IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

An Adaptive Approach For Mobile Wireless Sensor Network With Dynamic Cluster Head Selection

Abhinav R.B[1], Mr.Prasad A.M[2]

M.Tech Student, Dayananda Sagar College of Engineering, Bengaluru, Karnataka [1]

Associate Professor, Dayananda Sagar College of Engineering, Bengaluru, Karnataka [2]

Abstract: Wireless Sensor Networks (WSN) is the key resource of perception and is widely used trends now a days. In wireless sensor network clustering, Efficient clustering and proper Cluster Head (CH) selection schemes are required, in order to improve energy saving of sensor nodes. In this paper, Dynamic CH Selection Method (DCHSM) is used where CHs are selected dynamically to solve the problem of the unreasonable cluster head selection that may lead to the overlapping coverage and unbalanced energy consumption in the cluster communication. By comparing it with the other existed algorithms, Here the network lifetime is increased by 50%, higher than that of Low Energy Adaptive Clustering Hierarchy (LEACH), and increased by 30%, higher than that of Distribute Energy -Efficient Clustering Algorithm (DEEC). The survival time of the network is longer than that of energy-balanced deterministic clustering algorithm and adaptive energy optimized clustering algorithm. The effectiveness of the network energy consumption, and it has the longest network lifetime which can be achieved.

KEYWORDS: WSN, CH, DCHSM, DEEC, LEACH, AODV, TDMA.

I. INTRODUCTION

Wireless sensor network (WSN) has some great advantages such as flexible communication and arrangement, low power consumption and low cost. As the world is moving towards digitalization technology, The wireless mode of communication makes the network so updated with the current expectations. This wireless modes comes with ad hoc nature, ensures the communication while the objects are making movement. WSN is generally composed of hundreds and thousands of distributed mobile sensor nodes, these sensor nodes organize themselves into a network. The nodes which are in network should be handled properly to get good performance of the network. This could be achieved with the help of the clustering mechanism on nodes which are belonging to ad hoc network. Although sensor nodes are designed with low energy consumption in mind, they can survive for only a very limited lifetime energy consumption of the network can be effectively reduced while the sensor nodes are organized in the form of clusters. A network of wireless sensor consists a number of tiny detection devices, that are deployed in a region where it is needed. Each device contains the ease of processing and wireless communication that allows each device to gather information from the environment to generate and deliver report messages to the remote base station or to the user who tracks the information remotely. The architecture of WSN is shown in fig 1.

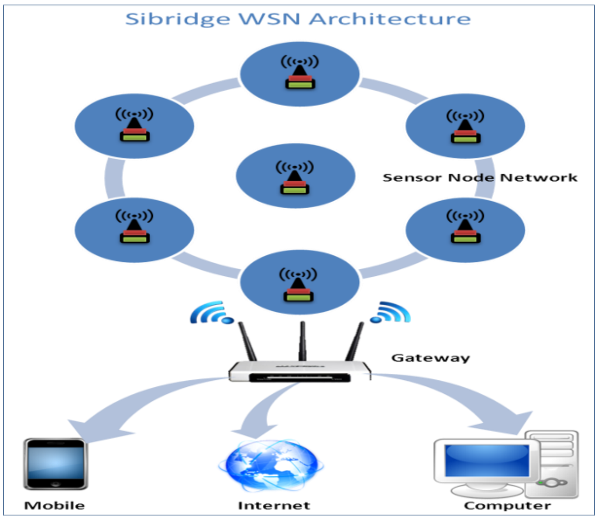

Figure 1 : Basic wireless sensor network

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

The paper is organized as follows: Section I has Introduction, Section II Methodology, In Section III Design and implementation, Section IV Results and discussion and Section V Conclusion and future work.

II. METHODOLOGY

The NS-3 Simulator is a discrete event network simulator primarily for research and education. The ns3 is an open-source project development tool. The purpose of this tutorial is to introduce new users ns-3 to the system in a structured way. It is sometimes difficult for new users to glean essential information from detailed manuals and convert that information into work simulations. NS-3 is not a backward compatible extension of ns-2; it's a new simulator. Both simulators are written in C ++ but ns-3 is a new simulator that does not support ns-2 APIs. Some ns-2 models have already been upgraded from ns-2 to ns-3. The basic architecture of NS-3 is shown in the below figure 2. NS-3 provides users with executable command ns which take on input argument, the name of a c++ simulation file. Users are feeding the name of a c++ simulation file (which sets up a simulation) as an input argument of an NS-3 executable command ns.

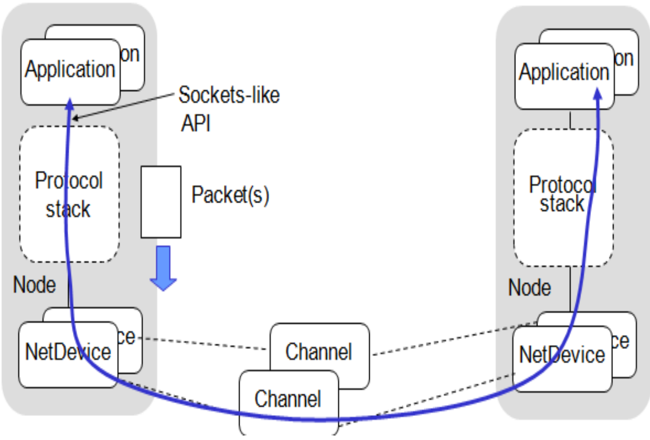

Figure 2 : Basic architecture of NS-3

A. NS-3 Simulation workflow

The general process of creating a simulation can be divided into several stages:
1. Definition of the topology: To facilitate the creation of basic equipment and to define their interrelations, ns-3 has a system of containers and aids that facilitates this process.
2. **Model development:** models are added to the simulation (eg UDP, IPv4, devices and point-to-point links, applications); most of the time, this is done using aids.
3. Node and link configuration: Models define their default values (for example, the size of packets sent by an application or MTU from a point-to-point link); most of the time, this is done using the attribute system.
4. Execution: Simulation facilities generate events, the data requested by the user is logged.
5. Performance analysis: Once the simulation is complete and the data available as a time stamped event trace. These data can then be analyzed statistically with tools like R to draw conclusions.
6. Graphical visualization: The raw or processed data collected in a simulation can be represented graphically using tools such as Gnuplot, matplotlib or XGRAPH.

III. DESIGN AND IMPLEMENTATION

Cluster head selection strategies in most existing systems lacked an adaptive and dynamic approach. The main objective of the project is to create a dynamic cluster head selection to improve the efficiency of the sensor network. The calculation of perceptual probability [P(si,m)], node public perception [NPP(m)] and Network perception contribution [NPC(si,m)] is done. The values of NPC(si,m) of each redundant nodes are compared, and the redundant node with minimum value is selected as the first level CH node. If the first level cluster head nodes die, The new class of cluster heads are selected based on the ratio of their energy and the average residual energy of the network. The node with higher residual energy becomes the new second level cluster head node.

A. Approach

NS-3 is open source network simulation application.NS-3 currently supports AODV protocol and various standard routing protocols for wire and wireless network. Our approach is to propose an adaptive two level selection of dynamic cluster head based on the distance and the residual energy respectively. The programming language is C++. C++ has also been found useful in many other contexts, with major assets such as software infrastructure and limited-resource

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

applications including desktop applications and critical applications. Animators are the most important tool in network simulation. The Network Simulator 2 version has many animation tools as the default NAM. But in the case of NS-3, it does not have a default animation tool. So we have to use some methods to animate a network. And for that, we currently use two methods :

1. PyViz Method
2. NetAnim Method

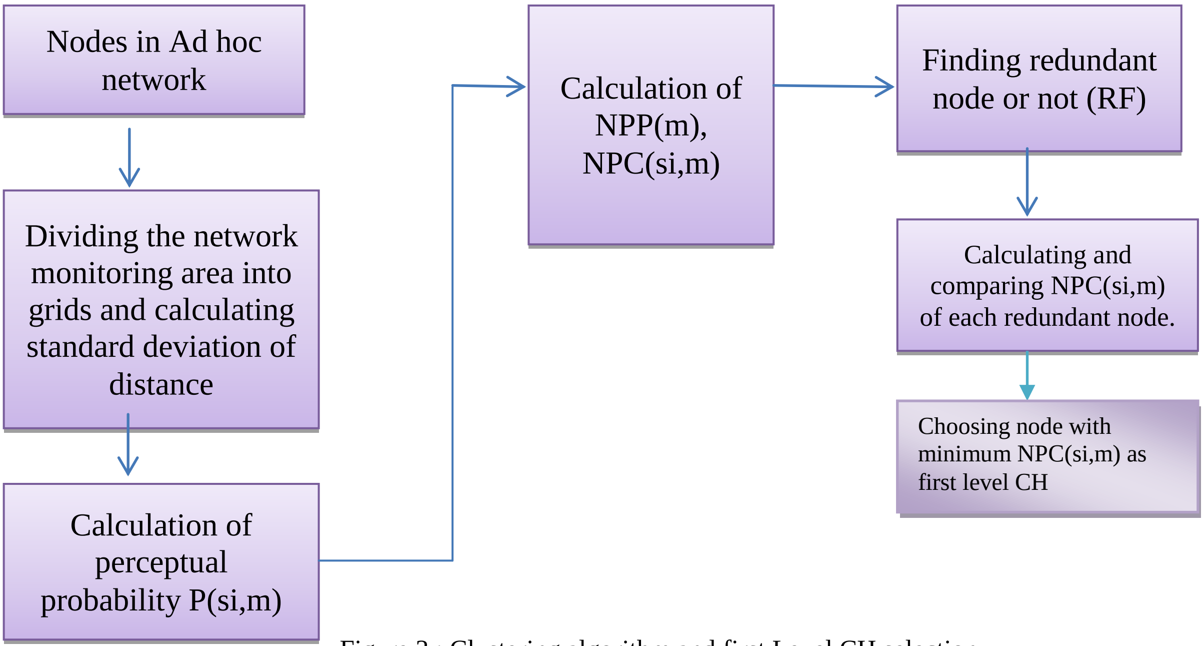

Figure 3 : Clustering algorithm and first Level CH selection

Figure 3 depicts the process in the formation of the cluster and first level CH selection. Based on the routing information finding nodes which can be treated as the cluster. The total area is divided into grids. Active nodes coming in one grid can form a cluster and standard deviation of distance is calculated. Sensing radius of nodes (Rs) are noted and The communication radius(Rk) is calculated based on the routing information from the broadcast communication. The calculation of perceptual probability [P(si,m)], node public perception [NPP(m)] and Network perception contribution [NPC(si,m)] is done. The number of redundant nodes are selected based on the size of NPP(m). If Redundant flag (RF) is greater than 0, the NPC(si,m) of each redundant node is calculated. The values of NPC(si,m) of each redundant nodes are compared, and the redundant node with minimum value of NPC(si,m) is selected as the first level CH node.

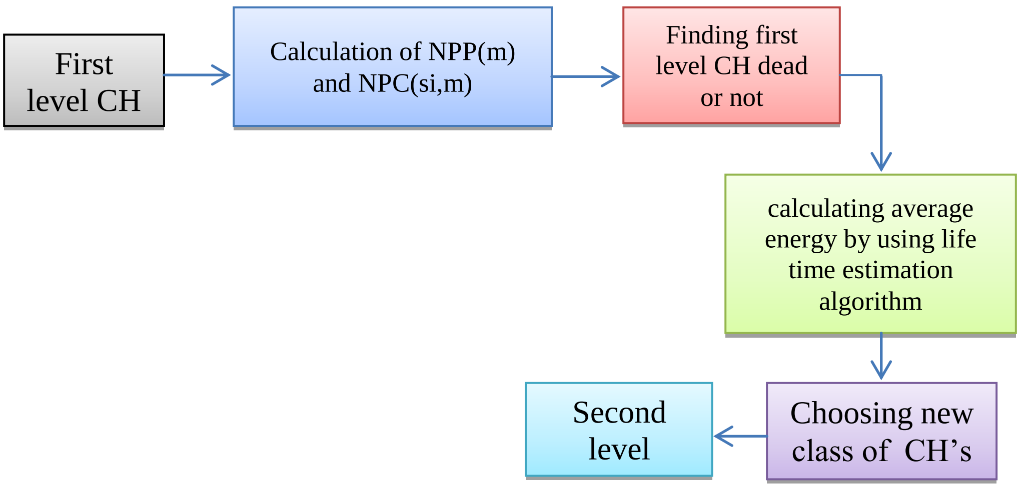

Figure 4 : Dynamic Cluster Head Selection with survival time estimation

Figure 4 depicts the process of Dynamic cluster head selection with survival time estimation algorithm.The calculation of perceptual probability [P(si,m)], node public perception [NPP(m)] and Network perception contribution [NPC(si,m)] is done. The number of redundant nodes are selected based on the size of NPP(m). If Redundant flag (RF) is greater

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

than 0, the NPC(si,m) of each redundant node is calculated. The values of NPC(si,m) of each redundant nodes are compared, and the redundant node with minimum value of NPC(si,m) is selected as the first stage CH node. If the first level cluster head nodes dies, The new class of cluster heads are selected based on the ratio of their energy and the average residual energy of the network. The node with higher residual energy becomes the new cluster head node. The average residual energy is estimated by the survival time estimation algorithm by choosing a new class of cluster heads.

A. Simulation Parameters

Sl.no	Parameters	Values
1	Number of nodes	50
2	Simulation Area	100*100m^2
3	Initial Energy	0.7 J
4	Sensing Range	50m
5	Energy Threshold	10
6	Packet size	200 bytes
7	Mobility	RandomWalk2dMobilityModel
8	Data rate	500Kb/s
9	Initial number of cluster	5
10	Data Payload	1024

Table 1 summarizes the simulation parameters required to evaluate the performance of the proposed system.

IV. RESULT AND ANALYSIS

In the project result and analysis section, system performance is estimated using a variety of factors to verify whether the predefined intensions are satisfied or not. This section includes the details of the project results, providing a description of the project's performance and explaining it using a graph. The below figure 5 shows the python visualizer execution window.

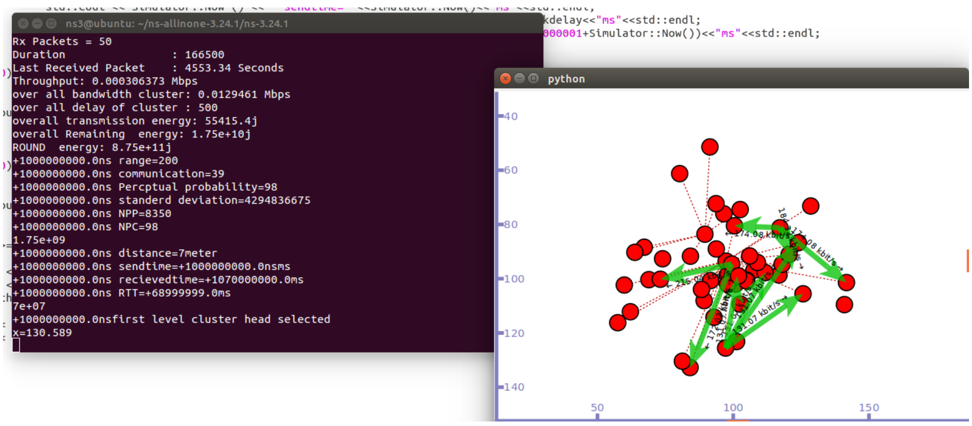

Figure 5 : First level cluster head selected.

Figure 5 shows that, based on the least NPC value of the redundant node the first level cluster head is selected. First level cluster head will be having higher probability of communication which can be calculated by NPP and NPC.

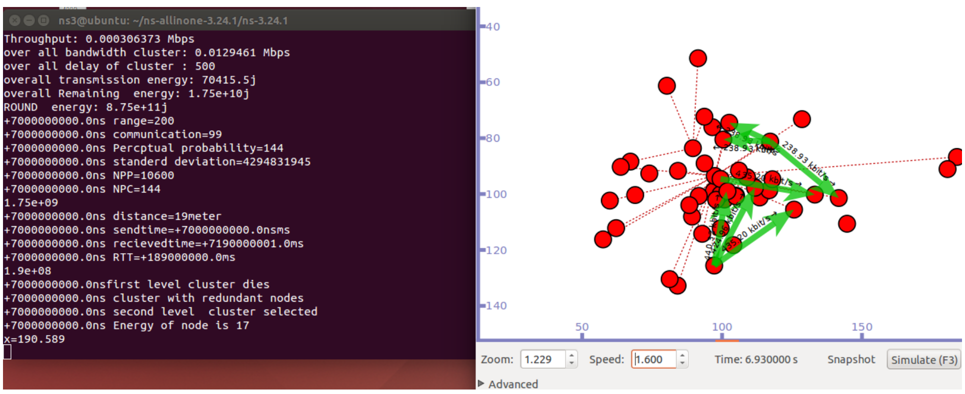

Figure 6 : selecting second level cluster head

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

Figure 6 depicts that when first level cluster head dies, second level cluster head is selected and node having highest residual energy is selected for secondary level cluster. When all first level cluster head dies new level of cluster heads will be selected.

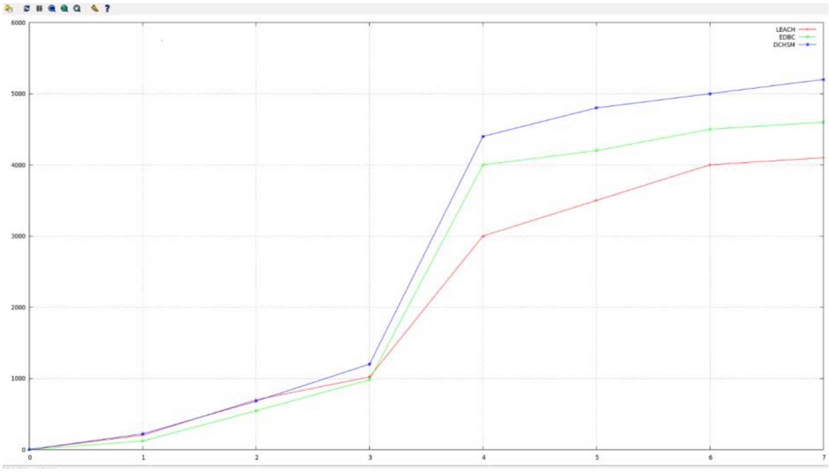

Figure 7 : Graph depicting the life time of nodes

The graph in figure 7 depicts the life time of nodes in various scenarios, the life time is noted based on how many rounds each algorithm has run, Algorithm DCHSM outperforms other two algorithm by running 5000 and above rounds. So it is best suitable for longer duration sensor networks.

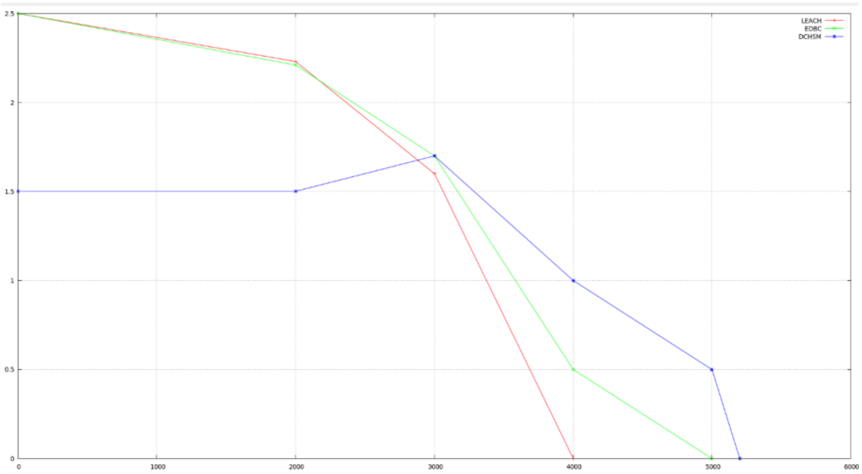

Figure 8 : graph depicting the residual energy in various round

The residual energy of the WSN nodes as well as cluster reduces as each round of transmission happens. The figure 8 depicts the graph that residual energy is longer for DCHSM compared to other two algorithm , nodes die of residual energy decrease only in the 5000 or above round, so it is an energy efficient approach compared to LEACH and EDBC.

V. CONCLUSION AND FUTUREWORK

A dynamic cluster head selection method for wireless sensor networks (DCHSM) is proposed in this project by analyzing the energy consumption of the sensor network based on redundant nodes and energy heterogeneity. The analysis of the experiment is done from four aspects, including coverage, life cycle, active nodes and average residual energy. It starts by calculating the standard deviation for the distance, then calculates the probability of perception for clustering, then calculates the public perception of the node of m and the network contribution (si, m) is computed and the redundant nodes are noted by the size of NPP (m). The network perception contribution of each redundant node is computed and the redundant node with minimal network perception contribution is selected as the top-level cluster head node. Once the first stage group head is dead, the second stage group head is selected based on the average residual energy of the network nodes. The method proposed in this project overcomes the disproportion of energy consumption and reduces the energy consumed by network nodes. It improves the redundancy of information in the transmission process, reduces power consumption and extends network life. The extension of this work would be a further discussion of the Cluster Reformation in the monitoring area only after the death of all the redundant nodes that

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, May 2018

will be elected as first level CH's and second level CH's in the same coverage area, we should also do more work to extend the time of the first period and to extend the life of mobile node networks.

REFERENCES

[1] V. Mhatre and C. Rosenberg, "*Design guidelines for wireless sensor networks: Communication, clustering and aggregation*" *Ad Hoc Netw.*, vol. 2, no. 1, pp. 45–63, Jan. 2004.

[2] L. M. Sun *et al.*," *Wireless Sensor Network. Beijing "*, China: Tsinghua Univ. Press, 2005.

[3] T. H. Arampatzis, J. Lygeros, and S. Manesis, "*A survey of applications of wireless sensors and wireless sensor networks*" in *Proc. 13th Medit. Conf. Control Autom.*, Limassol, Cyprus, Jun. 2005, pp. 719–724.

[4] N. Javaid, M. Waseem, Z. A. Khan, U. Qasim, K. Latif, and A. Javaid, "*ACH: Away cluster heads scheme for energy efficient clustering protocols in WSNs* " in *Proc. Saudi Int. Electron., Commun. Photon. Conf.*, Piscataway, NJ, USA, 2013, pp. 1–4.

[5] S. Tyagi and N. Kumar, "*A systematic review on clustering and routing techniques based upon LEACH protocol for wireless sensor networks*," *J. Netw. Comput. Appl.*, vol. 36, no. 2, pp. 623–645, Mar. 2013.

[6] S. Tyagi and N. Kumar, "*A systematic review on clustering and routing techniques based upon LEACH protocol for wireless sensor networks*," *J. Netw. Comput. Appl.*, vol. 36, no. 2, pp. 623–645, Mar. 2013.

[7] H. Bin and C. Wen, "*Analysis of wisdom agricultural systems based on wireless sensor network*," *Sens. Actuators B, Chem.*, vol. 8, p. 57, Feb. 2013.

[8] C. Alippi, G. Boracchi, R. Camplani, and M. Roveri, "*Wireless sensor networks for monitoring Vineyards*," in *Methodologies and Technologies for Networked Enterprises* (Lecture Notes in Computer Science), vol. 7200. Berlin, Germany: Springer, 2012, pp. 295–310.

[9] R. C. Shah and J. M. Rabaey, "*Energy aware routing for low energy ad hoc sensor networks*," in *Proc. IEEE Wireless Commun. Netw. Conf. (WCNC)*, Orlando, FL, USA, Mar. 2002, pp. 350–355.

[10] A. Lindgren, A. Doria, and O. Schelén, "*Probabilistic routing in intermittently connected networks*," *Mobile Comput. Commun. Rev.*, vol. 7, no. 3, pp. 19–20, Jul. 2012.

[11] Dongyao Jia, Huaihua Zhu, Shengxiong Zou, and Po Hu, "*Dynamic Cluster Head Selection Method for Wireless Sensor Network*" ieee sensors journal, vol. 16, no. 8, april 15, 2016.

[12] Aniji John and K. Vinoth Babu "Two *Phase Dynamic Method for Cluster Head Selection in Wireless Sensor Network for Internet of Things Applications*" IEEE WiSPNET 2017 conference.