maximize the sum of the sensor lifetimes and to minimize the travel distance of the charger while ensuring that the maximum sum of sensor lifetimes is achieved. We then proposed an efficient algorithm for each of the two problems, and we finally evaluated the performance of the proposed algorithms through experimental simulation. The simulation results demonstrated that the proposed algorithms are very promising.

REFERENCE

[1] A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, “Internet of Things: a survey on enabling technologies, protocols, and applications,” IEEE Commun. Surveys Tuts., vol. 17, no. 4, pp. 2347–2376, 2015.

[2] S. Bi, Y. Zeng, and R. Zhang, “Wireless powered communication networks: an overview,” IEEE Wireless Commun., vol. 23, no. 2, pp. 10–18, 2016.

[3] C. Chekuri and M. P´al, “Improved algorithms for orienteering and related problems,” ACM Trans. Algorithms, vol. 8, no. 3, article no. 23, 2012.

[4] R. Diestel, Graph Theory. Springer-Verlag, 2000.

[5] M. L. Fredman and R. E. Tarjan, “Fibonacci heaps and their uses in improved network optimization algorithms,” J. ACM, vol. 34, no. 3, pp. 596–615, 1987.

[6] L. He, Y. Gu, J. Pan, and T. Zhu, “Evaluating the on-demand mobile charging in wireless sensor networks,” IEEE Trans. Mobile Comput., vol. 14, no. 9, pp. 1861-1875, 2015.

[7] M. Hefeeda and M. Bagheri, “Wireless sensor networks for early detection of forest fires,” in Proc. IEEE Int. Conf. Mobile Ad-Hoc Sensor Syst., 2007, pp. 1–6.

[8] A. Kurs, A. Karalis, R. Moffatt, J. D. Joannopoulos, P. Fisher, and M. Solja˘ci´c, “Wireless power transfer via strongly coupled magnetic resonances,” Sci., vol. 317, no. 5834, pp. 83-86, 2007.

[9] J. Li and P. Mohapatra, “Analytical modeling and mitigation techniques for the energy hole problem in sensor networks,” Pervasive Mobile Comput., vol. 3, no. 3, pp. 233-254, 2007.

[10] W. Liang, W. Xu, X. Ren, X. Jia, and X. Lin, “Maintaining sensor networks perpetually via wireless mobile recharging vehicles,” in Proc. 39th Annu. IEEE Conf. Local Comput. Netw., 2014, pp. 270–278.

[11] W. Liang, W. Xu, X. Ren, X. Jia, and X. Lin, “Maintaining large-scale rechargeable sensor networks perpetually via multiple mobile charging vehicles,” ACM Trans. Sensor Netw., vol. 12, no. 2, article no. 14, 2016.

[12] W. Liang, Z. Xu,W. Xu, J. Shi, G. Mao, and S. K. Das, “Approximation algorithms for charging reward maximization in rechargeable sensor networks via a mobile charger,” IEEE/ACM Trans. Netw. (TON), to appear, 2017.

[13] K. Lin, J. Yu, J. Hsu, S. Zahedi, D. Lee, J. Friedman, A. Kansal, V. Raghunathan, and M. Srivastava, “Heliomote: enabling longlived sensor networks through solar energy harvesting,” in Proc. 3rd ACM Conf. Embedded Netw. Sensor Syst., 2005, pp. 309-309.

[14] X. Ren,W. Liang, andW. Xu, “Use of a mobile sink for maximizing data collection in energy harvesting sensor networks,” in Proc. IEEE 42nd Int. Conf. Parallel Process., 2013, pp. 439–448.

[15] X. Ren, W. Liang, and W. Xu, “Maximizing charging throughput in rechargeable sensor networks,” in Proc. 23rd IEEE Int. Conf. Comput. Commun. Netw., 2014, pp. 1–8.

BIOGRAPHICAL NOTES

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