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Enhancing Energy Exertion Using Multi Hop Data Aggregation in Wireless Sensor Network

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Abstract ***The Ad Hoc On-Demand Distance Vector (AODV), Hybrid Energy Efficient Distributed (HEED) and multi-hop LEACH protocols are discussed. In multi-hop clustering, the sensor is selected as CH according to the two parameters maximum envelop position reckoning of the sensor nodes. The multi-hop LEACH is to choose SNs as CHs by alternation, The towering energy indulgence in exchange the information among the BS is extend to all sensor Nodes in the set of networks. By means of this in sequence every node will prefer the presence cluster head (CH) based on the negligible packet failure. Mat lab simulations demonstrate that taking into consideration packet failure in choosing the most excellent communication path has a significant contact on plummeting the energy utilization of the complex as well as greater than ever network throughput.***

Keywords—Energy Exertion, Routing Protocols, Packet Failure, Wireless Sensor Networks.

I. INTRODUCTION

Data aggregation commonly moving parts on large information or data marts that do not present much in sequence significance as a whole. It is a few progression in which in sequence is gathered and articulated in a outline appearance, designed for purposes such as arithmetical investigation. A ordinary principle is to acquire more in sequence about scrupulous cluster based on unambiguous variables such as age, profession, or returns. Information aggregation procedure installation process given below. The sensing information collected from the node in the sensor network, and it is filtered by the method LEACH(Low Energy Adaptive Clustering Hierarchy),TAG(Tiny Aggregation) etc. This aggregated information is relocate to the sink node by selecting the efficient pathway.

There are many types of information filtering techniques are listed below [2].

- **Centralized Approach:** This is an concentrate on centric move toward where every node sends data to a middle node passing through the unswerving probable course by means of a Multihop wireless set of rules. The sensor nodes minimally send the information packets to a organizer, which is the commanding node.

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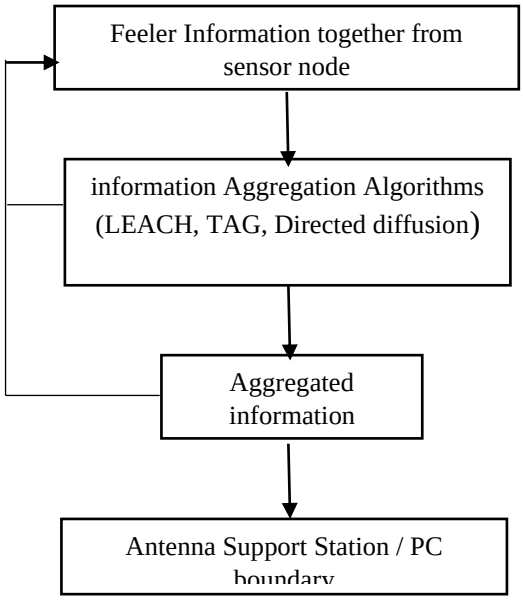

Figure 1 shows the common structural design of the information Filtering Procecure [1].

- **In-Network Approach:** In-network data filtering is the international progression of congregation and direction-finding in sequence in the course of a multi-hop association, dispensation data at transitional nodes with the purpose of plummeting supply utilization (in particular energy), thereby greater than ever network lifetime. In this method data filtering can be used two types
- **Tree-Based Technique :** In the technique move toward carry out the data by filtering constructing a logical method, which could be a smallest amount straddling tree, entrenched at be submerged and spring systems are well thought-out as vegetation. In every system has a parent node to forward its information. Flow of information starts from vegetation system to the source node and there in the process filtering completed by parent nodes.
- **Cluster-Based Approach:** In this technique come within reach of, whole network is alienated in to more than a few clusters. Each group has a group cluster member called Cluster heads do the responsibility of filtering the data conventional from group head members in the neighborhood and then broadcast the consequence to system.

The data is away from the sensor node to the base station . Therefore to group the data and filter it using the grouping technique. To unravel this predicament multi-hop transmission is projected.

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In the grouping process is usually handled by single system method the common group Head sends the data to the destination , and the difficulty of power expenditure surrounded by grouping head arises.As a result, they will depart this life past. Above the results the process is conclude by the system with multiple system technique[3].

II.METHODOLOGY

For WSNs various energy-efficient relaying schemes have been designed, in which clustering is specifically the most useful relay-based sensor network which requires scalability of more than 1000 nodes. Different cluster-based protocols have been present by examiners in current years that improve the network lifetime. The Ad Hoc On-Demand Distance Vector (AODV), Hybrid Energy Efficient Distributed (HEED) and multi-hop LEACH protocols are discussed.

A. Ad Hoc On-Demand Distance Vector (AODV)

AODV is an enhancement on the Destination-Sequenced Distance Vector (DSDV) algorithm. It is a imprudent routing protocol that uses an on-demand move toward to locate and ascertain routes. AODV maintains routes as extended as they are wanted by the basis nodes and it is painstaking one of the best routing protocols in provisions of power consumption and establishing the undeviating path. However, it is chiefly used for ad-hoc networks, but nowadays it is broadly used in WSNs as fighting fit.

The above protocol is used to find the route from one system to another system with required time division. Every system in the data transmission method used the frontwards the Route needed (RREQ) process when the information reaches its destination .The target system to the RREQ process by communicating (RREP) information. As the RREP flows throughout the network, it determines the route from basis node to target node. If any error will occurring means the RERR displayed.

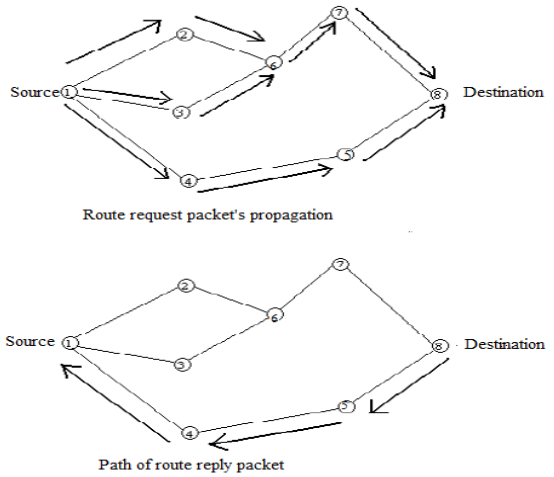

Figure 2 Route Request And Route Reply Of AODV Routing Protocol

Communication in AODV: 1. RREQ communication: It is worn to communicate one system to another system . 2. RREP communication: Mainly used connect the source to destination.3. RERR communication: Used only for the node broken. 4. HELLO communication: The successive connection of the network while sending data successfully.

AODV makes use of traditional routing tables, one route ingress per intention that the node is communicating through. It does not have to periodically exchange route information with the neighboring nodes. In AODV, each node maintains a route table for the destination node. A route chart contains the following in sequence: active neighbors for the route, destination address and its sequence number, hop count to the intention, and termination time for the chart which is restructured each time the route is used . For a particular period of time, if the route is not used, then it is not needed.

The Route fields are listed below:

i. IP Address: Destination system address which the packet data sent.

ii. Target progression number: The progression number of the target node.

iii. Next Hop: The next intermediate node to which the packets are to be forwarded.

iv. Hop Count: The number counting of source and the destination systems.

v. Lifetime: The reply of success communication between systems.

vi. Routing flags: Indicates the correct and incorrect values.

The message formats of AODV for the RREQ and R-RREQ is shown in figure 3 and 4 respectively.

Variety	Snobbish	Jump Calculation
Network Identification		
Target Internet Protocol Address		
Target progression Count		
Resource Internet protocol Address		
Foundation progression Count		
Appeal Instance		

Fig 3 Data Formats of Route Request (RREQ)

Variety	Snobbish	Jump Calculation
Network Identification		
Target Internet Protocol Address		
Target progression Count		
Foundation progression Count		
Appeal Instance		

Fig 4 Data Formats of Route Reverse Request (R-RREQ).

a.Sophisticated benefits of AODV

- The main advantage of this protocol is used to enrich the performance the network through finding the route and performance extraction.
- Used to communicate with the node with request and reply method.So it is secure for data transmission from source to destination.

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b. Disadvantages of AODV

- No efficient route maintenance technique is present.
- Bandwidth and Security overheads.

B. Leach

LEACH is a routing protocol and is the first of the energy protocols invented thus far which is employed in improving the WSN lifetime. Distribution cluster algorithm is added in LEACH. In every cluster, one node is considered as CH and the others as cluster members and this part is rotated at each round. Since more energy is devoured by CH over cluster members and selection of one node is carried out permanently since CH after that it will die quickly. There are two types of process round: 1. Initial process and 2.selection state.

The first process carry out the following activities

1. The process of selecting the group head node.

2. Group Formation

3. After the Group Formation round data transferred schedule is activated.

The first process the group selection will be formed after that testing packet will be sent by the following equation.

(1.1):

$$T(n) = \begin{cases} \dfrac{P}{1 - P(r \bmod \frac{1}{P})} & \text{if } n \in G \\ 0 & \text{otherwise} \end{cases} \quad (1.1)$$

Where P is proposed percentage, G is set of systems in the group which are not preferred as Group Node in prior 1/P rounds and r is recent round. Nodes choose themselves as CH for proposed percentage (P) and its earlier record of CH . The node that is chosen as CH in present round, it will suit CH again after 1/P rounds . This is for uniform energy indulgence during the network. Selected CHs transmit an advertisement packet to other nodes that are not chosen as CH to link their cluster. These nodes transmit joint request to those CHs from where they accept advertisement packet with strongest signal power. After cluster formation, CH create TDMA schedule for its CM in cluster, select CSMA code and transmit TDMA schedule table to its cluster members.

The node becomes the leader of contemporary selection process the value of the selection process T(n).Once the group leader node is elected then after the next process it is not re elected. So it is very useful for energy extraction. The Selection of group head formation given the below fig 5.

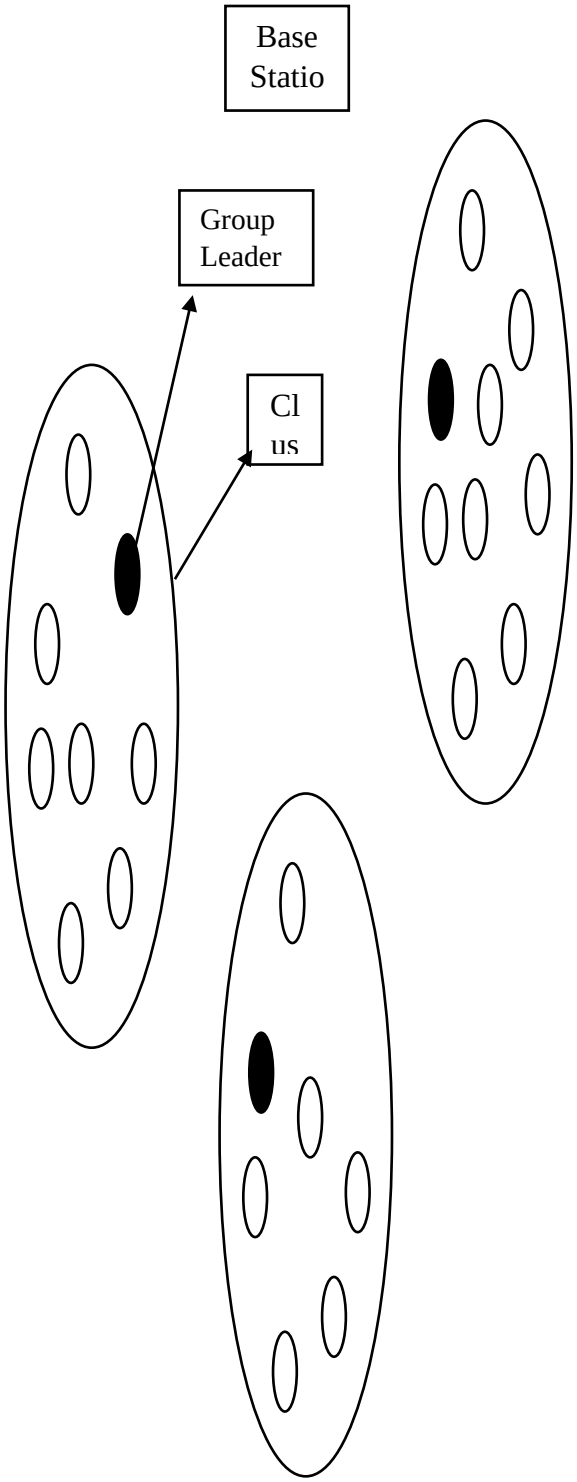

Fig 5 Cluster Formation in LEACH [4]

The benefit of selecting the group node is for saving the energy extraction. Because of group formation the non selection systems are saving their energy .

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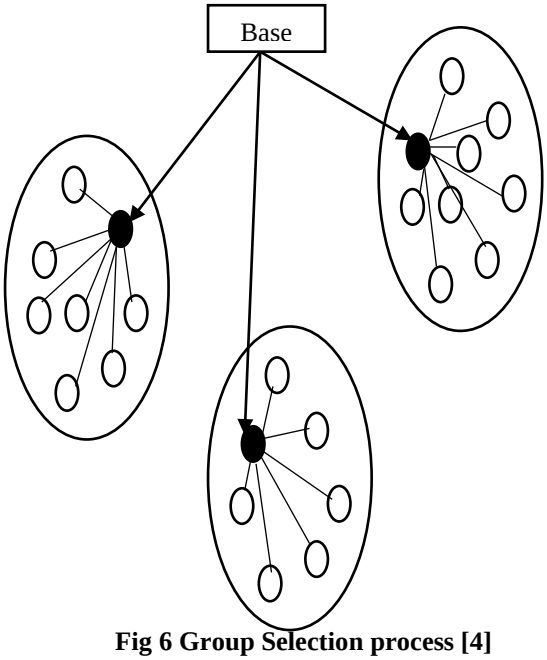

Fig 6 Group Selection process [4]

After the completion process of the group selection nodes another nodes in the group transmit the data to the leader. Later than the firm predefined occasion, which is decisive early, the connection goes flipside to the selection phase. That is in processing Phase group members send information to its CHs based on assigned TDMA moment slots. CHs collects information from its cluster members and snowballing this information to condense information quantity that send to BS.

C. Compensation and Disadvantages of LEACH

1. The group leader filter the whole data and sends to the destination.

2. As present is a on its own way steering is formed by the power consumption.

3. It takes time to transmits the data to the destination.

4. In this, spot in sequence of the system will choose is not obligatory.

Disadvantages of the protocol:

1. Selecting the group leader process is not proper manner.

2. At the time of data transmission the leader node have down energy means the transmission have dropped.

D.. HEED

HEED is a scattered clustering algorithm urban as an progress more LEACH. The augmentation is done in the CH mixture scheme. HEED, selects CH on the root of vigor as well as announcement cost. It is separated into three phases:

Step 1 Initialization Phase: Each SN sets the prospect C_{prob} of becoming CH follows (3.2):

$$CH_{prob} = C_{prob} \cdot \frac{E_{residual}}{E_{\max}} \qquad (1.2)$$

Where C_{prob} is the primary profit of CH essential in the network, $E_{residual}$ is the contemporary vigor of the join and $E_{\max}$ is the utmost vigor of the fully exciting battery.

Step 2 Repetition Phase: This is an iterative phase in which each node repeats the equivalent route awaiting it unearth a CH to which it preserve convey with slightest cost. If a few node finds no such group leader ,then itself change as a group leader and the message is communicated by the near by nodes.

Step 3 Finalization Phase: In this segment nodes any picks the slightest group and itself becomes a group leader . Nevertheless it is an perfection above LEACH still it has several disadvantages resembling more CH are generated than likely and it is not aware of heterogeneity.

The distance among BS and CH has no consequence in LEACH. The statistics is relay through the group leader to the destination end throughout single hop communiqué. With the increase in diameter of the network, there is also increase in distance between CH and BS. As distance increases, power consumption of battery will also increase. Consequently, to decrease the energy consumption Multihop LEACH is introduced which again is a modified protocol. Broadcast from CH to BS occurs in multi-hop communication in multihop LEACH data broadcasts. Data is rather send from one CH to another and then to another and the one nearer to BS transmits the entire data to BS. Multihop LEACH is a distributed routing protocol which has its basis on clustering and CHs execute the data aggregation to the data receive so as to mitigate total data transmitted in the network.

One of the cluster-based routing algorithms is multi-hop LEACH. This is alike to LEACH protocol. Multi hop-LEACH protocol has two major modifications with regards to LEACH protocol. There is application of multi-hoping to both inter-cluster and intra-cluster communiqué. Every cluster is made up of a CH and cluster constituent nodes. The sensed information is gotten from the respective CH where the information are aggregated and sent to BS through optimal multi-hop tree that is created among CHs with BS as root node. When the nodes that are sensed are arranged in areas of thick vegetation or uneven terrain, multihop communication might prove to be beneficial among nodes in the cluster to reach the CH where both inter-cluster and intra-cluster communication perform in a similar way. Figure 7 shows the pseudo code of HEED protocol.

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I. Initialize

1. $S_{nbr} \leftarrow \{v: v \text{ lies within my cluster range}\}$
2. Compute and broadcast cost to $\in S_{nbr}$
3. $CH_{prob} \leftarrow max(C_{prob} \times \frac{E_{residual}}{E_{max}}, p_{min})$
4. $is\_final\_CH \leftarrow FALSE$

III. Finalize

1. If (is_final_CH = FALSE)
2. If $((S_{CH} \leftarrow \{v: v \text{ is a final cluster head}\}) \neq \phi)$
3. $my\_cluster\_head \leftarrow least\_cost(S_{CH})$
4. join_cluster(cluster_head_ID, NodeID)
5. Else Cluster_head_msg(NodeID, final_CH, cost)
6. Else Cluster_head_msg(NodeID, final_CH, cost)

II. Main Processing

Repeat

1. If $((S_{CH} \leftarrow \{v: v \text{ is a cluster head}\}) \neq \phi)$
2. $my\_cluster\_head \leftarrow least\_cost(S_{CH})$
3. If (my_cluster_head = NodeID)
4. If $(CH_{prob} = 1)$
5. Cluster_head_msg(NodeID,final_CH,cost)
6. $is\_final\_CH \leftarrow TRUE$
7. Else
8. Cluster_head_msg(NodeID, tentative_CH,cost)
9. Elseif $(CH_{prob} = 1)$
10. Cluster_head_msg(NodeID,final_CH,cost)
11. $is\_final\_CH \leftarrow TRUE$
12. Elseif $Random(0,1) \leq CH_{prob}$
13. Cluster_head_msg(NodeID,tentative_CH,cost)
14. $CH_{previous} \leftarrow CH_{prob}$
15. $CH_{prob} \leftarrow min(CH_{prob} \times 2, 1)$

Until $CH_{previous} = 1$

Figure 7 HEED protocol pseudo code

III. RESULTS AND DISCUSSION

The table 1 and 2 and figure 8 and 9 shows the a typical packet defeat rate (%) and percentage of remaining energy for multi-hop LEACH respectively for HEED, AODV and Multihop LEACH.

Number of nodes	HEED	AODV	Multi Hop Leach
60	9.06	8.53	8.06
120	15.57	12.32	13.22
180	17.51	14.08	13.57
240	22.24	21.16	17.86
300	27.66	25.94	24.16
360	38.72	29.33	34.09

Table 1 Typical Packet defeat Rate (%)

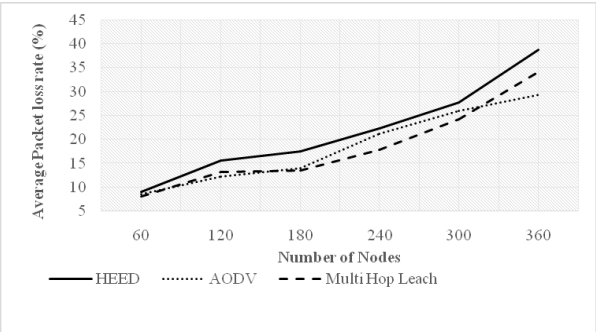

Figure 8 Typical Packet defeat Rate (%)

Commencing the figure 8, it can be pragmatic that the typical packet defeat rate in % performs better for multi-hop LEACH by lowering the loss rate by 11.68% &5.67% for 60 number of nodes, by 25.35% &3.69% for 180 number of nodes, by 12.72% &15.01% for 360 number of nodes when compared with HEED and AODV protocol respectively.

Number of nodes	HEED	AODV	Multi Hop Leach
100	91	85	94
200	80	74	81
300	63	54	69
400	21	11	35
500	9	3	12
600	0	0	0
700	0	0	0
800	0	0	0

Table 2 Percentage of remaining energy in joules

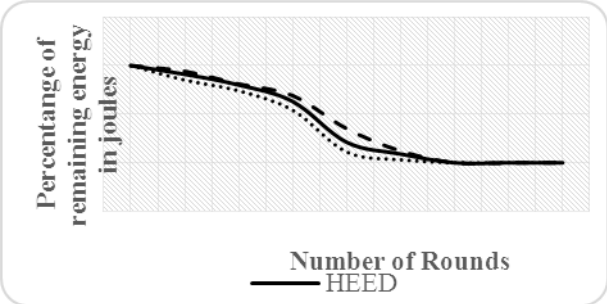

Figure 9 Percentage of Remaining Energy for Multi-hop LEACH

From the figure 9, it can be observed that the multi-hop LEACH has higher percentage of remaining energy by 10.05% & 3.24% for 100 number of rounds, by 9.03% & 1.24% for 200 number of rounds, by 24.39% & 9.09% for 300 number of rounds, by 104.34% & 50% for 400 number of rounds and by 120% & 28.57% for 500 number of rounds when compared with AODV and HEED protocol.

IV. CONCLUSION

Multihop communiqué is habitually compulsory when the announcement assortment of the SNs is narrow or the number of SNs is especially hefty in a network. In this occupation, AODV, HEED and multi-hop LEACH protocol is projected. AODV is a distance vector routing protocol that operates reactively to reduce overhead sentence routes only on exact. HEED is used to save the energy extraction unambiguous reflection of power.

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In multi-hop clustering, the sensor is selected as CH according to the two parameters remaining energy and node degree. The multi-hop method is to select SNs as group leader, so the soaring vigor rakishness. Results show the multi-hop LEACH has higher proportion of remaining energy by 10.05% & 3.24% for 100 number of rounds, by 9.03% & 1.24% for 200 number of rounds, by 24.39% & 9.09% for 300 number of rounds, by 104.34% & 50% for 400 number of rounds and by 120% & 28.57% for 500 number of rounds when compared with AODV and HEED protocol.

REFERENCES

1. Patil, N. S., &Patil, P. R. (2010, December). Data aggregation in wireless sensor network. In IEEE international conference on computational intelligence and computing research (Vol. 6).
2. Abhilash, L. N., Goenka, D., & Kumar, C. (2014, February). Dynamic data aggregation for energy optimization in multi-hop Wireless Sensor Networks. In Advance Computing Conference (IACC), 2014 IEEE International (pp. 143-148). IEEE.
3. Sony, C. T., Sangeetha, C. P., &Suriyakala, C. D. (2015, April). Multi-hop LEACH protocol with modified cluster head selection and TDMA schedule for wireless sensor networks. In Communication Technologies (GCCT), 2015 Global Conference on (pp. 539-543). IEEE.
4. Gill, R. K., Chawla, P., & Sachdeva, M. (2014). Study of LEACH routing protocol for Wireless Sensor Networks. In International Conference on Communication, Computing & Systems (ICCCS-2014).
5. Yassen, Muneer Bani, ShadiAljawaerneh, and Reema Abdulraziq. "Secure low energy adaptive clustering hierarchal based on internet of things for wireless sensor network (WSN): Survey." In Engineering & MIS (ICEMIS), International Conference on, pp. 1-9. IEEE, 2016.

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