



Trust Based Clustering With Multiple Mobile Sink for Effective Routing in Wireless Sensor Network

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ABSTRACT

Wireless sensor network, Network is the collection or bunch of small sensor nodes. All nodes sense the data and forward the data to the base station. This base station is also called as sink. There are three variations in base station or sink. Static and mobile sink are two variants. Static as the name indicates the sink cannot move. While in mobile sink, it can move in the network and collect the data from nodes with shortest path routing. In the static sink scenario, node transmits the data to the sink by hop by hop mechanism. The data will further be analyzed by various industries based on machine learning and pattern recognition. The data analysis deduce meaningful and desired results. These sensor nodes are having low cost but their battery life is minimum. The data which is collected in the sink is used to make smart decision based on the analysis. There is need to develop robust algorithm to effectively utilize energy. But much more light should be thrown on clustering algorithms and routing as well. As we all know, once we deployed the node in the network, we cannot replace or recharge the node. It is next to impossible to recharge the node in remote places. Here power consumption leads a big challenge. The basics of all energy efficient routing is clustering. If we make clusters properly, routing will be done in optimal way. Thus our ultimate goal of energy conservation can be achieved. Here in this paper, we propose algorithm which selects cluster head based on trust and reputation values Cluster head will be selected based on highest trust and reputation value so that cluster head will not die of energy depletion. So here effective data transmission can be achieved. Analysis shows that clustering done with the help of calculation of trust and reputation values proves more effective in comparison with traditional clustering approaches. Literature survey elaborates various clustering techniques with their advantages and limitations. Later Proposed algorithm shows trust and reputation based clustering technique with mobile sink in the network. Simulation results shows that this novel technique significantly improves network lifetime over traditional approaches.

Keywords: Wireless Sensor Network, Simulation, Mobile Sink

1. Introduction

Wireless Sensor network is having tremendous growth in current world due to low cost sensor and well planned techniques. Wireless sensor networks (WSNs) are large networks made of a large number of sensor nodes with power to sense the environment and communicate it with administrator. These nodes are backed up by small micro controller and radio transceiver. This setup collects data by sensing environment condition and passes the collected data to another node in the network. This way all data from sensor network is getting collected in the sink. Administrator can keep eye on sink and make smart decision on it. But the main challenge in the WSN project is the power consumption by sensor nodes. As the sensors nodes are having low capacity to store energy, the power consumption during data transmission should be low, but practically this condition is not achieved by researchers till now. Hence energy conservation in wireless sensor network is getting high importance and is vital and serious issue which should be taken into consideration while research studies. To enhanced network lifetime, communication module can be designed for minimum energy consumption and robust hybrid algorithm can be developed. For proper energy-awareness, some protocols should be designed and manage. Those protocols are explained further.

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Development of technology in the field of sensors and electromechanical system has made it necessary to research more in the area of wireless sensor network. Vast variety of sensor nodes are deployed in various climatic condition and remote areas. These tiny motes are packed with transceiver receiver system and limited amount of batter backup. There are some industries who are dependent on sensors to collect the data for their use. For example in whether forecast, data has to be collected from various remote places about climatic condition such as temperature and humidity et al. To predict whether forecast based on analysis of data provided by these tiny motes. However due to remote, untouched location and limited battery power nodes accidentally fails and suffers from early dying. Wireless sensor network always face issue when it comes to hardware. As its hardware is very tiny. Each node consists of one transmitter-receiver and small battery. To reduce energy consumption in wireless sensor network is always been crucial research. Typical configuration of wireless sensor network is shown in figure 1.

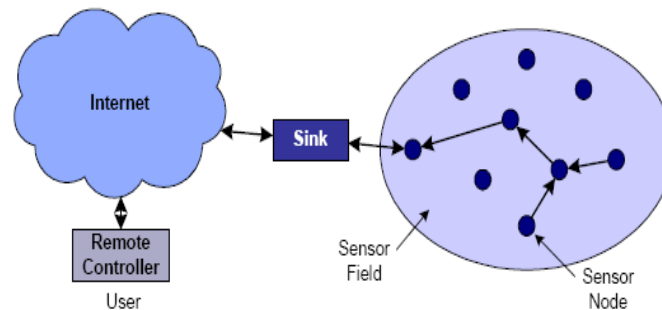


Fig 1. Typical configuration of wireless sensor network

In this paper we will cover different techniques by which we can overcome the issue of energy consumption in wireless sensor network. We will study challenging issue. Further section will describe gap Analysis done on energy consumption of wireless sensor network. In the next section we will Methodologies and techniques which we have proposed to overcome the Issue as our contribution. Conclusion and some open issues are discussed in the last section followed by references.

2. Literature Survey

Wireless sensor network and concern about their efficiency is increased in the recent years. As result of this some new approaches are put forward to improve the lifetime of sensor nod and so as to decrease the energy consumption. For this many algorithms are proposed to make the node more efficient. To enhance the life of wireless sensor network node a method used known as duty cycle and network coding. This method reduces the consumption of energy to 50%. Thereby increase the lifetime of wireless sensor network. The main agenda in this duty cycle is to reduce the network traffic. If the network traffic get reduced automatically packet delivery will be fast and consume minimum energy. Thus lifetime of the sensor will be increased. One more concept arises the is heterogeneous wireless sensor network. For low consumption of energy and to increase life spam of the particular node, they proposed Monkey Search algorithm. A network model is built in Monkey Search algorithm. This monkey search algorithm used a function known as fitness function. Value derived by experimental results of this fitness function should be always large. As there is increase in fitness function, there is increase in the lifetime of wireless sensor node. Especially heterogeneous wireless sensor network. Again Energy based clustering can be done to improve lifetime of WSN. An efficient clustering algorithm is used to place variety of cluster heads at such places that they should place to reduce energy consumption. When we place cluster heads at their proper position load balancing is done. So this parameter helps in improving the lifetime of wireless sensor network. Traffic is also much released due to this load balancing approach. If we want to enhance the lifetime of wireless sensor node and reduced the power and energy consumption STAR algorithm is used. This star algorithm makes wireless sensor network energy as well as cost efficient. Optimal routing techniques are used in star algorithm to reduce network traffic and increase the efficiency of wireless sensor network. To extend lifetime of wireless sensor network, many approaches are used. One of them is to use Sleep and wakeup protocols. By the use of this protocol Battery can be kept more efficient. In sleep protocol the battery when there is no use can get into the sleep mode. Whenever necessary node can swap into wakeup state. This will save tremendous energy and will help in extending lifetime of wireless sensor nodes. To increase the lifetime of wireless sensor network node we can decrease the probability of failure nodes by different advanced clustering algorithm. Clustering is one of the very important and beneficial techniques to improve the lifetime of wireless sensor network. The path in which data transfers takes place also plays very important role in minimizing the energy consumption. The path should be selected in such a way that minimum energy should be required. For this we can make clusters. Nodes are grouped into disjoint and non overlapping subsets called cluster. Cluster will create hierarchy so that minimum utilization of the energy will be done and processing will be fast. LEACH is one of the clustering algorithms that help in minimum consumption of energy and increase in lifetime of wireless sensor network. To minimize the operation time of wireless sensor network. A mechanism is proposed to make disjoint sets and only active sensors which are involved

in data process will be kept active. So that energy of the other disjoint sets will be kept as it is. This energy efficiency can be achieved by making disjoint sets.

Sr.No.	Author Name	Paper Title	Algorithm/Method Used	Outcome
1	RashmiRanjan Rout, <i>Student Member, IEEE</i> , and Soumya K. Ghosh, <i>Member, IEEE</i>	Enhancement of Lifetime using Duty Cycle and Network Coding in Wireless Sensor Networks	To reduce network traffic and to enhance the lifetime algorithm called duty cycle and network coding .	1.Upto 50% energy consumption is done. 2.Significant increase in packet delivery
2	NimaJafari Navimipour 1 , Sara Halimi Shabestari1, VahidSamadzad Samaei1	Minimize Energy Consumption and Improve the Lifetime of Heterogeneous Wireless Sensor Networks by Using Monkey Search Algorithm	MS algorithm Network model is built with experimental result.	Fitness function is used. As value of fitness function increases the lifetime of WSN increase.
3	Dr. Sami Halawani, Abdul Waheed Khan	Sensors Lifetime Enhancement Techniques in Wireless Sensor Networks - A Survey	Energy aware routing and data centric routing protocols are used to minimize the energy consumption.	Rather than having location based protocol, optimal solution can be achieved by schedule based mac protocol
4	SharadSaxenaDr.ShailendraMishra Dr. A.K. Dr. D. S.Chaan	Review on Protocol based Approaches to Extend Lifetime of Wireless Sensor Networks	Sleep/Wakeup protocols are used to keep battery more efficient in WSN.	Energy conservation is done at optimal level in this sleep awake protocol.
5.	Vaibhav V. Deshpande, A. R. BhagatPatil	Energy Distributed Clustering for Improving Lifetime of Wireless Sensor Network	Clustering algorithm is used to place multiple cluster heads at proper position for reducing poer consumptions.	can enhanced to incorporate load balancing among the cluster heads based on the parameter like traffic.
6	A. Anitha1, M. Selvi2, Dr. N. SaravanaSelvam	Life Time Enhancement Techniques in Wireless Sensor Network: A Survey	minimizing the power consumption, low cost operation, optimal routing algorithms, forwarding of residual power to every node to avoid the abbreviating of power in nodes	Fuzzy Approach IS used in star algorithm to make WSN energy and cost efficient

Algorithm	Energy consumption	Packet delivery ratio	Packet loss	Network traffic	Density	latency
Duty cycle and network coding	50% reduced	Fast	Very low	Reduced	Low	High
Monkey search algorithm	Reduced due to fitness function	Slow	Low packet loss	Medium	Low	High
MAC mechanisms	Optimum	Very low	Packet may be dropped	Congestion occurs accidently	high	Low
Data-Centric Routing Protocols	More Efficient than MS algorithm.	Fast	Very low	Medium	Low	High
Star Algorithm	Efficient	Medium	No packet loss due to star algorithm	Medium	High	Low

3. Aims and Objective

To reduce energy consumption

- Packet loss should be reduced
- Collision should be reduced. Due to collision the packet is retransmitted. It consumes more energy in retransmission.
- Overhearing should be minimized
- Idle state of sensor should be minimized. In Idle state, sensor consumes energy which is waste of resources.
- Packet delivery ratio should be increased.

4. Challenging Issues

Energy consumption has become severe issue in wireless sensor network. To avoid extra consumption of energy and to increase the lifetime of the network various algorithms are proposed till now. But in that algorithm some vital part is not taken into consideration that is Packet loss. If particular packet fails to deliver at sink or next node, Acknowledgement will not be given. the original node will wait for acknowledgment for certain time. After that, it will retransmit the packet. so extra energy is needed to transmit the packet again. So packet delivery ratio decreases and energy consumption increases. To avoid that we have proposed efficient trusted clustering algorithm which will reduce the packet loss at great extent.

So main challenge is

- 1] To reduce energy consumption, Packet loss rate should be minimized
- 2] Packet delivery ratio should be increased
- 3] Efficient clustering should be done.

5. Methodologies and Technologies Used

Every time when data is transferred from sensor nodes to the sink, there occurs heavy traffic nearby sink area. Because all the data is finally flowing to the sink, the traffic becomes high to sink area. It leads to packet loss sometimes and it consumes high amount of energy to load data into the sink. To avoid this network coding by using duty cycle mechanism is proposed. This mechanism will cause the overall improvement in the energy consumption of wireless sensor network. Lifetime of wireless sensor node will be increased by using this mechanism. As area nearby sink gets large traffic that area is termed as bottleneck zone. This bottleneck zone consumes high amount of energy. Our goal is to reduce the consumption of energy and to optimize energy conservation in wireless sensor nodes. In the network coding using duty cycle, the packet loss done during transmission has not given much importance. To avoid the packet loss and to improve energy conservation, we have developed the algorithm known as trusted clustering based algorithm. In this algorithm we will make group of nodes that is cluster. One will be cluster head. Trust value of each cluster will be calculated. According to the trust value .The node having very less trust value below threshold can be removed from cluster to save energy which will get utilized by that faulty node.

Trust and Reputation Calculation Module:

Trust based decision is taken while electing the cluster head. Trust values are calculated within the cluster and outside the cluster. Low and high trust values will be responsible for delay and smooth transmission of the data in the network. If the trust becomes zero, that dead node will be bypassed in the network. Generally in Static sink approach, low trust value is generated to the nodes nearer to the sink. Hence they create energy hole problem.

Step1: Initialize network N with n number of node

Step2: Local reputation value of every sensor node is calculated:

$$L_i = R_{ep} \times l_i$$

Where R_{ep} is the reputation value corresponding to sensor node i and l_i is the local reputation value of sensor node i from other sensor nodes perspective.

In reputation based technique each node will make its own decision based on own computation power.

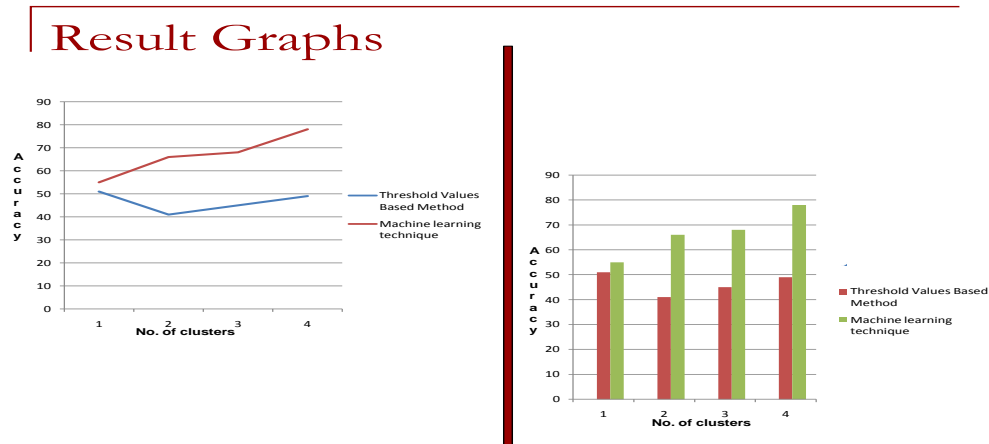
Step 3: The trust calculation between cluster head n_j and sensor node n_i at the time t is given by:

$$T_{n_i, n_j, t} = \frac{\sum_{k=0}^n T_{n_i, k} (t_{n_j, t-1} + 1)}{\sum_{k=0}^n (t_{n_j, t-1} + 1)}$$

Step 4: Cluster head creates an index of sensor nodes based on their trust value and reputation.

Step 5: Cluster head is elected based on best rep value and trust.

6. Result Graphs



7. Conclusion

Wireless sensor network is having great importance in the world, so energy conservation should be optimized to enhance the lifetime of the wireless sensor network. With the use parameters like trust and reputation energy efficiency can be achieved. The trusted clustering algorithm will minimize packet loss and increases packet delivery ratio so that no energy will be wasted during the retransmission of packet.

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