ISSN: 2348-2079

International Journal of Intellectual Advancements and Research in Engineering Computations (IJIAREC)

IJIAREC |Vol.11 | Issue 4 | Oct - Dec -2023

www.ijiarec.com

DOI : https://doi.org/10.61096/ijiarec.v11.iss4.2023.1-6

Review

Effect Of Harvesting Unpredictability In Energy-Harvesting Wireless Sensor

E.Yokesh[1], S.Abirami.,M.E[2]

PG Student, Dept. of C.S.E, Sri Shanmugha College Of Engineering And Technology, [Salem], Tamilnadu, India[1]
Assistant Professor, Dept. of C.S.E, Sri Shanmugha College Of Engineering And Technology, [Salem], Tamilnadu, India[2]

*Author for Correspondence: E.Yokesh
Email: yokeshshanmuga@gmail.com

Published on: 30 Dec 2023

Published by:
DrSriram Publications

Abstract

Harvested energy in Energy Harvesting-Wireless Sensor Network is never uniform by nature that causes unpredictable energy scavenging by harvesting systems. The energy load of WSN varying in nature and depends on many factors. In order to ensure uninterrupted power supply to the sensors the crucial aspect is to adjust unpredictable energy by using multiple resources. In the proposed study, we bring forth the effect of harvesting energy unpredictability on the network load and proposed a model for minimizing the gap between energy scavenged and energy requirement of the whole architecture.

To design a robust sensor network, in this paper, we use mobility to circumvent communication bottlenecks caused by spatial energy variations. We employ a mobile collector, called SenCar to collect data from designated sensors and balance energy consumptions in the network. To show spatial-temporal energy variations, we first conduct a case study in a solar-powered network and analyze possible impact on network performance. Next, we present a two-step approach for mobile data collection. First, we adaptively select a subset of sensor locations where the SenCar stops to collect data packets in a multi-hop fashion. We develop an adaptive algorithm to search for nodes based on their energy and guarantee data collection tour length is bounded. Second, we focus on designing distributed algorithms to achieve maximum network utility by adjusting data rates, link scheduling and flow routing that adapts to the spatial-temporal environmental energy fluctuations. Finally, our numerical results indicate the distributed algorithms can converge to optimality very fast and validate its convergence in case of node failure.

Keywords: WSN- Wireless Sensor Network, spatial–temporal energy,SenCar to collect data.

INTRODUCTION

Mobile computing is the discipline for creating an information management platform, which is free from spatial and temporal constraints. The freedom from these constraints allows its users to access and process desired information from anywhere in the space. The state of the user, static or mobile, does not affect the information management capability of the mobile platform. A user can continue to access and manipulate desired data while traveling on plane, in car, on ship, etc.

Thus, the discipline creates an illusion that the desired data and sufficient processing power are available on the spot, where as in reality they may be located far away. Otherwise Mobile computing is a generic term used to refer to a variety of devices that allow people to access data and information from where ever they are.

Structure of mobile computing

Different types of devices used for the mobile computing

- Personal digital assistance / Enterprise digital assistance
- Smartphones
- Tablet computers
- Netbooks
- Ultra-mobile PCs
- Wearable computers
- Palmtops/pocket computers

Applications of Mobile Computing

Vehicles

Tomorrow's cars will comprise many wireless communication systems and mobility aware applications. Music, news, road conditions, weather reports, and other broadcast information are received via digital audio broadcasting (DAB) with 1.5 M-bits/s. For personal communication, a global system for mobile communications (GSM) phone might be available offering voice and data connectivity with 384 k-bits/s. For remote areas satellite communication can be used, while the current position of the car is determined via global positioning system (GPS). Additionally, cars driving in the same area build a local ad-hoc network for fast information exchange in emergency situations or to help each other keeping a safe distance. In case of an accident, not only will the airbag be triggered, but also an emergency call to a service provider informing ambulance and police. Cars with this technology are already available. Future cars will also inform other cars about accidents via the ad hoc network to help them slow down in time, even before a driver can recognize the accident. Buses, trucks, and train are already transmitting maintenance and logistic information to their home base, which helps o improve organization (fleet management), and thus save time and money.

Emergency

Just imagine the possibilities of an ambulance with a high quality wireless connection to a hospital. After an accident, vital information about injured persons can be sent to the hospital immediately. There, all necessary steps for this particular type of accident can be prepared or further specialists

can be consulted for an early diagnosis. Furthermore,wireless networks are the only means of communication in the case of natural disasters such as hurricanes or earthquakes.

Business

Today's typical traveling salesman needs instant access to the company's database: to ensure that the files on his or her laptop reflect the actual state, to enable the company to keep track of all activities of their traveling employees, to keep databases consistent etc., with wireless access, the laptop can be turned into a true mobile office.

Benefits of Mobile Computing

- Improve business productivity by streamlining interaction and taking advantage of immediate access
- Reduce business operations costs by increasing supply chain visibility, optimizing logistics and accelerating processes
- Strengthen customer relationships by creating more opportunities to connect, providing information at their fingertips when they need it most
- Gain competitive advantage by creating brand differentiation and expanding customer experience
- Increase work force effectiveness and capability by providing on-the-go access
- Improve business cycle processes by redesigning work flow to utilize mobile devices that interface with legacy applications

Advantages of Mobile Computing

Mobile computing has changed the complete landscape of human being life. Following are the clear advantages of Mobile Computing:

Location flexibility

This has enabled user to work from anywhere as long as there is a connection established. A user can work without being in a fixed position. Their mobility ensures that they are able to carry out numerous tasks at the same time perform their stated jobs.

Saves Time

The time consumed or wasted by travelling from different locations or to the office and back, have been slashed. One can now access all the important documents and files over a secure channel or portal and work as if they were on their computer. It has enhanced telecommuting in many companies. This also reduces unnecessary expenses that might be incurred.

Enhanced Productivity

Productive nature has been boosted by the fact that a worker can simply work efficiently and effectively from which ever location they see comfortable and suitable. Users are able to work with comfortable environments.

Ease of research

Research has been made easier, since users will go to the field and search for facts and feed them back to the system. It has also made it easier for field officer and researchers to collect and feed data from wherever they without making unnecessary trip to and from the office to the field.

Entertainment

Video and audio recordings can now be streamed on the go using mobile computing. It's easy to access a wide variety of movies, educational and informative material. With the improvement and availability of high speed data connections at considerable costs, one is able to get all the entertainment they want as they browser the internet for streamed data. One can be able to watch news, movies, and documentaries among other entertainment offers over the internet. This was not such before mobile computing dawned on the computing world.

Streamlining of Business Processes

Business processes are now easily available through secured connections. Basing on the factor of security, adequate measures have been put in place to ensure authentication and authorization of the user

accessing those services.Some business functions can be run over secure links and also the sharing of information between business partners. Also it's worth noting that lengthy travelling has been reduced, since there is the use of voice and video conferencing.Meetings, seminars and other informative services can be conducted using the video and voice conferencing. This cuts down on travel time and expenditure

Objective of the project

- With billions in downloads and annual revenue, smartphone applications offered by Apple iTunes and Android are quickly becoming the dominant computing platform for today's user applications.
- Within these markets, a new wave of geo-social applications are fully exploiting GPS location services to provide a "social" interface to the physical world.
- The explosive popularity of mobile social networks such as SCVNGR and FourSquare (3 million new users in 1 year) likely indicate that in the future, social recommendations will be our primary source of information about our surroundings Unfortunately, this new functionality comes with signifi- cantly increased risks topersonal privacy.
- Geo-social applications operate on fine-grain, time-stamped location information.

System analysis

In this phase a detailed appraisal of the existing system is explained. This appraisal includes how the system works and what it does. It also includes finding out in more detail- what are the problems with the system and what user requires from the new system or any new change in system. The output of this phase results in the detail model of the system. The model describes the system functions and data and system information flow. The phase also contains the detail set of user requirements and these requirements are used to set objectives for the new system

.

Existing system

Environmental energy harvesting has emerged as a promising technique to provide sustainable energy sources for battery-powered wireless sensor networks (WSNs), whose network longevity is constrained by battery capacity. Renewable energy sources such as solar, wind, thermal necessitates Cyber Physical Systems (a network consists of sensors and actuators to interact with the physical world) for achieving energy efficiency and cost effectiveness. For example, solar harvesting is proven to be useful to provide energy to sensors from a solar panel of relatively similar size of sensors.

Disadvantages

- The introduction of mobility not only alleviates routing burdens on the congested nodes to save energy , but also shows flexibility to circumvent congested area that lacks of energy supply.
- We can easily direct the SenCar to collect packets from designated regions to avoid draining sensor's battery where the environmental energy supply is not sufficient at that time.

Proposed system

We propose a two-step approach. In the first step, we determine where the SenCar stops to collect data packets while guaranteeing that the total migration tour length is bounded by a threshold. These node positions are called anchors. In the second step, after the anchors have been selected, we formulate the optimization problem into a network utility maximization problem under the constraints of flow, energy balance, battery and link capacity. In particular, in our formulation, energy conservation captures the time-varying and spatial variations of energy harvesting rates.

Advantage of proposed system

- First, we propose a new framework by introducing mobile data collection for energy harvesting sensor networks.
- Second, we develop an adaptive anchor selection algorithm for the SenCar to achieve a balance between data collection amount and latency. Third, given the selected anchors, we propose distributed algorithms to find optimal data rates, link flows for sensors and sojourn time allocation for the SenCar.
- Finally, we provide extensive evaluations to demonstrate that the proposed scheme can converge to optimum, react to the dynamics of energy income effectively, maintain perpetual network operation and improve network utility significantly compared to the network with a static data sink.

Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

Methodologydistributed algorithm

A distributed algorithm is an algorithm designed to run on computer hardware constructed from interconnected processors. Distributed algorithms are used in many varied application areas of distributed computing, such as telecommunications, scientific computing, distributed information processing, and real-time process control. Standard problems solved by distributed algorithms include leader election, consensus, distributed search, spanning tree generation, mutual exclusion, and resource allocation.

Adaptive algorithm

An adaptive algorithm is an algorithm that changes its behavior based on information available at the time it is run. This might be information about computational resources available, or the history of data recently received.

CONCLUSION

In this paper, we have considered the problem of finding opti-mal mobile data gathering strategies for energy harvesting sensor networks. We first examine the impact of spatial-temporally varying energy distribution on the operation of the sensor network through an experimental study based on solar harvesting. To circumvent the negative effect of limited energy harvesting capability on some sensor nodes, a mobile collector is introduced for gathering data and balancing energy distribution in the network to improve performance. We then propose an adaptive anchor selection algorithm based on sensor's energy level which achieves a desirable balance between the amount of data gathered and data gathering latency. We then formulate the problem into a convex optimization problem in which the SenCar spends variable sojourn time at each anchor and each sensor tunes the data rate, scheduling and routing based on the individual energy harvesting rate such that the overall network utility can be maximized.

REFERENCES

1. Rahimi M, Shah H, SukhatmeGS, Heideman J, Estrin D.Studying the feasibility of energy harvesting in a mobile sensor networkIEEE International Conference on Robotics and Automation;2003. doi: 10.1109/ROBOT.2003.1241567.
2. ParadisoJA, Starner T.Energy scanverging for mobile and wireless electronics.IEEE Pervasive Comput.2005;4(1):18-27. doi: 10.1109/MPRV.2005.9.
3. Jiang X, Polastre J, Culler D.Perpetual environmentally powered sensor networks.IEEE IPSN.Apr2005.
4. Raghunathan V, Kansal A, Hsu J, Friedman J, Srivastava M.Design considerations for solar energy harvesting wireless embedded systems.IEEE IPSNApr2005. doi: 10.1109/IPSN.2005.1440973.
5. Ma C, Zhang Z, Yang Y.Battery-aware scheduling in wireless mesh networks.MobNetw Appl. 2008;13(1-2):228-41. doi: 10.1007/s11036-008-0032-x.
6. Ma C, Yang Y.Battery-aware routing for streaming data transmissions in wireless sensor networks.MobNetw Appl. 2006;11(5):757-67. doi: 10.1007/s11036-006-7800-2.
7. Kansal A, Hsu J, Srivastava M, Raqhunathan V.'Harvesting aware power management for sensor networks,' 43rd ACM/IEEEDAC;2006.
8. Ma C, Yang Y.A battery-aware scheme for routing in wireless ad hoc networks.IEEE Trans VehTechnolIEEE, translator.2011;60(8):3919-32. doi: 10.1109/TVT.2011.2166093.
9. Vigorito C, Ganesan D, Barto A.Adaptove control of duty cycling in energy-harvesting wireless sensor networks.IEEE SECON.2007.
10. Gorlatova M, Wallwater A, Zussman G.Networking low-power energy harvesting devices: measurements and algorithms.IEEE PublicationsINFOCOM;2011.

11. Liu R, Sinha P, Koksal CE.Joint energy management and resource allocation in rechargeable sensor networks.IEEE PublicationsINFOCOM;2010.doi: 10.1109/INFCOM.2010.5461958.
12. Lin L, ShroffNB, Srikant R.Asymptotically optimal energy-aware routing for multihop wireless networks with renewable energy sources.IEEEACM TransNetw.2007;15(5):1021-34. doi: 10.1109/TNET.2007.896173.
13. Shah RC, Rabaey JM.Energy aware routing for low energy ad hoc sensor networks.IEEE WCNC2002.doi: 10.1109/WCNC.2002.993520.
14. Ma M, Yang Y. SenCar: an energy efficient data gathering mechanism for large scale multihop sensor networks. IEEE Trans Parallel DistribSystIEEE, translator.2007;18(10):1476-88. doi: 10.1109/TPDS.2007.1070.
15. Ma M, Yang Y, Zhao M.Tour planning for mobile data gathering mechanisms in wireless sensor networks. Vehicular Technology, IEEE Transactions OnIEEE, translator. 2013;62(4):1472-83. doi: 10.1109/TVT.2012.2229309.