Energy Efficient Routing in Ad-Hoc Wireless Networks
(Research Proposal)
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Introduction to Wireless Ad-Hoc Networks
A wireless ad-hoc network is a wireless computer network where there is no fixed infrastructure. All wireless enabled devices within the range of each other can discover and communicate with each other in a peer-to-peer fashion without involving central access points. [1]

In the last few years wireless ad-hoc networks are rapidly gaining importance. The ad-hoc property makes them quite useful in situations where setting up of an infrastructure based network could be difficult, or even impossible. Because of this reason, wireless ad-hoc networks are being studied especially for their applications in disaster management, military, supply chain management, environment studies, conferences and classrooms etc.

Energy Constraints in Ad-Hoc Wireless Networks
An important constraint, to be taken into consideration, in wireless ad-hoc networks is that the nodes usually run on batteries. This means that energy expenditure must be carefully controlled or else the node life and consequently network life would be quite short. Most of the energy expenditure comes from the transmission and receiving of data packets. As discussed in [2], average consumption is 1 mJ for transmitting and 0.5 mJ for receiving a single bit. Now comparing this to only 0.8 mJ for 208 CPU cycles (approximately 100 instructions) we realize that much energy can be conserved if we can make data transmission and receiving more efficient, or reduce total data transfer.

Current Handling of the Problem
Apart from energy efficient application layer design, the energy conservation issue is currently handled at the MAC layer and also the network layer. Following are just a few examples of how this problem can be tackled at these two layers.

As discussed in [3], one way of addressing this problem at the MAC layer, is by reducing the transmission range (i.e. sending a weaker signal) and delivering a packet in a multi-hop fashion. As the power consumed by the network interface card (NIC) is directly proportionally to the strength of the transmitted signal a weaker signal means more node life. This may be especially advantageous in areas of high node density. [4]

At the network layer, this problem is handled by energy aware and efficient routing protocols. One way to achieve this is by finding multiple paths between source and destinations, and assigning each path a probability of being chosen, depending on the energy metric. To send a packet, one of the paths is randomly chosen depending on the probabilities. Hence none of the paths is used all the time, preventing energy depletion.
Another tradeoff to consider for energy efficiency is whether the routing policy would be proactive (table driven) or reactive (on demand). As evident, a proactive routing policy would consume much more energy because of frequent updates as compared to a reactive one. [8]

**My Area of Focus**
For this project my I will be focusing on the network layer only. This means that I would be focusing on energy efficient routing. I intend to give a broad picture of routing in wireless ad-hoc networks and then do a focused survey of all the current energy efficient routing techniques and approaches for both unicast and multicast traffic. I would discuss the pros and cons of these routing techniques and different conditions in which some may perform better than the other ones. In the process, I also hope to find any open issues and challenges on which further research could be pursued.

**References**