Energy Harvesting using LEACH and SEP Protocols in Heterogeneous Wireless Sensor Networks

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Abstract- Wireless sensor networks are progressively arranged to contrast with complicated functions in networking process may desire the battery capacity of sensors to increase the efficient network lifetime especially in heterogeneous settings. Clustered techniques have been engaged to raise the energy efficiency in this energy constrained of wireless sensor networks. There are many issues that associated to WSNs. These problems related to energy efficiency performance, reliability, installation, cost and also on hardware cost. In this paper we use LEACH and SEP protocols for energy conservation and figure out all the problems occur in LEACH and SEP. We designed a LEACH SEP HETEROGENEITY MODEL for energy conservation.

Index Terms- LEACH, SEP, HWSNs, Cluster based routing, CH, BS.

I. INTRODUCTION

In Wireless sensor networks the energy performance is an important research topic. Improvements in wireless communication have made it more beneficial to construct wireless sensor networks (WSNs). It involves in tens or thousands of small nodes which can be used an energetic tool for gathering data in distinct outlook. A remote sensor arrange (WSNs) comprises of hundreds or thousands of sensor hubs outfitted with detecting, registering and correspondence flexibility. Each hub has quality to detect the earth for a guidance or property and can likewise lead straightforward calculations. A sensor hub sends its friends in the wake of gathering the detected information or sends (gets) the information to a base station. A base station interfaces one sensor Networks to another sensor organize. WSN uses their system vitality in a successful way, so they can distinguish the earth for an extensive stretch of time. A sensor node comprises of four components specifically: detecting unit, handling unit, handset unit, and power unit. It might likewise have an extra application subordinate component, for example, an area discovering framework, control generator, and mobilizer. Detecting units are comprised of two sub-units as sensors and simple to-computerized converters (ADCs). One of the principle activities in WSNs is to manufacture a vitality powerful convention, which can have a noteworthy contact on system lifetime and perpetual quality. More interesting, the deficiency in energy results an incomplete flexibility and incomplete network lifetime. We can use different protocols and algorithms to improve the energy efficiency in most effective manner. Different Authors presents their solutions to solve this problem and found many ways to improve the network lifetime. The main drawback in memory dislocates more pressure on communication media and ensures the delivery of data. Economic achievability is a primary effect to take in huge number of nodes in the networks. The WSNs nodes are physically in a very small size. The emergent cost of hardware and software is to be advised before positioning these nodes. Formerly the functional environment is well understood, because it delivers a model rear which status and conditions the WSNs are expected to work. The preeminent category of routing data in WSNs is the hierarchical routing protocols according to various researchers. In clustering-based WSNs, the network splits into two layers, and the nodes in the same layer have the same attribute. This difficulty can resolve by different methods because many authors are trying to increase the energy efficiency using algorithms and protocols. A LEACH stands for Low-Energy Adaptive Clustering Hierarchy is used for energy conservation. This WSN is devised to be a dynamic clustering technique. It consists of two phases. SEP is carry beside subjective election probability of every node rotate into a cluster head reporting to the unexpended energy in every node. Both these protocols play an important role to improve the energy consumption and different solutions.

II. LITERATURE RIVIEW

In the past, different protocols have been addressed that primarily immerse on energy development to increase the network lifetime. LEACH protocol supported on clustering technique and it decreases the energy utilization. The network lifetime increases robotically using this protocol. It determines a small number of nodes as the cluster head energizing and recognized their residual energy in round robin manner in a network. The cluster heads collect the information from the sensor odes having a place with their very own groups, total it and after that send this accumulated information to base station. The steady race convention (SEP), is an augmentation of LEACH convention. It accepts the heterogeneous WSN with two-dimension of heterogeneity. It gives somebody invariance air because of extra vitality taking by means of increasingly compelling sensor hubs. The

heterogeneity can't be delayed for staggered heterogeneous WSNs. The introduced work is approximately on the way to exploit some security methods in LEACH protocol to supply a full proof security by utilizing additional rounds of transmitting to BS and small energy. For this principle, unusual assessment making are introduce to enhance the total security scenario and ingest less energy. At the last, introduced method is specified and then compared for energy utilization. The energy supply to nodes in a WSN is generally controlled by battery, which isn't battery-powered or replaceable. The real test in WSNs is to enhance the energy effectiveness and it is useful to expanding the lifetime of system.

(i)   TL-LEACH PROTOCOL

        In LEACH protocol, CH takes and unite the data from sensors in its own cluster and directly onwards the information to the BS. CH might be sited farther from BS, so it exploits most of its energy for forwarding. So CH will always die faster as compared to other nodes on each level.
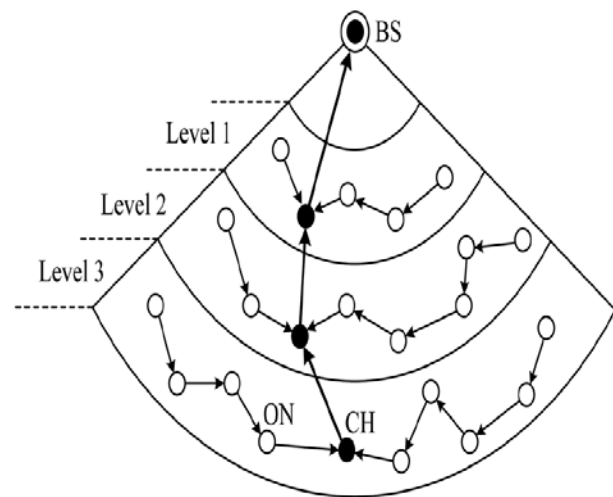

Figure 1 show different levels of cluster heads.

A novel version of LEACH identified as Two-level Leach was suggested. In TL LEACH protocol; CH collects data from other cluster fellows as solid LEACH. But on the other hand it delivers the data to the BS straightforwardly. It shares one of the CHs that settle between CH and the BS as a bypass station.

(ii)   E-LEACH PROTOCOL

        The CH selection route increases through Energy-LEACH protocol. It creates remaining energy of nodes as an important metric. Then it determines whether the nodes bend into CH or not after the first round. Corresponding to LEACH protocol, E-LEACH is categorized into pear-shaped.

        In the first round, every node has a similar plausibility to twist into CH, that mean nodes are picked as CHs in a characterized stochastic manner, in the following rounds, the remaining energy of every node is unmistakable after one round correspondence and taken into investigation for deciding the CHs. That mean nodes having more energy will turn into a CHs rather than nodes with less energy.

(iii)   LEACH-C PROTOCOL

  Flow supplies no fearlessness about the position or potentially number of cluster heads. Progress over the LEACH convention was introduced. The convention, recognized as LEACH-C, treated a concentrated grouping calculation and a similar relentless state stage as LEACH. At the season of set-up period of LEACH-C, every node advances the data about its genuine position (perhaps decided using GPS) and lingering energy level to the sink.
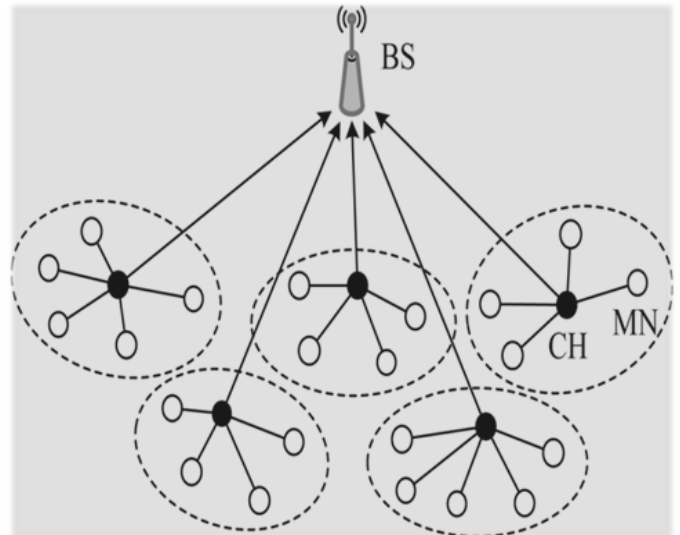

Figure 2 shows that how every node forward data to the BS.

III.   PROBLEM STATEMENT

  It is an alarming situation that energy is consuming day by day. In trying to solve the energy problems in WSNs, a limited resource of energy is used. Furthermore, the WSNs is designed in order to be able to supply such kind of resources. Energy can be conserved through different protocols and algorithms. In this paper we improve the problems that occur in LEACH and SEP protocols. Also identify that from both these which protocol is best.

IV.   PROPOSED SOLUTION

        Many authors present solution to improve the energy efficiency using different scientific methods, protocols and algorithms. Here we discuss some proposed solution for LEACH and SEP, highlight their problems and explain through planned model.
                We   proposed   a   LEACH   SEP Heterogeneity Model. Algorithm was tested by considering single jump correspondence between the CHs and the sink like LEACH.

(i)   PROBLEMS in LEACH
The reason we require organize convention, for example, LEACH is because of the way that a node in the system is never again valuable when its battery passes on.
                This convention grants us to space out the lifetime of the node, enabling it to do just the base

work it unavoidably to exchange the information. It lies in sensor nodes, which are called Cluster Heads.

(ii)   WEAKNESS in LEACH
LEACH suppose that
i)-It is only suited for little size network.
ii)-All nodes have data to send and so appropriate time slot for a node even some nodes might not have data to transfer.
iii)-Operating cost of clustering completed after a certain period of time.
iv)-System stop inclusion at the time of cluster head failure.
v)-LEACH needs CHs to deliver their collective data to the sink node over a single-hop link.

(iii)   CLUSTERING BASE ROUTING IN WSNs

Figure 3 shows cluster base routing in WSN.

The essential objective on any directing convention is to make the system progressively compelling and helpful. A bunch based steering convention arranged the sensor nodes where each gathering of nodes has a passage or CH.
Detected information is sending to the CH on the other hand and afterward to the BS. It likewise drives some fortune movement on information and acquires then advances it to the BS where this information is required.
(Time division different access) plan and forward exacerbated information from nodes to the BS where these information requirements to take CDMA (Code division different access). Left nodes are bunch individuals/accomplices.

(iv)   ENERGY EFFICIENT ALGORITHM
An energy competent algorithm is presented for P-LEACH protocol. It has the following steps.

Algorithm 1:

Energy Efficient Algorithm
Step1: Initializing the Network (Nodes (N), Base Station (BS), Location L (x,y), Energy(E))
    Ni = 1 to 16
    Ei = E1 to E16
    Ni – sends Ei info to BS
    Ni -- sends L(x,y) to BS
Step 2: Cluster Head Selection
For (i=0; i<=16; i++)
{

  If
     Ei = Emax
  Then
     Ni = Chi
}

  End if
    End for
  Step 3: Giving and receiving messages internally
     BS →CH(M) to Ni
     Ni→ack to BS
  Step 4: Chain Formation and selecting a leader

     Leader -- Chi (min L(x,y) & Emax)
     Path -- CH1 – CH2 – CH3- CH4- BS

  Step 5: Transferring the Data
    Ni of respective CHi→ D(Ni) to CHi
     CHi← D(Ni)
     CH1→CH2→CH3→CH4(L)→BS

  Step 6: Change of Cluster Head
    For (i=0; i<=16; i++)
  {

  If
    Emax(CHi) <= Eeff
  Then

    Ni(Emax2) = CHi
  }
  End if

(v)   CLUSTERING HIERARCHY
In LEACH, the groups are restored at each round.
i)-New bunch heads are chosen at each round, so the weight is very much partitioned and stable on the hubs of the system.
ii)-Furthermore every hub goes to the nearest group head to part the channel cost to the sink (which is multiple

times more prominent than the preparing and activity cost).

iii)-Only the bunch head can educate the sink and may expend a more noteworthy measure of energy, however it grows occasionally for each hub.
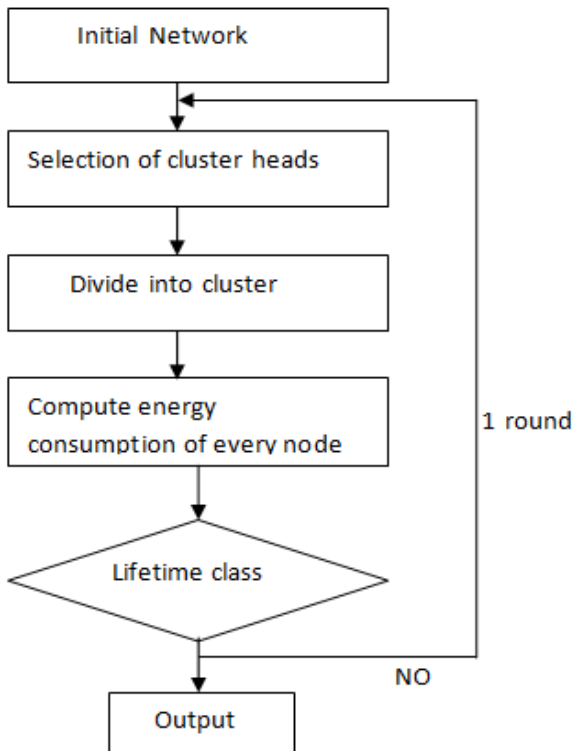

Figure 4: Flowchart for Cluster Heads

iv)-LEACH Protocol comprises of ideal level of nodes that needs to wind up group heads at each round and advances uniform game plan of nodes.

v)-If the nodes are homogeneous, LEACH guarantees that each node will turn into a bunch head definitely once at each round.

(vi) SEP PROTOCOL

In SEP, a portion of the higher energy nodes are summoned as cutting edge nodes and odds of cutting edge nodes to end up CHs is more as solicit to that of non-propelled nodes.
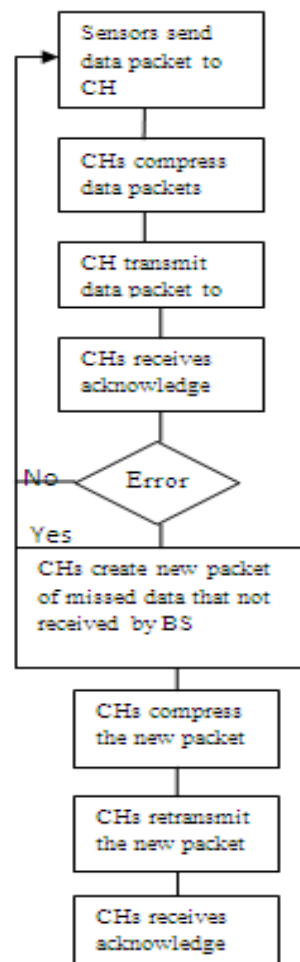

Figure 5: SEP

a. ADVANTAGES:

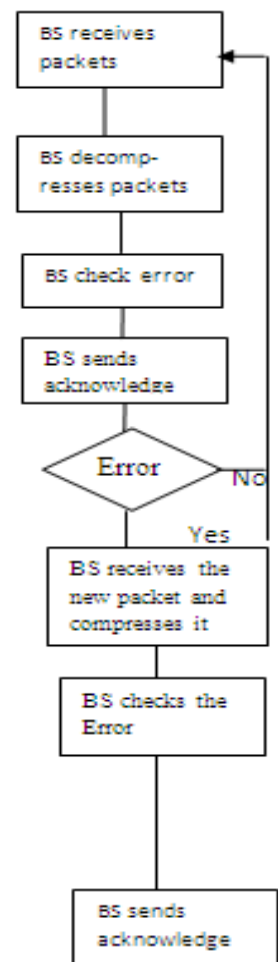SEP does not contain the worldwide learning of energy at each decision round.

b. LIMITATIONS

The disservice of SEP technique is that the decision of

the group heads between these two sorts of nodes isn't dynamic, which results that the nodes that are at a separation far from the ground-breaking nodes will bite the dust first.

c.   PROBLEMS IN SEP

Sensors are expensive, so it will be precious to analyze whether the lifespan of a network could be increased by simply assigning spare energy to some active nodes without informing new nodes. We have required to figure out this problem and maximize the lifetime of energy in WSNs using a LEACH SEP Heterogeneity model.

VI: LEACH-SEP HETEROGENEITY MODEL

We proposed a model which is called LEACH-SEP Heterogeneity Model. It analyzes both LEACH and SEP; also identify the solution of those problems which occurs in both. We have proposed a heterogeneous energy efficient model after merging the LEACH and SEP protocols to save the energy which is consuming day by day. This model helps us to save energy and increase its lifetime. It consists of two operations, one is transmission operation and other is receiving operation as shown in fig VI.

a- In transmission operation sensor nodes send data to CHs, it squeezes and transfers the data, and received the acknowledgment.
b- In the receiving operation BS receives and dissociates the packets. After checking the error BS sends data from BS to the destination station.
c- So we have to increase energy efficiency and level of heterogeneity, then nodes sends acknowledgment. This process is repeated for all CHs that are forwards to the base station.
d- Remembers that if error creates during both operations then process is repeated again till the start to that point and continues even when the error removes.
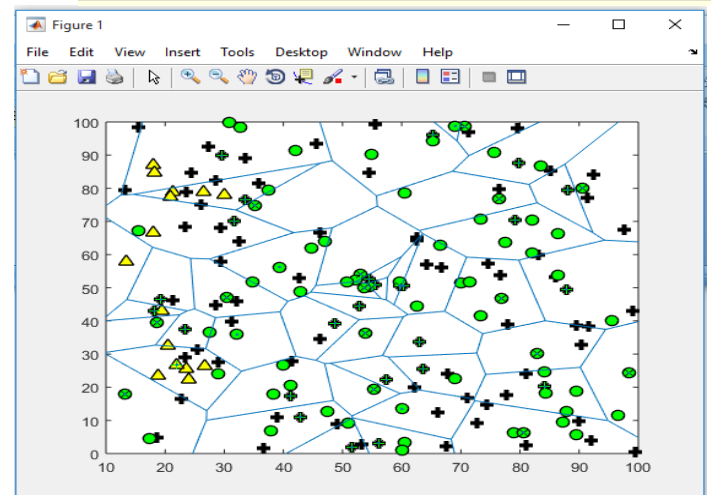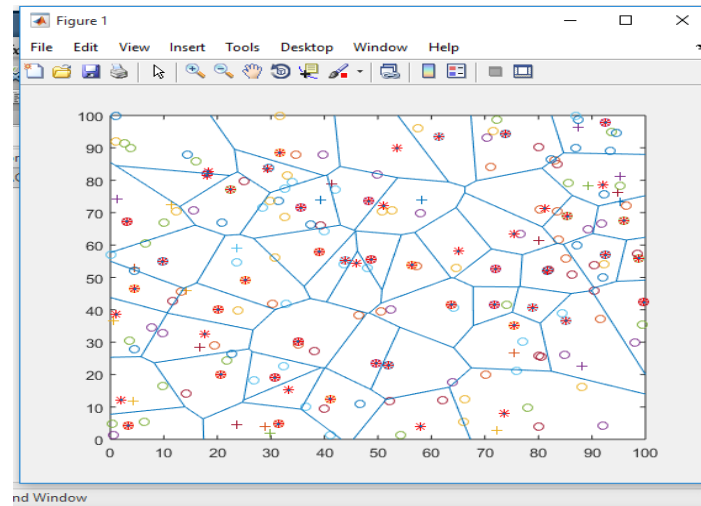
VII. SIMULATIONS AND RESULT

We have done simulation using MATLAB by running the code of LEACH and SEP protocols. We compare the LEACH and SEP protocols in this paper and also the weakness in LEACH and SEP protocols since of dynamic clustering. In SEP protocol, delay has lower as compared to LEACH protocol. The numbers of packets are not arrived the base station at the time forwarding is called as a packet loss. The output showing in MATLAB is following.

a).LEACH protocol results are following

These are some screenshots of cluster head pattern in LEACH protocol, total number of rounds, average residual energy, total energy, number of active nodes and dead nodes.
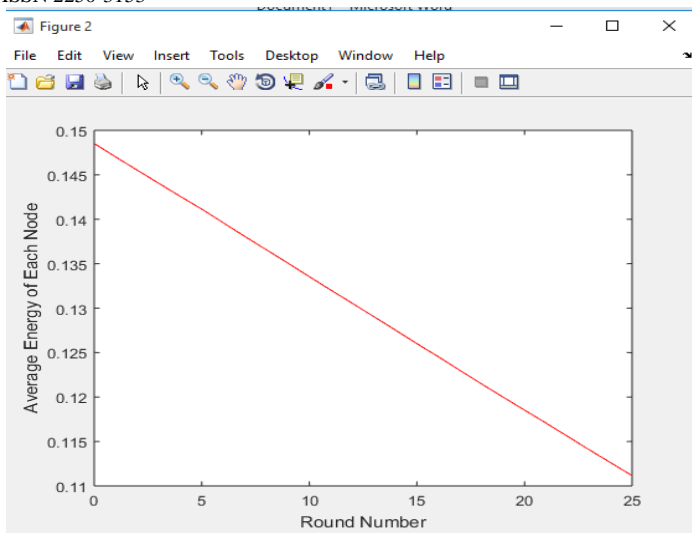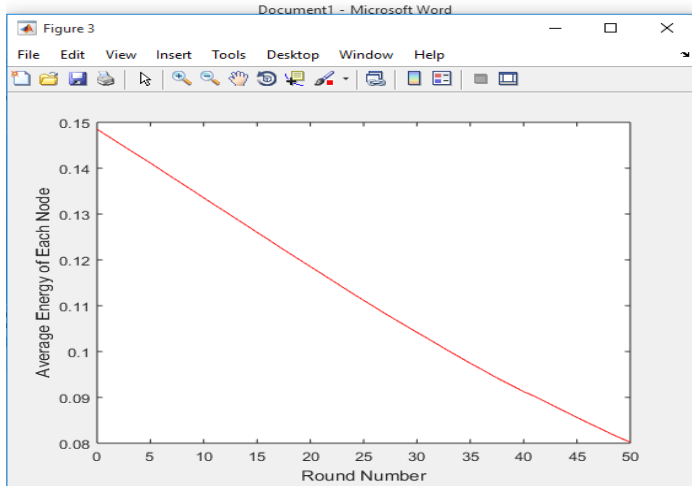

Figure 7:

Figure: 8

Figure: 9

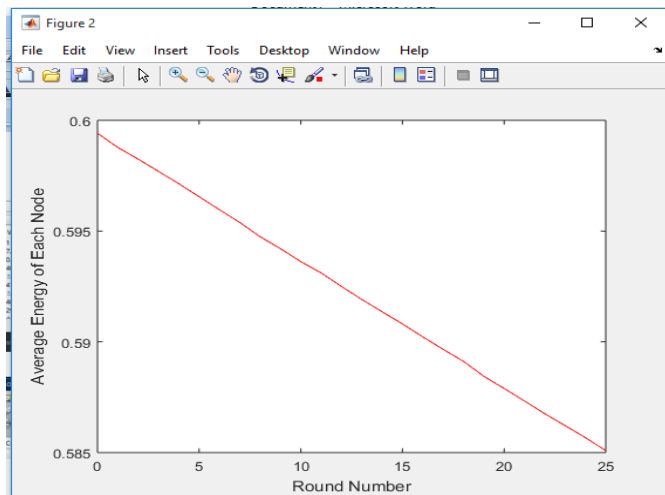**b). SEP protocol Results are following**
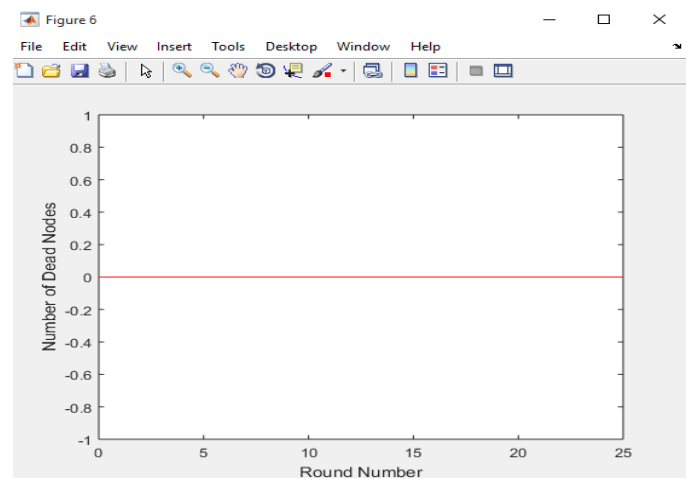**Figure: 10**

Figure: 11

Figure 12:

VIII. PERFORMANCE ANALYSIS

So we can conclude that SEP protocol is more stable than LEACH protocol.

SEP is more stable than LEACH due to its heterogeneity level in its structure. Table 1 presents the performance criteria of LEACH and SEP. This performance analysis shows that SEP is more stable than LEACH. Table: 1 shows the comparison and their performance Metris.

Table:1

Performance Analysis	LEACH	SEP
i-Heterogeneity Level	Not Present	Two
ii-Cluster Stability	Lower than SEP	Moderate
iii-Energy Efficiency	Low as compare to Sep	Moderate
iv-CH Selection	Based on Initial and residual Energy	Based on Initial and residual Energy
v-Network Lifetime	Lower than SEP	Moderate

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