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# OPTIMIZED SINK MOBILITY AWARE HETEROGENEOUS PROTOCOL OF WSN

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***Abstract:*** Wireless Sensor Network (WSN) has been extraordinary in facilitating human being by taking a control over the each aspects of modern technology. WSN has limited power constraints which makes it limited in its applicability. The routing if made energy efficient, sensor network might runs for longer duration. In the heterogeneous WSN, the main emphasis has been on the cluster heads selection by modifying the various probabilistic selection of CH. i-MBEENISH protocol is an improved version of BEENISH protocol with sink mobility incorporated in its operation. It has worked on the four levels of energy heterogeneity. The important aspect that it has worked on is the avoidance of penalizing the advanced nodes for the frequent selection as a cluster head. In this paper, sink mobility is optimized using Honey Bee Optimization (HBO) technique in the network by considering the parameters of energy and distance. HBO-iMBEENISH is proposed which outperforms iMBEENISH and MBEENISH protocols in terms of stability period and network lifetime.

***Keywords:*** Honey Bee Optimization, sink mobility, BEENISH, iMBEENISH, HBO-iMBEENISH, MBEENISH, Heterogeneous WSN

## INTRODUCTION

A WSN consists of a large number of nodes spread over a specific area where the changes are desired to be monitored. A sensor node generally consists of sensors, memory, a processor and they do have communication ability. It is an infrastructure comprised of sensing (measuring), computing and communication elements that gives an administrator the ability to instrument, observe and react to events and phenomenon in a specific environment. It is enabled by recent advances in Micro Electronic Mechanical Systems (MEMS). Energy Efficient Routing in WSN is one of the most significant concerns in achieving the enhanced network lifetime [1].

The rest of the paper is organized as follows: Section 2 contains the related work done; Section 3 presents the problem definition; Section 4 explains the proposed protocol; Section 5 shows the simulation results followed by conclusions and future work in Section 6 and then references are covered.

## RELATED WORK

There has been tremendous research in the enhancement of network lifetime. Since the development of various applications facilitated by WSN, the one of the major concern has been in the conservation of energy while the data transmission is in progress. Homogeneity in sensor network doesn't exist ideally. So introduction of heterogeneity in the network provides much stability to the network. SEP [2] which introduced the concept of different levels of energy nodes in the network provided much enhanced network lifetime to the network. It failed when it was being applied for more than two levels. DEEC [3] introduced the factor of energy ratio i.e. ratio of residual energy and average energy of the nodes. However, it made the advanced nodes suffering from penalized effect as it kept on making advanced nodes as Cluster Heads more frequently irrespective of their energy stock. DDEEC [4] worked in improving the DEEC protocol by declaring a threshold value, which decides the criteria of selection of Cluster Heads by treating all nodes equally. However, this algorithm worked only for two levels of heterogeneity. After the development of two levels routing protocols, EEHC [5] was the first one who introduced three levels of heterogeneity, containing normal nodes, advanced nodes and super nodes. The performance evaluation of EEHC has shown the improvement of 10% over the LEACH [6] protocol. However, results shows that EEHC suffered from the drawback that it could not handle the penalizing effect as happened in DEEC protocol. EDDEEC [7] worked similar to the DDEEC but on the three levels. It introduced the threshold concept to avoid the penalizing of high energy rich nodes. BEENISH [8] worked for the four levels of heterogeneity by introducing the ultra-nodes along with normal, advanced and super nodes.

Four energy level heterogeneous protocols This section covers the four energy level heterogeneous protocols; BEENISH, I-BEENISH, iM-BEENISH and the proposed HBO-iMBEENISH. Balanced Energy Efficient Network Integrated Super Heterogeneous (BEENISH) Protocol, Improved BEENISH (I-BEENISH), i-MBEENISHBEENISH has downside when it comes to the moment when the ultra-super nodes, super nodes and advance nodes get same level of energy with normal nodes. Then CH selection criteria keep on penalizing the ultra-super nodes, super nodes and advance nodes node to be CH. This penalizing effect happened in case of three-level heterogeneity in EDEEC and in two-level heterogeneity in DEEC which was removed by EDDEEC and DDEEC respectively. So, removing this penalizing effect at four-level heterogeneity designs a new protocol i.e. I-BEENISH [9]. Mobility is introduced on the basis of maximizing the stop time for the sink. When sink moves it doesn't collect data, but when it stops it collects data. So the maximization function is used in i-MBEENISH [9] protocol which drives its functioning.

## PROBLEM DEFINITION

In the heterogeneous WSN, the main emphasis has been on the cluster heads selection by modifying the various probabilistic selection formulae of CH. Many of the protocols have not considered the optimization parameters of energy, distance and node density (altogether) for the CH selection in the case of sink mobility in the network. Sink mobility not only helps in collection of data in an efficient manner but also it ensures the reliability for data collection. But the main concern is the way the sink is made to move.

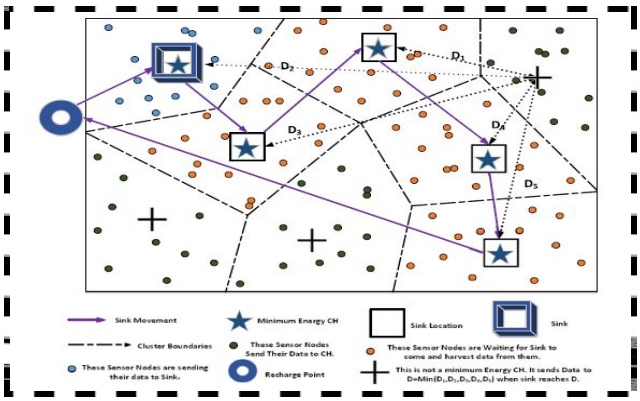


Fig. 1 Sink mobility Scenario [9]

iMBEENISH doesn't include any optimization for CH selection for the sink mobility as it only maximizes the stop time for the sink during which it collects data. Honey Bee Optimization (HBO) can be considered for the optimization of sink mobility as it gives the most effective solution as compared to the other optimization techniques. Till the time, the HBO has been giving best results for the homogeneous protocols but it is not effectively used for the heterogeneous protocols.

## PROPOSED PROTOCOL HBO-iMBEENISH

In the proposed work, the mobility of sink is optimized in a way that the sink is made to move to the HBO based optimally selected CHs to which sink has to move. HBO ensures the optimum CH by ensuring the high energy and at least distance from the sink. As it can be observed that the penalization of high energy nodes is already avoided by importing the concept of threshold from the i-BEENISH. So, with the incorporation of HBO in the proposed work, the battery of nodes can be preserved by reducing the energy consumption.

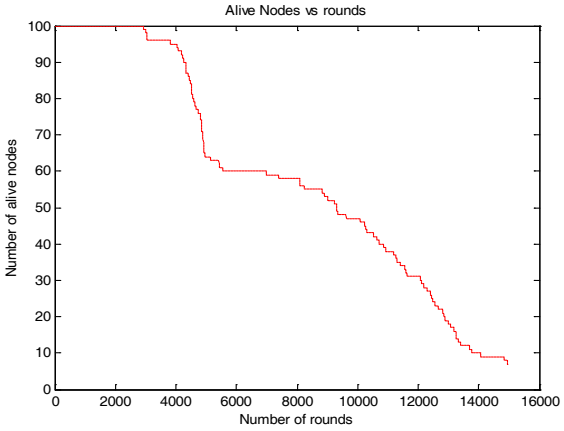


Fig. 2 Alive nodes vs rounds

## RESULTS AND DISCUSSIONS

It can be observed through the figures the stability period of HBO-IMBEENISH is at 2928 rounds. 50% nodes are dead at 9299 rounds and network lifetime is observed at 15000 rounds respectively. Fig. shows the graph of alive nodes vs rounds, Fig. 3 shows the dead nodes vs rounds. The protocols iMBEENISH and MBEENISH are also implemented and their stability period is observed at 2033 and 1565 rounds respectively. The graph of throughput of HBO-iMBEENISH is also shown in the Fig. 4 and Fig.5 shows the network lifetime. It is observed that throughput is achieved at high value. Fig.6 and Fig.7 represents the network lifetime of iMBEENISH protocol and MBEENISH protocol.

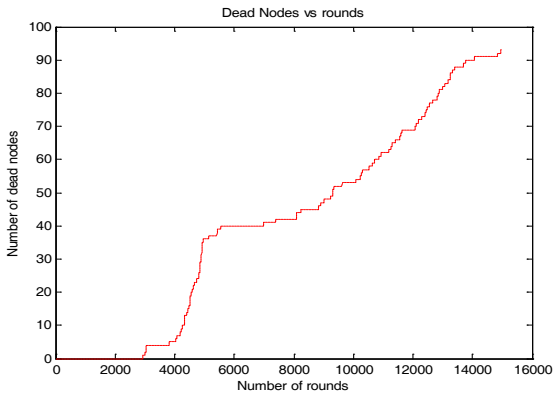


Fig. 3 Dead Nodes vs Rounds

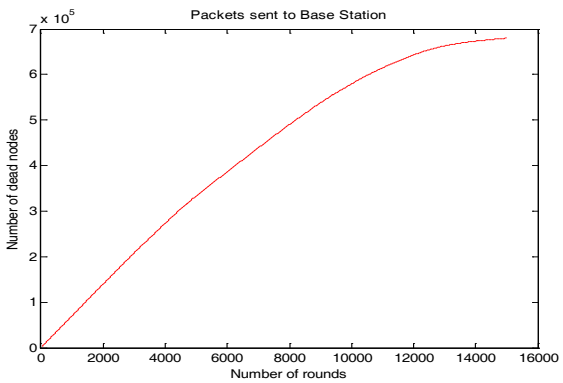


Fig. 4 Throughput

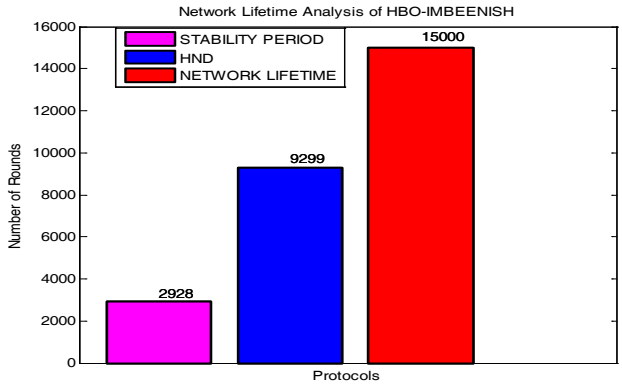


Fig. 5 Network Lifetime of HBO-iMBEENISH

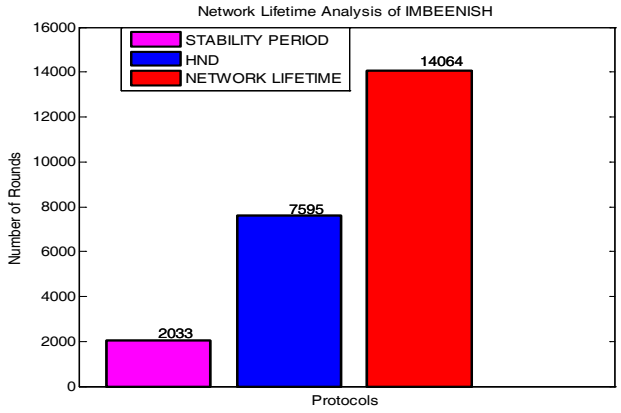


Fig. 6 Network Lifetime of i-MBEENISH

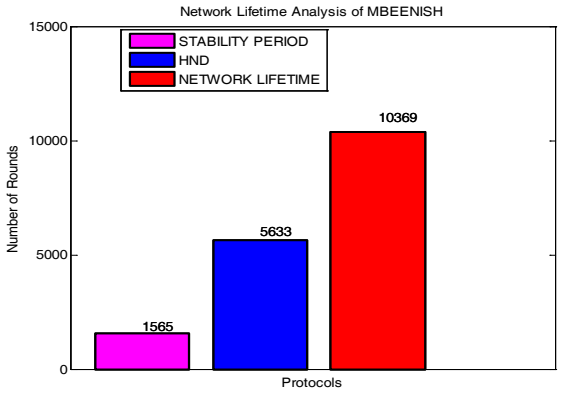


Fig. 7 Network Lifetime of MBEENISH

## CONCLUSION

Wireless Sensor Networks (WSNs) have been revolutionary technology in disseminating data from the remote place. Heterogeneous WSN has been focusing on enhancing the stability period by proposing energy efficient Cluster Head Selection. In this thesis work, the mobility in heterogeneous WSN has been optimized using HBO technique. While optimizing energy and distance factors are considered for selection of CHs where the sink has to move. It has been found through the simulation analysis that the proposed protocol has outperformed the IMBEENISH and MBEENISH protocols. Stability period is obtained at 2928 rounds where it was only 2200 rounds in case of IMBEENISH. The reason behind such enhancement is due to the optimized movement of sink in the network for data collection. In future work, it is proposed to investigate the performance of protocol by varying the energy values of nodes.

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