11th International Conference on Science, Technology and Management (ICSTM-18)
Osmania University Centre for International Program,Osmania University Campus, Hyderabad (India)
21st January 2018, www.conferenceworld.in ISBN: 978-93-86171-94-8

EISO Technique for Wireless Mesh Networks

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ABSTRACT

In this paper, we have proposed Energy Consumption Based On Improved Swarm Optimization (EISO) Clustering with SOCCOR protocol for improving the overall network energy. Simulation results shows ample minimum energy utilization is being achieved by EISO in SOCCOR compared to LEACH protocol. The proposed system was tested and the results were demonstrated with proposal effectiveness in improving the overall power efficiency over a wireless mesh network.

Keywords: *Energy, Cluster Head, PSO, EISO, LEACH, Wireless Mesh Networks*

I. INTRODUCTION

A wireless mesh network (WMN) is an accumulation of radio terminals in which every hub transfers information utilizing mesh topology. It is additionally characterized as a sort of wireless ad hoc networks. The engineering of wireless mesh topology contains gateways, switches and mesh clients. The switches are in charge of sending network traffic from or to the gateways which is not important to interface it to the internet. Mobile phones, laptops and different gadgets are considered as mesh clients [1]. For the radio nodes, the scope region is assessed in view of the working region of nodes called mesh cloud. To frame a radio network, the mesh cloud is gotten to just in view of the working between each radio nodes. In mesh network, in the event that one hub is not worked for quite a while then alternate nodes are speaking with each other to give repetition and unwavering quality. It might act naturally mend or self-shape on the grounds that the nodes can impart utilizing different nodes or middle of the road nodes. It is conceivable to execute it in all cellular and wireless innovations like 802.15, 802.11, and 802.16 without protocol confinements [2].

II. RELATED WORK

In a wireless mesh network, soaring is a well-known idea utilized with steering protocols. The explanation behind utilizing is the need of interfacing internet with broad band get to. It is influenced in the area where legitimate physical association is not given this network. Consequently the costly of developing the network surpasses the real advantages of this mesh network. The ad hoc network gives the imperative idea of protocol steering in WMNs. Contingent upon the aggregate number of nodes and conceivable ways the metrics based protocols are just utilized as a part of this network. This system does not consider the request of different innovations and execution of connections because of its adequacy. To make inventive steering and for the

advancement of existing protocols, the disadvantages and distinctive procedures of metrics are required. The differing number of value measures, for example, security, adaptability, issues in regards to QoS, Efficient utilization of vitality, limit of switches without troubles and diminished reaction time if any progressions happen in topology needs to fulfil for the determination of protocol [3].Energy management in WMN is defined as the set of rules to manage various energy supply mechanisms and then efficient consumption of the provided energy in a sensor node [4]. The overall aim should be to manage energy in such a way that no node becomes energy deficient and the network is operational perpetually [5].

III. ENERGY CONSUMPTION BASED ON IMPROVED SWARM OPTIMIZATION (EISO) CLUSTERING

EISO is an optimization technique during which normal species communal activities concentrating for the aim of reckoning. Swarm intelligence perceives that which attains the progression with the impartiality of adjusting a fitness function. So the energy will be consumed by the result of EISO in which the transmission is carried out from cluster head to cluster head. The foremost goal of this clustering process is to elevate average distance and average energy. During this EISO technique, fitness value is calculated for every reiteration. The proposed algorithm can be summarized as follows:

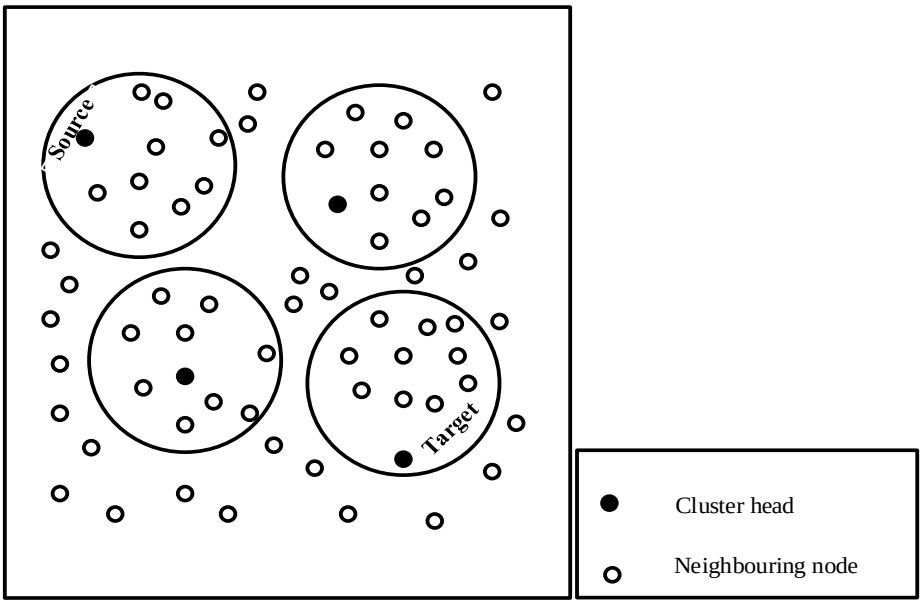

Figure 1 Clustering architecture in wireless mesh networks

To adjust consistent changes, the system requires a multi-hop network. Through the grouping hubs are isolated in gatherings called groups. The hubs in a specific bunch can be an entryway, straightforward hubs or the foundation of the group. CH is in charge of coordination of operations in the bunch, framing of new bunches

and procedure conservation. Additionally, it has accountability to partition possessions among associates of a group. Here, a sort of systems disarrangement of the CH is an obligation task. The procedure would not alter the mass outline regularly. The greatest significant compensations of these organizations are: the dispersed practice of requests, the likelihood of overwhelming escalation, well-organized behavior of movement, a recovering convention of bandwidth, aggregation procedures constructed evidence and denigration of essential storage capacity for evidence. Upgraded inertia weight efficiency depletion established on Improved particle swarm optimization (IPSO) consumes additional efficiency the optimize when associated towards different experiential and measured route of occurrence.. Clustering (figure 1) is the progression of dipping vitality in the WMN. So the data broadcast is conceded since the CH to the CH and thus power will be relatedly condensed.

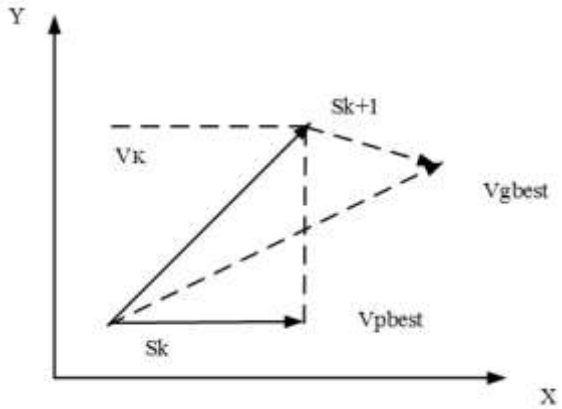

Figure 2 EISO searching point

Figure 2 represents the EISO searching point in which initial velocities and the positions of a set of elements remains adjusted arbitrarily, then the ideal result can be observed through modernizing groups in this phase. By way of, PSO pretends the performances of the flocking of bird. Supposing the subsequent state, a collection of birds is arbitrarily penetrating fare in an area. Here is a solitary portion of the fare in the partial existence examined. Altogether the fowl do not distinguish wherever the fare is located. Nonetheless, it recognizes just how far the fare is in each repetition. It is cast off towards resolve the expansion difficulties. In PSO, every solitary explanation is a "bird" in the examine gap and it is called as "particle". Every element has fitness standards, it is calculated through the appropriate role toward augmented, and then has accelerated which undeviating the winged of the atoms. The atoms fly over the problematic gap through subsequent the present optimal subdivisions.

PSO is regulated through a collection of accidental solutions and formerly explorations aimed at goals through appraising peers. In each replication, every single element remains modernized through subsequent binary "best" standards. The principal one is the finest answer and it has accomplished so far. This worth is named pbest. Additional "best" worth that is pursued through PSO is the best assessment, acquired so far by some

subdivision in the populace. This preeminent assessment is called gbest. In this EISO fitness value is deliberated for every repetition. Here the newest best element is "p_{best}", the position of the element is "l_{best}" and the superior assessment of engendered element is elected as the "g_{best}". The velocity of the element is regularly changed over in order to get different p_{best} and l_{best}. In this EISO algorithm three global tenets are commonly deposited and chronicle. Then base station originates the clustering enactment phases as follows,

$$f_1(x) = FV = \alpha_1 . f_1 + (1 - \alpha_1 - \alpha_2) . \frac{1}{number\ of\ members\ covered\ by\ C} \quad (1)$$

In this major stage is to split the particles into position and velocity. Subsequently fitness value is estimated for each and every element by the equation (2)

Where, Fitness value is

$$f_1 = \sum_{i=0}^{N} \frac{d(C, M_i)}{N} \quad (2)$$

Where C = current node, Mi = member node, N is the number of members covered with in the cluster and α_1, α_2 are the weighing parameters (values are 0.2 and 0.2 respectively).

Then the new velocity is calculated from the old velocity and l_{best} and g_{best} values. The time fluctuating weighting function z using eqn. (3) is given by

$$z^* = z \times f_1(x) \quad (3)$$

$$z = z_1 - z_2 \quad (4)$$

$$new\ velocity = z^*\ old\ velocity + z_1(l_{best} - p_{best}) + z_2(g_{best} - p_{best}) \quad (5)$$

Where z is the inertia weight (value is 1.5), z_1 and z_2 are the basic EISO tuning considerations (values are 0.9 and 0.4 respectively).Assessment of novel position by using new-fangled velocity is given below:

$$new\ position = old\ position + new\ velocity \quad (6)$$

Subsequently the fitness value is calculated for the new particle with the help of the new position and velocity. Among the fitness values highest value is chosen as the local best values. The fitness updating process is repeated until getting optimum value. Hence for each iteration maximum fitness value selected as the local best (l_{best}) and the final point from the local best (l_{best}) value is selected as the global best (g_{best}) value. Cluster Head is liable for best path choice, coordinating nodes and makes the stability of the load equivalently among all the

nodes. In order to choose the cluster head, the following cluster head is connected with all. At that time the fitness function for the cluster head assortment is given by the following equation (8)

$$FV = \alpha_1 . f_1 + (1 - \alpha_1 + \alpha_2) . \frac{1}{number\ of\ members\ covered\ by\ C} \quad (7)$$

$$\text{Where, } f_1 = \sum_{i=0}^{N} \frac{d(C, M_i)}{N^{\gamma}} \quad (8)$$

$$\text{Where, } \gamma = \begin{cases} 1, & if\ Mi\ is\ covered\ by\ C \\ 0, & else \end{cases}$$

In above calculation γ is the capacity of attachments in the existent cluster node, α_1 and α_2 are weighing features (standardized values), and N indicates the capacity of memberships surrounded inside the opposition expanse of the cluster head in the EISO.

The novel velocity of the different elements is premeditated from the original result. From the equation (3) new-fangled velocity will be calculated.

$$new\ velocity = z^{*} old\ velocity + z_1 (l_{best} - p_{best}) + z_2 (g_{best} - p_{best}) \quad (9)$$

Where z is the inertia weight, z_1 and z_2 are the basic PSO tuning parameters (values are 0.9 and 0.4 respectively). Assessment of novelty using novel velocity is as follows:

$$new\ position = old\ position + new\ velocity \quad (10)$$

The fitness value for the novel particle is estimated from the equation (7). Then the fitness value of the old and new particle is matched, from this best one is selected for the following iteration. Therefore, for every iteration maximum fitness is selected as the local best solution (l_{best}). Among this l_{best} best one is selected as the global best solution (g_{best}). Next to the cluster head selection the information security will be improved with the new technique known as sparse matrix encryption algorithm. Thus message security will be improved before it sends to the receiver side.

IV. RESULTS

The projected technique is enforced using NS-2 and valid by associated with the LEACH and SOCCOR protocol. The projected system can give energy economical .At that point, the computation and communication of the projected theme is related with different schemes. Simulation results are evaluated with the enactment metrics like variety of packets received by sink node, delay, and packet loss, normalized overhead. The projected work is implemented within the functional platform of network machine NS-2 and henceforth the concert are analysed by assessment with any of the recent prevailing method. The total number of iteration is 100. Additional parameters are explained in table1.

 ISBN: 978-93-86171-94-8

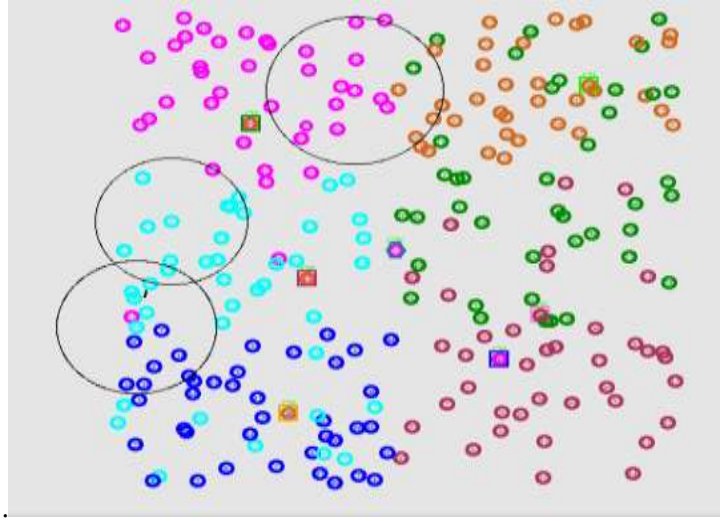

Figure 3 Node placement in mesh networks

In our work totally 250 nodes are placed around a mesh network (figure 3). Then the deployment area is covered by three clusters. Initially cluster heads are selected to form a cluster within the transmission area. In this figure marked area represents the cluster head and totally three clusters are formed.

Table 1: Simulation parameters

Parameter	Values
Number of nodes	250
Area(deployment)	300*300 m^2
Initial energy	1 Joules
MAC Type	IEEE 802.11
Data packet size	1024 bits/ sec
Transmitted power	0.02 watts
Received power	0.01 watts
Frequency range	5 GHZ
Transmission range	120m

Table 1 mentions the parameter which is required for the implementation and here the MAC type is IEEE 802.11 and the initial energy level is 1 joule. After that this energy will vary for each packet transmission.

Different performances are evaluated with the proposed EISO in SOCCOR protocol and its performance is compared with the previous LEACH protocol. This protocol is done through the MAC type protocol with

minimum power consumption. The overhead analysis is outlined because the computed quantitative relation between the amount of management packets and also number of transmitted packets.

$$Overhead = \frac{Energy\ of\ the\ corresponding\ node}{Sum\ of\ the\ transmitting\ and\ receiving\ energy} \quad (11)$$

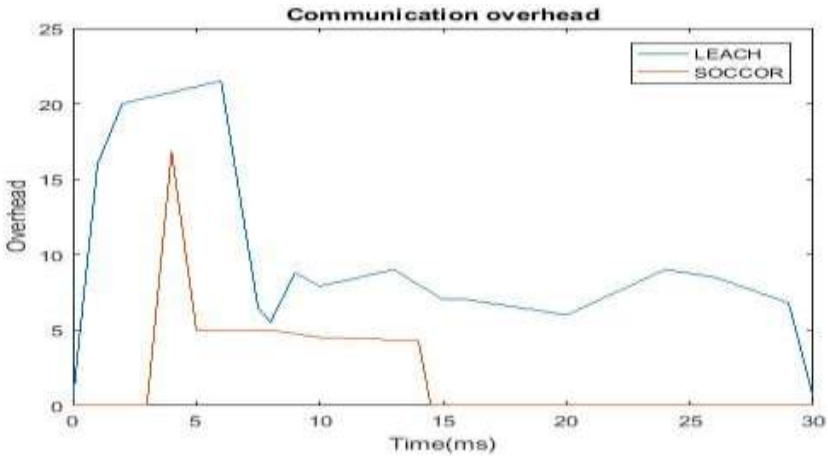

Figure 4 Overhead analysis

Energy consumption is defined as the sum of receiving energy with the number of nodes and the transmitted energy.

$$E_{consume} = \left(E_{RX} \times number\ of\ nodes\right) + E_{TX} \quad (12)$$

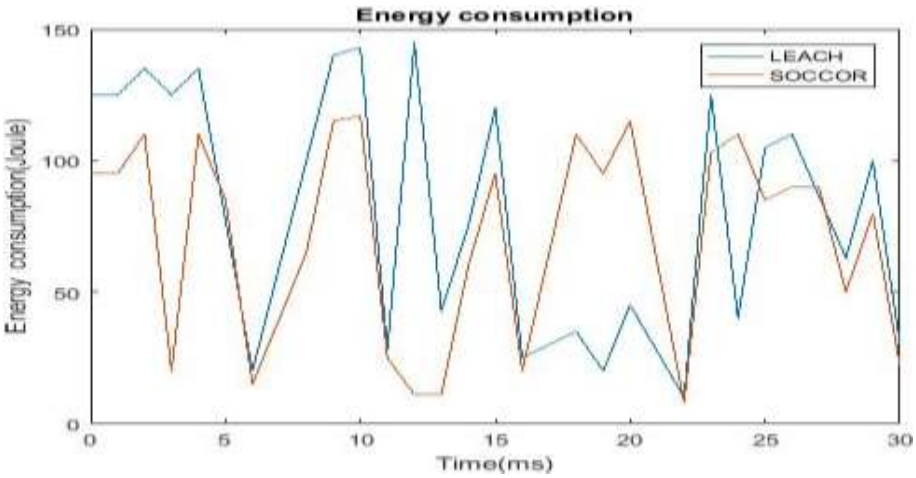

Figure 5 Energy consumption analysis

Subsequent to the numerical asses Subsequent to the numerical assessment achieved by means of optimization procedures, the succeeding statement is made with the results of differentiating overhead and energy consumption. Figures 4&5 displays the presentation, exploration of overhead and energy consumption for LEACH protocol. The result of LEACH must find the route to retransmit data packets that are misplaced due to the node's flexibility or fanciful route methods during the transmission. The results display that the values of the EISO in SOCCOR are much better than LEACH protocol.

V. CONCLUSION

The overall work of the paper concentrated on minimum energy utilization. Thus, proposed EISO clustering in SOCCOR protocol provides energy efficient, secure routing over the entire network. Secure packet is transmitted from the mesh nodes to another node. The delay will reduce while transferring the packet, and optimized routing is achieved with the ant colony optimization. Therefore, this motivates wireless carriers to pursue the most economical method for enhanced system having limited power consumption over wireless mesh networks.

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