MAXIMIZING THE LIFETIME OF NETWORK SECURITY BY DSDV PROTOCOL USING GAME THEORY TECHNIQUES IN WIRELESS SENSOR NETWORK

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ABSTRACT

In recent years wireless sensor network (WSN) is an active domain of research. A WSN consists of a number of sensor nodes each with limited energy, bandwidth, storage and processing capabilities. Clustering is one of the basic approaches that offer a practical way of providing scalability when designing a large and dense sensor networks. One of the approaches to enhance the survivability of WSN is to allow only some sensor nodes in a cluster of sensor nodes, called cluster heads, to communicate with the base station. In this paper we have proposed a Game theoretic approach for selecting a cluster head for every cluster in a WSN. In this work, our goal is to provide longitivity of network lifetime and network security by using game theoretical modeling of cluster-head selection for wireless sensor networks. A game of scheduling of nodes for taking the responsibility of cluster head, is an interactive decision making process between a set of self-interested nodes. In this paper we consider cooperation between the cluster heads in data transmission .A mobile node may move to a new location, in which it is desirable for the node to join a group. Hence using game theory technique with DSDV protpcol and proposed algorithm we maximized the network lifetime , network security minimised the energy consumption and decrease in end to end delay. Also, we propose an algorithm for nodes to choose the best group in their signal range, using coalitional game theory.

***Key words:** clustering, Cooperative Game Theory, DSDV protocol, Wireless sensor network.*

I. INTRODUCTION

Wireless Sensor Networks is a new technology which is used in a huge majority of applications. This network is a graph which consists of a large number of sense nodes. These nodes are able to gather the information and process it and send it to the relevant destinations. The sensors have some individual characteristics such as small dimension and low power consumption. Because of these characteristics, they could be used in different fields such as military, agricultural, industrial, and biomedical applications. Furthermore, they could easily be used in different environments such as unreachable or dangerous regions. Since there is no need to use a large amount of wire and complicated configuration and installation for these sensors in the network, we could use them with lower cost in comparison with traditional networks. Game theory is a tool for analyzing the interaction of decision makers with conflicting objectives. Economists have long used it as a tool for examining the actions of economic agents such as firms in a market. In recent years, it has seen some application by computer scientists to problems such as flow control and routing, but we believe that it can be applied fruitfully to a much broader class of problems in communications systems. In some sense, game theory is better suited to solving communication problems a wireless sensor network (WSN) typically consists of sensor nodes with sensing, computing, and communication devices. The main goal of the WSN is to gather data from the environment and transmit it to a sink node. The physical size of sensor nodes is very small, which introduces challenges for the design and management of WSNs. Data transmission is expensive therefore, the management of communication between nodes is an important factor Cooperation between sensor nodes can potentially reduce the total power consumed for data transmission in the whole network in a WSN. Grouping is a method to organize node cooperation in a WSN. A group of nodes has a leader which receives data from the group members and communicates with the outside of the group. Nodes which are close to each other, may in principle communicate using less power. By cooperating inside a group, the group's members can decrease their transmission power to a minimum and still reach the leader. However, if nodes do not have fixed locations, the network topology can change. Nodes should compute the most efficient way to communicate in the network. Consequently, the group structure of the network may need to evolve. In a self-organizing network, a new node may want to join a group and the group needs to decide whether to accept the node. This paper proposes a protocol to decide whether a node should join a group. We assume that a group leader forms and manages its group in a way that is beneficial for the group's members, and that a node can transmit directly to the group leader using maximum transmission power. Our protocol uses coalitional game theory to decide on group extensions. This paper proposes a DSDVprotocol which helps in longitivity of network life time and increase in throughput. The paper is organized as follows. Section 2 reviews the related work. Proposed framework and coalitional game theory has been discussed in section 3. Section 4 deals with the proposed protocol and algorithm. In section 5 Simulation Results of the paper has been discussed. Conclusion of the work and future directions are provided in the last section.

II. RELATED WORKS

In the literature, most of the research works on energy balancing models for wireless sensor networks deal with the planned networks. Therefore, researchers have not focused on energy balancing in these networks since such networks either do not require energy balancing necessarily or do not provide much opportunity for energy balancing. But, in randomly deployed networks, energy balancing is one of the key requirements due to unpredicted topology. Powell et al. have proposed a spreading technique to balance the energy among sensors of the same slice. The authors divided the whole sensing region in many slices. The technique has also been validated through simulation for data monitoring and propagating task by applying the probabilistic data propagation algorithm with optimal parameters . Energy-Balanced Transmission Policy (EBTP) has been proposed based on controlled transmission power by Azad and Kamruzzaman in . Authors have proposed that imbalance in energy consumption causes early demise of some of the sensors which ultimately leads to the problems of coverage and connectivity in the network. The analysis has been performed by taking concentric circles around the sink and load is balanced by decreasing the transmission range of different sensors near the sink. Efthymiou et al. have suggested an algorithm for energy balancing in the sensor network through routing. Sardouk et al. in , have proposed a scheme to maximize the lifetime of the network based on the cooperation among different sensors. This scheme considers information importance based communication for energy efficient data processing. In , Bouabdallah et al. have suggested a protocol that finds multiple paths for traffic generated by sensors to balance energy in the network. It is proved analytically that choosing multiple paths for sensors to forward data conserves energy to maximize the lifetime of a network. A scalable and distributed algorithm is presented for routing of data by Chang and Tassiulas . This routing technique is based on linear programming formulation used for choosing next hop. Chiasserini and Garetto proposed a scheme that schedules redundant sensors to go in sleep mode for saving the battery power and maximizing the lifetime of the network . An energy estimation approach has been suggested in , where authors claimed that their approach enables mobile agents to predict the remaining energy of all sensors in their clusters. Additionally, they have also presented a routing scheme to balance the energy among sensors using mobile agents. In authors have developed an clustering algorithm which selects a sensor as cluster head based on remaining energy, node degree, density, etc. This algorithm provides opportunity to each sensor to become a cluster head to balance the energy consumption among all the sensors. Heuristic based routing technique to control transmission power of all sensors has been suggested in . Authors have proposed load balanced clustering algorithm. This algorithm considers parameters such as radius of cluster based on distance and distribution, node degree and remaining energy of sensors to form clusters. Energy Balancing and unequal Clustering Algorithm (EBCAG) using gradient routing has been presented in. EBCAG assigns grades to each sensor of the network. A grade is the minimum number of hop-counts required to reach the sink. After assigning grades, unequal clusters have been created to achieve fairly balanced energy depletion among all the sensors. Descending gradient based forwarding strategy has been used by each cluster members to forward data to the sink. Algorithms for efficient cluster head selection and cluster formation have also been provided. Our motivation for this paper rests on the laxity of researchers for not addressing the problem of energy imbalance inadequately. A few of researchers addressed this problem once the distribution of sensors had been assumed. This assumption poses lots of limitations due to uneven load. Some others addressed the problem by assuming routing as one of possible candidates for energy balancing. Therefore, in this work, we have made an attempt to address the problem of energy imbalance by using adaptive sensing and transmission without compromising coverage and connectivity. This approach does not only fairly equalize the energy consumption by different sensors but also improves lifetime of network.

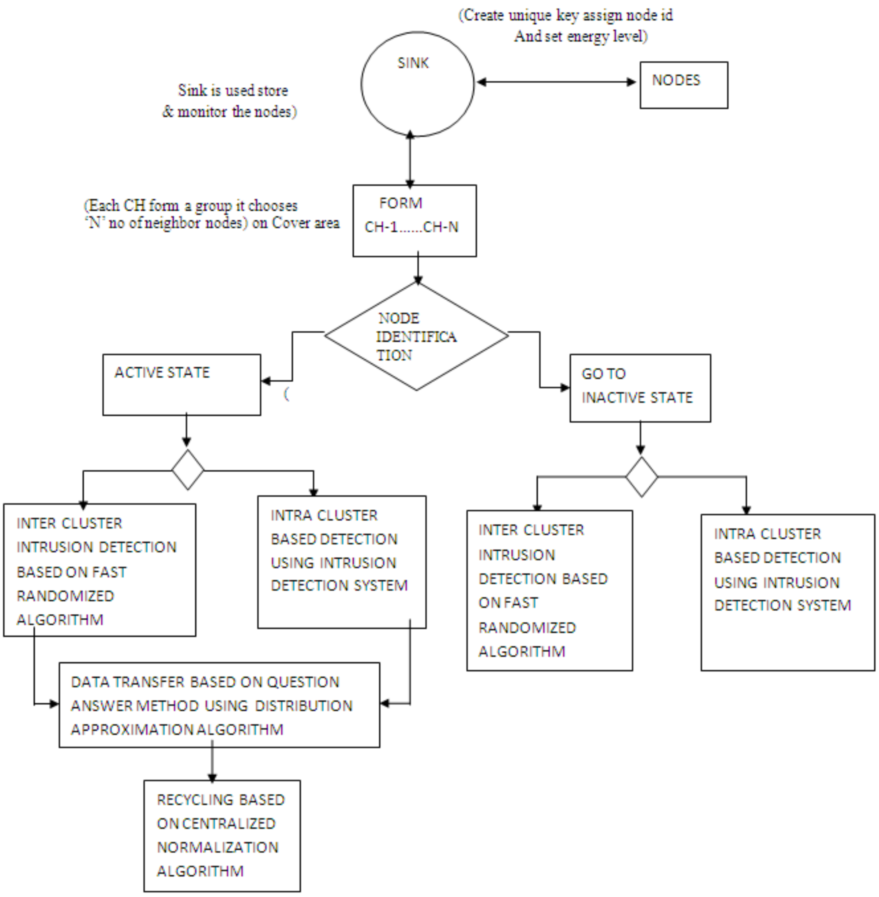
III. PROPOSED FRAME WORK

In this paper, we proposed a coalitional (Cooperative) Game theory between cluster heads. Initially nodes will be available in the sensor network. Where one of the node acts as the sink node or base station. Sink node or Base station will monitor the entire sensor network. The sink node assigns the Node ID and initial energy level to all the sub nodes. Sink node choose neighbor node as cluster head. Then cluster head will connect to the sub nodes up to the coverage area based. After first cluster head is chosen and sub nodes formed, then second cluster head is chosen and again forms the sub nodes. This process continued up to 5 cluster heads formed. Sub nodes send their packets to their specific heads. In this proposed frame work the following algorithms are applied.

Coalitional game theory: Game theory can be used to analyze behavior in decentralized and self organizing networks. Game theory typically models the nodes as players and choice of strategies of self-interested players, in order to capture the interaction of players in an environment such as a communication network. A game consists of

- a set of players N = {1, 2, ...,n};
- an indexed set of possible actions $A = A_1 x \ldots x\ A_n$ where A_i is the set of actions of player I (for $0 < i \leq n$)
- a set of utility functions, one for each player. The utility function u assigns a numerical value to the elements of the action set A; for actions x; y $\in A$ if $u(x) \geq u(y)$ then x must be at least as preferred as y.

Game theory can be divided into non cooperative and cooperative game theory. . Non cooperative game the ory studies the interaction between competing players, where each player chooses its strategy independently and each player goal is to improve its utility or reduce its cost. In cooperative games, groups of players are formed, called coalitions. players trying to find a coalition to strengthen their position in the game and make an agreement to act as a simple entity. Coalitional games have proved useful to design fair, robust, and efficient cooperation strategies in communication networks. In a coalitional game (N, v) with N players, the coalition is determined by a characteristic function $v : 2^N \rightarrow R$ which applies to coalitions of players. The core of the coalitional game (N, v) guarantees that no player has an incentive to leave N to form another coalition.



IV. PROPOSED PROTOCOL: DSDV PROTOCOL

DSDV is a Proactive gateway discovery algorithm where the gateway periodically broadcasts a gateway advertisement message which is transmitted after expiration of the gateways timer.

This protocol is based on classical Bellman-Ford routing algorithm designed for MANETS. Each node maintains a list of all destinations and number of hops to each destination. Each entry is marked with a sequence number. It uses full dump or incremental update to reduce network traffic generated by rout updates. The broadcast of route updates is delayed by settling time. The only improvement made here is avoidance of routing loops in a mobile network of routers. With this improvement, routing information can always be readily available, regardless of whether the source node requires the information or not. DSDV solve the problem of routing loops and count to infinity by associating each route entry with a sequence number indicating its freshness. In DSDV, a sequence number is linked to a destination node, and usually is originated by that node (the owner).

4.1 Proposed Algorithm

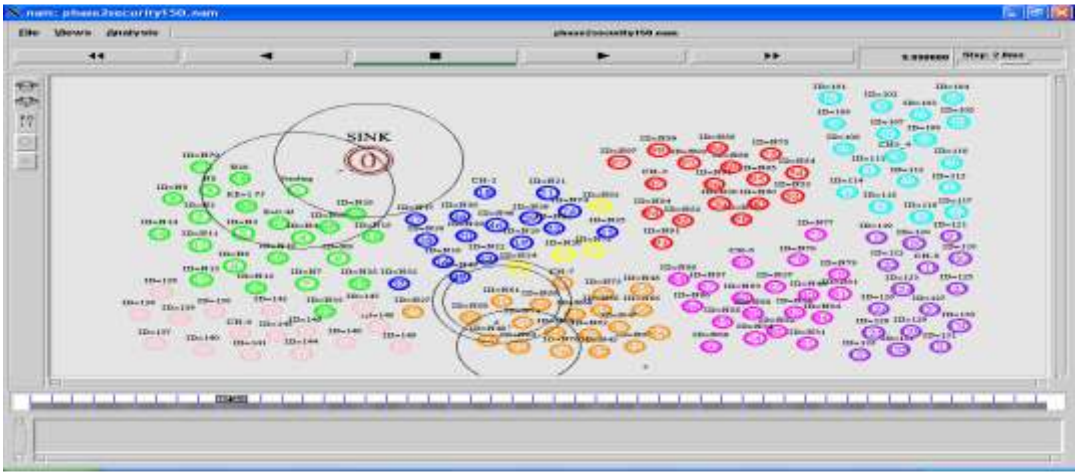
a. Centralized normalized algorithm: Use centralized normalized algorithm for verification of energy level from cluster head to sink. After sink recycling choose new cluster head based on energy level.

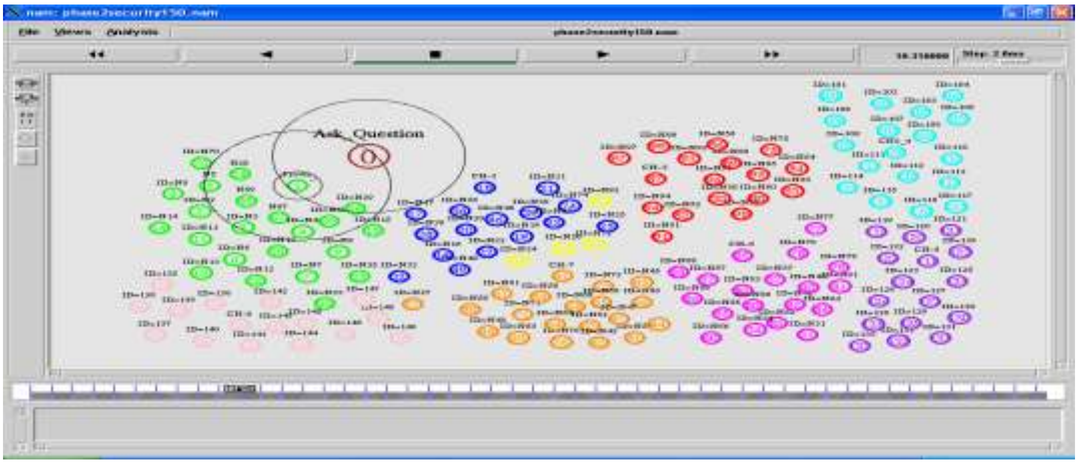
b. Distribution normalized algorithm: Distributed normalized algorithm will detect the IDS nodes from one network to another network while packet transmission. As well as the main security of network lifetime maximizes while base station transfer the queries with answer to all the cluster heads after every cycling process differently question and answer arises. This can be cluster head security maintenance from the base station monitoring. And further any of the mobile nodes will switch over into the any other cluster means then those moving mobile sensor nodes cluster authorization provide from this cluster to another cluster heads. So we can easily detects the mobile sensor nodes easily for already registered or not.

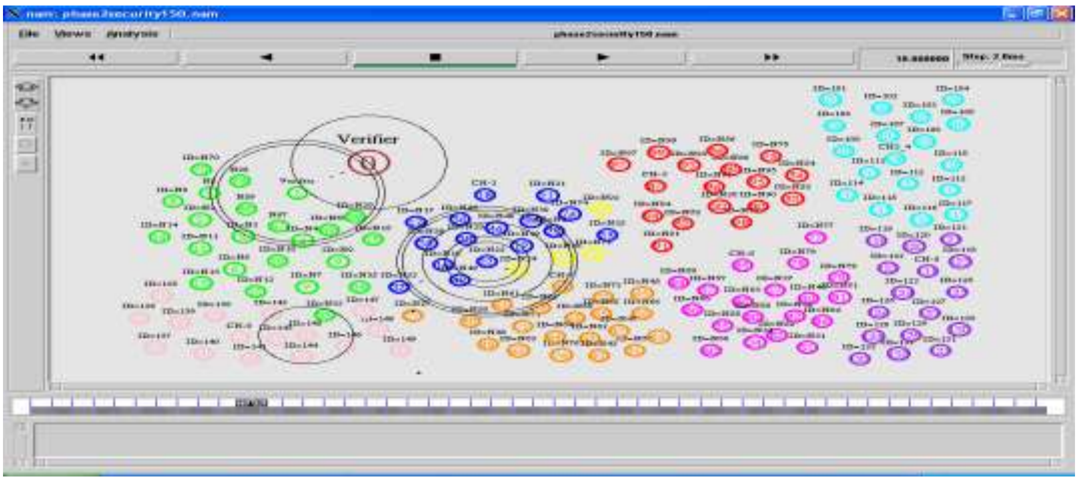
c. False Randomized Algorithm: This algorithm is used to generate secret key for each and every sensor node during recycling process. To maximize the network life time and security improvement base station will send question with answer to every cluster head. During every recycling process each question and answer will change differently to every cluster head. Sub nodes will transfer the data to cluster heads by centralized normalized algorithm and cluster heads will transfer the data to cluster heads by using distribution normalized algorithm . All cluster heads will check their questions and answers so as to detect the misbehavior nodes after verification cluster heads will transmit the data to the sink which will improve the network lifetime.

Using Timer setting TTL (Time to Leave) (i) we can improve the energy consumption and we can overcome end to end delay (i.e) end to end delay is decreased.(ii) Through put is increased. (iii) Network life time is maximized (iv) Increase in packet delivery ratio.

V. SIMULATION MODEL





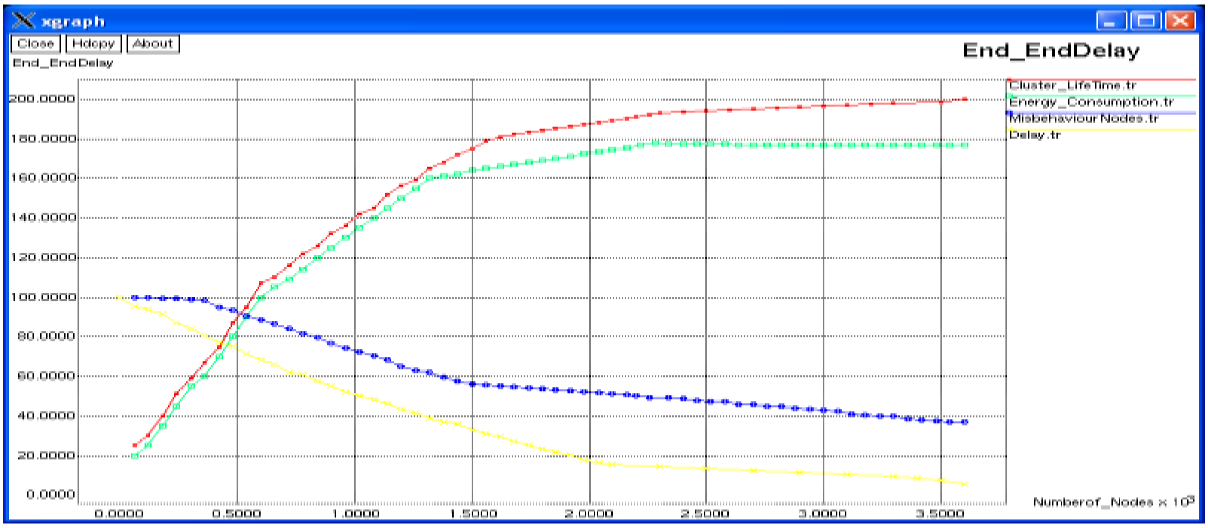


5.1 Simulation setup

Network Size	1900x1100
Number of Nodes	150
Number of Clusters	8
Throughput	25 Mbps
Bandwidth	5 Mbps
Frequency	10 Hz
Average Speed of nodes	4.2 m/s
Data Transmission	1200 Bytes
Packet Rate	100 Packets per second (pps)
Request message interval	5 – 1 5 Seconds
Mobility Factor	500 seconds
Request message jitter	200 ms
Mobility Detection Interval	100 seconds
Initial Energy Assigned	100 Joules
Energy Consumption	10 Joules
Protocol	DSDV Protocol
Simulation Time	8000 seconds

(1) End – End delay

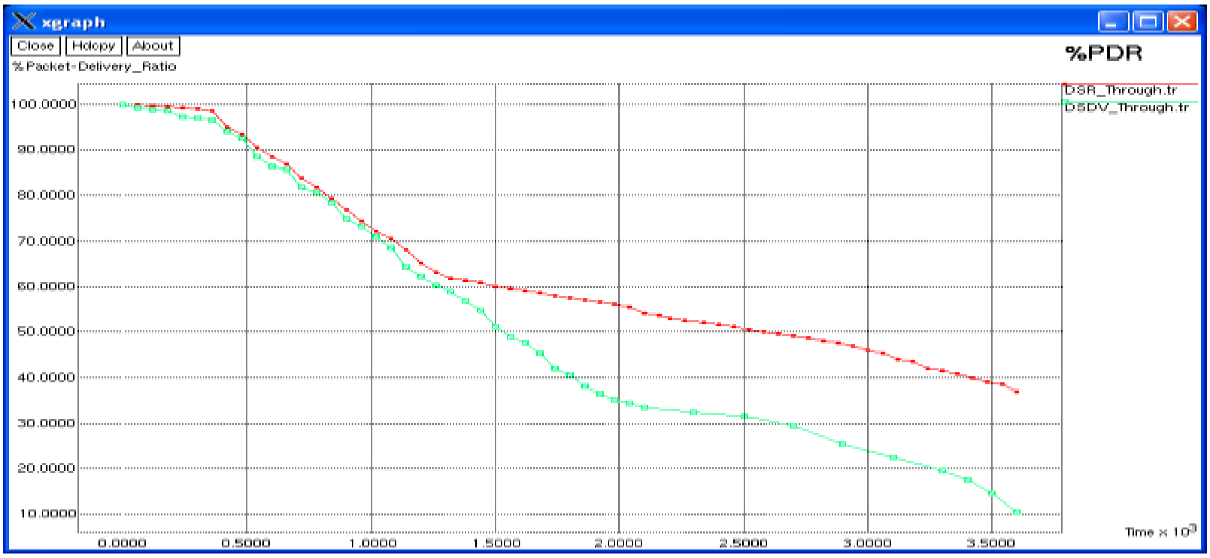
In x- axis number of nodes and in y- axis delay



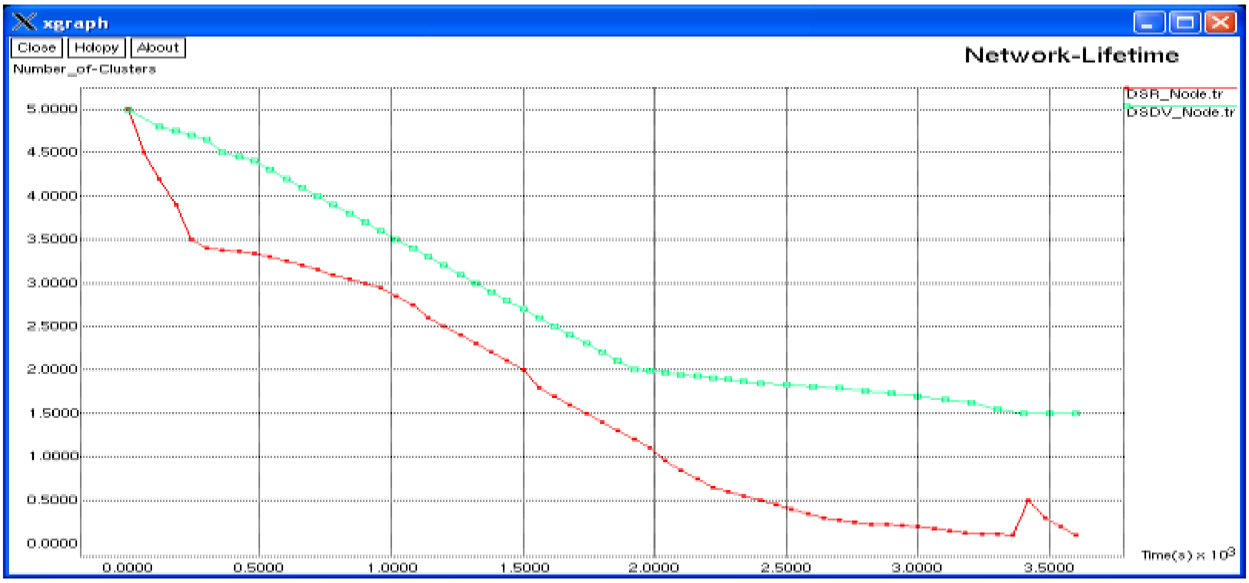
In the graph, whenever detects the misbehavior nodes and delay transmission decreasing while cluster lifetime and Energy consumption based on the security increasing in the network.

(2) Packet delivery ratio:

In x-axis is Time and Y-axis is Packet Delivery Ratio. When Using DSR protocol is less packet delivered than the DSDV protocol.



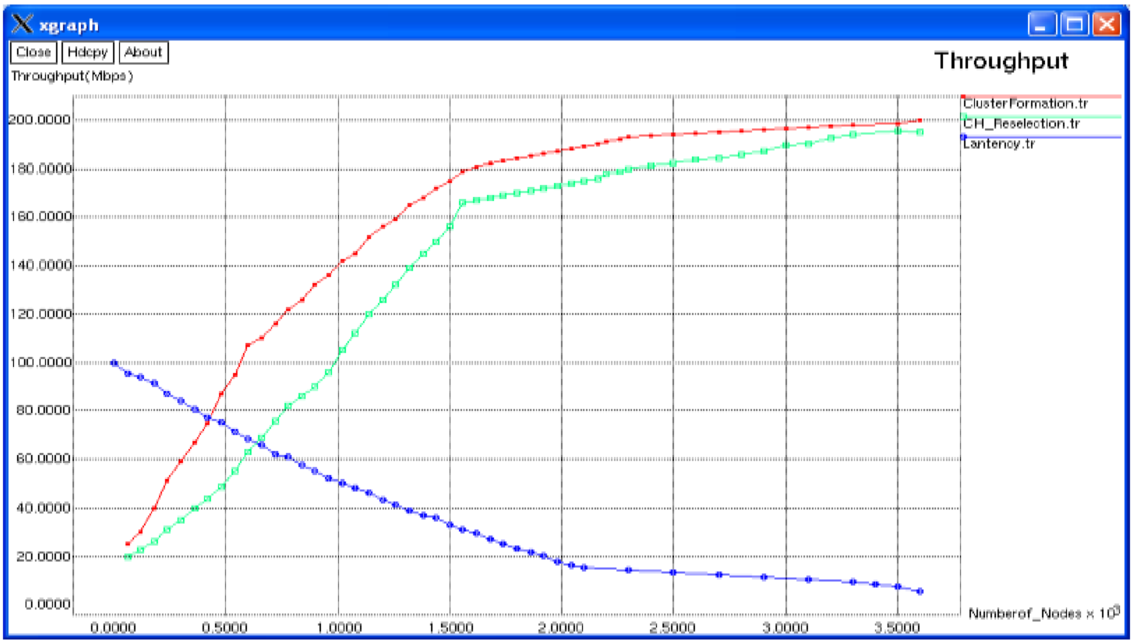
(3) Network life time



Using this graph, DSR protocol formation of cluster is less compare to the DSDV protocol based on time (s). So network lifetime easily judge to the best protocol.

(4) Through put

In x- axis number of nodes and in y- axis Throughput



The end to end delay decreases when throughput of the cluster formation and cluster head reselection increasing in the network.

VI. CONCLUSION

In this paper, we proposed DSDV protocol where the cluster head cooperate with each other to transmit data. Also we maximized the network lifetime and minimized the energy consumption and end to end delay is decreased. In future work we intend to build on our current situation as follows: Here after the formation of cluster heads all sub nodes will go to register the specific cluster heads within request time. All registered nodes are called as primary nodes and all unregistered nodes are called as secondary nodes or unlicensed nodes. Cluster head receives data from primary nodes to transfer to the sink node mean time secondary node will also send data to the same cluster head , but that cluster head will switch over the data the another cluster head so as to avoid the waiting time or holding time of secondary nodes. The idle Cluster head will handle the secondary nodes to get the packets and send to the sink node. Due to this we have reduced the load balancing energy level without time setting in entire wsn.

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