An Efficient Approach to Minimize Data Collection Delay in Wireless Sensor Networks

A.Vinoth[#1]
[#]Department of Computer Science and Engineering,
#K.S.R.College of Engineering,Tiruchengode,India.
[1]vinothctit@gmail.com

M.Somu[#2]
[#]Department of Computer Science and Engineering,
#K.S.R.College of Engineering,Tiruchengode,India.
[2]somumurugesan@hotmail.com

Abstract:

Data assortment latency might become higher attributable to the comparatively slow travel speed of mobile components . Thus , the planning of mobile components , i.e. , however they traverse through the sensing field and once they collect knowledge from that device , is of final importance and has attracted increasing attention from the analysis community. developed because the bagman drawback with neighborhoods (TSPN) and attributable to its NP-hardness , thus far solely approximation and heuristic algorithms have appeared within the literature , however the previous solely have theoretical worth currently attributable to their giant approximation factors. during this paper , following a progressive optimisation approach , we tend to 1st proposes/proposed a combine-skip-substitute (CSS) theme , that is shown to be able to acquire answers at intervals atiny low vary of the edge of the best solution. we tend to then take the realistic multirate options of wireless communications under consideration , that are neglected by most existing work , to additional cut back the info assortment latency with the multirate CSS (MR-CSS) theme . Besides the correctness proof and performance analysis of the projected schemes , we tend to additionally show their potency and potentials for additional extensions through intensive simulation . Finally assortment jobs requested by cluster heads instead device nodes to balance energy usage .

Keywords—Wireless sensor networks, mobile elements, data collection, latency, cluster head.

I.INTRODCUTION

Data assortment from the nodes deployed in a very sensing field is one among the foremost vital tasks of wireless device networks . Typically , information assortments depends on wireless communications between device nodes and also the sink node , which can suffer from the subsequent issues . First , wireless communications , particularly long-range ones , could consume the restricted on-board energy provide of device nodes too owing to super linear path loss exponents . Second , although shorter varies/varied , multihop wireless communications ar adopted , owing to the info aggregation toward the sink , nodes round the sink still got to consume rather more energy than others owing to heavier volumes of traffic transmitted by them , that ends up in a lower overall network time period . Another approach to information assortments in device networks utilizes the usually offered , controlled quality of bound nodes , By utilizing MEs , not solely additional energy may be preserved and balanced on device nodes , however conjointly the communications and networking become potential in terribly distributed networks with a "store- carry-and-forward" approach. we have a tendency to tackle this downside from a brand new angle . First , following a progressive improvement approach , we have a tendency to try and scale back the tour length of MEs , and so the time period we have a tendency to adopt a multirate communication model , that permits MEs to gather information about a lower rate of an extended distance whereas traveling. we have a tendency to extend the CSS theme consequently supported this mode land get the multirate CSS (MR-CSS) theme . Most existing work has not thought of this wireless communication option nonetheless , and so cannot totally utilize them. we have a tendency to prove the correctness of the progressive improvement approach , analytically judge its performance supported some ends of in Geometrical likelihood , and show its effectuality through a simulation-based performance study on each the essential and extended CSS schemes . Finally assortment jobs requested by cluster heads instead device nodes to balance energy usage .

II.EXISTING SYSTEMS

This paper planned event assortment in an exceedingly second region wherever sensors square measure deployed to find and collect interested events. mistreatment ancient multi-hop routing in wireless device networks to report events to a sink node or base station , can end in severe unbalanced energy consumption of static sensors. additionally , full property among all the static sensors might not be doable in some cases since typically the sensors square measure haphazardly deployed within the target region. during this paper , we have a tendency to exploit a mobile device because the sink node to help the event assortment by dominant the movement of the mobile sink to gather static device readings . A key observation of our work is that a happening has spatial-temporal correlations . Specifically , an equivalent event may be detected by multiple close sensors inside an amount of your time . Thus , it's a lot of energy-efficient if the mobile sink will by selection communicates/communicated with solely some of static sensors , whereas still groupings all the interested events. during this paper , we have a tendency to discuss the event assortment downside of investment the quality of the sink node and therefore the spatial-temporal correlation between the event , in favor of increasing the network time period with a warranted event assortment rate. we have a tendency to 1st model the downside |the matter as device choice problem and show that it may be solved in polynomial time , if world information about events is offered and there are not any rate constraints on mobile sink. we have a tendency to additionally analyze the look of a possible movement route for mobile sinks to attenuate the rate necessities for a sensible system . an internet theme is then planned to relax the idea relating to world data onto events which we have a tendency to prove that the expected event assortment rate could also be secured in theory . Through comprehensive simulation on real trace information , we've got an inclination to demonstrate that the network period could also be significantly extended , examination to a different schemes . Mobile components area unit used balance the energy consumption .

Minimizing energy consumption of wireless device networks has been a troublesome issue , and grid-based clump and routing schemes have attracted countless attention owing to their simplicity and practicableness. thus the way to verify the most effective grid size therefore on attenuate energy consumption and prolong network period becomes a vital draw back throughout the network planning and oriented section. up to currently most existing work uses the everyday distances within a grid and between neighbor grids to calculate the everyday energy consumption , that we've got an inclination to find for the foremost half underestimates the $64000 value. throughout this paper , we propose , analyze and price the energy consumption models in wireless device networks with probabilistic distance distributions . These model ar valid by numerical and simulation results , that shows that they'll be accustomed optimize grid size and minimize energy consumption accurately. Through comprehensive simulation on real trace information , we've got an inclination to demonstrate that the network period could also be significantly extended , examination to a different schemes

Power conservation is one of the most important issues in wireless ad hoc and sensor networks, where nodes are likely to rely on limited battery power. Transmitting at unnecessarily high power not only reduces the lifetime of the nodes and the network, but also introduces excessive interference. It is in the network designer's best interest to have each node transmit at the lowest possible power while preserving network connectivity. In this paper, we investigate the optimal common transmit power, defined as the minimum transmit power used by all nodes necessary to guarantee network connectivity. This is desirable in sensor networks where nodes are relatively simple and it is difficult to modify the transmit power after deployment. The optimal transmit power derived in this paper is subject to the specific routing and medium access control (MAC) protocols considered; however, the approach can be extended to other routing and MAC protocols as well. In deriving the optimal transmit power, we distinguish ourselves from a conventional graph-theoretic approach by taking realistic physical layer characteristics into consideration. In fact, connectivity in this paper is defined in terms of a quality of service (QoS) constraint given by the maximum tolerable bit error rate (BER) at the end of a multihop route with an average number of hops. Data collection latency is increased with reference of low travel speed of mobile elements. Mobile elements traverse pattern is collected from sensors. Css is used to identify the lower bound solutions. MR CSS is used to reduce data collection latency. Traveling Salesman Problem With Neighborhoods (TSPN) is used with mobile elements to reduce the tour size and delay. Skip-and-Substitute Algorithm and Combination Algorithm are used to schedule the data collection process.

III.PROPOSED SYSTEM

Mobile elements are used to reduce and balance the energy consumption in wireless sensor networks Combine-Skip-Substitute (CSS) scheme is used to identify solutions for lower bound Multi Rate CSS (MR-CSS) scheme is used to reduce the data collection latency Traveling Salesman Problem With Neighborhoods (TSPN) is used with mobile elements to reduce the tour size and delay. The tour selection problem with the consideration of the wireless communication range can be modeled as a TSPN a generalization of the NP-complete traveling salesman problem (TSP). Furthermore, it has been proven that TSPN in its general form is APX-hard (i.e., approximation hard) [25] and cannot be approximated within a factor of 1.000374 unless P ¼ NP [26]. The lower bound of the possible approximation factors was further pushed .On the other hand, approximation algorithms do exist for certain cases of TSPN. For example, a constant-factor approximation algorithm was proposed by Elbassionin, where the neighborhoods are discrete objects of comparable diameters. Furthermore, a PTAS for the TSPN with continuous disjoint neighborhoods was presented in. Although promising, these results do not apply to our problem due to the reason explained below. MEs exist in the network was considered in. The problem of tour selection for MEs was formulated as the label-covering problem in , and a heuristic algorithm using dynamic programming was presented there to solve the problem. Data collection schedule process is enhanced with traversal scheme of Mobile Elements. The scheduling scheme is tuned for multi radio environment. Multiple node data transmission supported by the system. Transmission coverage of sensor node is integrated with the ME data capture process. Cluster head based data collection mechanism is integrated with the system.

A. Combine-Skip-Substitute (CSS) Scheme

Utilizing the nonzero wireless communication range between the ME and sensor nodes and inspired by the fact that the communication ranges of nearby sensor nodes may overlap with each other, the CSS scheme employs three steps to progressively shorten the tour of the ME: It starts with a TSP formulation based on the set of sensor nodes in the sensing field, with which the optimal (or near optimal) TSP tour can be obtained by existing TSP solvers (or approximation algorithms), then it combines the data collection sites by a decisional Welzl's algorithm when possible, and finally it adopts the skip-and-substitute algorithm to further shorten the tour.

B. Find the TSP Tour

The formulation of the TSP instance based on S and B is quite straightforward, which we will not detail here. We can solve the TSP instance by adopting existing approximation algorithms [39], [40], or even, when possible, obtain its exact optimal solution using existing TSP solvers, e.g., Concorde [41]. Denote the resultant TSP tour as Ttsp. A schedule to collect data from all the sensor nodes is obtained from Ttsp. Although this schedule may exclude us from achieving the global optimal solution in some cases, it can reduce the search space and, thus, the computation complexity greatly, while guaranteeing a near-optimal performance. This approach is also adopted and its efficacy has been validated in. Clearly, without data-rate constraints, Ttspis always feasible. We then conduct the combine, skip, and substitute operations based on this schedule, first with the fixed communication range d.

Algorithm 2. Combination Algorithm (S: the set of sensors;

d: communication range).

1: Tcom ?;

2: obtain the TSP tour for S and B: i.e.,

Ttsp¼ hl0;l1;...;ln;l0i;

3: for all liði ¼ 1;2;...;n ? 1Þ do

4:find the maximum j ði ? j ? nÞ by the decisional Welzl's algorithm, such that all the locations in fli;liþ1;...;ljg can be covered by a disk with radius no more than d, with center ci;

5:ComSetðiÞ fli;...;ljg;

6: end for

7: find the ComSetðiÞ with the maximal cardinality,

m jComSetðiÞj;

8: while m > 1 do

9:for all lj2 CombineðiÞ do

10:delete ComSetðjÞ;

11:end for

12:replace them with ciin Ttsp;

13:for all ljstill in Ttspdo

14:update ComSetðjÞ;

15:end for

16:find the ComSetðiÞ with the maximal cardinality,m jComSetðiÞj;

17: end while

18: Tcom Ttsp;

19: return Tcom.

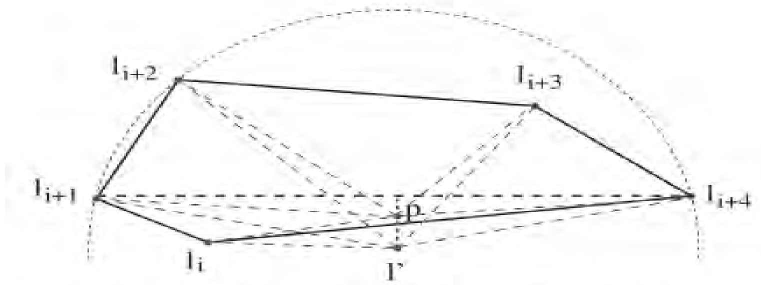


Fig. 1. l' falls inside the convex hull formed by $\mathcal{R}(l')$ if $k \geq 3$.

C. Multirate CSS Scheme

We extend the basic CSS scheme to make it fit the problem under the multirate communication model, i.e., the MR-CSS scheme, which is based on the following observation.

Lemma 3. jTcssj is a nonincreasing function of the communication distances of sensor nodes.

The above lemma is straightforward because the solution space is increased after the communication range is increased, and the same search scheme working in the larger space will obtain results that are no worse than those obtained when working in the smaller one.

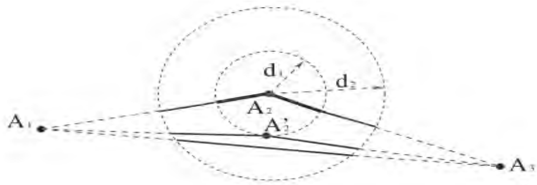


Fig 2: Tour length is nonincreasing when the communication rangeincreases.

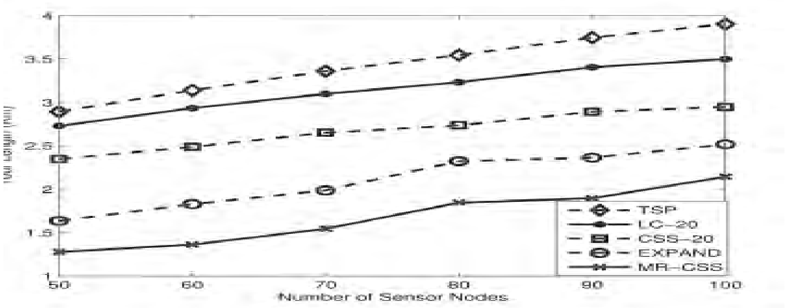
D. TOUR SELECTION WITH DATA-RATE

CONSTRAINTS

In the previous section, we did not consider the data-rate constraints between the ME and sensor nodes for the basic CSS scheme. However, due to the existence of data rate and travel speed constraints in practice, especially when considering the applications with a large volume of sensory data, Tcss may not always be feasible. In this section, we introduce the MR-CSS scheme that considers the realistic data-rate constraints when selecting the tour of the ME, which also returns the near-optimal schedule for each data collection job. By optimal, we mean that all data collection jobs are finished within the shortest time, and the ME returns to the base station at the end.

IV. Performance Evaluation

MR-CSS scheme, in which CSS-20 and LC-20 represent the tour length obtained by the CSS scheme and the Label-Covering algorithm when the communication range of all sensor nodes is 20 m, i.e., the shortest available communication range with the highest data rate, EXPAND is the tour length after the expand operations in the extended CSS scheme, and MR-CSS is the tour length after the entire MR-CSS scheme. We also calculate and show the length of the optimal TSP tour for comparison.



(a) Tour length obtained by the MR-CSS scheme

V.CONCLUSION

In this paper, by following the proposed progressive optimization approach, we have presented a CSS scheme to reduce the tour length, and thus the data collection latency, in wireless sensor networks with MEs. We have also proposed an MR-CSS scheme, which takes the advantage and reality of modern multirate wireless communications into account. We have Cluster head based data collection mechanism is integrated with the system.

VI.REFERENCES

[1] X. Xu, J. Luo, and Q. Zhang, “Delay Tolerant Event Collection in Sensor Networks with Mobile Sink,” Proc. IEEE INFOCOM, 2010.
[2] Y. Zhuang, J. Pan, and L. Cai, “Minimizing Energy Consumption with Probabilistic Distance Models in Wireless Sensor Networks,” Proc. IEEE INFOCOM, 2010.
[3] S. Panichpapiboon, G. Ferrari, and O. Tonguz, “Optimal Transmit Power in Wireless Sensor Networks,” IEEE Trans. Mobile Computing, vol. 5, no. 10, pp. 1432-1447, Oct. 2006.
[4] Y. Zhou, Y. Zhang, and Y. Fang, “Access Control in Wireless Sensor Networks,” Ad Hoc Networks, vol. 5, no. 1, pp. 3-13, 2007.
[5] W. Zeng, R. Sarkar, F. Luo, X. Gu, and J. Gao, “Resilient Routing for Sensor Networks Using Hyperbolic Embedding of Universal Covering Space,” Proc. IEEE INFOCOM, 2010.
[6] J. Luo and J. Hubaux, “Joint Mobility and Routing for Lifetime Elongation in Wireless Sensor Networks,” Proc. IEEE INFOCOM, 2005.
[7] W. Wang, V. Srinivasan, and K. Chua, “Extending the Lifetime of Wireless Sensor Networks through Mobile Relays,” IEEE/ACM Trans. Networking, vol. 16, no. 5, pp. 1108-1120, Oct. 2008.