International Journal of New Technology and Research (IJNTR)
ISSN:2454-4116, Volume-2, Issue-11, November 2016 Pages 76-82

Network Lifespan Growth by EASR Technique in Wireless Sensor Networks

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Abstract— **In the recent technologies, Wireless Sensor Network (WSN) becomes more emerging as well as grown enormously and becomes an important tier in IT technologies as well as generally used in many various fields of application because of their scalability, lower cost, self-organizing behavior of each sensor node, low power, distributed algorithms, data management and social and security factors. Basically, a sensor node has a capable of sensing changes in parameters in the WSNs and communicating with other devices. The sensor nodes are designed considering very limited resources such as battery power capacity, processing speed, etc. Therefore, it leads to an uncertain situation associated with the sensor network durability or a lifetime. As the senor nodes are battery driven devices, and it only can supply a limited amount power to its respective internal components thus, it leads towards a very limited number of network lifetime (nodes will exhaust soon due to coverage and connectivity issues). Usually, in the conventional sensor networking systems, sensor nodes gather its respective sensed data and transmit it to the sink node for further processing where so much power can be consumed due to the lack of proper interoperability issues. To mitigate the above-stated problems and to extend the network lifetime energy conservation should be considered. This proposed system implements the EASR method to improve the network lifetime as well as improve the efficiency of the throughput of the entire system. This method uses both energy aware transmission range adjustment and sink relocation mechanism scheme using MCP routing protocol.**

Index Terms —**EASR, lifetime, MCP routing protocol, sensor node, sink relocation, wireless sensor node.**

I. INTRODUCTION

Wireless Sensor Network it is a geographically, randomly distributed network of sensor nodes connected using adhoc technology. Where the data measured at each node is assumed to be delivered at a common collected node called a Sink Node, from where through a gateway the aggregated data could reach to the monitoring stations for a specific application. Sensor is an electronic device. Which is used for measuring the changes into environ. It is available in lower cost and enough research has been conducted to minimize the size of it, so today we have very cheaper and smaller sensor available, even on dust size. Sensor node is a computing device, which takes environ change as an input by its subunit called sensory unit (where the measured data is converted into electrical signal), this signal is further processed by its micro-controller unit (which will have typically, real-time operating system (RTOS), buffer and storage memory and processing unit), then the processed signal is further communicated to another such node in vicinity through a subunit called communication unit wirelessly.

In the recent technologies wireless sensor networks grown fastly and it becomes an attractive field in many different applications because of its low cost, less power, smaller in size, self-creating environment. It contains hardware and system software design, networking, programming model, distributed algorithms, data management, and network and security factors. The elementary idea of wireless sensor network it to scatter tiny detecting devices, they are capable of detect and send any change in network and communicating with other devices, like target tracking, environmental monitoring, surveillance etc. the clusters are used in WSN, to improve the lifetime of each sensor nodes and reduce the energy consumption in wireless sensor network. Power is the main consideration, when to analyse the routing protocol in WSN. This review discovers the security topics and challenges for the next generation in cluster based wireless sensor networks along with it give an important WSN parameters, it requires a wide investigation with proposes system design.

Initially for small area deployments, a direct communication from individual node to the sink node was adopted as the communication range of nodes falls within the location of sink. As the energy utilized for transmission is directly propositional to the square of distance between the two consecutive transmitter-receiver, thus the node at farther distance will die sooner. Therefore for large scale WSN Direct Transmission is not suitable. Further hop-to hop communication was suggested. Where the data goes from neighbor node to neighbor node, where the transmit-receive cycle increases and the nearby to sink node will die soon. Further, to overcome this problem a concept of grouping or clustering has been introduced, where some sensors become member of one group and one is elected as leader, who collects the data from all the nodes, but here the membership was static, thus the chosen leader energy will exhaust faster and die soon, which was broken by W. Heinzelman by introducing dynamic clustering concept called a low energy adaptive clustering hierarchy (LEACH), which became a bench mark. This proposed system implements the EASR method to improve the network lifetime as well as improve the efficiency of the throughput of the entire system. This method uses both energy aware transmission range adjustment and sink relocation mechanism scheme using MCP routing protocol. Section I briefly describes overview of the wireless sensor network, the proposed method and overall structure of this paper. Section II deals with literature survey which explains about the previous work done. Section III describes the design methodology for the proposed method as well as implementation details. Section IV gives results and

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discussion are obtained in this method. Finally, Overall conclusions from this paper and possible extensions are presented in Section V.

II. LITERATURE REVIEW

This section briefly summarizes specific related works about the WSN used to improve the network lifetime as well as throughput of the entire systems. Wang et al. [1] propose a moving system called EASR for portable sinks in WSNs. The proposed component utilizes data identified with the lingering battery vitality of sensor hubs to adaptively alter the transmission scope of sensor hubs and the migrating plan for the sink. Some hypothetical and numerical dissect are given to demonstrate that the EASR technique can augment the system lifetime of the WSN essentially.

Tseng et al. [2] A Genetic Algorithm based procedure is proposed to powerfully change the positions of sink hubs after some time. In this methodology, we consider the remaining vitality on every hub and conceivable directing topologies to decide the ideal positions for sink hubs and additionally the ideal number of sink hubs. At long last, the recreation results demonstrate that the proposed methodology can draw out the lifetime of WSN and a versatile system is expected to decide the sink movement time interim which considers the sink migration overhead and also streamlining the sink hub choice convenient. Sivakumar et al. [3] proposes an Adaptive Tree Based Sink Relocation (ATBR) model. The proposed instrument utilizes data identified with leftover battery vitality of sensor hubs to adaptively alter the directing tree and migrating plan for the sink.

Anitha et al. [4] propose a technique called Energy - Aware Sink Relocation (EASR) for portable sinks in WSNs which is an effective strategy to build the system lifetime. This instrument utilizes data of both transmission scope of sensor hubs and plan for sink migration. Subsequently, we included numerical strategies to broaden system lifetime and further the outcomes are plotted in NS2 stage. Wang et al. [5] propose a moving system called vitality mindful sink migration (EASR) for portable sinks in WSNs. The proposed instrument utilizes data identified with the lingering battery vitality of sensor hubs to adaptively change the transmission scope of sensor hubs and the moving plan for the sink. Some hypothetical and numerical investigate are given to demonstrate that the EASR strategy can expand the system lifetime of the WSN essentially.

Vadivazhagu et al. [6] concentrates the checking of the lingering battery vitality of the sensor for hotspot identification. This paper joins the components of sink movement system and the location of pernicious hub. The pernicious hub is made because of the parcel drops in transmission which is additionally educated to every other hub in that range to be careful every one of the hubs to stay away from the correspondence with it. Madhumathy et al. [7] propose to outline an effective steering convention for single portable sink and various versatile sink for information gathering in WSN. In this procedure, a one-sided irregular walk technique is utilized to decide the following position of the sink. The outcomes demonstrate that the proposed show adequately underpins sink versatility with low overhead and postponement when contrasted and Intelligent Agent-based Routing convention (IAR) furthermore expands the unwavering quality and conveyance proportion when the quantity of sources increments.

Pandya et al. [8] improved a MODLEACH by utilizing distinctive condition for group head decision as utilized as a part of HEED (Hybrid Energy-Efficient Distributed bunching) such that it choose hub as group head in view of remaining vitality of hub. Additionally we improved MODLEACH by putting vitality opening expelling component such that if hub has vitality not as much as limit, it puts a hub into rest mode. In the event that number of rest hubs more prominent than 10 then putting rest hubs one by one into dynamic mode. So our methodology expanded lifetime as far as first dead hub, security period and parcels to base station (BS) or sink.

Wu et al. [9] address the issue that the group heads is disseminated unevenly in the system, we separated the system observed region into a few divisions through the segment calculation. In the first round, the sensor hub which is the closest to the zone focus is chosen as the bunch heads by the sink hub, and alternate hubs in every part turn into the part hubs. The sensor hub which is the second nearest to the part focus is chosen as the bunch head for the second round. After the second round, the bunch leader of the following round is picked by the earlier group leader of its own group. Reproduction results demonstrate that PHCR enhance the system lifetime successfully.

Sajid et al. [10] present a versatile and vitality productive steering convention, A New Linear Cluster Handling (LCH) Technique towards Energy Efficiency in Linear WSNs with various static sinks in a directly upgraded field of 1000m×2m2. The entire system field is partitioned into four equivalent sub-locales. For effective information gathering, we put three static sinks i.e. Two at the both corners and one at the focal point of the field. A proactive steering convention Distributed Energy Efficient Clustering with Linear Cluster Handling (DEEC-LCH) is executed in the system field. Besides, a responsive convention Threshold Sensitive Energy Efficient with Linear Cluster Handling (TEEN-LCH) is additionally actualized for the same situation with three static sinks. Recreation demonstrates enhanced results for our proposed conventions when contrasted with basic DEEC and TEEN, between time of system lifetime, throughput and vitality utilization.

Bidai et al [11] investigated in this paper, multipath directing where numerous ways are utilized at the same time to exchange information between a source and the sink. We propose Z-MHTR, a hub disjoint multipath steering augmentation of the ZigBee various leveled tree directing convention in bunch tree WSN. The point of this work is to concentrate on and assess the executed multipath steering utilizing NS2 recreations. We principally confronted a few issues that impact the effectiveness of the multipath directing and the general system exhibitions as far as throughput, end to end delay information transmission and system lifetime under overwhelming and low information rates.

Priyankara et al. [12] proposed a mixture directing technique for heterogeneous WSN which adaptively joins bunching and multi-jump specialized strategies, in which hubs put close to sink perform a multi-bounce system (multi-jump zone) and hubs far from sink perform groups (bunching zone). In that technique, we concentrated on an extremely essential system topologies which are roundabout system ranges and

sink is set on focal point of the region. Thusly, we had some specialized challenges to apply our strategy for commonplace WSN with complex system limits and ideal sink areas. In this examination, we propose a novel and summed up scientific technique which can adaptably incorporate the imperatives on the physical system limits and area of the sink to characterize the spatial limit amongst bunching and multi-bounce zones. Recreation results demonstrate that our technique altogether expands system lifetime in examination with unadulterated grouping and multi-jump specialized strategies.

Zhao et al. [13] proposes BCTP (Balanced Collection Tree Protocol), which upgrades CTP by empowering the system to relocate the heap of the hub under substantial activity. BCTP utilizes the normal transmission rate as the metric to gauge a hub's long haul movement load. Once a hub is discovered intensely stacked, BCTP embraces a stochastic steering system to adjust the heap. BCTP is assessed by proving ground tries different things with 9 Telosb bits. Test result demonstrates that BCTP can lessen the heap of the problem area by up to 61.9% in a thickly conveyed system.

Campello et al. [14] depicts a bound together coordination-correspondence procedure to control the swarm of robots with the goal that it can go about as a WSN. Also, the correspondence system performs the errand of directing bundles from the producing hub until they achieve the sink hub decreasing pointless retransmissions. The recreations performed depict the effective utilization of the half and half calculation in looking and reconnaissance applications.

Xiaoming et al. [15] propose a swarm shrewd calculation based course keeping up convention in this paper to determine this issue. The convention uses the concentric ring component to control the course looking into heading, and the ideal directing choice to keep up the information conveyance course. Utilizing the resistant based simulated honey bee state (IABC) calculation to streamline the sending way, the convention could locate an option way productively when sink moves. The aftereffects of our investigations exhibit that the convention could adjust the system movement load.

Qian et al. [16] proposed the hub vitality utilization is not adjusted inexistent grouping steering convention of remote sensor system (WSN). A bunching directing calculation in light of separation likelihood (CRABDP). It is Figd likelihood chose into head as per the separation with sink and the remaining vitality of hubs. Bunch heads dissemination close sink is more than its dispersion a long way from the base station in order to constitute a heterogeneous chain of command system to understand the vitality harmony. Execution examination and recreation tests demonstrate that the new calculation can better adjusted vitality utilization and enhance the usage rate of vitality to drag out system life time contrasted and the established LEACH convention.

III. Proposed Method

This section gives the design part of the proposed system. Firstly, it introduces the system design architecture of the proposed method. This scheme, will improve the network lifetime by using energy aware transmission range adjustment method as well as sink relocation mechanism using MCP routing protocol. Then, this chapter continuous utilizing the concepts of data flow diagram. Then finally it will provide the flow chart of the proposed method. In this system, we implemented both single base station scheme as well as multiple base station scheme to improve the lifetime and decreases the energy utilized in this network.

Fig.1 shows the system architecture of the proposed method. The WSN input parameters are number of sensor nodes, area, communication range, packet size and initial energy given to all the sensor nodes. In this method the sensor nodes are deployed in a circular manner. We took number of nodes are 100, area size also 100, the communication range is 25, the packet size is 2000 and finally, the initial energy is given to each sensor nodes is 0.5J. Then allocating energy for each sensor nodes and also defined a static communication range for all the sensor nodes. The monitoring is done for the level of Hotspot. Apply the Energy Aware Sink Relocation (EASR) for mobile sinks in WSNs which will increase the network lifetime. Define energy for each communication range from all the sensor nodes to base station. Each and every sensor node should sense the data and it will send all the data to the sink nodes using hop by hop method. It will send the data to nearest node, then at the end, the sensor node near to the base station will collect all the data and sends to the sink node. In this process, we need to monitor the energy level of Hotspot of the entire network. If the energy level of Hotspot is below threshold level, it will connected another sensor node to transmit the data to sink node. To perform this operation, first we need to check the relocation is required or not. Then we done comparison of both methods. The results shows that our proposed method gives better life time of the network as well as better energy optimized in this network.

Fig.2 shows the process flow chart of the proposed method. Firstly, initialize all the wireless sensor network parameters like area, number of nodes, energy of each node, the communication range, packet size, transmission and receiving range etc. Then deploy the sensor nodes in circular manner in a network. Deploy the base station at outside of the network. Allocate energy to all the sensor nodes as 0.5J. Define energy for each communication range from all the sensor nodes to base station. Each and every sensor node should sense the data and it will send all the data to the sink nodes using hop by hop method. It will send the data to nearest node, then at the end, the sensor node near to the base station will collect all the data and sends to the sink node. In this process, we need to monitor the energy level of Hotspot of the entire network. If the energy level of Hotspot is below threshold level, it will connected another sensor node to transmit the data to sink node.

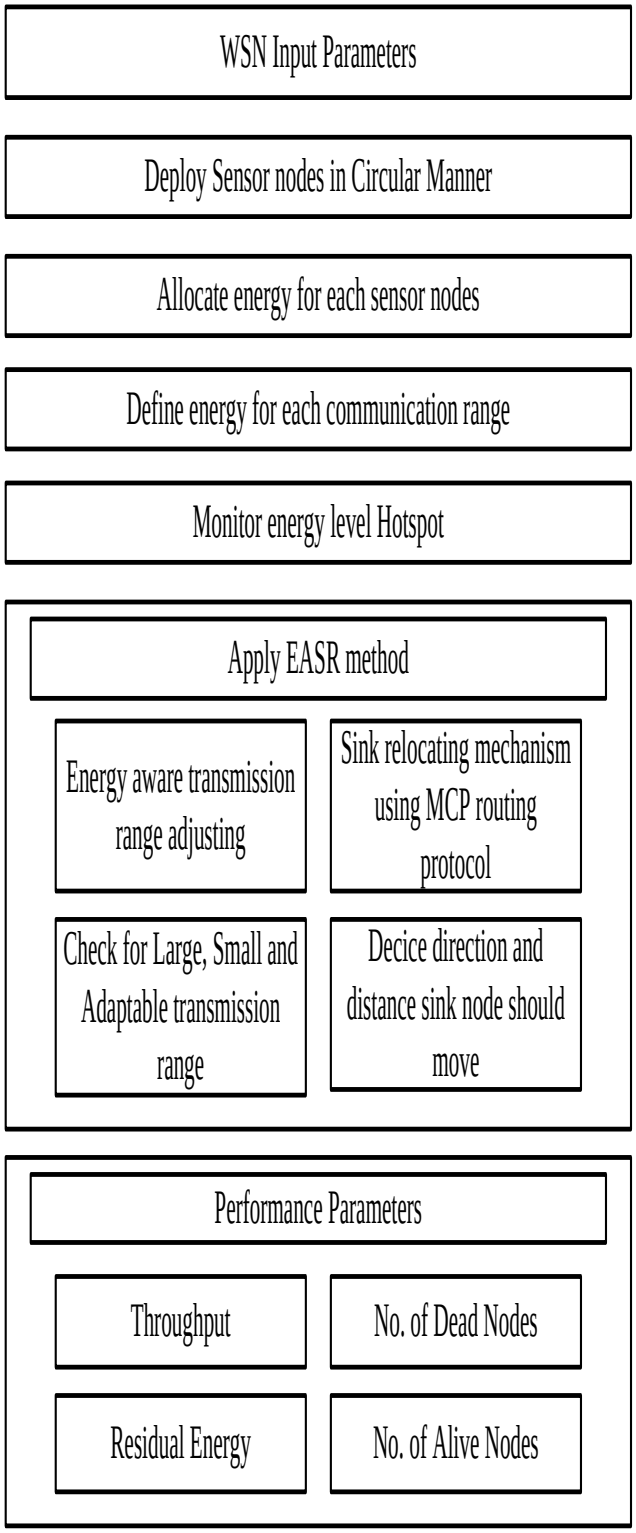

Fig.1:System architecture for the proposed method.

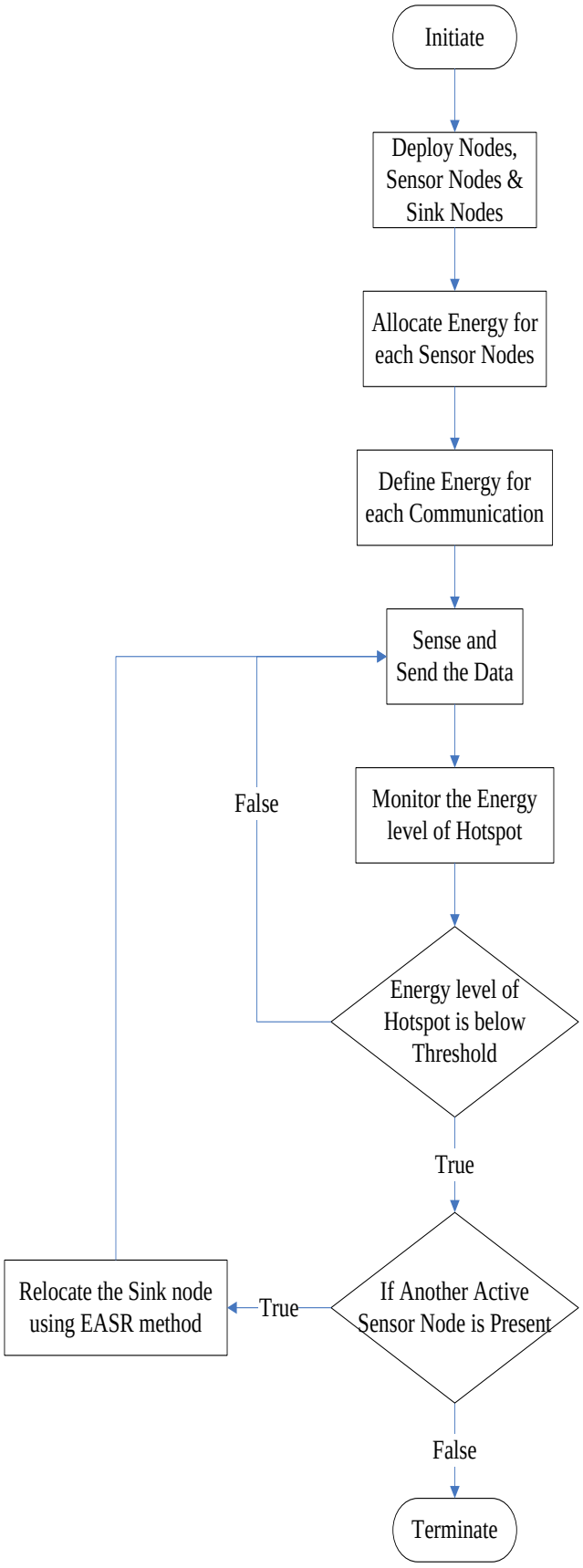

Fig.2: Flowchart for the proposed method

To perform this operation, first we need to check the relocation is required or not. If required means, we need to decide that in which direction we need to relocate the sink node and how much distance we need to move the sink node. By applying the MCP routing protocol algorithm we can perform the adaptable

transmission range to enlarge the lifetime of the entire network. In this proposed method, we simulated both single base station scheme as well as multiple base station scheme. Then we done comparison of both methods. The results shows that our proposed method gives better life time of the network as well as better energy optimized in this network.

A. Pseudo code for Multi_BS

The Pseudo code of the Multi_BS is described below with its input, variable initializations, computational statements and functions.

Start
Initialize *Inputs Area, Nodes, Communicating range, Energy;*
Deploy nodes in circular manner;
Cp ← Calculate centre point;
Store the coordinates;
[xt, yst] ← Generate node position randomly;
Dt ← calculate distance from centre to BS;
If *(Dt within range from circle)* ***then***
[x (idx), y(idx)] ← Accept and store;
Else
Reject sensor nodes;
End;
[xbs, ybs] ← Define BS path;
Make communicating map based on communication range;
Dt ← calculate neighbouring distance;
Idx ← find out nodes which are under range;
Make connection map=1;
Initialise Evec, Dvec, Avec, Tvec;
[Costs, paths] ← Apply ***MCP routing protocol*** *to all nodes [Amap, x, y, u1, ix];*
Store and plot paths;
Initialize *packet length ← 2000;*
Start communication;
Find nearest node to base station;
Make dead node to Zero;
Load paths;
Apply MCP routing protocol;
Et ← Calculate transmission energy;
Er ← Calculate receiving energy;
Transmission to BS;
[Evec, Dvec, Avec, Tvec] ← Calculate residual energy, dead nodes, alive nodes, throughput;
End;

B. Pseudo code for MCP_Routing protocol

The Pseudo code of the MCP routing protocol algorithm is described below with its input, variable initializations, computational statements and functions.

Start
Inputs *AorV, x. y, SID, FID;*
xyCorE ← collect all the data in nodes;
[E, Cost] ← perform processInputs(AorV, xyCorE);
Calculate FID and SID values;
If *(length (FID) less than length (SID))* ***then***
Calculate E and cost value;
End;
L ← length (SID);
M ← length (FID);
Store costs and path values;
[Minimum cost, paths] ← Apply Dijkstra's algorithm (sparse (1, n), TBL, Inf (1, n))
Update the table;
Calculate minimum cost, neighbour point, path;
Find minimum value in Table;
Settle the minimum value;
Store min_cost and Path (FID);
Convert adjacency matrix to edge list;
Compute Euclidean distance for edges;
End;

IV. Results and Discussion

This section presents the performance analysis of simulated work of the proposed method. This implements the EASR method to improve the network lifetime as well as improve the efficiency of the throughput of the entire system. This method uses both energy aware transmission range adjustment and sink relocation mechanism scheme using MCP routing protocol. Here, we firstly conducted the stationary sink method. In this technique, it having only one base station and it is stationary and it would not move it remain stationary at one point. The second method is MCP routing protocol method utilized as a message reporting. In this wireless sensor network the lifetime is taken for each node is 0.5J. Fig.3 shows the sink node is stationary in One_BS scheme.

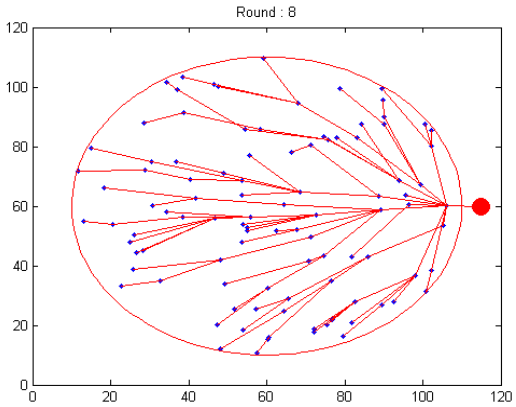

Fig 3: One Base station scheme at round 8.

This energy is common for each and every sensor node. In the process of transferring data form sensor node to base station the battery of each sensor node near to the base station will die soon as possible. Deploying the Multipliel BS around the cluster using MCP algorithm is shown in Fig. 4.

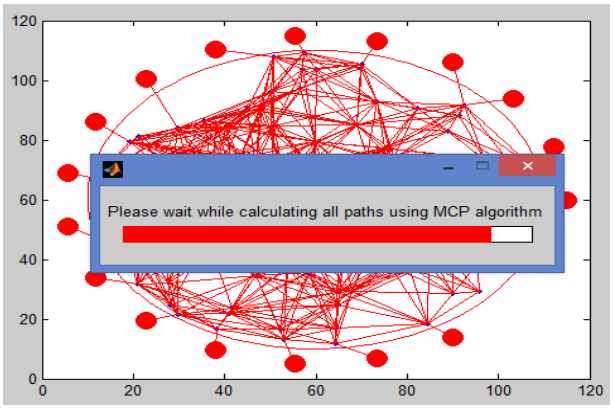

Fig. 4 Deploying the Multipliel BS around the cluster using MCP algorithm

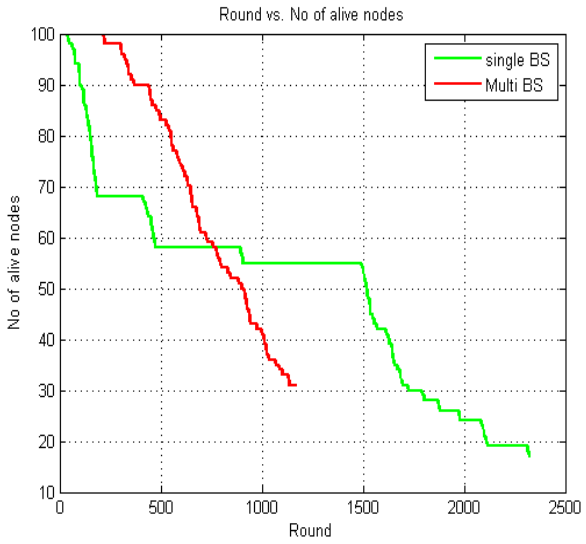

Fig. 5: Comparison One_BS and Multi_BS for Round vs. Number of Alive nodes.

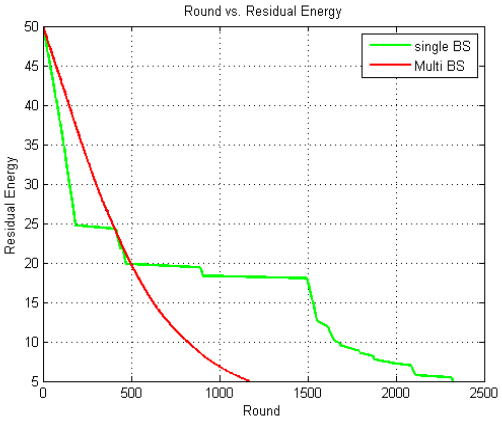

Fig. 6:Comparison One_BS and Multi_BS for Round vs. Residual Energy.

The comparison of single base station and multiple base station is conducted in this proposed method. In Fig. 5 We can observe that as the number of rounds increases the number of alive nodes will also decreases. But in single base station scheme, will gives more rounds compared to multiple base station scheme, but single base station scheme give very less number of alive nodes at the end compared to multiple base station scheme.

Fig 7: Comparison One_BS and Multi_BS for Round vs. Number of Dead Nodes.

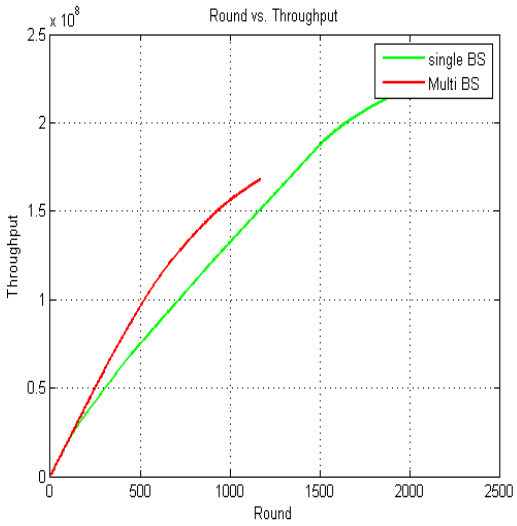

Fig. 8: Comparison One_BS and Multi_BS for Round vs. Throughput.

Similarly, in Fig 6, Fig 7 and Fig.8, we can observe that as the number of rounds increases, the residual energy will also deceases. But in multiple BS scheme give very less round compare to single BS scheme. As the number of rounds increases, the number of dead nodes will also increases. But in cases of single BS scheme, the number of dead nodes is more compared to the multiple BS scheme. As the number of rounds increase the Throughput of the network will also increase randomly, but Multiple BS scheme give more output compare to single BS scheme.

V. Conclusion and Future Direction

In this proposed scheme, we simulated the single base station scheme as well as multiple base station scheme. This project uses a novel EASR method. This method uses relocation of sink node based on energy level of the Hotspot. This also uses the adaptable transmission range to enlarge the lifespan of the entire network. It uses, MCP routing protocol algorithm to relocate the sink node around the entire network. It will also decides the direction and distance of sink node should move. Here, we given comparison of single base station scheme as well as multiple base station scheme. From this comparison we can decide that multiple base station scheme is better compared to single base station scheme. In future research direction, we can try to reduce the complexity of the model and also try to reduce the time taken to complete each and every cycle of the network.

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