

A Railway Warehouse Information Acquisition System Based on Passive RFID Tag

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Abstract – In this paper, an information collection system is proposed to manage a railway logistics warehouse based on Internet of Things technology. It consists of three layers of information transmission: RFID tag, shelf location identification code, and identification code on PC; i.e. radio communication through the tag, identification code, and identification. The wire communication is achieved through computer. Using the probabilistic power control algorithm to solve the collision problem of multiple readers, simulation experiments are carried out to confirm the expected effect.

Keyword -- *Railway Logistics; Electronic Recognition; Information Collision; Information collision*

I. INTRODUCTION

China's railway logistics management has been gradually moving towards information, but the Artificial process is still the main way of information collection. Application of networking technology will have an important impact on railway construction of logistics information to Achieve logistics information collection, transmission, reception, digital processing, real-time, and to improve overall storage management chain efficiency and competitiveness. Based on networking technology of railway logistics warehouse management system is a combination of hardware and software of integrated management system that consists of a variety of labels, Warehouse area recognition, vehicle recognizer, Beidou tag recognizer, handheld recognizer, repeaters, data transmission channel, transmission interface and tube software components, to achieve the information collection, processing, storage in accordance with the requirements of the actual operation.

II. SYSTEM COMPOSITION

The system consists of four parts: the inter-tag class, reading device, a server communication device and management software.

Label type: One dimensional bar code, two-dimensional code, active tag, passive tag and Beidou Positioning tag

Reading device: Reservoir area identification device, vehicle identification device, Beidou tag identification device, hand held device;

Inter server communication equipment: communication interfaces, repeaters and Compass ground enhancement station ground-based augmentation system;

Management software: Railway Logistics Center PC management software and the existing railway logistics center management information system interface software, etc.

Railway logistics centre networking system layout figure 1.

Different locations using different labels warehousing of goods: One dimensional bar code and two-dimensional code for identification of goods information; Identify pallets and other information changes frequently, identify distant logo; Passive tags are used to identify the shelves, loading and unloading vehicles and other information is not often, identification distance of the identification; Logo Beidou Labeling and out of the warehouse the goods or service vehicles.

The warehousing goods access process using a variety of reading device: Reservoir identifier in the storage access at identifying active tags and passive tags; Vehicle identification mounted on railway logistics center handling vehicle, active tags can be identified, missed the tag and handling vehicle position; The Beidou tag type identification device is installed on the railway logistics center distribution vehicle and the goods, and the active tag and the Beidou Positioning label can be identified; Handheld mobile station identifier equivalent, can scan one-dimensional two-dimensional bar code, identifying active tags and passive tags.

Communication equipment between servers: The Beidou ground base station is installed in the railway logistics center, and the positioning accuracy can reach the centimeter level positioning; The communication interface is connected with the host computer of the host computer, and the repeater is used for the amplification of the long distance transmission signal.

Management software: PC management software through the Internet middleware application business combined with various existing railway logistics center management information system applications, to achieve a variety of networking technology in Railway Logistics Center Management. For example: cargo tracking service, data management and task release, etc.

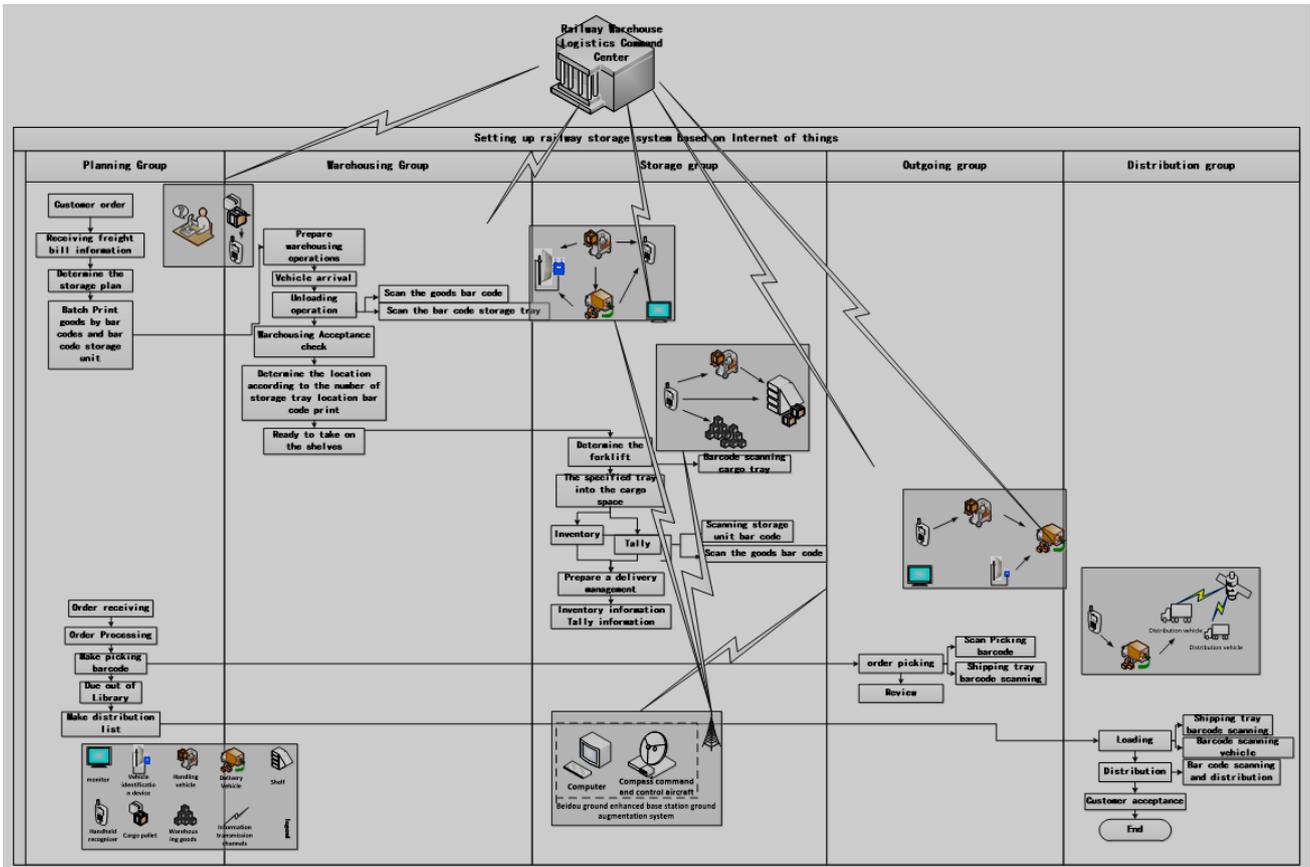


Figure (1): Railway logistics centre networking system layout

III. SYSTEM WORKFLOW

According to the requirements of the characteristics of rail transport organizations and freight purposes, improve system efficiency, all types of electronic tag data to be recorded is different, the underlying information and the transfer of goods into the station information overall.

Information of goods subject: Carrier single number, goods name, number, carriage trips, to send through to reach the ground.

Transfer station picking information: Location information transfer, the transfer of the trips, information delivery, receiving information, the handover date.

A. Processing of Electronic Cargo Information

The processing of electronic information of goods is shown in figure 2.

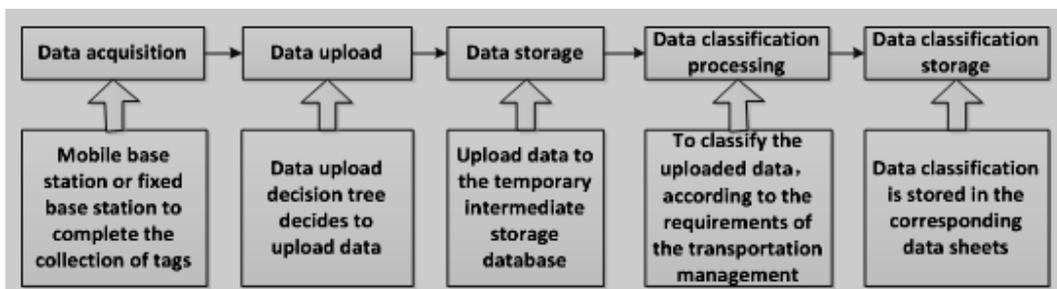


Figure (2) Handling of cargo electronic information

In order to improve the processing efficiency of the electronic information of a large number of goods in each link, in the process of processing the electronic information of goods, according to the characteristics of different stages of data, different treatment strategies are adopted.

Data collection: The data collection of the tag is completed by the mobile base station or the vehicle identification device. The mobile base station is a handheld device, which completes the information collection of the transfer station. The vehicle identification device is installed in the vehicle mounted to complete the information collection. The vehicle identification device is installed in the vehicle mounted to complete the information collection.

Data Upload: Through the mobile base station or reservoir identification device to upload the collection of tag data. In order to avoid invalid data upload, through the construction of the data to avoid invalid data upload decision tree to decide what data to upload

Data storage: The PC software of data storage module, the collection to upload data temporary storage to the host computer of the intermediate storage database to ready for further processing.

Data classification processing: Through the data classification and processing module of the host computer software, In view of the intermediate storage database staging a lot of uploading data. According to the requirement of the corresponding transport management, using the theory of decision tree and building data warehouse ETL tools, build the extract, transform and load data from an intermediate storage database into the data tables of each database.

Data classification storage: Through the PC software classification data storage module, the classification of the data stored in the corresponding data in the table.

B. Tag data upload decision tree construction

Through the label data from the mobile base station or a fixed base station, according to the requirement of the corresponding transport management build corresponding upload logic decision tree, as shown in figure 3.

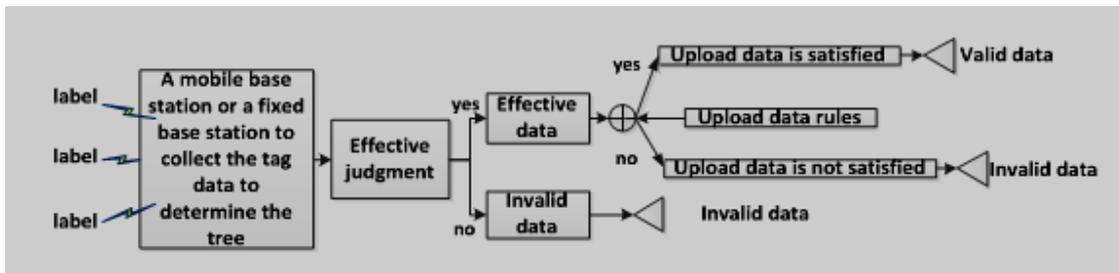


Figure (3) Upload electronic information logic decision tree

For electronic tag data collected, First of all to carry out a variety of electronic tag data to determine the effectiveness. For example, a variety of interference while the environment in which the electronic label garbled data etc. And then, in the electronic tag data to judge the validity of non garbled upload, upload to meet the rules require tag data upload.

According to the different forms of railway freight transportation, the rule of data upload is different. In view of the zero load and the container cargo electronic information mainly to consider from the loading, in transit, unloading three aspects of the various factors, the data upload rules according to the data change upload principle, some changes to meet certain conditions, changes in data can be uploaded, No other transaction data do not upload, so as to reduce the amount of data upload system.

C. PC data classification

Data classification processing is to temporarily store a large amount of data stored in the middle of the database, according to the requirements of the relevant shipping management, ETL technology through data mining, the data extracted from the intermediate storage database, transform from the intermediate storage database and bulk loading to the corresponding carrier management requirements of the database data in the table. Due to one from the mobile base station or a fixed base station to upload the records, data volume is very large, if direct deposit table, data processing speed is slow, at the same time will result in mass loss of data. Storing data from the intermediate data stored in the database to the processing of the data table in the target database process as shown in Figure 4.

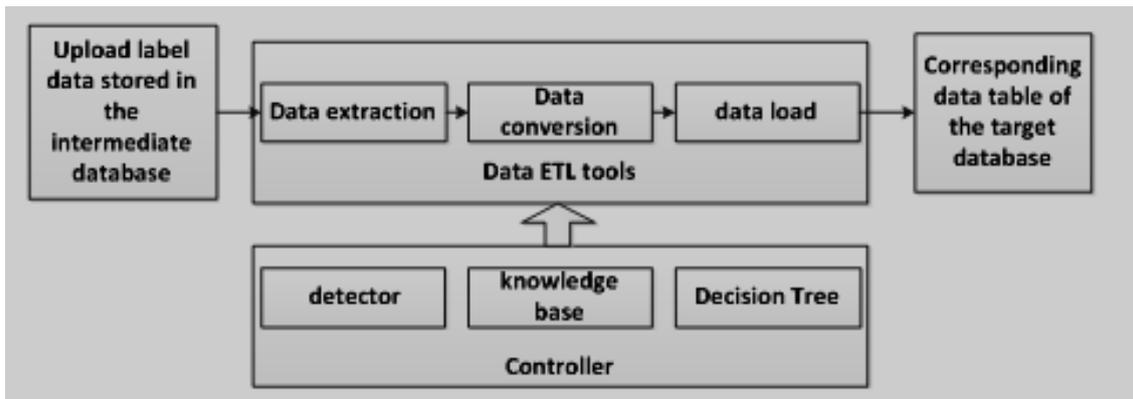


Figure (4) Upload data processing from the intermediate storage database to the target database table data corresponding process of FIG.

ETL data refers to the process of extraction, transformation, loading, is in accordance with the requirements of the certain data conversion and cleaning, finally will be high quality data is loaded into the database.

IV. PASSIVE RFID TAG READING INFORMATION COLLISION PROBLEMS

Passive RFID tag reader collision problem of information there are two types, one is the RFID tag information reading device with multiple collision problem, the other is more information on the problem of collisions between readers.

Passive RFID tag factory there is the only global codes, rules on the largest tag to read the number, tag collisions with reading device information through curing the corresponding algorithm and way of working within the label.

More information between the reader collision , according to the actual situation of railway networking technology applications in the same area reader more in between sets 2-5, the subject probabilistic power control algorithm to solve the multi-reader collision problem. Firstly, 2-10 sets of reader collision algorithm of probability of power control algorithm in MATLAB simulation experiment. Identified in the case of reader 5 below, the minimum distance between reader between 2.6 3.2 meters; Then, the field experiment in theory for the actual test and verify.

The probability of 2-10 reader power control algorithm MATLAB simulation experiment. Established in MATLAB simulation environment, reader power according to ISO15693 standard set 0 to 30 db, and the threshold SNR of 12 db. Multiple reader by using random distribution network topology and the minimum distance between reader was 3.5 m , the quantity ranges from 2 to 10.

Assuming that many readers expect under the environment of reading range is 2.5 m. The simulation

results as shown in figure 5, as shown in figure6. distribution of probability density distribution as shown in figure 5, changing the parameters of and , can control the power distribution to achieve desired reading range distribution.

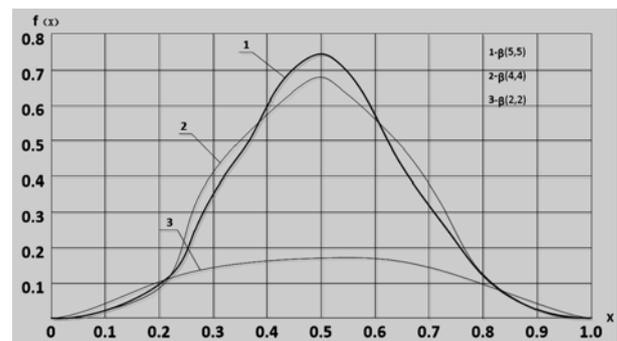


Figure (5) β Reader power distribution

The minimum distance between the reader's reading of 3.5 meters from the simulation results shown in Figure 6.

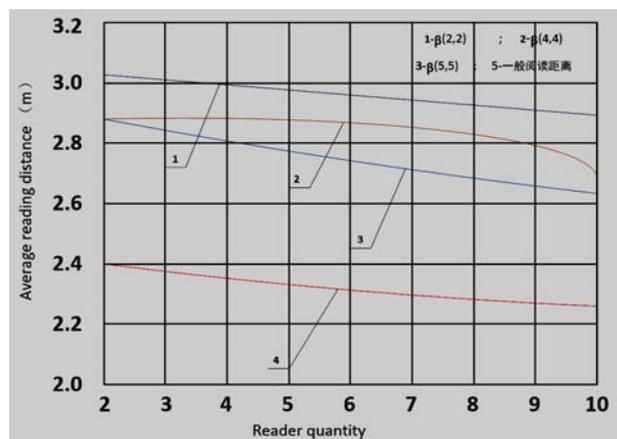


Figure (6) Minimum distance between the reader to read distance of 3.5 meters

V. ANALYSIS AND CONCLUSIONS

From the simulation results, using probabilistic power control algorithm, the reader must read distance is generally not using an algorithm reading distance larger than improve the read range of the reader. Under the same network, the reader to read and write power range distribution are (2,2), (4, 4), (5,5). Aiming at the condition of the reader 5 below, the minimum distance between reader between 2.6 3.2 meters. As a result, for many readers can use the embedded software to monitor more than 3.5 m, can reach the ideal state.

By the bureau in Kazakhstan dual high-speed rail line north of the entrance examination conducted field trials, the above theoretical analysis is feasible.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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