Performance Analysis of EPCglobl Gen−2 Q−Algorithm According to Weight and Initial Slot−Count

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ABSTRACT

In Gen−2 Q−algorithm, the value of initial Q_{fp} and weight C is not defined in the standard. If we let the initial Q_{fp} be large or small, the number of empty slot will be large during the initial query round or almost all the slots will be collided, respectively. Also, if the reader selects an inappropriate weight, there are a lot of empty or collided slots. As a result, it is anticipated that the performance will be declined because the frame size does not converge to the optimal point quickly during the query round. In this paper, we analyze how the performances of Gen−2 Q−algorithm will be affected by the weight and initial slot−count size.

키워드
RFID system, anti−collision algorithm, Q−algorithm, EPCglobal Class−1 Gen−2.

Ⅰ. INTRODUCTION

In Q−algorithm, the slot−count size may be incremented or decremented according to the status of reply slot. The standard did not specify the optimal weight C values, but suggests that the reader typically uses small values of C when the slot−count is large and larger values of C when the slot−count is small [1]. Also, the initial value of Q_{fp},which is the slot−count parameter of Q−algorithm, is not defined in the standard. If we let the initial Q_{fp} be very large, the number of empty slots will be large during the query round. On the other hand, if the initial Q_{fp} is very small, there will be a lot of collided slots [2]. Therefore, the performance of Q−algorithm will be dependent on the weight and initial slot count size. In this paper, we analyze how the performance of Q−algorithm will be affected by the weight and initial slot−count size with computer simulations.

Ⅱ. GEN−2 Q−ALGORITHM

Q−algorithm basically calculates the slot−count parameter Q based on the result of tag reply in a slot. The slot status is classified into three categories: success, collision, and empty slot.

Fig.1 shows an algorithm that the reader might use for setting the slot−count parameter Q in a query round. In the figure, Q_{fp} is a floating−point representation of Q. As shown in the figure, the reader updates Q_{fp} in accordance with the slot status at every slot. When a collision occurs, it adds the weight C value to the previous Q_{fp}, because it means the slot−count is smaller than the number of tags. If the result of tag's reply in a slot is idle, which means that there are no tag responses in the slot, the reader subtracts the weight C value from the previous Q_{fp}, because the slot−count is larger than the ideal one. When a new query round begins, the reader rounds Q_{fp} to an integer value Q in the Query command. Typical values for the weight C are $0.1<C<0.5$. EPCglobal Class−1 Gen−2 standard suggests that the reader typically uses small values of C when Q is large and large values of C when Q is small.

Ⅲ. SIMULATION RESULTS

In Q−algorithm of Gen−2 RFID system, the initial Q_{fp} is not defined in the standard. Also,

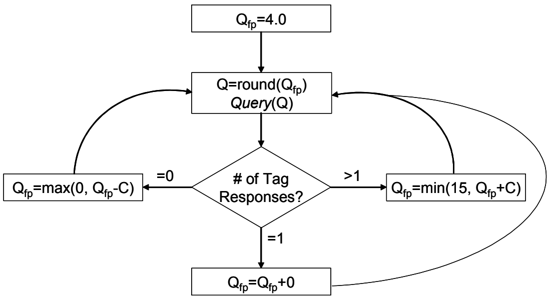

Fig.1. Q-algorithm.

the weight C values are not optimized. Therefore, in this section, we analyze how the performances of Gen-2 anti-collision algorithm are influenced by the initial Q_{fp} and weight depending on the number of tags within the identification range of reader.

The performance analysis was done by the computer simulations. The simulation parameters are same as the reference [3]. We assume that the Query commands will be transmitted as follows:

① When there is a successful reply, the reader transmits QueryRep command.

② When there is a collided reply or no reply, the reader sends QueryAdjust command if the slot-count gets changed or QueryRep command if the slot-count has no changes.

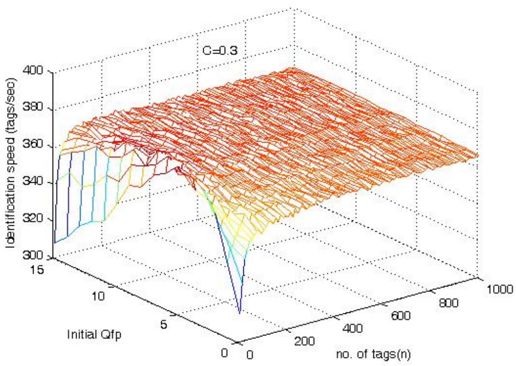

Fig. 2. Identification speed according to initial Q_{fp}.

Fig.2 shows the identification speed according to the initial Q_{fp}. The weight C value is assumed 3.0. As shown in the figures, if we let the initial Q_{fp} be very small or very large, the identification speed decreases when the number of tags is very small. This is because: i) if we let the initial Q_{fp} is very small, almost all the slots will collide, ii) if the initial Q_{fp} is very large, there are a lot of empty slots. Therefore, in order to maximize the performance, the optimal initial Q_{fp} value should be allocated according to the number of tags.

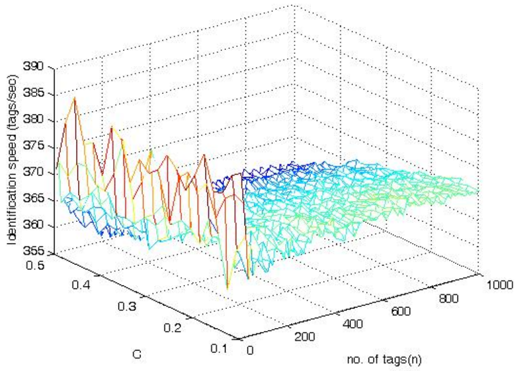

Fig. 3. Identification speed according to weight *C*.

Fig.3 depicts the identification speed according to the weight C. As shown in the figures, when the number of tags is small, the identification speed fluctuates severely. Also, the performance decreases when the weight C is getting large. When the weight is large or the number of tags is small, the slot-count size may vary frequently. As a result, the slot-count does not converge to the optimal point quickly. Therefore, it seems that the weight has to be adjusted according to the slot-count size of current query round.

IV. CONCLUSIONS

This paper showed the performance analysis results of Gen-2 Q-algorithm according to the initial slot-count and weight values. The simulation results demonstrated that if the initial slot-count was fixed with very small or large values, the identification speed and efficiency fluctuate severely when the number of tags is small. Also, the results showed that the performance decreases when the weight is increasing.

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