Report of project2

Shengyi Zhao

990160

1. Instruction

RFID is a kind of method to identify many kinds of things. Like the books ins the library and the products in the super markets. This method can help the system to transmit information with the label of the products.[1]

At present, all electronic tags in the same RFID system usually share the same wireless channel. When multiple electronic tags send signals to the reader at the same time, the information sent by different tags will interfere, so that the reader cannot be timely. The information of each electronic tag is accurately identified, thereby generating an RFID electronic tag conflict. The anti-collision algorithm is one of the effective methods to solve the multiple tag conflict problem in RFID systems. Therefore, designing an efficient multiple label anti-collision algorithm is the main problem and bottleneck of the current widespread application of RFID systems.

And the main anti-collision protocols usually are two kinds. The first kind of protocols is the tree structure like ABS and AQS proposed by Myung. [5]The second kind is based on Aloha protocols. Like 16.65 MHz ISM Band Class, ISO 18000-6A and C, EPI C1 Gen2 and some adaptive dynamic framed-slotted Aloha. In this report, I will introduce some of these methods, and give the advantages and disadvantages of each method. That can help us find out the characteristics and consider the future directions.

2 The Algorithm Based on Tree System

Based on the binary tree-based algorithm, Fikenzeller K proposed BS (Binary Search algorithm, which has the advantage that the algorithm implementation is concise, but the number of reader requests is too large and the tag return data is too large.
Using 0 and 1 to identify all the labels which send signals to the reader system. And we use binary tree to decide which labels should be read at first. And the labels should send signal again as sequence.

2.1 Improved Binary Search

Most basic binary tree anti-collision algorithm have many problems such as the number of requests from the reader and the amount of data returned by the tag are large. I will discuss an improved stack-based RFID binary tree anti-collision algorithm. This algorithm has the advantages of less request times, small amount of tag data transmission, fast recognition speed and low energy consumption.
This protocols also ask the labels send a ID with number 0 and 1. So the system can judge if there is collision. Secondly, if there is only a conflict between two labels. The system can identify sequence of labels. If there are more than one conflict. The system will replace first conflict by 0 ,send back the ID and replace other numbers with conflict by *. The label with same ID before first * will send their ID. Repeating this approach can get the signals from all the labels as sequence. By this way can we decrease request times, amount of tag data transmission, energy consumption and increase recognition speed.

3 Aloha

For the protocols based on Aloha. There are some difference between the details of these. Protocols. But they can be classified as three types by the main methods they use: simple Aloha, static framed Aloha and adaptive dynamic framed Aloha. And I will discuss the main part of each kind of protocols.[6]

3.1 Simple Aloha

Like the Aloha used in internet communication, the Aloha protocols use random time of waiting to solve problems of conflicts. It have a system of receiver. And it can receive the information from the labels on products. The system can identify the tags correctly if there isn't another tags send message at same time. But if there is a conflicts that more than one tags send the information, the receiver system will send a message to ask the tags wait random time and send their message again.

3.3 Static framed Aloha

The static frame slot Aloha algorithm is an improvement to the Aloha algorithm. In this algorithm, time is divided into multiple discrete time slots, N time slots form a frame, and the tag can only transmit signals at the beginning of each time slot. The reader sends the interrogation signal in a frame period. When the tag receives the inquiry request from the reader, each tag randomly selects a time slot and transmits its own ID code in the time slot. If a time slot Only selected by one tag, the ID code transmitted in this time slot will be successfully received by the reader, and the tag will be identified. If more than two tags select the same time slot to send the ID code, the conflict occurs, the reader The tag that sends the ID code cannot be identified. In this way, all tags are identified. The size of the frame is fixed, so if the number of tags at a certain time is much larger than the number of slots in the frame, then in one The probability of collisions in the frame will be increased, and the wasted time slots will also increase, extending the time to identify all tags.

3.3ADFA Protocols

The ADFL protocols is a adaptive dynamic framed Aloha method. It asked the system of reader has two counters:a slot counter and a readable counter. The SC add one after a time slot. If the SC is larger than the length of frame. The frame will end. And the RSC will add one after a readable slot to record the amount of readable labels. And the system will judge if the label is readable,is blank or have conflict. And the receiver system also have two counters: A tag slot counter and selected slot number. When the TSC>SSN, we know that this tag hasn't been identified is this frame. And if the tag send the message to the reader system and the system find out it's readable. The system will record it and the tag will become quiet until this frame is over.

This method can help us solve the problem of conflicts. And the most important problems of this methods is deciding the length of the frames. If it's too long, there will be many blank slots. But if it's smaller than the number of products, the efficiency of recognizing the labels on products will be low.

The method of adjusting the frame length can be roughly divided into two categories:The first type: By real-time estimation of the number of tags in the RF range of the reader, N, set the number of slots in the frame (the length of the frame) F = N. There are many specific estimation methods.

The second type: change the length of the frame according to a certain change rule. A common method is to adjust the length of the frame by using a ratio of q = 2, and when the collision rate is high, the length of the frame is doubled. When the rate is low, the length of the frame is halved.[2]

4 Comparison of Key Approaches

4.1 Comparison between same kind

As what I discussed above, we can find out most of improved algorithms want to improve some aspects of obvious protocols.

For the algorithms based on the basic binary tree, they try to using less request times and amount of tag data transmission, which can also improve the recognition speed. Like Regressive Style Binary Tree. This algorithm implements the ordered reading of the label, reducing the number of requests, but the disadvantage is the amount of data returned by the tag is still too large. Dynamic Binary Search improve the BS algorithm and the RSBT algorithm by effectively reducing the number of requests, but

DBS algorithm still has problems of too many tag return digits. Reduced Dynamic binary algorithm based on stack has greatly improved the number of data returned by the tag, but the number of requests is not very large. Comparing these algorithms, the Adaptive Reduced Dynamic binary algorithm is much better.

For the algorithms based on Aloha. The simple Aloha may have large amount of conflict because of giving random time to send the signals again. And if there are so much labels, the work of solving problems will be huge. But if the chance of conflict is very small, like car park system of identify the cars. The sample Aloha is useful and simple.

For the static framed Aloha, if the number of tags at a certain time is much larger than the number of slots in the frame, the probability of collision in one frame will be increased, and the wasted time slot will also increase, thereby prolonging the time for identifying all tags. But if there aren't very much labels, This algorithm is very useful. The adaptive dynamic framed-slotted Aloha is hard to be established. But it can solve series problems of much labels.

4.2 Comparison between different kinds

Comparing the difference of tree algorithms and Aloha algorithms, we can find out the structure of tree algorithms is simple. But these kinds of algorithm need the labels return their ID. Their will be many transmission between reader system and labels. And the work of judgement made by reader system is huge. It's hard to be completed in some situation. And the improvement based on binary tree algorithms is hard. Considering how to decide the length of frame, we can find out there is hug space of improvement of Aloha protocols. But deciding it is still very hard. We can't consider all the situation of changing of labels before the computers.

5 Conclusions and Future Directions

5.1 Conclusion

Considering the protocols we have now. The Improved Binary Search and ADFA Protocols have higher efficiency. If we want choose one of them. I think if we have fewer labels need identify, we can choose Improved Binary Search. But if the amount of labels is huge and the situation of labels is stable, the ADFA is better. Of course if we have fewer labels and fewer conflict, other simple protocols is a good choice.

5.2 Future Directions

Considering many people have spent much time in improving these two kinds of algorithms, it's so hard to improve them. So I think better solution is using other kinds of algorithms like the protocols have been used on internet transmission today. Maybe we can find out a algorithm which can have better performance after changing some details.

Reference

[1] Finkenzeller, K RFID handbook:Radio-Frequency Identification Fundamentals and Applications[M]. 2nd ed. New York:John Wiley and Sons,2003:1-100

[2] Haifeng Wu and Yu Zeng,ADFA Protocol for RFID Tag Collision Arbitration [C]Journal of Computer Research and Development，2011：802-810.

[3] Bo Feng and Jingtao Li,A Novel Anti-collision Algorithm for Tag Identification in RFID Systems[C]ACTA AUTOMATICA SINICA，2008：Vol 34, No6.

[4] Chunhua Wang and Jing Xu,Improved RFID tag recognition anti-collision algorithm [C]Computer Engineering and Applications，2011：47(31).

[5] Myung J, Lee W, Srivastava J. Adaptive binary splitting for efficient RFID tag anti-collision. Communications Letters, IEEE, 2006, 10(3): 144−146.

[6] Chaoyang Zhou,Algorithms for Anti-collision in RFID Systems [C]Computer system application，2013：22(10).