



# Multi Cultural Music Remote Assistant Teaching System Based on Mobile Internet of Things

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**Abstract.** In view of the imperfection of the current music teaching mode system in Colleges and universities, this paper puts forward the design of the multi-cultural music remote auxiliary teaching system based on the mobile Internet of things. Through the combination of emerging mobile Internet of things technology and teaching, optimize the system hardware structure and configuration parameters, further optimize the software function of multi-cultural music remote assistant teaching system based on mobile Internet of things, improve the collection and selection of teaching materials, so as to better improve students' interest in learning and ensure the quality of teaching.

**Keywords:** Mobile Internet of things · Multi culture · Music teaching

## 1 Introduction

In the process of music teaching, through the accumulation and summary of teachers' experience, we can find that the problems students encounter in learning have some similarities to a certain extent [1]. With the help of the distance assistant teaching system, the assistant teaching is carried out. Generally speaking, all the music equipment used in music classroom teaching activities and extracurricular music activities in the form of the Internet of mobile animals can be regarded as the music teaching system of the remote assistant teaching system. Music system is a series of mobile Internet of things system, which can stimulate students' interest and improve their memory.

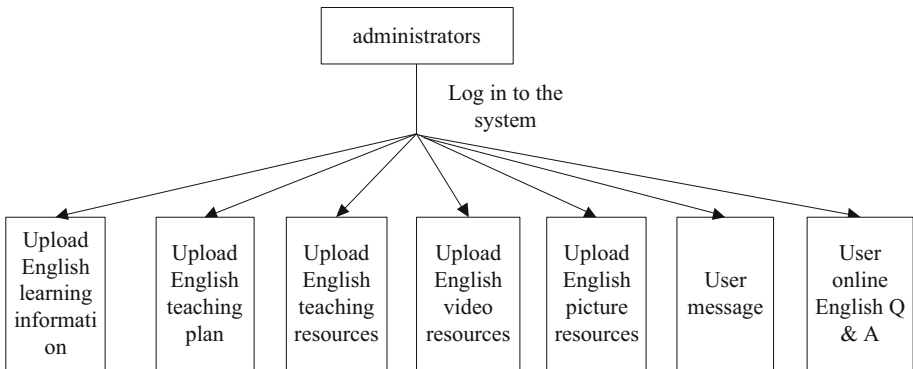
Relevant scholars have studied this. Literature [2] proposes a music privacy information protection incentive mechanism based on perceptual task allocation, which allocates tasks by perceiving IoT music information, constructs a crowd perception framework according to cloud and edge cooperation, and realizes music privacy information protection through greedy algorithm. This method can improve the quality of teaching, but the correlation between music teaching content and students' needs is poor. Literature [3] puts forward the music remote auxiliary teaching method based on flipped classroom teaching, which improves the learning experience of music students through flipped classroom teaching method, and measures the learning effect by students' academic performance. This method can enhance students' learning interest, but the teaching quality is poor.

The traditional music teaching mode system is not perfect, and the teaching quality is not good. This paper proposes the design of multi-cultural music remote assistant teaching system based on mobile Internet of things. Optimize the system hardware structure and configuration parameters, improve the collection and selection of teaching materials, improve students' interest in learning, and ensure the quality of teaching.

## 2 Multi Cultural Music Distance Assistant Teaching System

### 2.1 Hardware Structure of Music Remote Assistant Teaching System

The overall design of the system includes function structure design and system structure design, which can be simplified as modular design. In the modular design, it is not only necessary to divide the components of the whole system, but also to design the communication between modules, module continuity, module protection, module solvability and module combination [4]. The original framework of music teaching hardware system starts from the identity of system administrator, and every login needs to log in as an administrator. After login, users can upload music learning information, music teaching plan and music teaching resources. This paper introduces the technology of remote assistant teaching system, improves the system framework, retains all the functions of the original system, and on this basis, adds two modules: user message and user online music answering. Through the two modules of user's message and user's online music Q & A, learners can not only have a better understanding of music knowledge, but also effectively shunt the teaching video watching [5]. Some users will have questions in the process of watching the teaching video. Through the function of leaving a message and answering questions, users' doubts can be solved. In the stage of original users' leaving a message, new users can enter the system to watch other music teaching videos. The frame structure of the improved system is shown in the figure (Fig. 1).

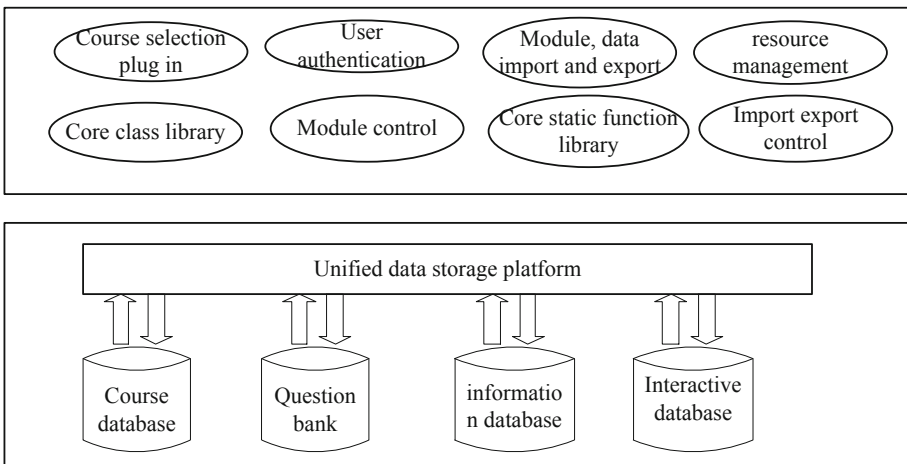


**Fig. 1.** The frame structure of the improved system

The core of the hardware equipment of the system is PC. The hardware equipment of other parts includes MIDI keyboard, monitor speaker, professional audio card, sound

source, microphone, etc. the software includes all kinds of music software. The function of the whole system is to carry out music teaching through MIDI production and digital audio recording and editing [6]. MIDI keyboard is used to input information in this system, which is a bridge for human-computer interaction; microphone is used as audio input equipment to input the voice of songs or other original musical instruments into the Internet of mobile animals. The Internet of things and all kinds of music software are responsible for recording and storing, no matter the information input by MIDI keyboard or the audio input by microphone, they are all stored in it. When the modular design of the system is carried out, it needs to meet the high cohesion characteristics within the module [7]. Therefore, the system equipment module must be able to run independently to complete the design function, but need to control the scale of the module. The properties of modules can be summarized as interchangeability, pluggable parallelism and boundedness.

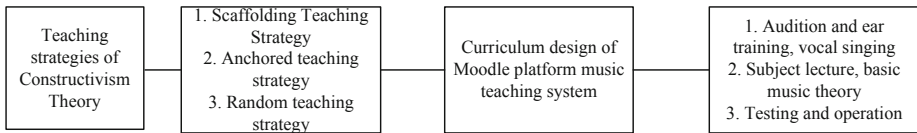
(1) When the internal requirements of the module change, the changes will not affect the normal operation of other modules; (2) when the module needs to be deleted, only the functions handled by the module will be affected; (3) if a new module realizes the same functions and has the same operation interface, the operation of the whole system will not be affected after replacement [8]. Based on this, the system equipment structure framework is optimized as follows (Fig. 2):



**Fig. 2.** Optimization of system equipment structure framework

The design of music teaching environment includes: the design of “situation” in music teaching, the design of “cooperative learning” environment in music teaching, the design of learning environment (non teaching environment) and the design of external information resources [9]. Based on the theory of music teaching design under the guidance of multicultural theory, this paper designs and refines the specific curriculum design of music teaching system based on mobile Internet of things, and applies the teaching strategies under multicultural theory to the specific curriculum design. As shown in the

figure, this paper presents the specific application of teaching strategies in curriculum creation (Fig. 3).

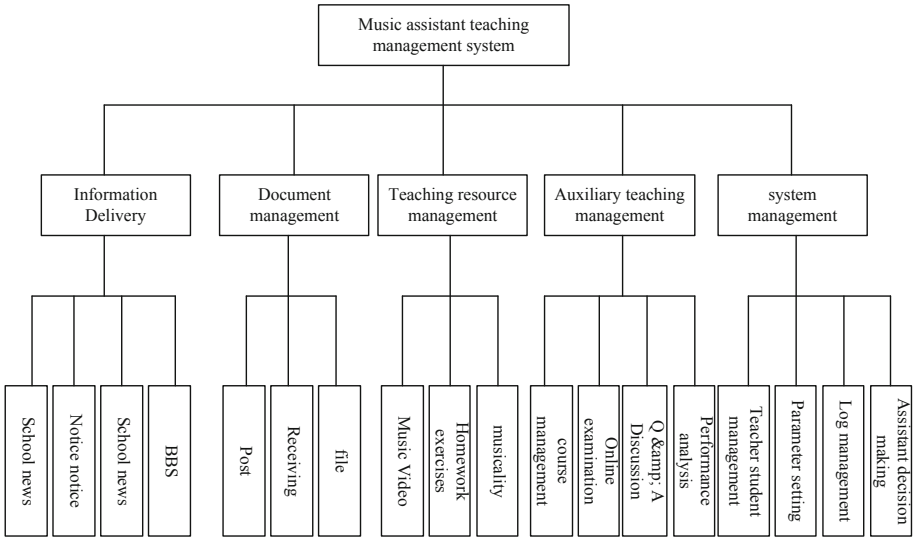


**Fig. 3.** Optimization of system equipment operation standard

The use of mobile Internet of things and remote auxiliary teaching system in music theory teaching can reduce the difficulty of teaching and enrich teaching means. Students should make comprehensive use of hand, brain, vision and hearing senses in learning, which can not only stimulate students' interest in learning, but also play a great role in promoting the efficiency of classroom learning, so as to realize the goal of classroom teaching "Double main teaching mode", so as to improve the teaching quality and efficiency [10]. Before the music theory class, the teacher first makes the music examples needed for the class, and saves them in the corresponding music software, so that in the class, the teacher only needs to move the mouse, and the students can see the music examples and hear the sound at the same time, and can listen to some part of the music examples repeatedly to strengthen the understanding [11]. At the same time, teachers can also use mobile Internet of things software to lead students to play music theory games, with the help of some staff learning software to teach basic music theory. On the one hand, it reduces the time for teachers to prepare lessons, on the other hand, it reduces the difficulty and dullness of music example explanation, and stimulates students' interest in learning.

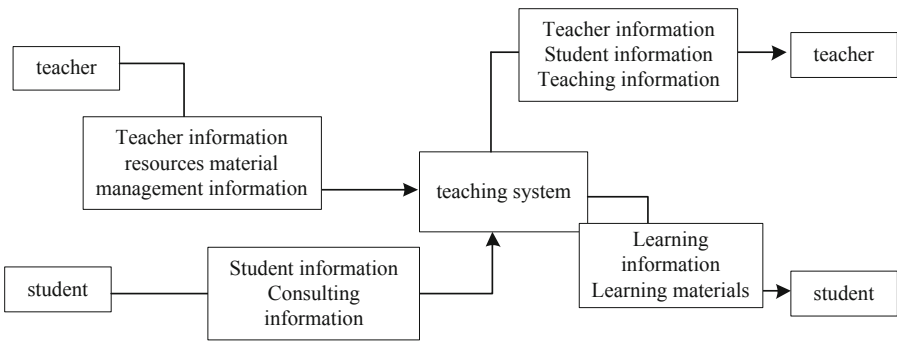
## 2.2 Function Optimization of System Software

Music assisted teaching management system is mainly composed of information release, document management, teaching resource management, assisted teaching management and system management modules. The information release module is divided into school news, notice, school news and BBS. Document management is divided into document management, receiving document management and filing management; teaching resource management includes music video courseware management, homework management and music knowledge management; auxiliary teaching management is divided into course management, online examination, question answering discussion and score analysis; system management is divided into teacher and student management, system setting management, log management and auxiliary decision-making management. The function structure of music assistant teaching management system is shown in the figure (Fig. 4).



**Fig. 4.** Optimization of software function structure of music teaching system

In the process of information service, information management and resource development, the system users and designers summarize an important experience that database technology is the most effective way to manage data [12]. With the progress of network technology and mobile Internet of things technology, data management through database has become an important consensus. In order to complete the sharing, integrity and consistency of system data, both large management systems and small transaction processing are using database technology to complete data management [13]. Based on this, the top-level data flow of the database is shown in the figure (Fig. 5).



**Fig. 5.** Top level data flow processing steps of database

The analysis of data model is mainly carried out by means of data flow chart, which can systematically and comprehensively depict the data logic of music teaching assistant management system. In the process of information storage, processing and flow, data

flow chart is mainly realized with the help of centralized common symbols. The data flow chart consists of the following four basic elements: external entity, data flow, processing (function) and data storage. Each module uses the data flow chart to represent the source of data and the relationship between data.

### 2.3 The Realization of Music Remote Assistant Teaching

The database design of music assisted instruction management platform mainly serves for the business knowledge base of music assisted instruction management. Through the management of the database, the processing of knowledge data and business data is optimized [14]. In the process of database design, the following aspects are taken as important standards: verification is based on the database design specification, and the data structure is designed in the form of standardization to ensure the consistency and normal operation of data operation. The naming standard is helpful to the later unified management and upgrade maintenance. Therefore, in the design of database and table, the naming standard must be strictly implemented, and all column information must be annotated. Data redundancy and normalization of data paradigm will affect the retrieval speed of later data. Therefore, in the design of data table, we need to master various degrees in order to achieve the highest retrieval value and reduce the system response time. The implementation of strict identity authentication management, users with different permissions access to different data and operation degree, improve the security of data. Through the use of triggers and stored procedures, we can strictly control the simultaneous operation of tables, ensure the control of simultaneous modification and access, and reduce the inconsistency of data. The detailed data flow of music teaching material management module is shown in the figure (Fig. 6):

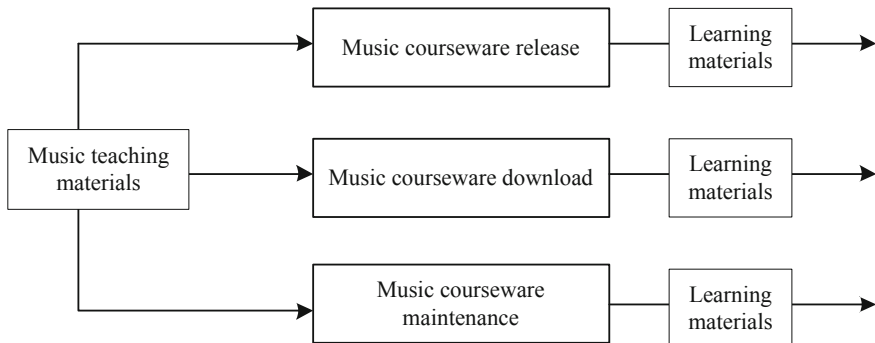


Fig. 6. Optimization of collaborative operation steps of teaching system

In the process of system operation, in order to better realize the management of music video, homework exercises, music knowledge and other teaching resources. In order to better ensure the realization of the functions of adding, modifying, deleting and querying music teaching video materials, and optimize the function of uploading and previewing music videos, students can download different music teaching videos

according to their permissions, and realize the editing management and online evaluation of homework exercises. Homework exercises editing includes adding, modifying and deleting homework exercises In addition to, query and release; exercise online evaluation function is similar to online examination evaluation function. Effective management of music text knowledge, including the addition, modification, deletion and release of music knowledge. In order to ensure the effective processing of the above requirements, further optimize the teaching resource management business process, as shown in the figure (Fig. 7).

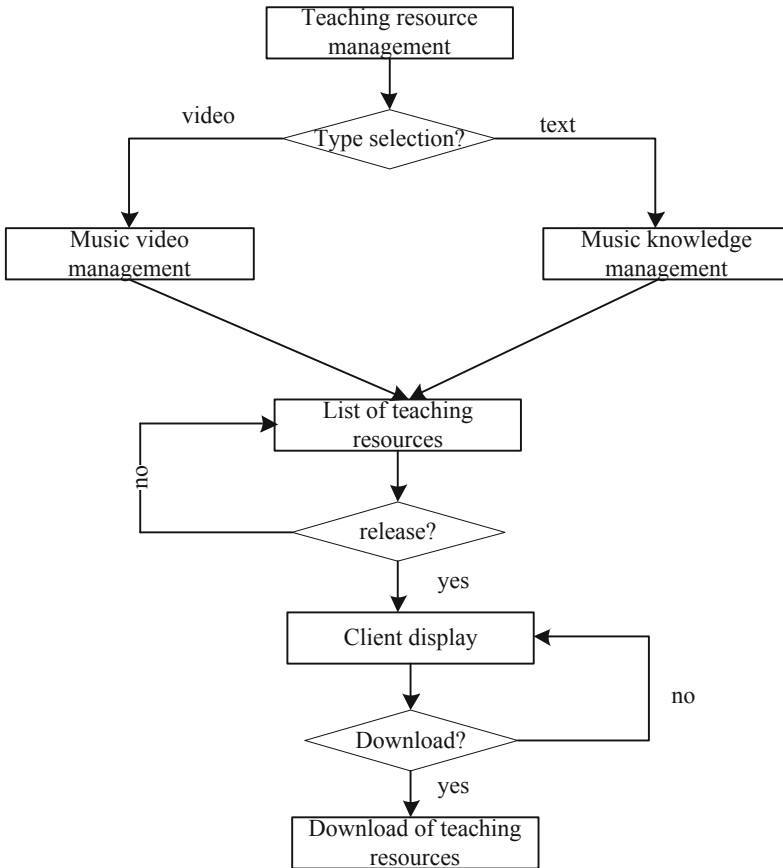


Fig. 7. Operation process optimization of auxiliary teaching system

Based on the optimization steps, the main functions of each module of the system are further optimized. The auxiliary teaching management module includes teacher-student communication module management, music video management, examination management and courseware management.

The management module of music question bank mainly realizes the classification management, question management and answer management of music related examination knowledge.

Classification management includes the functions of adding, modifying and deleting test questions or knowledge types. The types of classification include selection, filling in blank and objective questions. The management of test questions includes the functions of adding, modifying and deleting test questions. When adding test questions, you must select the corresponding type of test questions, score, answer and other detailed information, so that the parameter setting and automatic statistics of score analysis can be realized when generating test papers.

Answer management includes the functions of adding, modifying and deleting answers. Each answer must correspond to a specific question, otherwise it will not be operated.

The videos of music courseware and related materials are placed in the Resource Center for unified management, which provides convenience for students to browse related materials, expand their learning knowledge and deepen their understanding. At the same time, it helps to improve learning interest and enthusiasm. The materials and knowledge related to music teaching are the results of music teachers' accumulation and collection. There are many forms, including pictures and text, and remote auxiliary teaching system, such as video, audio or animation.

The authority to add related data is mainly given by the system administrator to teachers, and the related operations include data upload, modification and maintenance. At the same time, according to the students' views, this module automatically records the students' views, and teachers can analyze the popularity of relevant knowledge.

The music video courseware is released by the corresponding teachers, and the corresponding permissions are set. The students with the corresponding permissions can download the courseware materials.

Courseware video and information release: teachers release electronic handouts and teaching videos online.

Music video and material download: students with permission can download the material and video.

Maintenance of courseware and related information: the administrator can regularly maintain and manage the expired materials.

### **3 Analysis of Experimental Results**

System testing is an integral part of system development, which is not the content of system implementation. It is mainly to verify the functions of the system to ensure the quality of software. The process of software testing is to complete the test of the program or the whole system and evaluate the test according to certain limited conditions. The limited conditions can be abnormal or normal, and there is no complete limit. In software testing, we need to simulate errors by various means to ensure that any unexpected situation can be handled normally. The test of music teaching assistant management platform is an integrity test process, which includes not only various functions and modules, but also performance parameters, robustness, security and verification tests.

In the test process, the overall test is mainly carried out through the establishment and verification of test cases. The foundation and purpose of establishing test cases are from the requirements analysis document to verify the credibility of the satisfaction.

The system test must be implemented as quickly as possible, find the defects or deficiencies of the system, and propose solutions for the deficiencies, and finally make the system to meet the actual requirements of users. The purpose of music teaching assistant management system test is the same.

Hardware environment:

Server: the CPU of the application server requires Intel Pentium 2 GHz or above, and the data service and application service are configured separately. The memory configuration of each server is no less than 4G. The data server adopts the form of disk array for automatic increment, and the application server space is no less than 50 g.

Client:

The requirement of client is low, the CPU is Intel Pentium 3 or more, and the memory is 1 g or more.

Software environment:

Server: the operating system is Windows Server 2003 or higher. The database is SQL Server 2000 relational database.

Client: unlimited client operating system, recommended for windows, browser recommended IE6.0 and above, report and file access, install prompt software.

The effect evaluation of courseware recommendation can be analyzed by the change chart of difficulty coefficient and ability. The evaluation of learners' ability is dynamic. Every time learners submit their own learning results, the system will automatically evaluate their learning ability and save relevant records, and recommend new learning courseware according to the difficulty coefficient. The comparative relationship between

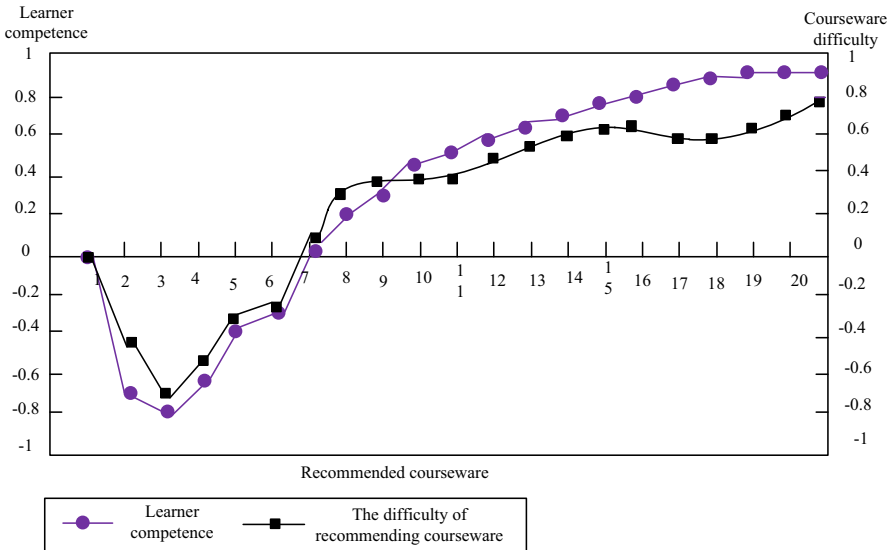


Fig. 8. Operation effect of teaching system in this paper

the difficulty coefficient of recommended courseware and learners' own ability is shown in the figure.

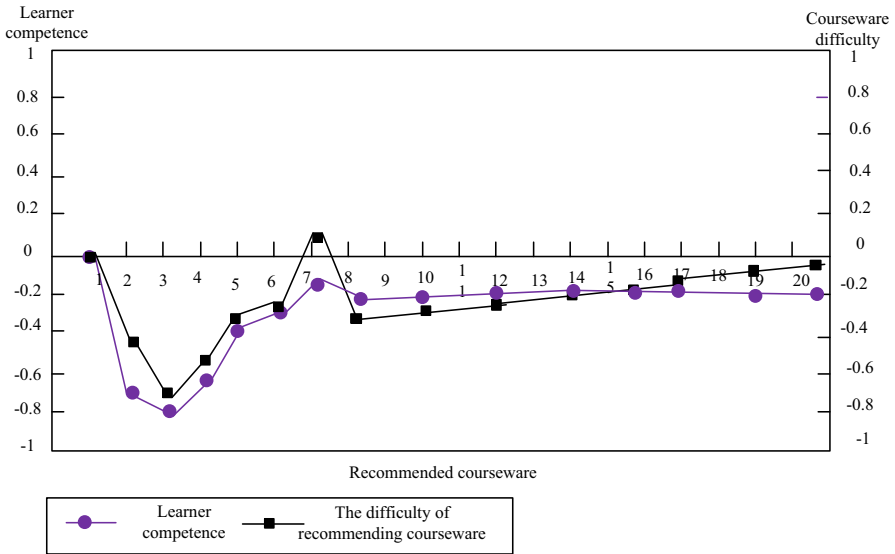


Fig. 9. Operation effect of traditional teaching system

It can be seen from the analysis of Fig. 8 and 9 that the operation effect of the teaching system under different methods is different. When the number of recommended courses is 12, the recommended difficulty of the designed system is 0.48 and the learner ability is 0.57. The recommended difficulty for the traditional teaching system is 0.30 and the learner's ability is 0.20. Comparing the two figures, it can be seen that the design system can effectively improve learners' ability. Moreover, compared with the traditional system, the multicultural distance assisted teaching system based on the mobile Internet of Things can provide more reasonable teaching information for learners in the practical application process, effectively improve the learning quality of students, and have a high specific effectiveness.

Further test the friendliness of the system, when there is a problem or input error, to give an error prompt. The function test is the core and focus of the system. Here we mainly introduce the function test cases of the system. The results of the function friendly survey are shown in the table (Table 1).

Through the test of the system, the current music teaching assistant management system can meet the design requirements, the system has good operation efficiency and stability; the human-computer interaction interface is friendly, all kinds of errors and friendly prompt information is perfect, which can guide the user to operate correctly and start quickly; Through the establishment of business use case and data model, online learning and teaching assistant business can be well realized, and the system has high security and reliability. To sum up, the music teaching assistant management system

**Table 1.** Function friendly use case table

User actions	Test case	Result	Result analysis	Is it up to expectations
Any input, and reset operation	Enter “123” and click “Refresh”	Reset input field	Through the browser client operation, the original state of the system is restored, and the interface is refreshed	Yes
Input 18 or 15 teacher ID numbers and fill in other information correctly	Enter “310005198504040611” and press “save”	Display “saved successfully”	1. The relevant information is saved to the database through the browser client; 2. After saving successfully, the client prompts “save successfully”	Yes
Fill in the correct form again and submit it	Enter “310005198504040611” and press “save”	Display “saved successfully”	1. Prompt operation success; 2, complete the database update; 3, do not need to repeat the input	Yes
Enter illegal characters in the client of browser, such as special characters of system database operation	Enter “@@@”	1. Display “input nonstandard” 2. Display “do not enter illegal characters”	1. In the client or smart client input is not standardized prompt; 2, the client prompt error, and display the correct way to fill in; 3, information return does not save	Yes

*(continued)*

**Table 1.** (continued)

User actions	Test case	Result	Result analysis	Is it up to expectations
When filling in the question information, fill in the non numerical form and submit it	Enter “one two three”	1. Please fill in the question information 2. Display “e.g.: 300158”	1. It is suggested to fill in the grade form of the type of the question; 2. Examples of correct filling; 3. Information is not saved	Yes

based on mobile Internet of things can well adapt to the actual requirements of teachers, students and managers for real-time management and learning of music teaching information.

## 4 Conclusion and Prospect

With the continuous development of economy and the acceleration of social progress, people pay more and more attention to quality education and art education. At the same time, higher requirements are put forward for music teaching. At present, although China’s middle school music teaching has made some progress in teaching conditions, teaching staff, teaching level and so on, there is still a certain gap between middle school music teaching and students’ aesthetic needs. In traditional middle school music teaching, simple blackboard writing is often adopted. In the past, this teaching mode can not really meet the current middle school music teaching needs. Therefore, it is necessary to improve the quality of middle school music teaching. This paper puts forward the design of multi-cultural music remote assistant teaching system based on mobile Internet of things, so that students can feel the charm of music more intuitively, stimulate students’ enthusiasm for learning music, and let students better experience the beauty of music.

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