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Effective Path Determination Strategy for Mobile Sink in WSN

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Abstract—In Wireless Sensor Network the delay in delivery of data problem can be reduced by using mobile sink. Mobility of the sink has been demonstrated to be the best method to reduce delay in the network. So the path selection for the movement of the sink plays an important role. Hence the selection of minimum number of stopping points are called Rendezvous Points (RPs) is very challenging in WSNs. So a productive procedure was proposed to choose the RPs to develop path for moving sink. At first set of potential points will be generated by using a technique and then using greedy algorithm the RPs were selected from the potential points set. Then an optimization method is used to get still more optimized points. At that point these points are utilized to select path for sink. Proposed algorithm was simulated with some current algorithms and results will be compared based on different performance metrics to demonstrate the viability of the present work.

Keywords: clustering, potential points rendezvous points, mobile sink, Wireless Sensor Networks

I. INTRODUCTION

Network of devices that communicates together to gather information from monitored fields is defined as Wireless Sensor Networks. To minimize the delay in WSN which is an important area in networking environment, many algorithms has been developed [18].

In delay tolerant WSNs an energy efficient collection of data by mobile sinks can be done in two ways: Direct-Contact data collection and Rendezvous-Based data collection [17].

- **Direct-Contact data collection.**

By one hop communication data will be collected from the data sources by mobile sink directly which was defined as direct contact data collection. Here the data can be retransmitted or it can be carried physically to the fixed base station using sinks. Data can be carried physically or can be retransmitted to fixed base station using sinks. Since the nodes need not to send messages to each other, by using this method energy utilization among sensor nodes for communication gets minimized. Computing ideal sink which covers every node in the network and reduces the delay in the network is the main purpose.

- **Rendezvous-Based data collection.**

Despite the fact that direct contact data collection saves energy but it increases the data gathering latency because of slow movement of sinks. To overcome usage of low energy as well as to lessen the lag in the time Rendezvous data gathering was used. The data present in the sensors will be sent to subset of nodes which is also called Rendezvous Points (RPs) with the help of multi-hop communication. The moving sink covers all the directions of the network to retrieve the data from RPs which it comes in contact with. This technique helps the sink to gather a huge amount of data instantly by covering short distance which in turn reduces the lagging in data gathering. Hence RP selection is the main focus area for the researchers.

1. RP Selection by Fixed Track:

In this approach collection of data are by means of fixed track. Different researchers use different techniques. A straight line sink strategy was used to collect data by Kansal et. al in [13]. In this strategy while moving in the straight line beacon message will be send by the sink. If the hop count is smaller, then the receiver node will resend the message. After initialization number of trees was constructed and root node will be taken as RP where all the other nodes will sends the measurements, then the RPs sends its data along with the data collected from its every child nodes to the moving sink. The authors presented two motion control algorithms to alter sink speed in order to maximize the amount of data gathered. The movement of sink is much easier in this method since the travelling path is fixed.

II. REPORTING TREE BASED RP SELECTION:

In this approach Xing G et.al in [14] used an algorithm which computes sink tour of the RPs where the weight will be allocated to every nodes in the network and the node with more weight will be chooses as RP (rendezvous point). The sink tour of RPs should not be greater than the maximum distance L= D*v where Maximum delay of packet allowed is D and speed of mobile sink is v. The sensed readings will be forwarded directly from non RPs to the nearest RP. The RP will add up and store every data which was sent by every node and onward it to sink, when the sink will present in RPs locality.

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As the chosen RPs might be found near one another, the data transferring way may become lengthiest to the sensor nodes that are situated in various areas of SMT. But data with various time limits are not considered by this method.

2. RP Selection by Clustering:

An algorithm based on cluster was described by Khaled Almiani et.al [15] which had the objective to reduce the hop count from every node to its appropriate rendezvous point. The algorithm repeatedly finds the mobile sink tour and the routing trees. A number of balanced size clusters are obtained by categorizing the networks with the help of algorithm. A single RP from every cluster will be chosen after which a tour path for sink is developed to visit maximum number of clusters and the tour length restrictions is satisfied. Sometimes in the scenario, the sink path does not proceed through the thick parts of the network resulting in lengthiest path of data transfer from the sensors to the RP. Because of this, life time of WSN will be reduced as the battery of sensor nodes will be draining in non-uniform manner.

III. RELATED WORK

Amar Kaswan et. al[1] demonstrated a method to select path for mobile sink. The method was partitioned into two stages. At first proposed an effective method for making various potential positions which will go about as RPs and after that utilized a greedy system to choose least RPs from the list of potential positions to plan a productive route for mobile sink. By using this RPs the path was constructed.

Amar Kaswan et. al[2] explained 2 algorithms, one is RkM and the other is DBRkM for creation of path for moving sink. Sensor nodes were connected to determine the path in RkM through hop communication. Similar technique was used by DBRkM to found delay bound path. An efficient data collection scheme was also used in every step of data gathering which will reduce the drop in the packets. Only limitation is that the assumption that every SN has same data formation load and the ending time is irrelevant.

Delay Constraint Routing algorithm for WSN with mobile sink[3]. Proposed upper bond and lower bond delay while optimizing sojourn time and location and they also used algorithm for delay constraint routing (Heuristic algorithm).

An algorithm was developed by Young Sang Yun et.al [4] in order to increase the life time of network in the presence of mobile sink within network and hidden application will endure certain measure of postponement for supplying the information to the mobile sink.

Yang Sang Yun et.al [5] explained a frame work in order to increase the WSNs (Wireless Sensor Network) lifetime by utilizing a moving sink when the basic application endure delay in the data conveyance to sink.

Seung Wan Han et.al [6] explained a steering topology (MWST) Minimum Wiener Index Spanning Tree for network with different moving base hubs. Two algorithms were structured for this purpose, one is branch and bound, the other is simulated annealing for small scale and large scale WSNs respectively.

Ricklef Wohlers et.al [7] showed how joining proactive and reactive methods of information collection is especially useful. The Twin Route, a novel hybrid algorithm that can adaptably blend the two accumulation modes at suitable levels relying upon the application situation was utilized.

IV. INTENT OF THE WORK

The main purpose of work is

- To limit the utilization of energy by the nodes by using moving sink in the network.
- To generate potential positions that will be used to select the rendezvous points.
- To design a shortest path by utilizing least number of rendezvous points (RPs) while guaranteeing the inclusion of all sensor node in the network.

V. PROPOSED WORK

The essential task of proposed work is partitioned into 3 stages. A random creation of sensor nodes will be done in first stage. Set of potential points will be discovered at second stage and after that RPs were chosen from the selected potential points with assistance of our proposed method so as to build path for mobile sink. At the end the sink experiences picked route to assemble data. The mobile sink stops at every RP so as to gather data; however before gathering the data from each node it communicates a notification to adjacent nodes and on getting the notification close-by nodes will send the data to the moving sink. The details of the suggested method are given beneath. Here, we initially build up a method for producing a potential points set. After that another method is used to get ideal number RPs from potential points. At that point an optimization strategy was connected to get more optimized RP to build a path which is delay effective for moving sink[16].

- **Potential points creation**

In this stage we produce and pick the potential points P keenly since it affects the structure of path of delay proficient in case of moving sink. For producing suitable potential points, initially we need to make sensor nodes haphazardly then ascertain the set for every sensor node and after that a straight line is drawn between the sensor nodes. After that the straight line middle point will be calculated by using Euclidian distance formulae. Purpose of using this method is that at any rate the middle point will cover 2 nodes under transmission range r and thus, it decreases the number of potential points and in this way the overall number of RP.

- **Choices of RP and assurance of path for sink**

Here the determination of RP from potential points P and then relating path for moving sink will be done. After the creation of potential points P= {p1,p2,…..pm}, we have to choose points which are ideal from P as RPs with the end goal through which the path of the selected RPs is delay proficient and ideal long. We need to pick some procedure by which we can choose least number of RPs so a greedy algorithm was utilized.

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The basic idea of this technique for choosing the RPs is as per the following. First we compute indegree for every potential point in P. From that point forward, the position having most extreme indegree and found closest from base station will be chosen as RP and that point will be incorporated into RP set.

At that point all nodes secured will be expelled from the arrangement of sensor nodes and points will be expelled from Potential point set P. again a similar procedure will be connected for remaining nodes and potential points in order to get next RP. This process will repeat till every nodes in the network is covered by selected points in RP. After this process the selected RPs will be optimized by using optimization method to get still more optimized RPs.

VI. RESULT AND DISCUSSIONS

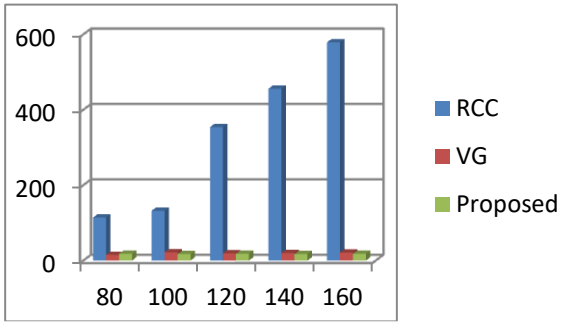

Fig.5.1 Number of RPs with fluctuating size in target area

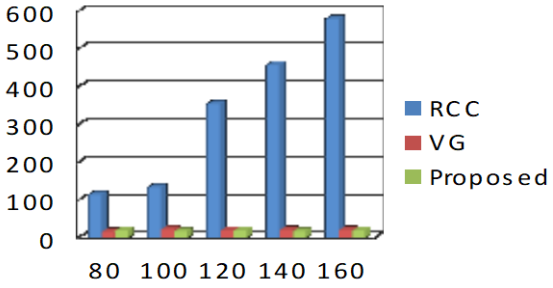

Fig.5.2 Number of RPs with fluctuating sensor nodes

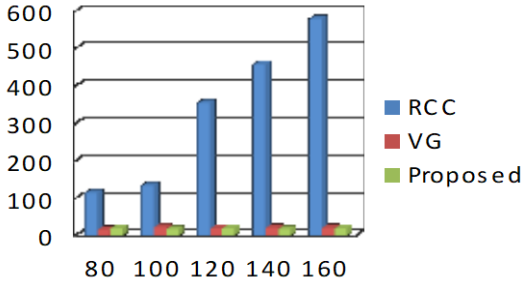

Fig.5.3 Number of RPs with fluctuating transmission range

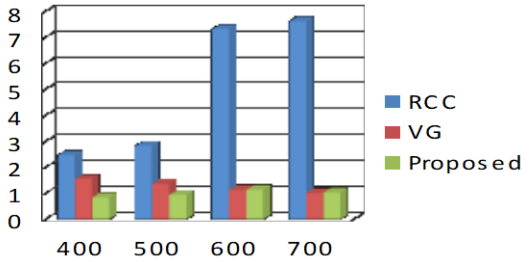

Fig.5.4 Travel Comparison

All the algorithms will run to compute the quantity of RP with fluctuating size in target area, number of nodes in the network and their transmission range. Fig.5.1, Fig.5.2, Fig.5.3 demonstrates the quantity of RPs in all algorithms with fluctuating size in target area, number of nodes in the network and their transmission range individually. The proposed method is appeared to limit the quantity of RPs in every situation.

VII. CONCLUSION

Energy utilization in wireless sensor network ought to be low so as to do that mobile sinks are utilized. Mobile sinks gathers the information from all the sensor nodes at rendezvous points. In this methodology at initial a strategy for producing a lot of potential points which go about as the potential points for RPs was utilized. At that point an Optimization method was used to get more upgraded points and then these points were utilized to build the path for moving sink. The proposed work was simulated with some present algorithms and outcome will be compared based on different performance metrics to demonstrate the viability of the present work.

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