Research on Optimization of Tracking Equipment Based on In-transit Materials

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Abstract. As an important link in the transportation of materials, material tracking management is becoming more and more important.In-transit material tracking management is to carry out relevant decision management on the basis of obtaining material information in-transit, so as to achieve the purpose of improving logistics transportation service level, improving customer service satisfaction, maintaining customer loyalty, and further realizing the sustainable development of logistics enterprises. In this paper, through tracking a series of materials in transit, to achieve the goal of optimization, and using related logistics information technology and geographic information technology such as GPS, GIS, GSM to develop optimization management plan and do a good job in tracking management can improve management service level and product quality and quality.

1. Introduction

With the continuous development of science and technology, the tracking and management technology of materials in transit has also been developed and perfected accordingly, and various or simple or complex vehicle tracking and cargo detection equipment have emerged, such as: GPS, GIS and cargo freshness testing equipment. Nowadays, in the process of using these advanced equipment and transportation, problems such as damaged goods, rotten vehicles, and wrong lines are still common, so it is very important to track and strengthen the management of materials in transit in real time[1].If the real-time detection of the material status in transit and the real-time tracking of the location of the vehicle are combined, the efficiency of vehicle transportation will be improved effectively, the number of damage in transit will be greatly reduced, so the customer satisfaction will also increase.

2. Technical analysis of material tracking management in transit

Goods in transit for business enterprises, generally refers to the enterprise has not yet arrived or has not yet accepted the purchase and storage of various materials. The tracking management of goods in transit refers to the process of enterprises providing goods transportation using certain information technology means to obtain information about the status of goods transportation in time, and to plan, organize, control and coordinate management on the basis of obtaining information, so as to improve the level of goods transportation service and customer satisfaction. Regular inspection of materials in transit and real-time tracking of vehicles can not be separated from the support of some advanced technology, the following is the information technology required for the tracking management of materials in transit.

2.1. GPS

GPS, the Global Positioning System, is a satellite system consisting of 24 satellites covering the world. The system ensures that four satellites can be simultaneously observed at any point on Earth at any time, to ensure that the satellite can collect latitude, longitude and altitude of the observation point, in order to achieve navigation, positioning, timing and other functions.

2.2. GIS

GIS, the geographic information system, is a computer system for collecting, processing, storing, querying, analyzing and displaying spatial information on the earth's surface. It is an integrated spatial information system based on computer graphics and image processing, database technology, remote sensing technology of surveying and mapping and modern mathematical research methods, which integrates spatial data and attribute data.

2.3. GSM

GSM, the Global System For Mobile Communication, is a European standard for mobile communication technology that has been developed to make it possible for all parts of the world to share a standard for mobile phone networks, allowing users to travel around the world using a single phone.

3. Vehicle monitoring device optimization

3.1. Problem description

Due to the imperfection of the modern information system, the information of many monitoring devices cannot be transmitted to the receiver quickly, and the problems in the transportation process cannot be solved timely, which leads to the damage of a lot of goods on the transportation route.This device is to carry on the real-time monitoring to the material in transit in order to reduce the loss.

3.2. Basic components

The on-board monitoring equipment is designed based on the concept of some modern GPS, GIS, temperature and humidity controllers, etc. It integrates the functions of GPS positioning system, line planning system and temperature and humidity controller to measure temperature and humidity, and has the functions of cargo status detection, transportation line. Its mobile communication system is linked to the network of shippers, transit stations and end customers and let enable network information sharing among vehicle drivers, transit stations and end customers. Real-time detection of transport vehicles and materials to ensure the safe delivery of goods, so that the vehicle transport cargo information can be timely understood by all parties.

3.3. Equipment optimization

With the database information system constructed by GPS, GIS and GSM technologies, this device integrates a amount of data and establishes a transfer station. Through the timing device, the data of vehicle status and material status is recorded every once in a while, which improves the accuracy and accuracy of the data while improving the security. Through the temperature and humidity detection module and satellite positioning module, the data of temperature and humidity of goods can be presented to the vehicle driver in real time to detect whether there is any loss of materials and check the in-transit status of the transport vehicle. Sound and light alarm is used to give early warning to the accident, and the information stored in the database is transmitted to the hand-held terminal through the electric signal in time, so that the driver can know the situation in time. And the driver will upload the information to the database of the relay station according to the road condition, time limit and transportation condition. Through its mobile communication system, the specific location information of vehicles and materials not only can transmit the network terminal of the relay station and the end

customer, but also can predict the arrival time of vehicles by providing location information, so as to facilitate the transfer station and end customers to prepare for the arrival of vehicles in advance. The operation process of the optimized vehicle monitoring equipment is shown in figure 1.

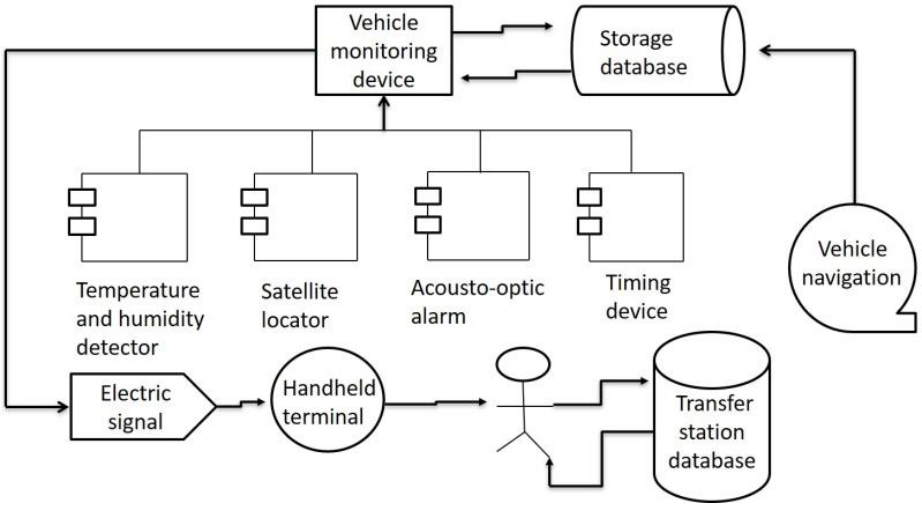

Figure 1. Flow chart of vehicle monitoring equipment operation

4. Transit site device analysis

4.1. Basic composition

Site equipment is mainly composed of data acquisition system, data processing system and road planning system.

The data acquisition system automatically collects non-charge or power signal from analog and digital units such as sensors and other equipment under test, and sends them to the upper machine for analysis and processing. The data acquisition system integrates signals, sensors, actuators, signal conditioning, data acquisition equipment and application software. Acquisition is a generally sampling mode that is a certain time for the same material data repeated collection[2].

Data processing system is the collection, storage, retrieval, processing, transformation and transmission of data. The basic purpose of data processing is to extract and derive data that is valuable and meaningful to certain people from a large, potentially cluttered, incomprehensible data. Because most of the data collected is non-standard, data is converted into structured data before it can be analyzed before it can be analyzed[3].Statistics and analysis mainly use distributed database, or distributed computing cluster to analyze and summarize large amounts of data stored in it to assist material allocation.

Road planning systems plan roads based on information within the site coverage. The road planning system includes geographic information technology and GPS technology, and in cooperation with map software for location sharing, according to the information collected, will be difficult to remove the road, from the site to the lack of material destination to plan an optimal route, and then plan another alternative route to meet the needs of the transport of goods.

4.2. Road planning links

Transit station equipment through the GPS receiver received satellite signal operation positioning data and status data, after system processing, data information through the wireless communication network sent back to the site equipment. With the support of GIS, the location and status of the vehicle are displayed in real time on the map through the electronic map matching technology, and the information is transmitted from the site equipment to the background database, thus realizing the logistics dispatcher's in-transit monitoring of the material transport vehicle. When the vehicle arrives at the site with supplies, the site transmits information about the vehicle and the materials contains to

the background. At the same time, the site equipment will be based on the required materials and vehicle-mounted materials to match, planning the road, and then, the route into the vehicle navigation system, according to the planned route to transport materials. Its main process is shown in Figure 2.

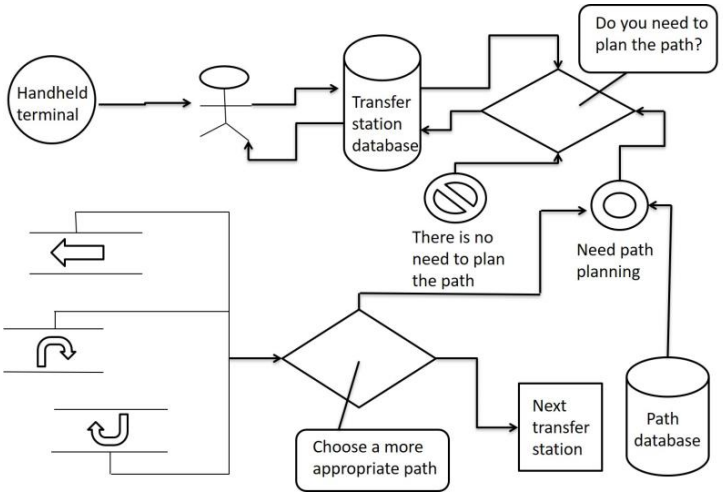

Figure 2. Flow chart of road planning

4.3. Data Processing

The transit station collects, organizes, stores, maintains, retrieves, transmits the data information from different channels and merges the data information with the information of the on-board monitoring device to form the transit station information base. Through contactless data integration, the management data is collected without affecting the state of the subject and the measurement environment, the data is guaranteed to be correct, and computer-aided mapping, mapping etc. are used to complete the complete transit station information processing for the digitization of graphics or images. Its main process is shown in Figure 3.

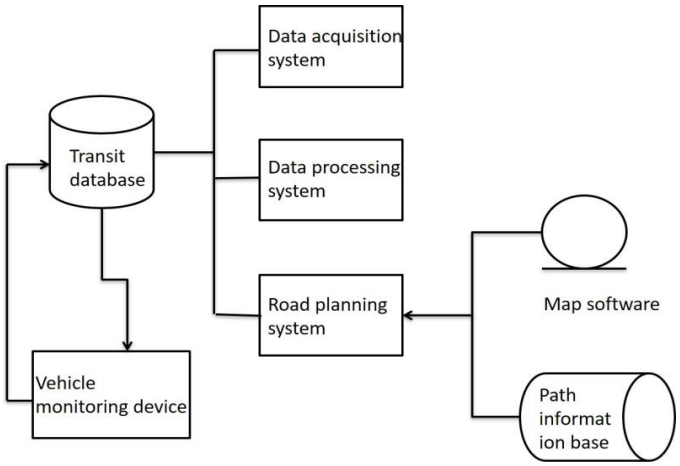

Figure 3. Database data processing flow chart

5. Optimization of material tracking equipment in transit

The combination of vehicle-mounted monitoring device and transfer station equipment system described in this paper is the optimal treatment of in-route tracking equipment, and the two form a resultant force. In this case, the role of the system will play to the maximum and can effectively solve the problem of the arrival time of materials [4].

5.1. Optimize the operation process

Firstly, the on-board monitoring equipment monitors the vehicle in real time through its equipment system and uploads the vehicle information and material information to the information base of the driver and the transfer station. Then the information base of the transfer station uses its data information system to integrate the road information and plan the optimal route for transmission to the driver's handheld terminal to complete the whole system. The main role of the transfer station equipment is to collect and transmit the information needed for the materials within the coverage area of the site and the smooth road information to the background. It can also carry out the road planning within the coverage area of the site according to the lack of materials, so that the materials can reach the required place faster. The on-board device can arrange the needed materials and plan the route according to the information from the station, and it can monitor the position of the vehicle and the quality and quantity of the materials contained in the vehicle.

5.2. Advantages of in-transit material tracking equipment

The main feature of in-transit material tracking management is logistics informatization, and its essence is visualization. To plan the storage, circulation of the relevant items for the corresponding visual monitoring and management, mainly including the storage of items to receive, release, storage and storage and a series of management activities. We use GPS, GIS and other technologies to feedback the status of the goods and vehicles in real time when the goods are in transit, so as to realize the actual control of the goods in transit and facilitate the enterprises to implement the scheduling of the vehicles in transit.

5.3. Feasibility of application of in-transit material tracking equipment

In the face of increasing traffic emergencies and frequent geological disasters in China, it is more and more important to strengthen transportation monitoring[5]. Therefore, the highway transportation industry needs to provide more accurate services for travelers, and the operation of the transit station resource planning library solves this problem.

6. Conclusion

With the further development of China's logistics industry, it is particularly important for various logistics enterprises to improve their service quality, improve customer satisfaction, and do a good job in tracking and management of in-transit materials. Tracking and management of in-transit materials plays a positive role in improving service quality and customer satisfaction of logistics enterprises, and plays a decisive role in winning customers and gaining competitive advantages among peers. Therefore, it is particularly important for logistics enterprises to understand the characteristics and importance of in-transit material tracking management and to master its effective implementation ways. We believe that with the support of these facilities and technologies, the emergency response capacity in most regions will be significantly improved.

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