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An Extensive Study on the Diverse Techniques on Mobile Charging in the Wireless Rechargeable Networks

Mr. N. Karthik[1], Mrs. S. Kawsalya[2]
Research Scholar[1], Associate Professor[2], Dept. of Computer Science, Kovai Kalaimagal College of Arts & Science, Coimbatore[1]

Abstract: Wireless rechargeable sensor networks (WRSNs) have emerged as a Conventional Solution in order to resolve the issue such as network size and operation time caused by traditional battery-powered sensor networks. In this paper, an extensive study is carried in the diverse technique applied to the node charging in the wireless rechargeable Sensor Network. Also this paper presents the overview of the wireless energy transfer techniques which opened up as new dimension to resolve the network lifetime problem. Based on this major design constrainst on the energy in the sensor network has been formulated with optimal solution. The optimal solution is achieved in terms of maximizing the charging utility of sensor through velocity control in the energy transfer. In spite of measuring the performance ratio of the solution, its time complexity, charging ratio was examined in each technique of wireless energy transfer to model a novel solution against the spatial and temporal constrainst. Furthermore, sensor replenishment scheduling has to be automated based on energy and navigation of the mobile chargers. Finally extensive study was also carried on the experimental results of the traditional algorithms in order to analyse their performance against the network utility rate.
Keywords: Wireless Rechargeable Sensor Network, Network Utility Maximization, Mobile Charging, Wireless Energy Transfer, Energy Harvesting, Sensor Replenishment

I. INTRODUCTION

Wireless Sensor Network with limited energy is major design constrainst against the long distance data communication [1]. Wireless energy transfer technology is exploited in the wireless rechargeable sensor network (WRSNs), enabling the transmission of electrical energy from a charger to sensor nodes, paves a new way of replenishing the energy or extending the lifetime of sensor nodes [2]. In most mobile charging scenarios, the movement of the charger is time- and space-constrained. Moreover, the mobile charger can be combined with the mobile base station to help alleviate network congestion and avoid energy hot spots during data collection. The mobile charging creates several challenges in energy provision in WRSNs has fundamental challenge in order to achieve charging control against the speed of the mobile charger. In the case of unidirectional wireless charging, the amount of energy charged in nodes is described in terms of the distance between sensor nodes and the charger and the duration of charging each node. Specifically, the charging power at nodes decreases as the distance to the charger increases. It is thus desirable to charge nodes as long as possible and at minimum distances from the charger. However, due to location diversity, the charged energy at different nodes cannot be maximized simultaneously.

The velocity of the charger plays an important role in energy provision in WRSNs Due to the non-uniform distribution of sensor nodes; it is non-trivial to continuously determine if the charger should move faster or slower along the path, in order to maximize the charged energy at nodes. In this paper, an extensive study is carried in the diverse technique applied to the node charging in the wireless rechargeable Sensor Network. Also this paper presents the overview of the wireless energy transfer techniques which opened up as new dimension to resolve the network lifetime problem. Based on this major design constrainst on the energy in the sensor network has been formulated with optimal solution.

The optimal solution is achieved in terms of maximizing the charging utility of sensor through velocity control in the energy transfer. In spite of measuring the performance ratio of the solution, its time complexity, charging ratio was examined in each technique of wireless energy transfer to model a novel solution against the spatial and temporal constrainst. Furthermore, sensor replenishment scheduling has to be automated based on energy and navigation of the mobile chargers. The rest of the section is organized as follows, section 2 describes the review of literature followed by section 3 to define the proposed methodology as outline and finally section 4 concludes the study of the paper.

II. REVIEW OF LITERATURES

The review of the literature is analysed in terms of Wireless Energy Transfer and charging constrainst in the Wireless Rechargeable sensor networks. Also its importance in the increasing the Network utility is also parallelly reviewed in detail.

A. Collaborative mobile charging for sensor networks

The collaborative mobile charging is an energy charging technique to wireless Sensor Network in these mobile chargers is allowed to charge each node in the similar network topology. The Scheduling multiple mobile chargers is examined in detail which collaboratively recharge sensors, to maximize the ratio of the amount of payload energy to overhead energy, such that every sensor will not run out of energy. Two different constrainst is evaluated in which first consider the uniform case where all sensors consume energy at the same rate, a scheduling algorithm, Push Wait, which has been proven to be optimal in one-dimensional WSN of infinite length. Second, in the non-uniform case, which is conjectured to be NP-hard, two observations from space and time aspects to remove some impossible scheduling choices is presented with heuristic algorithm named as ClusterCharging(β), which clusters sensors into groups and divides a scheduling cycle into charging rounds. Its approximation ratio is also presented [5].

B. Joint mobile energy replenishment and data gathering in WRSNs

In this Literature, steady and high recharging rates and energy efficient data gathering from sensors has been provided by utilizing the mobility for joint energy replenishment and data gathering [6]. In particular, a multi-functional mobile entity, called SenCar has been employed, which serves not only as a mobile data collector to gather data via short-range communication but also acts as an energy transporter that charges static sensors on its migration via wireless energy transmissions. Utilizing SenCar's controlled mobility, the joint optimization of effective energy charging and high-performance data collections is achieved with random topologies. A two-step approach for the joint design has been carried out. In the first step, the locations of a subset of sensors are periodically selected as anchor points, where the SenCar will sequentially propagate to charge the sensors at these locations and gather data from nearby sensors in a multi-hop fashion. To achieve a desirable balance between energy replenishment amount and data gathering latency, a selection algorithm to search for a maximum number of anchor points where sensors hold the least battery energy was provided [6]. In the second step, data gathering performance when the SenCar migrates among these anchor points has considered. A distributed algorithm to adjust data rates at which sensors send buffered data to the SenCar, link scheduling and flow routing so as to adapt to the up-to-date energy replenishing status of sensors is also been analysed.

C. Controlled sink mobility for prolonging wireless sensor networks lifetime

In this literature, controlled mobility in wireless sensor networks (WSNs) for increasing their lifetime has been analysed i.e., the period of time the network is able to provide its intended functionalities. More specifically, for WSNs that comprise a large number of statically placed sensor nodes transmitting data to a collection point (the sink), can be enabled by controlling the sink movements to obtain remarkable lifetime improvements.

In order to determine sink movements, a Mixed Integer Linear Programming (MILP) analytical model whose solution determines those sink routes that maximize network lifetime has been enabled. By defining the heuristics for controlled sink movements is been established as fully distributed and localized [7]. The Greedy Maximum Residual Energy (GMRE) heuristic moves the sink from its current location to a new location as if drawn toward the area where nodes have the highest residual energy. A simple distributed mobility scheme (*Random Movement* or RM) according to which the sink moves uncontrolled and randomly throughout the network has been designed. The moving sink always increases network lifetime is been determined from every protocol.

D. Data gathering optimization by dynamic sensing and routing in rechargeable sensor networks

In this literature, the energy harvested by sensors should be carefully allocated for data sensing and data transmission in order to optimize data gathering against time-varying renewable energy arrival and limited battery capacity. Moreover, the dynamic feature of network topology has been taken into account, since it can affect the data transmission. Further to optimize data gathering in terms of network utility by jointly considering data sensing and data transmission has to be analysed trrough data gathering optimization algorithm for dynamic sensing and routing (DoSR), which consists of two parts. In the first part, a balanced energy allocation scheme (BEAS) for each sensor to manage its energy use, which is proven to meet four requirements raised by practical scenarios. Then in the second part, a distributed sensing rate and routing control (DSR2C) algorithm to jointly optimize data sensing and data transmission, while guaranteeing network fairness has been discussed. In DSR2C, each sensor can adaptively adjust its transmission energy consumption during network operation according to the amount of available energy, and select the optimal sensing rate and routing, which can efficiently improve data gathering. Furthermore, since recomputing the optimal data sensing and routing strategies upon change of energy allocation will bring huge communications for information exchange and computation, an improved BEAS to manage the energy allocation in the dynamic environments and a topology control scheme to reduce computational complexity has been examined[8].

III. OUR PROPOSED MODEL

The velocity control of the mobile chargers travelling the 2D Trajectories is optimized using the Spatio Temporal Dynamic Routing (STDR) Technique to Rechargeable Wireless Sensor Network. In this protocol, heuristic conditions allowed to optimize the sampling rate and battery level by carefully tackling the spatiotemporally coupled link and battery capacity constraints of the wireless sensor nodes[9]. The Wireless Nodes utilities the dynamic node monitoring models has to gather the data about energy of the each node as well data sampling rate, Node failure and link failure etc. Each node exhibits different performance the movement of the mobile charger depends on the several criteria; hence we utilize joint heuristic solution to handle to charging movement of the mobile charges based on the requirement [10]. System demonstrates that the proposed algorithm always achieves higher network utility than existing approaches. In addition, the impact of link/battery capacity and initial battery level on the network utility is further investigated

IV. CONCLUSION

In this paper, an extensive review is carried out on the mobile charging control mechanism of Wireless rechargeable sensor networks (WRSNs). The detailed analysis on those mechanism yields effective information against maximizing the network lifetime. Based on this, optimal solution towards controlling the node charging can be modelled using heuristic condition incorporating both spatial and temporal constrainst. The conditions maximize the charging utility of sensor through velocity control in the energy transfer. Automating of the sensor replenishment scheduling provides network utility rate. Joint optimization of moving path and velocity is also worth investigating in order to increase the network lifetime and energy harvesting. .

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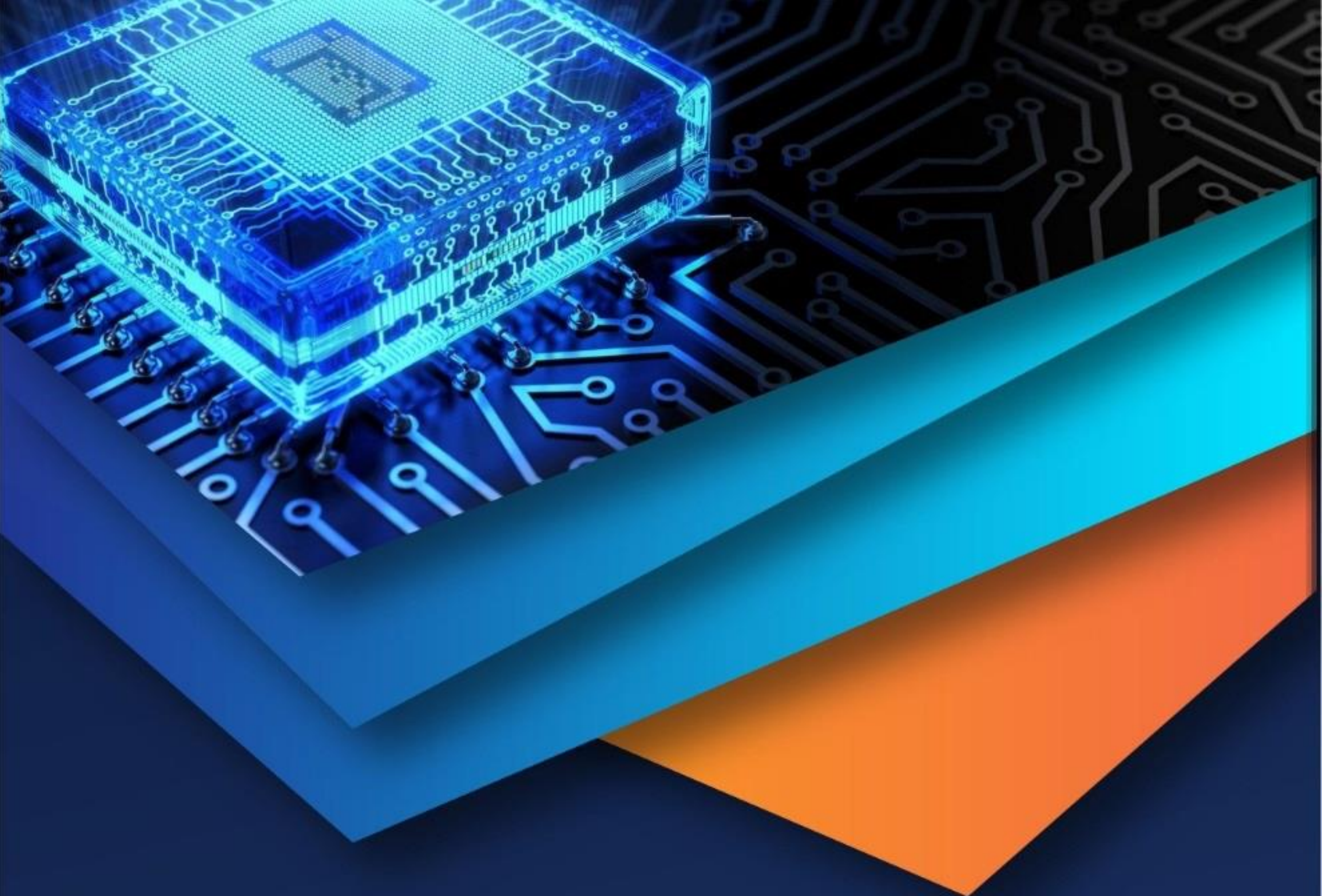

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