The Research and Application of College Student Attendance System based on RFID Technology

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Abstract

College student attendance management of class plays an important position in the work of management of college student, this can help to urge student to class on time, improve learning efficiency, increase learning grade, and thus entirely improve the education level of the school. Therefore, colleges need an information system platform of check attendance management of class strongly to enhance check attendance management of class using the information technology which gathers the basic information of student automatically. According to current reality and specific needs of check attendance and management system of college students and the exist device of the system. Combined with the study of college attendance system, this paper gave the node design of check attendance system of class which based on RFID on the basic of characteristics of embedded ARM and RFID technology.

Keywords: *Attendance system, ARM, RFID*

1. Introduction

Student is the largest union in the study environment of university, so it is hard for managing student things. Especially, in the respect of student class attendance, the original named style is hard to response the really situation of student attendance [1].

Therefore, the design of student attendance system based on RFID has significant reality meaning. The system not only can improve the work efficiency, students' study and development, but also can save human and material resources.

2. The principle of system work

When students who have RFID tag walk through the door of classroom, RFID reader will recognize the EPC (Electronic Product Code) of RFID tags, and then the EPC will be displayed on LCD. At the same time, the EPC will be sent to PC by TCP/IP net. The data management system will search database to get the information of student.

3. Structure of the system

With the development of science and technology, there are variety of attendance systems. Although the products and technology of the exist attendance systems have been relatively mature, but mostly used in residential, office buildings etc. Especially, these attendance system are commonly used contactless identification or biometric technology, it is difficult to meet the characteristics about large number of personnel and the strong liquidity.

In order to solve the above problem, combined with the specific circumstances of the college classroom, the attendance system node of student classroom based on RFID has been designed.

There are three part of the system: RFID tags, RFID reader, Database disposed system based on PC. The structure of system is shown as Figure 1.

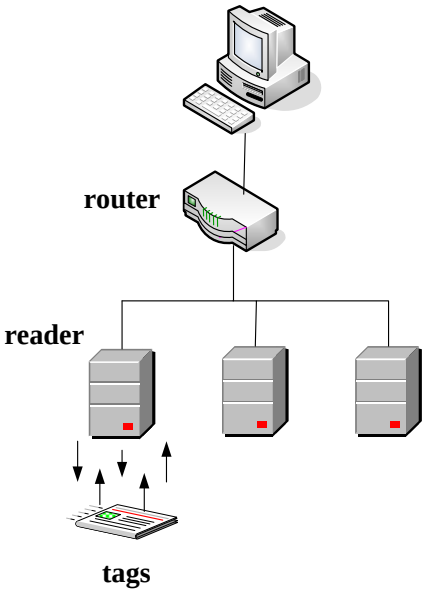

Figure 1. Structure of System

4. The selection of RFID tag

From different angles, the RFID tag can be divided into different types.

(1) According to data read and write type, tag can be divided into read-only tag and read-write tag.

(2)According to the power supply, tag can be divided into active tag and passive tag.

(3)According to modulation schemes, tag can be divided into initiative tag and passive tag.

(4)According to the work frequency, tag can be divided into low frequency, high frequency, ultrahigh frequency. Low frequency tag's work frequency range is 30~300KHz, classical frequency is 125KHz and 133KHz, the readable distance is 10cm. High frequency tag's work frequency range is 3~30MHz, classical frequency is 13.56MHz, the readable distance is 1m.Ultrahigh frequency tag's work frequency is 300Mhz~3Ghz, the classical frequency is 433Mhz, 902~928 MHz、2.45 GHz and 5.8GHz, the classical readable distance range is from few meters to ten meters [2].

In order to determine the type of RFID tag, conducted the width of the door of classroom. In the last, we determine the width of the door is 147cm. Therefore, we choose the ultrahigh frequency tag, read-write, passive RFID tag to design the system.

5. The design of RFID reader

RFID reader is an equipment that can read information from tags. Its main task is sent read signal to tags, and receive signal from tags, then transport the identification information to host computer [3, 4]. The structure of RFID reader is shown as Figure 2.

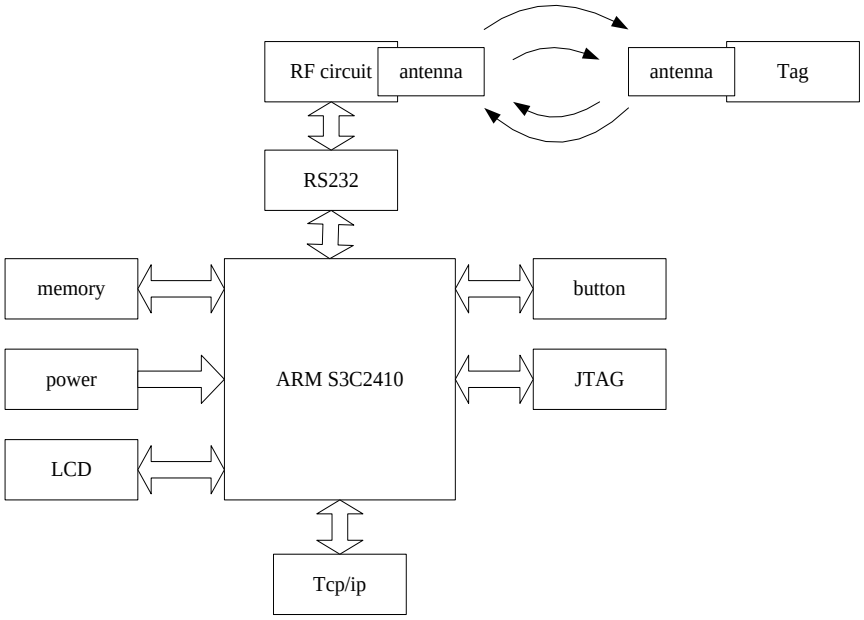

Figure 2. The Structure of RFID Reader

(1) In this paper, the main processor is s3c2410 which is a kind of chip that belong to ARM9 series. s3c2410 chip is a 16/32 bit RISC processor. s3c2410 chip integrates a wealth of on-chip functions, such as: the MMU virtual memory management, LCD controller, external memory controller, 3-channel serial port, NAND flash controller, 117 general purpose IO and 24-channal external interrupt sources, 8-channel 10bits ADC, 2-ports USB host and USB device port, at the same time, RTC has a calendar function, greatly reducing the cost of the system [5].

(2) LCD display module. The s3c2410 internal has integrated LCD controller, it supports monochrome, 4 gray, 256-color palette display mode, non-palette of 64k and 16M color display mode, and support 640*480 320*240 resolution, and a variety of other specifications. We choose 320*240 resolution and 565 format TFT screen.

(3) Communication interface module. This module can be divided into two parts, one part is a interface that connect to host computer through TCP/IP, the other part is a interface that connect to RF module through serial port. DM9000AE is an ethernet chip that used to network communications, its data bus is 16Bit, which connected to Bank2 of s3c2410, the 32th pin of DM9000AE is used to instruct that the data bus is index port or data port. Connect one data bus to A1 pin, in order to distinguish orders or data. The power supply voltage is 2.5V.

s3c2410 supplied 3-channel RS232 serial port, including UART0, UART1, UART2. UART0 is used as ARM terminal, UART1 is used connect to RF transceiver module for communication.

(4) Memory module. In the system, we use K9F1208 NandFlash chip. Because the s3c2410 internal has NandFlash controller, K9F1208 could connect to s3c2410 directly. In the development board, SDRAM is HY57V561620 chip, there are 32M bits in every chip. The data bus width is HY57V561620. HY57V561620 internal have 4 Banks, and every Bank have 4M bits. The 20th and 21th pin of HY57V561620 connected to LA25:24 of s3c2410.

(5) RF transceiver module. We use M5e-C RFID read-write module whose work frequency is 915MHz. M5e-C RFID read-write module is the smallest reader in Thing magic series and it is UHF RFID reader. This module has a lower power consumption, small size and has good RF performance, at the same time, the power is 0.5W and readable distance is 1.5m.

(6) Power module, the supply voltage of s3c2410 is DC5V， through the LDO chip AS1117-3.3V and AS1117-1.8V, the voltage 5V has changed into 3.3V, 1.8V work voltage. Among in the changed voltage, the 1.8V voltage is power voltage of s3c2410 kernel.

6. The improvement of the dynamic time interval algorithm

Studied on anti collision algorithm of the stochastic tag and analyzed the advantages and the disadvantages of anti collision algorithm of random tag. Simulated and improved the dynamic time interval algorithm. The results of simulation are shown as Figure 3 to Figure 6.

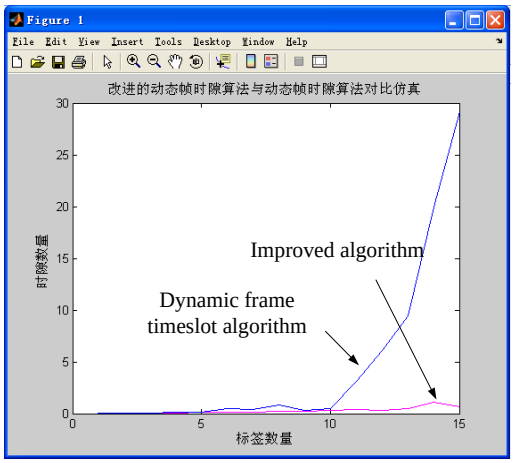

Figure 3. The Frame Length is 2, Comparison of Improved Algorithm and Dynamic Frame Timeslot Algorithm

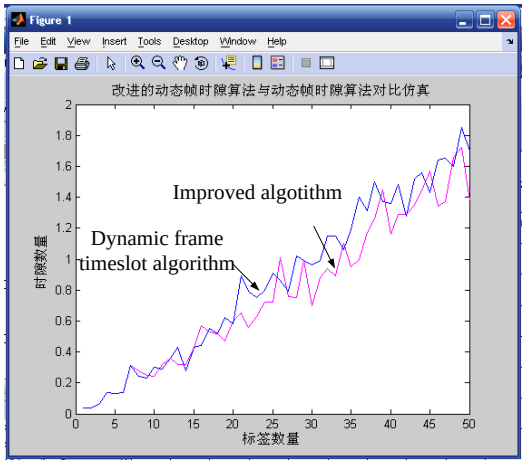

Figure 4. The Frame Length is 4, Comparison of Improved Algorithm and Dynamic Frame Timeslot Algorithm

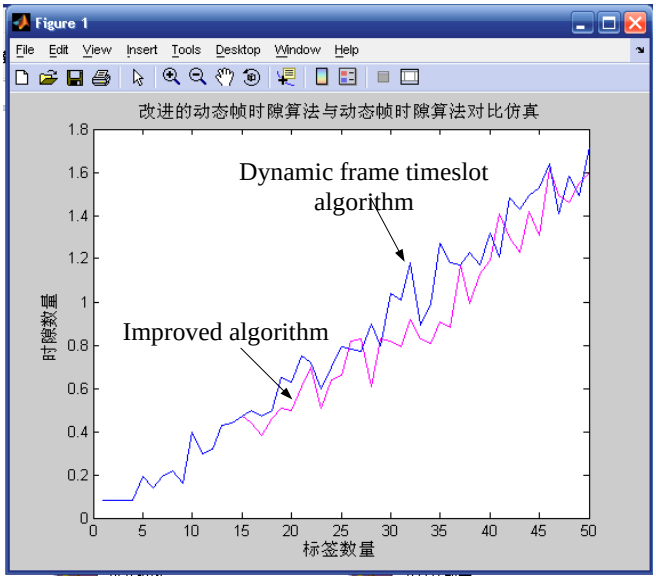

Figure 5. The Frame Length is 8, Comparison of Improved Algorithm and Dynamic Frame Timeslot Algorithm

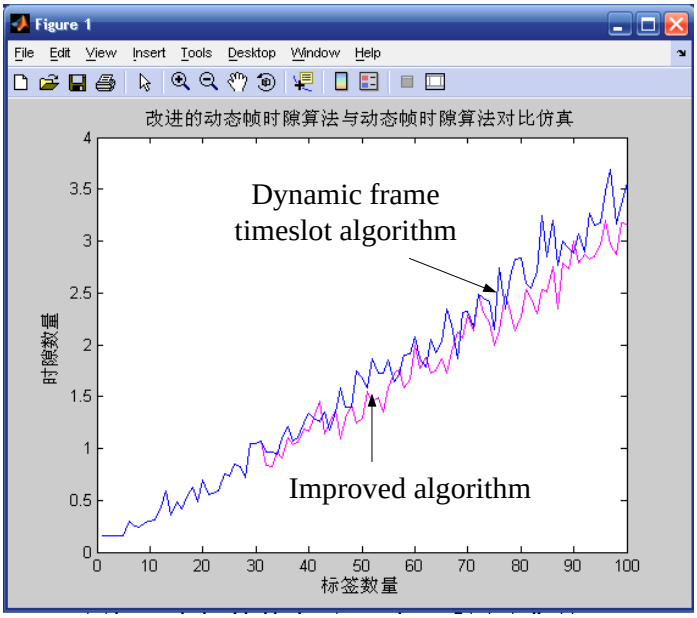

Figure 6. The Frame Length is 16, Comparison of Improved Algorithm and Dynamic Frame Timeslot Algorithm

Table 1 is simulation data comparison of two kinds of algorithm.

Table 1. Comparison of Two Kinds of Algorithm

algorithm	Number of total tags									
	1	2	3	4	6	8	10	12	14	15
Dynamic frame Timeslot algorithm	2	6	7	10	48	81	48	606	2000	2917
	2	2	9	7	16	120	100	282	1696	1724
	2	2	5	8	24	24	378	359	3772	1798
	2	4	5	14	12	56	162	185	1308	4397
	2	2	5	16	16	38	112	266	248	4473
	2	4	5	12	42	36	183	271	3254	513
	2	8	7	32	14	42	202	340	204	2653
	2	12	7	10	10	30	68	550	62	941
	2	4	5	10	36	18	299	354	852	4440
	2	4	7	10	30	22	84	72	2912	183
	2	4	5	7	16	190	62	420	2126	232
	2	6	7	18	14	62	212	348	1416	4341
	2	2	5	5	38	52	64	106	1056	1483
	2	2	5	10	22	32	212	352	488	217
	2	8	5	8	15	40	62	250	4052	379
	2	10	5	11	16	34	155	530	80	3341
	2	2	5	8	26	50	86	226	3952	1155
	2	2	7	8	12	40	176	496	1636	5439
	2	2	5	8	29	60	70	188	59	559
	2	6	7	12	14	42	130	420	742	225
average	2	5	6	11	23	53	143	331	1596	2071
Improved algorithm	2	6	7	7	12	20	29	28	106	66
	2	2	9	8	16	16	39	181	184	63
	2	2	5	4	10	20	22	44	46	93
	2	4	5	15	9	20	53	58	55	301
	2	2	5	9	14	28	33	50	78	135
	2	4	5	8	14	34	40	47	40	57
	2	8	7	7	13	24	30	68	390	253
	2	12	7	9	7	16	25	51	34	261
	2	4	5	10	35	20	32	53	66	75
	2	4	7	9	12	25	25	46	50	163
	2	4	5	10	12	19	17	54	60	55
	2	6	7	8	15	20	32	44	42	59
	2	2	5	8	12	20	40	57	40	161
	2	2	5	6	14	14	41	37	64	51
	2	8	5	9	13	13	32	91	82	147
	2	10	5	11	17	26	24	96	196	143
	2	2	5	9	26	17	28	60	84	105
	2	2	7	6	18	20	26	28	46	107
	2	2	5	7	20	22	41	27	68	67
	2	6	7	7	22	39	21	94	122	48
average	2	5	6	8	16	22	32	61	93	121

The simulation results showed that the improved scheme had superior performance, reduced the time slot numbers of identification label in system, and improved the performance of algorithm.

7. QT programming

Application program design of the paper is mainly divided into two parts:the application design for the LCD screen and PC processing program design of background data[6~11]. Information of LCD screen displayed: classroom number, time, date, ID number of students. Upper computer data processing system includes: landing interface, classroom selection interface, classroom information interface, database management interface.

(1) When design the LCD screen application, we use QWidget class, QLabel class, QTimer class, QtNetwork class, QLineEdit class, QdateTime class and qextserialport class, these classes are used to achieve the LCD screen application. The result of LCD display is shown as Figure 7.

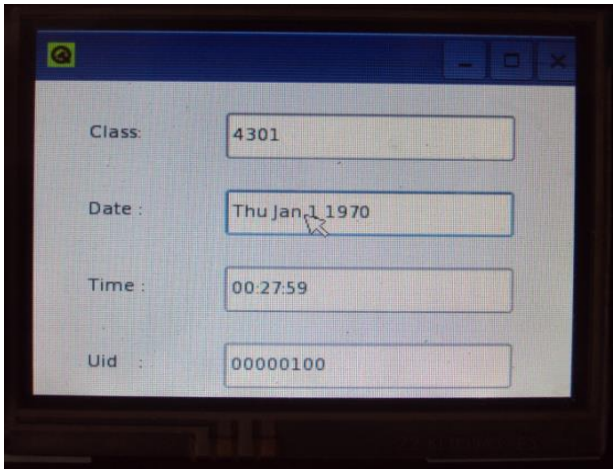

Figure 7. LCD Display

(2) PC background data processing program include: login interface, database management interface, classroom display window. Shown as Figure 8, Figure 9 and Figure 10.

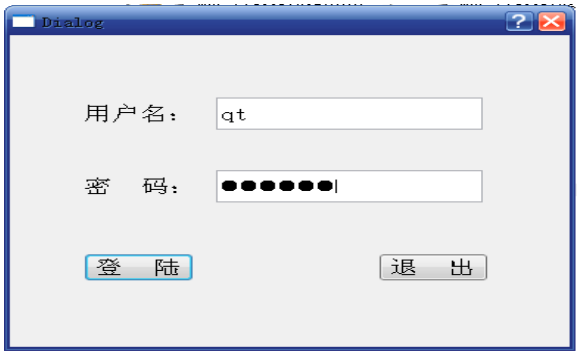

Figure 8. Login Interface

Figure 9. Database Management Interface

Figure 10. Classroom Display Window Interface

8. Conclusion

Combined with the actual situation of college students class attendance system, the design of student attendance system nodes based on RFID has be proposed. In this paper, the hardware node of system and the develop processes of related application have been detailed presentation. The designed system not only can improve the work efficiency, but also can save human and material resources.

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Zhang Yuru is a master tutor, teacher of Electronic Information Engineering Teaching and Research Section. Her main research fields include intelligent information processing and fault detection.