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Improving the Energy Level of Node and Prevent the Cluster Head Failure in Wireless Sensor Networks

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Abstract: In recent days research is focusing in improvement of node energy level and prevents the Cluster Head (CH) from failure in Wireless Sensor Networks (WSN). An important issue in most of the clustering process is the selection of Cluster Head (CH) that is reliable and more efficient. Definition of energy level and larger distance between the cluster head and the sink ultimately leads to CH failure or failure in data transmission. This study proposes the fuzzy decision model of an adaptive clustering and routing protocol in wireless sensor networks. This Cluster Head collects the information from any of the routing path available in wireless sensor nodes. The packets are transmitted in many different ways to the nodes and obviously every node will be in its own energy level and if any energy losses of CH occur, cluster head fails and it is unable to sink the node in a path and crosses communication. Alternate node of Cluster Head, due to failure or disability to recharge failed nodes, it is used for better communication, reduction of energy consumption of node and time delay reduction.

Key words: Wireless sensor networks, fuzzy decision model, cluster head, energy, node

INTRODUCTION

A huge amount of miniature components and sensors that are resource control and multi functional, which are self organized as an informal network to refer the physical world are the consistent of a physical wireless sensor network (Loia *et al*., 2015; Wenqing *et al*., 2006). There more often used in complicated applications where it is impossible to gather wired networks. The sensor nodes require energy to sense the surrounding environment, smooth communication among the node and compute local calculations. The battery gets dried out making the replacement of battery a difficult task due to their tiny size and the environment in which they are to be deployed. The cost of communication is large when compared to cost of computation and hence, protocol development that aims to reduce number of transmission and reception at each node becomes valuable thus increasing the Wireless Sensor Networks (WSN) overall network life that are used in data centric (Dakshayini *et al*., 2013; Zaman *et al*., 2012).

The major constraints being the energy of sensor nodes and the key functionality as the data gathering, currently emerging research trends are focusing on data gathering that are energy efficient. There are three ways to establish routing paths. They are: proactive, reactive and hybrid protocols. The proactive protocols are an active paradigm that computes all possible routes even before their required and these routes are then stored in the routing table in each node. The uncertainty effects can compromise the convergence of consensus based algorithm in the form of unwanted changes in the convergence time. A routing perspective, clustering allows splitting of data transmission in to intra cluster and inter cluster (Prabakaran and Karthikeyan, 2015). A distributed and co-operative optimization strategy which identifies optimal voltage control strategy, is implemented by network of dynamic agents CH performs cluster data aggregation a nd decreases the number of redundant or unwanted packets (Farazandeh *et al*., 2013; Anno *et al*., 2008).

Literature review: Mobile WSN employs weighted clustering algorithm for selection of CH's the change in time intervals. The proposed algorithm is re-run again after a fixed time interval to find new application nodes such that system lifetime lasts longer than usual. The result show the proposed algorithm works better on the WSN for a long system life time. During cluster phase broadcasting an energy consumption model is established for regular node acquisition data in order to reduce energy consumption and prolong network life time. Their simulation results proved that the clustering algorithm can achieve the longer sensor network life time, superior

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quality of monitoring the network and higher energy efficiency (Prabakaran and Karthikeyan, 2013; Maimour *et al*., 2010).

Consensus based algorithm (Yang *et al*., 2013). This algorithm, unlike centralized approaches, proposes generator to contiguously learn the mismatch between power demand and total power generated. The power generated by each generator is adjusted by the estimated mismatch used as a feedback mechanism. The only disadvantage of this method is that it has complex numerical analysis and difficult to implement.

Self synchronization algorithm (Scutari *et al*., 2008). This is a distributed algorithm for attaining optimal decisions that are global and estimation through a self-synchronization mechanism among linearly coupled integrators initialized with measurements that are local. Devising a double step consensus mechanism to provided an estimate that is unbiased and gaussian with least extra complexity, without any knowledge about channel parameter estimation this algorithm is applied where the goal of the network is to take decision, from the average consensus protocol available.

Iterative algorithm (Rezvani *et al*., 2013) concentrated on focusing and detecting malicious data injections in event detection WSN's, particularly during collision between compromised sensors occurs. This algorithm can be used in different customized applications, for different types of events. The problem of detecting malicious data injections is made complex when dealing with collision and the occurrence of events because they affect the system dynamics and measurements comparisons.

Numerical algorithm (Shigei *et al*., 2009). There are two clustering methods that posses less communications overhead. The first type, based on centralized management engages vector quantization for effective clustering. In this method, clusters and CH's are determined by BS considering the density of the node and the level of battery .The proposed methods effectiveness is demonstrated is numerical simulation. The numerical algorithm has more complex analysis and tedious process.

Furnishes effective algorithm (Ramanan and Baburaj, 2015). This metric is good at avoiding all other traffic measurements and reflecting the current dissipation of energy, similarly to the length of the queue and the numbers of links passing through the nodes. Not only increasing every node's life span, but also extending every links life span by means of maintaining path consistency from source to destination is the major objective of EEUPA (Efficient Energy Utilization Path Algorithm) (Manni *et al*., 2015; Gupte *et al*., 2013).

The disadvantages of existing system are increase the overhead, more energy consumption and maximize the time taken for packet transmission. The proposed approach has advantages of minimize the time usage; decrease the overhead and less energy consumption.

MATERIALS AND METHODS

The proposed technique is used to improve the energy of the node and can be able to get packet transmission capacity. If the energy loss by the cluster, it will not be useful for data transmission. Because the data collected by the cluster nodes could not able to reach the base station at any instant. In Fig. 1 choose CH recharging take more time in transmission efficiently so take an alternate path. Alternate path in transmission is easy for packet sending and receiving to base station available in network . The packet uncertainty is detected using fuzzy c means algorithm, to improve the security. The energy usage of each node is analyzed and choose minimum energy consumption node for efficient communication. The cluster head selection and fuzzy rules are given in Fig. 2. The fuzzy rules for selection of a cluster head are:

Step 1: A change in the route must propagate the change throughout the network.

Step 2: A WSN could posses nodes in thousands, and the routing table that each node would own must be huge nodes play different roles in the network in hierarchical-based routing.

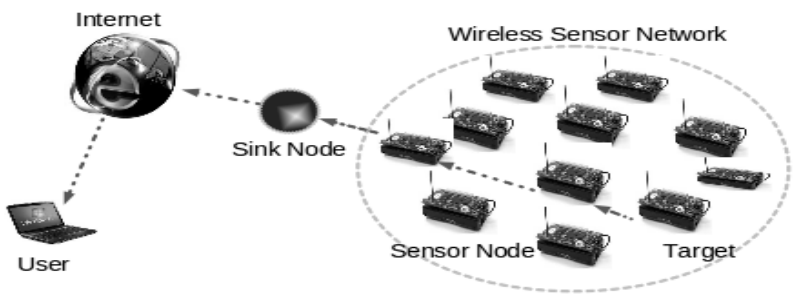

Fig. 1: Design model of wireless sensor networks

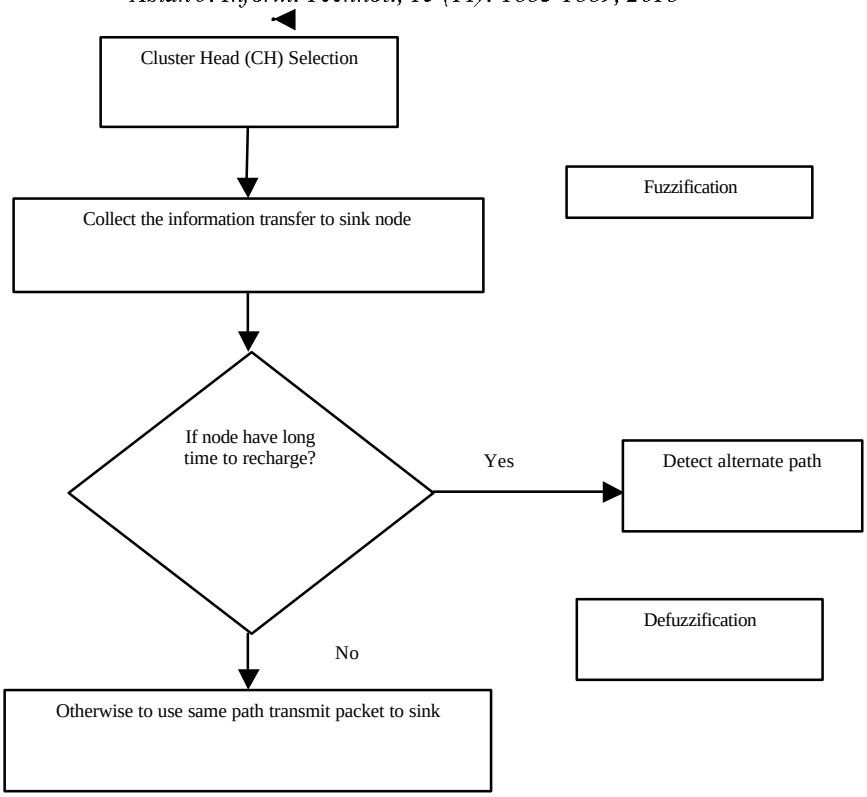

Fig. 2: Flow chart of proposed method

Step 3: Inter and Intra cluster communication: The data that is transmitted is split into intra and inter cluster communication. Within a cluster, the node with the highest energy is nominated as CH.CH helps in size reduction of routing table stored at individual nodes.

Step 4:Recharge node based on energy level: During transmission node get failure that means sudden energy loss or node get out of coverage. Node gets packet loss for each transmission, that time use battery to recharge and boost up the node energy level. Less time taken for transmission use same path, otherwise use alternate path, fuzzy means technique improve the security.

Step 5:Alternate cluster head selection: Alternate path is selected and transmit packet to sink node and receive acknowledgement from sink node. Deciding alternate path is only considering energy level of each node in transmission. The location of the sensor nodes and is robust enough to report reliable data to the base station.

Step 6: Sensor node, Base Station (BS) node and Cluster Head node creation with maximum efficiency.

RESULTS AND DISCUSSION

The different existing algorithm like consensus based algorithm, synchronization algorithm, iterative algorithm, numerical algorithm and furnishes effective algorithm are compared with our proposed technique. The simulation parameters are given in Table 1. The proposed adaptive clustering and routing using fuzzy decision method performances are analyzed by packet delivery ratio, Energy consumption, Time delay, Throughput, Efficiency and Transmission rate. Figure 3 shows the network life time of proposed technique for different number of nodes scenario. These results are proved that our proposed approach has 25% of increased life time of nodes than existing methods. Figure 4 shows the packet delivery ratio of different methods and the proposed model has 40% of higher than existing approaches. Figure 5 shows the throughput of proposed techniques for various ranges of nodes in the network and our proposed approach has 35% of highest rate compared with existing methods. In Fig. 6 various existing methods with proposed model delay is presented. The energy consumption of proposed

Table 1: Simulation parameters

Parameters	Range
Nodes in the simulation scenario	58 nodes
Coverage	1000X1000
Protocol	Mac 802.11a
Communication width	400m
Running period	48 sec
Data length	1MB
Node energy	11J
Packet delivery rate	100 to 300 KB

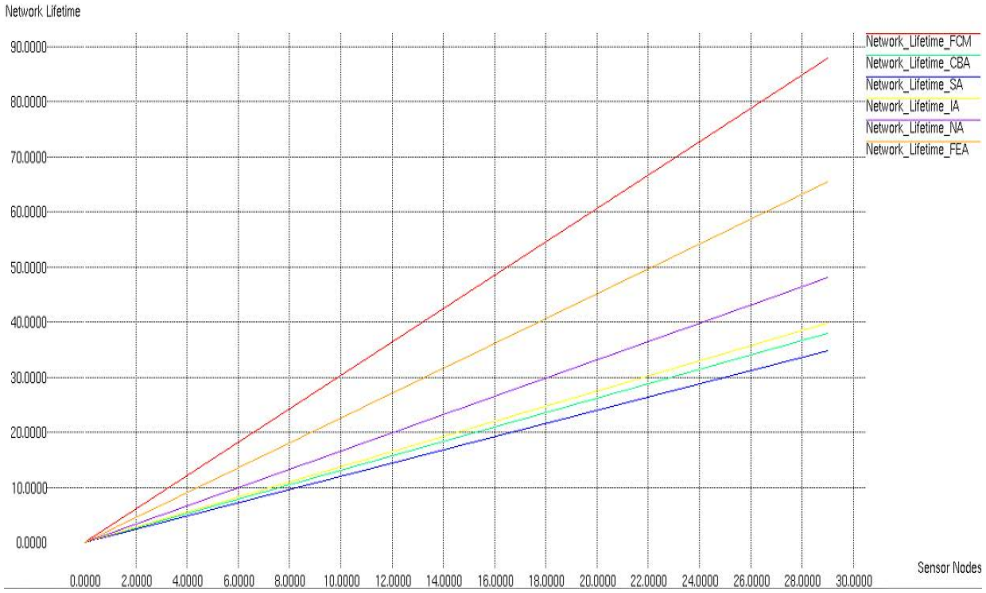

Fig. 3 : Network life time

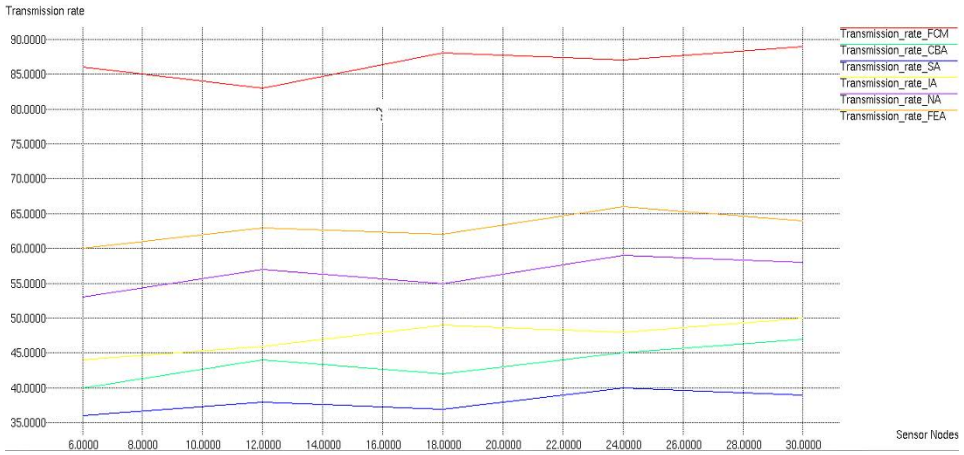

Fig. 4 : Transmission rate

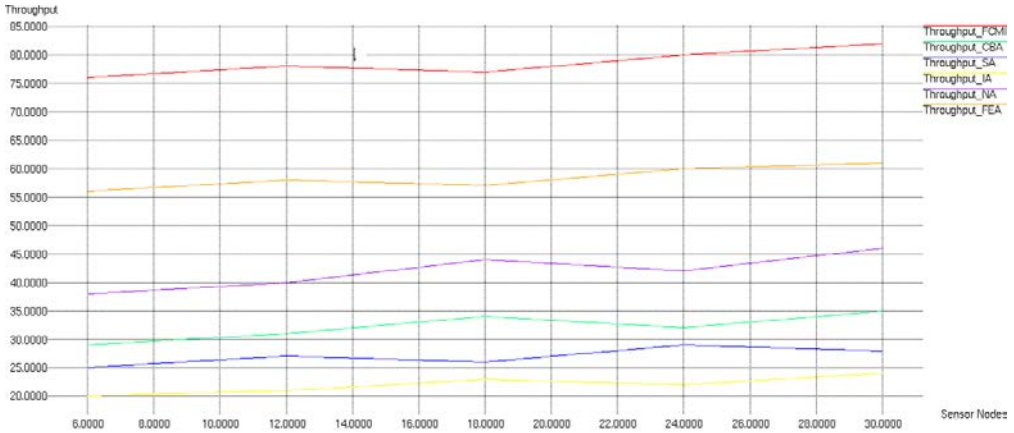

Fig. 5: Throughput comparison

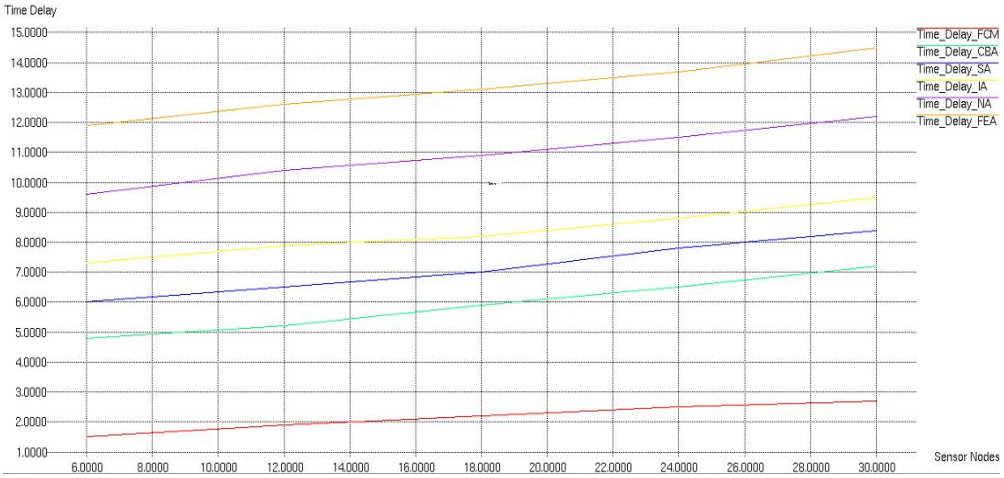

Fig. 6 : Time delay

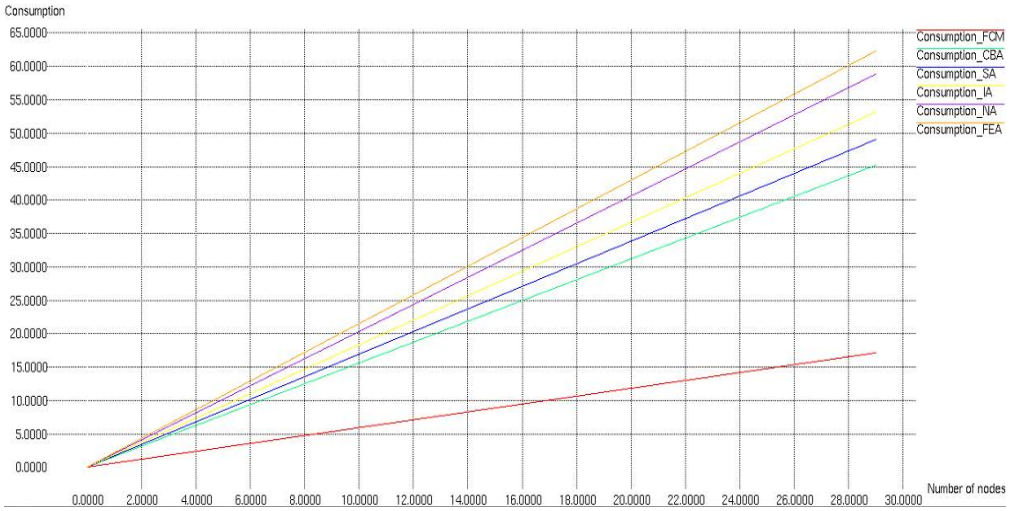

Fig. 7: Energy consumption

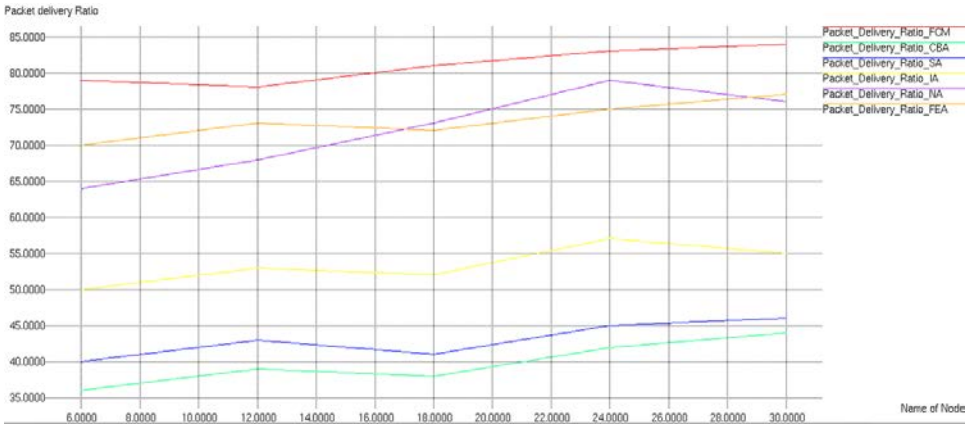

Fig. 8: Packet delivery ratio

technique has decreased by 10% shown in Fig. 7 and cluster head selection packet delivery ratio got increased by 10% than other existing approaches (Shown in Fig. 8). The energy efficiency of adaptive clustering and routing

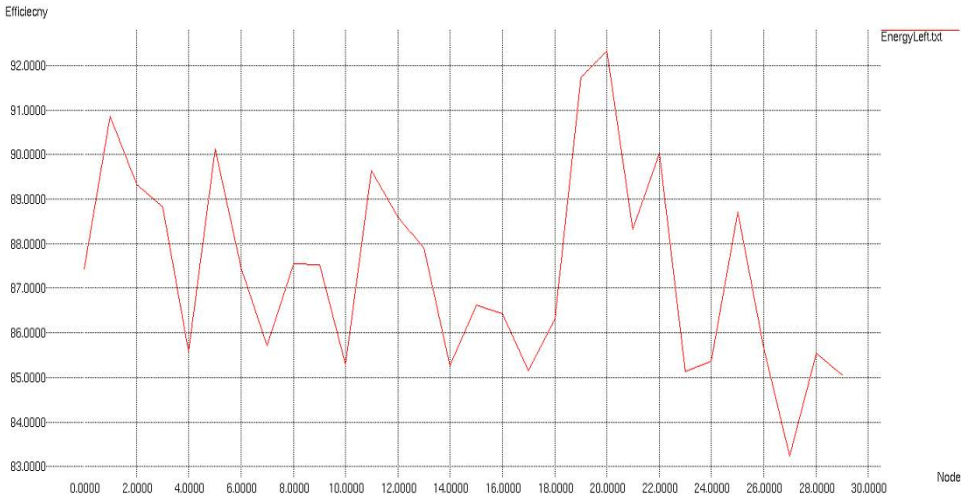

Fig. 9: Energy efficiency

Table 2: Comparison of different methods

Parameters considered	Proposed method	Existing method				
	Adaptive clustering and routing using fuzzy decision method	Consensus based algorithm	Self synchronization algorithm	Iterative algorithm	Numerical algorithm	Furnishes effective Algorithm
Energy consumption	7.27008	22.9987	32.5500	9.9802	40.2656	53.0187
Throughput	90	73	70	63	56	51
Time delay	3.4	5.4	10.9	12.5	16.8	19.0
Packet delivery ratio	88	62	59	45	37	22
Network lifetime	94.7244	88.0958	75.0142	56.0121	21.9732	10.8773

using fuzzy decision method has 20% higher than existing algorithms shown in Fig. 9. The Table 2 given the parameter comparison of different methods.

CONCLUSION

The optimum number of nodes in the cluster is estimated by the proposed method. The estimation is calculated by node transmission range and energy level of the node in the cluster. Once the estimation completed the cluster head will be selected and performance of the CH is analyzed. The presented results are clearly proved that the proposed technique is better in network life time, transmission rate, delay, packet delivery ratio, throughput, energy consumption and efficiency. All those parameters are compared with existing available techniques and results are presented. The maximum time taken to transmit the packets, increase in overhead and extraneous energy consumption are the disadvantages of existing system, yet there are still more advantages for the proposed approach which overcomes maximum overhead, energy consumption and time taken for packet transmission. In future, in order to avoid failure in cluster head, may provide a battery to recharge a cluster head using a Node Energy Charge Algorithm (NECA) and then an actual energy level to achieve the best data transmission.

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