

Research on vehicle monitoring system and data communication reliability based on Internet of Things technology

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Abstract: At present, there are many formed and put into use vehicle supervision systems in the society, but with the continuous progress and development of science and technology, most of the management systems can no longer meet the ever-increasing supervision requirements. Therefore, this paper mainly studies the realization of vehicle monitoring system under the background of Internet of Things, applies the concept of Internet of Things to vehicle monitoring system, and realizes an intelligent urban vehicle monitoring system through real-time communication between vehicles and people and intelligent monitoring platform.

1. Introduction

With the development of economy and the gradual improvement of people's living standards, cars, as the main means of transportation in the world, have basically entered every household. The automobile industry is already the pillar industry of the national economic development. The high-speed development of the automotive industry is inseparable from the continuous innovation and progress of electronic technology, resulting in the birth of research hotspots such as the Internet of vehicles and the Internet of things[1]. With the continuous development of wireless communication technology and sensor technology, the Internet of things, as a new generation of network technology, has attracted more and more attention. In view of the current development of the automotive industry and the development trend of Internet of things technology, it is particularly important to build an intelligent vehicle monitoring system based on Internet of things.

2. Function analysis of vehicle monitoring system

The so-called intelligent vehicle monitoring system should have relatively complete functions and stable operating performance, and have comparisons in the real-time monitoring, the accuracy of control, the rationality of scheduling, the rapidity of response, and the simplicity of operation. High requirements, which involve the rational use of many professional technologies. At the same time, the intelligent vehicle monitoring system is an important part of the entire transportation system. Its main advantage lies in the timely transmission of various information, the integration of various components of the transportation system, and the service of more units and individuals. It can organically integrate people, vehicles, roads, and equipment in the transportation system, taking into account the needs of various aspects[2], so that they can be effectively interconnected. From the perspective of economic efficiency, this can greatly improve the efficiency of traffic management. Efficiency, greatly reducing the input of manual management, reducing the daily workload of the transportation system, and also saving the unnecessary loss of vehicles in driving to the greatest extent.

The vehicle monitoring system can be divided into two functional modules: monitoring platform and monitoring terminal. The monitoring terminal is installed on each target vehicle, and runs with the vehicle, realizing the information collection and network communication functions of transport vehicles; The monitoring platform is installed in the monitoring center to realize data visualization, monitoring scheduling and other functions, as shown in Figure 1:

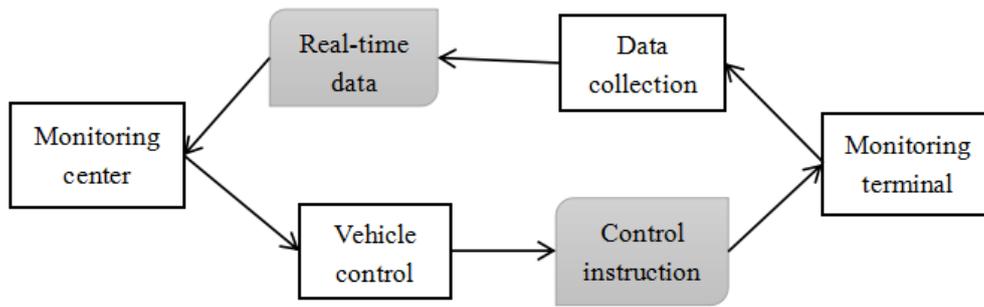


Figure 1 Business flow chart of vehicle monitoring system

2.1. Module functions of the vehicle terminal controller

Module function of vehicle terminal controller vehicle terminal controller is an embedded system installed on the monitored vehicle with ARM chip as the processor. It is the front-end equipment of the whole system. The central control module is the core module of the vehicle terminal controller and also the main controller. It completes tasks such as data processing and control nodes. Its specific function is to analyze and sort out the positioning information received by the GPS module and the working status information collected by the CAN bus interface module and the data acquisition module[3], store important information in the memory, build these information into data frames according to the format of the data communication protocol, and upload them to the monitoring center. If any abnormality is found when analyzing the working status information, the alarm information will be sent to the monitoring center immediately; The central control module can parse the data frames from the monitoring center.

2.2. Monitoring Center Module Function

The functional modules of the monitoring center can be divided into the following four parts: Communication link maintenance: This module is used to maintain the network communication between multiple target terminals and the monitoring platform, to ensure the connection, disconnection, data connection between each terminal and the monitoring platform. Sending and receiving can be carried out synchronously, orderly and relatively independently, the terminal connection queue runs stably, and at the same time ensures the security of shared data; data management: This functional module processes each part of the data received from each target terminal, and parses, decrypts and extracts the received data[4]. Then, it is stored in the database; corresponding function call processing is performed according to different types of received information; the function of data maintenance is realized for the received information; GIS platform display: This module realizes data visualization and is the main function module for central personnel to realize monitoring. Multi-target trajectory drawing calls the positioning and collection information sent by each target terminal, and simultaneously draws the transportation trajectories of each target on the GIS platform in real time, which is convenient for the center staff to view; Each target management module manages the tracking targets displayed in the GIS platform; Data security management: This module realizes the data security management of the monitoring system, receives and processes each group of data sent by each target terminal meeting the transportation agreement, shields other illegal data, and ensures the security of the received data; Encrypt the transmitted data to further ensure the security of data transmission; According to different permissions, set different functions that the center staff can perform to ensure that the stored data will not be tampered with.

3. The key technology of monitoring system implementation

3.1. GPS Technology

Vehicle drivers in the global satellite positioning system, GPS positioning system is the most mature and perfect in positioning technology, so it is widely used in vehicle positioning. The

existing GPS geographic information system technology can recommend effective routes for engineering vehicles to complete transportation in the shortest time[5]. In some places, the traffic network is complex and changeable, and the route selection of vehicle drivers at different times and different sections is unstable and uncertain. Therefore, the traffic behavior of the transportation section shall be comprehensively analyzed in combination with the traffic flow, distance and time of the section; For a given query point, the most effective and complete route should be recommended for the vehicle and the best route for the vehicle driver among the multiple possible driving routes, so that they can complete the task under the shortest path, improve the transportation efficiency and save the transportation cost[6].

3.2. Wireless Communication

This technology mainly realizes the link with the center communication, which is mainly based on GPRS in the system, as shown in Figure 2:

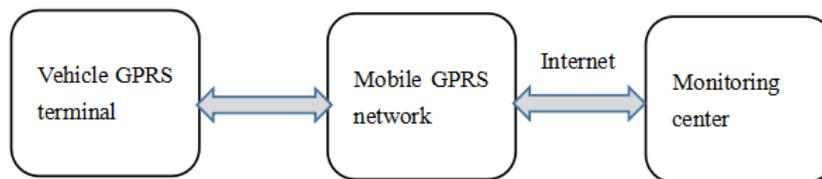


Figure 2: Communication module

GPRS is abstracted as a network device in the system, so the system socket operation can be used, which is the same as the general network connection operation. When the system is initialized, it is necessary to establish a TCP connection, and connect to the central server according to the designated central IP and the central monitoring port number. After the connection is established, it can communicate with the central server[7].

4. Research on reliability of vehicle communication data based on Internet of Things

The collection of reliability data is the basis for reliability research, which reflects the reliability status in different life stages and the influence of various relevant factors on product reliability and their change rules. Only when a certain amount and quality of data are collected, can effective samples be provided for reliability evaluation, making the evaluation results closer to the real reliability status of products. At present, the research on data acquisition methods mostly focuses on the use of sensor technology and computer technology to collect the reliability test data[8]. The Internet of things (IOT) is a hot spot in the information field emerging in recent years. It can realize a comprehensive perception of the dynamics of objects, and transmit the perceived information in real time, accurately and reliably. It can use intelligent computing technologies such as cloud computing to analyze and process massive data and information. The adoption of Internet of things technology can well solve the problems of real-time collection, transmission and massive data processing of reliability data in the whole life cycle of automobile, and can also formulate maintenance strategies in time according to the feedback information to realize the intelligent control of automobile reliability.

5. Solution of packet loss and disconnection in data communication

GPRS network is charged according to traffic, and the system only needs to pay when transmitting data. If TCP protocol is adopted, every communication must be connected first. Repeated connection not only affects the system performance but also increases the network communication cost[9]. It wastes network resources if you keep connected all the time. UDP protocol does not need to establish a connection before transmitting data, but the other party does not confirm the data frame after receiving it. This kind of communication is simple and unreliable. Moreover, the vehicle is disturbed by the environment, geographical factors, climatic conditions, etc.

outdoors, and the network communication signal is easily attenuated, resulting in packet loss. If the vehicle can't communicate with the monitoring center for a long time, it will be disconnected. Therefore, data reliability should be fully considered when designing data communication. In the data processing module, the monitoring center has designed a software function module with closed-loop characteristics, which is the core of the data processing module. In the data communication protocol, the confirmation mechanism is adopted to make information interaction, which ensures the reliability[10]. If the vehicle terminal controller replies that the monitoring center has received the data frame, the monitoring center sends the next data frame; if the vehicle terminal controller replies that the acceptance fails, it will resend the data frame. Every time data is sent or received, the latest transmission status information will be refreshed to the corresponding element in the data set. The monitoring center adopts timeout retransmission measures, that is, it does not receive a reply from the vehicle terminal controller within the predetermined time, and the monitoring center uses the element corresponding to the vehicle terminal in the data collection module to call the element timer System. The timer will not always send at intervals, but only send the number of times set by the counter at most. If no reply is received after the number of times set by the counter, it is considered that the vehicle terminal controller is disconnected. If the monitoring center closes the running program for various reasons, it will cause the loss of information in the collection, but the state information in the database will not be cleared.

6. Conclusions

Vehicle monitoring is an inevitable trend of today's social development. With the increasing number of road vehicles, it is of great practical significance to effectively monitor and manage vehicles. With the advent of the Internet of Things, the interconnection of home appliances, intelligent building and intelligent monitoring of vehicles have become important topics of social development, and the research on intelligent transportation is of great significance. "Internet of vehicles" will inevitably become the mainstream direction of intelligent management of vehicles, and the information interaction between vehicles and people will provide greater convenience for future urban life. In the near future, we will be able to know the road information in real time and feel it.

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