International Journal of advancement in electronics and computer engineering (IJAECE)
Volume 10, Issue 1, Jan. 2021, pp.102-109, ISSN 2278 -1412

Fault Analysis by using MINIMal Hopping routing topology

Manu Shukla[1], Chhatrapani Gautam[2]
[1]M.tech scholar, VITS Satna(M.P.) , manu7895shukla@gmail.com
[2]Assistant Professor, VITS Satna(M.P.) , acpg.77@gmail.com

Abstract- This paper addresses fault-tolerant topology control in a heterogeneous wireless sensor network consisting of several resource-rich super nodes used for data relaying and a large number of energy constrained wireless sensor nodes. We present the k-degree any cast Topology Control (k-ATC) issue with the goal of choosing every sensor's transmission range with the end goal that every sensor is k-vertex super node associated and the most extreme sensor transmission power is limited. Such topologies are required for applications that help sensor information announcing indeed, even in case of disappointments of up to k − 1 sensor hubs. We propose two answers for the k-ATC issue: a ravenous unified calculation that creates the ideal arrangement and a dispersed and limited calculation that steadily changes sensors' transmission range with the end goal that the k-vertex super node network prerequisite is met. Recreation results are displayed to confirm our methodologies.

Keywords :Fault-tolerant topology control, Heterogeneous wireless sensor networks

I. Introduction

In this paper we address topology control in heterogeneous WSNs consisting of two types of wireless devices: resource-constrained wireless sensor nodes deployed randomly in large numbers and a much smaller number of resource-rich super nodes, placed at known location. The super nodes have two transceivers, one to interface to the remote sensor organizes (WSN), and another to associate with the super node organizes. The super node system gives better QoS and is utilized to rapidly advance sensor information bundles to the client. With this setting, information assembling in heterogeneous WSNs has two stages: first, sensor hubs transmit and hand-off estimations on multihop ways towards a super node (see Figure 1). Once a Information bundle experiences a super node, it is sent utilizing quick super node-to-super node correspondence toward the client application. Also, super nodes could process sensor information before sending. A study by Intel [9] shows that using a heterogeneous architecture results in improved network performance, such as lower data gathering delays and a longer network lifetime. Hardware components of the heterogeneous WSNs are now commercially available.We model topology control as a range task Issue for which the correspondence scope of each Sensor hub must be processed. The goal is to Limit the greatest sensor transmission control while Keeping up k-vertex disjoint correspondence ways from every sensor to the arrangement of super nodes. Along these lines, the system can endure the disappointment of up to k − 1 sensor hubs. Interestingly with range task in specially appointed.

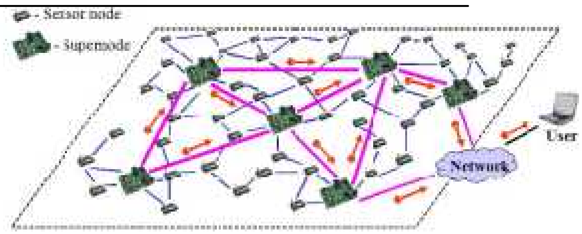

Figure 1: Wireless sensor network

Remote systems, this issue isn't worried about Availability between any two hubs. Our concern is Explicitly custom-made to heterogeneous WSNs, where information is sent from sensors to super nodes. The commitments of this paper are the accompanying: (1) we plan the k-degree Any cast Topology Control (kATC) issue for heterogeneous WSNs, (2) we propose two answers for taking care of the k-ATC issue: a unified insatiable calculation that gives an ideal arrangement also, a limited calculation functional for huge systems, what's more, (3) we investigate the calculations' exhibition through reenactments.

Mainly five different types of WSNs exist-

1. Terrestrial WSN: Consists of high number low-cost sensor nodes. Reliable communication among the densely deployed sensor nodes is important. Terrestrial WSNs can both be deployed in a random way or according to a deployment plan. Random deployment can be done by throwing the sensors from an airplane on a geographical area.
2. Underground WSN: In order to monitor the underground conditions sensor nodes are buried into the soil or put in cave, mine or so on. Nodes above the ground are located to gather the data from the sensor nodes and relay it to the base station. Sensor nodes are more expensive in underground WSNs according to terrestrial WSNs because they should be durable to harsh underground conditions and

require specialized equipment's in order to communicate under the high attenuation and signal loss. In addition, a very carefully planned deployment of sensor nodes is required since the sensors are expensive and redeployment is not an option.

3. Underwater WSN: Number of sensors in an underwater WSN is much less than a terrestrial WSN both because they are more expensive and they use acoustic waves for communication which is not suitable for dense deployment. Data from the sensor nodes are collected by the autonomous underwater vehicles. Low bandwidth and high latency are challenging problems for this type of WSNs.
4. Multi-media WSN: Consists of sensor nodes equipped with camera and microphone. They are deployed according to a plan in order to ensure the coverage of the monitored area. Multi-media WSNs require high bandwidth, quality of service and high energy consumption.
Mobile WSN: Consists of sensor nodes with capability of moving in order to reposition them in the network topology. Mobile nodes can move to area of events and communicate with other nodes when they are in communication range. They require dynamic routing protocols in contrast to static sensor networks. Localization, navigation and controlling the coverage and connectivity are the main challenges for a mobile WSN.

1.1 Heterogeneous Wireless Sensor Networks

Heterogeneous remote sensor systems comprise of hubs with various capacities. Hubs may vary in detecting abilities, transmitting range, preparing power, vitality limit, measure of capacity, etc. Hubs with better capacities concurring than ordinary hubs are called super nodes. Super nodes can have various jobs as per the applications. Some super nodes just overlay the information gathered from the sensor hubs to a base station. In this situation a super node is a portal hub. Super nodes can likewise make extra handling on the gathered information Prior to sending it to a base station. A super node can apply a few channels or can make information Collection to diminish the measure of information to be transmitted which additionally diminishes the vitality Utilization. Super nodes can likewise have some unique capacities like acting against an occasion or a specific condition. This sort of super nodes called as entertainers (or actuators) and sensor organizes that contain on-screen characters are called remote sensor and on-screen character systems (WSAN). WSANs as a rule have a two-layer design where the lower level is made out of minimal effort sensor hubs and the upper layer comprises of asset rich entertainer hubs which take choices and perform fitting activities [29]. In WSANs, there are typically two sorts of remote correspondence joins: on-screen character entertainer and sensor-on-screen character joins. The connections among sensors and entertainers are accepted to be less dependable, subsequently there are a few techniques proposed for keeping up solid sensor-actor connectivity . However, do not employ k-connectivity between sensors and actors and thus they do not guarantee fault-tolerance in case of k − 1 node failures. Although addresses the k-actor connectivity problem, it does not consider the energy efficiency of the resulting topologies. Our approach differs from these works by maintaining k-connectivity and addressing power efficiency at the same time.

Topology Control in Wireless Sensor Networks

In wireless sensor network, more often than not, organization isn't done physically thus arrange topology can't be known heretofore. System topology is developed self-governing by the sensors after the sending to the application region. Consequently a topology control component is expected to construct and keep up the system topology. What's more, topology in WSNs is liable to change for a few reasons including correspondence connection breaks, hubs running out of intensity, and versatility. So as to keep the system associated as far as might be feasible and improve the system lifetime and throughput; topology control instruments are basic for WSNs.
Topology control is characterized as controlling the neighbor set of hubs in a WSN by changing transmission go or potentially choosing explicit hubs to advance the messages. Topology control methodologies can be separated into two fundamental classifications, in particular, homogeneous and nonhomogeneous. In homogeneous methodologies transmission scope of all sensors are the same though in nonhomogeneous approaches hubs can have diverse transmission ranges.

1.2 Fault Tolerance in Wireless Sensor Networks

Adaptation to internal failure can be characterized as the capacity of a framework to continue working at an ideal level if there should be an occurrence of deficiencies which happen as often as possible in numerous remote sensor arranges because of blunder inclined nature of sensor hubs. There are different variables which cause blames in sensor hubs like vitality consumption, equipment disappointment, correspondence connect blunders, vindictive assault. Likewise, joins are additionally disappointment inclined which may flop for all time or briefly at the point when hindered by outer articles or natural conditions. Blockage may likewise lead
to shortcomings by causing parcel misfortune because of synchronous transmission of bigger number of sensor hubs . Multihop correspondence duplicates the issues that can emerge in WSN applications. In this manner adaptation to non-critical failure is a basic prerequisite for most remote sensor applications and there are

numerous works tending to this issue in the writing. Adaptation to internal failure can be tended to at various layers including equipment layer, programming layer, arrange correspondence layer and application layer. Our essential spotlight will be on application layer arrangements like finding numerous hub disjoint or meshed ways, having a specific level of network of sensor hubs to the sinks, observing vitality levels of the sensor hubs and keeping up the most solid ways. Paradis et al records the reasons why blames in sensor systems can't be taken care of similarly as in customary wired or remote systems as follows:

1. Energy consumption is not a constraint for constantly powered wired or rechargeable ad hoc devices.
2. Point to point reliability is important for traditional network protocols, but reliable paths from data source to sinks are more important in WSNs.
3. In WSNs node failures occur much more frequently than the traditional wired or ad hoc networks.
4. MAC protocols in WSNs are not sophisticated as in traditional wireless networks.

1.3 Fault tolerant techniques can be categorized into main groups

- Fault prevention: Includes ensuring network connectivity and coverage at the design stage, monitoring network status and taking reactive actions when necessary and maintaining redundant links and nodes.
- Fault detection: Largely depends on the type of the application and type of faults. Main indication of faults is packet loss (decrease in packet delivery rate), interruption, and delay in network traffic.
- Fault isolation and identification: Diagnoses and determines the real causes for detected alarms in the network in order to take the right actions.
- Fault recovery: Faults can be recovered within the sensor network or at the sink after the data collection and analysis. Fault recovery within the network is more appropriate for WSN applications since it is costly to forward the data to the sink.

II. Methodology

MIN Congestion aware algorithm takes into thought even the traffic stuck up at the router ports unlike the previous 2 approaches. MIN adaptive routing proposes that each router be aware of network's traffic situation and adapt its routing accordingly. It is also prologs a history window which keeps track of the queues of the nodes. The maintenance should be taken care by a device which has the capability to recharge itself or to be replaced easily and should have highest life. In fact the maintenance has to be done by router.

The MIN Congestion Aware algorithm can be described as below:-

Algorithm MIN Routing $(G' = N', L')$

1: **for** h = 1 **to** N - 1 **do**
2: /* for each link, set the link cost to the transmit power required to maintain the outage probability $£(h)$ on the link */
3: **for all** $l_{u,v} \in L'$ **do**
4: C (u, v) = $P_{u,v}(£(h))$
5: **end for**
6: /* compute the shortest h-hop path */
7: [∏ (H), C (H)] = Dijkstra $(G', s, d(h))$
8: /* store the path and its cost in (H) and C (H) */
9: **end for**
10: /* choose the best path for reaching the destination */
11: h^* = arg min C (H)
12: return [$\prod^h$ (H*);C(H*)]

$$MIN_{criteria} = q_{length} H_{length} + T_{packet\,move}$$

Where,

q_{length} = length of the queue

H_{length} = number of hops w.r.t. router or current source

$T_{packetmove}$ = time for removing packets from queue to an outgoing link

13: The MIN criteria for router port selection are defined as below: $MIN_{router\ port} = \frac{q_{length}\ H_{length}}{q_{avg}}$

Where,

q_{lavg} = average queue length across all queues of the router

H_{length} = number of hops w.r.t. router or current source

q_{length} = queue length of a specific node

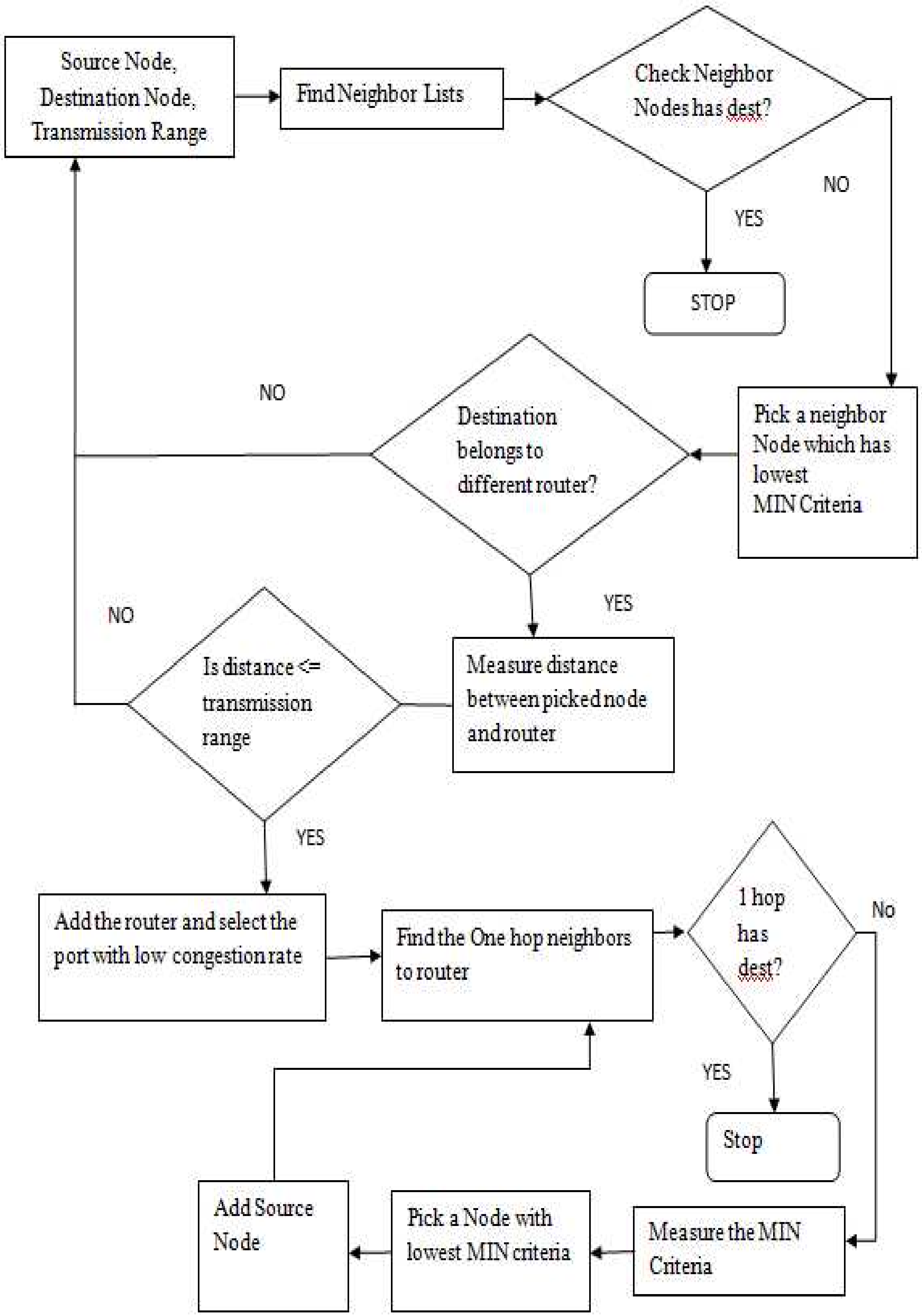

Fig.2 MIN congestion aware Routing algorithm

IV. Simulation Results

In this research work proposed MIN routing algorithm for overcome to congestion problem in the network this simulation results are shown below:

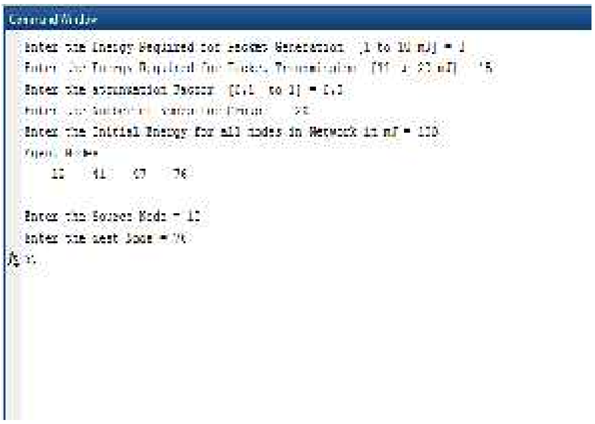

Fig.4 Show input data for simulation

Above graph shows the basis of total number of nodes. After running the program we assign the values of input. Energy required for packet generation, attenuation factor, and number of iterations for comparison, number of nodes for group and initial energy of nodes act as input. After giving input we get total number of nodes on command window for proposed algorithm.

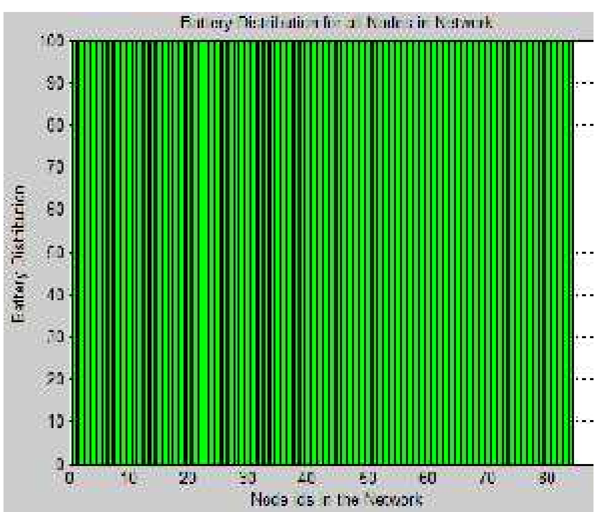

Fig.5 Battery distribution for all the nodes in the network

Above figure shows the graph of battery distribution for all the nodes. This graph is plotted between node IDs and battery distribution for nodes. This graph simply indicates that we have assigned same energy levels to each and every node of the network. In this graph Node IDs have a range from 0 to 90 and battery distribution has a range from 0 to 500mJ. Every node is distributed battery equals to total number of nodes multiplied by initial energy of the nodes.

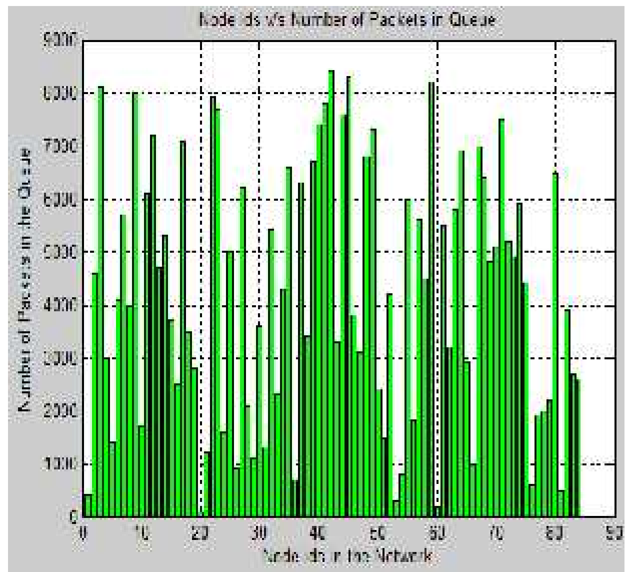

Fig.6 Node IDs v/s Number of packets in the queue

Above graph shows number of packets in the queue i.e. queue length. Above shown graph is plotted between Node IDs in the network and Number of packets in the queue. Node IDs in the network is shown in horizontal direction and Number of packets in the queue is shown in vertical direction.

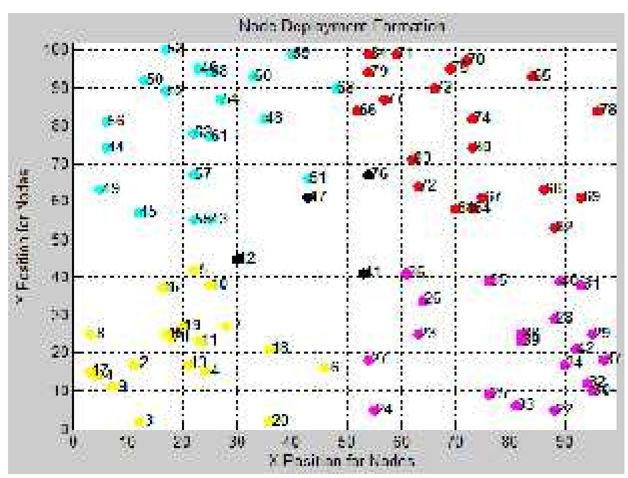

Fig.7 Node Deployment Formation

Above graph shows node deployment formation. Above shown graph is plotted between x position of nodes and y position of the nodes. X position of nodes is shown in horizontal direction and y position of nodes is shown in vertical direction. Different colors of nodes are indicating different coordinate of the graph.

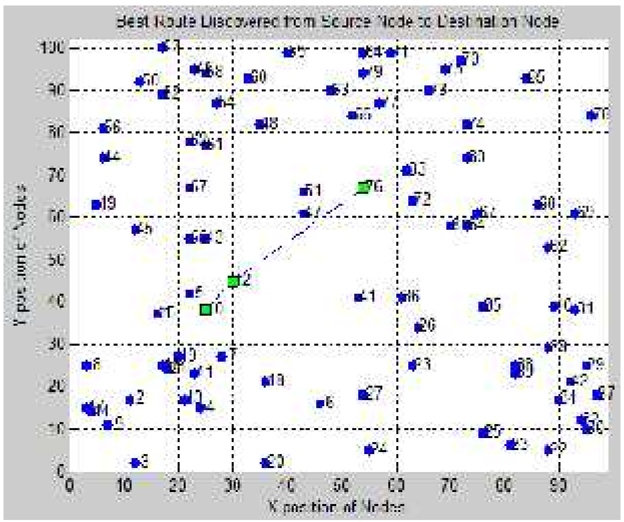

Fig.8 best route discover from source node to destination node

Above graph shows best route discover from source node to destination node for packet transmission. Above shown graph is plotted between x position of nodes and y position of the nodes. X position of nodes is shown in horizontal direction and y position of nodes is shown in vertical direction. Different colors of nodes are indicating different coordinate of the graph.

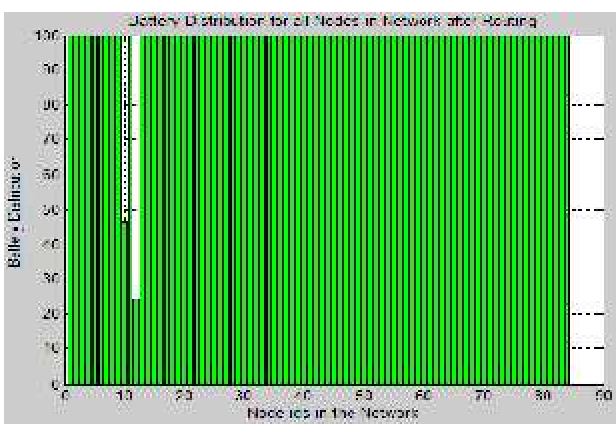

Fig.9 Battery distribution for all the nodes in the network after routing

Above figure shows the graph of battery distribution for all the nodes after routing. This graph is plotted between node IDs and battery distribution for nodes. This graph simply indicates that we have assigned same energy levels to each and every node of the network.

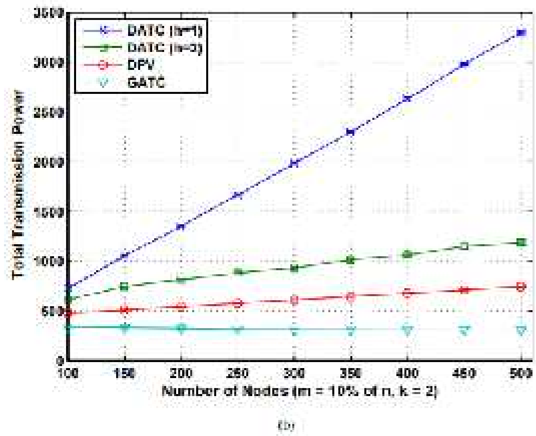

Figure10 : Total Transmission Power for k = 2.

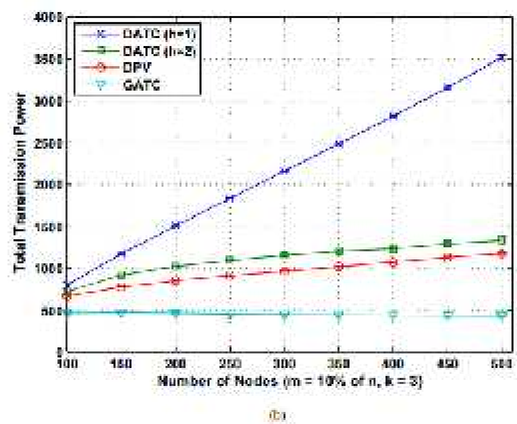

Figure 11: Total Transmission Power for k = 3.

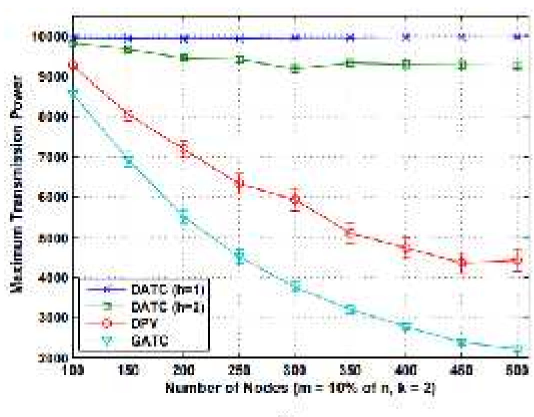

Figure 12: Maximum Transmission Power for k = 2.

I. Conclusion

The congestion at the far-end of the channel isn't accurately represented at the near-end since in-flight packets (or credits) that are being transmitted don't represent true congestion. As a result, we tend to additionally consult with far-end congestion as phantom congestion since the congestion is "false". To beat this limitation, we propose a MIN congestion aware routing algorithmic rule that removes the impact of in-flight congestion. Transient congestion is that the results of fluctuation of network queue occupancy because of random traffic variation and also leads to inaccurate adaptive routing decisions. Minimum congesion routing control fault by occur through node.

References

[1] Y. Chen and S.H. Child. A shortcoming tolerant topology control in remote sensor systems. In Computer Systems and Applications, 2005. The third ACS/IEEE International Conference on, 2005.

[2] H.K. Qureshi, S. Rizvi, M. Saleem, S.A. Khayyam, V. Rakocevic, and M. Rajarajan. Expanded ruling set and its applications in impromptu systems utilizing agreeable correspondence. PC Communications, 34:1235–1242, 2001.

[3] S.A. Borbash, and E.H. Jennings. Conveyed topology control calculation for multihop remote systems. In Proc. 2002 World Congress on Computational Intelligence (WCCI 2002), pages 355–360. Citeseer, 2002

[4] N. Li, J.C. Hou, and L. Sha. Plan and examination of a MST-based topology control calculation. IEEE Transactions on Wireless Communications, 4(3):1195–1206, 2005.

[5] L. Wang, H. Jin, J. Dang, and Y. Jin. A flaw tolerant topology control calculation for huge scale sensor systems. In Parallel and Distributed Computing, Applications and Technologies, 2007. PDCAT'07. Eighth International Conference on, pages 407–412, 2007.

[6] D.M. Blough, M. Leoncini, G. Resta, and P. Santi. The k-neigh convention for symmetric topology control in impromptu organizes. In Proceedings of the fourth ACM global symposium on Mobile impromptu systems administration and figuring, page 152. ACM, 2003

[7] R. Ramanathan and R. Kosales-Hain. Topology control of multihop remote systems utilizing transmit control alteration. In IEEE INFOCOM, volume 2, pages 404–413. Citeseer, 2000.

[8] N. Li, and J.C. Hou. Flss: A flaw tolerant topology control calculation for remote systems. In Proc. tenth ACM Int'l Conf. Portable Computing and Networking (MOBICOM), pages 275–286, 2004.

[9] N. Li, and J.C. Hou. Confined issue tolerant topology control in remote specially appointed systems. IEEE Transactions on Parallel and Distributed Systems, 17(4):307–320, 2006.

[10] M. Cardei, S. Yang, and J. Wu. Calculations for Fault-Tolerant Topology in Heterogeneous Wireless Sensor Networks. IEEE Transactions on Parallel and Distributed Systems, 19(4):545–558, 2008.

[11] D. F. Richards et al., "Beyond homogeneous decomposition: Scaling long-range forces on massively parallel systems" in Proceedings of SC'09, Portland, Oregon, November 2009, Article 60.

[12] P. F. Fischer, H. Adalsteinsson "A simulator for large-scale parallel computer architectures" Int. J. Distrib. Syst. Technol., vol. 1, no. 2, pp. 57–73, Apr. 2010.

[13] "Characterization of the doe mini-apps" National Energy Research Scientific Computing Center.

[14] J. Kim et al., "Flattened butterfly: A cost-efficient topology for high radix networks" in Proceedings of ISCA'07, San Diego, CA, June 2007, pp. 126–137.

[15] J. Kim et al., "Micro architecture of a high-radix router" in Proceedings of ISCA'05, Madison, Wisconsin, June 2005, pp. 420–431.

[16] J. Ahn et al., "Hyperx: topology, routing, and packaging of efficient large-scale networks" in Proceedings of SC'09, Portland, Oregon, November 2009, Article 41.

[17] N. Jiang et al., "A detailed and flexible cycle-accurate network-on-chip simulator," in Proceedings of ISPASS'13, Austin, TX, April 2013, pp.86–96.

[18] W. Dally, "Virtual-channel flow control," Parallel and Distributed Systems, IEEE

Transactions on, vol. 3, no. 2, pp. 194–205, 1992.

[19] D. Helbing, "Traffic and related self-driven many-particle systems," Rev. Mod. Phys., vol. 73, pp. 1067–1141, Dec 2001.

[20] J. Bell et al., "Boxlib users guide," 2013, Center for Computational Sciences and Engineering, Lawrence Berkeley National Laboratory.

[21] H. Dong et al., "Quasi diffusion accelerated monte carlo," 2011, Los Alamos National Laboratory.

[22] D. F. Richards et al., "Beyond homogeneous decomposition: Scaling long-range forces on massively parallel systems," in Proceedings of SC'09, Portland, Oregon, November 2009, Article 60.

[23] P. F. Fischer et al., 2008, http://nek5000.mcs.anl.gov.

[24] H. Adalsteinsson et al., "A simulator for large-scale parallel computer architectures," Int. J. Distrib. Syst. Technol., vol. 1, no. 2, pp. 57–73,Apr. 2010.