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Power Aware Energy Efficient Cluster Based Network Coding Algorithm for Dynamic Source Routing (PA-EECSNC DSR)

J. Lakshmi and R. Latha

Abstract--- *Wireless Sensor Network (WSN) is built by means of sensor motes that are in use to study the information about the environment like daylight, high temperature, moisture, pressure, location, tremor, noise etc. To carry out a variety of responsibilities like smart detecting, a detection of neighbor node, data processing and storage, data compilation, target tracking, monitoring and controlling, synchronization, node localization, and effective routing, these nodes can be used in different real-time applications between the base station and nodes. WSNs are great networks of small embedded devices, each with sensing, computation and communication capabilities. Developments and execution of low power micro-controllers based wireless sensors have been improved fast to resolve a lot of real life troubles like traffic monitoring, patient monitoring, and battlefield surveillance. Sensing, calculations, communication are routines of wireless sensor networks consumes more power of these sensor nodes. Since sensor nodes have small battery with a restricted life, power management is necessary to be addressed to make sensors work for a long time by an effective and efficient power management scheme. This research concentrates to introduce new algorithm for cluster based energy saving over DSR protocol. The proposed work is implemented and evaluated in OMNet++.*

Keywords--- *WSN, DSR, OMNet++.*

I. INTRODUCTION

In general, the activity of sensing, communication and processing with a inadequate amount of energy, ignites a cross-layer design approach characteristically require the united concern of distributed signal/data processing, medium access control, and communication protocols [6]. WSNs application and utility have gained global attention. Rising need for these small sensor nodes inform how these can be functional in many areas of real-life problem-solving applications.

J. Lakshmi, Research Scholar, Research & Development Centre, Bharathiar University, Coimbatore, India.
E-mail: laxmishravanmgc@gmail.com
R. Latha, Professor & Head Dept. of Computer Applications, St. Peter's Institute of Higher Education and Research, Avadi, Chennai, India.
E-mail: latharamavel@gmail.com

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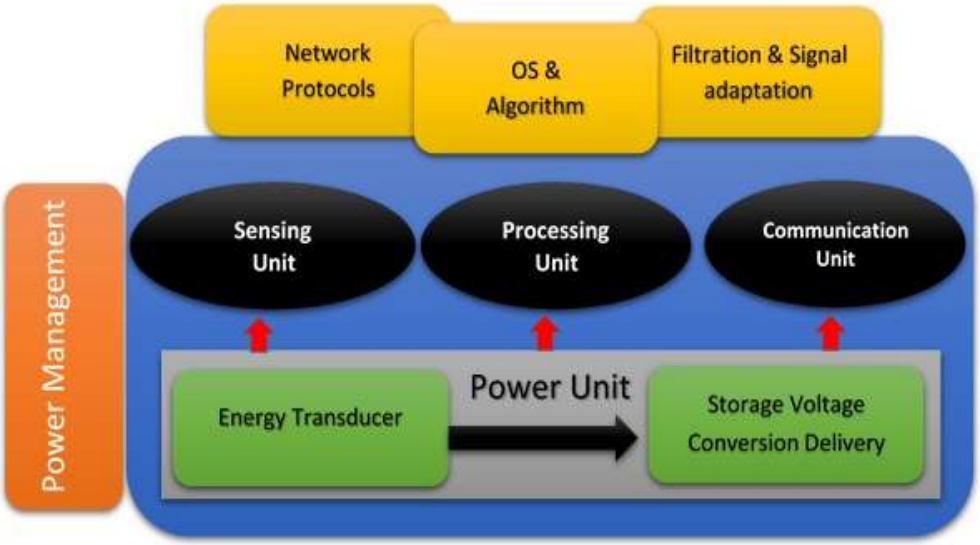

Fig. 1.1: Typical Sensor Node Architecture

1.1. Challenges in WSN

The only feature of the WSNs creates demanding necessities to the design of the fundamental protocol. Various enduring study projects in academic world in addition to industry aim at creating protocols that suit these necessities for sensor network. A few of the significant challenges are mentioned below:

Sensor nodes are limited, less in energy, computational capacities, and memory: Sensor nodes are small-scale nodes with volume awaiting a cubic millimeter in the near future. The battery with unchanging power supply must be successfully used for both computing and data exchange responsibilities. The transmission duty tends to direct over the computing task in terms of energy [8] utilization. Thus, in turn, to make the best use of energy, the number of transmissions be supposed to be reduced greatly as achievable.

Sensor nodes in the WSN are placed in an ad-hoc approach and distributed for computing and sensing: To form relations to set up the network to solve the application requirements [9-16]. In some cases modifications in the functioning of ecological pressure on the sensor motes that make them fail to lead to modifications in connectivity, this needs the network configuration and re-evaluating the transmission paths. Also, multi hop intercommunication can even competently conquer a few of the signal transmission effects in remote wireless transmission.

Network and intercommunication topology of a WSN often changes: the location of sensor nodes is not predetermined, while the sensor nodes are installed. This means that the sensor nodes have to be able to build themselves following installation. The Sensor nodes must recognize their locality furthermore globally or to some locally determined location. The major objective is to extend the wireless sensor network's existence and prevent link deprivation during destructive power organization as most of the devices have restricted battery life [17-23]. So the power preservation techniques to save energy by improving the existing protocol or algorithm should be followed.

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II. POWER MANAGEMENT SCHEMES IN WSN

Energy-aware routing protocol (EAR) is a reactive protocol that focuses on boosting the life span of the network. This protocol finds to keep up a group of path as an alternative of managing or administrating single best route at high data rate, even though the behaviour of this protocol is alike to directed diffusion protocols. These paths are chosen moreover controlled by a probability factor. The worth of the probabilistic measure rely on the lowest level of energy is attained in every route. Network stability is the main characteristic of this protocol. At first, here is a procedure of flooding, which is used to find out all the routes among a range of source/destination pair and their cost.

This will permit the formation of routing tables, where high-cost routes are removed [24-31]. On the other hand, have to gather locality details, and the organization of the navigation mechanism for nodes, make the pathway setting complicated. Prediction based dynamic power management be able to be segragated into two: adaptive and non-adaptive. Non-adaptive approaches fix the idleness threshold for the algorithm, and not to change them based on experimental input pattern. Alternatively, the adaptive approach uses the history of inactive period to direct strategies create approximate assumption concerning usage pattern and exploits the nature of probability distribution to devise an optimization problem, the key to which drive the DPM strategy.

III. CLUSTERING BASED APPROACH IN WSN

The structuring of a network is one of the first technique to accumulate power in every network node. Two types of architecture are available in sensor networks, flat architecture that constitute a homogeneous network where all the nodes have the same in terms of energy resources, calculation, and memory, and another hierarchical architecture where not all nodes have the similar role and consequently the same resources [32-37].

The differentiation analyzed among the flat and hierarchical organization at the energy utilization stage shows that the flat design has less gain than the hierarchical structural design, namely: well-structured network, high lifetime, less power consumption, easy network management, unless the message circulating on networks and the flood problem is avoided.

The two, cluster-based approach and chain-based approach is derived from the other hierarchical structure:

a. Cluster-based approach: The nodes are organizing the cluster; every group has its head to communicate information to the base station.

b. Chain-based approach: The node is structured in a string to transmit the data to the base station.

Several research activities have been carried out on the area of energy-efficient data gathering in WSN because the fundamental job of the WSN is to gather the data with lower resource utilisation efficiency[38-44]. The data gathering algorithms are majorly meant to reduce the energy utilization problem like LEACH Protocols.

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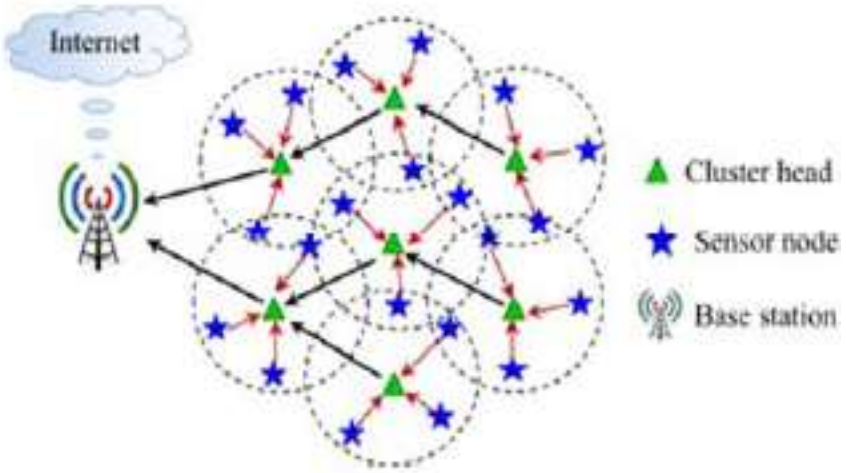

Fig. 3.1: Cluster-Based Approach

IV. NEED FOR THIS STUDY

Wireless sensor networks have risen as a capable technique that revolutionizes the method of finding data. It has comprehensive range of challenges like Security, topological changes and higher scalability still essential to be noted. This research work, have analyzed the performance evaluation of AODV, and DSR routing protocols [1] for CBR data traffic type are with node density (50) in NS2 simulator. This study assisted to discover extensive variety of problems associated to routing in WSN. The routing protocols have to be efficiently improved, or new protocols have to be deployed to resolve the challenges similar to dynamic topology changes and amplified scalability. Comparative study of hierarchical routing protocols is discussed. Future perspective of this work are aimed towards changing one of the above routing protocols such that the tailored protocol might deal with with dynamic topological changes and higher scalability with energy efficient routing for the Sensor Network.

The Energy-Efficient optimized routing is proposed in this research improves the QoS characteristics like throughput, packet delivery ratio and end-to-end delay. The proposed algorithm selects the efficient energy path with minimum delay and maximum energy nodes using Poisson distribution. The PB-EEP [2] produces improved outcomes compared to the traditional DSR in terms of packet delivery ratio, end-to-end delay, and residual energy at nodes and optimized routing load. The hardware implementation is also tested in real time and observed that PB-EEP outperforms DSR routing protocol.

WSN based on clustering, sleep wakeup techniques, end-to-end delay calculation and data network coding for data compression is simulated. The proposed EECSNC [3] model is compared with existing ENS-OR methodology. The result of the ns2 simulator shows that the EECSNC is more efficient than the existing method.

V. PA-EECSNC DSR

The proposed Power Aware Energy-Efficient Cluster-Based Network Coding Algorithm for DSR (PA-EECSNC DSR) is the combination of the Energy Efficient Cluster-Based Network Coding Algorithm (EECSNC) and PB-EEP algorithms. The proposed work provides an optimal route with cluster-based power saving [13]. The following

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shows the hot code of the PA-EECSNC DSR.

```
SeR[]=NULL
NoSa[]=NULL
Calculate cost of node (j, j) for all nodes belongs to CH (Cluster Head)
Calulate the energy efficient node NE(i,j) for all nodes belongs to CH (Cluster Head) Where
NE(i,j) € {Emax, ETmax, CS}
Calculate K(x,s);
cluster head  node x to the sink s.
Find k-least cost routes k-SR(x,s,k);
for(i=1;i<=k;i++)
{
        Rk=k-SR(x,s,k)\NoSa;
        Calculate DeteRk from (equ);
        if (DeteRk ≤ Δ)
        {
                SeR[]= Rk ;
        }
        else
        {
                NoSa[] = NoSa∪Rk ;
        }
```

5.1 Simulation

OMNeT++ is an object-oriented discrete event simulation environment developed by Andr´as Varga at the Technical University of Budapest. Its major use is in the simulation of network communications. The developers of OMNeT++ predict that one might use it as well for a simulation of compound IT systems, queuing networks or h/w architectures, since OMNeT++ is built generic, flexible and modular. As the construction is modular, the simulation kernel and models can be embedded easily into an application. C++ is the programming language used for the modules in OMNeT++.

5.2 Results and Discussion

a. Routing Overload

Table 5.1: Routing Overload

No. of Nodes	*DSR (%)*	*PA-EECSNC DSR (%)*
10	31.4	15.1
20	67.8	38.7
30	71.8	37.6
40	79.1	41.2
50	87.2	48.2

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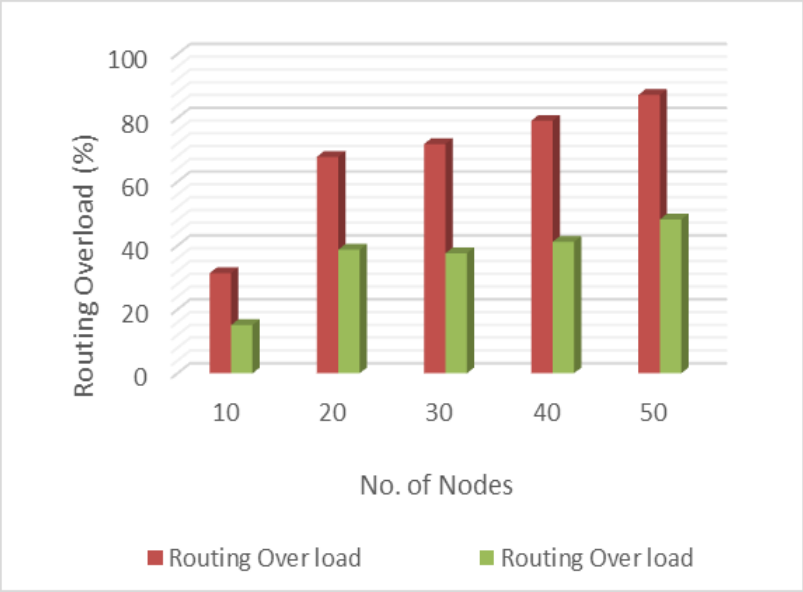

Fig. 5.1: Routing Overload

b. Power Consumption

Table 5.2: Power Consumption

No. of Nodes	*DSR (%)*	*PA-EECSNC DSR (%)*
10	88.24	87.21
20	87.61	82.5
30	90.35	70.18
40	91.76	70.62
50	91.15	65.3

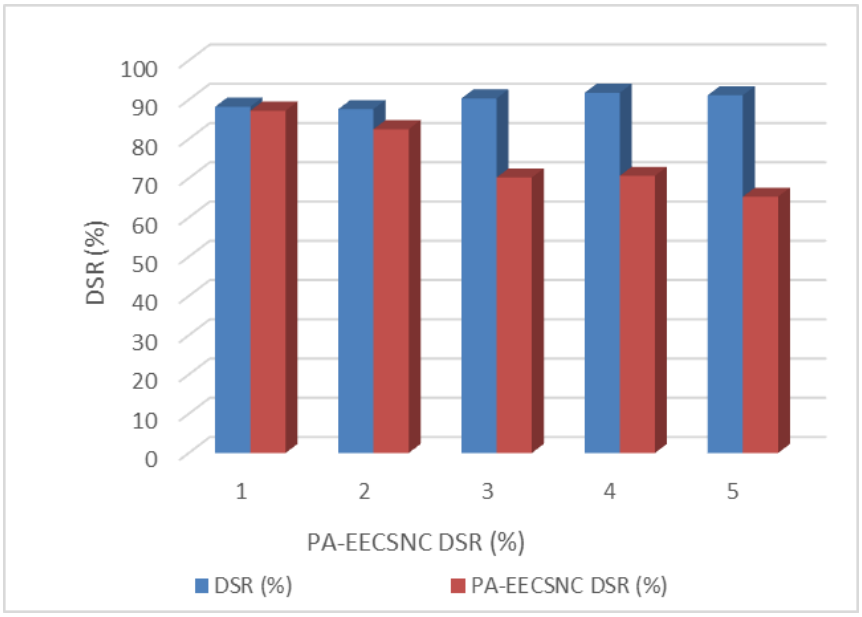

Fig. 5.2: Power Consumption

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c. Remaining Energy

Table 5.3: Remaining Energy

No. of Nodes	*DSR*		*PA-EECSNC DSR*	
	Remaining Energy	*Consumed Energy*	*Remaining Energy*	*Consumed Energy*
10	208.1324	2791.8676	397.11636	2135.2557
20	964.7701	5035.2298	1840.7812	3572.8125
30	1396.2204	7603.7795	2663.9885	5424.0077
40	584.8544	11415.146	1115.9021	8856.0653
50	2266.4013	12733.599	4324.2935	9117.1376

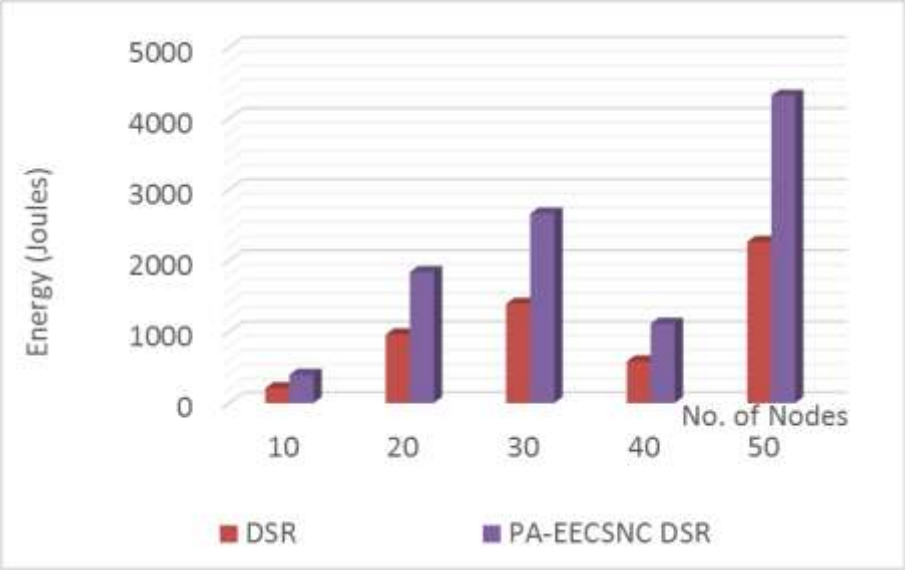

Fig. 5.3: Remaining Energy

VI. SUMMARY

The proposed PA-EECSNC DSR provides better power saving compared to the DSR. The testing metrics evaluates it. This result is obtained in the prescribed scenarios. The PA-EECSNC Algorithm is implemented and tested with five different situations. PA-EECSNC DSR gives excellent power saving with the optimal path in a defined environment. In future, it has to implement and test in the real-time test bed.

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