

Intelligent Auxiliary System of Shared Study Room

Xiuming Yue^{1,*}, Xiangli Dong², KeCheng Qu³

¹College of computer, Shandong Xiehe University, Shandong, China

²College of computer, Shandong Xiehe University, Shandong, China

³College of computer, Shandong Xiehe University, Shandong, China

*Corresponding author. Email:isophie@163.com

ABSTRACT

With the rapid development of mobile Internet, Sharing Resource Information Service has entered people's life. Sharing study rooms became a requirement. This paper introduces an intelligent assistant system of shared study room, which is constructed by means of sensor, wireless communication, Internet of things and so on. The system is composed of main control chip, wireless communication module, Light Sensor, pressure sensor, ultrasonic sensor, RFID and so on. The utility model can realize auxiliary functions such as lighting, monitoring of learning time, correcting of sitting posture and charging by time in the shared study room. The equipment of self-study room realizes the linkage of software and hardware. Compared with the management mode of traditional study room, the intelligent assistant system of shared study room has the characteristic function of satisfying people's needs, provides a good learning atmosphere, and can effectively solve the problem of insufficient learning resources at present. It provides an idea for the future development of the shared study room industry in the field of business models.

Keywords: Shared Resources, Study Hall, Sensor

1. INTRODUCTION

With the rise of the knowledge-based pay economy, paying for expertise and training has slowly gained acceptance, and now you need to pass an exam to get a certificate to enter almost every industry, especially in economically developed cities, during some important test periods, a quiet and comfortable test preparation environment becomes the most urgent requirement for many test preparation students. According to statistics, the average of 439,000 people share a public library, the public resources are very scarce, and the self-study room field opening threshold is low, and the cost is not high. Compared with the traditional industry to rely on work experience, the study room for this new field for everyone has not too much experience, many reasons led to the rapid rise of the shared study room. The emergence and development of shared study rooms can effectively solve the problem of insufficient resources.

Smart shared study rooms are already relatively mature in some countries, and South Korea was the first country to incorporate Internet of things technology into shared study rooms, originally designed as a black room, where the lights are turned on and then charged by the hour, ending with a bill. This is a major breakthrough in the traditional study hall. With the development of

science and technology, the upgraded shared study room makes use of human infrared sensing technology to place a sensor at each study table, which can turn off the lights. In addition, most study rooms in Japan and South Korea have been equipped with smart sockets, which are connected to handheld devices such as mobile phones using Wifi or Bluetooth technology, saving energy and making them more secure. Paid study rooms in foreign countries have developed very stable, rather than the short-term economic network, their many experiences are worthy of our reference.

2. OVERALL SYSTEM DESIGN

2.1. System requirement analysis

In the age of Internet economy, sharing economy has gradually become a hot topic that people pay attention to. In the age of Internet of things, the traditional study room cannot meet the needs of diversification and informationization. The intelligent assistant system of shared study room is the only way for the traditional study room to develop toward information and intelligence. To provide users with more convenient and comfortable services is the first consideration in building a new type of shared study room.

(1) Consumers pay to share the study room learning in the final analysis is the study room of the consumption of this strong atmosphere, the system should be able to achieve the function of encouraging users to learn.

(2) In the process of learning, people often do not pay attention to their sitting posture, bad sitting posture will affect people’s health, the system should be able to remind users whether or not to sit properly.

(3) Lighting system is an essential study room, the system to provide to meet the needs of the user lighting system.

(4) Study room seats are limited. The system must design a set of perfect seat reservation and payment system.

(5) through the comparative analysis method to study the advantages and disadvantages of various modules, the system design needs to select the appropriate hardware modules.

According to the demand analysis, the system is divided into 4 functional modules, which are learning time monitoring module, sitting posture correction module, lighting module and payment management module. The System Framework Diagram is shown in Figure 1.

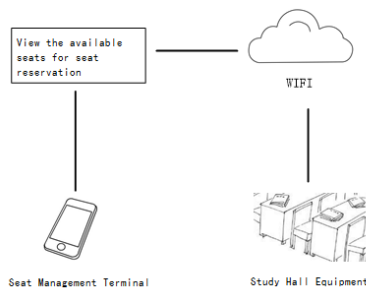


Figure 1 System Diagram

The lighting module of the intelligent assistant system in the shared study room can be divided into two modes: manual mode and automatic mode. In manual mode, the luminance is adjusted by potentiometer, and in automatic mode, the luminance is controlled by the light intensity collected by the light sensor. Both modes can switch between cold light and warm light to meet the different needs of users. Two ultrasonic sensors monitor the distance from the head and abdomen to the self-study desk, and the screen will display “Too close”to remind the user if the distance is too close. A pressure sensor is installed on the seat to monitor the learning time. The sitting posture correction and learning duration monitoring function can be paused using the button. Use Rfid radio frequency module to punch in and unlock, close the system and deduct fees. The system cannot be used before unlocking. After punching in, the system will start charging and display on the screen, and then punching in the second time for settlement. The content displayed on the screen includes timing, hours, modes,

brightness, and cost. For the management of the seats in the study room, the mobile phone APP and the study room equipment are connected through the Wi-Fi module, and the functions of showing the spare seats and occupying seats are realized through the mobile phone software.

2.2. Learning Time Monitoring Module

Many people have poor self-control, in a comfortable and relaxed environment will not be able to control the release of their inertia so that they can not fully devote their energy to learning. Shared Study Room intelligent support system set up the monitoring function of learning time, according to their own learning time to cheer, self-encouragement, so the energy into the study of the probability will be greater. The module is designed with a variety of options, such as using a human infrared sensor to collect information or a pressure sensor. The design finally selected the Keys thin-film pressure sensor, this sensor small size, very stable performance, long service life, very suitable for the system for the pressure sensor requirements.

The pressure sensor used in the system is the Keys thin film pressure sensor. It is based on a new composite nano-fiber pressure-sensitive waterproof material and comfortable young Modulus of ultra-thin waterproof film as a substrate, both comfortable waterproof and nano-pressure-sensitive two functions. When the pressure sensor senses the external pressure, the internal resistance of the sensor will change. The control circuit can be used to convert the corresponding change of pressure intensity received by the pressure sensor into a corresponding change of high voltage electric signal. The module is compatible with all kinds of single-chip control boards, and has the advantages of quick response, low power consumption and low price.

2.3. Sitting Posture Correction Module

This part of sitting posture correction is mainly to monitor whether the distance between the user and the self-study desk is too close, whether the sitting posture is appropriate. This part of the design can choose image acquisition, ultrasonic technology to achieve. This system selects the ultrasonic ranging scheme, uses 2 ultrasonic modules, separately monitors the user’s abdomen and the head to the self-study table distance. If the distance is too close the information will be transmitted to the CPU, the CPU control screen display “Too close”to remind the user to achieve the purpose of sitting posture correction. Make this system more characteristic.

The model used for the ultrasonic module is HC-SR04. This ultrasonic sensor has the advantages of accurate ranging, wide ranging and very stable performance. Using HC-SR04 in the intelligent assistant

system of the shared study room can accurately monitor the distance from the person to the study desk and remind. At the heart of the HC-SR04 ultrasonic ranging module are two ultrasonic sensors, one transmitter and one receiver. The transmitter converts the electrical signal into a 40 KHz ultrasonic pulse, which the receiver monitors and, if detected, produces an output pulse whose width can be used for ranging.

2.4. Lighting Module

The lighting module adopts adjustable potentiometer and photosensitive resistor to realize manual and automatic adjustment of self-study desk lighting. According to the different needs of users to choose their own lighting mode, automatic mode photoresistor automatic monitoring of the ambient brightness, with the change of brightness, LED lamp brightness also changes, to protect the user's vision. Manual mode through adjustable potentiometer adjustment for their own brightness, to facilitate learning. Lighting is divided into cold light and warm light, users can choose according to their preferences.

2.5. Payment Management Module

2.5.1. RFID module

RFID modules are used in this system to unlock devices and pay for them. After the seat reservation, the data will only be displayed on the screen after the card is unlocked, and the system will be turned off and paid for by Swiping the card when leaving at the end of the study. MFRC522 supports multimedia functions and high-level software composite interactive applications. The internal wireless signal control transmitter part and the antenna component can directly use an external electronic file reader. It can be used to communicate with ISO14443A/MIFARE card and some antennas of External Signal Control Repeater. No other signal control circuit is needed. Compared with MFRC500, MFRC522 has smaller volume and higher performance, so it is more suitable for the application of this system.

RFID application small non-contact, low-cost, low-voltage RC522 reader chip. It has flexible interrupt mode and powerful low power hard reset function. Communication between RC522 and host adopts SPI mode, which can greatly reduce the connection, reduce the size of PCB and reduce the cost.

2.5.2. Cloud applications

In order to make the self-study room seats be used reasonably, improve the efficiency of resource utilization, hardware and software linkage using cloud services to achieve. This system design uses the smart cloud APP to reserve seats. Creating products with smart cloud, generating code automatically, and porting smart

cloud protocols to software can save a lot of time. The CPU is connected to the smart cloud APP via the Wi-Fi communication module, and the device is unlocked via the RFID card reader after occupying the seat.

3. SYSTEM PERFORMANCE TEST

3.1. Hardware circuit test

Before the hardware is tested, the main control chip STM32, pressure sensor, ultrasonic sensor HC-SR04, RFID module, wireless communication module ESP8266 and TFT screen, light sensor are connected with dupont line. After the completion of the physical connection of the hardware, check the connection circuit is wrong, no error can be connected to the USB cable for power supply motherboard.

After powering up the system, the seat display shows no reservation. Through the mobile phone APP reservation, show the reservation, waiting for the swipe card unlock system. After swiping the card, the system is in good working order, time and charge start, ultrasonic module start measuring distance, and display lighting mode and current brightness. The hardware test rendering is shown in Figure 2.



Figure 2 Test rendering

3.2. System testing

At first the ESP8266 module had to be pushed to enter AirLink mode. Mobile connected to Wifi, open smart cloud software to operate, select one button configuration, fill in the mobile connected Wifi ID and password, then our device brand click Lexin, wait for the device debugging to connect to the state, click on the button I have completed the above operation, after the completion of the above steps can wait for distribution network success. After the success of the distribution network into the shared study room control interface, the hardware power on the seat switch to open, after the card can use the system. The APP automatically turns the seat off when the card is swiped out. After a number of tests, all the results are in line with the expected results, the system runs smoothly, stable performance.

3.3. Test results

After a number of tests, all the results are in line with the expected results, the system runs smoothly, stable

performance. The light can be turned on and off normally in automatic and manual mode, the ultrasonic module shows the monitoring distance is too close within 20 cm, and more than 20 cm shows the specific data. Light Press, do not press the pressure sensor, the system does not carry out time monitoring, press the pressure sensor system to carry out time monitoring. The results of the learning monitoring function test in the study room are shown in Figure 3.



Figure 3 Effect Diagram of monitoring function

4. CONCLUSION

This design uses the Internet of things, sensors, SCM, WIFI wireless communication technology research and design a shared study room intelligent auxiliary system. The system can achieve the following functions: Mobile APP booking, sitting posture correction, learning time monitoring, card unlocking, time charging, manual or automatic adjustment of lighting brightness, light color switch. Compared with the existing shared study room at home and abroad, the shared study room intelligent auxiliary system has the advantage of providing more diversified services for users, such as sitting Posture Monitoring, monitoring study time, etc., however, there are still many deficiencies in the system. For example, the intelligent assistant system of the shared study room still needs to be coordinated by the human administrator, which has not realized the complete autonomy and intelligentization. There is no detection function in the real study room environment, the ultrasonic sensor only used one to simulate the sitting posture correction function, in the future study, work to continue to seriously study the realization.

ACKNOWLEDGMENTS

I am greatly indebted to my leadership, Professor Zhao, for her valuable instructions and suggestions on my thesis as well as his careful reading of the manuscript.

I feel grateful to all the teachers in Shandong Xiehe University who once offered me valuable advice.

Last but not least, I owe much to my students for their valuable work which are of help and importance in making the thesis a reality.

REFERENCES

- [1]Ziyi Wang.Research on Library Management in Cloud Computing Environment[J].International Journal of Applied Mathematics and Soft Computing,2020,6(2).
- [2]Anupam Chanda. Usefulness of Android Application in the Library:A Case Study on Assam Don Bosco University Library[J].International Information & Library Review,2020,52(1).
- [3]Zhao Yayun. Study Room Monitoring System Design based on single chip microcomputer [J] . Electronic Production, 2022,30(05) : 81-83. Doi: 10.16589 J. No, no, no. CN11-3571/TN. 2022.05.002.
- [4]Lixin WANG.Transformation of University Library Management Model Based on Personalized Service[J].Creativity and Innovation,2020,4(6).