ABSTRACT

The wireless network is the network consisting of devices connected through radio frequency signals. The wireless network can be broadly classified into ad hoc networks and wireless sensor networks. These networks are commonly used when there is no fixed infrastructure and have its applications in surveillances, military sector, environmental monitoring and health care applications. The resource limitations and the unexpected link failures in the network is a challenging factor while designing a routing protocol. In this work, different energy efficient approaches are introduced and incorporated in the design of energy efficient routing protocols for wireless network.

The three conventional routing protocols predominantly used in different applications are Destination Sequenced Distance Vector (DSDV) routing protocol, Dynamic Source Routing (DSR) protocol and Ad hoc On-Demand Distance Vector (AODV) routing protocol. These protocols are implemented and the performance of these protocols is compared with standard metrics like Packet Delivery Rate (PDR), Average end to end delay, Routing Overhead (RO), Normalized Routing Load (NRL) and Throughput.

The Dynamic Source Routing protocol is chosen for further analysis since it can be applied in scenario where minimum overhead is required. The hop count based energy efficient routing protocol is the modification of DSR protocol where hop count and remaining energy of the nodes are used in routing decision. The routing protocol chooses stable path for transmission of packet. The protocol is compared with Energy Saving Dynamic Source Routing (ESDSR) protocol and results show that Hop count Based ESDSR (HBESDSR) protocol maximizes the life span of MANET and reduces the energy consumption and delay.

Multiple resources in wireless network are critical and hence routing protocol designed to handle shortest route or energy optimization cannot optimize other resources like bandwidth, link quality. Heuristic approaches are included in routing protocols to handle multiple criteria. The Multi Criterion Fuzzy based Energy Efficient Routing (MCFEER) protocol for Ad hoc Networks includes fuzzy system for optimizing the parameters like bandwidth, battery life, hop count and buffer occupancy. The fuzzy system is included in route discovery phase of the routing protocol to optimize the route selection. Multiple stable paths are chosen by MCFEER protocol and stored in route cache of nodes for later usage during route maintenance phase. MCFEER protocol is compared with Progressive Energy Efficient Routing (PEER) protocol and the results show that MCFEER protocol improves network performance.

Energy efficient routing protocol for energy harvesting sensor nodes is designed which effectively transmit the packet. The energy efficient routing protocol for energy harvesting sensor network involves three phases namely Cluster Head Selection, Base Station Process and Change of Cluster Head. The network model adopted divides the environment into four quads. For each quad a cluster head is chosen. The cluster head aggregates the data from cluster members and forwards to the base station. Each node maintains information such as node id, current energy level, battery capacity, node position and quad id. The priority of cluster head selection includes position, energy level and battery capacity. The base station process includes data aggregation and changing of cluster head when required.

A novel Beaconless Color theory based Routing Protocol (BCRP) is designed which is efficient in conserving energy by reducing control packets and choosing the link with higher bandwidth availability. Energy harvesting nodes are used as reference nodes whose residual energy is always sufficient

for localization of other nodes in the network. Color theory is adopted to localize nodes in the environment and DATA/ACK/SELECT handshake mechanism is used for packet transmission. The simulations are carried out and the performance of BCRP protocol is compared with Color theory based Energy Efficient Routing (CEER) protocol using metrics like throughput, average end to end delay, routing overhead and total energy consumption. The results show that the BCRP protocol improves network lifetime.

Another heuristic approach cuckoo search algorithm is used in designing an energy efficient routing protocol for energy harvesting sensor network. Energy Efficient Cuckoo Search Routing (EECSR) protocol is designed using cuckoo search heuristic algorithm during cluster head selection. The hierarchical network model is adopted where sensors form clusters and cluster head from each cluster forward the data packet to the sink node. The EECSR protocol is compared with Low Energy Adaptive Cluster Hierarchy (LEACH) protocol and the results prove that EECSR improves network lifetime.

An Energy Efficient Delay Aware Routing (EEDAR) protocol is designed which efficiently routes the information to release the signal and pave way for ambulance. Wireless sensor network is deployed and RFID tags are attached to the ambulance for tracking. The RFID reader is mounted on a lamp post which is 800 meters away from the intersection signal. The RFID reader senses the RFID tag, and transmits the information to the sensors. The sensors on receiving the data, route the packet to the sink node. The data is processed and the traffic signal displays green light. The sensor is placed along the roadside to sense the arrival of emergency vehicle. Once detected, sensors forward a data packet with minimum delay to set the green signal.