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Improving Energy Efficiency of SenCar by Energy harvesting in Wireless Sensor Networks : A Survey

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ABSTRACT

Wireless Sensor Networks (WSN), an element of pervasive computing, are presently being used on a large scale to monitor real-time environmental status. Recently in Wireless sensor networks the new technology implemented is energy harvesting to improve the energy of mobile collector called SenCar. It is used to collect data from designated sensors and balance energy consumption in the network. The optimized algorithm is used to improve the data collection tour length and to achieve maximum network utility by adjusting data rates, link scheduling and flow routing. In this paper we study the various approaches used for energy harvesting of mobile collector and proposed to use multiple mobile collectors by partitioning the network into different regions such that each mobile collector only deals with a portion of the network. Selection of anchors to minimize the hop count and to improve the hot spot of each node in the network is also considered. Finally, we compare the underlying approaches and solutions.

Keywords: Sencar, Energy harvesting, WSN, Energy efficiency.

I. INTRODUCTION

In recent years Wireless sensor networks(WSN) have become an established technology for large number of application like military reconnaissance, home automation, environmental monitoring, etc. Owing to the recent advances made in wireless technology and low power electronics, wireless sensors have a provision for self –powered devices. The devices are generally powered by a battery offering finite power supply. But batteries increase the size, and sometimes the cost of the devices in question and pose an additional burden of replacement or recharging. Thus there is an increasing effort to develop new sources of long-lasting and regenerative power to meet the energy needs of these wireless systems. The solution is to use energy harvesting technology to transform ambient energy from the surroundings into power to revive the batteries. However, due to temporal and spatial variations (e.g. zero energy output at nights in the case of solar technology), the energy output is virtually insufficient[13]. Therefore, energy management schemes are designed to provide efficient usage of the harvested energy. Examples of potential energy harvesting sources include electromagnetic energy in the form of solar, infrared or RF, mechanical energy in the form vibration, stress and strain, thermal energy from furnaces, combustion engines and other heat sources, etc. Energy from these sources can be captured using different sensors and converted to usable energy i.e. electrical voltages and currents. This can further be harvested, stored and processed as per the requirements of the low power wearable electronics and WSN (wireless sensor network) applications.

In order to route packets in an energy efficient manner, data gathering mechanism with mobile data observer,called SenCar,is used. SenCar starts the data gathering tour periodically from the static data processing center, traverses the entire sensor network, gathers the data from sensors while moving, returns to the starting point, and finally uploads data to the data processing center[13]. Data gathering network utility is maximized and packet latency is bounded by implementing anchor selection algorithm and sojourn

time allocation for the SenCar to achieve balance between data collection amount and latency.

The main contributions of this review paper can be condensed as follows:

1. Identification of main issues and challenges in WSNs.
2. Classification of energy management schemes based on applications.

This paper is structured as follows. Section 2 briefly deliberates the issues and challenges in WSNs, Section 3, explores the related works and section 4 provides a conclusion.

II. ISSUES AND CHALLENGES IN WSN

In WSN Energy conservation is as one the important critical aspect.Other related main issues include operating system, synchronization, QoS, security, architecture and data collection aspects with minimum communication and computation costs[2].

(i) Energy

Mobile Sensors require power for various operations. Energy consumption in data collection, data processing, and data communication demands a large amount of energy by node components. Batteries providing power need to be changed or recharged after energy consumption. It becomes tough to recharge or change the batteries because of demographic conditions. The most research challenge for the WSN researchers is to design, develop and implement energy efficient hardware and software protocols for WSNs.[2]

(ii)Quality of Service (QoS)

Sensor networks are provided with the required amount of bandwidth to achieve a minimal required QoS. Traffic is unbalanced in sensor network is due to data aggregation from many nodes to a sink node. QoS mechanisms must be designed for an unbalanced QOS traffic.

(iii)Security

Security is a challenging issue in WSN. In sensor networks information are travelled confidentially between the sensor nodes of the network or between the sensors and the base station; otherwise it result in eavesdropping. Secondly Integrity of data need to be maintained. spoofing and altering the routing information are the types of threats in sensor networks .[2]

(iV) Hot Spot Problem

The hot spot problem in wireless sensor networks is due to the sensor nodes around the base station need to forward more packets to the base station than other nodes. Therefore, these nodes potentially run out of energy resulting a critical area. A simple solution to this problem is to add supplementary nodes in the hot spot area since sensor nodes become inexpensive.

(V) Sojourn Time

Network lifetime maximization problem under multiple mobile sink environments. Maximizing the network lifetime equals maximizing the sum of sojourn times of the sink at the visited locations.

III. RELATED WORKS

Researcher	Year	Methods proposed
Ji Li, Miao Zhao and Yuanyuan Yang Ref[1]	2012	A novel wireless energy replenishment and mobile data gathering architecture (OWER-MDG) optimal wireless energy replenishment and mobile data gathering mechanism, collects data from the network using a mobile vehicle (SenCar) and charges sensor nodes effectively for each migration tour, allocate data rates according to the energy status of the nodes for network performance improvement. Heuristic algorithm was proposed in which mobile collectors move along parallel straight lines and gather data from nearby sensors with multihop transmissions. OWER-MDG is effective in guaranteeing network lifetime and network utility.
Thu Ngo-Quynh1, Kieu-Ha Phung2, Công Nguyen-Huy3 Ref[3]	2013	cluster-based and event-driven routing algorithm (called Reliable and Energy-efficient Cluster based and Event-driven Routing algorithm-RECER). The operation of our algorithm is divided into events like

		forming cluster stage and data transmission. Routing protocol RECER improve the energy consumption, load balance, network lifetime and rate delivery of EMRP. In future study adaptive source coding at two clusters is concentrated to improve the energy efficiency characteristics of RECER.
Fifa farouk,Rawya Rizk,Fawz.W.Zaki Ref[4]	2014	Stable Energy Efficient clustering(SEEC) protocol for heterogeneous WSNs. Here network is divided into small clusters with Advanced node(AN) and Normal Nodes(NN) and Sensing Nodes(SN) deployed randomly in cluster to predict the sensing area. Optimum number of powerful nodes that achieves the minimum energy consumption is obtained with high throughput and less overhead . Security in WSN may be considered as future work.
Trong Nhan Le, Alain Pegatoquet, Olivier Berder and Olivier Sentieys Ref[5]	2015	Wake-up Variation Reduction Power Manager (WVR-PM). Power Manager is applied for wireless nodes powered by a periodic energy source. An energy-efficient protocol, named Synchronized Wake-up Interval MAC (SyWiM) designed for autonomous wireless nodes in multi-hop networks powered by indoor light energy. The improvement of WVR-PM is the average number of wake-up variations is significantly reduced that enhance the global QoS in a multi-hop mesh network.
Yuan Zhou,Ning Wang, and Wei Xiang, Ref[8]	2016	Improved Particle Swarm Optimization algorithm and LEACH-centralized (LEACH-C) protocol to create the cluster structure to minimize the transmission distance and to optimize the energy consumption of the network. An effective topology control approach is used to prolong the network lifetime with minimum transmission distance and optimum energy consumption.
Adnan M. Abu-Mahfouz and Gerhard P. Hancke Ref[6]	2016	A localization algorithm called ALWadHA (An efficient Localisation algorithm for Wireless ad hoc sensor networks with High Accuracy) uses techniques like response mechanism, smart reference-selection and termination criteria to enhance the energy efficiency. Three techniques - single-estimation approach, dynamic Power Control, Incremental and Exponential requesting rate to improve the energy efficiency of the ALWadHA algorithm. ALWadHA consume less energy than other successive-refinement localisation algorithms. Drawbacks: position estimation accuracy is not compromised, dynamic power control and incremental and exponential requesting rate model does not provide accurate results.
Kenneth Li-MinnAng,Jasmine Kah PhooiSeng,andAdamu MurtalaZungeru, Ref[7]	2016	Two common models data mule (MULE), and sensor network with mobile access point (SENMA) for data collection using MDCs . The MULE and SENMA approaches of multihop and single-hop for mobile data collection over spatially separated geographical regions with lower node energy consumption. Drawbacks:MULE model not give best solution for increasing the number of clusters due to the "DREQ flooding problem." SENMA model , the sensor nodes would need to spend a substantial amount of node energy to transmit to the mobile AP when the number of clusters is fewer. partitioning of the network into multiple groups and clusters prior to data collection is not considered.

Ahmad H. Dehwaha, Shahrazed Elmetennania,Christian Claudel Ref[9]	2017	Dynamic version of the weather conditioned moving average technique (UD-WCMA) to estimate and predict the variations of the solar power in a wireless sensor network with adaptive weighting factors named Universal Dynamic-WCMA (UD-WCMA), in which the value of (α) is adjusted dynamically to give the best prediction performance with respect to the mean value of the stored data. The consistently excellent prediction performance of UD-WCMA and the lack of tuning parameter make the algorithm very suitable for distributed energy harvesting applications such as WSNs. Accurate solar radiant energy need to be considered for optimum results.
Hialong Huang, Andrey V. Savkin Ref[10]	2017	Energy aware clustering and routing algorithm constructs clusters based on local node density and hop distance to MS's trajectory . Selection of CHs and designing cover ranges for CHs with nonuniform node distribution feature .Two stages initial making awareness and collecting consists of data collection cycles. Future work more mobile sinks to increase the performance.
Aasem Ahmad and Zdenˇek Hanz´alek Ref[11]	2017	The algorithm Time Division Cluster Scheduling algorithm with a Period Crossing Constraint (TDCS-PCC) heuristic scheduling algorithm is based on interesting formulations of graph theory problem. Collision-free Cluster schedule a novel heuristic scheduling algorithm is implemented with zigbeeTree adjacency matrix of the cluster-tree topology to meet all the data flows deadlines in desired schedule. Increasing the number of retransmissions increases both the reliability of the data transmission and the energy consumption of the nodes. red.

Conclusive remarks about the overall energy management schemes.

Energy consumption of SenCar, the mobile collector to accomplish functions such as collecting data from anchor node and transmitting the data to the destination(mobile sink), Good Quality of Service for Real-time and critical applications ,Suitable anchor selection algorithm for SenCar to achieve a balance between data collection amount and latency, Elimination of the hotspot problem to minimize the data reporting delays of the mobile sink , Usage of Multiple SenCars and mobile simks to ensure scalable data collection for large size networks and security measures are not clearly summarized.

IV. CONCLUSION AND FUTURE WORK

By analyzing the above energy efficient protocol techniques used in WSN, we reviewed that most of the works concentrated on the energy efficient clustering protocols. We examined the recent types of homogeneous, heterogeneous clustering protocols. Survey results that, Firstly collision free cluster scheduling with smart reference selection improve the energy consumption of the nodes, The improvement of power manager reduces the average number of wake-up variations to enhance the global QoS in a multi-hop mesh network. Secondly, Centralized optimization algorithm prolong network lifetime with minimum transmission distance to improve energy efficiency. As future enchancement multiple sencars and multiple sinks are eeded to ensure scalable data collection for large size networks by eliminating hotspot problem and including security measures in WSN.

V. REFERENCES

[1]. Ji Li, Miao Zhao and Yuanyuan Yang,"OWER-MDG: A Novel Energy Replenishment and Data Gathering Mechanism in Wireless RechargeableSensor Networks" IEEE wireless networking, 2012,pp-5350-5355

[2]. Sukhwinder Sharma, Fatehgarh Sahib, Rakesh Kumar Bansal "Issues and Challenges in Wireless Sensor Networks" Int. Conf. on Machine Intelligence Research and Advancement Dec 2013,pp

[3]. Thu Ngo-Quynh1, Kieu-Ha Phung2, Công Nguyen-Huy3,"Reliable and Energy Efficient Cluster-based and Event-driven Routing Scheme for Wireless

Sensor Networks" ,Int.conf onLocal & Metropolitan Area Networks (LANMAN) 2013 ,pp

[4]. Fifa farouk,Rawya Rizk,Fawz.W.Zaki "Multi-level stable and energy efficient clustering protocol in heterogenous wireless sensor networks"IET wireless sensor network, May 2014,pp159-169

[5]. Trong Nhan Le, Alain Pegatoquet, Olivier Berder and Olivier Sentieys,"Energy-Efficient Power Manager and MAC Protocol for Multi-Hop Wireless Sensor Networks Powered by Periodic Energy Harvesting" , IEEE Sensors Journal 2015,pp

[6]. Adnan M. Abu-Mahfouz and Gerhard P. Hancke "ALWadHA Localisation Algorithm: Yet More Energy Efficient" IEEE pub 2016.

[7]. Kenneth Li-MinnAng ,Jasmine Kah PhooiSeng andAdamu MurtalaZungeru," Optimizing Energy Consumption for Big Data Collection in Large-Scale Wireless Sensor Networks With Mobile Collectors Networks With Mobile Collectors", IEEE Systems Journal, 2016.

[8]. Yuan Zhou, Ning Wang, and Wei Xiang," Clustering Hierarchy Protocol in Wireless Sensor Networks Using an Improved PSO Algorithm", IEEE journals, 2016,pp

[9]. Ahmad H. Dehwaha,⁎, Shahrazed Elmetennania, Christian Claudelb "UD-WCMA: An energy estimation and forecast scheme for solar powered wireless sensor networks" Journal of Network and Computer Applications 90 (2017),pp17-25

[10]. Hialong Huang, Andrey V. Savkin "Energy Efficient Approach for data collection in wireless sensor networks using public transportationvehicle",Int.J.Electron.Commun.(AEU) 75 2017,pp108-118

[11]. Constraint Aasem Ahmad and Zden˘ek Hanz´alek ,"An Energy Efficient Schedule for IEEE 802.15.4/ ZigBee Cluster Tree WSN with Multiple Collision Domains and Period Crossing" IEEE Transactions on Industrial Informatics, 2017.

[12]. Yuan Zhou, Ning Wang, and Wei Xiang," Clustering Hierarchy Protocol in Wireless Sensor Networks Using an Improved PSO Algorithm", IEEE journals, 2016.

[13]. Cong Wang,Songtao, and Yaunyuan yang,"An optimization framework for Mobile Data Collection in Energy-Harvesting Wireless Sensor Networks,IEEE Transaction on Mobile computing,2016,pp2969-2985.