ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 10, October 2016

Mobility Based Routing Protocol: A Survey

Sangeeta Vhatkar, Archana Nanade, Mohommad Atique

***Abstract*— this paper presents Mobility Based Clustering (MBC) routing protocol in wireless sensor networks for mobile nodes.in this proposed protocol, a sensor has the ability to elect itself as cluster head based on the residual energy and mobility. A non-cluster-head node on the other hand aims at its link stability with a cluster head during clustering according to the estimated connection time. Each non-cluster-head node is allotted a timeslot for data transmission in ascending order in a time division multiple address (TDMA) schedule based on the estimated connection time. Here simulation is done for 100 and 200 nodes and QoS parameters that are compared are Delay, Throughput, Packet drop ratio and Energy consumed. From th simulation results it is clear that 100nodes simulation outperforms 200 nodes simulation for QoS for the above parameters by 25%, 16%, 24% and 43 %. So as the node of nodes increase in a fix mobile environment the QoS parameters loss their efficiency.**

***Index Terms*—WSN, CBR, PEGASIS, LEACH, MBC, TDMA ,QoS.**

I. INTRODUCTION

A wireless sensor network is a collection of nodes organized into an accommodating system. Each node comprises of processing capability (one or more microcontrollers, CPUs or DSP chips), may contain several types of memory (program, data and flash memories), have a RF transceiver (usually with a single omnidirectional antenna), have a power source (e.g., batteries and solar cells), and can add various sensors and actuators. The nodes connect wirelessly and often are self-organize after being deployed.

Currently, wireless sensor networks are beginning to be organized at an enhanced step. It is not irrational to expect that in 10-15 years that the world will be enclosed with wireless sensor networks with access to them via the Internet. This can be well-thought-out as the Internet becoming a physical network. This novel technology is electrifying with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces. [1]

Wireless Sensor Networks (WSNs) [2] involves a large number of distributed and dedicated sensors in order to sense the physical conditions of the environment like sound, temperature, humidity, pollution levels and pressure and so on. WSN has invested in the improvement of low cost, low power, multi-functional smart sensor nodes. The nodes also have limited amount of communication capacity and computing power. How to enhance the transmission distance and route, load balance, network lifetime and energy efficiency has become a key subject of routing protocols.

In order to prolong the lifetime of the WSN, designing efficient routing protocols is serious. It has been conventional that most of the energy consumption in a WSN arises from data reception and transmission. A good routing protocol therefore can lessen the number and size of unnecessary transmissions that take place, thus helping improve the energy catastrophe in WSNs. Hierarchical routing [1] algorithms are techniques with special advantages related to scalability and efficient communication. The main aim of hierarchical routing is to optimize energy consumption of sensor nodes by arranging the nodes into clusters. Data aggregation and fusion is performed within the cluster in order to decrease the number of transmitted messages

Routing protocols in wireless sensor network might differ depending on the application (Protocol Operation based) [12] and network architecture (Network Structure based) [12] as shown in Figure 1.

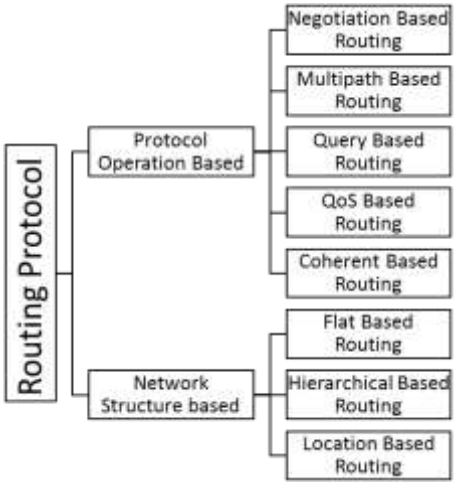

Figure 1 Classification of Hierarchical Routing protocol

Our concern will be towards Hierarchical Routing protocols as the main aim of hierarchical routing is to efficiently maintain the energy consumption of sensor nodes by involving them in multi-hop communication within a particular cluster and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the sink. Cluster formation is typically based on the energy reserve of sensors and sensor's proximity to the cluster head.

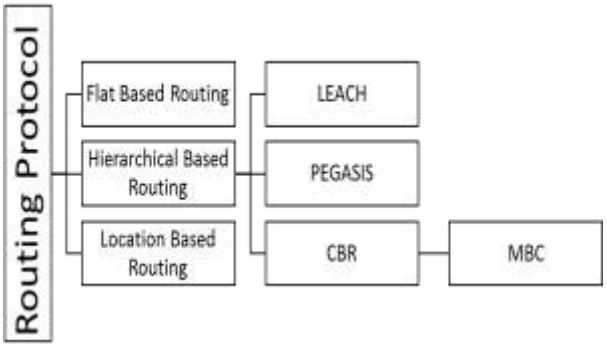

Figure 2 Classification of Hierarchical routing protocol

In this paper our concern is towards CBR [3] variant MBC i.e. Mobility based protocol [3].

II. CBR (CLUSTER BASED ROUTING) PROTOCOL

Cluster Based Routing (CBR) Protocol is a routing protocol in mobile ad hoc networks. The CBR protocol changes TDMA scheduling adaptively according to the dynamic traffic and mobility conditions in the network. As a result, the CBR protocol can significantly reduce the packet loss compared to the LEACH-mobile protocol. However, the control overhead used in the CBR protocol is higher than that in the LEACH-mobile protocol because of the control messages used.

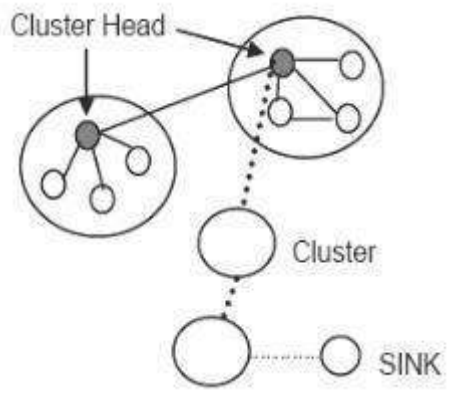

Figure 3 CBR

Both the LEACH-mobile and CBR protocols aim at increasing the successful packet delivery rate at the cost of increased control overhead, which may cause more energy consumption and reduce the network lifetime [9]. Santhosh et al. [14] and Lan et al. [15] focus on the stability of each cluster by considering the mobility of each node and the distance between a non-cluster-head sensor node and a cluster-head node. However, this may result in unfavorable cluster-head selection because the two sensor nodes may have opposite moving directions. To address this problem, we propose a mobility-based clustering (MBC) protocol for WSNs with mobile nodes in this paper.

Features

- Completely distributed operation.
- Minimizes flooding traffic during the dynamic route discovery process.
- Explicit utilization of unidirectional links that would or else be unused.
- Broken routes are repaired locally without rediscovery.
- Sub-optimal routes are reduced as they are utilized.

Advantages

- On-demand route discovery traffic and routing overhead is reduced due to clustering approach.
- To minimize route acquisition delay and new route re-discovery traffic, "local repair" mechanism is utilized.
- Speeds up the packet delivery ratio to a high extent.

Disadvantages

- The overhead per packet increases due to source routing, with increase in cluster size.
- In routed packet every node of the route is stored. So the packet size increases proportional to the path length of the route.
- With increase in cluster size and path length of the route transmission time increases.

III. MBC PROTOCOL

In this section, we present an MBC protocol for a WSN with mobile nodes. We will first introduce the network model under study, and the mobility model and radio model used in the study, and then we will describe the characteristics and procedures of the protocol.

A. Network model

We consider a sensor network shown in Figure 4, where the sensor nodes are clustered into a group of clusters, and periodically collect and transmit sensed data about a target or an event in a region of interest to a remote observer (for example, a base station). Each sensor node within a cluster transmits its data to its cluster head within one transmission hop. The cluster head performs data aggregation on the data it receives from its cluster members and then transmits the aggregated data to the base station along a multi-hop path. Note that this paper focuses on clustering. Multi-hop routing is beyond the scope of this paper.

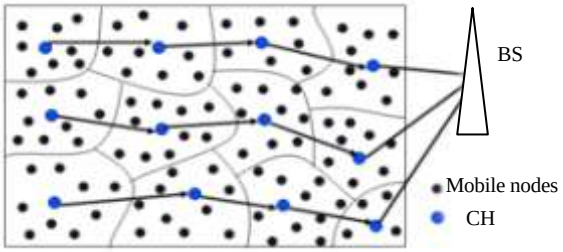

Figure 4 Mobile Network

B. Protocol description

Similar to the LEACH-mobile protocol [16] and the CBR protocol [17], our proposed MBC protocol can also be divided into two phases: the set-up phase when a set of clusters are organised and a TDMA schedule is created,

followed by a steady-state phase when data are delivered to the base station.

C. Implementation of MBC.

There are various hierarchical routing protocols which are known for clustering, out of which we have studied MBC which is an extended technique of CBR protocol. The implementation phases are as follows.

- Network Deployment
- Set-up phase
- Steady-State phase

Network Deployment

The network has 1000m × 1000m network area in which 100 nodes scenarios are densely deployed. All sensors in the network are homogenous. The sensors have the same physical characteristics, the same energy capacity and the same transmission range at the time of network deployment .Each sensor in the network knows its own location and velocity. The base station is stationary. All sensors in the network are time synchronised. Each sensor node can estimate the time it takes to transmit a packet, which is defined as the ratio of the packet length and the transmission rate.

Setup Phase

The node with the largest residual energy is selected as a cluster head. The node with the smallest relative mobility is selected as a cluster head. Each sensor node in the network will first choose the most suitable cluster head to join based on the information it receives from the cluster heads. Once a cluster head is chosen, the sensor node will send a registration message to inform that cluster head. After the cluster head receives the registration message from a node that would like to join the cluster, it will create a TDMA schedule and assign the node a timeslot for transmission. After a cluster head is selected, it broadcasts an advertisement message as well as its location to the sensor nodes within its transmission range. On receiving the advertisement messages from one or more cluster heads, a non-cluster-head sensor node will decide which cluster it would like to join.

Steady Phase

All nodes are time synchronised and start the set-up phase at the same time. A non-cluster-head node always has data to send to the cluster head in its allocated timeslot. After receiving a data packet successfully, the cluster head will send an ACK message to the non-cluster-head sensor node. The sensor node will confirm that the packet has been successfully transmitted if it receives the ACK message. The cluster head upon receiving a cluster joint request message will transmit a cluster-head message.

IV. Simulation And Result Analysis

In this section, we evaluate the performance of our proposed clustering protocol through simulation results.
Table 1 shows the value assigned to different network parameters.

Table 1. Network Model

Parameters	Value
Network Area	1000 × 1000 m2
Sensor Nodes	100
Node Sensing Range	250 meter
Data Rate	512 kbps
Initial Energy	100 J
Transmission Power	0.9 J
Receiving Power	0.8 J
Sensing Power	0.0175 J

The simulation focuses on delay, energy consumption, packet loss ratio and throughput which are important indicators to measure end to end performance of different routing algorithms.

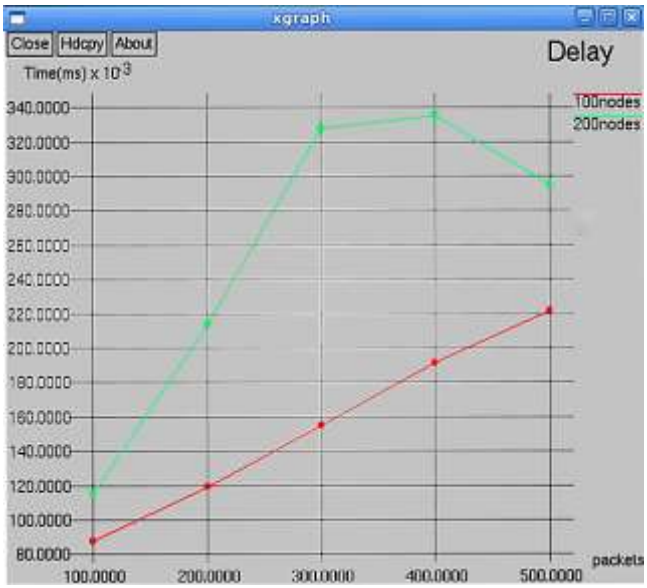

Figure 5 Delay

Figure 5 shows the delay of MBC protocol for 100 and 200 nodes in terms of completion of one round of communication. The graph indicates MBC has 25 % less delay compare to 200 nodes. It indicates that in a fixed mobile environment if the mobile nodes are increased the delay increases.

Figure 6 Energy Consumed

Figure 6 indicates energy consumption ratio for 100 and 200 nodes for MBC protocol. For the maximum number of packets transferred, MBC for 100 nodes consumes 43 % less energy than 2oo nodes. It shows that MBC has better lifetime when less nodes are used in fixed environment.

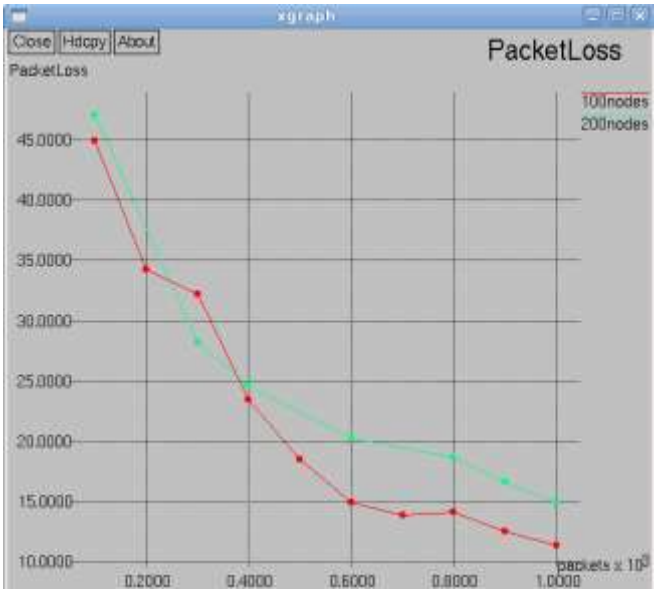

Figure 7 Packet drop ratio

Figure 7 shows the packet loss ratio for 100 nodes and 200 nodes for MBC protocol. The graph shows packet drop gradually decreases by 24% for 100 nodes than for 200 nodes for MBC protocol.

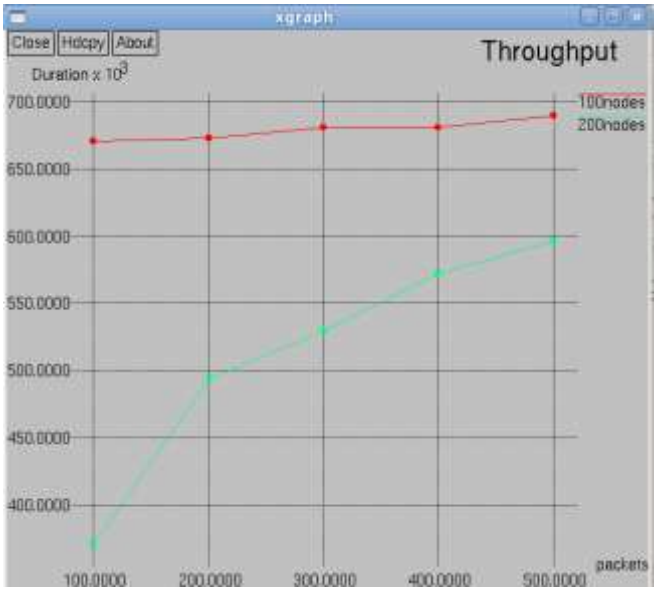

Figure 8 Throughput

Figure 8 shows throughput for 100 and 200 nodes. It shows that throughput for 100 nodes is better than for 200 nodes. Throughput is measured in terms of the number of data packets received with respect to time. The graph shows throughput for 100 nodes is 16 % higher throughput than for 200 nodes.

V. CONCLUSION

In this paper, we proposed an MBC protocol for WSNs with mobile nodes. The proposed clustering protocol allows a sensor node to elect itself as a cluster-head based on its residual energy and mobility. A non-cluster-head node aims at its link stability with a cluster head during clustering according to the estimated connection time. Each non cluster-head node is allocated a timeslot for data transmission in an ascending order in a TDMA schedule based on the estimated connection time. The simulation results clearly show that as the number of nodes is increased in a fixed environment the efficiency of the protocol decreases. The simulation was done for 100 and 200 nodes. The QoS parameters that were compared were Delay, Throughput, Packet drop ratio and Energy consumed. From the simulation it was clear that 100nodes simulation outperforms 200 nodes simulation for QoS for the above parameters by 25%, 16%, 24% and 43 %. So as the node of nodes increase in a fix mobile environment the QoS parameters loss their efficiency.

REFERENCES

[1] Jamal Al-Karaki, and Ahmed E. Kamal, "Routing Techniques in Wireless Sensor Networks: A Survey," in IEEE Communications Magazine, vol. 11, no. 6, Dec. 2004, pp. 6–28.
[2] Akyildiz, I. F., Su, W., Sankarasubramaniam, Y. & Cayirci, E. (2002). "A survey on sensor networks", IEEE Communications Magazine 40(8): 102–114.
[3] Vhatkar, S., & Atique, M. (n.d.). "Design Issues and Challenges in Hierarchical Routing Protocols for Wireless Sensor Networks". 2014 International Conference on Computational Science and Computational Intelligence.

[4] Kim, D., & Chung, Y. (n.d.). "Self-Organization Routing Protocol Supporting Mobile Nodes for Wireless Sensor Network". First International Multi-Symposiums on Computer and Computational Sciences (IMSCCS'06).
[5] Jaideep Lakhodia & Rajeev Kumar. "CLUSTER BASED ROUTING PROTOCOLS FOR MOBILE WIRELESS SENSOR NETWORK: A REVIEW". International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3 Issue 7, July 2014
[6] Almalag, M., Olariu, S., & Weigle, M. (n.d.). "TDMA cluster-based MAC for VANETs (TC-MAC)." 2012 IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM).
[7] Jun Zheng and Abbas Jamalipour, "Wireless Sensor Networks: A Networking Perspective," A book published by A John & Sons Inc. and IEEEE, 2009.
[8] Feng Sen, Qi Bing and Tang Liangrui, "An Improved Energy-Efficient PEGASIS-Based Protocol in Wireless Sensor Networks," in Proceedings of 8th IEEE International Conference on Fuzzy Systems and Knowledge Discovery (FSKD), vol. 4, Jul. 2011, pp. 2230–2233.
[9] S. Deng, J. Li and L. Shen "Mobility-based clustering protocol for wireless sensor networks with mobile nodes," in IET Communication Journal, vol. 1, no. 1, Mar. 2011, pp. 39–47.
[10] Divya Rai, Anil. S. Hiwale "Enhanced MBC (mobility-based clustering) protocol for wireless AD-hoc networks" in International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 5, September 2014.
[11] T. –H. Hsu, P. –Y. Yen, july-2011 "Adaptive time division multiple access-based medium access control protocol for energy conserving and data transmission in wireless sensor networks", published in IET communications.
[12] Heinzelman, W., Chandrakasan, A., Balakrishnan, H.: 'An applications pecific protocol architecture for wireless microsensor networks', IEEE Trans. Wirel. Commun., 2002, 1, (4), pp. 660–670
[13] S. Chen, B. Mulgrew, and P. M. Grant, "A clustering technique for digital communications channel equalization using radial basis function networks," *IEEE Trans. on Neural Networks*, vol. 4, pp. 570-578, July 1993
[14] Santhosh, G.K., Vinu, P.M., Poulose, K.J.: 'Mobility metric based LEACH-mobile protocol'. Proc. 16th Int. Conf. on Advanced Computing and Communications, San Francisco, American, December 2008, pp. 248–253
[15] Lan, T.N., Xavier, D., Razvan, B., et al.: 'An energy efficient routing scheme for mobile wireless sensor networks'. Proc. IEEE Int. Symp. on Wireless Communication Systems, Reykjavik, Iceland, October 2008, pp. 568–572
[16] Kim, D.S., Chung, Y.J.: 'Self-organization routing protocol supporting mobile nodes for wireless sensor network'. Proc. First Int. Multi-Symp. on Computer and Computational Sciences, Hangzhou, China June 2006, pp. 622–626

Sangeeta Vhatkar
Assistant Professor, TCET, Ph.D. Scholar, P.I.E.T, Nagpur.
Archana Nanade
M.E I.T , Thakur College of engineering, University of Mumbai
Mohommad Atique
Associate Professor P.G. Department Computer Science S.G.B.A.U, Amravati