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AN IMPROVED RELIABLE REACTIVEROUTING ENHANCEMENT FOR WIRELESS SENSOR NETWORKS

[1]Dr.S.M.NANDHAGOPAL., M.E.,Ph.D, [2]A.MOHANRAJ (M.E-CSE)
[1]Associate Professor, Department Of Computer Science and Engineering,
ASL Pauls College of Engineering and Technology, Coimbatore, Tamil Nadu, India.
[2]Assistant Professor, Department Of Computer Science and Engineering,
ASL Pauls College of Engineering and Technology, Coimbatore, Tamil Nadu, India.

ABSTRACT: *In wireless detector network routing may be a terribly difficult drawback owing to the inherent characteristics that differentiate such networks from alternative wireless networks. In recent years, several algorithms are planned for the routing issue in wireless detector networks. In existing bestowed the Reliable Reactive Routing sweetening (R3E) to extend the resilience to link dynamics for WSNs/IWSNs. R3E is meant to reinforce existing reactive routing protocols to supply reliable and energy-efficient packet delivery against the unreliable wireless links by utilizing the native path diversity. to maximize the network survivability by mistreatment equal energy among as several nodes as potential, this paper presents an improved R3E (IR3E) that is that the combination of a completely unique load reconciliation multipath routing formula and Signal strength and Energy Aware routing protocol (SEA-DSR). The sensor networks area unit created into a layered network. Supported the layered network, we tend to propose a load balanced formula for constructing multiple routing ways to transmit information. This model defines a metric referred to as responsibility issue for route choice among the possible routes. The SEA-DSR directly incorporates signal strength and residual battery capability of nodes into route choice through cross layer approach.*

Key Words: *Sensor Networks, Routing, Energy Aware, Balancing Multipath Routing Algorithm, Reliable Forwarding, Opportunistic Routing, Unreliable Wireless Links, Reliable Routing, Link Stability, Residual Energy.*

1.INTRODUCTION

A wireless detector network incorporates an oversized variety of cheap, low power and multi-functional detector nodes. Detector nodes have power provide unit, sensing parts to collect info, processing unit and communication unit to transmit and receive knowledge. In general, detector nodes square measure powered, therefore it's necessary to attenuate the ability consumption of detector networks to maximize their post-deployment active life, that is that the most life downside of wireless detector networks.

In wireless detector networks, energy potency is a vital metric that directly influences the network life, therefore the energy-aware protocols square measure needed at every layer of the protocol stack. Akyildiz et al. gave a survey on the particular optimizations at totally different protocol layers [25].

For instance, at network layer, it is extremely fascinating to develop the energy-efficient routing algorithms for routing the invention from the detector nodes to the sink node so the network life is maximized.

Routing in wireless detector network may be a terribly difficult downside attributable to the inherent characteristics that differentiate such networks from different wireless networks like accidental networks and cellular networks [26]. In recent years, several algorithms are projected for the routing issue in wireless detector networks.

The routing protocols may be classified into flat-based, hierarchical-based and location-based in line with the network structure [27]. During this paper, we have a tendency to specialize in the load equalization multi-path flat routing protocol in WSNs. It prices three Joules of energy to transmit one computer memory unit of knowledge a distance of 100m [29]. On the opposite hand, a general purpose processor with a modest specification a hundred million instruction per second (MIPS) process capability will execute three hundred million directions for a similar quantity of energy.

Therefore, it's fascinating to conserve energy of the detector nodes within the networks whereas routing question responses back to the sink node. Because the detector networks have restricted resource, if all detector nodes transmit packets on to the sink node, the furthest nodes from the sink node can die early. On the opposite hand, among detector nodes transmission packets through multiple hops, detector nodes highest to the sink node tend to die early, casing network partition and also the routing algorithms that use fastened methods in ancient wired networks aren't appropriate for detector networks.

Detector nodes that find within the fastened path suffer server energy consumption and exhaust quickly as a result of the supply relaying services to variety of compatriots. This extreme unfair load sharing between the detector nodes on the trail and also the different nodes incurs the network separating. additionally, applying the fastened methods routing mechanism to detector networks [1, 2] should pay the prices of sporadically re-establishing the methods as a result of detector networks don't have pre-planning infrastructure typically. Load equalization is particularly helpful in energy affected detector network as a result of the relative energy of the nodes will have an effect on the network life over their absolute energy. With classic shortest path routing schemes, some nodes that lie on several of those shortest methods square measure depleted of their energy at a way quicker rate than the opposite nodes. As a result of these few dead nodes, the nodes in its neighborhood might become inaccessible, that successively cause a ripple impact, resulting in network partitioning. Once all sensors have equal initial energy and equal probabilities to become sources, network might maximize its life if all detector sensors dissipate energy at a similar rate, since no loss of connectivity would result from node failure. In [28], Chang Jiang and Tassiulas have well-tried forward every node to own a restricted life; the life of the network may be improved if the routing protocol minimizes the inequality within the residual energy of each node, instead of minimizing the whole energy consumed in routing. During this paper, we have a tendency to propose a brand new methodology to balance energy consumption and keep approximate network wide energy equivalence by equalization the network load. Our approach concentrates on a way to change the routing methods so as to equalization load. within the projected theme, every node will balances the energy consumption overall network caused by routing while not knowing world info and only 1 network traversing is required rather than maintaining the total network standing all the time. Many routing protocols are projected for WSNs. supported the route discovery principle; we will classify them into either proactive or reactive. Proactive routing protocols update routes for each try of nodes at regular intervals regardless of their demand. The reactive or on-demand routing protocols, verify route only if there is a desire to transmit a knowledge packet, employing a broadcasting query-reply (RREQ-RREP) procedure. Most of those protocols use min-hop because the route choice metric. It is found that shortest path route has short life, particularly in extremely dense accidental networks even with low quality, attributable to edge impact. They are doing not address the problem of reducing the trail breakage throughout knowledge transmission. In most of the on-demand routing algorithms it will take a while to sight the link failure once that, route recovery and maintenance procedures square measure initiated These procedures consumes substantial quantity of resources like information measure, power, process capability at nodes and additionally introduce further delay.

Choosing routes that endure durable scale back the chance of route failure and route re-discovery method that significantly improve the network performance of ad-hoc networks. Link stability indicates however stable the link is and stability primarily based routing protocols tend to pick out methods that square measure long route. Signal strength, pilot signals, relative speed between nodes square measure the parameters used for the computation of link stability. Life of network is significantly reduced by inefficient consumption of battery. Power-Aware routing ensures that the mean solar time to node failure is inflated considerably.

2.RELATED WORK

We initial expose relevant analysis work associated with signal strength based mostly routing. Then, we are going to specific however our approach combines each the signal strength and energy metrics, to search out reliable path for communication and extend the network life. Most of the routing algorithms planned for painter is predicated on reactive routing strategy, during which route is established only if there is a necessity to transmit a packet. In these protocols route recovery and maintenance procedures area unit initiated solely when a route break. This procedure consumes further information measure and power at process nodes and additionally will increase the delay. It’s necessary to search out routes that last longer, to scale back the route breakage and consumption of resources. In [8], Link stability is outlined as a live off however stable the link is and the way long the communication can endure. Signal Strength is one among the parameter wont to estimate the steadiness of links. In [9], the route discovery is predicated on signal strength and site stability of nodes.

In SSA, a mobile node determines the typical signal strength at that the packets area unit changed between nodes and site stability is employed to settle on longer-lived route. Sulabh Agarwal and Pal Singh propose RABR [10], during which the route choice is finished supported the intelligent residual life assessment of the candidate routes. This major challenge with this protocol is, to settle on the optimum threshold values. In [11], the authors calculable the link stability supported the signal strength. If the received signal strength is larger than a definite threshold, the link is taken into account to be stable. In [12], Min-Gu and Sunggu lee planned a route choice supported Differentiated signal strength [DSS]. DSS indicates whether or not the nodes obtaining nearer or getting farther apart. If the signal strength is obtaining stronger, the link is taken into account to be stable. If the signal strength is obtaining weaker just in case of node moving away is taken into account to be unstable link. In [13], N.Sharma and S.Nandi propose RSQR, during which the link stability and route stability area unit computed mistreatment received signal strength. Supported the brink values the links area unit classified as stable or unstable link.

Link stability and link uncertainty values area unit used for stable route choice among all the possible routes. Gun Woo and Lee propose EBL [14], during which the authors offer importance to all link stability and therefore the residual Battery capability. The EBL not solely improve the energy potency however additionally scale back network partition. Floriano and Guerriero propose LAER [15], during which they take into account joint metric of link stability and energy drain rate into route discovery, which ends in reduced management overhead and balanced traffic load. The expected route life is principally expected with the parameters node battery energy and link stability.

It's preferred to pick out stable links i.e. links having longer expected life, rather than choosing weak links that break presently and introduce routing overhead [16]. In [17], Guerriero propose PERRA, and reactive routing protocol, that accounts each link stability and power potency. Intermediate nodes in PERRA propagates route request, given that it meet the energy demand specific by the supply node. Thus, the trail established may be a stable path that incurs residual energy, path stability and calculable energy for information transmission. It additionally maintain alternate path, which might be used before link break happens to scale back the trail breakage.

Management overhead is greatly reduced because of affected flooding and maintenance of alternate path. Flooding is natural for wireless detector networks; however it consumes an excessive amount of energy on relaying unnecessary information. Several variant of flooding have designed as routing protocols for detector networks. For instance, GRAdient Broadcast (GRAB) [18] sets up price field by flooding. Well-known Directed Diffusion [19] uses restricted flooding an acknowledgement theme to line up route. Geographical and Energy Aware Routing (GEAR) [20] bounds flooding to satiny low region. Rumor protocol is Associate an integration of Gossip and GRAB. It combines question flooding and event flooding. Cluster-based schemes [8] that kind detector nodes to clusters or a series are introduced to assemble information.

In cluster-based schemes, each detector node should be able to adapting its radio power that increase manufacture prices of every detector node. Besides, the information delivering delay is long bonded. Considering the load balance of detector nodes and therefore the restricted memory areas, dynamic multi-path routing schemes [9, 10] was planned for detector networks. In multi-path routing theme [9, 10], detector nodes have multiple methods to forward their information.

On each experience information sends back to sink, detector node picks up one among its possible methods supported special constrains like most offered energy, minimum delay times, or security. Multipath routing has the benefit on sharing energy reduction between all detector nodes. On the other hand, the downside of the multipath routing is that detector nodes solely keep a neighborhood read on energy usage and nodes in network can't have even traffic dispatch. Thus, this paper focuses on a way to get a world read on energy of detector nodes be exchanging the native info of every detector node and provides an improved load sharing over all detector nodes.

The minimum energy routing shortcoming is notified in [21, 22, 23]. The minimum total energy routing approaches in these papers area unit to attenuate the full devoured energy. However, if every the traffic is routed all the way through the minimum energy path to the target, the nodes on the trail can run out of batteries quickly cacophonous different nodes useless because of the network partition even though they are doing have offered energy.

In most network life, routing drawback has been self-addressed in [24]. In [25], the matter of getting bounds on the network life was self-addressed once the likelihood of the information aggregation at some detector nodes was thought-about. In [24], this drawback was known as a applied math drawback, and it had been extended to the multi-commodity case in [26].

The matter with the constant information-generated rate case and a few absolute information-generation method models were thought-about in [26] and [27], severally. In [28], the matter of getting bounds on the network life was self-addressed once the nodes have the restricted information measure and therefore the affected battery energy, then the unvarying algorithms was planned.

2.1 Improved Reliable Reactive Routing Enhancement

In this section, we tend to present the Improved R3E practical design summary, followed by an in depth description of R3E style, that is compatible with most existing reactive routing protocols in WSNs/IWSNs.

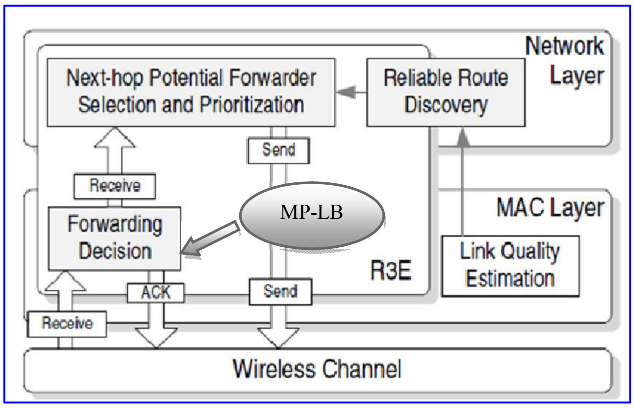

Fig 1: Functional architecture overview of IR3E

Fig. 1 illustrates an outline of the practical design of IR3E, that could be a middle-ware style across the mackintosh and therefore the network layers to extend the resilience to link dynamics for WSNs/IWSNs. The R3E sweetening layer consists of 3 main modules, the reliable route discovery module, the potential forwarder choice and prioritization module, and therefore the forwarding call module. During this work the helper node and potential forwarder area unit will be interchangeable. The reliable route discovery module finds and maintains the route data for every node. Throughout the route discovery part, every node concerned within the cooperative forwarding method stores the downstream neighborhood data. That's to mention, once a node is a forwarder, it already is aware of the next-hop forwarding candidates on the discovered path. Once a node with success receives an information packet, the forwarding call module checks whether or not it is one in every of the supposed receivers.

If yes, this node can cache the incoming packet and begin a backtrack timer to come back Associate in Nursing ACK message, wherever the timer worth is expounded with its ranking within the supposed receiver list (called forwarding candidate list). If there's no different forwarder candidate with higher priority transmittal Associate in Nursing ACK before it's backtrack timer expires, it will broadcast an ACK and deliver the packet to the higher layer, i.e., trigger a receiving event within the network layer. Then, the potential forwarder choice and prioritization module attaches the ordered forwarder list within the information packet header for consequent hop. Finally, the outgoing packet are submitted to the MAC layer and forwarded towards the destination.

The potential downside in current routing protocols is that they have a tendency to seek out rock bottom consumption ways for every route and use the trail for all communication between the supply nodes and destination nodes. However, from the appraisal of the network period this can be not a decent mechanism, it's going to cause unbalanced load distribution within the network. Unbalanced load reduces him period of the extremely loaded node and therefore the energy depletion invariably converges on a number of the nodes that area unit on the simplest ways and should cause network partition. To avoid such partitioning, the consumption energy is wireless network should be distributed fairly across all nodes. During this paper, we tend to propose a brand new routing theme known as Multipath Load-Balanced routing (MP-LB). The fundamental plan of the planned theme is that every device node chooses its next hop node in step with the honest load of its next hop node. To do this, the device network is built as bedded network and every device node computes its honest load according the common load of its layer. To introduce the MP-LB theme, we tend to divide the planned MP-LB theme into four phases: Topology Constructing, Load Balancing, information forwarding, and Routing Maintenance. Topology Construction part is for putting in places the configuration.

Load Balancing is to calculate the fair load of all sensor nodes; Data Transmission is the working phase that is the sensor network creates its task; Routing Maintenance is to adjust the fair load of the sensor node whose energy has reduced a specified value. In general, the wireless sensor networks can be converted into a graph $G = (V, E)$ in that each node is set V locates for a sensor node (including the *Sink* node), an edge (u, v) is in *E* if sensor nodes *u* and *v* can converse each other straightforwardly. We guess all the nodes in the networks are homogenous except the *Sink* node that is the initial battery energy and the transmission power of all the sensor nodes are similar, while there is not battery restriction for the Sink node. According to the hop distance from a node to the sink node the routing models the sensor network into levels. A node is in level L, if it is L hops apart from the sink node which is a $level\ 0$ node. All nodes that can talk directly with at least one level *L* node but cannot converse directly with any level $L - 1$ node are described as Level $L + 1$ node. As a result, level N nodes have path length of L hops reverse to the sink node. The layered network can be constructed as follows:

ALGORITHM 1: The layered network construction

1. Procedure construct_network layer. Let hop count $h_v - \propto$ and node u, v , packet(p) also sink set $h_s = 0$
2. Broadcast h_s →neighbors.
3. check u : $msg()$ then call extract()
4. extract(h, p)
   i. $if\ h > h_u, v \leftarrow son\ of\ u.$
   ii. (2) $if\ h = h_u, v \leftarrow$ Sibling $of\ u.$
   iii. (3) $if\ h = h_u$-1, $\leftarrow parent\ of\ node\ u.$
   iv. (4) $if\ h < h_u$-1, $\leftarrow parent\ of\ node\ u.$
5. Re-broadcast $h_u = h + 1\, h_u$ →neighbors.

Through broadcasting the packet and comparing *h* with h_u step by step, the layered network can be constructed. At last, each node is aware of its minimum hop count to sink node, and knows its parent nodes, sibling nodes and son nodes.

ALGORITHM 2: MP-LB algorithm

1. Procedure call construct_network layer. Let node $u \rightarrow$ leaf node. $u\ (packet(D_u, S_{uv})) \rightarrow v$ Where, $D_u = L_u\ and\ S_{uv} = L_u \times \frac{F_{uv}}{\sum_{i \in FS_i} F_{ui}}$
2. $v \leftarrow (packet(D_u, S_{uv}))$ then add (S_{uv}, L_v). $v\ (packet((D_v, S_{vw})) \rightarrow w$ Where, $D_v = D_u \parallel L_v\ and\ S_{vw} = (L_v + S_{uv}) \times \frac{F_{vw}}{\sum_{i \in FS_i} F_{vi}}$
3. Compute average load AL of each layer
4. $u \leftarrow AL$ changed load $CV \rightarrow$ son nodes. Here,

$$CV = (L_i - AL) \times \frac{SL_{ij}}{\sum_{K \in SS} SL_{ik}}, if\ L_i > AL$$

$$CV = (L_i - AL) \times \frac{1/SL_{ij}}{\sum_{K \in SS} 1/SL_{ik}}, if\ L_i < AL$$

2.2 Route Discovery at Intermediate nodes

If an intermediate node obtains a RREQ packet from its neighbor, it calculates the potency at which it established the packet and energy level of the node. If the signal strength is higher than the threshold value $CN(i,j)$, then consistency count is increased by $H(i,j)$ otherwise it is increased by (t_{ij}, p).

Subsequent to this the RREQ is broadcasted. Intermediate nodes are not permitted to respond for the RREQ it received. If node energy is lower than t_{ij} or signal strength is less than (t_{ij}, p), the RREQ is dropped.

ALGORITHM 3: Route Discovery at Intermediate nodes

1. Procedure: void $RecvRREQ\ (Packet\ * p)$
2. if $Non - duplicate\ RREQ$ then
3. if $vj\ is\ the\ destination\ node$ then
4. release RREP;
5. else
6. $CN(i,j) = N(i) \cap N(j)$;
7. *//obtain common neighbor set* $CN(i,j), vk \in CN(i,j)$;
8. Sort $CN(i,j)$ descending ordered by $P_{ik} P_{kj}$;
9. $H(i,j = \{c_{n1}\}, CN(i,j) = CN(i,j) - \{c_{n1}\}$;
10. *//* c_{n1} *is forever the first item of* $CN(i,j)$;
11. while $CN(i,j) = \emptyset$ do
12. if CheckConnectivity$(H(i,j),\ c_{n1})$ then
13. *//* c_{n1} *is within the transmission range of any node in* $H(i,j)$;
14. $H(i,j) = H(i,j) \cup \{c_{n1}\}$;
15. end
16. $CN(i,j) = CN(i,j) - c_{n1}$;
17. end
18. Calculate tij and call $Backoff(t_{ij}, p)$;
19. *//schedule a timer whose value is* t_{ij} *, then call* $forwardRREQ(p)$ *when the timer terminates;*
20. *Call* $MP - LB\ ()$
21. end
22. else
23. Drop(*p*);
24. end

2.3 Route Selection at Destination Node

When the purpose node obtains the first RREQ and it accumulates all the RREQ particulars in the route cache.

Subsequent to the timer terminates; it discovers the path with maximum dependability factor and sends the RREP to it. The whole route demand that appears after timer concludes will be dropped.

ALGORITHM 4: Route Selection at Destination Node

1. Procedure: void $RecvRREP\ (Packet\ * p)$
2. if $Non - duplicate\ RREP$ then
3. if $v_j == v_{i-1}$ then
4. Mark for my part as a guide node;
5. Record v_i and $H(i-1, i)$;
6. Acquire RREP's next-hop node id v_{i-2};
7. Fix v_i , $H(i-1, i), v_{i-1}$ and $H(i-2, i-1)$ to RREP;
8. */** v_{i-2} *is* v_{i-1}*'s upstream guide node; the partner set is ordered descending by the PRR toward the downstream guide node;*/*
9. Call $forwardRREP(p)$;
10. else if $v_j \in H(i-1, i)$ then
11. *//*v_j *is a partner in* $H(i-1, i)$;
12. Record $v_{i+1}, H(i, i+1), v_i$ and $H(i-1, i)$;
13. Drop(*p*);
14. else
15. Drop(*p*);
16. end
17. else
18. Drop(*p*);
19. end

3. CONCLUSION

We presented a novel multipath load balanced routing scheme for wireless networks that deals with the difficulty of spreading routing load in the network to make certain uniform energy utilization in the network . The SEA-DSR suggested for dependable route discovery and route preservation in MANET. The suggested routing strategy considerably enlarges the time to network partition and decreases the path breakage through balanced energy utilization at the intermediate nodes. We in addition presented IR3E that can expand most existing reactive routing protocols in WSNs/IWSNs to endow with reliable and energy-efficient packet delivery in opposition to the unreliable wireless associations.

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Dr.S.M.Nandhagopal completed his B.E. (Computer Science and Engineering) in 2004 from Dr.Pauls Engineering College under Madras University and M.E. (Computer Science and Engineering) in 2009 from Vellalar College of Engineering & Technology under Anna University, Coimbatore. Ph.D (Computer Science and Engineering) in 2013 CSJM University at kanpur,He is working as an Assistant Professor, Department of Computer Science and Engineering at ASL Pauls College of Engineering & Technology, Coimbatore. He is a member of various professional bodies like ISTE, IEEE and IAENG. His research areas include ADHOC networks, and Wireless Sensor Networks and having 7 years of teaching experience in Engineering Colleges.