

ENERGY EFFICIENT ROUTING PROTOCOL LEACH FOR WIRELESS SENSOR NETWORKS

Apune Sagar, Gawate Abhimanyu, Kotwal Sagar, Patil Mahesh
Department of Computer Engineering
Marathwada Mitra Mandal's Institute of Technology, Lohgaon,
Pune, India
sagarapune@gmail.com, abhimanyu062@gmail.com,
kotwal.sagar111@gmail.com, maheshpatil1308@gmail.com

Abstract: In Wireless Sensor Network Data Aggregation is an important technique to achieve power efficiency in the sensor network. Sensor node has limited battery power so data aggregation techniques have been proposed for wireless sensor networks. A challenge to data aggregation is how to secure aggregated data from disclosing during aggregating process as well as obtain accurate aggregated results. The proposed approach includes a security mechanism, and an innovative cluster head election mechanism and the route will be selected with less energy needed. The simulation output shows that the Low Energy Adaptive Clustering Hierarchy (LEACH) has the security, energy efficiency and prolongs the network life time is high when compared to DSDV and AODV, respectively. In this case, data fusion is helpful to reduce the amount of data transmitted between sensor nodes and base station. The LEACH protocol is an elegant solution to this problem.

Keywords: LEACH, WSN, CH, BS, DSDV, AODV, Data Aggregation, Clustering, Energy efficient, Security.

1. INTRODUCTION

In recent years, Wireless Sensor Network (WSN) plays a vital role in various application domains such as object detecting, medical caring, forest monitoring and so on. Energy ability and scalability are two greater challenges in Wireless Sensor Networks. For example, the number of nodes in a randomly unfold network needs to be enough high to ensure connectivity. As a result, when using its maximum transmission power, a node may have very large of neighbors. Therefore, it becomes critical if it tries to store the information about its neighbor. Having more neighbors than the required leads is unnecessary for energy consumption in the network. This problem can be overcome by using topology control which restricts the set of neighbors of given node. The transmission power can be reduced along power consumption by carefully choosing the set of neighbors. Lack of energy efficiency which delays the lifespan of the network is one of the serious issues in the WSN.

LEACH (Low Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster based station (cluster-heads) to evenly distribute the energy load among the sensors in the network.

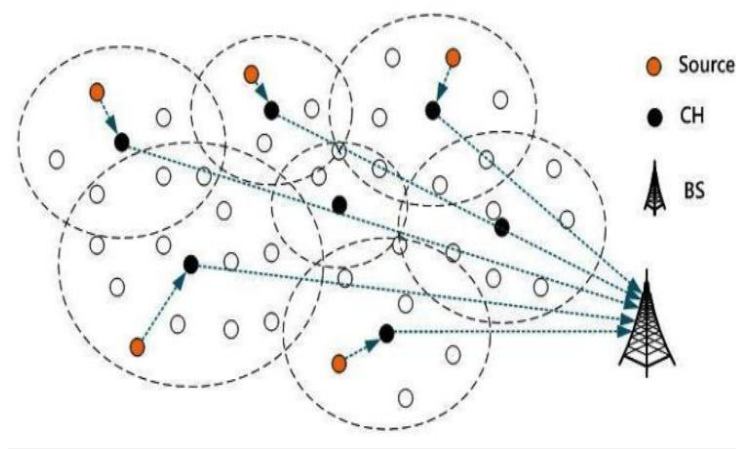


Fig.1: System Architecture [1]

LEACH uses localized coordination to enable scalability and robustness for dynamic networks, and incorporates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station.

2. SYSTEM MODULE

LEACH Phases: This protocol is divided into rounds, each round consists of two phases;

- (i) Set-up Phase (ii) Steady Phase

2.1. Set-up Phase: Set-up phase is further divided into 2 parts:

- Advertisement Phase
- Cluster Set-up Phase

LEACH forms clusters by using a distributed algorithm where nodes make autonomous decisions without any centralized control. As shown in Fig.2, In the Advertisement Phase, CHs inform their neighborhood with an advertisement packet that they become CHs. Non-CH nodes pick the advertisement packet with the strongest received signal strength.

Each node decides independent of other nodes if it will become a CH or not. This decision is made by looking into account when the node served as a CH for the last time (means the node that hasn't been a CH for long time is more likely to elect itself than nodes that have been a CH recently). This is done according to a threshold value, $T(n)$.

2.2. Steady Phase: Steady phase is further divided into 2 parts:

- Schedule Creation
- Data Transmission

Once the nodes have elected themselves to be cluster heads. The cluster head nodes must let all the other nodes in the network know that they have chosen this role for the current round.

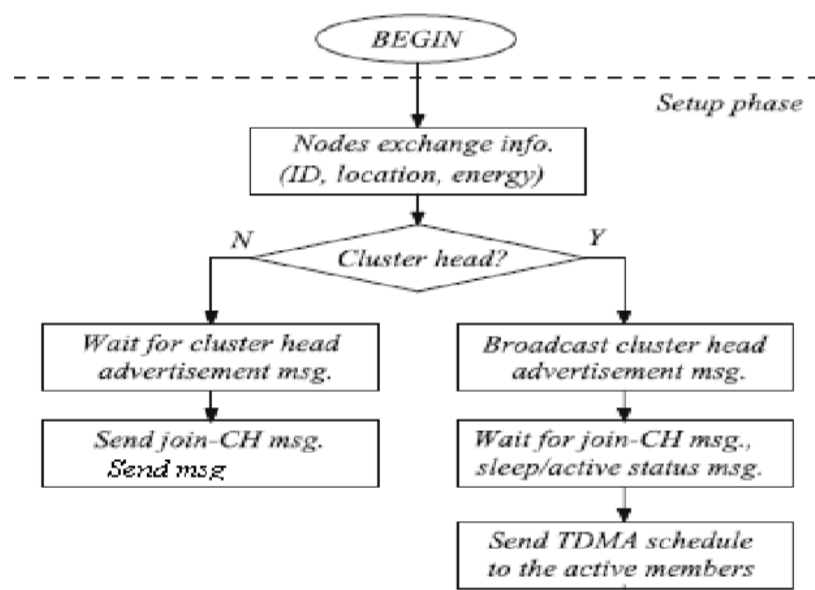


Fig.2: Flowchart of LEACH protocol in Set-up phase [1]

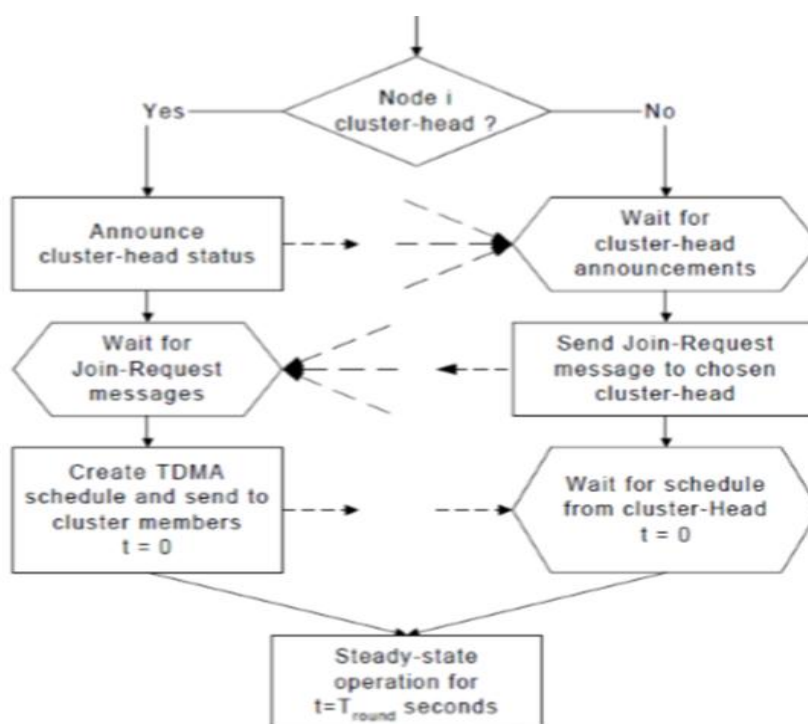


Fig.3: Flowchart of LEACH protocol in Steady phase [1]

To do this each cluster head node broadcasts an advertisement message ADV using a non persistent carrier sense multiple access CSMA. This message is a small message containing the nodes ID and a header that distinguishes this message as an announcement message. Each non cluster head node determines to which cluster it belongs by choosing

the cluster head, that requires the minimum communication energy based on the received signal strength of the advertisement from each cluster head.

3. PROPOSED WORK

It contains the algorithm for set up phase and steady phase. In the set up phase the CH send the advertisement packet to give a message to neighbors he become the CH. In the steady phase there are two processes done such as schedule creation and data transmission.

3.1. Algorithm

- Sn:Sensor node
- Sch:Cluster head
- C:Cluster formed

```
//Setup phase
1.for each Sn to n do
2.Ci={s1,s2,sn}
3.selectSch
//data transmission phase
//Send data to cluster head
4.Ci(s1,s2,sn)->Sch
//Send data to next cluster head or node
5.Sch->next Sch or Sn
   If(Energy(Sch<Threshold Energy))
       then select new Sch within C
```

3.2. Mathematical Module

We have used the graphical method and set theory for calculation.

Let S be the system where

$S = \{n, Si, P, Ad, CH, N\}$

n: Sensor Node

Si: Sink Node

Ad: admin

CH: Cluster Head

N: Network

$n = n1, n2, \dots, n$

Si = only one sink node

$P = P1, P2 \dots Pn$

Ad = only one Admin

CH = cluster head (depend on cluster formation)

N = Network

3.3. Activity

$f(Si)$	$\longrightarrow$	N	 Sink node is depends on Network
$f(CH)$	$\longrightarrow$	n	 Cluster head is depends on Node
$f(n)$	$\longrightarrow$	N	 Nodes are included in Network
$f(Si)$	$\longrightarrow$	Ad	 Sink Node site use by Admin

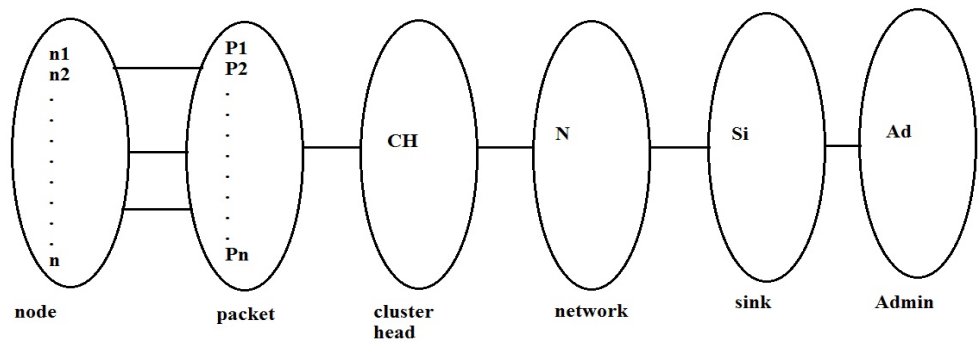


Fig.4: Dependency Graph of system

CH: CH cannot aggregate data without any packet received
N: Cannot send packet without any network

3.4. Observation

If packets received by CH then aggregate data and forward to next hope. If CH failed then perform election algorithm with parameter as distance.

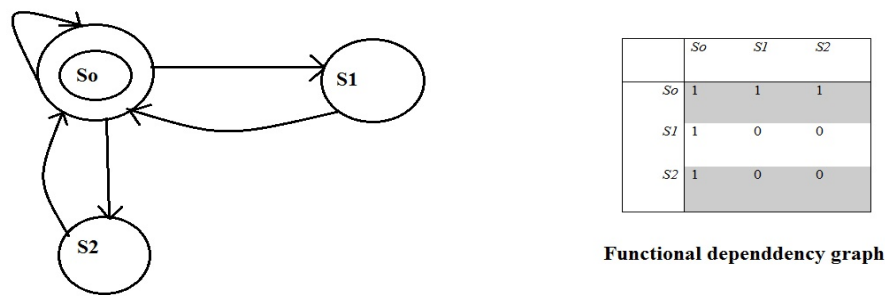


Fig.5: State diagram of Module and Functional dependency graph

So: Aggregate data and send packet.
S1: If CH failed perform CH election algorithm
S2: If intermediate node fails perform alternative path finding algorithm.

4. RESULT

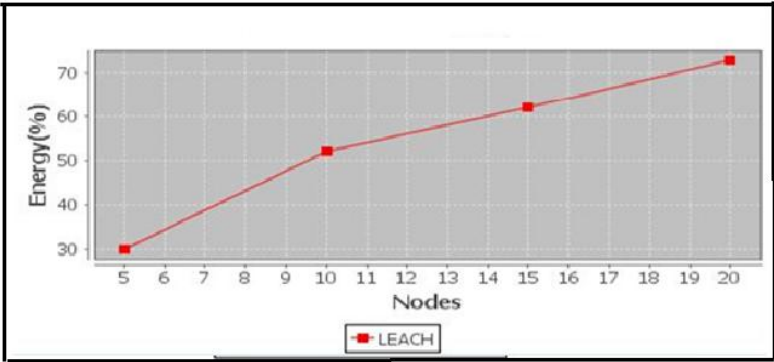


Fig.6: Energy of network

Graph 6 shows energy of network in LEACH, In LEAH when the number of nodes is 5 then energy of network is 30 percentages. When number of nodes are 20 then energy of network is 75 percentages which shows LEACH protocol is quite energy efficient

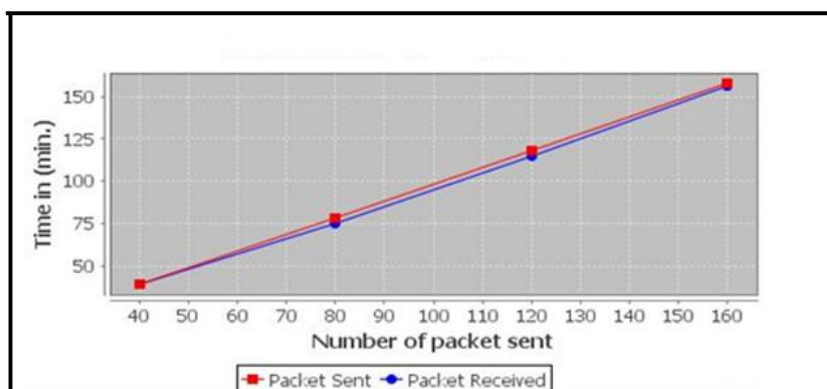


Fig.7: Packet delivery ratio.

As shown in graph 7 which shows packet delivery ratio in which number of packet send are nearly equal to number of packets received.

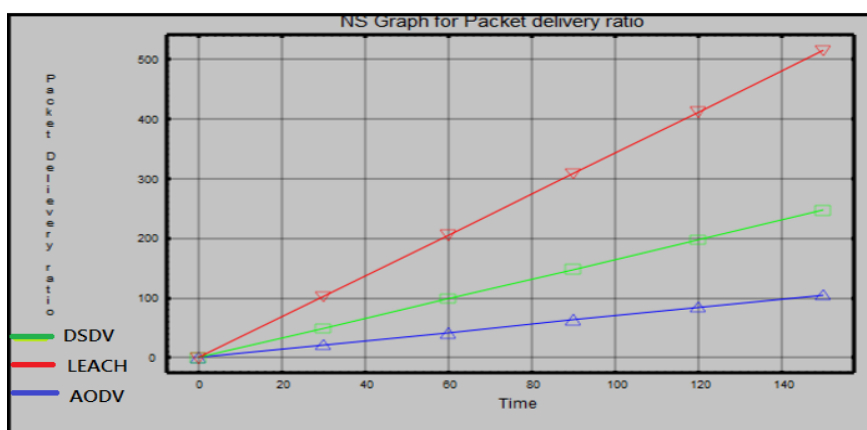


Fig.8: Packet delivery ratio

The above graph shows the result of Number of packet delivery ratio from node to node in given Time between 20 nodes with 5 Mbps speed.

5. CONCLUSION & FUTURE SCOPE

The main focus of proposed work is to analyze the energy efficiency by using clustering approach and data aggregation method. We have performed LEACH protocol using own set of parameters. We succeed to get the simulation result as mentioned in the result. This paper we covered performance of LEACH protocol only, we can also compare this protocol with other routing protocols.

ACKNOWLEDGEMENT

We would like to express our gratitude to all those who helped us to complete this work. We want to thank our guide Ms.M.V.Khadse for her continuous help and generous assistance.

She helped in a broad range of issues from giving us direction, helping to find the solutions, outlining the requirements and always having the time to see us.

REFERENCES

- [1]. Research On Energy Efficient Routing Protocol LEACH For Wireless Sensor Networks Kajal V. Shukla Smt. Chandaben Mohanbhai Patel Institute of Computer Applications CHARUSAT CHANGA I.S.Jacobs and C.P.Bean, "Fine particles, thin films and exchange anisotropy,"
- [2]. M. Bani Yassein, A. Al-zou'bi, Y. Khamayseh, W. Mardini. Application-Specific Protocol Architectures for Wireless Networks. International Journal of Digital Content Technology and its Applications, Volume 3, Number 2, June 2009. Nicole J. Name Stand. Abbrev., in press.
- [3]. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
- [4]. Name of Authors-Sudarchan Omprakash, Giridharan Nathagopal, "Title- A secured energy efficient clustering and data aggregation protocol for WSN" Name of Conference or Journals-AASCIT, Vol. No-1, Date-20/4/2014, Page-18-23
- [5]. "A secured energy efficient clustering and data aggregation protocol for WSN", Available-<http://www.aascit.org/journal/ajccc>
- [6]. Raghavendra, "Wireless Sensor Network", Edition-fourth, Publication-BSP, Year-2010.
- [7]. Chunyao FU, Zhifang JIANG, Wei "Title-A energy balanced algorithm of LEACH protocol in WSN" Name of Conference or Journals-IJCSI, Vol.No-10, Date 1/1/2010, Page:354-359