# A Small-World Routing Protocol and the Effect of Pass-Over for Wireless Sensor Networks

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## Abstract

One of the fundamental issues of wireless sensor networks is that an event can be detected by some sensor nodes and delivered to the query devices. This kind of queries and events can be happening anytime and anywhere. Due to the battery constrained nature of sensor nodes, it is important to design routing protocols that are efficient and power saving. In this work, we propose a new routing protocol, the Small-World Routing protocol (SWRP), which is at the same time a generalization of both flooding and rumor routing and can be operating in between both extremes. With the idea originating from the small-world theory, the proposed protocol finds paths between the queries and events through recurrent propagations of strong and weak links. The operation of the protocol is simple, flexible and requires not much computational power. The SWRP may also minimize the pass-over problem, which occurs when a query agent passes over an event agent even though the two lines cross each other and thus prevents a query from finding the event. It has been shown that by increasing the number of strong links of the SWRP within a controlled area, we may be able to reduce the occurrences of pass-over. Accordingly, the proposed SWRP may achieve much better successful rate in routing as well as cut the number of hop-count at the same time. In particular, our simulation results show that with approximately the same routing overhead (in term of number of routing messages), our protocol may achieve up to 22% more in success rate and 10-hop less in average path length. To reach a 100% successful routing rate, our protocol may save up to 41.2% additional routing overhead as compared to the rumor routing. Most important of all, the SWRP makes the improvements without sacrificing the power consumption of each individual sensor node as the average inter-hop distance for discovered routing paths does not increase as a result of

shorter path length.

Keyword：wireless sensor networks, small world, routing protocols, power saving