Abstract

Wireless Sensor Network (WSN) is composed of large number of low-cost Sensor Nodes (SNs) to co-operatively monitor certain physical or environmental phenomena. It is an emerging technology that shows various applications both for public and military purpose like disaster relief, military surveillance, habitat monitoring, target tracking and in many civic, medical and security applications. The network must be energy efficient and survive for a long time in order to operate these applications successfully. The nodes are constrained in terms of communication ranges, computation, energy, bandwidth, and storage. Power is one of the most critical parameter that must be considered as prime factor.

In hostile environment where reach-ability is not possible, the manual replacement or recharging of a dead sensor is not possible. Therefore provision should be there to recharge these sensors by some device within the network itself. To recharge dead SNs, the device must be able to harvest the energy from surrounding and locate SNs to be recharged. Though GPS is available to find the location of such sensor but it is not very much accurate and at the same time by using GPS cost of the network is tremendously increased. Another solution is to provide mobility to SNs in the area of deployment to cover the location of dead sensor, but Mobile WSN poses a new challenge and consumes very high energy. Therefore alternative solutions are highly desired.

Energy harvesting is a technique that captures, harvest or scavenge unused ambient energy (such as thermal, vibration, solar, wind, etc.) and transform the harvested energy to electrical energy. The harvested energy from ambient are used to power WSNs and mobile devices for extended operation instead of relying on finite energy sources such as rechargeable/alkaline batteries.

In this research we have considered few of the above WSNs challenges and proposed some energy harvesting model to make the system sustainable. Brief of the work is as follows:
• To provide network survivability and network connectivity a Possible Location Deployment Protocol (PLDP) is developed. It identifies possible locations for the deployment of forwarding nodes (FNs) used to harvest unused ambient energy from the surrounding.

• To achieve energy efficiency and accuracy a 2-Way Energy Efficient Localization (TWEEL) scheme is developed which provides better localization without employing GPS on mobile sensor nodes (MSNs) hence reducing the network setup cost. Energy harvesting on mobile anchor nodes is used to reduce the need of energy refill.

• To provide fault tolerance and prolongs network life a Hierarchical, Fault tolerant, Adaptive and Scalable (HiFAS) protocol is developed. This protocol uses super clustering and isolated node joining concept, to achieve scalability and fault tolerance.

• To support uninterrupted network operation a power ambulance system (PAS) is developed. The system provides a dedicated power supply to static SNs through mobile power nodes (MPNs) which are equipped with solar cells and super capacitors to store harvested energy.

• To support scalability and sustainability in Underwater WSNs (UW-WSNs) a Scalable and Energy Efficient deployment scheme (SEEDS) is developed. This scheme uses mobile Autonomous Underwater Vehicle (AUV) which is an energy rich node, deployed at each layer, to aggregate the data at its own layer and to deliver the same to the next higher layer AUV.