Design the Structure of the Wireless Recharging for Wireless Sensor Network

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Abstract
To address the facility constraint drawback in wireless detector network the recharging batteries of detector nodes in detector network through wireless energy transmission may be a nice different. To extend the period of the detector network through wireless charging numerous schemes has been planned. During this paper we have a tendency to planned associate degree NDN based mostly wireless recharging framework for detector nodes, during which the detector nodes are recharged once its level of the battery reduces below the edge price. To trip the nodes the minimum weighted add algorithmic program has been employed in that with minimum motion value the mobile sinks reaches the nodes. The priority schedule has been introduced to recharge to the emergency detector nodes. The simulation results demonstrate that the planned framework elongates the network period compared to the prevailing recharging framework.

Keywords:
Wireless energy Transmission, sencars, wireless recharging, minimum weighted sum algorithm, named data networking.

1. Introduction

In Wireless detector network, the nodes are power-driven with batteries. The restricted power of battery has constraints an enormous challenge, particularly wherever the network is employed for long run watching of associate events. Within the last decade there are a flourish of analysis efforts to extend the detector network lifespan. Though varied energy harvest home ways are planned for extraction of energy from wind noise vibration star these approach has limitations [2]. As a result of extraction of energy is depends on the resource handiness. What is {more} the dimensions of harvest home devices are additional compared with the detector node wherever these devices consume more power than the nodes within the network.

Wireless energy transmission technique has opened a new dimension to power wireless sensing element networks. The key plan of wireless charging technology is to dispatch a sencar to maneuver round the network and charge energy to the node that has lower battery level. Because the applications of wireless energy transfer area unit many. As an example, wireless energy transfer has already been useful to fill battery energy in medical sensors and implantable device in tending business.The recharging of those nodes and within which order can impacts critically the potency and also the time period of the network. A couple of works have studied the recharging of detector nodes downside. The gathering of the energy state of nodes data is A difficult issue and these data delivering to sencar is an another vital issue. Once the energy standing data of nodes is delivered in delay to the sencar, then the node whose energy state is low has been died. The time to recharge for a couple of hundred nodes can take many days. Throughout this era the energy state of detector node can amendment considerably due to some unpredictable external events and activities and so the battery has been drained. This ends up in the energy depletion of nodes and resulting in disruption in detector network functions.

The Named knowledge networking technique has been wont to gather and inform the energy standing data to sencars. The only sencar can supports to the smaller network sizes. During this paper multiple sencars has been wont to support for the larger network sizes. The multiple sencars provides quantifiability and hardiness. The sencar has additional energy provides than the only detector node and therefore it's capable of recharging the detector nodes.Until the detector nodes report their energy state when some amount of your time a scalable and economical energy info aggregation protocol has been used that gathers battery standing level unceasingly from detector node. Supported the newest energy info received the sencars recharges to the nodes.

The wireless charging technology has many benefits, supported these benefits very little work has been planned. During this work, the network style is framed as (1) Multiple sencars, (2) network of sensing element nodes equipped with wireless power receivers, and (3) head nodes and proxy node for deciding the charging sequences to be dead by the sencars. The NDN primarily based energy aggregation and gathering protocol has been used that

Manuscript received May 5, 2026
Manuscript revised May 20, 2026
https://doi.org/10.22937/IJCSNS.2026.26.5.14

satisfy each traditional and emergency nodes desire multiple sencars for recharging.We have conducted wide simulations to get the performance of the planned system in massive scale networks. Simulation results shows that the planned system will entirely build use of the wireless charging technology effectively to extend the lifespan of the wireless device network.

The rest of paper is organized as follows. Section two shows the connected work. Section three presents the planned system. Section four report the simulation results on massive scale networks severally. Finally section five concludes the paper.

2. Related Work

In analysis field there has been a lot of effort in wireless energy transmission. The breakthrough technology by kurs has through an experiment showed the economical non radioactive energy transmission in sensible. They showed by exploitation the 2 magnetic resonant objects of same frequency of resonant to exchange energy expeditiously. They showed the ability is transfer expeditiously with regardless of the surroundings and even while not line of sight.In paper [3], the preparation of the detector nodes is finished in industrial wireless sensing platform and business off the shelf RFID readers. A greedy algorithmic program has been designed to search out the recharge sequence to extend the nodes life in detector network by wireless charging [4].An experimental check has been performed by victimization the facility solid devices.

In paper [5], J-RoC joint routing has been introduced wherever it needs continuous info exchanges between detector nodes in the sector and also the mobile charger. As during this theme associate single mobile charger has been used to charge the detector nodes.The decisive works[6],[7] of resonant inductive coupling based mostly wireless energy transmission square measure capable of transferring great deal of energy in very little time with high ably .In the paper [8],for travel and to recharge the device node varied schemes has been used and therefore the nodes batteries square measure recharged part.In [2], the author has been made the shortest Hamilton cycle rule that provides the nominal movement path to achieve the device nodes by mobile vehicle. In paper [9], the author has created the mobile chargers to recharge device nodes and conjointly to recharge another charger, so massive network is lined and mobile chargers come back back to same purpose.

A. Coordination of mobile vehicles

In wireless sensing element network, for collection information from the nodes multiple mobile vehicles are allowed to traverse within the network and therefore information are collected. In paper [10], the mobile vehicles are acquiring random excess of the nodes and collection the info. Within the paper [11], multiple controlled mobile vehicles are adopted for information assortment within the objective of reconciliation the load. In [12], {a set|agroup|a assortment} of heuristics are projected to schedule the info collection of multiple mobile vehicles to satisfy sensors dynamic buffer overflow time constraints. Reckoning on the node buffer size the nodes are visited by mobile vehicles.

In paper [13], the author has projected associate degree approach to reduce the full movement value of multiple mobile vehicles is studied. Within the assortment of knowledge a lot of than one vehicle might visit constant sensing element node in terribly short amount. Whereas victimization multiple sencars to recharge, once constant sensing element node incur high value and this example ought to be avoided altogether.

3. Proposed System

The device nodes area unit placed every which way within the field and also the network is split into ranked layers. The energy data is gathered in mass forms from every layer head nodes. So for giant space network the recharge is often performed and so quantifiability is magnified. The nodes in every layer area unit done to make the world. Based mostly on the geographical coordinates of sensing field the world is divided.

Each space is any divided into tiny subareas and so the amount in the network will increase. This division method is sustained till in bottom level layer there's no any division of subareas. So once the sencar goes to recharges to such areas the nodes energy state don't modification additional and so they not interrupt to recharge. In Name knowledge Networking for every sub layers the names has been allotted. So by distinctive name the sub space is known in gradable. Every and each node has ID together with the name of its bottom level sub space associated a symbol. The top node in every division of sub areas is chosen supported the node that has the very best residual energy and additional no of neighbors. Once the top node energy is low, another node is chosen supported highest residual energy and neighbor's .Then it acts as new head node.

When the sencar request for energy info of nodes, the head node sends the question to alternative traditional

nodes. These head nodes info is shipped to the highest level head node through the mechanism of named knowledge networking that perpetually update the routing states in intermediate nodes to follow the movement of sencars.

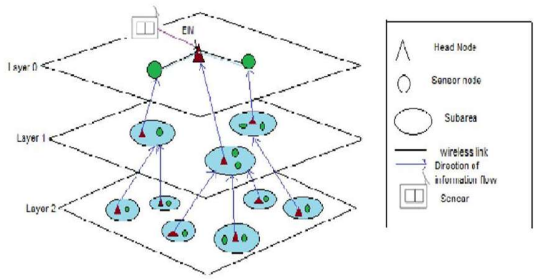

Figure1: Nodes Energy

Input: weight parameter $\alpha \in [0,1]$ in step size δ {A+1} sencar position at node k, travelling time from node i, j $t_{i,j}$ residual lifetime L_i, V_i j $\in$ M, node list Q_i at service station, I $\in$ M

Output: weighted parameter α and schedule sequence Q

Initialize minDist = ∞

For α=0,.....1

While M=0

Compute weight $w_{k,i} \leftarrow \alpha t_{k,i} + (1-\alpha) L_i$

Communicate service station IF Q_i = 1 see $w_{k,i}$=∞

END IF

Find $j \leftarrow \arg\min w_{k,i}$

$Q_i \leftarrow Q_i + j$, $M \leftarrow M - j$

Update $\forall i \in M$, $L_i \leftarrow L_i - t_{k,j} - t_j$

If $L_j \leq 0$

Declare unfeasible and break (inform service station)

End If

Move to position j, $k \leftarrow j$, recharge and update L_j

End While

If feasible

Compute total cost dist(Q)

If dist(Q) < minDist

MinDist ← dist (Q), Q ← Q

End if

End if

End for

The highest head node so sends the aggregative info to the sencar. To reduce overhead of energy info transmission the pinnacle node is allowed to pre choose the device nodes to be recharged. The pinnacle node selects the realm wherever the nodes may be recharged with higher quantity of energy. The emergency happens once the node energy goes below the emergency threshold worth. This node identity is send to the proxy node that is in prime level of hierarchy. These proxy nodes maintain the queue of emergency nodes data. The node that's not head nodes is that the traditional sensing element nodes. These emergency nodes have the very best priority than the opposite nodes and therefore the sencar initial recharges the emergency node. The sensors communicate among themselves as they square measure equipped with powerful antennas. To grasp there location within the field they use international positioning system. To avoid duplicate choice of same node to be recharged by quite one sencar, the sencar is allowed to receive the data that is nearest to the nodes to be recharge. Therefore travel price is additionally reduced. The sencar can get the energy data solely when it recharges the nodes.

4. Simulation

To evaluate the performance of Named knowledge Networking based mostly framework in giant networks the simulation are conducted in machine. In simulation a hundred and fifteen nodes square measure placed willy-nilly within the 150m x one hundred m field.

Table.1. SimulationParameters

Parameters	Value
Field length	150 X100,
Number of nodes	100
Number ofsencars	4
Transmission range	15m
Energy consumption	37.5mJ
Sencarspeed	1m/s
Threshold value	15%
Battery capacity of sencar	2000 E c(KJ)
Battery capacity of a sensor node	10 E s(KJ)
Sensor'stxpowerconsumption	0.05(J/Packet)
Sensor's rx power consumption	0.06(J/Packet)
Number of levels	3

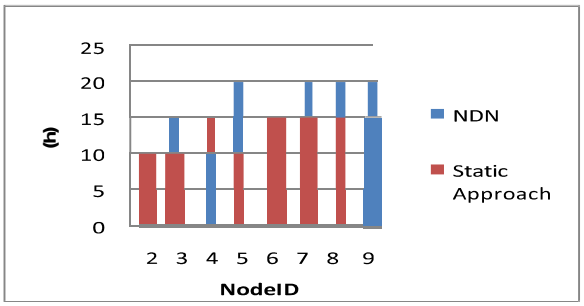

Figure 2: Lifetime of Individual sensor Node

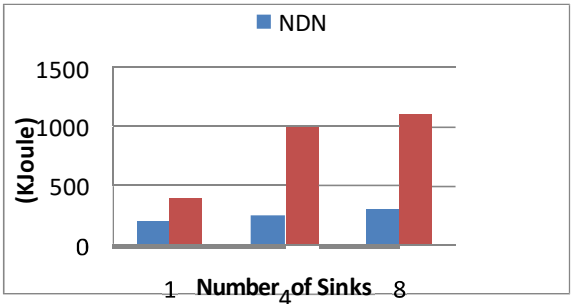

Figure3: Energy Consumed by Sencarmovement

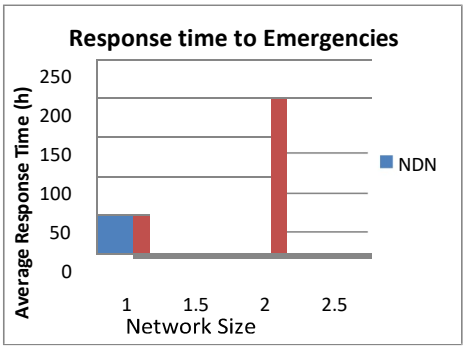

Figure 4: Average Response time to emergency sensor nodes in network

The NDN based mostly networking has improves the lifespan of the device nodes of eightieth. This is often delicate by charging to the nodes that has lower energy. Supported the info packets transferred by nodes they consume the energy.The sencar charging capability is embedded, increasing the nodes to be recharge would decrease the quantity of energy to charge to device nodes.In NDN based mostly networking by victimization the minimum weighted total algorithmic rule the sencar will reach the node in tiny distance and so the sencar energy consumption is reduced and so the sencar will charge for a lot of range of nodes to be recharged.The named knowledge networking based mostly framework takes around ten hours to response to the emergency nodes than compared with static approach that takes minimum 60hours as a result of in static approach the priority has not been given to emergency nodes and therefore the traditional nodes. So this approach resolves non- sensible things prior to static approach.

5. Conclusion

In this paper the NDN based mostly wireless recharging framework has been projected to enlarge the sensing element network period of time. We tend to gift the look of named information networking based mostly wireless recharge framework and judge its potency. This framework satisfies the wants of each traditional and emergency sensing element nodes and so all the nodes within the network are recharged before their energy is entirely exhausted. The simulations show that the network period of time has been prolonged drastically.

References

[1] I. A. Kinalis, S. Nikoletseas, and J. Rolim, "Fast and Energy efficient detector knowledge assortment by Multiple Mobile Sinks," Proc. ACM Fifth ACM Int'l Workshop quality Management and Wireless Access (MobiWac), 2007.

[2] M. Ma and Y. Yang, "SenCar: associate degree Energy-Efficient information Gathering

Mechanism for Large-Scale Multihop device Networks," IEEE Trans. Parallel and Distributed Systems, vol. 18, no. 10, pp. 1476- 1488, Oct. 2007.

[3] S. Zhang, J. Wu, and S. Lu, "Collaborative Mobile Charging for Sensor Networks,"Proc. IEEE Ninth Int'l Conf. Mobile Ad-Hoc and sensor Systems (MASS), 2012.

[4] R. Shah, S. Roy, S. Jain, and W. Brunette, "Data MUL [2] Y. Shi, L. Xie, T. Hou, and H. Sherali, "On Renewable sensing element Networks with Wireless Energy Transfer," Proc. IEEE INFOCOM, 2011.

[5] S. He, J. Chen, F. Jiang, D Yau, G. Xing, and Y. Sun, "Energy Provisioning in Wireless reversible sensing element Networks," Proc. IEEE INFOCOM, 2011.

[6] Y. Peng, Z. Li, W. Zhang, and D. Qiao, "Prolonging detector Network lifespan through Wireless Charging," Proc. IEEE thirty first IEEE period of time Systems Symp. (RTSS), 2010.

[7] Z. Li, Y. Peng, W. Zhang, and D. Qiao, "J-RoC: A Joint Routing and Charging theme to Prolong detector Network period," Proc. nineteenth IEEE Int'l Conf. Network Protocols (ICNP), 2011.

[8] A. Kurs, A. Karalis, R. Moffatt, J.D.Joannopoulos, P. Fisher, and M. Soljacic, "Wireless Power Transfer via powerfully Coupled Magnetic Resonances," Science, vol. 317, pp. 83-86, 2007.

[9] A. Karalis, J.D. Joannopoulos, and M. Soljacic, "Efficient Wireless Non-Radiative Mid-Range Energy Transfer," Annals of Physics, vol. 323, no. 1, pp. 34-48, Jan. 2008.