International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:2682
Vol.4, No.1, January 2015 DOI:10.15693/ijaist/2015.v4i2.436-441

AALBA-R: Adaptive Dynamic Connectivity Hole Load-Balancing Geographic Routing in Wireless Sensor Networks

D.Punitha M.E.,
Assistant Professor,Department of ECE,
UCETW,
Madurai-625 104

N.Abirami,M.Alamelu,M.Karthigaiselvi
Student,Department of ECE,
UCETW,
Madurai-625 104.

Abstract:A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.A routing hole consist of a region in the sensor network where either nodes are not available or the available nodes cannot participate in the actual routing of the data due to various possible reasons. These holes can be formed either due to voids in sensor deployment or because of failure of sensor nodes due to various reasons such as malfunctioning, battery depletion or an external event such as structure collapse physically destroying the nodes. AALBA-R features the cross-layer integration of geographic routing with contention-based MAC for relay selection and load balancing (ALBA) as well as a mechanism to detect and route around connectivity holes (Rainbow). The protocol is localized and distributed, and adapts efficiently to varying traffic and node deployments.AALBA very wells with the traffic and proves back to back transmissions helps to maintain and reduce the overhead.

1.INTRODUCTION

Over the past decade we have witnessed the evolution ofwireless sensor networks, with advancements in hardware design, communicationprotocols, resource efficiency, and other aspects. Recently,there has been much focus on *mobile* sensor networks, and we have evenseen the development of small-profile sensing devices that are able tocontrol their own movement. Although it has been shown that mobilityalleviates several issues relating to sensor network coverage and connectivity,many challenges remain. Among these, the need for position estimationis perhaps the most important.

Not only is localization requiredto understand sensor data in a spatial context, but also for navigation,a key feature of mobile sensors. Distributed sensing and seamless wireless data gathering are key ingredients of various monitoring applications implemented through the deployment of wireless sensor networks (WSNs). The sensor nodes perform their data collection duties unattended, and the corresponding packets are then transmitted to a data collection point (the sink) via multihop wireless routes (WSN routing or convergecasting). The majority of the research on protocol design for WSNs has focused on MAC and routing solutions. An important class of protocols is represented by geographic or location-based routing schemes, where a relay is greedily chosen based on the advancement it provides toward the sink. Being almost stateless, distributed and localized, geographic routing requires little computation and storage resources at the nodes and is therefore very attractive for WSN applications. AWireless sensor network is a set of small devices,called sensor nodes, which are able to sense, process,and communicate data. Sensor networks have been deployedin environmental monitoring, precision agriculture,home automation, and other application areas in recentyears. One important issue among the various designchallenges in developing sensor nodes is to ensure network-wide wireless communication among a multitude ofnodes, each with limited transmission range and limitedprocessing capabilities while using a shared communicationmedium. A lot of effort has been invested in developingtopology control and routing strategies to reduce thecommunication overhead and guarantee message delivery.Geographic routing algorithms are most appropriate tomeet these requirements.

International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:2682
Vol.4, No.1, January 2015 DOI:10.15693/ijaist/2015.v4i2.436-441

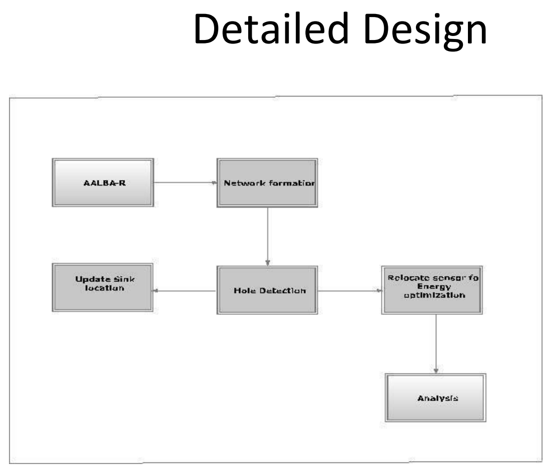

Fig.1. Block diagram

In this paper, we propose an approach to the problem of routing around connectivity holes that works in any connected topology without the overhead and inaccuracies incurred by methods based on topology planarization.Specifically, we define a cross-layer protocol, named ALBA for Adaptive Load-Balancing Algorithm, whose main ingredients (geographic routing, load balancing, contentionbased relay selection) are blended with a mechanism to route packets out and around dead ends, the Rainbowprotocol. The combination of the two protocols, called ALBA-R, results in an integrated solution for convergecasting in WSNs that, although connected, can be sparse and with connectivity holes.

II.RELATED WORK

A.HOLE DETECTION AND HOLE SIZE ESTIMATION

Voronoi diagram can be used to detect a coverage hole and calculate the size of a coverage hole [8, 9]. A Voronoidiagram for N sensors s1, s2,…,sN in a plane is defined as the subdivision of the plane into N cells each for one sensor, such that the distance between any point in a cell and the sensor of the cell is closer than that distance between this point and any other sensors. TwoVoronoicells meet along a Voronoi edge and a sensor is a Voronoineighbor of another sensor if they share a Voronoi edge. We refer the reader i for more discussions on Voronoi diagram and its applications.

A Voronoi diagram is first constructed for all stationarysensor nodes, assuming that each node knows its own andits neighbors' coordinates. Wang et al. [9] proposes alocalized construction algorithm to construct a localVoronoi diagram: Each node constructs its own Voronoicell by only considering its 1-hop neighbors. After the localVoronoi diagram construction, the sensor field is dividedinto sub regions of Voronoi cells and each stationary nodeis within a Voronoi cell. A node is a Voronoi neighbor ofanother one if they share a Voronoi edge. According to the property of a Voronoi diagram, allthe points within a Voronoi cell are closest to only onenode that lies within this cell. Therefore, if some points of aVoronoi cell are not covered by its generating node, thesepoints will not be covered by any other sensor andcontribute to coverage holes. If a sensor covers all of itsVoronoi cell's vertices,then there are no uncovered pointswithin its Voronoi cell; otherwise, uncovered points existwithin its Voronoi cell.

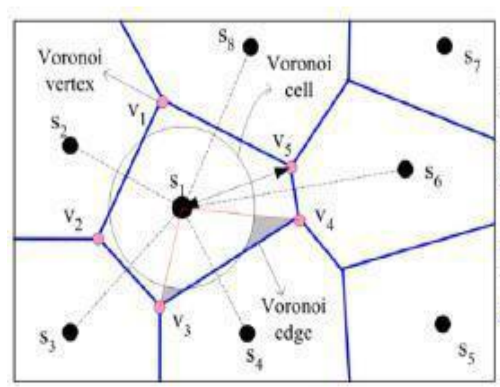

Fig.2. Illustration of using Voronoi diagram to detect coverage hole and decide the hole size.

B.THE RAINBOW MECHANISM AND ALBA-R

In this section, we describe Rainbow, the mechanism used by ALBA to deal with dead ends. The basic idea for avoiding connectivity holes is that of allowing the nodes to forward packets away from the sink when a relay offering advancement toward the sink cannot be found. To remember whether to seek for relays in the direction of the sink or in the opposite direction, each node is labeled by a color chosen among an ordered list of colors and searches or relays among nodes with its own color or the color immediately before in the list. Rainbow determines the color of each node so that a viable route to the sink is always found. Hop-by-hop forwarding then follows the rules established by ALBA.More formally, let x be a node engaged in packetforwarding. We partition the transmission area of x into two regions, called F and FC, that include all neighbors of x offering a positive or a negative advancement toward the sink, respectively .When x has a packet to transmit it seeks a relay either in F or FC according to its colorCk, selected from the set ofcolors fC0; C1; C2; C3; . . .g. Nodes with even colors C0; C2; . . . search for neighbors in F (positive advancement). Nodes with odd color C1; C3; . . . search for neighbors in FC (negative advancement). Nodes with colorCk, k _ 0, can volunteer as relays only for nodes with colorCk or Ckþ1. Nodes with colorCk,k> 0, can only look for relays with color Ck_1 or Ck. Finally, nodes with color C0 can only look for relays withcolor C0.3 The nodes assume their color as follows: Initially,all nodes are colored C0 and function according to the standard ALBA rules . If no connectivity holes are encountered, all nodes remain colored C0 and always perform greedy forwarding. Since the nodes on the boundary of a hole cannot find relays offering positive advancement, after a fixed number Nhsk of failed attempts, they infer that they may actually be dead ends and correspondingly increase their color to C1.4 According toRainbow, C1 nodes will send the packet away from the sink by searching for C0 or C1 nodes in region

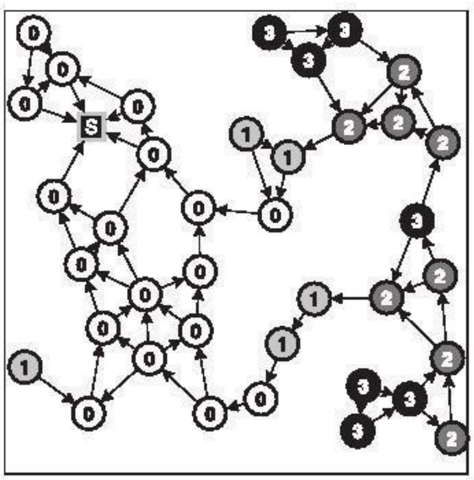

Fig.3. Rainbow coloring.

FC. If a C1 node cannot find C1 or C0 nodes in FC, it changes its color again (after Nhsk failed forwarding attempts), becoming a C2 node. Therefore, it will now look for C2 or C1 relays in F. Similarly, a C2 node that cannot find C2 or C1 relays in F turns C3 andstarts searching for C3 or C2 nodes in FC. This processcontinues until all nodes have converged to their final color. Note that, at this point, any node that still has color C0 can find a greedy route to the sink, i.e., a route in which all nodes offer a positive advancement toward the sink. In other words, once a packet reaches a C0 node, its path to the sink is made up only of C0 nodes. Similarly, packets generated or relayed by Ck nodes follow routes that first traverse Cknodes, then go through Ck_1 nodes, then Ck_2 nodes, and soon, finally reaching a C0 node. As soon as a C0 node isreached, routing is performed according to ALBA greedyforwarding. A sample topology where four colors aresufficient to label all nodes is given in Fig. 4. In the figure,the numbers in the nodes indicate the color they assume.Higher colors are rendered with darker shades of gray.

C..ALBA versus GeRaF and IRIS

We compare ALBA with two protocols that are exemplary of cross layer routing in dense WSNs, i.e., in network where dead ends are not likely to occur. The first protocol I GeRaF, one of the first cross layer protocols based ongeographic greedy forwarding. The other protocol iIRIS, which performs convergecasting based on a hop count metric and on a local cost function.ALBA achieves the best performance in terms of all investigated metrics (packet delivery ratio, per packet energy consumption, and end-to-end latency). It scales to increasing traffic much better than the other two protocols because of the effectiveness of the QPI-based selection scheme in balancing the traffic among relays, of its low overhead, and its being able to aggregate packets into burst. The ability of ALBA in balancing traffic is shown in Fig for a given topology with 300 nodes. It depicts nodes surrounded by “halos” colored depending on the amount of packets they handle. Nodes closer to the sink (square), as expected, are more congested (darker “halos”). However, traffic is fairly shared by the nodes.

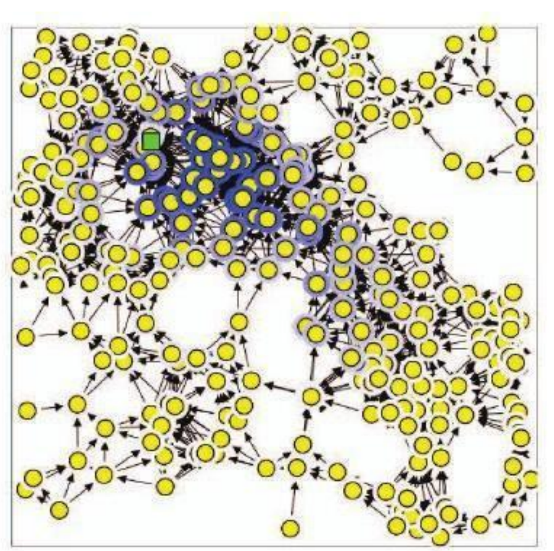

Fig.4.ALBA distribution of the traffic among nodes.

III .PROPOSED SYSTEM

The proposed scheme is to defend against coverage holeattacks.AALBA-R focuses on the forwarding capabilities in the relays.AALBA-R very well works with the traffic and proves back to back transmissions helps to maintain and reduce the overhead.

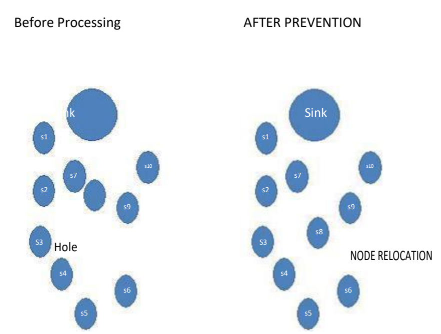

Fig.5. Hole detection and node relocation

They are an effective paradigm for distributed applications, and especially attractive in a dynamic network environment. It does not need any encryption or decryption mechanism to detect the sink hole attack . Proposed system gives an effective solution to recover from a Sinkhole attack in a Wireless Sensor Network.

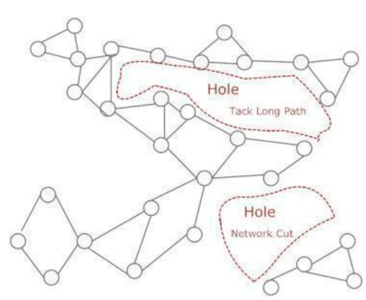

Fig.6. Occurrence of hole

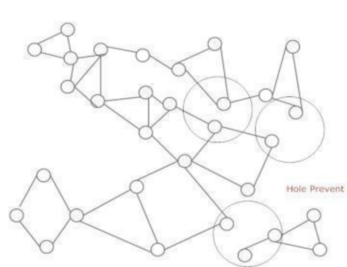

Fig.7. Relocation of nodes

The following are the step:

NETWORK FORMATION:In this model proposed a network architecture with nodes of 100.Simulated Area is about 2km * 2Km.We Initialize the node size, position, color in the network.

HOLE DETECTION:Finds least cost and energy efficient paths that meet the end-to-end delay during connection.To address this problem proposed a Class-based queuing model used to support best-effort and real-time traffic generated by imaging sensors.Experimental results shown that the greedy paths always find anyone of the source to destination, some of the routes were no longer available the holes are arise in those routing are detected.

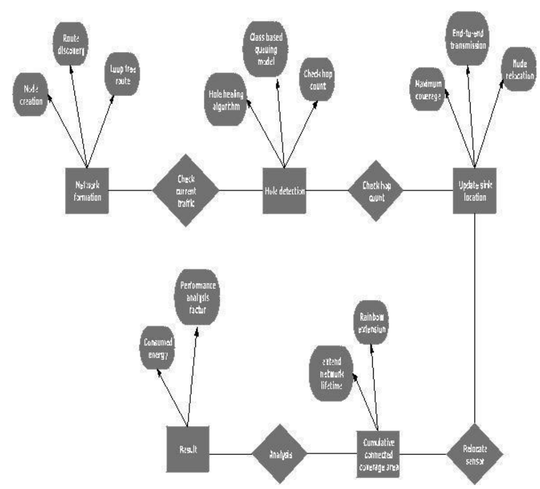

Fig.8.Entity Relationship diagram

UPDATE SINK LOCATION:After deciding the existence of a coverage hole and its size, a stationary node needs to decide the number of mobile nodes and the target locations of these mobile nodes to heal its holes.We want to aim maximum coverage so after calculate the area of hole we choice one of the circum circle or in circle type.If the area is less than mobile sensor sensing region we use the circumcircle center for target location, if area of hole is larger than sensor sensing reign we use the in circle center for target location to aim maximum coverage

RELOCATE SENSOR FOR ENERGY OPTIMIZATION:The primary motivation of our algorithm is increasing CC, cumulative connected coverage ratio, of the WSN. It is mentioned above that, in order to reach this goal, maximization of connected coverage as well as extending network lifetime at the same time is required, both of which largely depends on low energy consumption, meanwhile appropriately utilizing the consumed

International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:2682
Vol.4, No.1, January 2015 DOI:10.15693/ijaist/2015.v4i2.436-441

energy.Simulation results shown that the packets are sent through loop free routes.Rainbow extension to ALBA always found loop-free routes.

IV. PERFORMANCE EVALUTION

. In the simulated scenarios, nodes experience a higher number of transmission attempts per packet, a higher average duration of each contention and a much higher probability that a node backs off for lack of an available relay. For instance, the simulated contention time is from 10% to 77% higher than that measured in the testbed. This is because it is typically easier to find a relay in practice (testbed) than in the simulations, where links with high PER are not included in the simulated topology. These links are instead sometimes used successfully to advance packets in the testbed. As expected, the difference is less remarkable for $d = 0.3$, as there is a higher chance to find an awake relay. In the case of higher traffic and longer duty cycles ($\lambda = 1.0$ and $d \geq 0.1$), all behaviors contributing to latency in the low to medium traffic cases are still observed. However, the impact of re-transmissions because the channel is sensed busy ("backoff busy") becomes dominant. The sporadic transmissions over longer links observed in the testbed results in higher chances that transmission is detected through carrier sensing, causing a higher number of "backoff busy" and making latency on the testbed higher than that measured through simulations.

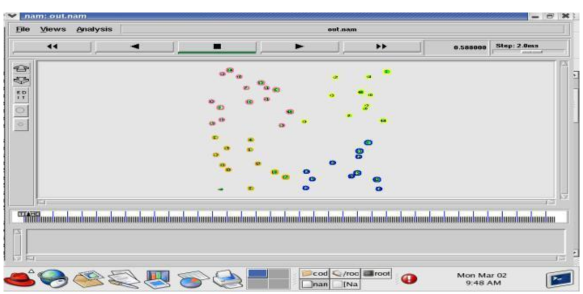

Fig.9.Node formation

V. PERFORMANCE METRICS

Gnu plot is a command line driven graph plotter tools for us to generate graphs. The common graphs that are looking forward to present the resource performance per seconds, hours, days, weeks or months are usually plot graphs, which it consist of lines and dots. Gnu plot allows us to read the data from text files which contains values intabular format. It will be called in plot files to draw the graph.In the proposed system Gnu plot is used to plot the graph with the given simulation parameters. The simulation parameters values are assigned in X, Y axis.

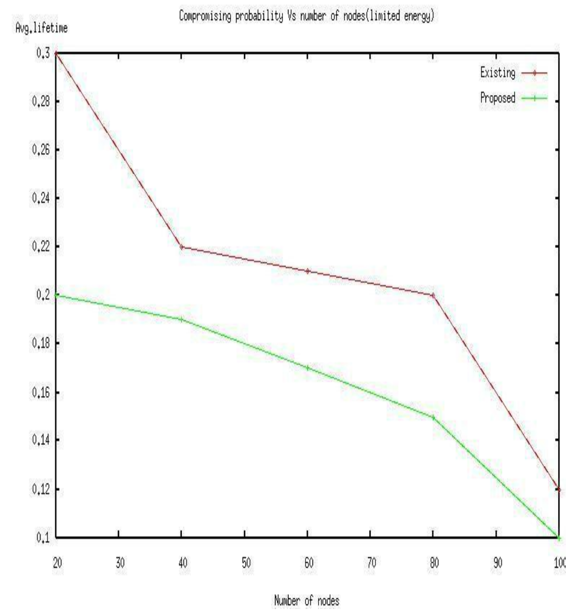

Fig.10.Energy efficiency

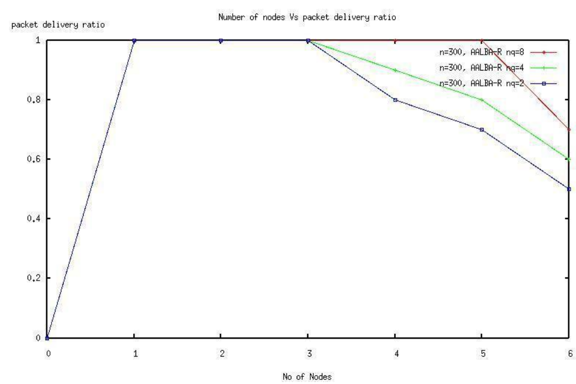

Fig.11.Packet delivery ratio

VI.CONCLUSIONS

Proposed an energy efficient adaptable routing protocol that will performs the routing with loop free routes.Loop free routes are colored, depends on the color ,node identifies to establish the route.Holes are detected and it is prevented using hole-healing algorithm for the targeted mobile location.Simulation results shows that the proposed system reduces the energy consumption in order to maximizes the network lifetime, reduces the end-to-end delay and increases the throughput compared with the existing one.RS routing is designed for static WSNs. It requires stable neighborhoods during the contention period. To avoid being trapped in a loop due to mobility, edges created after entering recovery mode should be ignored For highly mobile networks, the RTS-CTS messages could be omitted and the data sent directly as in BLR without subsequent selection by the forwarder . Then, an increase in success rate at the cost of message duplication can be expected.

REFERENCES

[1].C. Petrioli, M. Nati, P. Casari, M. Zorzi, and S. Basagni, “ALBAR: Load-balancing geographic routing around connectivity holes in wireless sensor networks,” IEEE Transactions on Parallel and Distributed Systems, 2013, in print.

[2]. S. Basagni, M. Nati, and C. Petrioli, “Localization Error-Resilient Geographic Routing for Wireless Sensor Networks,” Proc. IEEE GLOBECOM, pp. 1-6, Nov./Dec. 2008.

[3]. A. Camillo` , M. Nati, C. Petrioli, M. Rossi, and M. Zorzi, “IRIS:Integrated Data Gathering and Interest Dissemination System for Wireless Sensor Networks,” Ad Hoc Networks, Special Issue on Cross-Layer Design in Ad Hoc and Sensor Networks, vol. 11, no. 2, pp. 654-671, Mar. 2013

[4]. I. Stojmenovic, “Position Based Routing in Ad Hoc Networks,”IEEE Comm. Magazine, vol. 40, no. 7, pp. 128-134, July 2002.

[5]. K. Seada, A. Helmy, and R. Govindan, “On the Effect ofLocalization Errors on Geographic Face Routing in SensorNetworks,” Proc. IEEE/ACM Third Int’l Symp. Information Processing in Sensor Networks (IPSN ’04), pp. 71-80, Apr.

[6].Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "Wireless sensor networks: a survey," Computer Networks, vol. 38, 2002. [CrossRef]

[7].Feng Zhao, Leonidas Guibas: "Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2004.

[8].Hairong Qi, Yingyue Xu, Xiaoling Wang, "Mobile-Agent-Based Collaborative Signal and Information Processing in Sensor Networks," in Proceeding of the IEEE, Vol. 91, NO. 8, pp.1172-1183, Aug. 2003

[9].Hairong Qi, Iyengar, S., Chakrabarty, K., "Multiresolution data integration using mobile agents in distributed sensor networks," IEEE Transactions on Systems, Man and Cybernetics, Vol.31, No.3, pp. 383-391, Aug. 2001

[10].Wu, Q., Rao, N.S.V., Barhen, J., etc, "On computing mobile agent routes for data fusion in distributed sensor networks," IEEE Transactions on Knowledge and Data Engineering, Vol.16, NO. 6, pp. 740-753, June 2004.

AUTHORS PROFILE

D.PUNITHA received her A.M.I.E., degree in Electronics and Communication Engineering from the Institution of Engineers(India), in 2008. And M.E. degree (VLSI Design)from Sethu Institute of Technology, Tamilnadu, India.at present working as a assistant professor in ultra college of engineering and technology for women. Her research interest includes: low Power VLSI and Testing of VLSI circuits.

M.Karthigaiselvi currently doing the**B.E.** degree in electronics and communication engineering from the ultra college of engineering and technology for women, Madurai.

N.Abirami currently doing the**B.E.** degree in electronics and communication engineering from the ultra college of engineering and technology for women, Madurai.

M.Alamelu currently doing the**B.E.** degree in electronics and communication engineering from the ultra college of engineering and technology for women, Madurai.