An Effective Way to Search Tags from Large Scale RFID System

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Abstract:
Radio frequency identification (RFID) technology has many applications in inventory management, supply chain, product tracking, transportation, and logistics. The research issue of practical importance is to search for a particular group of tags in a large-scale RFID system. Time efficiency is a crucial factor for search protocol to ensure its execution will not interfere with other normal inventory operations. The proposed research work will design a novel technique to reduce transmission transparency during search process, thereby shortening search time.
Keywords: RFID, Tags, large-scale, search time

Introduction

RFID systems can discern many different tags located in the same general area without human assistance. It enables identification from a distance, unlike earlier bar-code technology, it does so without requiring a line of sight. In recent years, radio frequency identification technology has moved from obscurity into mainstream applications.

An RFID system comprises three components: one or multiple RFID readers, a large set of RFID tags, and a back-end server. Each tag has a unique ID to identify the object to which it is attached. Equipped with an antenna, a tag is capable of transmitting and receiving radio signals, through which communications with the readers are achieved. Hence, the readers can collect the IDs and other useful information from tags located in their coverage areas, and then send the gathered data to the back-end server for further process. This paper focuses on the tag search problem in large RFID systems.

Types of Tags:
There are three types of tags.

Active tags
Active tags have an on board power supply, there by enabling them to transmit data at all times

Passive tags
Passive tag have no battery, It must be "powered up" by the RFID reader before they can transmit data.
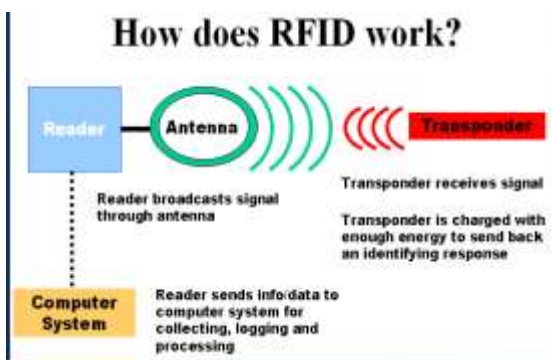
Semi-passive tags
Semi-passive tag use battery, but communicate by drawing power from the reader.

Passive RFID, and particularly the EPC Class-1 Generation-2 standard, promises to enable large tracking applications at much better cost and convenience. This is not only because passive tags cost tens of cents while active tags cost tens of dollars, but because passive tags do not require periodic change of battery. Although passive RFID technology is successfully used in constrained industrial settings. Though many applications have been proposed for passive RFID .

RFID Frequency
The frequency of a RFID system usually refers to the frequency of radio waves selected by reader to sending its predefined data. Various frequencies of RFID system are usually chosen according a particular intended use. For instance, lower

frequencies have a better ability to penetrate through objects which are not metal and water while with a relatively short operating range. On the other hand, higher frequencies, with a limited penetration ability, have a longer operating ranges which can cover a larger area.

Generally there are 4 types of the most commonly used frequencies while not the only 4 frequencies available for RFID, which are LF (nominally 132 kHz), HF (13.56 MHz), UHF (860 - 960 MHz) and microwave (2.45 GHz and 5.8 GHz).10

Low Frequency

Low Frequency usually refers to a operating frequency lower than 135KHz. This kind of frequency has some following special characteristics.

1)They have the strongest ability to recognize the tags even though there are obstructions between reader and tags, also a good tolerance with water and metal environment.

2)They have both the shortest operating range of reading (usually smaller than 60cm) and the slowest speed of reading (smaller than 1m/s).

3)They have the slowest speed of data transmitting, which is lower than 8 kbps.

4)They have a better noise endurance compared with higher frequency but still
unsatisfactory.

5)The LF tags is relatively costly than others. The most common use of LF RFID technology is identification of animals or humans. It is also appropriate as lock-and-key system on a door or a automobile. Due to the limitation of a high cost and a short rang of reading, LF tags can hardly be considered as the worldwide application.

High Frequency

High Frequency is usually referring to the frequency of 13.56MHz. This type of frequency has some following special characteristics.

1)They have good tolerance with water and metal which means they can also work well in the environment with water or metal, even though not as good as LF, but better than UHF.

2)They also have a relatively short read range (usually less than 1m) while a faster reading speed than LF (smaller than 5m/s). 3)The data transmitting speed of HF technology can reach a maximum 64 kbps.

4)A ability of multiple passive tags recognition is impressive in HF systems, for instance, 10 to 100 tags can be read in a second within a range of 1m.

5) HF tags have the lowest cost prices, which is also reflect the big popularity they achieve in current markets.

Nowadays, HF technology is widely used for asset tracking and supplied management, etc.. Although the short read range is still a challenge to HF, there is a solution with a combination of a large size antenna. Moreover, the availability of high power at short range also means that HF tags can acquire a large memory space (up to several thousands bits). This advantage allows a record of unique information stored in tags which is an important function in RFID field.

Ultrahigh Frequency

Ultrahigh Frequency refers to the frequency range from 860MHz to 930 MHz. This kind of frequency has some following special characteristics.

1)UHF is very sensitive to the environment. Which means that places surrounded by water or metal will have significant effect on the performance of UHF.

2) UHF has a longer read range (maximum 6m) while a faster reading speed than HF
(maximum 50m/s).

3)The data transmitting speed of HF technology can also reach a maximum 64kbps.

4)UHF have an outstanding ability to recognize multiple passive tags, for instance, 100 to 1000 tags can be read in a second within a range of 6m.

5)The cost of UHF tags is relatively high since the high frequency circuit in the tags are usually very expensive.

UHF tags are widely used in automobile tolling and rail-car tracking, for a range of several meters add considerable installation flexibility. Meanwhile, they are increasingly used in supply chain management , transport baggage tracking, and asset tracking. Moreover, UHF tags with batteries can provide a range of tens or hundreds of meters, and are used for tracking shipping container and locating expensive individual assets in large facilities.

Microwave

Microwave is a more special, it operates on 2.35GHz and 5.8GHz. This kind of frequency has following special characteristics.

1)Microwave has limited ability to penetrate objects, it almost impossible for
Microwave signal to travel through the medium covered with a water or metal surface.

2) Microwave can reach a reading range of up to 15m for active tags and less than half
a meter for passive tags, and reading speed which is about 10m/s.

3)Because of the highest frequency, Microwave have a highest data rate compared to the other frequencies which are about 64kbps or more.

4) The cost of Microwave tags is also the highest. Due to a limited penetration ability and a very high cost, Microwave is used in some specialize applications, such as airline baggage tracking and electronic toll collection.

RFID Functions

1) **Time calculation:** To reach the Zone with respect to RTC (Real Time Clock)
2) **Tolerance Value:** Registered Time to Zone Reaching Time
3) **Permissions:** Access to be allowed or denied
4) **Profile:** Zones to be separated to allowing the respective profile

Existing System

The polling protocol:

It does not work well when $|X| >> |Y|$. The energy consumption of tags is significant because tags in Y have to continuously listen to the channel and receive a large number of IDs until its own ID is received

CAT protocol:

When optimizing the Bloom filter sizes, CATS approximates $|X \cap Y|$ simply as $|X|$. When $|X| >> |Y|$ it provides Less efficient.

ALOHA protocol:

The ALOHA-based approach defines collision and the reader does not acknowledge positively, the tag will continue participating in the next frame.

Drawback of Existing System

RFID protocol takes a significant step forward in solving the tag search problem, it still has several important drawbacks.

The collecting all RF IDs in *Y*, the reader can broadcast the IDs in *X* one by one. The rough approximation may cause considerable overhead when $|X \cap Y|$ deviates significantly from $|X|$. The number of wanted tags may be *far greater* than the number in the *coverage area* of an RFID system. It can still work under the constraints of $|X| >> |Y|$, it will become less efficient.

Conclusion:

The Conclusion is to resolves tag IDs from crashed signals, thereby improving the identification throughput. The transmitting IDs from tags to a reader more reliably, over a longer distance, and using less energy. The MAC-layer technologies for improving the rate at which a reader can collect IDs from tags.

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