# Energy Efficient Load Sharing Mechanism for Multipath Routing Protocol in Wireless Sensor Networks

Kulkarni Prasanna, Saumya Hegde, and Shiva Murthy G.

Deparatment of Computer Science and Engineering, National Institute of Technology Karnataka, Surathkal, India
{kulkarni.prasanna87,kgshivam}@gmail.com

**Abstract.** Many existing energy efficient routing protocols in wireless sensor networks attempt to reduce the energy usage in data routing from source to sink node. Energy efficient routing in wireless sensor network is a paramount requirement to prolong the lifetime of the network. To increase the network lifetime, effective distribution of the traffic from the source node is very much necessary. We would like to propose a novel energy efficient load sharing mechanism in multipath routing for wireless sensor networks. The load sharing mechanism improves the wireless sensor network effectively.

**Keywords:** Load Sharing, Multipath Routing, Wireless Sensor Networks.

## 1 Introduction

A wireless sensor network consists of light-weight, low power, small size sensor nodes. The areas of applications of sensor networks vary from military, civil, healthcare, and environmental to commercial. Examples of application include forest fire detection, inventory control, energy management, surveillance and reconnaissance, and so on [1-4]. The sensor nodes perform desired measurements, process the measured data and transmit it to a base station, commonly referred to as the sink node, over a wireless channel. Recent past researchers proposed a single path routing protocol to transmit data. The optimal path is selected based on the metrics, such as the gradient of information, the distance to the destination, or the node residual energy level.

Some other routing protocols that use multiple paths choose the network reliability as their design priority [5]. Multipath routing protocols enhances the network lifetime effectively compared to single optimal path routing by distributing the traffic among multiple paths. To increase the network lifetime, uniform expenditure of network resources such as energy, bandwidth is much necessary. This work proposes an effective load sharing mechanism for multipath routing protocols. The load sharing mechanism distributes the traffic from the source node to its multiple paths to sink node based its available residual energy.

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The rest of this paper is organized as follows. In Section 2, it discusses the related work. The multipath routing scheme in Section 3. In Section 4 the load balanced algorithm for multipath routing. In Section 5 results and discussions are provided and conclusions are drawn in Section 6.

## 2 Related Works

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) is an extension of AODV. AOMDV is a multi-path routing protocol [6]. In the route discovery mechanism every RREP is being considered by the source node and thus multiple paths can be discovered in one route discovery. When the source node wants to send the traffic to the destination node, route discovery is initiated by locally flooding the route request packets (RREQ) targeting the destination and waiting for the route reply packet. A reverse path to the source is found by the intermediate nodes using previous hop of the RREQ as the next hop on the reverse path. Intermediate node generates route reply only when valid route to the destination is available, else the RREQ is rebroadcast. Duplicate copies of the RREQ packet received at any node are discarded. When the destination receives a RREQ, it also generates a Route Reply (RREP). When a link failure is detected, a Route Error (RERR) is sent back via separately maintained predecessor links to all sources using that failed link. When the source receives the RERR, it initiates a new route discovery if the route is still needed. AOMDV selects the paths to route the in random. There is no fixed mechanism to share the load among the multiple paths.

## 3 Multipath Routing Scheme

The sensor nodes are distributed randomly in the sensing field. A network composed of a sink node and many wireless sensor nodes in an interesting area is considered. Assume that all nodes in the network are assigned with a unique ID and all nodes are participating in the network and forward the given data. The sensor nodes are assumed to be fixed for their lifetimes, and the identifier of sensor nodes is determined a priori. Additionally, these sensor nodes have limited processing power, storage and energy, while the sink nodes have powerful resources to perform any tasks or communicate with the sensor nodes. Once the nodes are deployed, they remain at their locations for sensing tasks. The sensor nodes can receive messages from other nodes. The Energy Efficient Load Balanced Multipath Routing Protocol (EELBMRP) assumes the network into number of stages based on the number of hops between source and destination as assumed in [7]. The sink is stage 0 node. Every node that can communicate with sink node is in stage 1. We assume that stage $N$ node can communicate with nodes on the same stage and next stage *i.e.*, $n + 1$ stage but cannot with the $n - 1$ stage nodes. This back communication prevents the formation of loop paths.