CHAPTER 7
CONCLUSION AND FUTURE WORK

7.1 CONCLUSION

Wireless Sensor Networks (WSNs) has become an important technology for monitoring and tracking applications. Reducing power consumption is an important design objective in sensor network. Clustering is a good technique for reducing the power consumption and increasing the network lifetime of sensor networks. This thesis has investigated the various energy efficient clustering algorithms for WSNs. The main aim of this research work is to develop a novel routing model or framework to solve the shortcomings of existing cluster based algorithms. The thesis proposes three novel cluster-based routing algorithms DEEN, EEC and M-ECCDA to make the efficient use of critical resources of sensor network such as energy supply and prolong the network lifetime. Nodes in the proposed algorithms have made fast decisions (i.e., to become cluster heads or not) based on some probability or other local information (i.e., on their residual energy, distance from base station). Therefore there is no need of any global
knowledge for their operation. The initial probability assigned to serve as the primary criterion for the nodes to decide individually on their election as CHs in a flexible, uniform, fast and completely distributed way. However other local information such as residual energy of a node or the distance of a node from base station serves as secondary criteria for the cluster head election process. EECP and M-EECDA suggest three-tier architecture for heterogeneous environments. They integrate the clustering and multihop short distance communication to reduce the range of data transmissions and save energy of sensor networks significantly. They further suggest a sleep state for nodes which are in base station direction and joining to nearby clusters is not energy efficient.

7.2 FUTURE WORK

Thesis presents some novel methods for routing strategy in wireless sensor network. In the future, a number of interesting research problems require further investigation Some ideas that need to be investigated and developed further are given in the following:

- **Extension of the proposed protocols:** We have proposed three novel routing algorithms for wireless sensor network and proven that the proposed techniques are better than many existing schemes. However, there are certain issues that need to be addressed, in order to use these algorithms from simulations to large-scale real world deployments.

- **Introduction of Mobility:** The entire algorithms presented in this research assumed that the network nodes and the base station are
becoming static after deployment. However in dynamic applications, the
base station and/or the nodes can move. This type of work behaviour of
both nodes and base station is not studied in the research. In the future
work we will try to investigate the effect of mobility on the performance
of various algorithms.

- **Study of asymmetric links:** Asymmetric link commonly exists in low
  power wireless sensor networks. Many reasons contribute to the existence
  of asymmetric links, including transmission power disparity, interference,
  obstacles, noise level difference as well as radio irregularity. However, in
  this research the radio links are assumed to be symmetric therefore the
  network topology may affect this symmetry. The asymmetric links will
  have an impact on the network performance and in future work we will try
to investigate this issue.

- **Combining spatial and temporal aggregation strategies:** Sensed data in
  Wireless Sensor Networks (WSNs) shows the spatial and temporal
  correlations in the different physical attributes of the sensed environment.
  Clustering techniques use the spatial aggregation to reduce the data
  redundancy. If spatial and temporal data aggregations are combined with
each other, then the network performances will be improved considerably
i.e. ideally a node should be able to autonomously decide whether to use
only spatial or temporal correlations or both, depending on the
characteristics of the monitored environment.