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Logistics Vehicle Monitoring Intelligence System

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Abstract. In this paper the design and the manufacture of the logistics vehicle monitoring system based on ARM11 is proposed. Camera module, sensor module, barcode scanning module, GPS positioning module, wireless communication module, and GPRS module are employed on the terminal, which use LINUX and ARM11 to realize software system and hardware system separately, to make the system more practical and convenient. In data acquisition part, data including vehicle interior images, vehicle inclination angle and goods weight, goods information obtained by the camera module acquisition, the sensor module and bar code scanner module separately is sent to the monitoring terminal via a wireless communication module for display after data processing. Monitor terminal display real-time vehicle location information collected by GPS module, and at the same time, send location information to the server via GPRS module, displaying on the electronic map. Thus we realize the real-time monitoring of vehicles and logistics management.

Introduction

With the development of economy and society, the logistics industry is growing rapidly, and showing a merit of large amount of cargo transportation, short transit time and fast transport speed. To improve the interest share in the market, logistics enterprises use different ways to improve their overall quality of service. While current logistics vehicles is monitored and managed in an artificial way, it takes up lots of manpower, financial and material resources, and has low management efficiency. The design is based on the current situation and demand of logistics monitoring and management system, making full use of the bar code, RFID [1], GPS, and GPRS technology, it shows the design of logistics vehicles intelligent monitoring and management system [2] can manage the logistics information intelligently.

Composition and Function of the System

The whole set of equipment is composed of a plurality of wireless node modules, a monitoring terminal and a server of vehicle logistics management center. These wireless nodes are distributed in some fixed parts of the transport trucks, collecting various real-time parameters of vehicles and goods, and sending data image or video signal wirelessly to the monitoring terminal equipped in the truck cab. The monitoring terminal process and store the received data while monitoring the status real-timely, and in the event of emergencies, audible alarm would remind the vehicle personnel dealing with the problems of vehicle in time. GPS system locate the vehicle location, vehicle state and location information is sent to the logistics vehicle management center server through the GPRS wireless module, logistics vehicle management center can get the vehicle status information and the position systematically. The diagrammatic sketch is shown in Figure 1.

The functions of the system are as follows:（1）The automatic acquisition management of cargo information loaded in logistic vehicle; (2) The monitoring and alarm of the safety on operating

stability, speed threshold, and interior state; (3) The location and management of vehicles for the monitoring center to assign them conveniently.

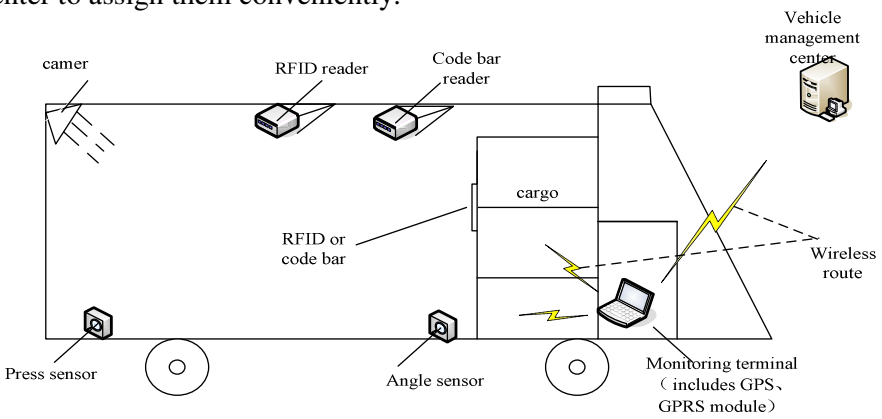

Figure 1.The diagrammatic sketch of logistic vehicle monitoring and management system

System Design

System Hardware Design

The system hardware structure is shown in Figure 2.

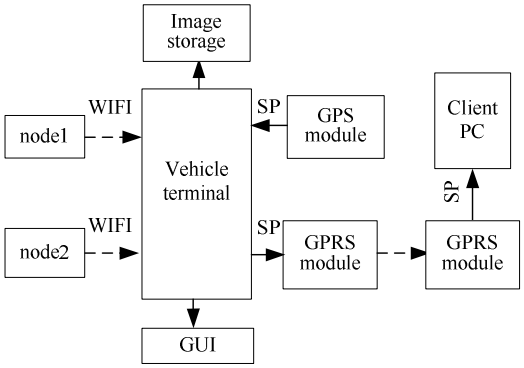

Figure 2. System hardware block diagram.

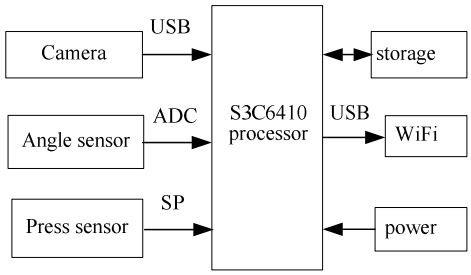

Figure 3. Data Acquisition Node one.

Figure 2 presents the overall block diagram of the system hardware design. The system can be divided into two networks and three levels, i.e. data acquisition node, vehicle monitoring terminal, logistics vehicle monitoring and management data center of the three levels. And there are two the data acquisition node, those two data collection node and the vehicle monitoring terminal establishes a vehicle internal network by Wi-Fi, to achieve data exchange and data transmission, this system is a network of local network. While the vehicle monitoring terminal and remote management of data center exchange data by GPRS module, a plurality of vehicle monitoring terminal and vehicle monitoring and management center constitute a remote data exchange network.

Data Acquisition Node. Data acquisition node is for collecting vehicle-related images and data with state, such as logistics vehicle compartment inside image data, the total logistics vehicles carrying goods quality data, the bar code data of goods, and vehicle angle data. Two data acquisition nodes are designed, i.e. data collection node1 and node2. Samsung S3C6410 processor is selected as the core processor of Data collection node 1, data collection node 2, and the aforementioned Feiling company's core processing unit based on S3C6410 chip is selected as core board. Data collection node collected the interior of image data from different angles, and they are responsible for collecting the relevant data of cargo compartments. The data acquisition node hardware block diagram is shown in Fig.3 and Fig.4.

Data collected by collection node is encapsulated in TCP packets is sent via the LAN, which is composed by Wi-Fi module and the control terminal module based on the composition of ad-hoc protocol, to the onboard monitoring terminal.

Vehicle Monitoring Terminal System. Vehicle monitoring terminal onboard is the host computer, it receives data from the data acquisition nodes and display it on the LCD monitor. Fig.5 shows a block diagram of vehicle monitoring terminal hardware design.

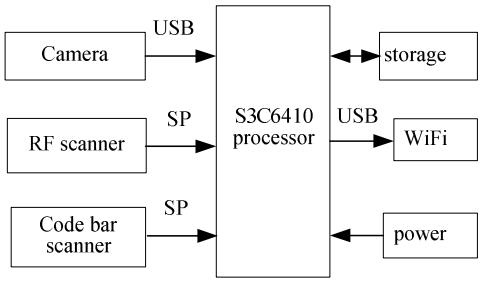

Figure 4. Data Acquisition Node two.

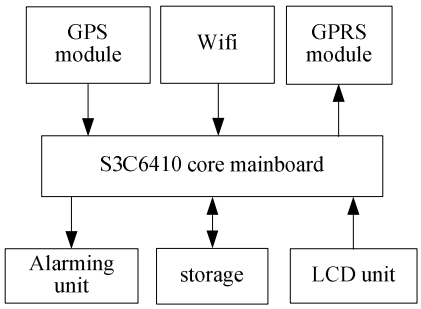

Figure 5. Vehicle monitoring terminal hardware block diagram.

In vehicle monitoring terminal hardware block diagram, we can figure out that , vehicle monitoring terminal hardware design is divided into S3C6410 core processor module, GPS module, GPRS module, Wi-Fi module, memory module, LCD module, alarm unit and power supply. GPS module is used for acquiring location information of the vehicle [3], Wi-Fi module is used for slave data acquisition node building ad-hoc wireless local area network to receive data transmitted from the data acquisition node with a memory storing the transmitted data, LCD display can display the received data for the vehicle cabin staff to view information; GPRS module is to build telecommunications unit between vehicle monitoring terminals and logistics vehicle monitoring management of data centers [4],the module is responsible for transmitting important vehicle data acquired to logistics vehicle monitoring and management of data center [5], the buzzer composed alarm unit is mainly focused on situation of the exceeded goods quality, the dangerous vehicle deflection caused large goods vehicle or an unsafe situation to the police.

GPS module, GPRS module and the core board is connected via serial ports which enable the exchange of data. Other parts of the interface are designed as data acquisition node.

The Server of Data Center. Logistics vehicle management system data center take a PC machine as a server of monitoring and control system. the application software is designed by VB programming, VB network plugin called Baidu map, make access to the online electronic map, at the same time, the periphery connect a GPRS module, which is used to receive GPS positioning information from the vehicle monitoring terminal, then logistics software Java API calls Baidu map, makes the position of the vehicle show in the map, thus we can view real-time location information of the vehicle.

Software Design of System

Software Design of Data Acquisition Node. The software of Data acquisition node is responsible for controlling the core processor to read the relevant data from each sensor [6], so it can be software flowcharting of data acquisition node is shown in Figure 6.

The displaying of the software is realized by the Qt programming, and the received data of the two threads should be displayed on the UI interface of Qt, when thread data reception is completed, the interface display as well as limit data input and video size switching are realized by a custom Qt signals and slots mechanism; limit data play the role for comparison when receiving pressure data and angle data, if they are within range, normal operation will be carried out, otherwise the program will drive alarm hardware to achieve the function of surveillance.

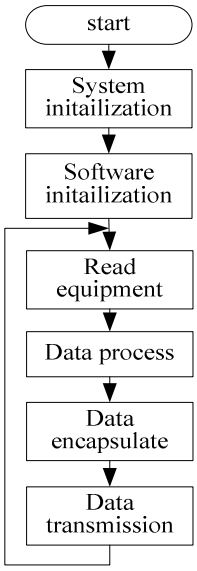

Figure 6. Data Acquisition Node software flowchart.

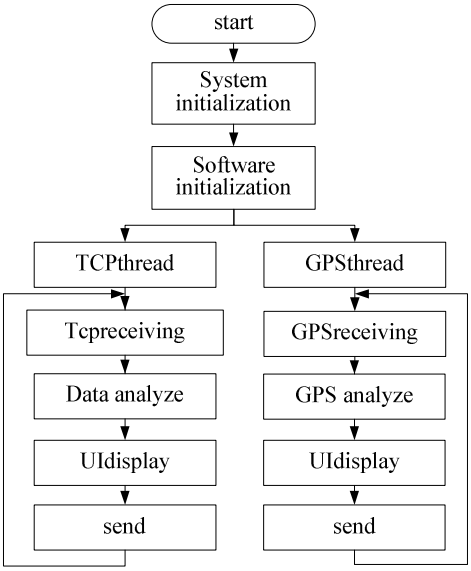

Figure 7. Vehicle monitoring terminal software flowchart.

Monitoring and Management Center Software Design. Software of monitoring and management center server is mainly used for displaying vehicle location on the electronic map, the software is written in VB program language. The function of the software is as follows: displaying the electronic map, the storage of data into database, and the query of historical data.

The software requires a network to work properly. Connected to the Internet, the software can get access to Baidu maps and control GPRS module receiving GPS data from each vehicle terminals. After being analyzed, the data is sent to the server of Baidu map by calling the JAVA API of Baidu to achieve the function of vehicle location display; At the same time, the received data is stored to Microsoft access database called by the software for viewing, the operator can export data to excel spreadsheet, which is easy to access and manage.

System Test Results

In accordance with the state and design of preceding chapters, build logistics vehicle monitoring and management system. When doing the System testing process, firstly connect the various parts of the system, keep PC connecting to the network and monitoring terminal board and the data acquisition node system on power, the vehicle monitoring terminal display interface is shown in Figure 8.

Figure 8. Vehicle monitoring terminal

Figure 9. Data center electronic map

In Fig.8, according to the meaning of the data displayed on the screen, the interface can be divided into four parts, which is identified by A, B, C, D. Region A displays the image data acquisition node acquired, in the test, image can be properly displayed on data the vehicle terminal, the switching button "change" is used for switching two cameras to enlarge image display; Region B displays the data which node 1, node 2 collected such as angle data, cargo weight and goods bar code data, test

results show that information can be displayed correctly; Region C is data alarm setting section , the system runs successfully by changing alarm limit many times, "Alarm" function key control the system to identify whether it is emergency or not; Region D display the GPS data, we test many times that the data is correct. Based on the test above, data communication between vehicle monitoring and data collection terminal node operate correctly during the long-term stability test. The vehicle-mounted portion of the communication has the merit of good stability and short delay data communications.

Data center servers of logistics vehicle monitoring and management system on PC is show as Fig.9, when connected to the network, terminal send the information GPS module collected to the center and display the information in the electronic maps on PC. The red dot on the map indicates the vehicle's current position, when click on the red symbol, client can view the current status of the vehicle.

The test results show that the system operates well in data acquisition, transmission and real-time display. It can meet the requirement of logistics vehicle real-time monitoring and management.

Summary

In this paper a logistic vehicle monitoring and management system based on ARM, sensor, and wireless network technology is proposed. The design can be connected easily and has a simple structure. It is of importance to logistic vehicle monitoring and management system design.

Acknowledgement

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