Review Paper on Wireless Powered Communication Networks: Peer Harvesting

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ABSTRACT

In present technology each person desires wireless system, however nonetheless energy transmission for low power device we are the usage of wired system non-stop power supply is one of the foremost issues which is overcome by wireless sensor network. But in the power system of wireless Sensor Network (WSN), the battery has a very confined lifetime and is no longer replaced but by using any different non-stop power system. That is why power harvesting for WSN in alternative of battery is the solely and special answer , we current the idea of transmitting power without the use of wires i.e. transmitting microwaves from source to destination is in order to decrease the cost, extend efficiency, and distribution losses. Typical WPT is a point to- point energy transmission. In wireless communication only tiny quantities of energy received at receiver. By contrast, in wireless power, the quantity of strength received is the vital thing, so the effectively is the extra enormous parameter. We had better concentrate power to receiver in WPT. It was once proved that the energy transmission effectively can high enough that the data can be acquired intelligibly.

In this paper, we look into simultaneous wireless information and power transfer (SWIPT) systems for multiuser multiple-input single-output impenetrable broadcasting channels. Considering imperfect channel state information, we introduce a strong invulnerable beam forming design, we place the transmit energy is minimized subject to the secrecy rate outage chance constraint for legitimate users and the harvested energy outage probability constraint for power harvesting receivers. The actual hassle is non-convex due to the presence of the probabilistic constraints. With the resource of Bernstein-type inequalities, we rework the outage constraints into the deterministic forms. Based on a successive convex approximation (SCA) method, we endorse a low-complexity method which reformulates the authentic trouble as a second order cone programming problem. Also, we show the convergence of the SCA-based iterative algorithm. Simulation indicates that the proposed scheme outperforms the traditional technique with lower complexity.

Keyword: - *WSN, SWIPT, SCA, WPT, Heuristic Algorithms, EH.*

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1. INTRODUCTION:

Wireless Power Transfer (WPT) makes it possible to furnish energy via an air gap, barring the prefer for current-carrying wires. WPT can grant energy from an AC provide to well suitable batteries or gadgets barring physical connectors or wires. WPT can recharge cellular phones and tablets, drones, cars, even transportation equipment. It may also additionally even be possible to wirelessly transmit strength gathered with the aid of solar-panel arrays in space. Researchers have developed various methods for transferring electrical energy over lengthy distance besides wires. Some exist only as theories or prototypes but others are already in use. Simultaneous wireless information and power transfer (SWIPT) is a promising energy harvesting (EH) technique to resolve energy shortage trouble in energy-constrained wireless networks. This paper presents the techniques used for wireless power transmission. It is an oftentimes going on time period that refers to a vast variety of unique strength transmission applied sciences that use time a number electromagnetic fields.

Energy harvesting from the surrounding environment has become a prominent way to prolong the lifetime of energy-constrained wireless networks, such as sensor networks. Compared with conventional energy supplies such as batteries that have fixed operation time, energy harvested from the environment potentially provides an unlimited energy supply for wireless networks, because renewable energy sources such as solar and wind, background radiofrequency (RF) signals radiated by ambient transmitters can be utilized for wireless power transfer. RF signals have been widely used for wireless information transmission and it can also be used for power transmission at the same time which potentially offers great convenience to mobile users. For an energy-constrained wireless network, energy harvesting (EH) is a promising technology to prolong the network life. Whether traditional near-field wireless power transfer (WPT) using inductive and resonant coupling or far-field WPT via radiated electromagnetic waves.

A wireless powered communication (WPC) network consisting of one hybrid access point (H-AP) and K wireless nodes. The H-AP broadcasts wireless energy to nodes in the downlink and receives information from K nodes abided by TDMA protocol in the uplink. The wireless nodes have energy harvesting capabilities and can harvest energy from H-AP and other nodes in different assigned time slots.

Two new schemes for the WPC network that perform energy harvesting among peer nodes. In the first scheme, each wireless node harvests energy from peer nodes transmitting in the previous time slots, while each wireless node harvests energy from all nodes in the second scheme. The maximization of the sum achievable throughput and the minimization of the required harvested energy are studied. An effective heuristic optimization algorithm is proposed to solve them. The proposal of two new peer harvesting schemes, the formulation of two relevant optimizations and their solutions using heuristic optimization algorithm, which has better technical adaptability for solving complicated objective functions.

2. LITERATURE REVIEW:

Wireless energy harvesting (WEH) is becoming one of the key methods in energy harvesting in wireless networks. Nan Zhao, F. Richard Yu, and Victor C.M. Leung [6]. Provide an overview of Wireless energy harvesting (WEH) in interference alignment (IA) networks, and current a unified framework to together learn about WEH and IA. To concurrently optimize both information transmission (IT) and (WEH) performance in IA networks, he recommend a power splitting optimization (PSO) algorithm. In addition, he find out about the power allocation hassle in the proposed PSO algorithm. Simulation outcomes are introduced to evaluate the overall performance of the proposed schemes for WEH in IA networks. Some interesting research challenges are also introduced for the WEH in IA networks.

Caijun Zhong, Gan Zheng, Zhaoyang Zhang, and George K. Karagiannidis [12]. Have optimized the throughput of a relay-assisted wirelessly powered communication system, where a power restrained source, assisted with the aid of an energy restricted relay and both powered by way of a devoted power beacon (PB), communicates with a destination. Considering the time splitting approach, the source and relay first harvest energy from the PB, which is geared up with a couple of antennas, after which transmits the information to destination. Simple closed-form expressions are derived for the most effective PB energy beam forming vector and time break up for energy harvesting and data transmission. Numerical consequences and simulations show the most suitable overall performance in contrast with some intuitive benchmark beam forming scheme .Also, it is observed that setting the relay at the core of the source-destination route is no longer optimal.

Gaojie Chen, Pei Xiao, James R. Kelly, Bing Li, and Rahim Tafazolli [16]. They consider a wireless powered communication (WPC) network consisting of one hybrid access point (H-AP) and K wireless nodes .The H-AP proclaims wireless energy to nodes in the downlink and receives in formation from K nodes abided via TDMA protocol in the uplink. The wireless nodes have energy harvesting abilities and can harvest energy from H-AP and different nodes in distinct assigned time slots. He advocate two power harvesting schemes to optimize sum practicable throughput and required harvested energy. Both of them are numerical optimization solutions based on heuristic algorithms. To obtain the maximum sum possible throughput, CEH is better than SEH, but CEH is greater computationally complicated. Also, to acquire minimal required harvested energy, SEH and CEH have comparable performances .Simulation outcomes have shown the considerable overall performance acquire of the new schemes. For WPC system, there are still many challenges to be tackled. For example, energy control may also be used to enhance its performance further, the tradeoff between most desirable transmission order and implementation complexity must be investigated, though they are tricky coupling problems, and how can user-centric equity be assured is additionally an important goal for future works. Simulation consequences display the effectiveness of the proposed schemes in WPC networks.

Gaojie Chen, Pei Xiao, James R. Kelly, Bing Li, and Rahim Tafazolli [10]. They investigated the throughput performance of a full duplex wireless-power communication networks with time switching (TS) and static energy splitting (SPS). The time division duplexing (TDD) and full duplex static power splitting (SPS) protocols had been proposed to similarly make use of the self-interference (SI) energy, leading to significantly extended battery life and expanded the throughput overall performance and decreased device complexity. An easy relay selection scheme has been used to enhance the joint outage probability. The closed-form outage probability and throughput for distinct protocols have been analyzed and derived below the lengthen limited transmission framework. The proposed time division duplexing static power splitting (TDDSPS) schemes have been proven to yield higher throughput performance than the TS and SPS schemes in the instances of high residual SI and low SNRs. For the low residual SI and excessive SNRs, the full duplex SPS achieves the perfect throughput. The introduced theoretical framework offers deep insights and beneficial guidance for the layout and improvement of full-duplex wireless powered relay systems. In his future work, they will think about multi-antenna scheme and the unique kinds of channel fading, i.e., Rician and Nakagami-m fading.

Gaofei Huang, and Dong Tang [7]. Proposed simultaneous power and data switch in two-way amplify-and-forward orthogonal-frequency division-multiplexing (OFDM) relay networks, the place an energy limited relay node geared up EH devices harvests energy from two terminals and makes use of the power to ahead data in a time-switching (TS) manner. By at the same time designing TS ratios of EH and data processing at the relay as nicely as power allocation over all subcarriers at two terminals and relay, their goal is to maximize end-to-end achievable rate of two-way relay networks problem to transmit energy constraint at two terminals and EH constraint at relay. The formulated problem is difficult to handle due to the fact the EH constraint is non-convex and the objective rate characteristic has a distinctly non-convex structure. Also endorse to resolve this non-convex problem through reworking it into a non-linear fractional trouble which can be solved through successive convex approximation and Dinkelbach's procedure, and as a result suggest an efficient iterative algorithm which achieves best performance with quick convergence speed.

Hang Li, Chuan Huang, and Shuguang Cui [3]. The multiuser gain was investigated for EH based totally communication system. Multiuser achieve with the emphasis on energy range is studied for multiuser energy harvesting communications, the place the scaling law of the anticipated throughput over the number of customers is investigated. The centralized access schemes are shown to have a scaling law of log (μN) for the common throughput, and the disbursed one has the same scaling law with a regular loss factor e^{-1}. Besides the amplify of complete power arrivals, the multiuser gain additionally advantages from the energy variety in time and space, which improves the positive transmission power. Analytical and numerical effects disclose that compared to the point-to-point energy harvesting communication system, the multiuser throughput reap comes from two aspects: the power reap due to the enlarge of whole energy arrivals; the variety gain due to the expand of power arrival dynamics. The get right of entry to schemes capture the "energy accumulating" function in EH communications, and the corresponding throughput scaling sets the recommendations for the future transmission format of EH wireless systems.

H. Ju and R. Zhang [5]. Studied a new type of wireless RF (radio frequency) powered communication network with a harvest then- transmit protocol, the place the H-AP first broadcasts wireless power to allotted customers in the downlink and then the user transmit their independent data to the H-AP in the uplink by using TDMA. Their outcomes divulge an interesting new phenomenon in such hybrid energy-information transmission networks, so-called doubly near-far problem, which is due to the folded signal attenuation in both the downlink WET and uplink WIT. As a result, fantastically unfair time and throughput allocation amongst the user takes place when the traditional metric of network sum-throughput is maximized. To overcome this problem, they recommend a new common-throughput maximization method to allocate equal rates to all users regardless of their distances from the H-AP via allocating the transmission time to customers inversely proportional to their distances to the H-AP. Simulation consequences showed that this strategy is positive in solving the doubly near-far hassle in the WPCN, however at a value of sum-throughput degradation.

Xiaojing Chen, Wei Ni, Xin Wang, and Yichuang Sun [2]. Proposed the new DST algorithm to generate the most appropriate off-line transmit schedule for delay-limited traffic underneath non-negligible circuit power. Only consisting of a set of string tautening guidelines that they derived from the optimality stipulations of the authentic problem, the proposed algorithm has a low complexity (i.e., O (N2) in the worst case). Also prolonged the algorithm to generate power efficient transmit schedules on-the-fly. Simulation indicates that algorithm reduces the average complexity by way of nearly two orders of magnitude, compared to typical convex solvers. The positive transmit area can also be appreciably enlarged by way of his algorithm. Significantly greater records or less power can be supported in the proposed algorithm. Building on work, promising future instructions consist of modeling more sensible battery unit with finite potential and power leakage, accounting for charging/discharging loss, and creating low-complexity on line schemes with analytical overall performance guarantees.

Jian Yang, Qinghai Yang, Kyung Sup Kwak and Ramesh R. Rao [4]. Proposed the inherent power-delay tradeoff for the newly rising WPCN used to be investigated. In order to expose the power-delay tradeoff, they formulated a stochastic optimization hassle issue to the information queue stability and harvested power availability constraints. Also solved the stochastic optimization Problem with the aid of Lyapunov optimization concept and preferred convex optimization techniques. Correspondingly, they proposed an on line energy and time allocation algorithm, which is adaptive to each the CSI and the DQSI, and does not require any a prior information of channel state and data arrival distributions. Most importantly, the inherent power-delay tradeoff is quantitatively characterized by means of [O (1=V); O (V)], and gives a large insight to manipulate the power-delay overall performance on demand in machine format for the newly rising WPCNs. In general, WPCNs is a type of energy harvesting networks, whilst the energy harvesting efficiency is very low due to the deep fading wireless channels. Hence, conventional power harvesting methods, which harvest power from surrounding environments (solar, wind and thermoelectric energy, etc.) can be mixed with WET to construct a green and self-sustainable WPCN, which looks to be lots extra desirable as it requires much less power to be drawn from constant energy sources by means of the PS. As a result, in the future work, it will prolong proposed analytical framework to this green WPCN.

Slavche Pejoski, Zoran Hadzi-Velkov, Trung Q. Duong, and Caijun Zhong [8]. suggest two realistic protocols that optimize the overall performance of the harvest-then transmit wireless powered communication networks (WPCNs) beneath two distinctive objectives: one proportional fair (PF) resource allocation, and second sum rate maximization These targets lead to most useful allocations for the transmit energy by means of the base station (BS), which broadcasts RF radiation over the downlink, and most fulfilling periods of the EH phase and the uplink data transmission phases inside the dynamic time-division a couple of access (TDMA) frame. Compared to the max-sum-rate protocol, the PF protocol attains a greater stage of system equity at the fee of the sum rate degradation. The PF protocol is effective over the max-sum-rate protocol in terms of system equity regardless of the circuit power consumption, whereas the uplink sum charges of each protocols converge while this power intake will increase.

Caijun Zhong, Xiaoming Chen, Zhaoyang Zhang and George K. Karagiannidis [9]. Detailed investigation on the average throughput of point-to-point wireless powered communication systems used to be presented. Which has purposes in future medical, sensor, and underwater communications systems. For each prolong illiberal and prolong tolerant transmission modes, analytical expressions for the average throughput had been derived, which provided environment friendly ability for the comparison of the average throughput. In addition, the ideal time split maximizing the common throughput used to be examined, and closed-form approximations have been obtained, which have been proven to be very accurate. Since the most desirable time split does now not depend on the immediate channel state information, it is a low complexity solution to enhance the system throughput. Finally, the effect of co-channel interference on the average throughput was studied, and the findings recommend that whether or not the co-channel interference will exert an advantageous or negative impact on the common throughput depends on the propagation environment and device setup, i.e., the direction loss exponent, transmit power, network topology, and interference power. Wireless powered communications is a newly emerged area, and there are still many theoretical and realistic challenges to be tackled. For instance, the minimum required power to prompt the circuit is a vital constraint to be taken into consideration; the situation the place power storage is available at the cellular is especially relevant; the multiuser scenario, which can better make the most the available wireless power.

Yang Huang, and Bruno Clerckx [13]. have proposed the energy-flow-assisted (EFA) relaying protocol for the MIMO self-reliant relay network, the place the wireless-power relay node can relay the more than one source records streams and harvest the energy for forwarding with the aid of processing the superposition of the energy flow (EF) from the destination and the source information signal. It is proven that opposite to the non-energy-flow-assisted (NEFA) relaying, the EF can significantly enhance the rate of the EFA schemes, when the relay is close to the destination. It is also published that the extra antennas at the relay can expand the dimension of the signal space at the data detecting receiver of the relay. By making use of the extra dimension, the data signal can be much less interfered with the EF leakage, used to amplify and in advance the preferred data signal. The advantages for future studies, e.g. sensible impairments and sturdy format for imperfect CSIT.

3. EXISTING SYSTEM:

The peer harvesting have brought by our new idea, although it is straightforward that harvesting energy from other devices besides the HAP will improve the performance. However, the implementation and the analysis of such system are more challenging due to the coupling among all nodes to optimize the time of EH and transmission.

Two optimization problems need to be formulated for practical designs. Since the optimization is more complicated than the existing works without peer harvesting and the objective functions of proposed schemes are difficult, we have to use feasible and low complexity method to achieve the optimization process.

In this work, we deserves a WPC network consisting of one H-AP and K wireless nodes the place EH amongst nodes is also performed. Effective peer harvesting techniques are used to enhance the gain of WPC system. This paper affords two new schemes for WPC system are serial energy harvesting (SEH) & circular energy harvesting (CEH). In SHE, the k th node harvests energy serially from the H-AP and previous k-1 transmitting nodes and goes to sleep after data transmission. In CEH scheme, the k th node not only harvests energy from the previous k -1 transmitting nodes, but also from the following K-k nodes, every node can harvest power from the H-AP and other nodes when it does not transmit information. Although CEH can usually obtain higher performance, it is greater difficult than SHE and requires the energy harvester to be turned on all the time without sleeping. They are suitable to different scenarios, which is the network has average energy gain by SEH with fewer computational complexity. Otherwise, the network can offer better possible throughput performance, when it adopts CEH scheme. Therefore, the proposed schemes can provide different tradeoffs between performance and complexity, and can be applied to different scenarios. SEH is suitable for a network with cellular nodes and unbalanced topology structure, where some nodes are a bit far away from the H-AP but nearer to the pervious nodes. SEH is additionally suitable for applications with simple power storage and management. CEH is appropriate for a network with constant and clustered nodes, the place all nodes are close to every other. CEH is additionally suitable for applications the place energy storage and management are not restrained by complexity.

This paper proposes a heuristic recursive optimization algorithm using particle swarm optimization (PSO) to search most desirable options of two optimizations primarily based on different working modes. The proposed recursive optimization method can effectively resolve the optimization problems, regardless of the complexity of goal functions. Put another way, it has better adaptability technically to solve some objective functions that are complex multidimensional problems. As a result, it doesn't need too many extra works to simplify the objective function to fit the needs of solving process. Otherwise, it will occupy extra time on expression derivation instead of optimization. Relatively speaking, the proposed methods can provide a greater simple way if any one just wants to fulfill an engineering requirement.

4. PROPOSED WORK:

Consider a wireless powered communication network with one H-AP (node 0) and K wireless nodes (nodes 1… K). Assume that all nodes are outfitted with a single antenna. In addition, anticipate that the H-AP has a constant energy and that the K nodes do not have any embedded energy supply. In the first time slot, the H-AP transfers the preliminary energy to all the wireless nodes in the down link for t_0T seconds, the place T is the total duration of communication and $0 < t_0 < 1$. In the second time slot, node 1 transmits data to the H-AP for t_1T seconds, observed by using node 2 for t_2T seconds, until node K for t_K T seconds. One has $t_0 + t_1 + \ldots\ldots + t_K = 1$. WPC system model is shown in Fig.1, and adopts two working schemes. In the SEH scheme, the k th node only harvests energy serially from the previous k- 1 nodes when they transmit data to the H-AP. In the CEH scheme, the k th node not only harvests energy from the previous (k -1) nodes, however additionally from the (k +1) th to the Kth nodes.

Assume that the H-AP assigns the random transmission order and initial time slots through the control channel, and the WPC system abides through the TDMA protocol. This means that the nodes can transmit signals within the assigned time slot and then harvest energy or fall asleep in their idle time slots. Because each time slot simply exists one user node to transmit data, other nodes can estimate their CSI between themselves and working node, respectively. Finally, H-AP achieves optimization and schedule based on nodes' remarks information.

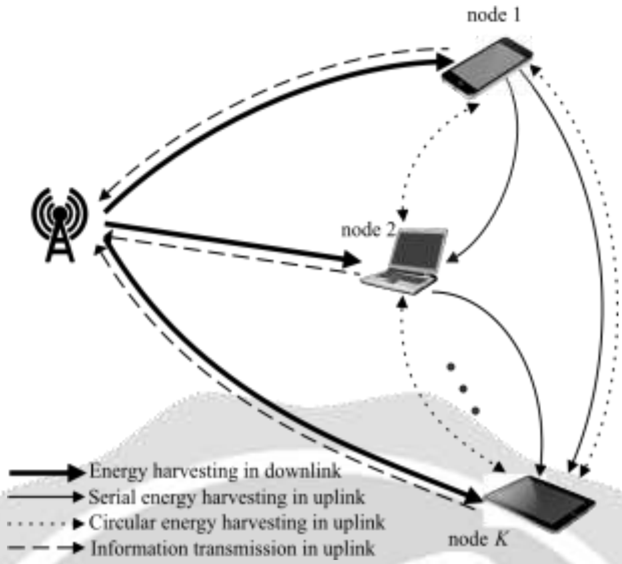

FIGURE 1. WPC network model

5. CONCLUSIONS:

This paper inspect two kinds of energy harvesting schemes to optimize sum practicable throughput and required harvested energy. Both of them are presented numerical optimization solutions based on heuristic algorithms. To gain the maximum sum possible throughput, CEH is better than SEH, but CEH is greater computationally complicated. Also, to obtain minimum required harvested energy, SEH and CEH have similar performances. Simulation results have proven the considerable performance achieve of the new schemes. For WPC system, there are still many challenges to be tackled. For example, power control may be used to improve its performance further, the tradeoff between finest transmission order and implementation complexity should to be investigated, although they are difficult coupling problems, and how user centric equity be assured can is additionally an important target for future works.

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