REVIEW OF TRIPLE HETEROGENEOUS PROTOCOL FOR ENERGY EFFICIENT WSN

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ABSTRACT

Abstract: Wireless Sensor Networks(WSN) have developed as a promising tool for monitoring real world physical conditions such as sound, temperature, humidity etc. in sensor network, energy efficiency is a big issue due to energy constrained of sensors. In these networks some of the nodes are chosen as cluster heads, they aggregate the data of their cluster members and transmit it to the sink. This research was conducted in the following phases: Study the basic principle of wireless sensor networks. Review existing energy efficient routing protocols in WSNs. Design a Triple Heterogeneous WSNs Architecture to achieve energy efficiency in wireless sensor networks using custom simulator designed in Mat Lab. Compare the existing protocols in the form of table given below.

Keyword : - *LEACH cluster-head selection charge balanced; Network life time Mat Lab.etc….*

INTRODUCTION

Wireless Sensor Network : Wireless Sensor networks(WSN)[2] have emerged as a promising tool for monitoring (and possibly actuating) the physical world, utilizing self-organizing networks of battery powered wireless sensors that can sense, process and communicate with each other. There are a large number of nodes in WSN of low-cost, low power, and multifunctional with sensing capability, wireless communications and computation capabilities. Resources like CPU (for data processing), memory (for data storage), battery (for energy) and transceiver (for receiving and sending signals or data from one node to another). These sensor nodes can communicate with each other either directly or through other nodes and form a network. There will be one or more sink which are elected among sensor nodes. Theses sink nodes can communicate with the user either directly or through the existing wired networks. In sensor network, sensor is the primary component that senses real world physical conditions such as sound, temperature, humidity, intensity, vibration, pressure, motion, pollutants.

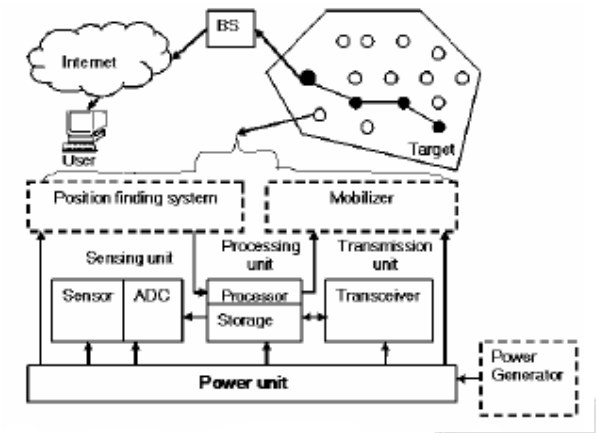

Fig1.1:WSNArchitecture

Applications of Wireless Sensor Network [2]:

I. **Military Applications**:

In sensor networks, low cost sensor nodes are deployed for monitoring activities and destruction of some nodes by hostile actions does not affect a military operation as much as the destruction of a traditional sensor, which makes sensor networks concept a better. Some of the military applications of sensor networks are approach for battlefields.

Monitoring friendly forces, equipment- In battlefield, information is gathered by using sensor networks. This task is accomplished by attaching sensor nodes with every troop, vehicle, and equipment to monitor the status of friendly troops, the condition and the availability of the equipment in a battlefield and these sensor nodes report the status. These reports are gathered in sink nodes and sent to the troop leaders. The data can also be forwarded to the upper levels of the command hierarchy while being aggregated with the data from other units at each level.

II. **Health Applications:**

In some health applications, sensing technology is used to sense the internal movements of human and internal processes of insects or other small animals. The health applications for sensor networks also provide interfaces for tracking and monitoring doctors and patients inside a hospital.

III. **Environmental Applications:**

Some environmental applications of sensor networks[3] include tracking the movements of birds, small animals, and insects; monitoring environmental conditions that affect crops and livestock; irrigation; macro instruments for large-scale Earth monitoring and planetary exploration; chemical/ biological detection; precision agriculture; biological, Earth, and environmental monitoring in marine, soil, and atmospheric contexts; forest fire detection; meteorological.

Need and proposed work

In this dissertation, we are needed to increase the energy of nodes or saving the energy of nodes in large WSN.A heterogeneous wireless sensor network consisting in several resource-rich super nodes used for data relaying and a large number of energy constrained wireless sensor nodes. Sensor nodes are deployed randomly to monitor a number of clusters. Since clusters are redundantly covered by more sensors, in order to conserve energy resources, we organize the sensors in clusters that are activating successively. We are need to finding the sensor nodes according to their energy in large area of WSN using LEACH (Low Energy Adaptive Clustering Protocol) [1], SEP (Stable Election Protocol) [9], and three level of heterogeneity[8]. Wireless sensor networks consist of a number of sensing nodes which are distributed in a wide area. They sense an event occurring in the environment and these sensing nodes are distributed or placed according to the requirements of the application.

(i) Firstly, make cluster.
(ii) Choose low energy of nodes in WSN.
(iii) Choose high energy of nodes in WSN.
(iv) Choose super energy of nodes in WSN.
(v) Compare above energy of nodes with each other for finding compromise energy in WSN.

Thus, when low energy nodes transmit data to high energy nodes then energy will be saved.

Literature survey :

LEACH (Low – Energy Adaptive Clustering Hierarchy)

Energy-efficient routing protocols for wireless microsensor networks introduced by W. Heinzelman, A. Chandrakasan, and H. Balakrishnan , in Proc. 33rd Hawaii Int. Conf. System Sciences (HICSS), Maui, HI, Jan. 2000. Propose a protocol, called LEACH (Low-Energy Adaptive Clustering Hierarchy) a clustering- based protocol which distributes the energy load among all the nodes to minimize the energy dissipation. By using this protocol each node in the network chooses randomly as cluster head. This protocol does compress the data by collecting all nodes and then send to the base station to reduce the amount of information. LEACH outperforms direct transmission, minimum-transmission-energy, multihop routing, and static clustering. Simulations show that LEACH can achieve 8 times more reduction in energy dissipation as compared to conventional routing protocols. Additionally LEACH also distributes energy dissipation evenly among the sensors nodes throughout the network and improves the lifetime of network.[1]

PEGASIS (Power Efficient Gathering in Sensor Information System)

S. Lindsey, C. S. Raghavendra, PEGASIS: Power Efficient Gathering in Sensor Information Systems, IEEE Aerospace Conference, 2002. RECENT ADVANCES in NETWORKING, VLSI and SIGNAL PROCESSING. Author describes a protocol, PEGASIS (Power Efficient Gathering in Sensor Information System). It uses greedy chain algorithm in which instead of transmitting data by each and every node to base station, each node sends data to neighboring node and a chain forms, thus reducing the amount of energy spent per round. PEGASIS outperforms LEACH protocol. This protocol eliminates the overhead of making clusters and reduces the number of transmissions and receives among all sensor nodes and it uses only one transmission to the base station per round. Simulation result shows that PEGASIS works better than LEACH. It distributes all energy load among all the nodes of sensor network and thus increase the lifetime and quality of sensor network.[3]

SECURE ROUTING

Secure routing in wireless sensor networks: attacks and counter measures introduced by C. Karlof, D. Wagner in 2003. In this paper, author describes routing security in wireless sensor networks which is an important aspect. Many sensor network routing protocols are proposed, but these routing protocols focus mainly on transmission and receives not on security of network. This paper focuses on the security of routing. For this purpose security goals for

routing in wireless sensor networks and two classes of novel attacks against sensor networks are introduced namely sinkholes and HELLO floods. Also show how attacks against wireless network and peer-to-peer networks can be adapted into powerful attacks against sensor networks and here the security of all the major sensor network routing protocols has analysed. Authors suggest countermeasures and design considerations against attacks.[4]

SPEED

SPEED: a stateless protocol for real-time communication in sensor networks introduced by Tian He, John A Stankovica, ChenyangLub, Tarek Abdelzahera in May, 2003. In this paper, author proposes a protocol, called SPEED for sensor networks. SPEED protocol is a stateless protocol for real-time communication in networks. It offers three types of real-time communication services, real-time unicast, real-time area-multicast and real-time area- anycast. SPEED combines feedback control and non - deterministic QoS-aware geographic forwarding and maintains a desired delivery speed across the network which improves node to node delivery and controls the congestion in network. SPEED is a highly efficient and scalable protocol for sensor networks where each node having limited resources like battery power, bandwidth, memory. Simulate the result on GloMoSim and experiment on Barkeley motes and compare the performance of SPEED with DSR, AODV, GF, SPEED-S and SPEED-T.[5]

SEP (Stable Election Protocol)

SEP: A Stable Election Protocol for clustered heterogeneous wireless sensor networks, in (SANPA 2004) introduced by G. Smaragdakis, I. Matta, A. Bestavros), 2004. Author proposes SEP, a heterogeneous-aware protocol to increase the time interval before the death of the first node which is essential for many applications where the feedback from the sensor network must be reliable. Sensors nodes in sensor network having additional energy are assumed to be static and randomly deployed in sensing field to sense the data. In this technique, cluster head is elected based on weighted probability. Simulation that SEP always prolongs the stability period compared to the one obtained using current clustering protocol LEACH. Study the sensitivity of our SEP protocol to heterogeneity parameters by capturing energy imbalance in the network. We found that SEP provides better stability period due to the powerful nodes having additional energy. [6]

DEEC (distributed Energy – efficient clustering)

Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks introduced by Li Qing, Qingxin Zhu, Mingwen Wang in 4 August 2006. In this paper author describes DEEC (distributed energy-efficient clustering) protocol for heterogeneous wireless sensor network. This scheme selects cluster head probability basis on the ratio between residual energy of node and average energy of network. Nodes which have more initial energy they have more chances to elect as cluster head than nodes having low energy. DEEC can also perform better in multi-level heterogeneous sensor network. Simulation shows that it gives better result than SEP and LEACH in terms of stability period and network lifetime. [10]

SECURITY ISSUE

A Survey on Wireless Sensor Networks Security by Abhishek Pandey,R.C. Tripathi, in June 2010. This paper describes the introduction of WSN, layered architecture and attacks like denial of service which is prevented by powerful authentication and identification technique, blackhole attack in which attacker creates shortest path in network so that all data passes through it, warmhole attack may destroy security by interruption so these are prevented by encryption decreption algorithm and data aggregation technique. Used simulators like TOSSIM, NS2, OMNeT++ and GloMoSim to provide security in WSN.[12]

BEEG (Balanced Energy Efficient Grouping)

"Improving lifetime in Heterogeneous Wireless Sensor Networks with the Energy Efficient Grouping Protocol" introduced by Jiun-Jian Liaw, Lin-Huang Chang and Hung-Chi Chu in September 2012. Propose the protocol BEEG (balanced energy efficient grouping) to improve the lifetime of WSN network for reducing energy consumption. The protocol divides all the sensor nodes into groups or clusters having same energy. In this paper BEEG protocol is compared with DEEC, SEP and LEACH protocol. Simulation result shows the stability period of BEEG is more than others.[13]

3 – LEVEL HETEROGENEITY

"3-Level Heterogeneity Model for Wireless Sensor Network" introduced by Satish Chand, Samayveer Singh and Bijendra Kumar in 2013. In this paper author propose a 3-level heterogeneous model which describes 1-level, 2-level and 3-level heterogeneity. A parameter is used here to qualify the model. As the value of parameter increases, the lifetime of network decreases and as the heterogeneous level increases, the lifetime of parameter increases. Simulate the result by applying load balancing protocol ALBP and get the hetALBP.[14]

EECP (Energy Efficient Clustering protocol)

Sanjeev Kumar Gupta1,Neeraj Jain2,Poonam Sinha3 "Energy Efficient clustering Protocol for Minimizing Cluster Size and Inter Cluster Communication in Heterogeneous Wireless Sensor Network Research Scholar" ABV,IIITM,2013. In this paper author describes an Energy Efficient Clustering Protocol (EECP) for cluster head selection and coordination among grouped cluster heads. In existing clustering techniques, cluster head is chosen randomly or based on probabilistic threshold. Since cluster head is selected randomly, any of the sensor nodes can become cluster head and also size of cluster varies. In larger area network, more data transmission from cluster head to BS (Inter cluster communication) consumes lots of energy. Grouping of cluster heads is done at the end of steady state phase in each round. The concept of sub- cluster head reduces the transmission distance from cluster head to BS and thus consumes less energy. Simulation shows that the EECP protocol performs better for stability period and network lifespan than LEACH. [15]

Comparison of Routing Protocols in WSN

Classification of Routing Protocols is necessary to evaluate and decide which protocol is applicable for a particular situation. The study of routing protocols in detail made it easy to evaluate and compare each protocol depending upon the factors that are mentioned above. Now we will compare the above mentioned routing protocols according to their performance depending on the different parameters. An evaluation is done on all the protocols depending upon their operation using the sensor nodes in the network. Table-I shows the operability of protocols with regard to type, connectivity, Energy Awareness and features.

Table1:-Comparison of Routing Protocols

Characteristics / Protocol ↓	Type	Connectivity	Energy awareness (low / moderate / high)	Feature
LEACH	Homogeneous	cluster head leads the transmission	High, uses clustering technique to save energy	Requires no control information from BS, improve quality of N/W

SEP	Heterogeneous	cluster head leads the transmission	High, uses clustering technique to save energy	More stable than FAIR and LEACH
SPIN	Homogeneous	Data shared with interested nodes, to reach sink	Moderate, the nodes which have energy resources only take part in transmission.	
SPEED	Real time communication protocol	Soft real time node to node delivery	Low	Reduce congestion
PEGASIS	Homogeneous Energy efficient protocol	Data send to neighbouring node by forming a chain to reach sink	High, use greedy chain technique to save energy.	Uses greedy chain algorithm
DEEC	Heterogeneous	Data are sent by cluster head to BS	Moderate, use clustering technique, nodes with high initial and residual energy have more chances to take part in transmission.	Achieves longer lifetime of network and also fit for multi - level heterogeneous network
BEEG	Energy efficient grouping protocol	All nodes are divided into groups	High,	Fit for multilevel heterogeneous N/W
EECP	Energy efficient	A main cluster head (which receives data from other cluster heads) leads the transmission to BS	High, groups all cluster heads into a small region	Reduce transmission distance b/w cluster head and BS

Conclusion :

In this paper, we have described some routing protocols for wireless sensor networks and compared all existing routing protocols. PEGASIS protocol uses greedy chain algorithm to reduce energy dissipation. EECP protocol reduces the transmissions to main cluster head to BS by grouping all cluster heads into a small region. LEACH and

SEP are highly energy aware protocols than SPIN as they use clustering techniques to save energy usage. SPEED protocol reduces the congestion in the network. DEEC, a heterogeneity aware protocol, prolongs the lifetime of network and also suitable for multilevel heterogeneous network.

REFERENCES

[1] [1]. W. Heinzelman, A. Chandrakasan, and H. Balakrishnan, ―Energy-efficient routing protocols for wireless microsensor networks, in Proc. 33rd Hawaii Int. Conf. System Sciences (HICSS), Maui, HI, Jan. 2000.

[2] Stephanie Lindsey Cauligi S. Raghavendra. "PEGASIS: Power-Efficient Gathering in Sensor Information Systems". In Proceedings of IEEE Aerospace Conference, Vo1.3, pp. 1125-1130. Big Sky Montana, March 9-16 2002.

[3] S. Lindsey, C. S. Raghavendra, PEGASIS: Power Efficient GAthering in Sensor Information Systems, IEEE Aerospace Conference, 2002. RECENT ADVANCES in NETWORKING, VLSI and SIGNAL PROCESSING ISSN: 1790-5117 27 ISBN: 978-960-474-162-5

[4] C. Karlof, D. Wagner, ―Secure routing in wireless sensor networks: attacks and counter measures‖, Ad Hoc Networks, Vol. 1 (2003) pp. 293315.

[5] T. He et al., SPEED: a stateless protocol for real-time communication in sensor networks, in: Proceedings of International Conference on Distributed Computing Systems,Providence, RI, May 2003.

[6] G. Smaragdakis, I. Matta, A. Bestavros, SEP: A Stable Election Protocol for clustered heterogeneous wireless sensor networks, in: Second International Workshop on Sensor and Actor Network Protocols and Applications (SANPA 2004), 2004

[7] J.-H. Chang and L. Tassiulas, "Maximum lifetime routing in wireless sensor networks," IEEE/ACM TRANSACTIONS ON NETWORKING, vol. 12, no. 4, Aug. 2004, pp. 609-619. RECENT ADVANCES in NETWORKING, VLSI and SIGNAL.

[8] Kemal Akkaya, Mohamed Younis,‖ A survey on routing protocols for wireless sensor networks‖, Ad Hoc Networks 3 (2005) 325–349.

[9] Zhou, J. and De Roure, D., Designing Energy-Aware Adaptive Routing for Wireless Sensor Networks, The 6th International Conference on ITS Telecommunications, 21-23 June 2006, Chengdu,China.

[10] Li Qing, Qingxin Zhu, Mingwen Wang, Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks, Computer Communications, Volume 29, Issue 12, 4 August 2006, Pages 2230-2237.

[11] Ameer Ahmed Abbasia, Mohamed Younisb, A survey on clustering algorithms for wireless sensor networks, Computer Communications, 30(15), October 2007, pp2826-2841

[12] Abhishek Pandey,R.C. Tripathi, ―A Survey on Wireless Sensor Networks Security, International Journal of Computer Applications (0975 – 8887) Volume 3 – No.2, June 2010.

[13] Jiun-Jian Liaw, Lin-Huang Chang and Hung-Chi Chu, "Improving lifetime in Heterogeneous Wireless Sensor Networks with the Energy Efficient Grouping Protocol". International Journal of Innovative Computing, Information and control. Volume 8,Number 9,September 2012.

[14] Satish Chand, Samayveer Singh and Bijendra Kumar,"3-Level Heterogeneity Model for Wireless Sensor Network", I.J.Computer Network and Information Security, 2013,4,40-47.

[15] Sanjeev Kumar Gupta1,Neeraj Jain2,Poonam Sinha3 "Energy Efficient clustering Protocol for Minimizing Cluster Size and Inter Cluster Communication in Heterogeneous Wireless Sensor Network Research Scholar" ABV,IIITM,2013.