www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume2 Issue 8 August, 2013 Page No. 2560-2564

Novel Approach for Secured Data Delivery in Congested Wireless Sensor Network

Divya Hiran[1], Dr. Jitendra Kumawat[2]

[1]Amity University ,Amity School of Engineering and Technology,
NH 8, kantkalwar, Jaipur, 303007, Rajasthan
Er.divya25@gmail.com

[2]Amity School of Enginnering And Technology,Amity University
221 NH 8, kantkalwar, Jaipur, 303007, Rajasthan
Sokil_jitu@yahoo.com

Abstract: ***: Wireless Sensor Networks has turn out to be an explorative area of research since last few years, due to energy constraints of sensors. Reduction of energy is a vital part of the research in this field. Congestion control is a key problem in mobile ad-hoc and sensor networks. In case of congestion system require more power to deliver data. The standard Transmission Control Protocol congestion control method is not able to handle the special properties of a shared wireless multi-hop channel. In particular the frequent changes of the network topology and the shared nature of the wireless channel pose significant challenges. Many approaches have been proposed to overcome these difficulties. In this paper, we present an overview over Congestion Aware Routing and propose a new protocol to introduce secured transfer of data and avoid loss of low priority packets which is a bottleneck of Congestion Aware Routing.***

Keywords: about four key words separated by commas**.**

1. Introduction

There is an electrifying new wave in sensor applications wireless sensor networking which enables numerous sensors and actuators to be deployed independent of the costs and physical constraints of wiring, opening up a new world of sensing application possibilities. The ad hoc nature of wireless mesh networks enables the sensor nodes form a network automatically with minimal human interference. However, energy possessed by sensor nodes is limited, which becomes the most challenging issue in designing sensor networks [1].
The main power consumptions in sensor networks are computation and communication between sensor nodes [2, 3, 4]. In particular, the ratio of energy consumption for communication and computation is typically in the range of 400. Therefore it is critical to enable mutual information processing and data aggregation to prolong the lifetime of sensor networks. Minimizing the communication costs between sensor nodes is critical to lengthen the lifetime of sensor networks. In other words, we should carefully select sensor nodes to contribute in the task.

2. Motivation

Let us consider the scenario of a battlefield in which an army battalion is deployed. An attack is focused on one portion of the field that we call the battlefront or critical area. The commanders and the data processing centers are in a safe place on the other side of the battlefield. Before the battle starts, sensors are deployed throughout the battlefield and fill the area between the data processing centers and any possible critical area.

In such a scenario, there might be several data processing centers to collect different types of information like: one for temperature, one to measure the presence of any lethal chemical gases, one to process a video feed and so on. There might also be one data processing center dedicated for collecting sensitive data from the sensors that would help the commanders to lead their troops. Such data is assigned a higher priority than other data such as periodic temperature reports. Similarly, different levels of officers (platoon, company, battalion level) at different parts of the network may rely on the sensor network to collect data. At one particular moment, if a platoon is in danger, all sensor data distend to the commanding officer (sink) in that platoon may be assigned higher priority than data distend to other parts of the network [5].

Such applications require prioritization of data. The high priority data should serve better, such as higher delivery ratios and minimal delays. It should also experience low jitter, especially for real-time data. The low priority data, such as periodic temperature readings or measurements of environmental conditions away from the critical area, do not require any special service. In fact, some low priority messages may be significantly delayed without severe consequences.

3. Problem Description

Congestion control is a key problem in mobile ad-hoc networks. The standard TCP congestion control method is not able to handle the unusual properties of a shared wireless multi-hop channel well [5, 6]. In particular the frequent changes of the network topology and the shared nature of the wireless channel pose significant challenges. Many approaches have been proposed to overcome these difficulties. All data generated in a wireless sensor network may not be alike; some data may be more important than others and hence delivery requirements may have different. As deployment sizes and data rates grow, congestion arises as a major problem in these networks. This congestion leads to indiscriminate dropping of data, i.e. data of high importance might be dropped while others of less importance are delivered.

The existing schemes detect congestion while considering all the data to be equally important. It is very much important to examine the data delivery issues in the presence of congestion [7]. The data packets can be prioritized as High-Priority packets and Low-Priority packets. To achieve better delivery of the high priority packets in highly congested environment, Congestion-Aware Routing (CAR) [5] is introduced. CAR discovers the congested zone of the network that exists between high-priority data sources and data sink and, using simple forwarding rules, dedicates this portion of the network to forwarding primarily high priority traffic. But CAR drops all low priority data. Low-priority data also contains data that may not be useful at that instance but helpful in future. In this case low priority packets are also to be transmitted.

The main objective is to derive a new congestion aware routing protocol for sensor networks to avoid loss of packets.

4. Existing Techniques

A. Congestion Aware Routing (CAR)

CAR is a network-layer solution to provide differentiated service in congested sensor networks. CAR also prevents severe degradation of service to LP data by utilizing uncongested parts of the network.

Here we connect the independent Nodes and assign the depth to all nodes and Assign all the nodes as off congestion zone discovery (Conzone) [7, 8]. In this Nodes discover if they are on the Conzone by using the Conzone discovery mechanism. A Conzone must be then discovered from that neighborhood to the sink for the delivery of HP data. To do this, critical area nodes broadcast “discover conzone to sink” (To Sink) messages [8, 9]. This message includes the ID of the source and its depth and is overheard by all neighbors. When a node hears more than Sink messages coming from its children, it marks itself as on conzone and propagates a single To Sink message. Once the conzone is discovered, HP data is routed in the conzone, and LP data is routed off the conzone. LP data generated inside the conzone is routed out of the Congested Zone.

Advantages

- High priority (HP) data delivery is assured without loss

Limitations

- Conzone is an overhead.
- Low priority (LP) data is often dropped

B. MAC-Enhanced Congestion Aware Routing (MCAR)

MCAR is primarily a MAC-layer mechanism used in congestion with routing to provide mobile and lightweight conzone to address sensor networks with mobile HP data sources and/or bursts HP traffic [7]. Compared to CAR, MCAR has a smaller overhead but degrades the performance of LP data more aggressively [1].

We compare CAR and MCAR to an Ad hoc On-Demand Distance Vector (AODV) [7] scheme enhanced with priority queues (AODV+PQ). Both CAR and MCAR lead to a significant increase in the successful packet delivery ratio of HP data and a clear decrease in the average delivery delay compared to AODV+PQ [8]. CAR and MCAR also provide low jitter. Moreover, they use energy more uniformly in the deployment and reduce the energy consumed in the nodes that lie on the Conzone, which leads to an increase in connectivity lifetime. In the presence of sufficient congestion, CAR also allows an appreciable amount of LP data to be delivered. We further show that, in the presence of mobile HP data sources, MCAR [1, 11] provides mobile conzone, which follow the HP traffic. Here we connect the independent Nodes and assign the depth to all nodes.

Advantages

- Low priority data delivery is also assured along with high priority data.

Limitations

- The channel is virtually divided for both priorities.
- Still low priority data is often dropped

5. Proposed System

In the proposed system, also the data is differentiated as High Priority and Low Priority to make the delivery of the High Priority data delivery fast. In presence of congestion the High Priority data is forwarded through the congested nodes and the Low Priority data is routed in a less congested long route by a Route_Change message intimated to source by the neighbor of congested node. Discovery of Conzone (congested zone) is very easy in this method.

Advantages

- Low Priority data delivery is assured to maximum extent.
- The burden on intermediate nodes is decreased for discovering Conzone (congested zone) which is overhead in existing system.
- The request and acknowledgements traffic is reduced in this method.

Limitations

- The Low Priority data has to travel in long path which has less congestion, but in the long path all the sensor nodes has to be in active position which increases battery consumption.

A. System Description

If the intermediate node finds the route congested for a long time, it sends a Route_Change message to the source

Route_Change message contains the alternate route to the destination from the intermediate node.

The source after receiving the Route_Change message saves the route and the next onwards it forwards the LP packets through the alternate route.

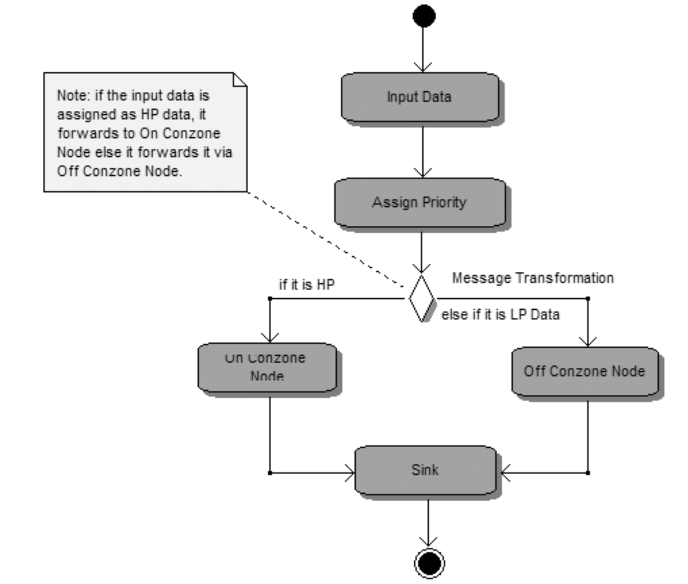


Figure 1: Functional flow of proposed system.

B. Routing in proposed system

Whenever a node has to transmit a packet to the destination, it prioritizes the packet. It sends a route request (RREQ) to find the best route to the destination. The intermediate nodes maintain a record of the visiting packets as shown in table 1.

When an intermediate node receives a RREQ, it calculates the approximate congestion in the network surrounding it. The congestion is calculated as the density of the packets passing through the node. The previous ten packets are taken and the first received packet time is considered. The number of packets to the time difference gives the density of the traffic through the node. Each intermediate node calculates the density of traffic through it. It compares the value to the value recorded in the RREQ. If its value is greater than the value in the RREQ, it replaces the value. Otherwise it keeps the same value and forwards the RREQ.

traffic_density = 10/(now_time - first_pkt_received_time) (1)

Thus to the destination, RREQs with the maximum value of the traffic density in particular routes reaches. The destination compares all the values in the all the RREQs and selects a value according to the priority of the data from the source. If the data is HP packet, the destination selects a route with an average of the best route arrived and the less congestion route. For the LP packets, the destination selects the route with less congestion. Thus both the HP and LP packets are delivered to the destination without the effect of congestion on them. This will not affect the Quality of Service (QoS) of the network.

route_selected = fn(best_route_len,less_congested_route) (2)

Where fn = function that calculates the average.

To achieve better results, the procedure can be followed in Request Reply (RREP). The traffic density values are noted in the RREP and the selection of the route is done by the source node. This gives the updated traffic information to the source and avoids the congestion problem through the network layer itself.

6. Implementation

The present routing algorithm is implemented using NS2. The proposed routing approach is implemented with changes in the scripts as follows.

A. Routing Table

Every node has its own routing table which stores the information about the various routes. For each destination in the table the corresponding next hop, total hops, and the expiry time are specified. As the expiry time elapses the route gets deleted or updated. In ns2 the routing table can be accessed at any time from the tcl script and the routing updating can be studied.

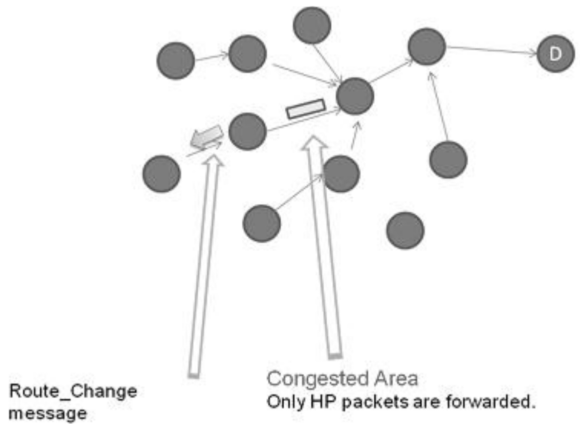


Figure 2: Functional flow of proposed system

B. Priority

A new parameter called "priority" has been added to the routing table to specify the priority to critical nodes. The critical nodes are assigned a priority of 1 while the other nodes are assigned 0.

C. Conzone Formation

The conzone is built using the RREQ. The critical node ids are checked and the function to build conzone is called. When the RREQ appears the intermediate node calculates its traffic density and compares it with the value in the RREQ. If the value is greater than the value in the packet, it replaces. Otherwise it keeps the same and forwards the RREQ.

D. Conzone Routing

The high priority packets are routed through the route calculated as the average of the best route and the route with less congestion. The low priority packets are routed through the less congested route.

E. Encryption-Descryption of data transfer

As we proposed this model for the application where security of data is essential. Like in military system security of data is more important than data itself. Hence to improve security we are using RSA algorithm for encrypting and decrypting the data. The algorithm is like:

Key Generation:

1. Generate two large prime numbers, p and q
2. Let n = pq
3. Let m = (p-1)(q-1)
4. Choose a small number e, coprime to m
5. Find d, such that de % m = 1

Publish (e, n) as the public key.

Keep (d, n) as the secret key.

Encryption:

C = Pe % n

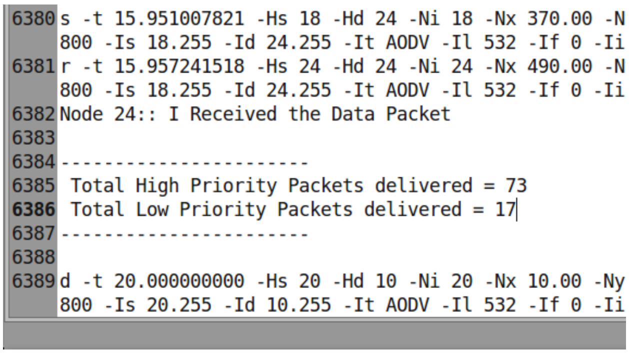
Decryption:

P = Cd % n

All the data that is transmitted from source node to sink node is encrypted using this algorithm for security purpose.

7. Implementation

For the simulation, we create a square flat platform of finite dimensions for simulation. Various parameters are kept permanent while others are varied to help us analyze the performance of the three protocols. The simulation is done in the random waypoint model in a rectangular field. The field configurations used is: 400 m x 400 m field with 9, 16, 25, 36 and 49 nodes. Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed (uniformly distributed between 0–20 m/s). Once the destination is reached, another random destination is targeted after a pause. The pause time, which affects the relative speeds of the mobiles, is varied. Simulations are run for 14 simulated seconds. We do the simulation work with taking different no. of nodes. In this paper we have tested our work for 9, 16, 25, 36 and 49 nodes. If we compare the results of CAR and proposed system then we will found that proposed system works fine even when CAR starts dropping data packets. After the simulation and analyzing the trace files, it has been obtained the graphs as presented.

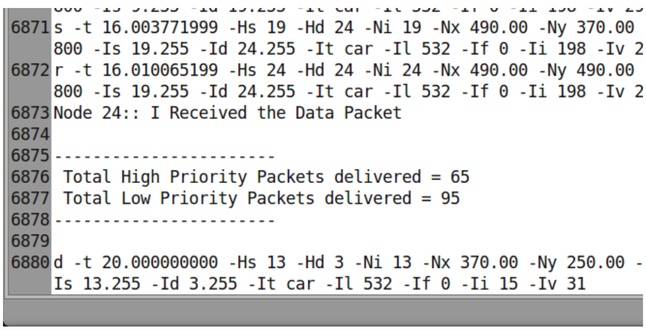


```
s -t 15.951007821 -Hs 18 -Hd 24 -Ni 18 -Nx 370.00 -N
800 -Is 18.255 -Id 24.255 -It AODV -Il 532 -If 0 -Ii
r -t 15.957241518 -Hs 24 -Hd 24 -Ni 24 -Nx 490.00 -N
800 -Is 18.255 -Id 24.255 -It AODV -Il 532 -If 0 -Ii
Node 24:: I Received the Data Packet

----------------------
 Total High Priority Packets delivered = 73
 Total Low Priority Packets delivered = 17
----------------------

d -t 20.000000000 -Hs 20 -Hd 10 -Ni 20 -Nx 10.00 -Ny
800 -Is 20.255 -Id 10.255 -It AODV -Il 532 -If 0 -Ii
```

Figure 3: Number of high and low priority data packets delivered in car



```
s -t 16.003771999 -Hs 19 -Hd 24 -Ni 19 -Nx 490.00 -Ny 370.00
800 -Is 19.255 -Id 24.255 -It car -Il 532 -If 0 -Ii 198 -Iv 2
r -t 16.010065199 -Hs 24 -Hd 24 -Ni 24 -Nx 490.00 -Ny 490.00
800 -Is 19.255 -Id 24.255 -It car -Il 532 -If 0 -Ii 198 -Iv 2
Node 24:: I Received the Data Packet

----------------------
 Total High Priority Packets delivered = 65
 Total Low Priority Packets delivered = 95
----------------------

d -t 20.000000000 -Hs 13 -Hd 3 -Ni 13 -Nx 370.00 -Ny 250.00 -
Is 13.255 -Id 3.255 -It car -Il 532 -If 0 -Ii 15 -Iv 31
```

Figure 4: Number of high and low priority data packets delivered in proposed system

For the simulation, we create a square flat platform of finite dimensions for simulation. The graphs obtained show that the Packet delivery for the LP packets is much higher for proposed system compared to CAR. The graphs also show that there is a little increase in Packet Delivery for HP packets for proposed system compared to CAR. This may be because of routing the LP through other route than best route. Hence proposed system achieves the best Packet Delivery compared to CAR both for HP and LP packets. Proposed system not only achieves LP packet delivery but also helps to reduce congestion in the best route from source to destination. Hence without the loss of QoS and the effect of the congestion, the packet delivery of both the HP packets and the LP packets is to be achieved. The prediction of the congestion avoids the effect of congestion in the network and dropping of the LP packets. So the packet delivery is achieved without any conciliation in QoS.

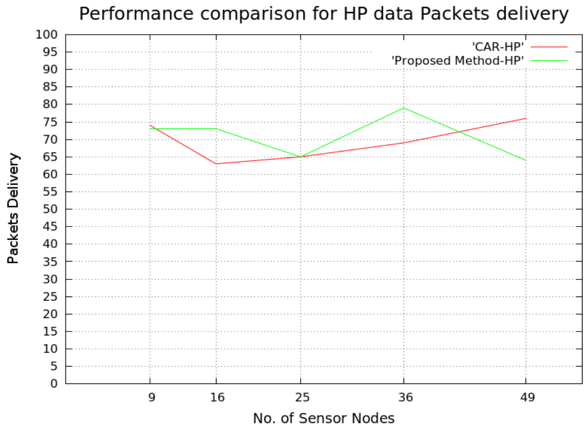


Figure 5: Performance comparison graph for HP data packets.

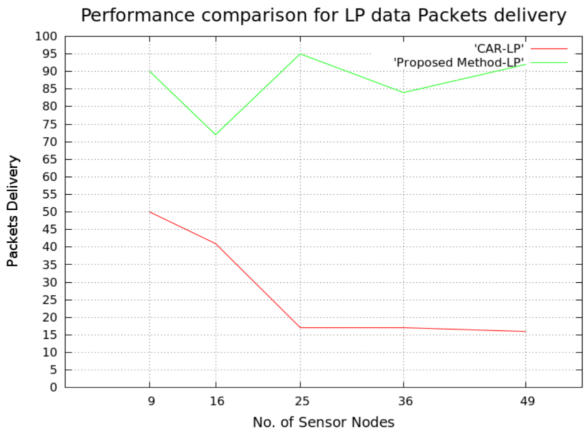


Figure 6: Performance comparison graph for LP data packets.

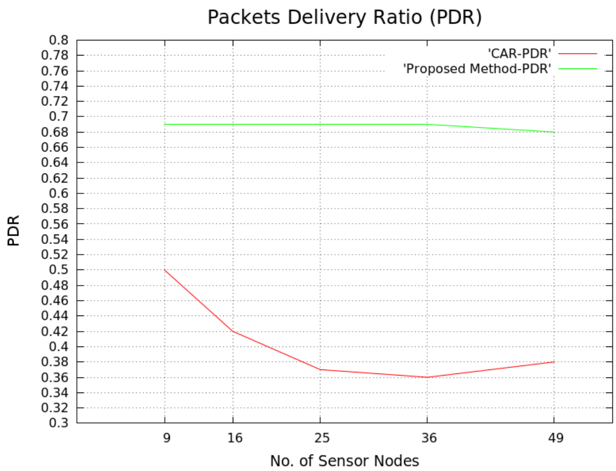


Figure7: Packet Delivery Ratio comparison graph

8. Conclusion

Designing a sensor network congestion algorithm is a challenging task due to the application specific nature of these networks. The frequency of event sensing is a deciding factor in the occurrence of congestion. Numerous sensors, simultaneously transmitting data, increase the probability of packet drops due to congestion close to the base station(s).

In this the importance of the consideration of the congestion in the sensor network followed by the previous works done to reduce its effect on routing. Along with HP packets, LP packets also contain information that may not be useful at the instance of time but may be helpful in future. Hence without the loss of QoS and the effect of the congestion, the packet delivery of both the HP packets and the LP packets is to be achieved. We proposed a new mechanism that achieves the packet delivery of the HP and LP packets by predicting the congestion in the network. The prediction of the congestion avoids the effect of congestion in the network and dropping of the LP packets. Thus the packet delivery is achieved without any compromise in QoS.

References

[1] K. Hanumantha Rao, G. Srinivas, A. Damodhar, “Wireless Sensor Networks: A Study on Congestion Routing Algorithms” IJCST, Vol. 2 Issue 2, 2011.

[2] Jason Lester Hill, “System Architecture for Wireless Sensor Networks” University of California, Berkeley, Spring 2008.

[3] C.K. Toh, “Maximum battery life routing to support ubiquitous mobile computing in wireless ad hoc networks” IEEE Communications Magazine, vol. 89, no. 11, pp. 188–147, June 2001.

[4] Baghyalakshmi, D. Ebenezer, J. Satyamurty, S.A.V. , “Low Latency and energy Efficent Routing Protocols for Wireless Sensor Networks” IEEE 207 D.O.I. 7.179/ICWCSC.207.1411892 (1-11)

[5] R. Kumar, H. Rowaihy, G. Cao, “Congestion Aware Routing in Sensor Networks” NAS-TR-00811-20011.

[6] J.Miguel- Alonso, C.Izu, J.A Gregario,”Improving the performance of large interconnection networks using congestion-control mechanisms" from Science Direct Performance Evaluation 111(2008) 208-211.

[7] R. Kumar, H. Rowaihy, G. Cao, “Congestion Aware Routing in Sensor Networks” NAS-TR-00811-20011.

[8] R. Kumar, H. Rowaihy, G. Cao, “Mitigating Performance Degradation in Congested Sensor Networks” IEEE transactions on mobile computing, Vol. 7 No. 7, 2008.

[9] N. Sengottiyan, Rm. Somasundaram, “A modified Routing Algorithm for Reducing Congestion in Wireless Sensor Networks” European Journal of Scientific Research, Vol. 81 No. 4, 129 (2009).

[10] Matulya Bansal and Gautam Barua, “Performance Comparision of Two On-Demand Routing Protocols for Mobile Ad hoc Networks” IEEE Trans. April 2004.

[11] S. Kim, O. Lee, S. Choi, “MAC-Aware Routing Metric for 802.11 Wireless Mesh Networks” IEEE, (2008).

.