RedFame

Network-based Management on Repairing Tool Kits of Civil Aviation Engineering Maintenance

Xiaoxu Tian[1], Xinlei Zheng[2], Ting Wang[2], Na Li[2], Haifeng Wang[2], Fuqing Huang[3]

[1]Person-in-charge of project, Civil Aviation University of China, Tianjin, China

[2]Members of project, Civil Aviation University of China, Tianjin, China

[3]Instructor, Civil Aviation University of China, Tianjin, China

Correspondence: Xiaoxu Tian, Person-in-charge of project, Civil Aviation University of China, Tianjin 300300, China. E-mail: 1403712140@qq.com. Fuqing Huang, Instructor, Civil Aviation University of China, Tianjin 300300, China. E-mail: fqhuang@cauc.edu.cn

Abstract

Based on features of high speed of network transmission and easy operations, this thesis covers two aspects to realize network-based management on repairing tool kits of civil aviation engineering maintenance. Firstly, develop a network inquiry system, which can help employees and administrators inquire tool borrowing information. Secondly, a module is designed that has functions to transmit text messages to tool kits borrowers prompting them to return tools at times when the returning date approaches.

Keywords: network, management, inquiry system, text messages

1. Introduction

As the civil aviation industry is developing very fast in China, working loads of engineering maintenance is increasing with each passing day. The traditional registration method for repairing tool kits can no longer meet requirement by modern management and hence. It is extremely urgent to develop a highly efficient management platform for engineering maintenance tool kits. This thesis solves the problem from two aspects. Firstly, using ASP (Active Server Page) technology and network database theory, we design a network inquiry system for repairing tool kits based on the B/S (Browser/Server) mode. This system contains two parts, which are employee inquiry and administrator inquiry. For employees, they can inquire their own real-time tool borrowing information and submit tool booking requests on line according to their needs. For administrators, they are able to remotely inquire tool borrowing information of all the employees and approve or reject applications by employees. Secondly, design a module that has text message transmission functions based on GSM (Global System For Mobile Communication) network to tool borrowers prompting them to return tools at times when the returning date is approaching.

2. Methodology

This system using the B/S model , the Dreamweaver homepage manufacture software, the ASP dynamic homepage technology and the SQL Server(Structured Query Language Server) backstage data server, realizes network-based management on repairing tool kits of civil aviation engineering maintenance.

In the mode of B/S, the client does not need any special software except the browser. The browser exchanging information with database through the web (World Wide Web) server, can work in different platforms expediently. This system achieves the function that employees and administrators inquire their borrowing information through the browser based on the B/S model. Dreamweaver MX 2004 is used to design or develop web pages and web applications. It is a strong software, which contains the visual layout tools, application development function and code editor support and it has a strong function of multimedia webpage design.

ASP (Yue, et al., 2002) is a server-side scripting environment and it can create and run dynamic web pages or web applications. When the browser of client sends a request to server, the ASP interpretive program of server carries out the ASP program at the server-side and delivers the result to the browser in HTML (Hyper Text Markup Language) format. In the production of web pages, the name of the object which saves and takes database is ADO (ActiveX Data

Objects). The main target of ADO is saving, taking or altering the data of source or adding data to the specified data source.

This system uses SQL Server2000 (Shaosong, et al., 2006) as the data server. SQL Server2000 has many advantages, such as convenient operation, good scalability and high related software integration degree and it can be used in many platforms. In this system, the name of database is SCHOOL and many tabulations in the SCHOOL have been used, such as EMP (tabulation of employee), ADM (tabulation of administrator), BOR (tabulation of borrowing tools), ABOR (tabulation of available borrowing tools), BOO (tabulation of booking tools) and APP (tabulation of approval). Furthermore, this system uses a lot of scripting language, which is an explanatory language. Not only can scripting language be executed by browser directly, but also it can access to the various objects in the browser. With the help of scripting language, this system completes the task of data validation before the tabulation is submitted and achieves the function of opening or closing the window.

The above methodology is for the network inquiry system, the methodology of text message prompt modules will be introduced in the fourth part of the thesis.

3. Network Inquiry System

3.1 Employee Inquiry

The network inquiry system (Chenzhi, et al., 2013; Iahad, et al., 2012) offers employee a platform, where they can inquire their real-time tool borrowing information in order to avoid forgetting owing to too long a time. Figure 1 illustrates flowchart of the employee inquiry. Employees only input their account number in the log-in page to enter their own tool borrowing information interface, where information about tool kits they have borrowed and tools that can be borrowed can be searched. Based on the above two basic functions, we have perfected the network platform so as to realize tool online booking functions. If employees apply online, tool kits can be borrowed, thus simplifying borrowing procedures and increasing efficiency. Figure 2 shows the interface of employee inquiry.
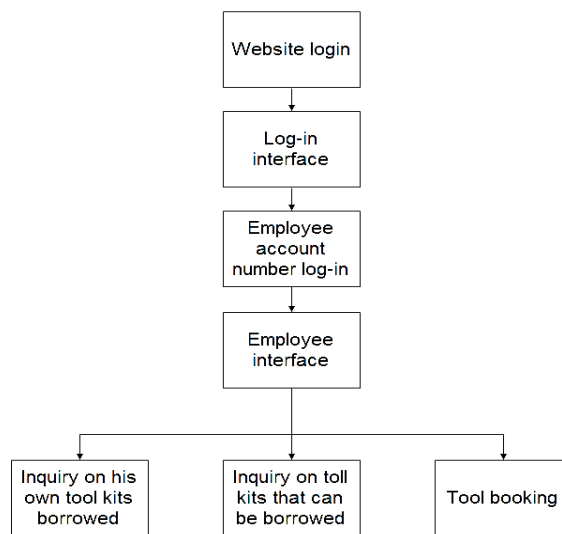

Figure 1. Flowchart of employee inquiry

No.	Serial No.	category	Type	Name	Model	Piece No.	Specs	Qt.	Warehouse No.	Sheet No.	date
1	HY10	Tool	T001	Pliers	12	LK	50vv	1	A3	JL003	2013-10-11
2	HY11	Tool	T003	Wrench	13-15	HH	15-13	1	A3	JL004	2013-10-11
3	HY12	Tool	T004	Box	14mm	TT	14mm	1	A3	JL005	2013-10-11
4	HY13	Tool	T006	Box	14mm	DD	14mm	1	A3	JL006	2013-10-11
5	HY14	Instrument	T009	meter	M	HL	009	1	A3	JL007	2013-10-11

Figure 2. Interface of employee inquiry

3.2 Administrator Inquiry

How to manage tools in an overall and unified way is hard to administrators in maintenance practices and in order to solve this problem, we have developed the administrator inquiry, flowchart of which is shown in Figure 3. In the flowchart, you can find four functions of the administrator inquiry.
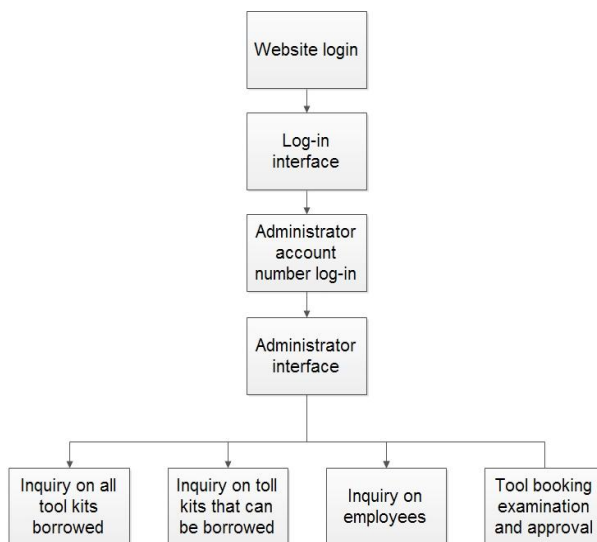
Figure 3. Flowchart of administrator inquiry

There is no difference in appearances between employee and administrator inquiry interface. However, there is essential difference in power and permission of them. First, for employee inquiry, only tool borrowing information of the employee himself can be inquired. While for administrator inquiry, tool borrowing information of all employees can be inquired. Second, employees only have right to apply for tool borrowing, while administrators have right to approve or reject applications by employees.

4. Text Message Prompt Modules

4.1 Basic Targets of the Modules

In maintenance practices of employees, it is hard to avoid forgetting tool borrowing owing to too long a time, thus decreasing tool utilization rates. We have developed text message transmission modules based on GSM network to deal with this problem. When tool returning date is approaching, the module will transmit text messages to borrowers prompting them to return the tools they have borrowed on time.

4.2 Fundamental Principles of the Text Message Transmission Modules

Flowchart of the module is shown in Figure 4.The upper computer transmits instructions to a single-chip microcontroller for processing and AT (Attention) instructions are then transmitted to the GSM modules through a serial port, completing control on the GSM modules and transmitting text messages.
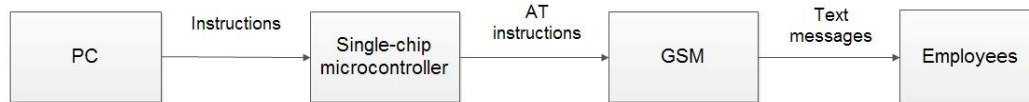
Figure 4. Flowchart of text message transmission module

4.3 Hardware Development of the Text Message Modules

The system hardware comprises two modules, i.e. controller and communication. As the communication module will generate strong current during starting and text message transmission and reception . In order to enhance resistance to interferences and expandability, we made the two modules in two separate boards. Figure 5 is a picture of the text message transmission module.
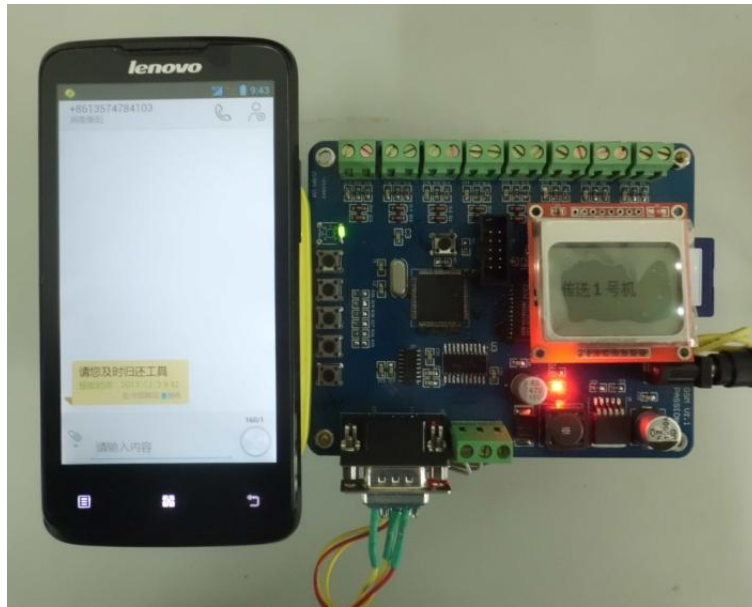
Figure 5. A picture of text message transmission module

The controller mainly controls and protects the single-chip microcontroller, and C8051F020 (Ling, et al., 2006) is used in this design as the MCU (Micro Control Unit), where pipeline architecture is used in its internal core at a speed as high as 25MIPS (Million Instructions Per Second), ten times faster than common ones. The controller circuits comprise eight sub-modules. They are C8051F020 minimum system, NOKIA5110 liquid crystal display, keyboard, SD card, power, RS232 (Recommend Standard 232) communication interfaces, MC52 control interface and external memory interface, totaling eight. Two modules, i.e. SD card and RS232 are described in detail as the following.

The reason for designing a SD memory module in the controller circuits is mainly for real-time records of messages transmitted for future access. There are two bus modes, one being SD and one being SPI(Single Program Initiation), the more popular SPI mode is used in this system. Figure 6 shows actual SD card driving circuit, where R31 - R35 are pull-up resistors. The RS232 interface circuits are mainly for realization of data transmission between the single-chip microcontroller and GSM module. Because the main controlling board is supplied with power 3.3V, so, the level translation chip used is MAX3232, actual circuit of which is shown in Figure 7.
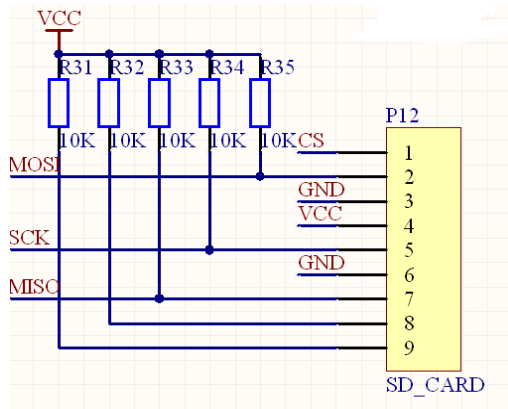

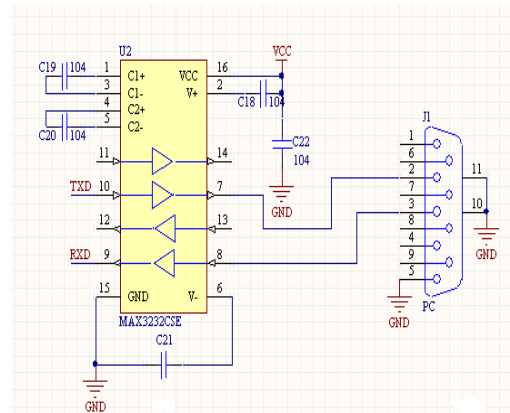Figure 6. SD card driving circuits

Figure 7. RS232 Interface circuits

Core of the communication module is a GSM module (Wei, et al., 2008), which is a communication module similar to the cell phone, having functions of sending text messages, voice communications and so on. Although being small, this module has been utilized widely in many fields. The GSM module makes control by means of AT instructions and can be connected to computer RS232 serial ports. Furthermore, it can be controlled by single-chip microcontrollers. Compared with other kinds of remote transmission networks, GSM has higher security and confidentiality features, which makes it suitable for applications in sensitive industrial sites. Besides, GSM networks covers wide areas and is basically not limited by transmission distances and there is no need to establish special network and maintenance

networks, enjoying great superiority in communication costs. Hence, GSM modules are selected for this text message prompting module.

4.4 Software Development of the Text Message Transmission Modules

The software developed this time is based on the platform Keil uVision 4, using language C as shown in Figure 8 program flowchart. After the device is powered, all the modules will be initialized and text messages can be sent after success. Information transmitted can be stored in the SD card.
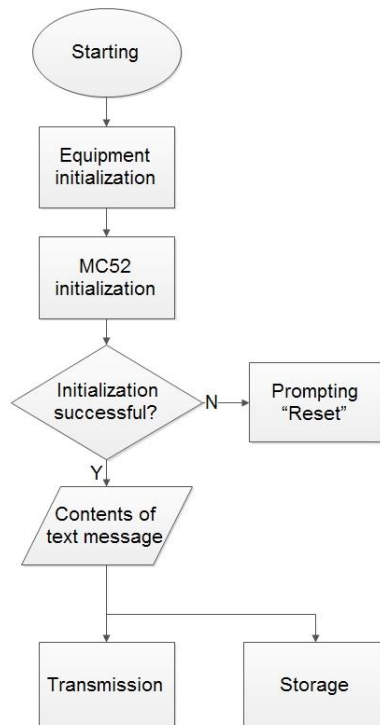

Figure 8. Flowchart of programs

The AT instructions general apply in the connection and communication between PC and terminal equipment. As mentioned in the previous paragraphs, the GSM (Biancucci, et al., 2013) modules perform control through AT instructions. In other words, control processes on the GSM modules are, in reality, processes of sending AT instructions. Sending a piece of text message is completed through the following steps:

1) Sending AT+CMGF, setting text message format;
2) Sending AT+CSCA, setting text message center number;
3) Sending AT+CMGS, setting user's cell phone number;
4) Inputting characters to be sent.

The SD card memory (Huan, 2009) is another highlight in this design. In order to read text messages on different platforms, FAT32 (File Allocation Table) file system is transplanted into the SD card read-write operations so as to write all communication messages into SD card in format TXT, realizing data records.

5. Conclusions

We complete the network inquiry system and the text message prompt modules through intensive research and development, realizing network management and efficient management on civil aviation engineering maintenance tool kits. This system solves practically the hard-to-solve problem facing the civil aviation engineering maintenance sector and it meets the modern requirement of the development. We believe that once this project is promoted and used widely, efficient management on civil aviation engineering maintenance tool kits is expected.

Based on the system, we will continue to develop the management of tool kits to improve the speed of borrowing and returning tools. We will establish a POS (Point Of Sales) machine terminal, which can replace the way of manual input with scan mode. If the terminal is complete, the whole system will be a powerful tool management system.

Acknowledgement

References

Anonymous. Record management system based on the B/S model. Retrieved from http://wenku.baidu.com/view/d307220c6c85ec3a87c2c53d.html

Biancucci, G., Claudi, A., & Dragoni, A. F. (2013). Secure data and voice transmission over GSM voice channel: Applications for secure communications. *Proceedings - 4th International Conference on Intelligent Systems, Modelling and Simulation, ISMS 2013*, 230-233. http://dx.doi.org/ 10.1109/ISMS.2013.10

Chenzhi, G., & Zhenya, L. (2013). An inquiry-based blended learning system for computer network curriculum. *Proceedings of the 8th International Conference on Computer Science and Education, ICCSE 2013*, 1340-1345. http://dx.doi.org/10.1109/ICCSE.2013.6554130

Huan, H. (2009). Development of network monitoring system based on the CAN buses. Retrieved from http://d.wanfangdata.com.cn/Thesis_D066827.aspx

Iahad, N. A, Mirabolghasemi, M., & Huspi, S. H. (2012). A blended community of inquiry approach: The usage of social network as a support for Course Management System. *2012 International Conference on Computer and Information Science, ICCIS 2012 - A Conference of World Engineering, Science and Technology Congress, ESTCON 2012 - Conference Proceedings,180-183*. http://dx.doi.org/ 10.1109/ICCISci.2012.6297235

Ling, X., & Xiaoyan, C. (2006). Single-chip microcontroller C8051F020, its features and applications in telecommunication systems. *Journal of Henan Mechanical and Electrical Engineering College*, *14*(6), 15-16. http://dx.doi.org/10.3969/j.issn.1008-2093.2006.06.007

Shaosong, Y., Xiangfa, R., & Yan, Z. (2006). Design and research of storehouse manage system based on SQL Server 2000 database. *MACHINERY DESIGN & MANUFACTURE*. http://dx.doi.org/ 10.3969/j.issn.1001-3997.2006.02.078

Wei, X., & Jianqing, Z. (2008). GSM modules – A New prominent in realization of remote control. *Radio*, *10*, 54-56. http://lib.cqvip.com/qk/94496X/200810/28294784.html

Yue, Z., & Yushun, F. (2002). The Design and Implementation of Workfiow Management System Based on COM and ASP. *COMPUTER ENGINEERING AND APPLICATIONS*, *38*(1), http://dx.doi.org/10.3321/j.issn:1002-8331.2002.01.080