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Dynamic Interface to Enhance Network Efficiency Using Channel Allocation

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Abstract-- Wireless Sensor Networks (WSN) is a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. The sensor nodes are extraordinarily limited in resources, so the important aim of designing routing protocol of WSN is to improve the routing efficiency and maximize the lifetime of networks. In the recent past, the routing efficiency and its issues can be solved by various protocols. In this paper we enhanced many to one transmission with AODV protocol and efficient channel allocation. We have implemented flat multi-hop routing algorithms which enable routing of data in a fashion that minimizes the power consumption of the WSN they fail to exploit the data aggregation opportunities by virtue of data collected from the WSN. In many WSN applications with the relatively high node density, the data collected by individual nodes are highly redundant, thus making data aggregation a very attractive scheme in WSNs. Hybrid multi-hop routing algorithms aim to capitalize on the highly correlated nature of WSN's collected data. It can improve the routing efficiency and channel allocation in cluster networks. The cluster head selection is obtained based on energy level and routing efficiency of the network.

Keywords-- Wireless Sensor Network, Cluster Head, AODV, Sensor Nodes

I. INTRODUCTION

Recent technological advances have enabled the inexpensive mass production of sensor nodes, which, despite their relatively small size, have particularly advanced sensing, processing and communication capabilities. A WSN consists of spatially distributed sensor nodes, which are interconnected without the use of any wires as depicted in Fig 1. In a WSN, sensor nodes sense the environment and use their communication components in order to transmit the sensed data over wireless channels to other nodes and to a designated sink point, referred to as the Base Station (BS). BS collects the data transmitted to it in order to act either as a supervisory control processor or as an access point for a human interface or even as a gateway to other networks. Through the collaborative use of a large number of sensor nodes, a WSN is able to perform concurrent data acquisition of existing conditions at various points of interest located over wide areas. Nowadays, WSNs, due to the numerous benefits that their utilization offers, support an ever growing variety of applications, including agriculture, traffic control, environment and habitat monitoring, object tracking, fire detection, surveillance and reconnaissance, home automation, biomedical applications, inventory control, machine failure diagnosis and energy management.

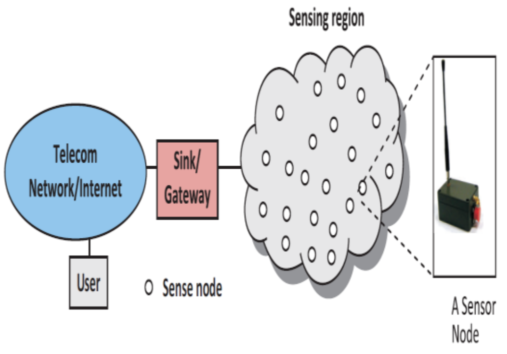

Fig. 1 Wireless Sensor Network

However, despite the advantages that the utilization of a WSN offers, their use is severely limited by the energy constraints posed by the sensors. The energy expenditure of the sensor nodes occurs during the wireless communication the environment sensing and the data processing. Therefore, most of the routing protocols in WSNs aim mainly at the attainment of power conservation. Since most of the routing protocols

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developed for wired networks pursue the attainment of high Quality of Service (QoS), they are practically improper for application in WSNs. For these reasons, many protocols have been proposed for data routing in sensor networks.

Most of the protocols use clusters in order to provide energy efficiency and to extend the network lifetime. Each cluster first elects a node as the cluster head (CH), and then, the nodes in every cluster send their data to their own cluster head. The cluster head sends its data to the base station. This data transfer can be performed in two alternative ways. Either directly, in the case in which the cluster head is located close to the base station, or via intermediate cluster heads.

This paper is organized as follows. In Section 2, related work is presented. In Section 3, the proposed protocol that models the network as a linear system, in order to select the cluster head that minimizes the energy consumption in the cluster, is described. In Section 4, the results and discussion are present. In Section 5, conclusions are drawn.

II. RELATED WORK

There exists a considerable research effort for the development of routing protocols in WSNs. The development of these protocols is based on the particular application needs and the architecture of the network. However, there are several factors that should be taken into consideration when developing routing protocols for WSNs. Energy efficiency is the most important among these factors, since it directly affects the lifetime of the network. There have been a few efforts in the literature pursuing energy efficiency in WSNs.

A.Manjeshwar and D.P.Agrawal [2] executed APTEEN (Adaptive Periodic Threshold sensitive Energy Efficient sensor Network) protocol. In this protocol once the Cluster Heads are decided in each round CH first broadcast the attributes, threshold, schedule and Count Time. It combines both reactive and proactive policies and provide periodic data collection as well as event detection. Ching-Wen Chen and Chann-chi Weng [5] proposed a protocol MTPCR (Minimum Transmission Power Consumption Routing. This protocol finds a path with high transmission bandwidth by considering the distance between two nodes and channel contention in MAC layer. Kai Lin, et al [7] implemented EBMA (Energy Balancing Cluster on Mobile Agent) is based on the cellular topology cluster and energy is balanced in inter and intra cluster. Lei Shi et al[10] executed DDRP protocol. It is an approach in which an efficient data-driven routing protocol for wireless sensor network with mobile sinks. It will reduce the topology overhead and extend the lifetime of WSN. Eduardo Cañete et al[16] proposed a protocol HERO which is a hierarchical, efficient and reliable routing protocol for wireless sensor networks and actor networks. It will form the cluster in an efficient way using metadata. It not only allows developer to send data from sensor node to CH and vice versa but also allow them to define the desired reliability level in quantitative way.

III. PROPOSED SYSTEM

This paper is the enhancement of many to one transmission with AODV (Adhoc On-Demand Distance Vector Routing) protocol and efficient channel allocation. This work focuses on single sink based WSNs, in which a WSN is composed of a number of sensor nodes associated with a single sink node. The primary role of sensor nodes is to gather data of importance from its surroundings. In this work, we consider a WSN design that is practical, and low cost. In this we are using the Flat multi hop routing and Hybrid multi hop routing are used.

A. Adhoc On-Demand Distance Vector Routing (AODV)

We propose an improved protocol based on Ad hoc On-Demand Distance Vector Routing (AODV) to adapt to the features such as energy limited and frequent topology changes in Wireless Sensor Networks (WSN). Based on the residual energy and communication load of each node, this protocol creates some routes from the source node to destination node, and then chooses a route to send data packets according to their reliability. When the route breaks up caused by the node's mobility or running out of energy, this protocol will choose a backup node which has a strong communication capability to forward data packets according to the backup routings information.

AODV is capable of both unicast and multicast routing. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. To find a path to the destination, the source broadcasts a route request packet. The neighbours in turn broadcast the packet to their neighbours till it reaches an intermediate node that has a recent route information about the destination or till it reaches the destination. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only.

When a node forwards a route request packet to its neighbours, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source, the nodes along the path enter the forward route into their tables.

If the source moves then it can reinitiate route discovery to the destination. If one of the intermediate nodes move then the moved nodes neighbour realizes the link failure and sends a link failure notification to its upstream neighbours and so on till it reaches the source upon which the source can reinitiate route discovery if needed.

B. Flat multi Hop Routing Algorithm

In these networks, all nodes play the same role and there is absolutely no hierarchy. Flat routing protocols distribute information as needed to any reachable sensor node within the sensor cloud. There is no effort to organize the network and its traffic. The effort is made only to discover the best hop by hop route source to a destination by any path. Flat routing protocols are similar to the conventional multi hop ad-hoc routing protocols. Each sensor node determines its parent node(s) to forward data packets. The nodes are not organized into hierarchical clusters as is done in the hierarchical protocols. The advantage of this approach is that all the nodes can reach the base station irrespective of their position

Each of the flat routing protocols can be decomposed into several constituent blocks as depicted in Fig 2. The arrows in the figure depict the depends-on relation between functions. Multi hop routing is an essential prerequisite for data aggregation; this is because there is no scope for aggregation if each node transmits directly to the base station. Similarly, reliable neighbour discovery depends on channel symmetry. If the radio link are not bidirectional, (for example, as a consequence of the hidden terminal problem) then reliable communication is not possible. Link layer broadcast is a fundamental requirement for sensor network routing, since radio channels are inherently broadcast in nature.

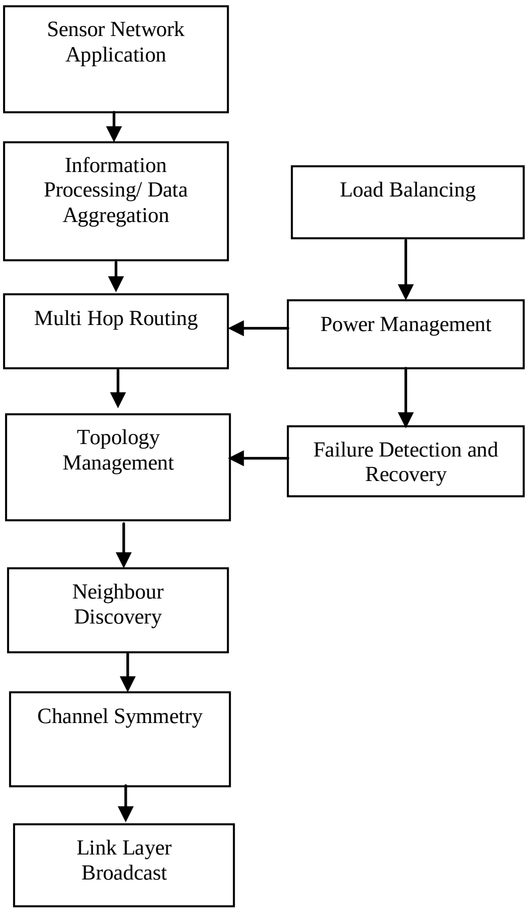

Fig. 2. Depends-on hierarchy for flat sensor network routing protocols. The function at the tail of an arrow depends on the function at the head of the arrow

Multihop routing makes it possible to achieve load balancing by restricting the power level at which sensor nodes communicate. Since the sensor nodes have severely restricted power resources, this can greatly increase the lifetime of the network. Finally failure detection and recovery is possible if each node is aware of its surrounding network topology.

C. Hierarchical and cluster-based routing protocols

Hierarchical routing protocols organize the network into groups called clusters. Each cluster selects a node that serves as the cluster-head. The cluster-head is responsible for collecting the sensor data from all the cluster members, aggregating them and transmitting a summary to the base station. This results in eliminating a large number of redundant messages from the nodes. Thus reducing the overall power consumption in the network. It also avoids many MAC layer collisions that waste the available bandwidth. This enables the sensor network to scale to a large number of nodes.

The disadvantage of cluster-based algorithms is that the base station should be reachable from all the cluster-heads. This drains the power reserves of the cluster-heads quickly, thereby disconnecting the corresponding clusters from the network. It is possible to avoid this problem by periodically rotating the cluster heads among the nodes to ensure uniform energy consumption.

Hierarchical routing protocols can be decomposed into several constituent blocks as depicted in Fig.3 The dependencies are essentially similar to those for flat routing protocols with a few additions. Since hierarchical routing protocols depend on the formation of clusters, a new Cluster formation block is introduced. Cluster formation involves not only the organization of nodes into groups, but also the election of cluster-heads. Clustering facilitates MAC layer scheduling of transmissions. The cluster-head computes and distributes the MAC schedule among its cluster nodes. Each node transmits only during its time slot; it can switch its radio off during all the other slots thereby conserving energy. Cluster maintenance depends on failure detection and recovery to determine if the cluster-head is alive or not. If the cluster-head has failed, the cluster formation process can be reinitiated. Failure detection in turn can be implemented by techniques like hierarchical heartbeat that are well suited for cluster-based topologies.

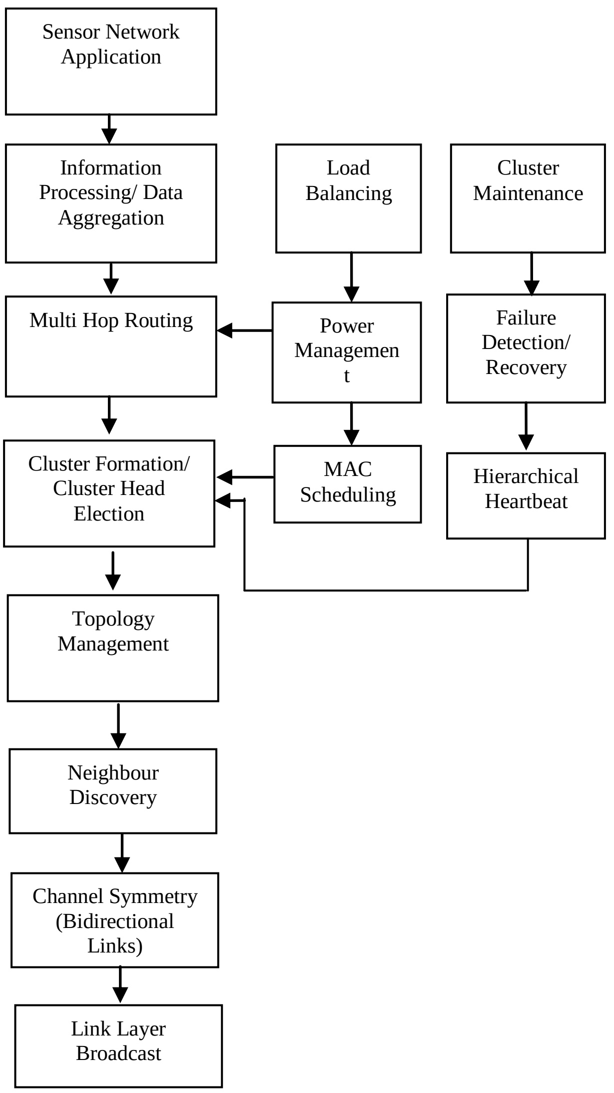

Fig. 3. Depends-on hierarchy for cluster-based sensor network routing protocols. The function at the tail of an arrow depends on the function at the head of the arrow.

D. Hybrid Multi Hop Routing (HYMN)

HYbrid Multi-hop routiNg (HYMN) algorithm, which is a hybrid of the two contemporary multi-hop routing algorithm architectures, namely, flat multi- hop routing that utilizes efficient transmission distances, and hierarchical multi-hop routing algorithms that capitalizes on data aggregation as depicted in Fig 4.

In general, since the number of sensor nodes in the SCA(Sink Connectivity Area) is much smaller than that outside the SCA, the amount of data generated by the nodes in the SCA can be negligible as compared to the volume of data flowing into the SCA from outside. This implies that most of the power consumption in the SCA is due to transferring the data that comes from outside the SCA to the sink node. In other words, in order to limit the power consumption in the SCA, the amount of data flowing into the SCA needs to be reduced, and/or the power consumption to relay the data from outside the SCA to the sink node needs to be minimized. In fact, the proposed scheme, referred to as HYbrid Multi-hop routiNg HYMN), illustrated in Fig.4, aims to achieve the effect of both solutions by employing a hierarchical multi-hop routing algorithm outside the SCA and using a flat multi-hop routing algorithm inside the SCA.

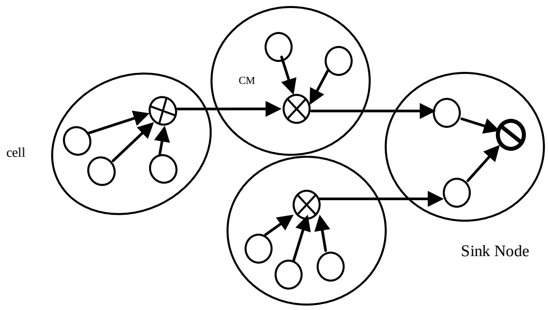

Fig.4. HYMN

IV RESULTS AND DISCUSSION

A. Experiment Contents

In this section, we aim to evaluate the performance of our proposed algorithm. For evaluation, Network Simulator version 2 (NS2) is used to carry out our experiments. Table 1 exhibits the configuration of the simulation environment where values of each parameter are set according to the configurations adopted in references, Sensor nodes are randomly deployed in the circular sensing field centred on the sink node. Since the nodes have a maximum transmissions range of 200m. The sensing field radius is set to a relatively high value of 500m. The experiment is set up so that each sensor node in the network generates a single packet periodically, and all packets are transmitted to the sink node. We assume that nodes are distributed without large deviation of node density.

The choice of hybrid boundary depends on the characteristics of the flat and hierarchical multi-hop routing algorithm employed and the environment. Fundamental analysis of our proposed hybrid multi-hop routing algorithm has been proposed Sec 3.4

TABLE I. SIMULATION PARAMETER

Item No.	**Item Description**	**Item Specification**
1	Simulation Area	2000×2000
2	No. of nodes	20
3	Channel Type	Channel/ wireless channel
4	Radio Propagation Model	Two Ray ground
5	Simulation Time	400 ms
6	Antenna Model	Antenna/ Omni Antenna
7	Energy Model	Battery
8	Interface Queue Type	Queue/ Drop Tail/ PriQueue

9	Link Layer Type	LL
10	Communication Model	Bidirection
11	Min Packet in ifq	30

B. Performance Comparison

We set the hybrid boundary of our proposed algorithm to 500 meter the reason for this will be explained in the following subsection. To compare our hybrid multi-hop routing algorithm with respect to both flat and hierarchical multi hop routing algorithms we considering numerous metrics, as follows. Fig.5 depicts Packet Delivery comparison between Flat Multi-Hop Routing, Hierarchical Multi-Hop Routing and HYMN.

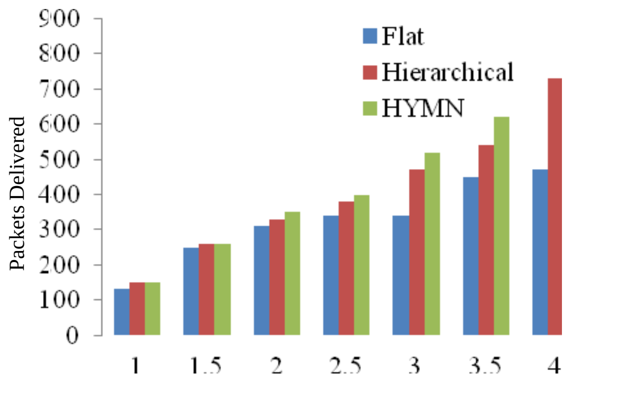

Fig. 5. Packet Delivery comparison between Flat Multi-Hop Routing, Hierarchical Multi-Hop Routing and HYMN.

It can be obviously observed that the hierarchical multi-hop routing suffers from a larger transmission distance as compared with the flat multi-hop routing. In addition, it should be noted that, in our proposed method, the communication distance is entirely different from the remaining algorithm. It can be noticed that at the hybrid boundary (d=500), the transmission distance fluctuates. The reason behind it, is that the alteration of the employed routing algorithm occurs at that point.

C. Considering the Hybrid Boundary location on performance

We consider the influence of hybrid boundary location on the performance of the proposed hybrid routing algorithm. The choice of hybrid boundary depends on the characteristics of the flat and hierarchical multi-hop routing algorithm employed and the environment. Fundamental analysis of our proposed hybrid multi-hop routing algorithm has been proposed. We aim to analyze the effect of radius(r) of the particular area. In this paper, we adopt an experimental approach towards investigating the effect of r. The distance between the sink node and the hybrid boundary, r, is varied and the changes in the network lifetime and the power consumption in the area are examined. From Fig. 6, it is very evident to see that the network lifetime is maximized when the area's power consumption becomes minimum. Intuitively, the optimal hybrid boundary exists in the area, i.e., r is equal to 500m (less than 600m). Fig. 7 depicts how the hybrid multi-hop algorithm performance behaves for different values of hybrid boundaries, i.e., r is set to 400m, 500m, and 600m

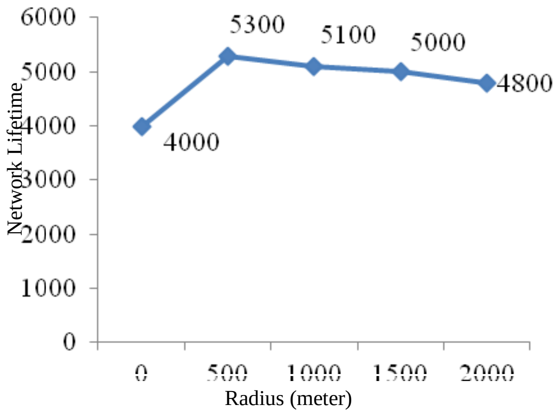

Fig. 6 Effect of hybrid boundary on network lifetime.

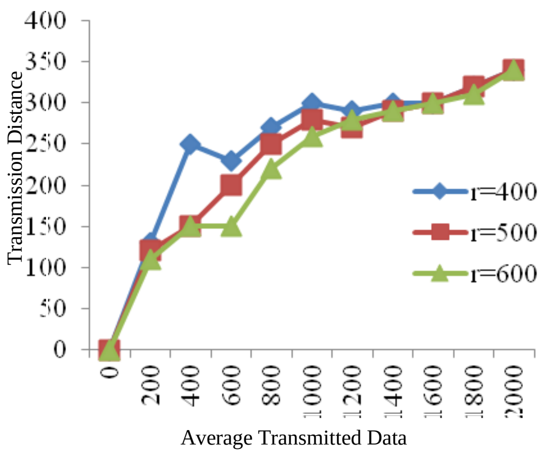

Fig. 7. Transmission distance in each node.

V. Conclusion

In this paper, we have proposed a hybrid multi-hop routing algorithm, which prolongs the network lifetime of wireless sensor networks. Existing routing algorithms developed for wireless sensor networks can be categorized into two classes, flat multi-hop routing algorithms which minimize the total power consumption in the entire network and hierarchical multi-hop routing algorithms which efficiently reduce the amount of traffic flowing through the network by using data aggregation mechanism; both approaches do not take into account the network isolation. To tackle this issue, we have proposed the hybrid multi hop routing algorithm by combining flat and hierarchical multi-hop routing algorithms. Through rigorous computer simulations, we analyze our proposed multi-hop routing algorithm with regards to various metrics, and evaluate its performance. Finally, it can be concluded that the hybrid multi-hop routing algorithm is a promising solution and extending the network lifetime

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REFERENCES

[1] Nitaigour P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications", Chapter 1, 7 & Spinger, 2007.

[2] A. Manjeshwar and D. P. Agrawal, "An Efficient Sensor Network Routing Protocol (APTEEN) with Comprehensive Information Retrieval," Proc. Second Int'l Workshop Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, Apr. 2002.

[3] Y. Xu and W. Wang, "Scheduling Partition for Order OptimalCapacity in Large-Scale Wireless Networks," Proc. ACM MobiCom,Sept. 2009.

[4] K. Jung, "Approximate Inference: Decomposition Methods with Applications to Networks," PhD dissertation, Massachusetts Inst.of Technology, June 2009.

[5] Ching-Wen Chen, Chuan-Chi Weng" A power efficiency routing and maintenance protocol in wireless multi-hop networks", Volume 85, Issue 1, January 2012, Pages 62–76

[6] W. R. Heinzelman, A. Chandrakasan, and H.Balakrishnan, "Energy Efficient Communication Protocol for Wireless Micro Sensor Networks", Proceedings of IEEE HICSS, Jan 2000.

[7] Lin, K.; Chen, M.; Zeadally, S.; Rodrigues, J.J.P.C".Balancing energy consumption with mobile agents in wireless sensor networks" Future Generation Computer Systems, Volume 28, issue 2 (February, 2012), p. 446-456

[8] Jamal N. Al-Karaki Ahmed E. Kamal, "Routing Techniques in Wireless Sensor Networks: A Survey," IEEE Wireless Communications, volume: 11, pp. 6-28, 2004.

[9] L. Jiang and J. Walrand, "A Distributed CSMA Algorithm for Throughput and Utility Maximization in Wireless Networks,"IEEE/ACM Trans. Networking, vol. 18, no. 3, pp. 960-972, June 2010.

[10] Lei Shi, Baoxian Zhang, Hussein T. Mouftah, Jian Ma " DDRP: An efficient data-driven routing protocol for wireless sensor networks with mobile sinks",2012

[11] Rajashree. V.Biradar, Dr.S.R.Sawant, "Classification And Comparison Of Routing Protocols In Wireless Sensor Networks," Ubiquitous Computing and Communication Journal volume 4, pp.704-711, 2009.

[12] H.-H. Yen, and C.-L. Lin, ―Integrated channel assignment and data aggregation routing problem in wireless sensor networks‖, IEEE, In Special Issue on Wireless Ad-Hoc Networks, 2009.

[13] Yanwei Wu, Xiang-Yang Li, YunHao Liu, and Wei Lou, ―Energy-Efficient Wake-Up Scheduling for Data Collection and Aggregation‖ IEEE Transaction on Parallel and Distributed System, Vol. 21, No. 2, pp. 275-287, February 2010.

[14] W. Song, R. Huang, B. Shirazi, and R. LaHusen, "TreeMAC: Localized TDMA MAC protocol for real-time high-data-rate sensor networks," in *Proc. of IEEE PerCom*, 2009.

[15] S. Sharma, "Energy-efficient Secure Routing in Wireless Sensor Networks", Dept of Computer Science and Engineering, National Institute of Technology Rourkela, Rourkela, Orissa, 769 008, India, 2009.

[16] Cañete, Eduardo; Díaz, Manuel ; Llopis, Luis ; Rubio, Bartolomé" HERO: A hierarchical, efficient and reliable routing protocol for wireless sensor and actor networks", Computer Communications, Vol 35, p 1392-1409.