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Data Rate and Remaining Power Based Multi hop Routing Protocol

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Abstract—Wireless multimedia sensor network (WMSN) is an apparatus equipped with multimedia devices. The sensors have the ability to record audiovisual datas and deliver the multimedia content through the sensors network. Because of multi rate and power, the consumption of devices used in WMSN networks brought more challenges to designing efficient protocols that are both aware of power and transmission rate.A research paper firstly discusses the challenges of routing protocols currently used, and secondary presents a new algorithm data rate and remaining power based multi-hop routing protocol.

Keywords— WSNs, WMSNs, AODV, Transmission Rate, and Power-based multi-hop routing

I. Introduction

The design challenges of routing protocols currently used in WMSNs considered having strict power constraints and high data rates as compared to the traditional wireless sensor network. A large number of routing protocols have adopted different major strategies: on-demand such as in AODV and DSR, and proactive such as in DSDV and OLSR. Originally, the vast majority of these protocols were designed for single-rate networks and thus have used the shortest path algorithm with a hop count metric (min hop) to select paths. While min hop is an excellent criterion in single-rate networks where all links are equivalent, it does not accurately capture the trade-offs present in the more complicated multi-rate networks. Transmission Count Metric (ETX) brought a multi-rate support algorithm that selects and minimize the expected number of transmissions required to deliver a packet from the source to the destination but this algorithm fails to take into account the remaining power of nodes and might route the packets over highly weak nodes likely to die during packets transmission. This leads to an increase in congestion, delay, and packet losses, which in turn may cause retransmission of packets, thereby, increasing energy consumption [1].

Newly algorithm data rate and remaining power based multi-hop routing protocol presents the logical sequence design and performance of the routing protocol. It deals with both remaining power and transmission rate to ensure that the selected route is reliable. It finds a solution to a problem caused by not considering the remaining power battery of each node during route decision.

Table 1: WMSNs routing protocols [2]

Category	Approach	Idea
Minimum hop count	AODV [3]	Reactive protocol establish and maintain an ad-hoc network
Medium Time Metric	ETX [4]	Measure link reliability and select the paths to the destination

A. *WMSNs difficulties*

WMSN criteria make routing protocol architecture quite complex and capacity limitations. The Wireless multimedia sensor network applications produce a high volume of traffic that requires high transmission rate, power demand and processing capabilities which lead to consuming more energy than WSN. Quality of service parameters metrics (latency, bandwidth, reliability, jitter) must be considered unequally as needed. To preserving a high compression ratio in conventional WSN it was necessary to reduce bandwidth and energy usage. Multimedia sensor network requires a high bandwith traffic demands therefore new transmission techniques to provide an appropriate level of energy consumption to the necessary bandwidth in order to optimize the resource constraints of WMSN nature considered.

II. Multi-rate routing scheme considering remaining power

WMSNs considered having strict power constraints and high data rate as compared to traditional WSNs. Typically various protocols have adopted different major strategies: on-demand such as in AODV [5] and DSR [6], and proactive such as in DSDV [7] and OLSR [8]. The vast majority of these protocols were originally designed for single-rate networks and thus have used the shortest path algorithm with a hop count metric (min hop) to select paths. While min hop is an excellent criterion in single-rate networks where all links are equivalent, it does not accurately capture the trade-offs present in the more complicated multi-rate networks. Expected Transmission Count Metric (ETX) [9] proposed as multi-rate support algorithm that selects paths that minimize the expected number of transmissions required to deliver a packet from the source to the destination but this algorithm fails to take into account the remaining power of nodes and might route the packets over highly weak nodes likely to die during packets transmission.

A. *Energy-Aware, Multi-rate aware and proposed algorithm*

1) *Energy-Aware:*

- The energy consumed for every packet transmission is different according to the selection of the routing path. Therefore, a packet that re-transmitted many times before reaching its destination will use more energy than the one re-transmitted fewer times.
- If a route selection strategy uses some nodes consistently more than others, then their energy will be consumed faster, and they will "die" sooner. When a critical number of nodes in the network have no energy, then the network cut off and the communication among the sensors will become impossible. To overcome this problem, power-aware route selection mechanisms needed. The new routing scheme has been proposing to make multi-rate AODV energy efficient and for all practical purposes, it has been assuming that battery status must be divided into 3 categories:

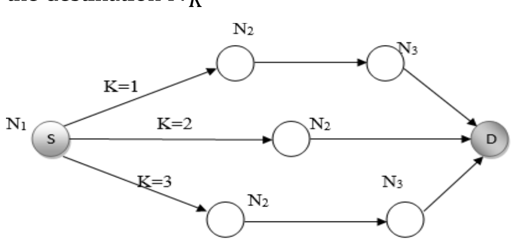
1)If (battery status < 20%) It is danger state.

2)If (20% > battery status < 50%) it is critical state

3)If (battery status > 50%) It is active state

We define all nodes includes in all possible paths to the destination by the following formula: N_I, K ∈ N_K

Where N_I are nodes in K^th path from all candidate paths to the destination N_K



Candidate paths =3

2) *Multi-rate aware*

Problem definition of multi-rate aware; Figure.1. Represents a topology with node connectivity and available data rate of each link. We assume that each node uses IEEE 802.11b so that each link has a different data rate that related to the distance of two nodes. The routing protocol (e.g., DSR or AODV) will select routes A, C, E because it based on shortest hop count. However, if we route data through A, B, C, D, E instead of A, C, E, we can utilize higher link bandwidth. This may increase the number of hop count, consequently, the channel access overhead (e.g., backoff time) could be increased in proportion with a hop count. However, it can reduce link-level transmission time (= packet size/Bandwidth), which is highly affected by the packet size. By reducing transmission time, we can achieve better throughput and always reduce the total energy consumption in the network-wide but since the route selected based on better throughput, some nodes are likely to be used several times and their power discharged very fast, then the network will become partitioned, and the communication among the sensors will become impossible.

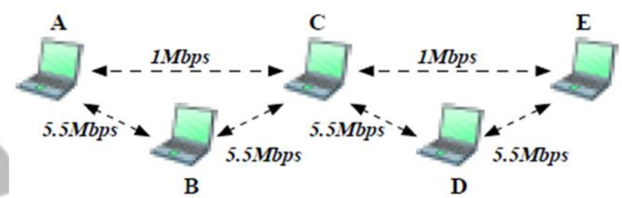


Fig. 1. Multi-rate network topology

3) *Proposed algorithm*

Based on the above route selection schemes, we have proposed a new scheme that aims at improving the network lifetime

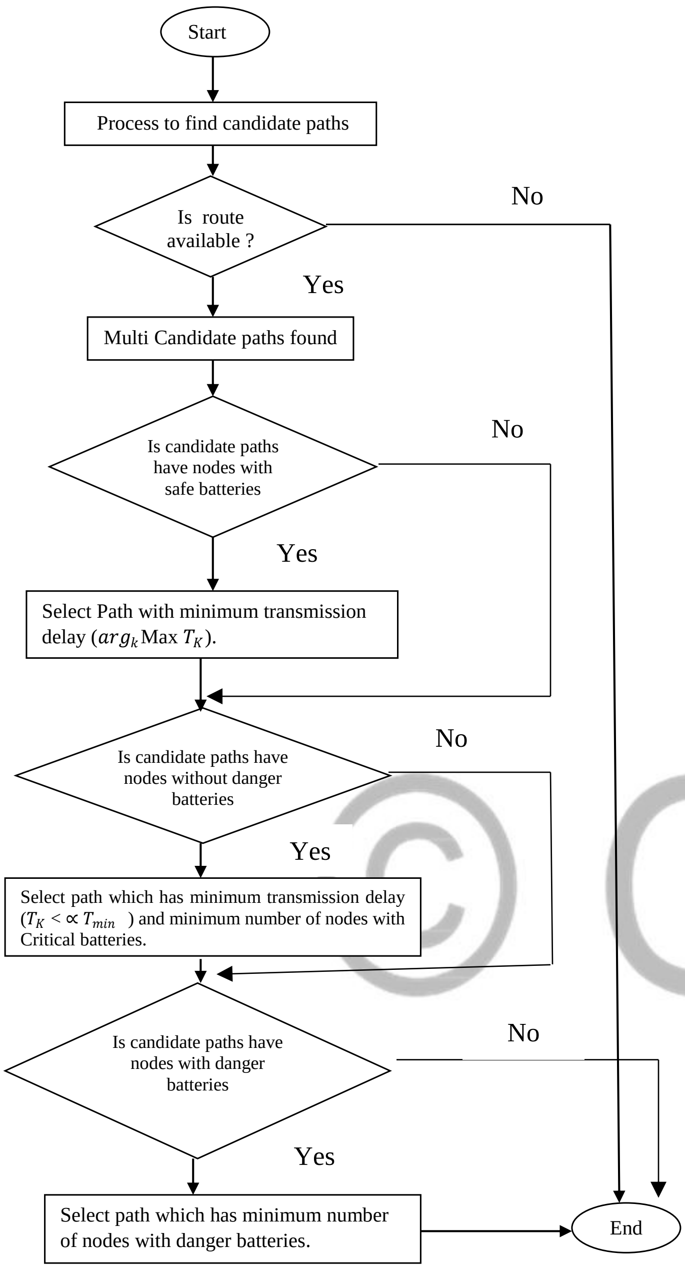


Fig. 2. Multi-rate routing based on the remaining power flowchart

Figure. 2. Is demonstrating the logical sequence design of how the proposed routing protocol performed. Due to multimedia data (image, voice, videos, etc.) which require high transmission rate and consuming more energy, most of current routing protocols continue to face the challenges of delay, packet loss and congestion that caused by not considering remaining power battery of each node during route decision. This multi rate routing scheme considering remaining power deals with both remaining power and transmission rate to ensure that the selected route is reliable.

Table 3: Battery power of each node

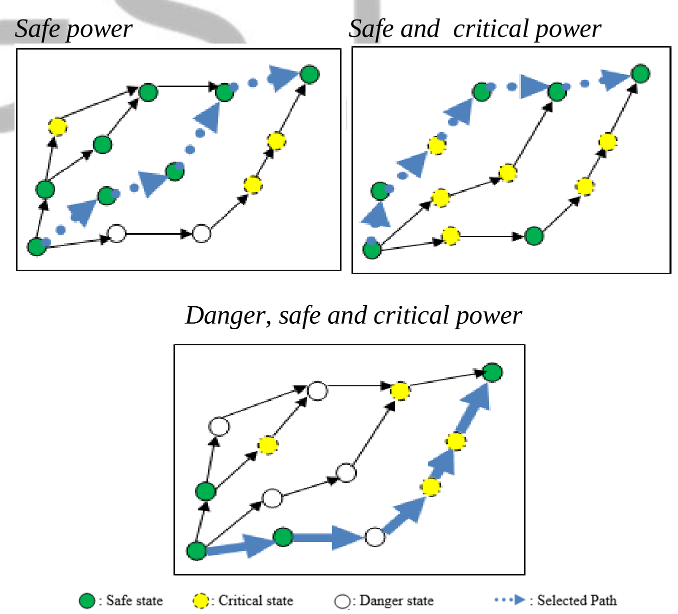
Category	Power %	Condition
Safe power	Above or equal 50%	Power is trusted to deliver the packet
Critical power	Below or equal 20%	Minimum power trusted to deliver the packet
Danger power	Less than 20%	Untrusted power to deliver the packet

III. Route Selection Algorithm

A. Transmission Rate and Power-based multi-hop routing algorithm:

RREQ- Route request send to discover the path. From different multi-paths found, the power and transmission rate will be evaluated and select route as follow:

1) If Paths ∈ S (Safe);
Select the Path = path with minimum transmission delay (arg_kMax T_K);
2) Else if Paths ∈ S && C (Safe & Critical)
Select paths which have $T_K < \propto T_{min}$ then among these paths, Select path, which has the minimum number of nodes in C.
3) Else if Paths ∈ S && C && D (Safe & Critical && Danger)
Select the path, which has the minimum number of nodes in D.



IV. Conclusions

In this paper, a new WMSN algorithm data rate and remaining power based multi-hop routing protocol created. The bottlenecks of routing protocols currently operate surveyed and discussed.The novelty lies on route selection by considering both remaining power and high transmission rate of each channel.

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