Transmission Control for Highly Efficiency Data Gathering in Packet-Level Index Modulation

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1. Introduction

The authors considered a mathematical optimization of the mapping format for minimizing the collision probability of two packets in the PLIM(Packet-Level Index Modulation)[1]. In addition, as the packet collision occurs, the premeasured average value of sensing data is used for compensating the loss of the sensing data. When this data compensation is performed in the receiver, the mapping format between the sensing data and the index is constructed by the minimum mean square error [2]. This paper proposes the transmission control of each sensor in the PLIM for suppressing the packet collision as well as improving the recognition of the monitoring environment.

2. Proposal: Transmission Control

In considered system, the lost data caused by the packet collision is compensated by the pre-measured mean value of sensing data [2]. In the proposed transmission control, if the measured sensing data is equal to the pre-measured average value or within one quantization level around this pre-measured average value, the sensor stops the transmission. Although the receiver fails to receive the sensing data, the receiver can compensate it by the pre-measured average value. Owing to the proposed transmission control, a fewer frequently the data transmission of each sensor is, a fewer packet collision occurs. As a result, the packet delivery becomes more successful and thus the proposed transmission control improves the accuracy of recognition to the monitoring environment.

3. Simulation Results

In this paper, a radio sensor is used to transmit the RSSI (Received Signal Strength Indicator) observed from the radio source to the aggregation station as sensor information. The RSSI is quantized to a fixed width interval, converted to a value called RSSI Number, and transmitted. A flowchart on transmission is shown in Fig.1. The simulation results are shown in Fig.2. The simulation parameters are the same as in [2]. The packet collision probability and RSSI Number errors for different numbers of aggregate sensors are compared for four mappings. The evaluation criterion, the RSSI Number error, is the RSSI value error divided by the quantization interval. The dotted graph indicates the performance with the proposed transmission control. Fig.2(a) compares the packet collision probability and Fig.2(b) compares the RSSI Number error. In Fig.2(b), all mappings also apply a process of supplementing to the average value in the event of packet collisions. By using the proposed transmission control, the amount of sensor transmissions can be reduced by about 24 %. In addition, the number of aggregate sensors can be increased by one unit when the collision rate of 3 % is used as the criterion in the comparison between the solid green line and the dotted line in Fig.2(a). Next, if the recognition error of RSSI is 0.8 in comparison with the solid black line and the dotted black line in Fig.2(b), the number of aggregate sensors can be increased by one.

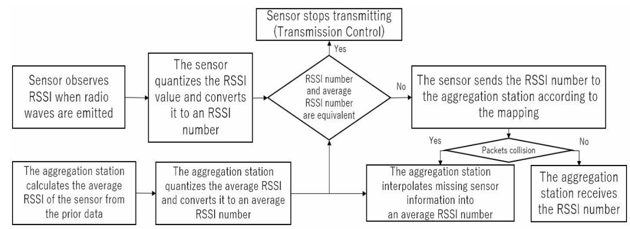
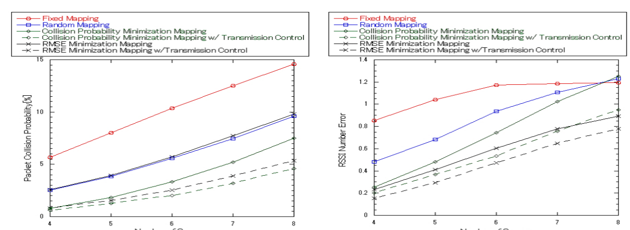


Fig. 1 Transmission Flowchart



(a) Packet Collision Probability (b) RSSI Number Error

Fig. 2 Simulation Results

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References

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