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A Study on Multipath Based Routing in Wireless Sensor Communication Networks

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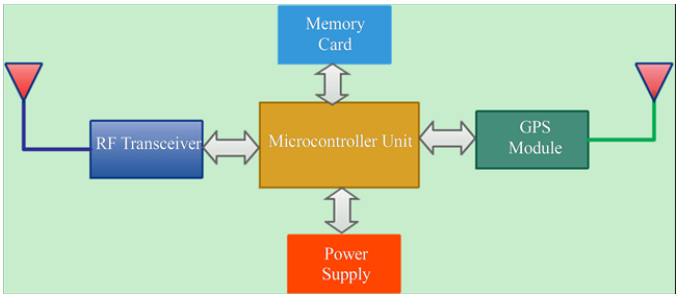
ABSTRACT

Multipath routing is a well-organized method to direct data in wireless sensor networks (WSCNs) because it can provide reliability, security and load balance, which are especially serious in the resource constrained system such as WSCNs. In this paper we provide a survey of the proposed multipath routing protocols for WSCNs, which are classified into three categories, infrastructure based, non-infrastructure based and coding based, based on the special techniques used in building multiple paths and delivering sensing data. For each category, we study the design of protocols, analyze the exchange of each design, and overview several representing protocols. In addition, we give a synopsis of design goals, challenges, and evaluation metrics for multipath routing protocols in resource constrained systems in common.

Keywords: WSCNs, H-SPREAD, Multipath Multispeed Protocol, Multi-Constrained QoS Multipath Routing Introduction

I. INTRODUCTION

A wireless sensor network (WSN) is a network consisting of spatially spread free devices using sensors to monitor physical or environmental situation. A main location acts like an interface between users and the network. One can take back required information from the network by insert queries and gathering results. A wireless sensor network contains number of sensor nodes. The sensor nodes can communicate between themselves using radio signals. A wireless sensor node is set with a micro controller unit , memory card , RF transceiver , GPS module and power supply fig.1. The split nodes in a wireless sensor network (WSN) have limited processing speed, storage capacity, and communication bandwidth. After the sensor nodes are deployed, they are responsible for self-organizing an appropriate network infrastructure often with multi-hop communication with them. Wireless sensor devices also react to queries sent from a "control site" to perform specific instructions or provide sensing samples. The working mode of the sensor nodes may be either continuous or event driven. Global Positioning System (GPS) and local positioning algorithms can be used to obtain location and positioning information. Wireless sensor devices can be set with actuators to "act" upon certain conditions.[1]



Figuer 1

Applications:

Wireless sensor networks have gained substantial regard due to their flexibility in solving troubles in different application domains and have the potential

to change our lives in many different ways. WSCNs have been successfully applied in various application domains such as:

- **Military applications:**

WSN is used as the main part military command, control, communications, computing, intelligence, battlefield and targeting systems.

- **Area monitoring:**

The sensor nodes are installed over a region where some experience is to be monitored. When the sensors detect the event being monitored (heat, pressure etc).

- **Transportation:**

Immediate traffic information is being collected by WSCNs to supply models and alert drivers of congestion and traffic problems.

- **Health applications:**

Sensor networks are helping for the disabled, integrated patient monitoring, diagnostics, and drug administration in hospitals, and tracking the doctors or patients inside a hospital.

- **Environmental sensing:**

WSN has developed to coat many applications of WSCNs to earth science research. This includes sensing volcanoes, oceans, glaciers, forests etc.

- **Agricultural sector:**

With WSN releases the farmer from the maintenance of wiring in a difficult environment. Irrigation automation enables more efficient water use and reduces waste.

Types of routing:

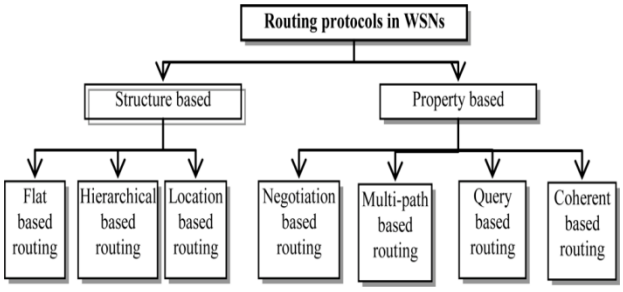


Figure 2

II. MULTIPATH ROUTING

The multipath routing approach is mostly utilized as one of the achievable solutions to manage with this limitation. This presents the main motivations behind using multipath routing approach in wireless sensor networks[2]. The real idea of using multipath routing approach in wireless sensor networks was to provide path toughness and consistent data transmission. In the fault tolerance domain, whenever a sensor node cannot forward its data packets towards the destination, it can profit from the availability of alternative paths to rescue its data packets from node or link failures. Through this method, as long as an alternative path is available from a target area towards the destination node, data forwarding can be continued without any disturbance even in the case of path failure. Multiple paths also can be used simultaneously to lift data transmission reliability[3]. There are two different approaches to provide consistent data transmission through concurrent multipath routing. The initial approach is based on transmitting one or more copies of an original data packet over different paths to guarantee packet recovery from several path failures. Through this system, data transmission consistency can be guaranteed, if data forwarding over at last one path is done effectively. Removal coding is another method used by some of the presented protocols to provide desired reliability demand of different applications. Based on the utilized coding method, each source node adds some additional information to the original data packets and then distributes the generated data packets over different paths. To reconstruct original packets, at last a certain number of transmitted data packets from each source node should be received by the end node. Accordingly, if a few numbers of paths failed to transport some data packets to the end node, still the reliability of data transmission can be guaranteed through reconstructing data packets from successfully received data packets by the end node[4].

Benefits of Multipath Routing:

- **Reliability and Fault-Tolerance:**

The real idea of using multipath routing in WSN was to provide path toughness and reliable data transmission. In the fault tolerance domain, whenever a sensor node cannot forward its data packets towards the end, it can profit from the ease of use of alternative paths to rescue its data packets from node or link failures [5].

- **Load Balancing:**

As transfer distribution is not equal in all links in the network, distribution the traffic along multiple routes can improve congestion in some links and bottlenecks[6].

- **QoS Improvement:**

QoS maintain in conditions of network throughput, end-to-end latency and data delivery ratio is an important objective in designing multipath routing protocols for different types of networks [5].

- **Reduced Delay:**

The waiting time is minimized in multipath routing because backup routes are recognized during route invention [

- **Bandwidth Aggregation:**

Dividing data to the same destination into multiple packets while everyone is routed through a various path, the effective bandwidth can be aggregated. This strategy is particularly profitable when a node has multiple low bandwidth links but it requires a bandwidth that is greater than the one which an individual link can provide [7].

Data Transmission Reliability:

Transfer one or more copies of data across different paths, multiple paths can be used simultaneously to improve consistency. As long as one of the multiple paths does not fail, the destination node will receive the data [8].

To increase the chance of data delivery,the redundancy of data is delivered in the form of multiple copies of the same packet which travels to the destination among multiple paths [9].

III. RELATED WORKS

H-SPREAD:

H-SPREAD proposed an expansion to find more further routes at cost of additional messages, by breaking the property of using "one message per node". When a sensor node invents a new alternative path, it informs its nearby about it. Repeatedly, this information is propagated through the network to exploit the number of disjoint paths per node [10]. In less risk conditions the improvement would be more important .The consistency performance of H-SPREAD is able to maintain attractive good message delivery ratio in the face of both link and node failures that the situations we studied are very stressful [11].

N-to-1 Multipath Routing Protocol:

This protocol finds various node-disjoint paths between a destination and a source node and also multi-paths, which are used to issuing the traffic to improve the consistency and safety of the data transmission by traversing the tree. The N-to-1 routing protocol does not take the node energy level during the route creation stage [12].

Multipath Multispeed Protocol (MMSPEED):

It is an expansion of the SPEED protocol [13]. It is characterized by offering multi-speed transmission and the establishment of more than one path to the destination. For each offered speed, a Quality of service(QOS) level and an extra path can be set to improve the quality of traffic. This protocol allows to send packets with respect to end delay parameter required by the applications in order to avoid

congestion and minimize the packet loss rate [14].It is designed to provide probabilistic QoS differentiation with respect to timeliness and consistency domains. For the timely delivery of packets. This provides multiple delivery speed options for each incoming packet. Thus, the protocol is scalable and adaptable to large networks. The only limitation of the protocol is that the energy metric is not taken into consideration [15].

Multi-Constrained QoS Multipath Routing (MCMP):
Multi-constrained QoS multi-path routing (MCMP) protocol that uses braided routes to deliver packets to the destination node according to certain QoS requirements expressed with consistency and delay. The protocol's objective is to utilize the multiple paths to increase network performance with fair energy cost. The protocol always routes the information over the path that includes minimum number of hops to satisfy the required QoS, which leads in some cases to more energy consumption [16].This MCMP routing algorithm trades exact link information for sustainable computation, memory and overhead for resource limited sensor nodes [17].

Energy Constrained Multipath Routing (ECMP)
Energy constrained multi-path routing (ECMP) extends the MCMP protocol by formulating the QoS routing problem as an energy optimization problem constrained by consistency, play-back delay, and geo-spatial path selection constraints. This protocol trades among less number and energy of hops and by selecting the path that satisfies the QoS requirements and reduces energy utilization [16].

IV. FINDINGS

In this study we came to know that the energy efficiency is to be concentrate more in WSCNs. Except ECMP all other protocols were not satisfying the energy efficiency in wireless sensor communication networks.

Table 1

Protocols	Path Disjointedness	Energy-Efficient	Delay	Fault-Tolerance	Reliability	scalable large	QoS
H-SPREAD	Node-disjoint	No	No	No	Yes	No	No
N-to-1	Node-disjoint	No	No	No	Yes	No	No
MMSPEED	Partially disjoint	No	Yes	No	Yes	Yes	Yes
MCMP	Partiallydisjoint	No	Yes	No	Yes	Yes	Yes
ECMP	Partially disjoint	Yes	Yes	No	Yes	No	Yes

V. CONCULSION

Routing in Wireless sensor Communication networks is a new area of research, with a limited, but rapidly growing set of research results. In this paper, we presented a comprehensive survey of Multi path routing techniques in wireless sensor networks which have been presented in the literature. They have the common objective of trying to extend the lifetime, Qos, Reliability etc. Although many of these routing techniques look promising, there are still many challenges particularly Extending the life time, that need to be solved in the WSCNS . We highlighted those challenges and pinpointed future research directions in this regard.

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