Volume : 4 | Issue : 6 | Special Issue June 2015 • ISSN No 2277 - 8179

Hierarchical Mobile Sink Routing Protocols in Wireless Sensor Networks

Engineering

KEYWORDS:PSR, Energy efficiency, mobile sink, sensor node, wireless sensor networks.

Sreeja U.P. Student, Department of Computer Science and Engineering , MES College of Engineering, Kerala, India

Annes Philip Asst. Professor, Department of Computer Science and Engineering MES College of Engineering, Kerala, India

ABSTRACT

In wireless sensor networks recent developments to enable development of low power, low cost, sensor nodes that are small in size and communicate in the network. Network lifetime is enhanced by aggregation technique in which collect and aggregate in energy efficient manner. Energy consumption of sensor node must be controlled because of limited capacities of the batteries. Hierarchical routing is the one of the mechanism used to enhance lifetime of wireless sensor networks(WSNs) Hierarchical routing in the network provide better aggregation and scalability for sensor network with conserving energy in sensor nodes. In this paper we present a survey on hierarchical mobile sink routing protocols in WSN to make the energy efficient and improve lifetime of the network.

I. INTRODUCTION

Wireless sensor network [1] are highly distributed networks of small and light weight wireless nodes. There are deployed in large numbers. The network monitors the environment or system by measuring physical parameters like Temperature, Pressure, Humidity, Sound, Motion ,Vibration, Pollutants. Characteristics of WSN are Restricted energy resources, Concurrency processing, Self organization, Small radio range, Low cost, Data Centric, Application Specific, Scalability. WSN applications are Constant monitoring and detection of specific events, Military and battlefield surveillance, Forest fire and flood detection, Habitat exploration of animals, Patient monitoring and Home appliances. Data collecting protocols are three types Flat based routing, Hierarchical routing, Location based routing. Hierarchical routing protocols mainly based on hierarchical addressing, higher energy node processes and send message, lower energy node detect data in the network. Then establish a virtual hierarchy of nodes imposing different dynamic roles on sensors for decreases the load of advertising sink's location to the network.

II. RING ROUTING

It is a novel hierarchical routing protocol. This protocol [2] enforces three roles on sensor node, Ring node, Regular node, Anchor node. Regular node obtaining sink position information from the ring whenever necessary and Node disseminating their data through anchor node.

A. STEPS FOR RING ROUTING

Step 1: Ring Construction

First determine initial ring radius. Start from a certain node, Select ring node in a greedy manner, if starting node is reached. Else Procedure is repeated by selecting different neighbors at each hope. If ring not be formed after certain number of trials . Radius is set to different value and procedure is repeated. Perform neighbor discovery for each regular nodes.

Step 2: Advertisement of sink position

First select the Anchor Node(AN) when sink moves, selects closest node as its AN. For this purpose broadcast the AN Selection(ANS) packet. AN is selected depend on continuous link quality estimation. Use more resilient method: Beaconing. Deliver newly selected ANs position and MAC address information to the ring. Selection of a new AN, it sends an AN Position Information(ANPI) packet towards the ring. If AN outside ring, it sends ANPI packet towards network center. If AN inside ring, sends towards a point which resides on opposite direction of of network center. After a ring node receives an ANPI packet, it give this information by sending an AN Position Information Share (ANPIS) packet to its clockwise and anti-clockwise ring neighbors. Until the two ANPIS packets arrive at the same ring node. At this point all the ring nodes are known the position and the MAC address of AN.

Step 3: Obtaining Sink Position From the ring

AN Position Information REQuest(ANPIREQ) packet send towards the ring. Source nodes position is also in it because source node are send it. Ring node receive ANPIREQ packet generates an AN Position Information RESPonse (ANPIRESP) packet containing current AN's position. Sends it to the source node. Reception of ANPIREQ packet, then source node learns position of AN and Send data towards it. Then fetch AN position information from ANS broadcast it avoids unnecessary contact with ring. Ring routing uses this ability.

Step 4: Data dissemination

Once a source node receives a response (ANPIRESP) to its request (ANPIREQ) Learns position of AN and send its data directly to it.

Step 5: Ring change

Ring nodes are consume more energy. Switch roles with regular nodes. Select ring node candidates according to current ring change direction Ring node broadcasts a ring change (RC) packet informing ring candidates of their new role. Ring node drops their role and becomes a regular node. New ring node inform neighbors of their new role. If search in both directions fail, ring node continues to act as ring node.

III. AN ENERGY-AWARE GRID-BASED ROUTING SCHEME

Data Disperse between target and multiple mobile sinks. Uses a rerouting method [3] to reduce rerouting frequency. Introduce a Time-scheduling method for Manage the energy consumption of the grid.

A. STEPS FOR EAGER

Step 1: Construction of the virtual grid structure

Divides the monitored area in to a number of virtual grid cells Grid identification numbers the unique pair of number, identifies each grid cell. All sensor nodes located in same grid cell share the same GID. Location (x0, y0): geographic position of the origin of the monitored area. Before the sensor nodes are deployed, both the origin and grid size, are set as built-in system parameters for the sensor nodes. Grid size based transmission range Rtr. Communicate among 8 adjacent grid cells through radio channel. After deployment, each node calculates the GID of the grid cell.

Step 2: Election of the grid head

Grid head is coordinate elected by all member in grid cell. Responsible for disseminating data and managing all members. Election of the GH based on the first-mover rule. First, each node invokes a timer with random intervals and then broadcasts an election packet with its GID. If the node makes election attempt before it receives an elec-

tion packet from any other member, then this node becomes the GH. If the node receives an election packet before the timer expires, the attempt will be canceled. Once the GH has been elected, it will broadcast a hello packet with its GID to all members and all GHs in adjacent cells. Receiving hello packet, the members will turn their radios periodically. Keep only their sensing channels active until they sense a stimulus from a target. If the adjacent GHs receive the hello packet, they will record the GID of the sender of this packet, in their neighboring list.

Step 3: Time scheduling method for the grid head

Introduce a Time-scheduling method. It allows a number of the idle GHs to be asleep at any given time. Node has been elected as the GH, determine whether to keep radio active or inactive based on sum of x and y coordinates of its grid. If the sum is even, the GH will keep its radio active. Otherwise, the radio will be turned to allow the GH to sleep. Divides a time unit into 2n timeslots and assigns a fixed timeslot number for sleeping.

Step 4: Establishing an initial routing path

It is the key feature of the EAGER scheme. Before disseminating data, EAGER builds the initial routing paths from source to sink. Receipt of the data announcing message by means of a simple request-reply operation. Once a node becomes the source, it will report the sensing data to its local Grid Head (LGH). The LGH will check whether it has a routing path to the sink. If such a path exists, the LGH will disseminate the data directly. If not, it will flood a route request packet (REQ) to inform the source location and to find the accurate path to the sink. The GH is responsible for relaying REQ packet, and the REQ packet contains three fields. Identification number, Hop count, Visited list. Initially, the value of the hop count is zero and the list is empty. Receiving the REQ, the first step of the GH is to examine the identification number. Received a REQ, the GH will discard this packet to avoid the delivery loop. Otherwise, the GH will increase the hop count of this packet by one and append the visited list of that with its GID before flooding this packet. Receiving the REQ, the GH caches one REQ packet with the smallest hop number value. If the sink wishes to inquire the sensing data, then sends a query packet to its LGH. The sinks LGH will then check whether the route path exists. The path does not exist, this LGH will send back a route reply packet (REP) with the reverse visited path of its cached REQ to establish the initial route path. Once the sources LGH has received the REP packet establishment of initial route path complete.

Step5: Handling sink mobility

The mobile sink is location-aware and it also periodically check its current location. If the sink finds that it is in the same grid cell as during the last check, it does nothing. Otherwise, it will broadcast an INFORM-LOC packet containing its current and previous GIDs. On receiving the INFORM-LOC packet, the current sinks LGH is then responsible for sending a BUILD-ROUTE packet to attach the old routing path. The BUILD-ROUTE packet have the GIDs of two endpoints. Ending point is the sinks previous LGH and starting point is the LGH. The next hop for relaying is determined by the Relaying Next hop algorithm. Once the sinks previous LGH receives this packet, it will reply a BUILD-REPLY packet with the reverse relaying path. Receiving this BUILD-REPLY packet, the intermediate GHs will insert a new routing entry into their built-in RIT table. Once the LGH has received the BUILD-REPLAY packet and updated its RIT, the establishment of the new routing path for attachment to the original one is complete.

IV. MOBILE SINK BASED ROUTING PROTOCOL (MSRP)

In this method [4] combine two approaches ie, address hot spot problem and mobile sink approach. In the clustered WSN mobile sink moves for collect sensed data from the CHs. Mobile sink depend on residual energy of CHs. Hotspot problem minimized as the immediate neighbor of the sink is high energy node. It changes because of the regular sink movement. It results in a balanced use of energy in WSN and improves network life time. Forwarding data to the sink, consider mobile sink in clustered based network. In clustered sensor network, the whole sensor network is divided into small regions known as cluster. One node in each cluster is elected as Cluster Head (CH). Elected CH is capable for aggregating sensed data from its cluster member node and forwards it to base station or to the next CH. Then CHs in the neighborhood of the mobile sink forward their data to the sink. All CHs in WSN wait till mobile sink come in their neighborhood. All the CHs in the network forward their data to the mobile sink, when mobile sink reach in their neighbor. Hotspot is not formed around the sink as with the mobile sink movement, nodes in sink neighborhood changes all the time.

A. STEPS FOR MSRP

Step 1: Setup phase

During this phase the mobile sink send beacon message to the sensor nodes in its vicinity. Sensor nodes which happen to receive that message send registration message.

Initialization: Clustering is done and nodes send their data to the CH and then wait for mobile sink to come in its vicinity to send sensed data to it.

Mobile Sink Advertisement: Mobile sink broadcast beacon message to sensor nodes in its vicinity. which contains the location of the mobile sink.

CH Registration: All the CHs which receive mobile sink beacon message and responds by sending registration message to mobile sink.

Step 2: Steady phase

Mobile sink performs actual work for which it is moved in the network, data gathering.

TDMA Scheduling: Responsibility of mobile sink to assign the time slots to all the registered CH i.e. slots when the registered CH nodes can send the sensed data to the mobile sink. Consequently in this phase sink send the TDMA schedule to the registered CH.

Forwarding to Sink: In this phase, each CH use single hop or multihop communication to forward sensed data to the BS. It involves sending sensed data to the sink movement.

Sink movement: In this phase mobile sink takes the decision to move to the next place. Movement of the mobile sink in first movement cycle is according to pretended position. But to ensure balance used of energy movement of mobile sink in second and subsequent cycles are dictated by the residual energy of the nodes in network and mobile sink will move to higher Chs.

TABLE I. COMPARISON TABLE

Protocol	Data aggregation	Sink mobility	Protocol overhead	Hotspot mitigation
Ring Routing	No	Random	Low	High
EAGER	No	Random	Medium	Medium
MSRP	Yes	controlled	Medium	Medium

V. CONCLUSION

In this paper we present a comprehensive survey of hierarchical routing protocols in WSN. The three protocols namely Ring Routing, EAGER and MSRP. The WSN consist many sensor nodes to cooperatively reporting environmental situations in a region. The hierarchical routing technique is most suitable for large scale WSNs to reduce communication overhead. Data aggregation performed at cluster heads so there will be overhead at CH. If one CH fails aggregation possible in other clusters. So In MSRP is data aggregation but

sink mobility is controlled. In EAGER data aggregation is not possible. In Ring Routing to reduce the hotspots on the ring a local structure change method is used. So Ring Routing is an efficient routing to mitigate the hotspot problem.

ACKNOWLEDGMENT

We thank GOD almighty, who showered His abundant grace on us to make this paper. We express our heartfelt thanks and deep sense of gratitude to our Principal. We extend our deep gratitude to our Head of the Department for her valuable help and support.

REFERENCE

[1] M. Di Francesco, S. K. Das, and G. Anastasi, "Data collection in wireless sensor networks with mobile elements: A survey," ACM Transactions on Sensor Networks, vol. 8, no. 1, pp. 1–31, 2011. | [2] Can Tunica, Sinan lsik Yunus Donmez, "Ring Routing : An Energy Efficient Routing Protocol for Wireless Sensor Networks With a Mobile Sink," IEEE Transactions on Mobile Computing, oct, 2014. | [3] Yuan Po, Chang, "An Energy Aware Grid based Routing scheme for wireless sensor networks," Springer, 2013. | [4] Babar Nazir, Halabi, "Mobile Sink based Routing Protocol for prolonging network lifetime in clustered wireless sensor network," IEEE, 2010. | [5] J. Alkaraki, "Routing techniques in wsn" IEEE 2004.