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Research Article

Efficient Routing Techniques for Congestion Mitigation in Wireless Sensor Networks

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ABSTRACT

The previous routing approaches like Purely random propagation(PRP),Non-repetitive purely random propagation (NRRP),Directed random propagation (DRP)perform the routing of packets without considering congestion might occur. When the intermediate nodes receive a substantial quantity of packets they directly drop the packets. The second problem is that will occur back and forth propagation which decreases the effectiveness of the net-work and increases route discovery time. The intention is to find out the routes in the net-work without any back and forth propagation on order for the packetwilln't be send back and forth between nodes (optimized routing algorithm).The second aim in algorithm will find out the motive of congestion and the packets will be send through alternate paths by considering buffer occupancy factor and power level of nodes the network. The paths will be sent through dispersive routesin order for theadversarydoesnottake thepackets. Thepacketswillbesendthroughthepathwho'sround trip moment will be minimum.

Keywords: **PRP, NRRP, DRP, Optimized algorithm, DAlPa's algorithm, TARA algorithm, Congestion Control, Power utilization, route discovery time.**

1. INTRODUCTION

Wireless Sensor Networks (WSNs) are wireless networks made up of geographically dispersed independent gadgets' that work together to jointly observe environmental or physical parameters including pressure, motion, sound, vibration, temperature.

, or pollutants at various locations. In classic routing, the procedure is deterministic. Once a malicious node learns how data is routed From the beginning to the end, it may calculate the routes, modify the data, or intercept the data, jeopardizing the transmission. Additionally, Certain routing algorithms presume nodes' positions are fixed , It's not achievable to use mobile ad-hoc networks.for them to live their full lives.where nodes can change positions over time. Earlier routing algorithms did not address congestion control effectively. In some previous systems, congestion was determined by directly sending a packet; Should the source node fail to obtainan acknowledgment (ACK) packet, it assumed there was congestion and reinitiated the conveyance within packet through the same or a different route

Nodes of sensors are in-expensive, lightweight, tiny gadgets with limited battery life. Congestion occurs when the load that is offered exceeds the network's available ability, there are 2 methods for managing congestion:either raising capacity (resource control) or

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decreasing the offered load (traffic control).Every strategy has particular benefits'&drawbacks' placed on the situation. Generally, traffic control Techniques work better fortemporary overload circumstances, but resource control techniques are extra appropriate forcontinuous, high load requirements. Even though resource control is more complicated and expensive than traffic control,reducing the no of packets exactly the event being watched is happening can render it in-sufficient for certain application's. In such cases, the resource management techniques need to be applied[1].

The test with resource control is twofold. First, aa straight-forward algorithm using few computations must be developed. Second, It ought to possess the ability to consider several performance parameters before deciding on a different route. When congestion occurs in dense topologies, selecting another method might be hard since diverse critical parameters must be managed. These parameters include:

1. The remaining energy of individual nodes (microscopic view) and the network as a whole (macroscopic view)
2. Congestion levels, regarding buffer occupancy & interference
3. The time required to transmit data from the origin to the sink.
4. The network's rate of packet loss.

Rout-ing using a single pathalgorithms endure suffering from the matterof the single node's power outage, as they tend to have been utilize shortest path to forward data. This eventually leads to the discovery and creation of new paths, that is a power-consuming process. Additionally, controlling congestion with Rout-ing using a single path typically involves reducing the trans-mission rate of source nodes, which is inadequate for an abundance of applications.

2.PURELYRANDOM PROPOGATION

One-hop neighbourhood information is employed for propagate shares in PRP (Purely Random Propagation). A sensor node specifically keeps keeping track of each node

ID within its broadcast range in a neighbour list. A Time-To-Live (TTL) with an initial value of N is included in each share that a source node wishes to send to the sink .Next, for every share, the source node chooses a neighbour at random &the share is unicast to that neighbour. The neighbour reduces the TTL after getting the share. This technique is repeated if the new TTL exceeds o & the neighbour chooses at random a different node from its list of neighbour (not the source node) to receive the share from. The last node to the share halts random propagation and starts utilising standard minimum-hop routing send it in the direction of the sink when the TTLapproaches[3].

PRP's low propagation efficiency is its primary flaw, since a share may spread back and forth between adjacent nodes several times. Raising the TTL amount doesn't completely fix this problem since, with a high TTL, the technique of random propagation achieves a steady state where its distribution remains' un-changed even after additional TTL increases.

3. NONREPETATIVEPURELY RANDOMPROPOGATION ALGORITHM(NRRP)

NRRP is a PRP upgrade that monitors the nodes travelled to increase propagation efficiency. To have greater precise, NRRP appends an initially empty "node-in-route" (NIR) fie-ld to each share's header. Every time a node spreads its share to the subsequent hop, it adds the upstream node's ID to the NIR field, starting from the source node. The random selection process at the following hop doesn't include the nodes indicated in the NIR. Increased efficiency of propagation results from this non-repetitive propagation, which makes sure the share is sent to a distinct node at each stage.

The advantage of NRRP over PRP is that nodes in theNIR are not included in the subsequent hop's random selection, ensuring non-repetitive propagation and thus improved efficiency.

However, the disadvantage of NRRP is thatIn the event when the source & destination nodes are separedared by a large distance the data payload containing the NIR field will keep increasing, resulting in higher overhead.

4.DIRECTEDRANDOM PROPOGATION (DRP)

By using 2-hop neighbor - hood information, DRP improves propagation efficiency. In particular, DRP appends a "last-hop neighbour list" (LHNL) fie-ld to every share's header. Prior to transferring a share to the subsequent node, the relaying node modifies the neighbour list in the LHNL field. Following receipt of the sharing, the subsequent node finds a random

neighbour that is not in the LHNL by comparing the LHNL fields within own neighbour list. After that, it updates the LHNL field, decreases the TTL amount, and sends the contributing to the subsequent hop., continuing this process.

The benefits' of the DRP algorithm compared to PRP and NRRP are:

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1. To ensure non-repetitive propagation, nodes identified's LHNL are not included in the random selection at the subsequent hop. Increased effiecncy of propagation results from ensuring that the portion is delivered to a distinct node at each stage.
2. Through the elimination of such spreading during any 2 consecutive stages, DRP lowers the probability of a share being propagated back and forth. DRP aims to shift a share further from the source in resistance to PRP, which improves propagation efficiveness at specific TTL amount.

5. OPTIMIZEDALGORITHM

The optimized algorithm increases the effectiveness of propagation by utilisingneighbourhood knowledge from two hops. It specifically modifies each share's header by adding a "last-hop neighbour list" (OL) field. The relaying node changes the OL field with its neighbour list prior to propagating a share to the next node. Upon receiving the sharing, the subsequent node proceeds to match the OL field with its own neighbour list and arbitrarily chooses a neighbouring node that is not included in the OL. The procedure then continues by lowering the TTL value, updating the OL field, and relaying the share to the subsequent hop.

The benefits' of the optimized algorithm compared to PRP, NRRP, and DRP are:

1. The random selection process at the following hop doesn't include the nodes indicated in the OL.increased efficiency of propagation results from ensuring that an alternative node recives the share.
2. The optimised method prevents a share from propagating back and forth by preventing it from happening in any of 2 phases that follow. For TTL value, the optimised algorithm has a higher propagation efficiency than PRP since it pushes aexchange externally from the source.

6. CONGESTIONCONTROLIN WSN'S

6.1 TARAALGORITHM

The TARA (Topology Aware Resource Adaptation) protocol emphasises on utilizing the networks' additional resources to alleviate congestion, specifically targeting intersection hot spots. TARA manages both buffer utilisation& channel loading. Congestion alleviation in TARA involves two key nodes: the distributor and the merger. A "detour path"between these 2 nodes is created.starting at the distributor and ending at the merger. The distributor disperses traffic coming from the hot spot between the original path and the detour path, while the mergercombines the two flows.congestion and the formation of a hot spot, traffic is rerouted from the hot spot through the distributor node along the detour path, reaching the mergernode at which the streams combine

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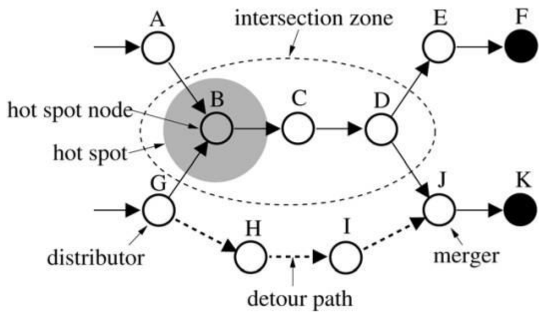
Figure 1.1 illustrates the topology employing TARA[6].

Figure1:Topology employingTARAalgorithm.



6.2 DAlPa'SALGORITHM

Dynamic Alternative Path Selection Scheme (DAlPaS) capable of making effective decisions analternative routing path whchthe occurence of congestion. Takes the critical work parameters such as, power of nodes, available buffer space, mediuminterference,node'sdistancefromsink.The algorithm'snoveltyliesondynamicparametersthat are examined with minimal overhead. Ideal for low processing capable terminals [1].

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amongPRP,NRRP,DRPandoptimized algorithms.

The Figure2 displays the contrasting route discovery time for PRP,NRRP,DRPand Optimized algorithm. From this The figure demonstrates that the optimized algorithm takes less routing time in contrast to randomized algorithmslike PRP, NRRP and DRP.

The Figure3 compares no of hops in each case inPRP,NRRP,DRPandOptimizedalgorithm.
From this figure we can see The optimized algorithm will take fewer steps compared to the randomized algorithms.to PRP, NRRP, and DRP algorithms.

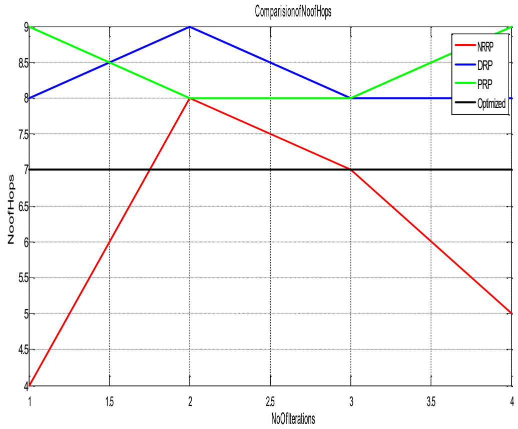

Figure3:ComparisionofNoofHops among PRP,NRRP,DRP, and optimized algorithm

DAlPaSschemeemploystwostages

- Hard decision- When performance threshold is exceeded we pick the top path and force packet flow through it.
- Soft decision- when optimal performance is required we choose two best paths & send packets through them.

7 SIMULATIONRESULTS

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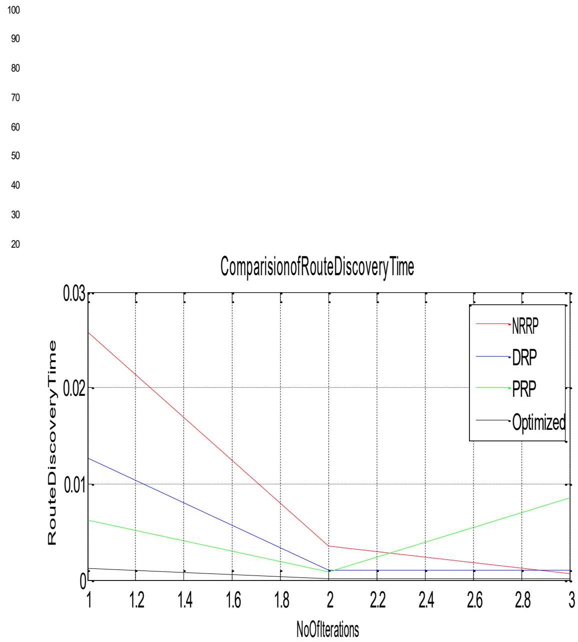

Figure2:comparisionofRoutediscoverytime

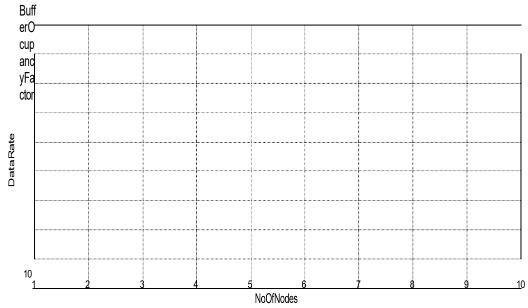

Figure4:Bufferoccupancyfactor.o of nodes vs. data rate.

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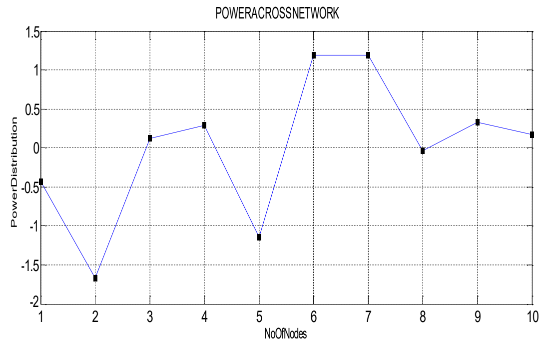

Figure5:Poweracrossnetwork,no ofnodes vs powerdissipation

The Figure4 and figure5 shows the simulation of DAlPaS algorithm showing buffer occupancy factorandpowerlevelofeverynodecontaining10 nodes in network.

The Figure6 shows the comparison of DAlPaS approachandTARAapproacheswithrespectto number of hops taken.

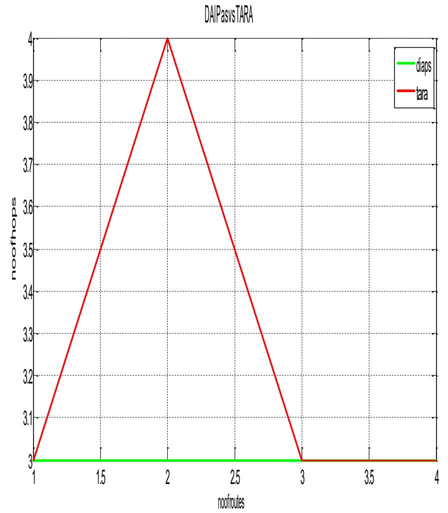

Figure6:comparisonofNumberofroutesvs. number of hops between TARA and DAlpa's.

8 CONCLUSION

By observing the simulation results of different routing algorithms as shown in figure2 and figure3,The optimized routing algorithm is best routing compared to PRP,NRP algorithms because Optimizedalgorithmwilltakelessroutingdiscovery time and less number of hops compared to PRP,NRRP and DRP algorithms. By observing the comparison between the DAlPaS algorithm and TARA algorithm as shown in figure4,figure5 and figure6,wecanconcludethatAnovelCongestion Control and avoidance algorithm called DAlPaS (Dynamic Alternative Path Selection)which has the capacity To continuously make use of network resources (sensor's node power), while, concurrently maintain robustandreliabledatadelivery.Thestrengthwithin algorithm work's properly, with simplicity, and with improved performance compared to TARA algorithm w.r.t number og hops for routing.. The DAlPaSadvantage's are according on the "soft stage" phase, where every node aims to prevent potential transient congestion by handling only one flow at a time

. The factors which are considered are- 1) Route Reply Time. 2) Buffer Occupancy Factor 3) Power Available at each node.

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