

## Retraction

# Retracted: Artificial Intelligence-Based Online Education System for University Music

### Security and Communication Networks

Received 17 October 2023; Accepted 17 October 2023; Published 18 October 2023

Copyright © 2023 Security and Communication Networks. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### References

- [1] Y. Xie, "Artificial Intelligence-Based Online Education System for University Music," *Security and Communication Networks*, vol. 2022, Article ID 5842900, 13 pages, 2022.

## Research Article

# Artificial Intelligence-Based Online Education System for University Music

Yi Xie 

Hebei Institute of Communication College, Shijiazhuang 050000, China

Correspondence should be addressed to Yi Xie; [xieyi@hebic.edu.cn](mailto:xieyi@hebic.edu.cn)

Received 23 June 2022; Revised 22 July 2022; Accepted 2 August 2022; Published 24 August 2022

Academic Editor: Tao Cui

Copyright © 2022 Yi Xie. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Aiming at the problems that students in the traditional music teaching system seldom participate in the system interaction and the relatively few types of system transportable files, this research designs and researches the music teaching system in school through artificial intelligence technology, streaming media technology, and webcast technology. The system mainly designs specific online classroom teaching modules according to the main characteristics of college music teaching. The system mainly adopts the b/s framework. Through the system performance test, the system response time is less than 2.5 when 200 people visit. Even when 500 people visit, the response time exceeds 3S, but it also maintains a certain performance level.

## 1. Introduction

In recent years, with the infiltration and development of quality education, generalist education, and other concepts, as well as the introduction of the spirit of the National Education Department on strengthening the public art education in colleges and universities, colleges and universities are paying more and more attention to the development of art education. Affected by this, the direction of music teaching management in some colleges and universities has also begun to change. Modern college music teaching management is gradually moving towards a more standardized and standardized direction. As for music teaching management, scientific and efficient teaching management systems are closely related to the improvement of teaching quality. How to use modern science and technology and network technology to serve the improvement of teaching quality in colleges and universities is an important issue in front of teaching innovation reform in colleges and universities [1, 2]. This research takes music online education as the object, with the help of the integration of artificial intelligence technology, and uses ant colony hybrid algorithm to build an intelligent composite system to serve the construction of music online education information system.

There are few special systems for music teaching in school, mainly comprehensive teaching systems. Therefore, there is no special system using music related technology. Information technology started early, and streaming media technology under the Internet environment has also developed rapidly. Many companies have started to develop many streaming media technologies for a long time. For example, a company applied streaming media technology to the Internet for the first time. Subsequently, they successively exited RealAudio, a media software system based on C/S architecture. A company further developed related technologies and launched RealPlayer series products. China's online education has begun to be applied to school teaching, but it is mainly aimed at Chinese and appreciation courses. Generally, audio tapes are simply played in music classes. With the continuous development of Internet technology, music has been able to spread through the network and has successfully achieved nondestructive quality. People also begin to use the Internet to appreciate music more and more. Under this background, there are more and more music training institutions. With the rapid development of Internet technology, many new online music education institutions are also slowly developing. Through the timeliness and locality of Internet technology, develop and build an online music education platform,

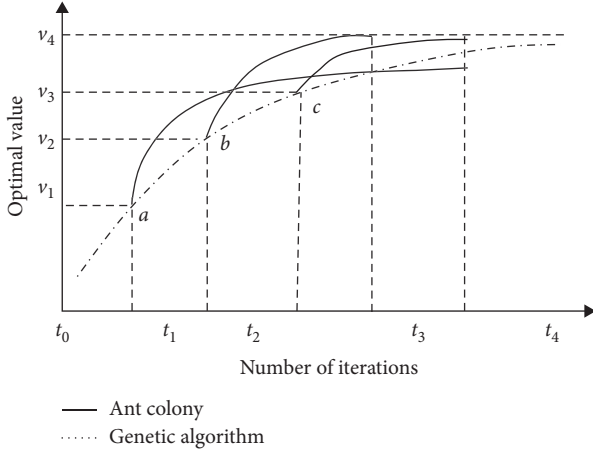


FIGURE 1: Optimal value iteration times curve.

provide learning resources, promote students' autonomous learning ability, and improve the quality of education to a certain extent [3, 4].

On the basis of this research, this paper proposes a research method for the online music education system in colleges and universities based on artificial intelligence. First, we design according to design principles and design requirements; secondly, we realize the connection between the main interface of the system and other interfaces through design. Then, the design of the system function is realized; finally, the design of the database is realized. Using streaming media and live broadcast technology, a set of online teaching system specially designed for music teaching is designed to realize the special functions of live broadcast classroom, performance appreciation, and so on. Through information technology, improving teaching quality and improving the overall teaching level is one of the steps of the corresponding information reform in contemporary times.

## 2. Intelligent Teaching System Based on Ant Colony Hybrid Genetic Algorithm

**2.1. Algorithm Principle.** The overall operation of genetic algorithm and ant colony algorithm in the whole optimization process is shown in Figure 1.

Because the hybrid algorithm combines the common characteristics of the two algorithms, it avoids the defects of the two algorithms to a great extent and gives full play to the advantages of the two algorithms in the process of solving the optimal solution. Using the Gaussian mutation method, all gene sequences are replaced by random numbers  $\sigma$  and  $\mu$  normally distributed with the mean and variance of the corresponding mutation process. In the evolution strategy, it mainly includes two elements  $(X, \sigma)$ , where  $X$  represents the next access node and  $\sigma$  represents variance [5]. Its node descendant generation formula is as follows:

$$\begin{aligned} \sigma' &= \sigma eN(0, \Delta\sigma) \\ x' &= x + N(0, \Delta\sigma'). \end{aligned} \quad (1)$$

The mean value of  $N(0, \Delta\sigma')$  is 0 and the variance is  $\sigma$ , which are independent and Gaussian random number vectors.

For ant colony algorithm, the calculation here refers to the method of solving TSP, and the specific process is shown in Figure 2.

**2.2. Hybrid Algorithm Design and Process.** The binary coding method is adopted in the algorithm implementation, and the codes of the same type of questions in the question bank are collected together. Suppose that the test paper requires  $m$  types of questions, each of which needs to contain  $n_i, i = 1, 2, \dots, t$  questions. The corresponding code length is

$$\sum_{i=1}^m n_i. \quad (2)$$

The coding form is

$$b_{11}b_{12} \dots b_{1n}b_{21} \dots b_{2n} \dots b_{mn}, \quad (3)$$

where

$$b_{ij}, i = 1, 2, \dots, t, j = 1, 2, \dots, t, \quad (4)$$

$n_i$  is for the questions in the examination question bank. The coding table is shown in Table 1.

During the design and implementation of hybrid algorithm, the same fitness function shall be used for genetic algorithm and ant colony algorithm, as follows:

$$F = \max f + \min f - f. \quad (5)$$

The evolution rate is the difference between the objective function of offspring and the average value of incidental objective function  $f$ . The selection operator adopts the offset roulette selection mode [6]. The crossover operator adopts the improved single point crossover method, and the mutation operator adopts the 0, 1 simultaneous mutation method. The flowchart of hybrid algorithm is shown in Figure 3.

In the hybrid algorithm, the evolution rate is defined as the absolute value of the difference between the average values of the parent and child populations. When the evolution rate of the parent and child is less than  $Q$  (set as a constant), it indicates that the genetic algorithm enters the invalid redundant iterative calculation stage after this time point and then enters the ant colony algorithm. That is,

$$|\overline{f_{fu}} - \overline{f_{zi}}| < Q. \quad (6)$$

The optimal solution of genetic algorithm is transformed into the pheromone of ACA. Suppose that the genetic algorithm obtains a group of optimal solutions with the number of  $m$ , and assume that the pheromone on the  $i$ -th test question in the test question bank at a certain time is

$$\tau_{ij}, j = 1, 2, \dots, t. \quad (7)$$

Then the initial pheromone settings are as follows:

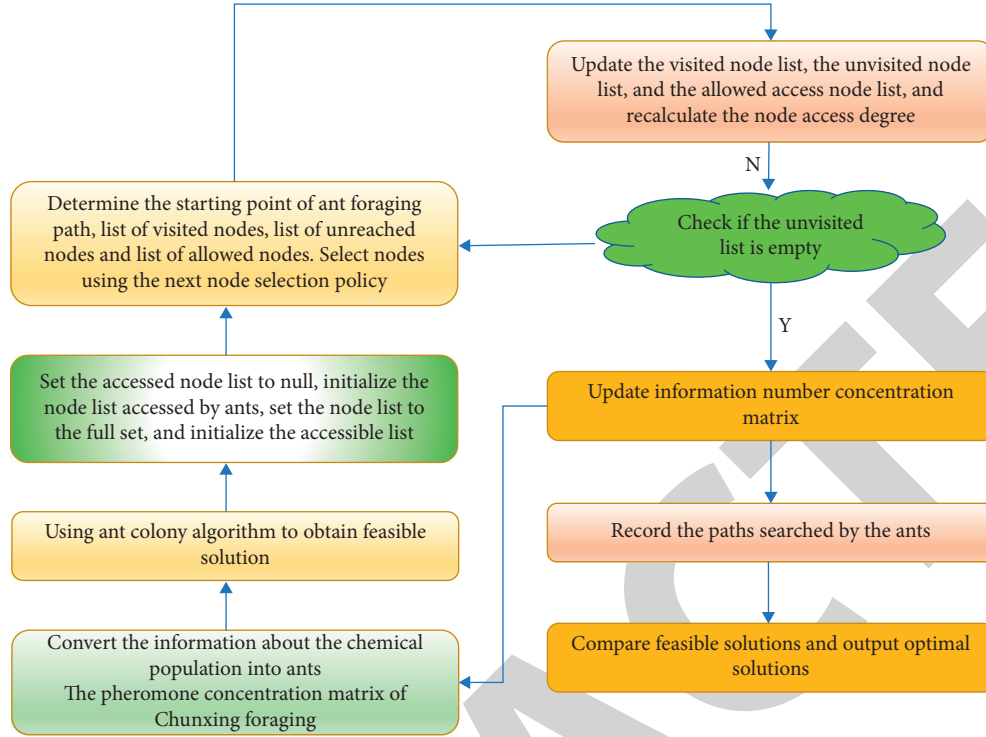


FIGURE 2: Algorithm mixing steps.

TABLE 1: Coding table.

$b_{ij}$	1	If $b_{ij}$ is selected
	0	If $b_{ij}$ is not selected

$$\tau_0 = 1 + \sum_{n=1}^m A_n, A_n = \begin{cases} \frac{1}{f_n} \\ 0 \end{cases} \quad A_n, A_n = \begin{cases} \frac{1}{f_n} \\ 0 \end{cases} \quad (8)$$

$$\tau_1 = 1 + \sum_{n=1}^m$$

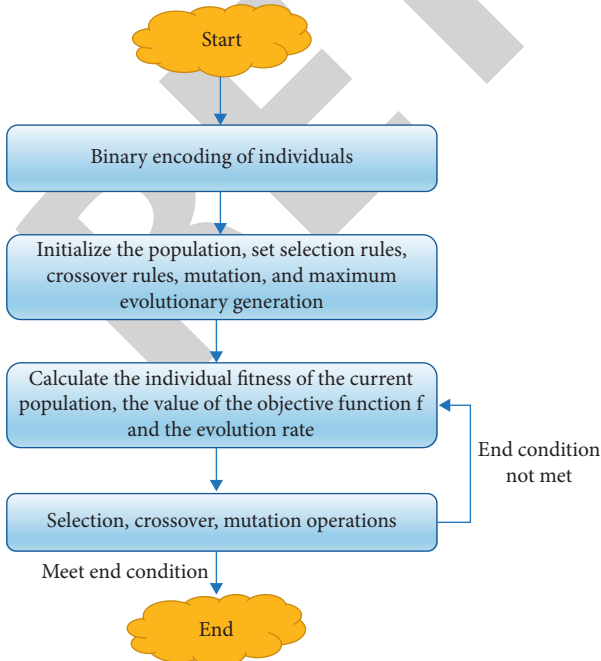


FIGURE 3: Flowchart of genetic algorithm in hybrid algorithm.

The pheromone updating method uses the max-min rule. In the traversal process of ant colony algorithm, pheromones are added only to the ant traversal path with the highest fitness. The relationship between the years of information concentration changes is expressed by introducing the binary  $(A, T)$ .

$$A = \{a_{11}a_{12}\dots a_{1n_1}a_{21}\dots a_{2n_2}\dots a_{mm}\},$$

$$T = \{\Gamma(a_{ij}, c) | \Gamma(a_{ij}, c) \in R, i = 1, 2, \dots, m, j = 1, 2, \dots, n\}, \quad (9)$$

where  $a_{ij}$  represents a test question.  $T$  is the set of pheromone trajectories, and  $c$  is 0 or 1.  $\Gamma(a_{ij}, c)$  refers to the pheromone with or without test question  $a_{ij}$  selected.  $T$  can be expressed as a 13-dimensional matrix:

$$2 * \sum_{i=1}^m n_i$$

$$\begin{bmatrix} \Gamma(a_{11}, 1) & \Gamma(a_{12}, 1) & \dots & \Gamma(a_{1n_1}, 1) & \dots & \Gamma(a_{mm}, 1) \\ \Gamma(a_{11}, 0) & \Gamma(a_{12}, 0) & \dots & \Gamma(a_{1n_1}, 0) & \dots & \Gamma(a_{mm}, 0) \end{bmatrix}_{2 * \sum_{i=1}^m n_i} \quad (10)$$

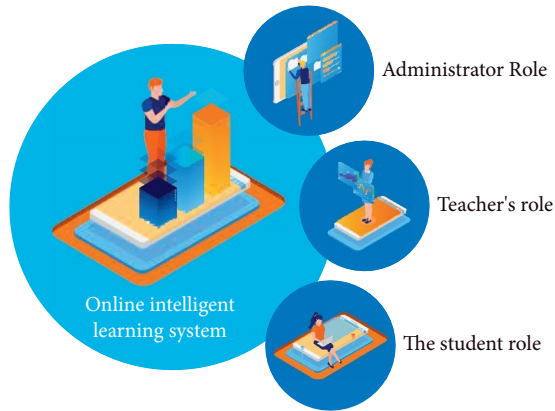


FIGURE 4: Schematic diagram of the online intelligent learning role module.

The search ability and convergence speed of the algorithm are closely related to the number of ants in the algorithm. The search ability of the algorithm is positively related to the robustness and the number of ants, while the convergence speed of the algorithm is negatively related to the number of ants. Due to this special situation, if there is no special requirement, the selection range of individual ants is [30, 60]. The path selection of the individual ant is based on the transition probability. When the signal is transmitted to the  $i$  of the ant, the individual ant determines the transition direction according to the transition probability  $p_{i0}$  or  $p_{i1}$ . The algorithm terminates when the chromosomes that meet the test paper generation requirements and the maximum number of iterations are reached [7–9].

### 3. Summary Design of the College Music Online Education System Based on Artificial Intelligence

**3.1. System Function Module.** The online intelligent learning system is mainly divided into three roles, administrator, teacher, and student. The example of role module is shown in Figure 4.

The main user role in the management of the online intelligent learning system is the administrator of the system, who has the right to add, delete, and modify specific basic information. The system adopts unified identity authentication. When users log in to the system with different identities, they can only see the functions corresponding to the identity. System management: The main task of this module is to maintain the normal operation of the college music education and teaching management system and important data security settings, including adding new users, modifying login passwords, and relogin. In addition, system management includes basic information management in education and teaching management, mainly including adding, modifying, deleting, and querying basic information such as departments, majors, etc., which is the basic module used by system administrators. The department, class, and data dictionary information of the college music education teaching management system are described.

The administrator role is divided into four submodules: teacher management, administrative class management, student management, and school course viewing. The example of the administrator submodule is shown in Figure 5.

The teacher's role is divided into four submodules: curriculum management, topic selection management, student learning module management, and personal basic information management. The example of the teacher submodule is shown in Figure 6.

The student role is divided into 4 submodules, including optional course viewing, my topic selection, my learning module, and personal basic information management. The example of the teacher submodule is shown in Figure 7.

**3.2. System Flowchart.** The sample flowchart of topic selection of students in the system is shown in Figure 8.

In this system, teachers first set up their own courses and edit the relevant materials of the courses, such as course overview, course setting cycle, corresponding chapters of the courses, courseware under the chapters, and standardized test questions. After editing, they choose to publish the courses. After the teacher publishes the course, students can log in to the system to query the course information available for selection and view the course overview and course outline. If students are interested in selecting the course, they can select the course to be reviewed by the opening teacher. After receiving a student's course selection application, the teacher can view the basic personal information and previous learning of the student. If the teacher agrees with the students to choose their own courses, then the topic selection is successful, and the students can start learning the courses [10, 11].

The system database includes the following three modules, a total of 12 tables:

- (1) Basic information related modules: school and school system maintainer table SchoolList, college table CollegeList, teacher table TeacherList, administrative class table NatureClassList, student information table StudentList
- (2) Course information related modules: course list, course chapter list CourseListt, courseware list CoursewareList, and test topic list ContentTestList
- (3) Modules related to students' questions: StuCourseList, StuAnswer, and StuScore

Course List is used to store information about courses offered by teachers in the system. The data structure of table Course List is shown in Table 2.

The Course Chapter table ChapterList is used to store the relevant information of the course chapters in the system. The data structure of table ChapterList is shown in Table 3.

The test question table ContentTestList is used to store the standardized test question information under the corresponding chapter of the course in the system. There may be multiple standardized test questions under a chapter. There are three types of test questions: single choice questions,



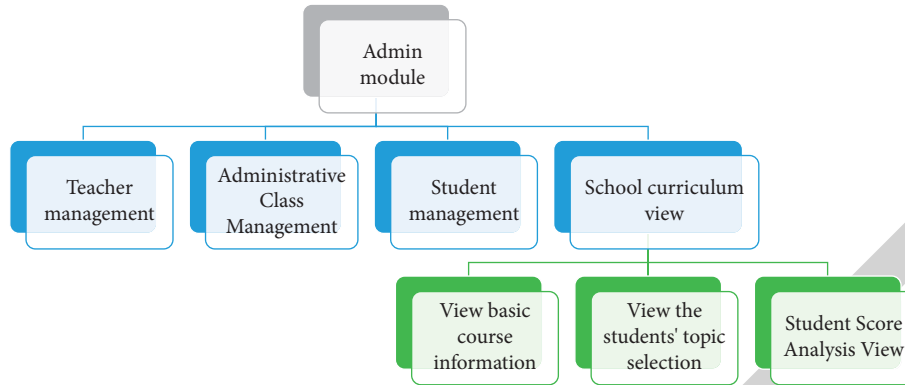


FIGURE 5: Schematic diagram of online intelligent learning system—administrator role—submodule.

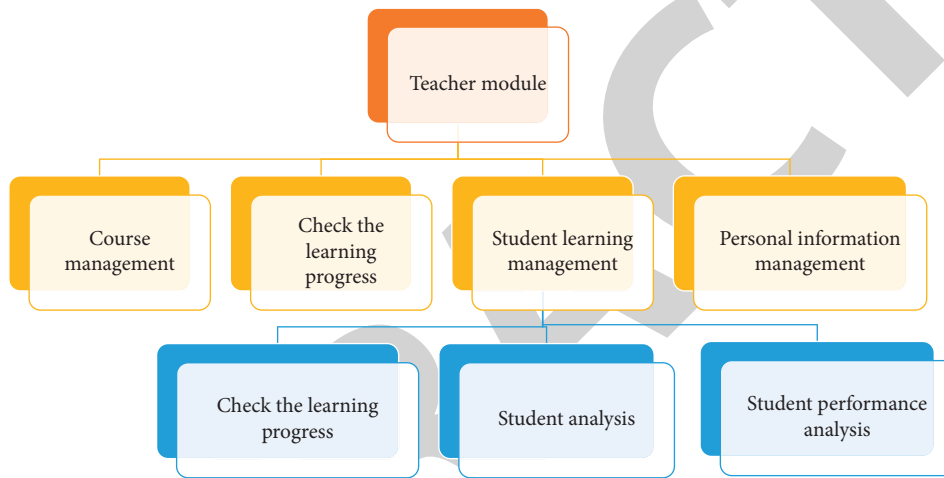


FIGURE 6: Schematic diagram of online intelligent learning system: teacher role submodule.

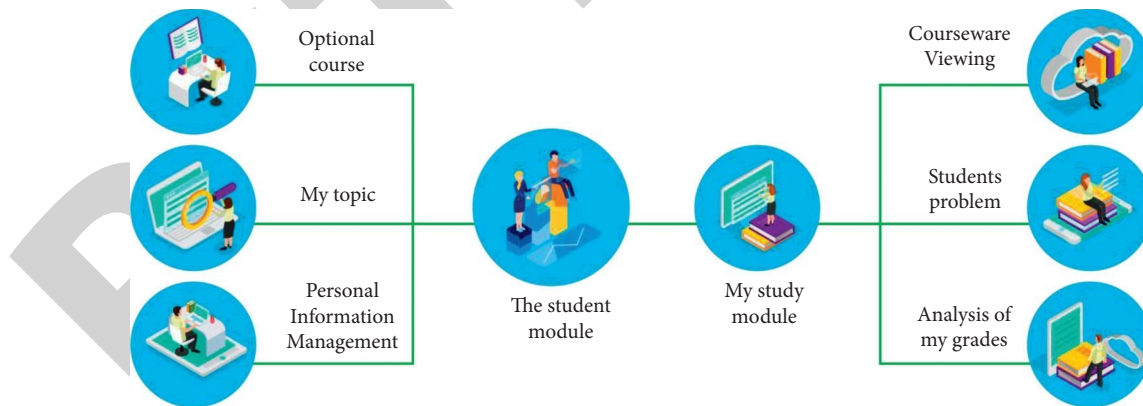


FIGURE 7: Schematic diagram of online intelligent learning system: student role submodule.

multiple choice questions, and judgment questions. The data structure of table ContentTestList is shown in Table 4.

The student course selection table StuCourseList is used to store relevant information about student course selection in the system. The data structure of table StuCourseList is shown in Table 5.

**3.3. Database Design.** The design of system database can greatly affect the performance of the system. Reasonable database design can make the system speed up the search in the process of related business processing. Before the database form design, it is necessary to design the database form in strict accordance with the actual needs of users and

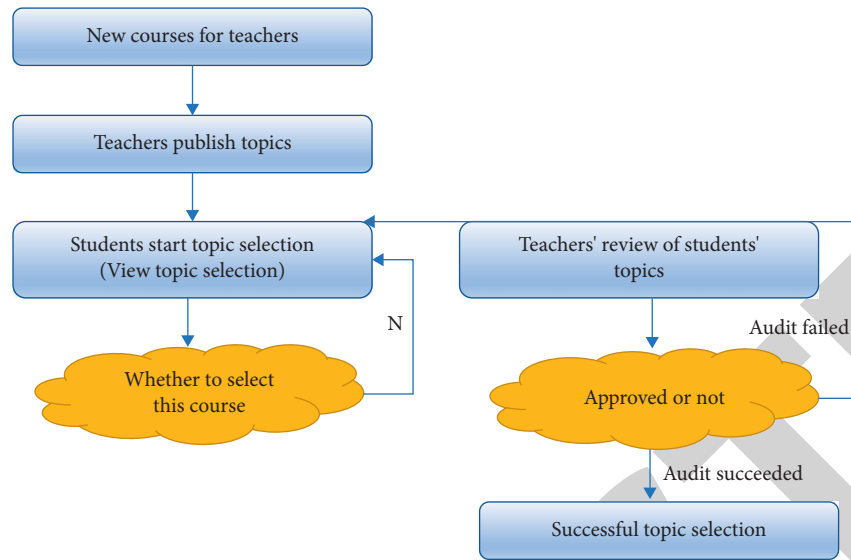


FIGURE 8: Online intelligent learning system: schematic diagram of topic selection process.

TABLE 2: Structure of CourseList.

Number	Field name	Data type	Explain
1	COURSE_ID	CHAR (36)	Course ID, primary key, null string allowed (no)
2	TEACHERID	CHAR (36)	ID of the teacher to which the course belongs. Foreign key, allow empty string (no)
3	COURSE_NAME	VARCHAR (100)	Course name, required field (yes), null string allowed (no)
4	COURSE_START	VARCHAR (20)	Start time, required field (yes), null string allowed (no)
5	COURSE_END	VARCHAR (20)	End time, required field (yes), null string allowed (no)
6	STATUS	CHAR (1)	Status, the default value is 0 0-course valid, 1-course invalid
7	COURSE_MEMO	VARCHAR (5000)	Course introduction

TABLE 3: Structure of Course Chapter table ChapterList.

Number	Field name	Data type	Explain
1	Nodeld	CHAR (30)	Node ID, primary key, null string allowed
2	COURSE_ID	CHAR (30)	Teacher ID of the node, foreign key, null string allowed (no)
3	Node order	CHAR (2)	Node sort number
4	NodeName	VARCHAR (20)	Node name, required field (yes), null string allowed (no)
5	IsChapter	CHAR (2)	Chapter or not, the default value is 0 0-section, 1-chapter
6	ChapterID	CHAR (30)	Parent chapter ID, which is null by default. When isChapte is 0, the column needs to fill in the NodeID of the parent chapter

TABLE 4: Structure of test topic table ContentTestList.

Number	Field name	Data type	Explain
1	ContentTestID	CHAR (30)	Courseware ID, primary key, null string allowed (no)
2	Nodeld	CHAR (30)	Courseware node ID, foreign key, null string allowed (no)
3	ContentTestName	VARCHAR (20)	Back dot name, required field (yes), null string allowed (no)
4	Order	CHAR (2)	Courseware sorting number
5	Type	CHAR (2)	Test question type. The default value is 0 0-single choice, 1-multiple choice, 2-judgment
6	TaskContent	VARCHAR (5000)	Title content, required field (yes), null string allowed (no)
7	RightAnswer	CHAR (10)	Title answer, required field (yes), null string allowed (no)
8	ScorePoint	Char (2)	Title score, required field (yes) allow empty string (no)
9	CREATE_DATE	VARCHAR (20)	Creation date in the format of yyyyymmdd. Empty string is allowed (no)
10	CREATE_USER	CHAR (36)	Created by allow empty strings (no)

TABLE 5: Structure of StuCourseList.

Number	Field name	Data type	Explain
1	COURSE_STUDENTS_ID	CHAR (36)	Student course selection ID, unique keyword, primary key, null string allowed (no)
2	STUDENT_ID	CHAR (36)	Student ID
3	COURSE_ID	CHAR (36)	Course ID
4	STATUS	CHAR (1)	Status, the default value is 0 0- course selection is valid, 1- invalid course selection
5	CREATE_DATE	VARCHAR (20)	Creation date in the format of yyyyymmdd. Null string is allowed (no)

the functional requirements of the system. It takes a certain amount of time to improve the database. According to the requirement analysis, the fields and forms in the database are designed strictly, and the database design is realized according to the normative design style. According to the actual situation, the functional modules of the system are mainly divided into virtual classroom management, music appreciation function, course live teaching function, and streaming media resource management function. Corresponding to these functional modules, they have their own corresponding database forms. The following is a specific introduction to the important forms [12].

**3.3.1. Student Information Form.** The student information form mainly stores some basic information of students. It mainly includes the storage of students' Student ID, name, password, nickname, contact information, and other personal information. The student ID is used as the primary key for storage. The student ID is automatically generated by the system. Each student user has a unique student ID corresponding to it. Other basic information of students can be accessed and called through the student ID. The details are shown in Table 6.

**3.3.2. Teacher Information Form.** The teacher information form mainly stores the basic personal information of the teacher user, focusing on the storage of basic personal information such as the teacher user's number, name, password, and contact information. The teacher number is used as the primary key for storage. The teacher number is automatically generated by the system. Each teacher user has a unique number corresponding to it. You can access the information of other fields in the form by numbering. Table 7 shows the specific teacher user form information [13].

**3.3.3. Administrator Information Form.** In order to ensure the system security, the relevant information logged in by the system administrator is generated into the system log. See Table 8 for details.

**3.3.4. Virtual Classroom Information Form.** The virtual classroom information form is mainly used to store some basic information of the virtual classroom. The main fields include classroom number, classroom size, and creation time. The creator is the foreign key of the teacher name in the teacher form. Table 9 shows the specific information of the virtual classroom form.

**3.3.5. Electronic Courseware Table.** The electronic courseware information form is created for the course management function in the system. It is used to record the courseware information uploaded by teachers, mainly including the storage of visible number, producer, applicable courses, number of people, and other basic information. Table 10 shows the specific contents of the courseware form [14].

### 3.4. Realization of the Music Education Teaching Management Information System

**3.4.1. System Implementation Ideas.** The implementation and development of this system will use the standard MVC development architecture, use vs 2010 under Windows environment as the development platform, and use https://asp.net technology to realize each functional module of the system. The system database uses SQL Server 2008 to store data. The following aspects should be paid attention to in the realization of system functions.

(1) *Accuracy.* The accuracy of system functions means that the functions corresponding to the modules divided in the system need to be clear so that users can use the system functions more conveniently. In the process of developing and implementing this system, we also need to pay great attention to the fact that developers need to closely follow the user needs to design, so as to avoid the occurrence of the discrepancy between the developed and designed functions and requirements. The adjustment of some functional modules of the system due to unclear functions or requirements is very resource-consuming. Therefore, in the process of development, attention should be paid to the accuracy of functions.

(2) *Stability.* System stability refers to the ability of the system to operate normally under various conditions and to bear a certain amount of heavy load access. Attention should be paid to the configuration of the server on the hardware and to the handling of some exceptions on the software. For example, when operating on the web client, try to avoid the occurrence of error pages. For some wrong operations, more humanized prompts can be used. The stability of the system can be guaranteed after the preliminary pressure test of the system.

(3) *Compatibility and Scalability.* Compatibility and expansibility means that the system needs a certain development space. The needs of users may change with the passage



TABLE 6: Student user table.

Field name	Type	Primary key	Foreign key	Can it be blank	Explain
StudentID	Int	Y	N	N	Student ID
Name	Varchar (50)	N	N	N	Full name
Password	Varchar (50)	N	N	N	Password
Nickname	Varchar (50)	N	N	N	Nickname
Sex	Varchar (5)	N	N	N	Gender
Age	Int	N	N	N	Age
E-mail	Varchar (50)	N	N	Y	E-mail
Address	Varchar (50)	N	N	Y	Contact address
Telephone	Varchar (20)	N	N	Y	Contact number
PicPath	Varchar (100)	N	N	Y	Photo path
Balanced	Int	N	N	N	Card balance
Grade	Int	N	N	N	User level
RegTime	Date	N	N	N	Registration time
Comments	Varchar (200)	N	N	Y	Remarks

TABLE 7: Teacher user table.

Field name	Type	Primary key	Foreign key	Can it be blank	Explain
TeacherID	Int	Y	N	N	Teacher ID
Name	Varchar(10)	N	N	N	Full name
Password	Varchar(20)	N	N	N	Password
Age	Int	N	N	N	Age
Sex	Varchar(5)	N	N	N	Gender
E-mail	Varchar(50)	N	N	Y	E-mail
Address	Varchar(50)	N	N	Y	Contact address
Telephone	Varchar(20)	N	N	Y	Contact number
Grade	Int	N	N	N	Qualification level
PicPath	Varchar(100)	N	N	N	Photo path
RegTime	Date	N	N	N	Registration time
Comments	Varchar(200)	N	N	Y	Remarks

TABLE 8: System administrator table.

Field name	Type	Primary key	Foreign key	Can it be blank	Explain
AdminID	Int	Y	N	N	Administrator number
AdmType	Varchar (20)	N	N	N	Accounts
Password	Int	N	Y	N	Password
Name	Data	N	N	N	Full name
LastTime	Date	N	N	N	Last login time
LastIP	Date	N	N	N	Last login IP
Comments	Varchar (200)	N	N	Y	Remarks

TABLE 9: Table of virtual classroom.

Field name	Type	Primary key	Foreign key	Can it be blank	Explain
ClassID	Int	Y	N	N	Classroom no
ClassType	Varchar (20)	N	N	N	Classroom type
Creator	Int	N	Y	N	Creator
CreTime	Data	N	N	N	Creation time
CourseNum	Date	N	N	N	Number of courses
StudentNum	Date	N	N	N	Number of students
Comments	Varchar (200)	N	N	Y	Remarks

TABLE 10: Electronic courseware table.

Field name	Type	Primary key	Foreign key	Can it be blank	Explain
VideoNum	Int	Y	Y	N	Courseware no
VideoType	Int	N	N	N	Courseware type
Author	Int	N	Y	N	Producer
CourseID	Varchar (20)	Y	N	N	Course
CourseCN	Varchar (200)	N	N	Y	Courseware content
Time	Time	N	N	N	Courseware duration
PlayCount	Int	N	N	Y	Audience
Comments	Varchar (200)	N	N	Y	Remarks

of time. Therefore, some program interfaces need to be added in the process of development and design to facilitate the further improvement of system functions in the subsequent process. Compatibility means that the system can be compatible with a variety of operating environments. Since the system adopts b/s network application architecture, it is necessary to ensure the stability of system functions for different browser versions; that is, the compatibility ability must be guaranteed [15, 16].

(4) *Code Reusability*. In the development process, it is necessary to develop according to the standard development mode. And it should be noted that, for some repeated code fragments, code reuse technology can be used to reduce the development cost and shorten the development cycle, so as to improve the development efficiency, and code reuse can ensure the stability of the system code to a certain extent.

## 4. System Performance Test

### 4.1. Test Method

*4.1.1. Module Test*. Module test is mainly to test the function of each functional module in the system. During the test of the system, the black box test method will be adopted, mainly aiming at whether the relevant functional logic of the system is tight, whether some data inputs can be correctly responded to, and whether some illegal inputs can be intercepted [17]. For example, in the form input of the page, if you enter a blank value or some meaningless value, the system can make a correct response. For some fields, specific data type definitions are given in the system code.

*4.1.2. Function Test*. The function test is mainly to test the overall operation logic of the system, which is mainly divided into three aspects, including specific function test, logic effectiveness test, and system load test. The function test mainly aims at whether the operation logic in the system is normal and whether it can make correct response to various requests of users. The specific function test ensures the practicability of the system to a certain extent. Logical validity test refers to whether the system can meet the most basic needs of users, whether the system can work in different environments, and whether the text display information is correct. System load test refers to whether the

system can operate normally and display effect and system response time when the number of visits is very large.

*4.1.3. Assembly Test*. Assembly testing refers to testing the interfaces of the modules that have been implemented in the system by assembling them into a whole. The specific content is to check whether the output result is correct by entering different data. Through the combination of different modules, input and output tests are carried out to make the system more functional.

*4.1.4. Safety Test*. Security test is the guarantee of system security. In this system, the security vulnerability that needs attention is mainly the input detection of some forms. The system automatically filters out the illegal input in the table to prevent the attack in the form of SQL injection that affects the system security [18].

*4.2. Test Cases and Results*. The table used for the test is as follows: The virtual classroom test case is represented by the creation function. The virtual classroom is created by the teacher user. The teacher clicks the "create" button and fills in the corresponding form information. After that, the system creates a virtual classroom according to the data entered by the user. Table 11 shows the specific virtual classroom test case table.

The test of students' application to join the virtual classroom is mainly aimed at the students' correct login to the system. After searching and browsing the virtual classroom information, click the "apply to join" button, the system will respond successfully, and the student information will be entered into the system database. After receiving the relevant notification information, the old teacher can view the information of the new students in the student information list [19]. Table 12 shows the functional test case table of the specific student virtual classroom.

The music playing function test is for all users of the system. After entering the system, click the corresponding module to enter the music playing interface, select the music you want to play, click play, and the system successfully responds and starts playing. And the fluency of the music in the playback process is also one of the test content indicators. Table 13 shows the specific music playing test cases.

The live teaching function test of the system is aimed at the teachers and students in the system. The teachers and students have different permissions and need to be tested

TABLE 11: Creating the classroom test case table.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Virtual classroom management module
Test function point	Create virtual classroom
User oriented	Teacher users
Test purpose	Verify whether the teacher user can create the virtual classroom normally
Testing procedure	(1) Teacher user login system (2) Set basic information of virtual classroom (3) Click the create button
Expected results	The virtual classroom was successfully created and assigned to the classroom number

TABLE 12: Test cases for applying to join the classroom.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Virtual classroom management module
Test function point	Apply to join the virtual classroom
User oriented	Student users
Testing procedure	(1) Student users log in to the system (2) View the list of virtual classrooms and select the virtual classroom you want to join (3) Click the “apply to join” button
Expected results	The system sends the student user’s request to the teacher user

TABLE 13: Test cases of playing music.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Performance appreciation module
Test function point	Play song
User oriented	Teachers, students, and tourists
Testing procedure	(1) Enter the performance appreciation module (2) View the system song library list (3) Select a favorite song to play
Expected results	The selected song can be played smoothly

separately. Student users can normally watch the live broadcast content of the teacher, and the quality and fluency of the live video are within the controllable range. Teacher users can normally apply to the system for live broadcast, and the system correctly responds to broadcast the live broadcast content of teachers to student users. Table 14 shows the test cases of live video broadcasting.

The course management function refers to the course management module of the teacher in the system, which can normally add, delete, modify, and edit courses. The users are teachers. Teachers can create new courses, delete existing courses, and operate the system database accordingly. Table 15 shows the course management test case table.

The system security test aims at the detection when users need to input forms in the system. In these places, the system needs to detect some illegal input from users to prevent malicious attacks. The system can automatically identify malicious codes and filter them out. Table 16 shows the security test cases of the system.

**4.3. Performance Test Analysis.** For system performance analysis, a very mature simulation test system that has been developed at present can be used for system detection. The load capacity of the system is tested by automatic test method. Through the load function test, we can intuitively see how the performance parameters of the system are under different loads. In addition, the critical value of the traffic that the system can withstand can be obtained through the stress test method. Through the understanding of this point, the system performance can be further improved. The system performance analysis ensures the stability of the system to a certain extent, enabling the system to adapt to a variety of environments and operate normally [20].

Mercury’s load runner tool can be used to test the scalability of the system and the load capacity of the system. During the test, the response time of the website application under massive access is mainly simulated. Before the system is formally put into operation, the stability of the system can be guaranteed through certain performance tests. As many unexpected situations may be encountered in real situations, it is very necessary to adopt highly integrated and excellent performance test software. The load runner software can analyze the functions of the system layer by layer and can simulate many users to use the system. Testing with this software can ensure the normal operation of the system in a variety of complex situations to a certain extent.

Mercury load runner is a test software often used in the industry. It can accurately test the system performance before it is launched and provide a detailed and specific system performance analysis report. At the same time, it can also analyze the scalability of the system, generate the corresponding report files, and visually express the scalability of the information system, preventing many mistakes in the formal operation of the system. Load runner can

TABLE 14: Test cases of live video broadcasting.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Live classroom module
Test function point	Live video
User oriented	Teacher user
Testing procedure	(1) Start online live broadcast service (2) Capture video signal with digital video camera (3) The video signal is transmitted to the live broadcast server
Expected results	The live broadcast server outputs streaming video signals

TABLE 15: Course management test case table.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Management panel module
Test function point	Course management
User oriented	Teacher users
Testing procedure	(1) Teacher user enters the management panel module (2) Show all courses created by this teacher (3) Select a course to edit
Expected results	Can add, delete, and edit courses

TABLE 16: Table of safety test cases.

Test plan	Specific description
Product name	Online music teaching system
Function module name	Any module
Test function point	Security management
User oriented	Teachers and students
Testing procedure	(1) Teachers or students log in to the system (2) Select any module and enter malicious query code (3) Click submit
Expected results	Malicious query code is blocked by the system

measure the performance indicators of the main business in the system. And this test software is now able to test the performance of the system in real time with the continuous development of information technology. It can collect more system operation data. By capturing these details, load runner can analyze these data in detail through its own algorithm logic and obtain accurate performance analysis reports.

Load runner enjoys a high reputation in the industry. It supports convenient tests including system performance and scalability for all kinds of information systems in all walks of life. It is also a performance testing tool tailored to the ERP/CRM environment of Oracle and Siebel. The software itself adopts J2EE platform, including Microsoft's .Net platform integrated in the software, so it covers a wide range of fields. Through these tools, it is more convenient to test the information system accurately in all aspects.

Through the use of a series of test tools, the online music education system is tested under 200, 400, and 800 user visits. By determining the system response time and other data as index parameters, these index parameters are tested

to realize the detection of the overall function of the system and finally get an accurate analysis section report. The results of the pressure test on the system through the tool consist of the following aspects:

- (1) User visits: 200, 400, 800.
- (2) Pacing: 60 seconds.
- (3) The user successfully accesses the system and stays in the system for 20 minutes for continuous operation.
- (4) User scheduling: 30 virtual users/s. From Figure 9, we can see the response time curve of the system under different user visits. From this curve, we can conclude that the system is in good condition when 200 people visit the system within 2.5 s. However, with 300 or 500 visitors, the system performance exceeds 3 s, which will bring bad experience to users. When the system cannot access a large number of users, it will maintain a certain performance level, and the system load capacity needs to be improved.

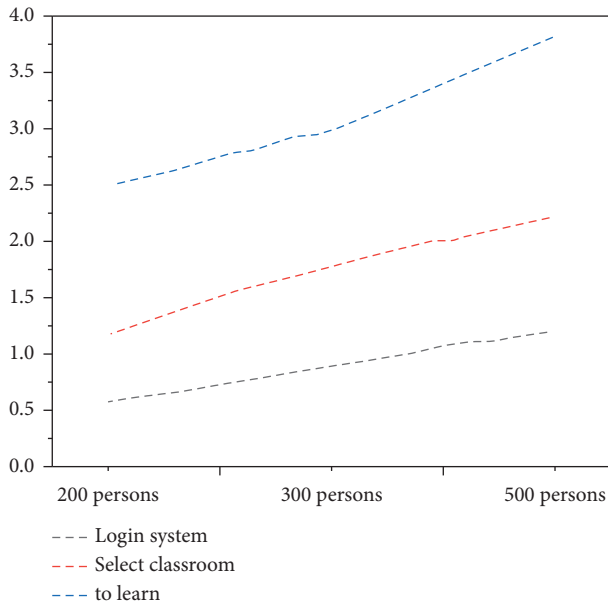


FIGURE 9: Response time curve.

Through the test of all aspects of the initially completed system, the specific content is to briefly introduce the test methods, and to apply each method, a specific test case table is given. The results show that the system works well in performance, but the performance under heavy load needs to be improved.

## 5. Conclusion

This paper mainly describes the management of related knowledge and working technology of online network teaching system, as well as two model technologies (b/s and c/s), as well as the application of security and network technology and database technology. Through the above technical learning, our project researches and designs a set of special online music teaching system. Main contents of this article are as follows:

- (1) First of all, this paper investigated many teaching related institutions and made a questionnaire survey on some teachers and students to determine the subject. Then, through going to the library to learn relevant knowledge and obtaining information on the Internet, we can learn and understand relevant technologies. We have a deep understanding of the current teaching system, especially the online music teaching system. In addition, in order to realize the development of the system, the author studied Visual Studio 2010, <https://ASP.NET>, and SQL Server 2008.
- (2) For the design and implementation of the system, we mainly have the following four aspects. First, we design according to the design principles and design requirements. Secondly, we designed and realized the connection between the main interface and other interfaces of the system. Then, the design of system function is realized. Finally, the design of database is

realized. Using streaming media and live broadcast technology, an online teaching system for music teaching is designed to realize the characteristic functions of live broadcast classroom and performance appreciation.

- (3) After the system is improved, it needs to be tested. The system functions are determined by analyzing the system implementation. We generally use the black box test method when testing the system. When testing the system, we are based on the test plan and design, which can better achieve the purpose of testing. There are still unsolved problems in the security design of our system. For example, if we only rely on the user's account name and password to log in to our system, we cannot achieve the security label. Because there are still many places in the system with high security requirements, simple security settings cannot play a protective role. Therefore, there are many places in the system that need to be improved. Some problems can be exposed through the later use of the system, and then we can improve and perfect it.

Due to the rapid development of information network and its penetration and application in all walks of life, the informatization of education industry is also the trend of the times. Therefore, we need to actively apply informatization to education. Improving teaching quality and overall teaching level through information technology is one of the steps of contemporary corresponding information reform. At present, there have been many information-based education systems, all of which are striving to build a better education quality. The advantage of information education is that teaching can be carried out at any time and anywhere and the richness of resources, which is lacking in traditional education. This paper is an attempt to develop a courseware making system based on education, hoping to exchange and learn from each other. In the future research work, we will continue to learn to make the system more perfect.

## Data Availability

The labeled data set used to support the findings of this study is available from the author upon request.

## Conflicts of Interest

The author declares that there are no conflicts of interest.

## Acknowledgments

This work was supported by the Hebei Institute of Communication College.

## References

- [1] Z. Wei, G. Zhai, Z. Wang, W. Wang, and S. Ji, "An artificial intelligence segmentation method for recognizing the free surface in a sloshing tank," *Ocean Engineering*, vol. 220, no. 4, pp. 108488–108492, 2021.

- [2] H. A. Gabbar, M. I. Adham, and M. R. Abdussami, "Optimal planning of integrated nuclear-renewable energy system for marine ships using artificial intelligence algorithm," *Energies*, vol. 14, no. 11, pp. 3188–3192, 2021.
- [3] J. Yang, J. Xu, and D. L. Zhai, "Integrating phenological and geographical information with artificial intelligence algorithm to map rubber plantations in xishuangbanna," *Remote Sensing*, vol. 13, no. 14, pp. 2793–2798, 2021.
- [4] A. R. Ghumman, M. Jamaan, A. Ahmad et al., "Simulation of pan-evaporation using penman and hamon equations and artificial intelligence techniques," *Water*, vol. 13, no. 6, pp. 793–799, 2021.
- [5] G. Dilip, R. Guttula, S. Rajeyagari et al., "Artificial intelligence-based smart comrade robot for elders healthcare with strait rescue system," *Journal of Healthcare Engineering*, vol. 2022, no. 5, pp. 9904870–9904912, 2022.
- [6] S. Mohan, O. Shoghli, A. Burde, and H. Tabkhi, "Low-power drone-mountable real-time artificial intelligence framework for road asset classification," *Transportation Research Record*, vol. 2675, no. 1, pp. 39–48, 2021.
- [7] J. W. Xiang, "Numerical simulation driving generative adversarial networks in association with the artificial intelligence diagnostic principle to detect mechanical faults," *Scientia Sinica Technologica*, vol. 51, no. 3, pp. 341–355, 2021.
- [8] Y. Kardovskyi and S. Moon, "Artificial intelligence quality inspection of steel bars installation by integrating mask r-cnn and stereo vision," *Automation in Construction*, vol. 130, no. 8, pp. 103850–103855, 2021.
- [9] X. Xu and J. Song, "Enterprise financial leverage and risk assessment based on mobile payment under artificial intelligence," *Mobile Information Systems*, vol. 2021, no. 4356, pp. 1–10, 2021.
- [10] A. Grassi and M. Vallati, "An exploratory study on the use of artificial intelligence to initiate legal understanding for business development," *Journal of Applied Logic*, vol. 8, no. 4, pp. 1065–1082, 2021.
- [11] H. M. Asfahan, U. Sajjad, M. Sultan et al., "Artificial intelligence for the prediction of the thermal performance of evaporative cooling systems," *Energies*, vol. 14, no. 13, pp. 3946–3950, 2021.
- [12] Y. Su, G. Chen, M. Li, T. Shi, and D. Fang, "Design and implementation of web multimedia teaching evaluation system based on artificial intelligence and jquery," *Mobile Information Systems*, vol. 2021, no. 12, pp. 1–11, 2021.
- [13] S. Agostinelli, F. Cumo, G. Guidi, and C. Tomazzoli, "Cyber-physical systems improving building energy management: digital twin and artificial intelligence," *Energies*, vol. 14, no. 8, pp. 2338–2342, 2021.
- [14] J. Yu, "Academic performance prediction method of online education using random forest algorithm and artificial intelligence methods," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 05, pp. 45–50, 2021.
- [15] K. Sharma and B. K. Chaurasia, "Trust Based Location Finding Mechanism in VANET Using DST," in *Proceedings of the 2015Fifth International Conference on Communication Systems & Network Technologies*, pp. 763–766, Gwalior, India, April 2016.
- [16] P. Ajay, B. Nagaraj, B. M. Pillai, J. Suthakorn, and M. Bradha, "Intelligent ecofriendly transport management system based on iot in urban areas," *Environment, Development and Sustainability*, no. 3, pp. 1–8, 2022.
- [17] X. Liu, J. Liu, J. Chen, F. Zhong, and C. Ma, "Study on treatment of printing and dyeing waste gas in the atmosphere with CeMn/GF catalyst," *Arabian Journal of Geosciences*, vol. 14, no. 8, pp. 737–746, 2021.
- [18] R. Huang, *Framework for a smart adult education environment*, vol. 13, no. 4, pp. 637–641, 2015.
- [19] Q. Liu, W. Zhang, M. W. Bhatt, and A. Kumar, "Seismic nonlinear vibration control algorithm for high-rise buildings," *Nonlinear Engineering*, vol. 10, no. 1, pp. 574–582, 2021.
- [20] Y. B. Lin, F. Z. Lee, K. C. Chang et al., "The artificial intelligence of things sensing system of real-time bridge scour monitoring for early warning during floods," *Sensors*, vol. 21, no. 14, pp. 4942–4946, 2021.