AN OPTIMIZED CENTRALIZED CLUSTERING FOR WIRELESS SENSOR NETWORKS USING HARMONY SEARCH ALGORITHM BASED CLUSTERING PROTOCOL

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Abstract: In wireless sensor networks (WSN), data communications are incomplete computation energy, less bandwidth, and less data aggregation. Evaluated to wireless sensor networks, such as cluster based energy can be executed comparatively easily in wireless networks due to the unsupervised access to the wireless medium. In WSN, Cluster head assignment is a fundamental networking method in each data gathering technique, and several wireless networks are elimination. Distributed Clustering-Task Scheduling for Wireless Sensor Networks has been employed by numerous researchers to solve such problems and choosing cluster head and packet transmission. These problems of the previous clustering techniques are making them inappropriate for selecting an amount of cluster heads in a network environment. To overcome this problem, this paper presents a secure centralized clustering of Harmony Search Algorithm based Clustering Protocol (HSACP) algorithm based dynamic routing framework that permits the detector to confirm of reliability packet delivery message reported by mobile nodes. Meanwhile the HSACP framework for recognizing compromised mobile nodes based on observant created by explicit collision exposure mechanisms in cluster based wireless networks in Network Simulator 2.34. Through extensive simulations, the proposed work verify that the HSACP mechanism achieves significantly better detection accuracy than Dynamic Hyper Round Policy (DHRP) algorithm in wireless sensor networks.

Keywords: Wireless Sensor Network, Cluster, Cluster Head, Routing, Harmony search.

I. INTRODUCTION

Wireless sensor network, "A network of devices that can communicate the information grouped from a checked field through wireless links". The data is forwarded through multiple nodes, and with a gateway, the data is connected to other networks like wireless Ethernet. WSN is a wireless network that consists of base stations and numbers of nodes (wireless sensors). These networks are used to monitor physical or environmental conditions like sound, pressure, temperature and co-operatively pass data through the network to a main location

In WSN, Clustering is a routing technique wherein the sensors are grouped into clusters. Each cluster has a lead node, also referred to as a Cluster Head. The Cluster Head (CH) is responsible for all transmissions to the sink emanating from the nodes within its cluster. Figure 1 illustrates the clustering technique in WSNs.

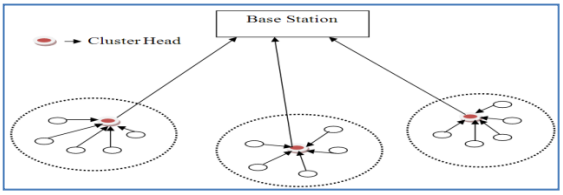

Fig. 1.1: Data transmissions from clusters in Wireless Sensor Networks

Clustering is used in large scale sensor deployments for monitoring applications that cover vast regions. In these regions, physically-close nodes often have correlated data. In such cases, an overall description of the events in the region is sufficient rather than individual node data. Physically-close nodes can be grouped into a cluster as shown in Fig. 1. In each cluster, the CH aggregates the data from all nodes in its cluster, and sends the aggregated data to the Base Station. This kind of localization reduces the number of data packets transmitted, thereby resulting in decreased energy consumption.

Many researchers have projected different energy efficient techniques to reduce energy consumption and enhance the network lifetime. Some of these include selectively keeping certain nodes active and the others in sleep state (Suresh Singh, and C. S. Raghavendra, 1998 [1]), use of signaling messages to avoid simultaneous packet transmissions by nodes (P. Karn, 1990 [2]), reducing redundant broadcasts by the sensors, and creating subsets of sensors to perform sensing and data transmissions rather than using all the nodes in the network (Amiya Nayak and Ivan Stojmenovic, 2010, [3]).

Efficient sensor routing is another technique that can reduce a sensor node's energy consumption to a great extent. It has hence gained the attention of various researchers (K. Akkaya and M. Younis, 2005 [4]).

Sensor nodes used in WSNs are equipped with transceivers for transmitting and receiving data. These transceivers require a battery, and it is often impossible to recharge the batteries when they are exhausted. Thus, one of the main considerations in sensor networks is the node lifetime. Often, large numbers of sensors are required in monitoring applications, and low cost becomes a requirement. The low cost requirement necessitates batteries of medium capacity, and low energy consumption for the specified battery capacity. Therefore, ad hoc WSNs are considered to be energy limited. It is hence necessary to identify the main causes of energy consumption in the WSNs.

This paper presents improved new dynamic and adaptive approaches for reliable Distributed Clustering-Task Scheduling for Wireless Sensor Networks algorithm obtain the Path optimization in distributed cluster network by using cluster head selection, and to improve the performance of network.

The main contributions of this paper are as follows:

- Evaluate the minimum most congestion rate in Wireless Networks and investigate the delay in the networks.
- Analyze the transmission range in user-centric network and to avoid the frequent link failures.
- Predicting the nodes mobility in WSN and maintain the reliable packet delivery from source to destination.

The rest of the paper is organized as follows: Related work is detailed in Sect. 2. In Sect. 3, Research methodology in Sect. 3, Experimental results are described in Sect. 4; finally conclusion is in Sect. 5.

II. RELATED WORK

(*Ali Chamam and Samuel Pierre*, **2010**) [5] Considered minimizing energy dissipation and maximizing network lifetime are between the central concerns when manipulative submissions and protocols for sensor networks. Clustering has been established to be energy-efficient in sensor networks as data routing and transmit are only functioned by cluster heads. Also, cluster heads can procedure, filter and collective data sent by cluster members, thus dropping network load and improving the bandwidth. The authors proposed a narrative distributed clustering algorithm where cluster heads are chosen subsequent of 3-way messages switch over between every sensor and its neighbors. Sensor's eligibility to be chosen cluster head is based on its remaining energy and its degree. Their protocol has a communication exchange complexity of O(1) and a worst-case convergence time complexity of O(N).

(*Bo-Chao Cheng, Hsi-Hsun Yeh, and Ping-Hai Hsu*, **2011**) [6] authors discussed network lifetime preventability is an important system requirement for the category of wireless sensor network (WSN) used in safety-significant and highly-dependable applications. The entire sensor nodes in these time-serious WSNs should assemble the duration limitation at several time instances; furthermore it may cause cruel cost that involves profitable losses, or even fatalities. In the literature, clustering sensors into sets is an accepted approach to exploit the network lifetime, but nothing of the clustering algorithms deal with the preventability issue for time-critical WSNs. The authors proposed the High Energy First (HEF) clustering algorithm is selected as a design orientation model, which is established to be a finest clustering rule under certain ideal conditions. To address network lifetime expectedness in perform, the network lifetime bounds and possibility test for the HEF are developed through the worst case energy utilization analysis.

(*Sang H. Kang and Thinh Nguyen*, **2012**) [7] authors discussed central to the cluster-based routing protocols is the cluster head (CH) choice process that permits even distribution of energy consumption between the sensors, and consequently extending the duration of a sensor network. They proposed distributed CH selection approaches that attain into description the distances from sensors to a support station that optimally stability the energy consumption between the sensors. NS-2 simulations showed that their proposed method outperforms existing approaches in conditions of the common node lifetime and the time to initial node death.

(*Sheng-Shih Wang and Ze-Ping Chen*, **2013**) [8] proposed a link-aware clustering method, called LCM, to conclude an energy-efficient and dependable routing path. The LCM mainly believes node conditions and association condition, and uses a narrative clustering metric called the predicted transmission count (PTX), to assess the condition of nodes for clusterheads and gateways to build clusters. Each clusterhead or gateway contestant depends on the PTX to obtain its priority, and the applicant with the highest precedence suits the clusterhead or gateway. Simulation outcomes authenticate that the proposed LCM extensively outperforms the clustering methods using random selection and by believing only link excellence and residual energy in the packet or message delivery ratio, energy utilization, and delivery delay.

(*Xuxun Liu*, **2015**) [9] authors observed Hierarchical routing in wireless sensor networks (WSNs) is an extremely significant topic that has been drawing the research society in the last decade. Classic hierarchical routing is called clustering routing, in which the network is separated into several clusters. Newly, various types of unusual hierarchical routing happen, together with tree-based, chain-based, area-based routing and grid-based routing. There are numerous review papers that presented and compared the hierarchical routing protocols from different viewpoints, but a survey on atypical hierarchical routing is still absent. The authors initialized a primary attempt to afford a complete review on atypical hierarchical routing. To presented a classification of atypical hierarchical routing of WSNs, and

give comprehensive analysis of special logical topologies. The most representative different hierarchical routing protocols are explained, discussed, and qualitatively evaluated.

(*Peyman Neamatollahi, et.al.,* **2018**) [10] authors developed extending the network life cycle is an important requirement for several types of Wireless Sensor Network (WSN) applications. Dynamic clustering of sensors into collections is an accepted policy to exploit the network lifetime and amplify scalability. In that approach, to attain the sensor nodes' load balancing, with aspire of extending lifetime, network operations are divide into rounds, i.e., predetermined time intervals. Clusters are constructed for the present round and reconfigured for the subsequently round so that the expensive role of the cluster head is turned amongst the network nodes, i.e., Round-Based Policy (RBP). This load balancing method potentially expands the network duration. Though, the imposed overhead, due to the clustering in each round, desecrates network energy resources.

III. RESEARCH METHODOLOGY

In this paper, proposed Harmony Search Algorithm based Clustering Protocols (HSACP) in Hyper round (HR) policy for small-scale WSNs to optimally determine the HR length system in Network Simulator 2.34 simulator. In order to know the methodology of HSACP in Network Model, Routing Process, Cluster Head Assignment and Harmony Search Algorithm based Clustering Protocol algorithm is performed. The proposed work flow diagram is described in figure 1.

A. *NETWORK MODEL*

In network model formation, they network imagines that mobile nodes are positioned within a simulation area with radius *R*. They are circulated consistently with density or compactness *dn*. In calculation, mobile nodes (*mn*) converse with all other at a consistent rate *cr*. The network and traffic weight are symmetric in the cleverness that every *mn* of the related distance *dst* from the middle of the network area are parallel, i.e. the amount of weight obtainable throughout whole *mn*'s, which are of a lasting distance *ldst* from the centre, is the identical.

Let believe a network model with *nm* nodes where *nm* is in arrange of 50 to 100. A node has a position (*a, b*) measured from numerous direction summit. Every mobile node is embedded to be in the identical level surface. All mobile nodes of parallel deterministic, positive and controlled message range *mr*. In further words, two nodes *C* and *E* are honestly linked if and just if

$$d(C,E) = \sqrt{(a_C - a_E)^2 + (b_C - b_E)^2} < mr \quad \text{eqn. (1)}$$

Where *d* (C, *E*) indicates distance between two *mn*'s. This engages that the packet controls are symmetric, (i.e., if *C* is a neighbor of *E*, *E* is a neighbor of P and connects versa).

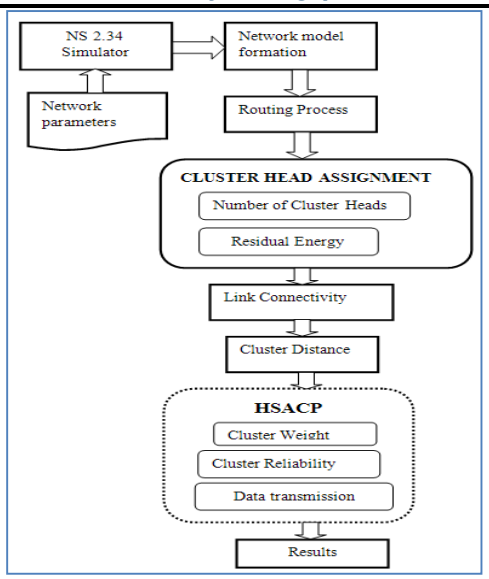

Fig. 1: Proposed flow diagram

B. *ROUTING PROCESS*

The routing procedure is entirely on-demand ad hoc network routing protocol described as two portions: Route Discovery and Route Maintenance.

- Route Discovery to explore a path; the discovery node is recognized as the inventor of the Route Discovery, and the node target of the message or packet is predictable as the Discovery's objective.
- Route Maintenance is the process by which a node transmits a message along with an exacting path to different targets recognizes if that path has not working, for instance, the two mobile nodes in it have stimulated additionally unconnectedly.

This proposed routing process presents as follows: When the route request packet appears at the end node or an isolating node with a direction to the destination, a route reply message will be formed. This reply message or packet is consequently sent reverse to the origin mobile node resulting the invalidate route controlled in the route request message. All intermediate nodes will inform the Path Error Rate (PER) assessment if its connection values of PER lesser than the preceding recorded assessments in the route reply message. If PER value of its association is superior to recorded value, the mobile node will not update the value. The method will preserve until the route reply packet attain the origin node. At the current, origin node there are several of accessible routes with exceptional values of PER. The origin node will select the route based on the value of top of bad obtainable values of PER.

C. *CLUSTER HEAD ASSIGNMENT*

The cluster head selection (CHS) believes the collection of Cluster heads (CH) in a wireless sensor network of nm mobile nodes such that every node in this network is surrounded by distance hn hops of a CH, for a specified DEFINED-VALUE. In the proposed CHS form, the Cluster period specifies the

instance from the location of mobile node is selected as cluster head awaiting the location of a mobile node adjusts its circumstance to standard node. It must be distinguished that the cluster creation is reliant on mobility issues; the cluster period in established network depends on connection dependability. In the simulation network model (using NS2.34) a clustering packet or message is send every 3 seconds. Thus, a neighbor mobile node is kept in the neighbor routing table for 3 ∗ count R seconds and unnecessary if there is no further clustering packets established. Mostly, the Statement History (SH) for entire mobile nodes has been calculated as unfilled (empty) or ⩾ 1. Algorithm 4.1 signifies the Cluster head(s) selection or assignment procedure.

Algorithm 4.1: CLUSTER HEAD SELECTION

Initialize: $CH_{present} \leftarrow 0$; $CH_{existing} \leftarrow 0$; $Time_{existing} \leftarrow 0$;; $Present() \leftarrow 0$;

Step 1: Time – $OUT_{loop} \leftarrow 3$

Step 2: equation (1) DEFINED-VALUE can be additional evaluate

$$D_{mnab}(t_2) = D_{mnab}(t_1) \times \exp[-(D_{mnab}(t_1)\Delta t)]^{2l}$$

where $\Delta t = t_2 - t_1$ and l is an integer such that $l \geq 1$

Step 3: while $Time_{existing} \leq Present()\|$ DEFINE – VALUE($CH_{existing}$) ≤ 1 = true **do**

$CH_{existing}$ remains as Cluster head

End while

Step 4: if DEFINE – VALUE($CH_{existing}$) = DEFINE – VALUE($CH_{present}$) && $SH(CH_{existing})$ = SH(CH_{cur}) **then**

Both $CH_{existing}$ and $CH_{present}$ remain as cluster heads

Else

Choose novel Cluster Heads

End if

D. HARMONY SEARCH ALGORITHM BASED CLUSTERING PROTOCOL

The proposed Harmonic Search algorithm has a extremely easy perception and utilizes the employ of extremely less parameters however a extremely strong comprehensive search capability has. The traditional Harmony Search algorithm contains the following major steps.

1) Initializing the searching optimization issue and algorithm establishment.
2) Assigning the Harmony Memory (HM).
3) Creativeness of a novel harmony.
4) Revising the Harmonic Memory.
5) Repeating step (3) and step (4) until the termination measure is fulfilled.

The Harmony Memory considered to accommodate harmonies of the similar dimension can't be used for routing for WSNs, as in amount of sensor nodes in path is undecided. Thus, the dimension of the harmony in HM may be dissimilar. Consequently, the traditional HS algorithm can't be directly used to resolve routing problem of WSNs. Several developments to the classical method have been complete to make it appropriate for use in WSNs.

IV. RESULT AND DISCUSSIONS

The proposed research work results describe a beginning experimental evaluation of the HSACP algorithm performed in which the dynamic hyper round policy procedure in NS2.34 environment and compared with the results of the LEACH and DHRP algorithm. Comparison is done in the amount of alive nodes, energy of the network and the number of received packets to the cluster head (CH). Simulation parameters are scheduled above in previous table 1. The proposed system performed all the experiments on a Fedora Operating system with a Intel core I5 processor with 3.20 GHZ speed and 8 GB of RAM. In this experiment study, we compare the performance of Energy Packet Delivery Ratio (EPDR), Energy Throughput and Energy End-To-End Delay.

Table 1: SIMULATION PARAMETERS

Algorithm Parameters	LEACH	DHRP	PROPOSED HSACP
Number of mobile nodes	40	50	51
Time slots	6	6	5
Set of Links	30	45	55
Transmit Power	100 joules	100 joules	100 joules
Network Bandwidth	2 MBPS	2 MBPS	2 MBPS
Number of Frames	60	75	85
Throughput session	150 kbps	173 kbps	189 Kbps
Channel vector	10	25	37

The Energy packet delivery ratio is the percentage of the amount of packets established by the target to the amount of messages generated by the source node. The Proposed system executes the finest in terms of packet delivery ratio followed by distributed weight cluster method.

$$EPDR = \left(\frac{Amount\ of\ Sending\ \ messages}{Amountof\ Receive\ messages}\right) \times 100 \quad eqn.(2)$$

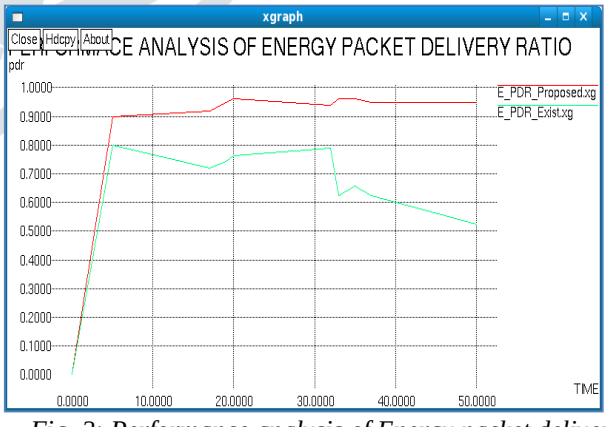

Fig. 2: Performance analysis of Energy packet delivery ratio

The evaluation of energy throughput of the network is specified in figure 3 in this diagram the proposed method presentation is signifies using the red mark and the green mark demonstrates the performance of the conventional cache management method. For representing the presentation of network the Y axis encloses the throughput and the X axis encloses the execution time duration in network experimentations. According to the established outcomes the proposed approach throughput is additional than the conventional approach of the cluster head management.

$$EX = \frac{Number\ of\ message\ requests}{Total\ Time\ duraiton} \quad eqn.(3)$$

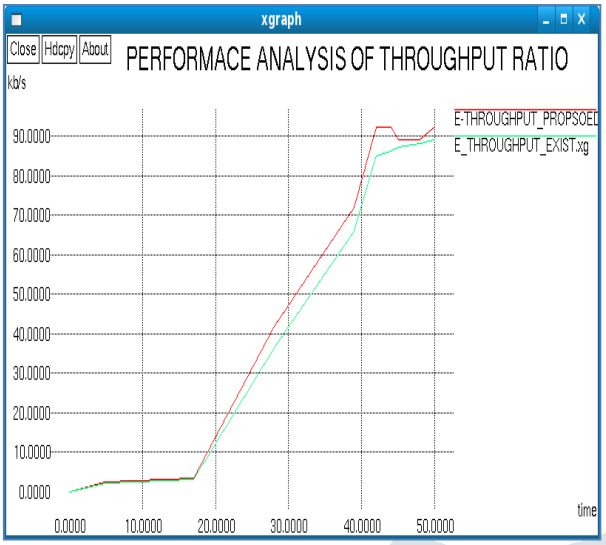

Fig. 3: Performance analysis of Energy Throughput

Energy End to end day on network performs to the time taken for a packet to be broadcasted through a network from source to destination mobile node. In figure 4 in this diagram the proposed algorithm's performance is represented using the red line and the green line shows the performance of the traditional cache management technique.

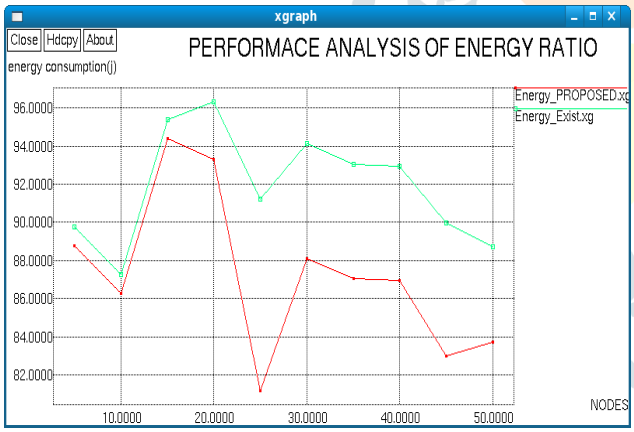

Fig. 4: Performance analysis of Energy End-to-End Delay

V. CONCLSUION

In this paper, presents Harmony Search Algorithm based Clustering Protocols (HSACP) in Hyper round (HR) policy in centralized clustering algorithm that can be easily allocated number of clusters in dynamic manner in NS 2.34 simulation. The proposed model analyzes the impact of Distributed Clustering-Task Scheduling for Wireless Sensor Networks Using Dynamic Hyper Round Policy clustering algorithm for wireless sensor networks on the strength of linkage and cluster formation. Special factors such as node speed, relative energy, remaining energy and weights are considered to establish an appropriate clustering update period and choose cluster head. These constraints lead to better cluster head stability, reduction in the amount of clusters in the network, and improving the HR length due to its distributed nature. Meanwhile, the proposed system establish a link generation model to calculate approximately the generation of every link and proposed a highest cluster head revised interval (link generation) model to recognize the clustering update frequency.

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