Data Compression and Transmission Method of Vehicle Monitoring Information Collection Based on CAN Bus

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ABSTRACT

Real-time remote monitoring and fault diagnosis for commercial buses has important significance in reducing the occurrence of potential accidents. This paper presents a real-time remote monitoring system for the running state of commercial passenger buses. The vehicle Controller Area Network (CAN) bus is able to collect the information of key indicators being monitored, such as brake pressure, oil pressure and fault code. Then, the collected data are uploaded to the central remote monitoring platform through a General Packet Radio Service (GPRS) module for further analysis and decision-making. In this work, a classification based data acquisition method and a hybrid configuration data transmission method are proposed to improve the efficiency of data acquisition and transmission. The authors also proposed a Run-length based relative coding algorithm to compress the massive monitoring data. Experimental results shows the average data compression ratio is 32.17%, which effectively reduces the data transmission cost.

Keywords: CAN Bus, Data Acquisition, Data Compression, Data Transmission, Passenger Bus, Remote Monitoring

INTRODUCTION

With the rapid development of Internet and mobile communication technologies, remote data transmission for real-time monitoring of motor vehicles has been put into reality. The domestic mainstream monitoring and management platforms are able to collect some conventional information of the vehicles, such as position and speed. However, the monitoring
for the running state of the engines and automatic gearbox are neglected, which decreases the ability in fault diagnosis and prediction for some key working units. In recent years, the Controller Area Network (CAN) bus has been widely used in motor vehicles, especially in high-level passenger buses. From 2007, the ministry of transport in China clearly required that commercial passenger buses above high level two must be equipped with CAN bus systems, which lays a good foundation to the rich the type of vehicle monitoring information.

The CAN bus is flexible in networking and it has strong expansibility. Besides, the multi-agent broadcast data communication way facilitates the data expansion and sharing. When a new data acquisition node is added on the bus, it is able to receive all the data of the CAN bus and no changes need to be done for the original CAN bus system. This advantage greatly reduces the designing difficulty of the real-time data acquisition and monitoring system, thus the data collection system for the running state of the vehicles based on CAN bus has become the main tendency of application (LIU Cheng-xu et al., 2012; He Chuangxin et al., 2009). In practice, the amount of the data collected in a single passenger car is relatively large, hence the data amount of the large transport enterprises with thousands of vehicles are enormous. However, the lack of in-depth study on the compression techniques for the different types of data collected in by the CAN makes it difficult for the central platform to process and analysis the uploaded data quickly and effectively. The problem of data redundancy has become a problem urgently awaited to be solved. Therefore, it is significant to study the collection, compression and transmission techniques of the classified vehicle monitoring data.

In this article, a large passenger bus equipped with CAN bus is used as the study object. In the basis of the analysis on its CAN bus control system and open information, we design and develop a remote state monitoring system for passenger bus and the system has a software and hardware architecture with both good compatibility and scalability. Then we studied the remote information acquisition, data transmission and data compression techniques and validated the proposed data transmission and data compression method in real vehicles. At last, the research is applied in the software of the developed remote state monitoring system.

**SYSTEM ARCHITECTURE OF DATA ACQUISITION**

We take YuTong ZK6117H as the example to illustrate the vehicle CAN bus. The vehicle CAN bus is consisted by two CAN buses using different protocols: one is denoted as CANA, which is based on the SAE J1939 protocol and it is centered on electronic control diesel engine (J08E-UP); another is denoted as CANB, which is based on the Viti CAN protocol and it is centered on the whole network of the vehicle. The electronic control diesel engine has a good internal monitoring and self-diagnosis system, which is able to broadcast the real-time monitoring data and fault code in the CANA bus. The running state indicators, like the front and rear brake pressure, mileage, speed, fault of lights, brake pressure, water temperature, are mainly broadcast in CANB.

The remote state information acquisition system is realized by modular expansions in the basis of using the existing CAN network equipped on the passenger cars. The system architecture includes two man parts, as shown in figure 1.

1. Remote information acquisition and transmission terminal: the two CAN buses are used to gather the state information and fault information. From the latitude and longitude obtained from the embedded GPS module, the vehicle location can be determined. And also, the terminal realizes the remote real-time monitoring by exchanging data with the central remote monitoring platform.

2. Extension modules: the existing monitoring parameters are not able meet the needs of the remote fault diagnosis, thus extension
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