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Priority-based Traffic Control Mechanism in Wireless Multimedia Sensor Network

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Abstract. Wireless Multimedia Sensor Networks should transfer a large quantity of multimedia data in a timely manner within a limited time; thus, it is very important to provide a low degree of delay and the maximum throughput. This paper proposes an efficient traffic control mechanism of multimedia data requiring real-time transmission in wireless multimedia sensor network with the path determination based on path cost. The proposed mechanism conducts routing by calculating path cost in accordance with the priority of packet by using the hop count up to the sink, the information on residual energy quantity of neighbor nodes and the quality of wireless communication link. The proposed traffic control mechanism can guarantee real-time of multimedia data and the quality of service required by users through performance analysis. Also, it enhances the network reliability and energy efficiency by minimizing the energy consumption.

Keywords: Traffic Control, Energy Efficiency, QoS, WMSN

1 Introduction

The miniature CMOS image sensor module has been recently developed. As a result, there are many studies currently in progress in relation to wireless multimedia sensor networks(WMSNs) that process not only numerical data such as temperature, humidity, etc. but also multimedia data such as voice or video[1][2]. The previous works on wireless multimedia sensor network have focused on energy retention in order to prolong the network lifetime. However, it is imperative to support for the quality of service(QoS) to transmit multimedia data promptly and reliably in wireless multimedia sensor networks [3] [4].

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This paper proposes a traffic control mechanism to efficiently process the multimedia data requiring real-time transmission in wireless multimedia sensor networks. The proposed mechanism conducts routing by calculating path cost in accordance with the priority of packet by using the hop count up to the sink, the information on residual energy quantity of neighbor nodes and the quality of wireless communication link. Thus, it reduces end-to-end delay and possesses long network lifetime even while supporting for QoS in accordance with the priority of packet.

2 Related Works

The recent researches on traffic control mechanism have mainly focused on low power technologies to prolong the sensor network survival time by balancing the entire use of sensor node energy in wireless sensor networks [5][6]. In this regard, there are many studies currently in progress as to the traffic control mechanism to allow users to select an uncongested path with a small hop count and low power consuming path. In addition, there are the other studies currently in progress in relation to the IP routing techniques, scalability, cross-layering routing, dynamic address assignment, network topology control, mobility support technology, etc. for connecting to IP network in sensor networks.

3 Proposed Traffic Control Mechanism

The proposed traffic control mechanism in this study shall take into consideration the characteristics in accordance with the traffic pattern to which the packets to be transmitted belong. The reason why the packet traffic pattern should be considered is that transmitting promptly high priority data such as real-time multimedia traffic and pre-determined field monitoring allows for the support of service differentiation to guarantee QoS. Packet priority transmits the level for quality of service by three steps of green, yellow and red in accordance with the data information to be transmitted by corresponding packets at a source node by using packet marking algorithm[7]. The level for quality of service is transmitted to a sink node after being saved in the priority field within packet. Wherein, green means the packet with the highest importance, whereas red means the packet with the lowest importance. Yellow packet possesses an intermediate level of importance between green and red. Table 1 shows the detailed fields of routing table.

The path cost would be estimated by considering hop count toward sink, residual energy of neighbor nodes and link quality. Green packet's path cost is calculated such that green packet conducts reliable transmission by a high quality link of the shortest distance since the packet loss rate and delay are reduced. Red packet does not consider a high quality link of the shortest distance; thus, it has a high degree of packet loss and delay. However, the quantity of packets to be lost on the way is small as the residual energy quantity is given a priority; thus, it is effective in terms of reliability. Yellow packet to use the intermediate path of green and red packets will

have more capacity in terms of resource utilization; thus, the overall transmission rate will be enhanced.

Table 1. Routing table.

Field Id	Description
Node ID	Node Number
Neighbor Nodes	List of neighboring nodes
Hops	Hop count of neighboring nodes up to sink node
Energy Level	Residual energy quantity level of neighboring nodes
LQIs	LQI values of neighboring nodes
Path Costs	Path cost up to sink node for each packet priority(green, yellow and red) of neighboring nodes
Next Node	Next node for each packet priority
Alternate Node	Alternate next node for each packet priority

4 Performance Evaluation

For performance evaluation, the simulation was conducted on the min hop routing technique, CR-WMSN [4] QoS routing protocol, the mean throughput of proposed traffic control mechanism, delay between terminations and network lifetime.

Figure 1 shows the results of simulation as to the mean end-to-end delay time of packet. As a result of the experiment, the mean end-to-end delay for the min hop routing protocol has increased rapidly with an increase in the number of sources. On the other hand, the mean delay time will gradually increase with an increase in the number of source nodes in the case of CR-WMSN routing technique. The proposed mechanism showed the result that the mean end-to-end delay time was more different for each packet priority than CR-WMSN routing technique. In the case of yellow and red packets, the mean end-to-end delay is less serious than the min hop routing technique. However, the delay has increased by more than CR-WMSN routing protocol. Green packet has the highest priority and its packet loss rate and delay were reduced by transmitting with a high quality link of the shortest distance rather than the residual energy quantity.

5 Conclusion

This paper proposed a traffic control mechanism to efficiently process multimedia data requiring real-time transmission in wireless multimedia sensor networks. The proposed traffic control mechanism reduced the end-to-end delay and improved the network lifetime while supporting for QoS in accordance with the packet priority by setting the path in consideration of LQI value that could identify the hop count up to a sink, information on residual energy quantity of neighboring nodes and link quality depending on the packet priority.

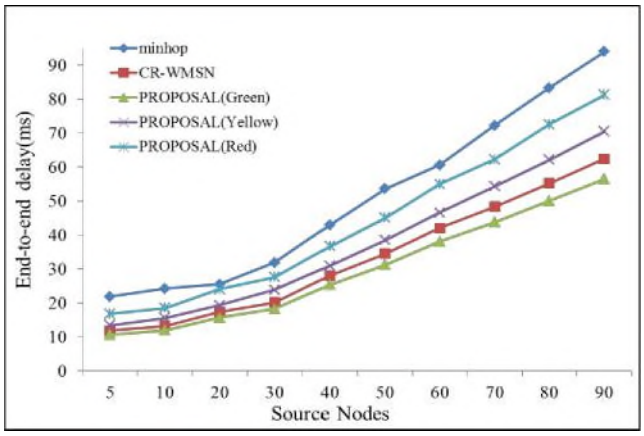

Fig. 1. Average end-to-end delay

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