CHAPTER 6

CONCLUSION

6.1 CONTRIBUTION

Maximizing energy savings is a crucial research area in Wireless Sensor Network (WSN). Network life expectancy can be computed based on the available energy. This becomes more challenging in nodes with mobility. An optimal load balanced route needs to be found from a mobile source to the fixed sink such that minimum energy is utilized and at the same time to be ensured that all the nodes degrade uniformly in terms of available energy. Lower Energy Adaptive Clustering Hierarchy (LEACH) is a popular distributed single-hop clustering protocol where clusters are formed depending on received signal strength. The CH role is rotated periodically amongst sensor nodes in a cluster to ensure balanced energy consumption. This algorithm is inefficient when large area sensor networks indulge in single-hop CHs communication to sink. And also it is seen that LEACH solutions are sub optimal as the cluster formation is NP Hard. In this work, the NP hard problem in wireless sensor network is addressed. Genetic Algorithm (GA) has been proposed in literature but has found to have slower convergence.

This work investigated the performance of LEACH and the popular GA LEACH proposed in literature. As the convergence time is slower in GA based optimization techniques, it has been proposed to investigate the performance of Swarm Intelligence based algorithms. In particular, Bacterial Foraging Optimization (BFO) Algorithm was chosen for its coarse grained
faster convergence solution. The BFO algorithm was modified to handle the discrete dynamics of WSN. As link quality is attributed to the node mobility as well as energy consumed, a novel fitness function based on link quality and energy has been derived.

Experiments for various numbers of nodes were simulated for M-LEACH and GA-LEACH to evaluate the performance of the network. The average improvement in the PDR of GA-LEACH was by 3.93% over M-LEACH. Similarly, energy savings to the tune of 25.26% was achieved over 800 rounds when the first order radio model design was used.

The proposed GA-LEACH lowers End to End Delay by 20% than M-EACH for a 50 node network but proposed GA-LEACH has higher End to End Delay of 3.85% than M-EACH for a 175 node network. Remaining energy in nodes is higher by 3.11% in a 50 node network and by 7.37% for 175 node network for GA-LEACH when compared to M-LEACH.

The proposed technique was investigated using the same experimental setup used for M-LEACH and GA-LEACH. The proposed BFO technique improved the PDR by 3.63% compared to GA-LEACH and further improved the energy savings by 16.7 % compared to GA based technique.

The proposed BFO technique improves PDR by 4.93% than M-EACH and by 3.2% than GA-LEACH with 50 nodes in the network. The proposed BFO technique improves PDR by 7.43% than M-LEACH and by 1.42% than GA-LEACH with 175 nodes in the network. The proposed BFO technique increases remaining energy in joules by 1.98% than M-LEACH but decreases by 1.1% than GA-LEACH when number of nodes is 50.

The proposed BFO technique increases remaining energy in joules by 5.26% than M-LEACH but decreases by 5.26% than GA-LEACH when number of nodes is 175.
Effectiveness of the optimization algorithm depends upon its search capabilities. Two new techniques are proposed:

1. Using a local search algorithm.
2. A new BFO algorithm with Travelling Salesman Problem (TSP) scheme is proposed for efficient clustering.

TSP tries to find the shortest route among the nodes to reach the sink. Average PDR improvements of 3.97 and 4.65% were observed from these two schemes compared to the proposed BFO algorithm. Similarly average energy savings to the tune of 5 and 11.2% were observed over BFO.

From the work carried out using BFO it can be summarized that BFO can be used as an efficient method for clustering in WSN.

6.2 SCOPE FOR FUTURE WORKS

This work investigated efficient energy saving mechanisms in WSN. Investigations have been carried out with node mobility and with various numbers of nodes. However the impact of node pause time was not considered and a constant was used throughout the simulations. Investigating the impact of node pause time can be an interesting research area. Similarly the impact of high mobility in the range of 35m/s and above can be investigated.

The research focused on constant bit rate traffic and all the simulations were carried out using constant bit rate traffic. However, with the emergence of high bandwidth and multimedia communication, further work can be carried out on the impact of using live streaming multimedia traffic.