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Mobile Sink: A novel and Profitable approach for data collection

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ABSTRACT:

WSNs will be an instrumental system for data aggregation in future. The data aggregation task required to collect the data from sensor and routed to base station or sink node. To forward the data from one node to another node, we need some systematic way which is known as routing algorithm. They define a specific rule about where to forward the packet. Tradition way all the node in WSNs consider as steady node. Where, node uses one of the routing algorithms to forward the packet to best node toward the destination and ultimately it reached to the base station or sink node. The new approach rather than node send the data to the sink node, a mobile node or rendezvous node visit the particular path at regular interval and collect information form the node. This approach avoids the direct long distance transmission of packet, which leads to save energy of network. This paper covers some important algorithm of mobile sink data collection approach.

INTRODUCTION:

Mobility in WSN can be achieved by ether moving the sensor node or moving the sink node. [1]. But in this paper our discussion is limited to mobile sink node.

Sink node or collecting point is the instrumental part routing algorithm for the WSNs. Other protocol, which falls under the flat architecture i.e. flooding do not have any hierarchical structure, they usual select the best node from the neighbour and forward the packet to that node and ultimately reach to the destination. But in case of hierarchical routing algorithm there is one central node which is known as cluster head, which collect the data from the cluster aggregate them and send to sink node directly or via other cluster head. In short the data generated in WSNs ultimately reach to the sink node.

Normally, the sink node is considered as static node. Data generated at any point of WSNs will reach to the sink node. In that case most of the energy is consumed in transmitting the data at long distance. Energy is most scariest and important part of WSNs. So the alternative approached had been developed in which the sink node consider as mobile node, which will visit the specific area at regular time duration to collect the data. In this approach as the sink node come to collect the data, sensor node do not need to send data at long distance.

The movement or the mobility of sink node in WSNs categorized in two ways:

i) Random Movement: In this category the sink node moves in unplanned manner throughout the WSNs. Painless implementation is attractive feature of this scheme but the agony of uncertain behaviour and penniless performance restrict its use.

ii) Controlled Movement: In this category rather than uncertain movement of sink node it uses controlled and specified movement of sink node throughout the WSNs. It increases the complexity of the network but with contentment of definite behaviour and solvent performance.

Controlled movement bypass the random movement in every aspect of benefit in performance improvement which is supported by recent research. Controlled mobility needs deterministic schedule of sink node, which include path of movement and collection point where to stop for collecting the data. Behalf of that mobility cause the delay in data delivery. That is also the prime concern. There are several algorithm which claim to solve this issue by phony fast mobility, where they consider the speed of sink is enough fast to avoid the possible delay. When we think real life situation if we planned our WSNs in War field or in Forestthe geographical situation put bar on sink speed.

DATA COLLECTION THROUGH MOBILE SINKS:

There are several algorithms which try to address this issue. In this paper we try to cover some of the important and attractive algorithm for controlled sink mobility. The data collection can be further classified in two broad categories: no data forwarding and partial data forwarding. [3] In no forwarding approach mobile sink visit each sensor to collect the data whereas, in partial data forwarding instead of visiting all the sensor it only visit selected collecting point.

R.C.Shah et al[4] comes with idea of DATA MULEs to collect the data from the network and send it to sink node. It falls in to no data forwarding category. Data MULEs stands for Data Mobile Ubiquitous LAN Extensions. MULEs are mobile agent which freely move in network and collect the data from deployed sensor. MULEs can be a Human being, animal or any vehicle. Basically they divide WSNs in three tiers. Top tier contain WAN connected device which is located at suitable location having adequate available power. They can directly communicate to central data warehouse. Middle Tier contains MULEs which provide connectivity between sensor network and access point. It is assumed that, movement of MULEs are not predictable. When MULEs passes from the sensor area, they upload the data and carries until it reach to the access point so it can deliver to the access point. MULEs contain more power and data storage capability compare to sensor node. The bottom tier is of sensor nodes which are randomly deployed to sense particular quantity. This approach offers improvement in network life time but it adds latency to data delivery. More over the movement of MULEs are not predictable and reliability issue in communication between MULEs. In this case sensor node need to continuously remain in listening mode as, the MULEs movement is unpredictable.

M.Ma and Y.Yang [5] presents the idea to data gathering mechanism by M-collector which may be Mobile robot or vehicle equipped with adequate power and transceiver capacity for gathering data from the field in no forwarding manner. A single mobile collector never be enough adequate for the faithful data delivery, so they used more than one M-collector, which moves on specified path and collect the data. This approach enhance the data latency issue occurred in previous approaches. More over its moves to specified path so the there isn't any uncertainty about M-collector path. These approaches significantly improve the network life time. The co-ordination and path selection of multiple M-collector make it little bit complex.

R.Sugihara and R.K.Gupta [6] present improvement of data MULEs approaches. Data MULE move across the sensor field, collect the data from each sensor and when it came back to the base station it deliver the data to base station. Although it offers improvement in network life time it suffers from latency in data delivery. They have formulated problem of optimum motion control of data mule to reduce the latency in data delivery. Proposed heuristic algorithm performs better than its previous one.

Above described approach mobile sink need to visit each sensor for data collection. It gives balance in energy consumption of all nodes but it also adds latency issue with data delivery. More over the traveling path for mobile collector will be longer one as it needs to be in touch with all the available nodes. This result in excessive energy use in mobile collector and buffer overflow problem in at sensor node.

To overcome this long path problem, mobile sink visit only subset of sensor rather than each and every sensor. This subset sensor will gather the data from their neighbour and collect it. When mobile node comes to its vicinity it will forward the data to the mobile sink node.

G. Xing et al [7] proposed Rendezvous based approach for data gathering. Instead of visiting each sensor node, mobile node visit only selected node known as rendezvous node. In this algorithm first find the rendezvous point from deployed sensor in such way that energy consumed. The mobile element or mobile sink visit only this Rendezvous point and collect the data. This rendezvous node will collect the data from its entire neighbour and store until the mobile element visit this points. They also find the optimal path for the mobile element to cover each rendezvous points. They use two different algorithms for path planning PR-CP and PR-UG. They also developed a Rendezvous based data collection for robust data transfer between Sensor networks to Mobile elements. It offers significant improvement in life time of network as well as increase data delivery speed.

K. Almi'ani et al. [8] proposed cluster base approach for mobile sink data gathering. Algorithm fragments the network in to energy aware clusters. From each cluster a collecting point is selected. Cluster based algorithm plans mobile element tour in iterative manner where every time it compares with previous output for improving the path selection. The function of cluster based algorithm divides in two part: tour building and final tour improvement. During the first phase, algorithm tries to include as much as possible cluster in tour. Once tour is established, algorithm enters in to second phase where it finds the optimum path by iteratively comparing each result and coversallclusters. It offers improvement in network life time and latency in data delivery compared to previous one. But question remain open for both, how to deal with network which contain node with heterogeneous communication capabilities.

H. Salarian et al [9] proposed algorithm based on rendezvous approach where rendezvous point collect the data from other node and deliver to mobile sink as and when it comes to its vicinity. But the critical part is to define the tour path for the mobile sink node so that it covers all the rendezvous point in efficient manner. For that they proposed algorithm named Weighted Rendezvous Planning (WRP). In this algorithm each sensor node designated with weight based on number hop distance from the rendezvous point and numbers of data packet it forward to the nearest rendezvous point. By using this information it find near optimal path for mobile sink node. When it compare to other approaches, it offers more energy consumption and better energy distribution.

S.Trapasiya and H.Soni [10] proposed rendezvous point selection scheme for increasing network life time and reducing the latency of data delivery. In this algorithm actor node moves on specified path to collect the data from rendezvous point. Here they use genetic algorithm to find the optimum path. They select the rendezvous node by set covering algorithm. Be half of that, this algorithm proposed innovative rendezvous node rotation scheme. As if a single node remainsas rendezvous point results in early drain out from the energy. So, rotation scheme will maintain the energy balance in network which leads to network life time.

W.wen et al [3] proposed algorithm that find better set 0pf collecting point using benefit calculation which include distance, buffer, battery and flow of data as constraints. They develop new approach known as EAPC which consider length cost between any two successive collecting point and construct an optimal path which cover maximum collecting point. The attractive feature of algorithm is data collection while moving. It might be possible that during path journey mobile sink will pass through a node which is not a collecting point, at that time mobile sink will collect the data from that node too. That leads to energy saving of node.

CONCLUSION:

Mobile sink is a novel and profitable approach to collect the data from WSNs. Mobile sink either use no data forwarding approach or partial data forwarding approach to collect the data. In formal approach, mobile sink visits each and every node of network and collect the data and it is relatively easy to implement. In this approach the network energy is well balanced but it increases the data latency as mobile sink need to visit all the nodes. In second approach, data latency is decreases as mobile sink only visit particular data collecting points. It increases the complexity of the algorithm as first it needs to select the collecting point among the sensor node. If the duty of collecting point do not alter at time to time, than it may possible that collecting point will drain out of its energy. So, there is always network energy balancing issue with this approach.

REFERENCES:

[1] Y. Wang, F. Wu, and Y. Tseng, “Mobility Management Algorithms and Applications for Mobile Sensor Networks”,Wireless Comm. Mobile Computing, vol. 12, pp. 7-21, 2012.

[2] C. Kanimozhi, M.MohamedMusthafa, “Mobile Sink based Data Gathering and Forwarding in WSN” International Journal of Innovative Research in Computer and Communication Engineering, Vol.2, Special Issue 1, March 2014

[3] W.Wen, S.Zhao,C.Shang and C.Y.Chang, “EAPC: Energy Aware Path Constuction for data collection Using Mobile Sink node in Wireless Sensor Networks” IEEE Sensor Journal, Vol.18,No.2,Jan-2018.

[4] R. C. Shah, S. Roy, S. Jain, and W. Brunette, “Data MULEs: Modeling and analysis of a three-tier architecture for sparse sensor networks,” Ad Hoc Netw., vol. 1, nos. 2–3, pp. 215–233, Sep. 2003.

[5] M. Ma and Y. Yang, “Data gathering in wireless sensor networks with mobile collectors,” in Proc. IEEE Int. Symp. Parallel Distrib.Process. (IPDPS), Apr. 2008, pp. 1–9.

[6] R. Sugihara and R. K. Gupta, “Optimal speed control of mobile node for data collection in sensor networks,” IEEE Trans. Mobile Comput., vol. 9, no. 1, pp. 127–139, Jan. 2010.

[7] G. Xing, T. Wang, Z. Xie, and W. Jia, “Rendezvous planning in wireless sensor networks with mobile elements,” IEEE Trans. Mobile Comput., vol. 7, no. 12, pp. 1430–1443, Dec. 2008

[8] K. Almi’ani, A. Viglas, and L. Libman, “Energy-efficient data gathering with tour length-constrained mobile elements in wireless sensor networks,” in Proc. 35th IEEE Conf. LCN, Denver, CO, USA, Oct. 2010, pp. 582–589.

[9] H. Salarian, K.-W.Chin, and F. Naghdy, “An energy-efficient mobilesink path selection strategy for wireless sensor networks,” IEEE Trans. Veh. Technol., vol. 63, no. 5, pp. 2407–2419, Jun. 2014.

[10] S. Trapasia and H.Soni, “ Energy Efficient tour planning for mobile actor in Rendezvous point selection scheme” IEEE ICC 2015 Ad-hoc and Sensor Network Symposium,