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DESIGN OF MULTIMEDIA EDUCATION AND TEACHING MANAGEMENT SYSTEM BASED ON ARTIFICIAL INTELLIGENCE AND COMPUTATIONAL TECHNOLOGY

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Abstract. The multimedia education and teaching management system's capacity to confront significant issues faced by conventional education systems is the fundamental justification for its relevance and significance. It is necessary to efficiently manage educational resources, accommodate to a variety of learning styles, and meet the expectations for highly personalised educational experiences. The system's goal, enabled by artificial intelligence (AI), is to build a classroom that is more adaptable to each student's individual requirements and interests. Personalised learning, efficient use of resources, and the ability to scale are common challenges faced by conventional educational institutions. Additionally, having scalable computing methods is crucial for making certain the system can handle different user needs and adapt to different classroom environments. The Intelligent Multimedia Teaching Tracking System (IMTTS) combines AI-based algorithms to track student interactions and enhance the transmission efficiency of multimedia content. Besides providing insights that teachers may put into practice, the system additionally provides a personalised learning route that is based on each student's performance and preferences. The deployment of scalable computing ensures that the system can effectively handle large datasets and a large number of users under heavy load. A thorough simulation analysis is conducted to ascertain the effectiveness and productivity of the IMTTS. The analysis shows that the system can change educational management by providing reliable solutions that address present issues and meet evolving educational needs. Furthermore, it highlights the system's capacity to handle compute needs that scale.

Key words: Multimedia, Education, Teaching, Management, System, Artificial Intelligence, Technology, Intelligent, Multimedia, Teaching, Tracking System, Scalable Computing.

1. Introduction. Multimedia education management has evolved into an essential part of many educational institutions in overtime [1]. The conventional approach to managing universities is becoming more obsolete as reforms in the sector continue to gather steam [2]. The teaching management system is under increasing strain due to the recent gradual implementation of educational measures in multimedia education institutions and the constantly increasing source of students in these institutions [3]. A new challenge for multimedia education institutions is figuring out how to make better use of computer and network technologies to aid education [4]. Internet, information, and smart computer and digital tool usage are having an ever-increasingly significant influence as computer network technology advances [5]. Database and communication technology are built under the scalable computing environment via the advancement of these technologies [6]. In today's world, where campus networks are constantly expanding, educational administration supervision systems are becoming more crucial [7].

These systems provide the groundwork for better instructional management and more efficient multimedia education [8]. The intelligent education system was built on cognitive science, which makes extensive use of AI technology in multimedia education systems to execute efficient student administration of their lessons [9]. An AI-powered, scalable computing system integrates the best features of both conventional and cutting-edge computer systems, while also reaping the benefits of conventional methods [10]. Modern education has progressed further thanks to the steady development of artificial intelligence and computer technology, which have allowed intelligent teaching systems to advance in a better and higher path [11]. This paper's main novelty is that it uses scalable computing technology and AI to record and analyse students' behaviours, digital

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footprints, and outcomes from conventional classroom activities [12]. Create a model of the role of students and teacher managers in the classroom using AI and computer technologies, and then use this model to inform intelligent teaching management [13]. Using this IMTTS as a foundation, the management should build a student model that caters to each student's unique traits, and then use it to execute intelligent customisation based on specific knowledge areas [14]. The management now has a better foundation for future remote learning thanks to its multimedia education system that is built on AI and scalable computing technology [15]. One of its benefits is that it offers a useful supplementary tool for teaching management system [16]. This paper presents the results of an inquiry of real multimedia equipment, and then utilizes IMTTS to create a web-based system for managing multimedia teaching tools [17]. For routine basic data maintenance of multimedia teaching tools and classrooms, and to serve as a model for the future installation of such tools and systems at other educational institutions [18]. The operator may enhance teaching efficiency with the help of the query, search, and database design features in the optimized intelligent multimedia pedagogy, which has been enhanced with optimized functions [19]. The invention of teaching modes of multimedia teaching classroom on online learning platform improves the teaching management system [20].

The main contribution of this paper is as follows:

1. *Enhanced Personalization and Adaptability in Education:*
   By using AI algorithms to observe student interactions and customize instructional information, the paper introduces customized learning. This personalised learning path takes into account student performance and interests to cater to different learning styles. By doing so, the IMTTS hopes to convert conventional classrooms into dynamic, personalized learning environments that boost student engagement and performance.
2. *Scalable Computing and Resource Efficiency:*
   The paper's emphasis on scalable computing approaches to educational resource efficiency is crucial. Since it can handle huge datasets and many users, the system can adapt to different classroom contexts and manage compute needs that scale. For universities with limited resources and infrastructure, the system optimizes multimedia content delivery and resource allocation for cost-effective and sustainable education management.
3. *Comprehensive Simulation and evaluation:*
   For IMTTS efficacy and productivity, the report includes a complete simulation analysis. By providing scalable, flexible, and individualized learning environments, the system solves traditional educational management problems. The system's capacity to improve educational practices and fulfil changing educational demands is confirmed by this paper, providing insights for intelligent education system research and development.

The remaining of this paper is structured as: In section 2, the related work of multimedia teaching is studied. In section 3, the proposed methodology of IMTTS is explained. In section 4, the efficiency of IMTTS is discussed and analysed and finally in section 5, the paper is concluded with the future work.

2. Related works. The old model of managing multimedia classrooms isn't going to cut it in today's ever-changing network landscape; it won't be able to swiftly identify and fix malfunctioning multimedia teaching equipment; it won't be able to accurately record the status, use time, and maintenance records of different pieces of multimedia teaching equipment; and it will have a negative impact on college and university teaching quality and education informatization efforts in the long term. Integrating multimedia pedagogical tools with the university's online presence is crucial.

Training high-quality, inventive skills in the modern day is greatly aided by music education, which is a crucial component of good education. The difficulty in popularizing musical instrument training on occasion stems from the fact that it is dependent on musical instruments. This study proposes a multimedia teaching platform for indoor instrument teaching based on SOA, with the goal of improving instrument instruction via the use of multimedia technologies and SOA architecture. It uses real-world testing and building a small-scale multimedia teaching platform and confirms its efficacy [21].

There is a lack of engagement and efficient use of resources on the present multimedia online education platform. This research will investigate the development of a multimodal online learning platform using a fuzzy neural network as a potential solution to this issue. An FPGA serves as the brains of the online education platform's hardware architecture, while a FNN processes and mines the platform's resources. Make better use of platform resources via the use of cloud computing and enhance the efficiency of platform operations [22].

According to the trend toward education management informatization is becoming more apparent against the backdrop of the big data era, which has brought about significant changes in the administration of higher education institutions via the use of big data [23]. As a result, school management will likewise see revolutionary shifts as a result of the big data tsunami. Further, educational institutions should adapt to new circumstances by optimizing and adjusting their education management practices, making sure their student management practices can handle the management demands of the big data era, effectively enhancing their education management in general, and providing ever-improving student services.

Students of English as a second language may develop feelings of animosity and diminished learning efficacy when exposed to emotionally detached computer screens in multimedia English instruction. An intelligent network teaching system model based on deep learning speech enhancement and facial expression identification is proposed in this research to address the absence of emotion in multimedia English education and increase its efficiency [24].

One factor that could impact the impact and quality of online education is how well resources are searched for and retrieved. To optimize the design of an accurate resource classifier, this study follows the methodological framework of design science and uses the algorithm. Quan, Z. et al. [25], to provide online learners with more accurate and quick access to educational materials, they want to enhance the inadequate categorization impact of conventional approaches for online education resources.

Xiaoyu Liu and Rujing Yao [27] suggested Artificial Intelligence and CAD Technology for Visual Communication Teaching Systems. New computer-aided design (CAD) and artificial intelligence (AI) developments have generated new ideas, approaches, and educational tools. This paper begins with how AI and CAD have affected modern visual communication design and their effects on design methods, design tools, and presentation techniques. It then moves on to explore how these technologies can revolutionize visual communication design education by enhancing the teaching of visual correspondence design through the integration and development of AI and CAD.

Panpan Li et al. [28] proposed the Artificial intelligence translation under the influence of multimedia teaching to study English learning mode. As a text data source, use the SQLite software database server. The user enters the query term into the translation platform when they want an English translation done, and the text is translated using the Google API translation technology powered by artificial intelligence. Construct edge computing solutions and examine user data input records based on the acquired real user service use records. Build the word's feature vector using word2vec, then build the text's word ranking with LSTM. To preload the service, the word ranking approach estimates the user's service consumption, chooses the appropriate edge server and combines the appropriate probability model. Information is kept in sync and monitored using the Internet of Things data processing technology, including edge algorithm compression. The translated text is shown on the application interface in voice and words once the data is compressed. Intelligent translation platforms anticipate a 90% matching degree of users' translation inquiries, and research shows that using IoT edge computing boosts the retention rate of past query data by 30%.

Qichao Cui [29] recommended the Integrated Multimedia Teaching Model (IMTM) for the Linguistic Smart Education System. The suggested IMTM uses intelligent educational resources, focusing on listening and oral expression skills, and employs linguistic-based instruction to improve students' comprehensive competence. At the same time as it meets the demand for growth, IMTM equips students with better self-study skills and comprehensive learning capacities. The experiment's findings demonstrate that compared to other techniques, the IMTM-based smart education system meets students' learning goals and uses linguistic-based individualized learning to enhance student performance by 92.3%, assumption by 90%, and flexibility by 91.2%.

Wang Zheng [30] discussed the adaptive learning algorithm and artificial intelligence technology for Intelligent e-learning design. The system aims to facilitate effective art course mastery by providing a tailored learning environment. The intelligent e-learning system, which analyzes students' learning behaviours and traits and employs an adaptive learning algorithm to modify the learning material and techniques continually, is described in depth by the author. The system's intelligent tutoring and assessment features aid autonomous learning and feedback. The author discovered that the intelligent e-learning system significantly outperforms the conventional e-learning system in terms of learning impact and motivation when we compare the two systems in an experiment. Students' interest in studying and information acquisition level was enhanced after using the intelligent e-learning system.

In multimedia-assisted teaching, Shanshan Cheng et al. [31] discussed the EMLP-SNN, an improved multilayer perceptron integrated spiking neural network, for use in online interactive teaching systems. The EMLP-SNN method is recommended to recognize spoken English pronunciation. This approach enhances the integration of multilayer perceptrons with spiking neural networks. The trials show that the suggested algorithm has a 97.5% success rate. It may help students improve their oral English learning by pointing out when their pronunciation differs from the norm and providing them with the tools to correct their errors.

RanaAlShaikh et al. [32] introduced Automatic Speech Recognition (ASR) using OpenAI's Whisper and Google's Large Language Model (LLM) for multimedia learning. The twin objectives are to create an AI helper tool and evaluate its influence on improved learning experiences. The study used a mixed methods approach, integrating human review by nine educational professionals with automated measures. Participants rated the tool from highest to lowest regarding engagement, information organization, clarity, and usability. Readability and Content Distinctiveness ratings were among the automated measures which were calculated. Findings from the human assessment point to beneficial effects in every area that was considered. The tool's natural metric generation capabilities further demonstrated its content generation and readability capabilities. Taken as a whole, these early findings demonstrate how the technology might completely transform instructional design by delivering highly customized and visually appealing learning experiences.

Xi Zhang et al. [33]proposed anArtificial Intelligence Technology for the Design and Application of Intelligent Classroom for English Language and Literature.Universities face unprecedented demands for creative talent nurturing due to economic globalization's increased intermingling of economics and culture. This study provides a methodology and evaluation framework for building an AI-powered smart classroom specifically for the English language and literature. This technique focuses on helping pupils get comfortable with the English context and cultural backdrop to improve their general language ability. By implementing the suggested strategy, we want to provide students with a more stimulating and fruitful educational environment in which they may grow in their language proficiency and cultural literacy.

RamtejaSajja et al. [34]suggested anartificial intelligence-enabled intelligent assistant (AIIA) for Personalized and Adaptive Learning in Higher Education.The AIIA system uses cutting-edge AI and NLP methods to provide a dynamic and exciting educational platform. This platform is designed to make learning more accessible by making material readily available, testing knowledge, and offering individualized learning assistance based on each learner's requirements and style. This article outlines the framework, architecture, intelligent services, and interaction with learning management systems (LMSs) for AI-enabled intelligent educational assistants. Then, it discusses the obstacles, constraints, and potential future paths for their development.

TatikMariyanti [35] introduced an Android Based on Artificial Intelligence for the Development of Mobile Learning Applications. The study aimed to collect information from students in Raharja University's informatics engineering department. Techniques To collect data, researchers use questionnaires and tests of instrument validity and reliability. A data analysis technique is then used to examine the feasibility of the media and student response. Data from the student responses were analyzed descriptively. First, the data show that professional validators have validated the media at a rate of 92.5%. This suggests that the M-learning app for Android is suitable for use and belongs to the "Very Excellent" tier. (1) A whopping 79.5% of students using the Android-based M-learning app had a positive experience.

Xiaofei Yu et al. [36] presented an Artificial Intelligence in Music Education for Developments and Applications. Artificial intelligence (AI) is an outcome of the fast expansion of IT; it incorporates several multidisciplinary fields, including music education, and brings novel aspects to the field. This study thoroughly examines the use of artificial intelligence (AI) in music education, outlines its current applications, and discusses its potential future growth by reviewing the benefits of AI in this field. By integrating AI-powered smart technology with face-to-face instruction, we can address the conventional method's absence of personalization while simultaneously stimulating students' interest in the subject field.

The planned research would leverage cutting-edge technology to update music instruction and online learning environments. The goal of a SOA based multimedia teaching platform in music education is to improve

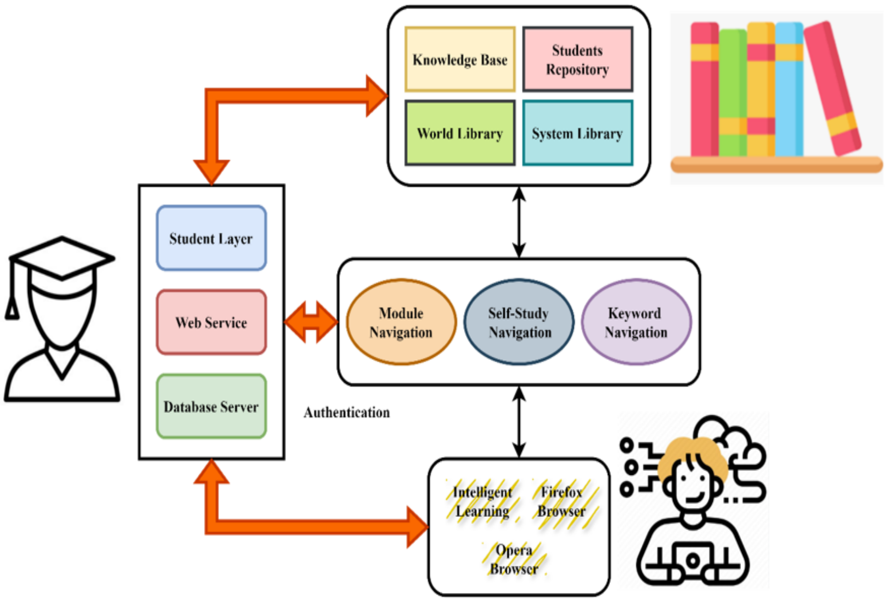

Fig. 3.1: Intelligent multimedia teaching tracking system

instrument learning. To address the shortcomings of existing online multimedia education, a hardware design based on field-programmable gate arrays FNNs is suggested. Big Data has changed the face of educational administration and how it might lead to better student services and more efficient overall operations. By recognizing facial expressions and voice, a DLA improves English language learning with multimedia. The last step in improving the efficiency and accuracy of retrieving educational materials from the web is a SVM, which improves resource categorization.

3. Proposed method. New instructional tools are now more accessible than ever before thanks to the Internet, lightning-fast computer science, and electrical engineering. These advancements are used by intelligent online multimedia learning to evaluate large datasets, forecast trends, and extract important insights using machine learning. By providing more complex and dynamic evaluations, this strategy goes beyond conventional approaches that depend on test results. Through the integration of AI systems, educational institutions have the ability to analyse and synthesize intricate data sets, uncovering patterns and standards that are pertinent to the field as a whole.

3.1. Contribution 1: Enhanced Personalization and Adaptability in Education. Intelligent online multimedia learning's technique is shown in Figure 3.1. It undertakes extensive analysis to determine the optimal course of action, predict future trends, and much more than just look at previous data and identify any links. When applied to appropriate database sets, machine learning may consistently extract useful information, such as laws or higher-level data, which can then be utilized to extract new knowledge.

Rapid advances in information technology, electrical science, and the spread of the Internet have made it possible to access the electronic archives of many different types of educational institutions. There is a shift away from using test scores to categorize students. The assessment methodologies' remarkable achievements have become indispensable in education. Using AI systems, data from a variety of complex sources may be summarized and evaluated using scalable computing. These systems have the ability to transform and extract information, revealing previously unknown conceptual standards and connections that are pertinent to the group's overall state. The ideal browser for students, according to the Student Helpdesk, is Firefox. Our instructors found this browser to have the most forgiving connection and the most consistent improvements out of all the ones they looked at. In most cases, the Student Help Desk suggests Firefox as the best web browser to use. To improve the process assessment system and make it applicable, there are a number of components that may be thoroughly and exhaustively examined to conceal the evaluation findings and the connections between the student and teacher.

$$-\sum_{j=1}^{p} m_k(H_j(p)|\alpha_w j|e^{r-2} f_d p) = Q(y,w,\alpha,\forall)\ \ in\beta \tag{3.1}$$

To improve educational administration m_k, the suggested approach makes use of an IMTTS, or intelligent educational multimedia tracking system $H_j(p)$, which makes use of algorithms $\alpha_w j$ based on artificial intelligence $e^{r-2}\ f_d p$. Optimizing the monitoring of interactions β between students $(y,w,\alpha,\forall)$ and efficient multimedia information Q transmission is emphasized by previous equation.

$$-\partial wq(p,e) \geq \sum_{k=1}^{D} \int_{w}^{e} df(y) \times dy + (\forall k_f - W_s p) \tag{3.2}$$

The equation 2 provides a mathematical correlation $< -\partial wq(p,e)$ between the intelligent multimedia educational monitor $df(y)$ (IMTTS) and the suggested technique $\forall k_f - W_s p$. With an emphasis on administering educational resources dy and customized learning experiences, previous equation represents the efficient use of system-wide tracking efficiency and the allocation of resources.

$$-pgt(Z(n)h) = (y(s+jp)) - (w - s2q) + 1 \tag{3.3}$$

By symbolizing the (IMTTS) dynamic modifications -pgt $(Z(n)h)$, the previous equation coincides with the suggested approach $y(s+jp)$. Optimized performance is achieved by balancing the input variables $(w - s2q)$ such as student interactions with the system parameters using scalable computing.

$$\sum_{j=1}^{W} \int_{\forall}^{e} H_j(m(y))|Nt_{y-p} + (rs - (qpt)) = \int_{e}^{1} Q(y, g(t-p)) \tag{3.4}$$

The complicated interaction of factors is captured by previous equation, which corresponds with the suggested strategy $H_j(m(y))$. It spells out the steps the system y,g takes to improve learning routes Q and resource allocation Nt_{y-p} by integrating student performance measurements $(rs - (qpt))$ and periodic adjustments $(t-p)$.

To increase their interest in the topic, students might be encouraged to build tactics and materials by designing a multimedia teaching model. IMTTS propose an ecological method of teaching that builds on the interaction process to establish a sustainable educational system and support effective teaching. Through the use of AI, universities assess their relevance to multimedia teaching. The environment for teaching with artificial intelligence is shown in Figure 3.2. Given that these components are now standard in education, it has created a wealth of new opportunities for instructors. A classroom may be prepared for a particular course or program in a variety of ways. There are many more aspects of a learning environment than only the physical spaces itself, such as classrooms, lecture halls, and labs using scalable computing. There will also be details on the students' personalities and the goals of the lessons. The objective of this research is to develop AI systems that can store data using data directories, metadata, and encryption. A variety of AI data sets pertaining to multimedia acquisition may be housed, assembled, and organized using data warehouse technologies. The AI used in this investigation is stored via metadata and encryption. AI data for many types of multimedia learning datasets may be stored, assembled, and sorted using scalable computing.

$$\left| G(y,e,q) > 1\big(d_i - \sum_{j=1}^{p} |r_f - p_k|\big) + d_2 \right| |u|s^{-1} + c_4 \tag{3.5}$$

This equation shows (IMTTS) need balance $G(y,e,q)$ and improvement $r_f - pk$, which is in line with the suggested strategy d_1. It records the integration of metrics d_2 such as system efficiency (c_4), student involvement

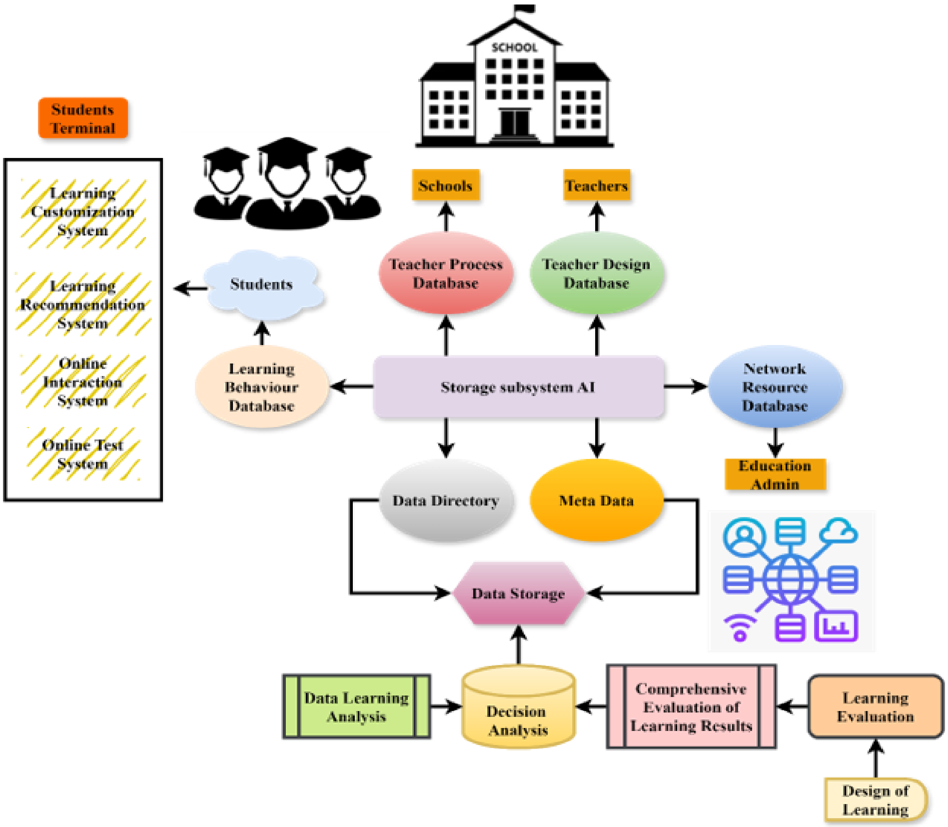

Fig. 3.2: Teaching ecosystem using AI

(d_2), and resource allocation ($|u|s^{-1}$)

$$S_f = H(y, p, \alpha, q), w\beta(dy - 1p) - (\sigma_p + jp) \tag{3.6}$$

The suggested strategy is supported by equation 6, which shows the complex interactions H among student feedback (S_f), learning parameters ($y, p, \alpha q$), and system modifications ($\sigma_p + jp$). The (IMTTS) uses AI algorithms to analyze these characteristics $dy - 1p$ and make the learning experience better and more tailored to each student.

$$\int_f^1 |Q(y, p, \partial q)|dp > dz\left(\sum_{j=1}^{E} \int_\partial^w |e_s| + \int_\alpha^1 |v|dp - 1\right) \tag{3.7}$$

Last equation and the suggested technique are related since it show well the system can manage $|v|dp$ and optimize learning assets ($Q(y, p, \partial q)$) concerning several indicators for student involvement (dp). To successfully address individual learning demands, the (IMTTS) uses AI-driven insights to fine-tune resource allocation and material delivery $|e_s|$.

3.2. Contribution 2: Scalable Computing and Resource Efficiency . The multimedia education technique that is based on artificial intelligence has created methods for assessing and developing abilities. The development of AI educational solutions will soon allow schools and instructors to do more than ever before. The efficiency, customisation, and automation brought forth by AI may free up teachers' time and provide them greater flexibility to impart knowledge and adaptability to student.

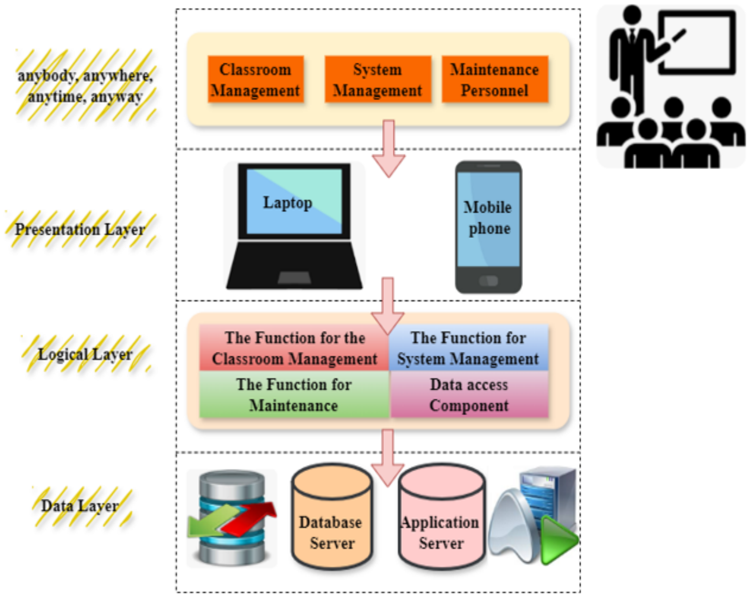

Fig. 3.3: Architecture for teaching with multimedia management

Figure 3.3 depicts a Service-Oriented Architecture based multimedia learning platform for indoor instrument education. At the very top of the organizational chart are the three main management positions: classroom instructor, system administrator, and maintenance staff. These positions offer simple access and control by interacting with the system via mobile devices and computers with the help of scalable computing. The Function for System Management, the Function for Maintenance, the Function for Classroom Management, and a Data Access Component are all part of the middle layer's role-specific functions. Teaching, system operations, and upkeep can all be better managed with these features. Database and Application Servers are the backbone of the platform, supporting applications and storing and retrieving data. Instrument training is made more efficient and effective by the integration of multimedia technologies in this SOA-based design, which also makes it more accessible and structured for administrators and instructors is shown in figure 3.3.

$$|Q(p, sf, mt)| > d_1 \sum_{p=1}^{q} |T^P| - df^2 + d_2[u]s^1 + s^2 \tag{3.8}$$

By using indicators of performance ($Q(p, sf, mt)$) and system variables (d_1, d_2, s^2) to optimize the (IMTTS), the equation aligns with the suggested strategy. To improve the learning experience, the AI algorithms in IMTTS balance the quality of instruction (T^p) with the efficiency of resources (df^2), as shown in previous equation.

$$|| < M(S_p), e_f - k \geq \left| \int_{\forall}^{1} Q(y, w_{sp}, \beta_{jk-1}) \right| - Lf^{t-1} \tag{3.9}$$

The (IMTTS) may be optimized using student measurements (S_p), engagement factors ($e_f - k$), and adaptive algorithms for learning ($Q(y, w_sp, \beta_(jk-1))$), consider the previous equation. The AI-powered system adapts resources and instructional tactics (Lf^{t-1}) in real-time to suit individual requirements, using these factors to make the learning experience more personalized and effective.

$$\sum_{j=1}^{W} \int B_p(y(z))|e_f(m(v-1)q^w sw) = \int_{\partial}^{1} Q(y, wq, (p - kq)) \tag{3.10}$$

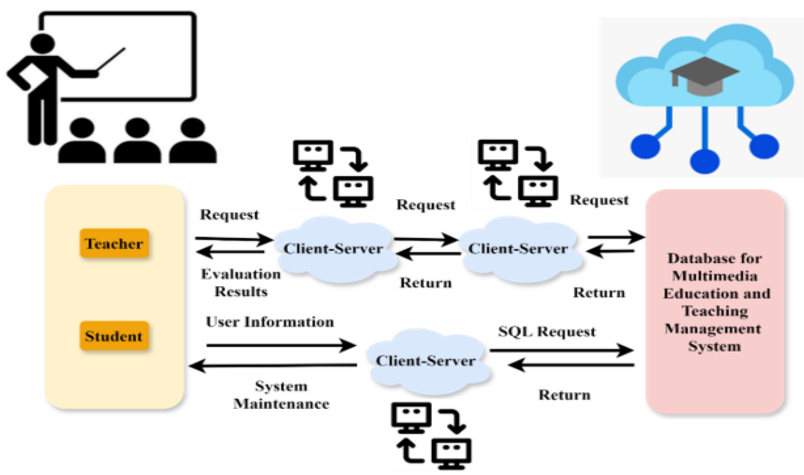

Fig. 3.4: Intelligent education teaching tracking system

In the (IMTTS), the equation 10 describes the equilibrium between customized learning metrics $(B_p(y(z)))$ and educational engagement factors $(e_f(m(v-1)q^w sw))$. This equilibrium is in line with the suggested strategy. The AI algorithms make use of these connections to adapt the system's teaching tactics and resource allocation $(Q(y, wq, (p-kq))))$ in real-time, tailoring it to each student's unique learning requirements.

Figure 3.4 shows the client-side settings and internet servers for the PE and assessment software there. The major goal of the software is to review and assess online teacher syllabi, correct management reports, and assess and evaluate students. The application is run by the administrator during the assessment. The student must be acknowledged as the focal point of learning in order for education to undergo contemporary transformation. Both teachers and students need to be able to actively participate in class discussions in real time. One traditional approach to evaluating computer education is the normal programs mode, which is a limited mode for assessing the manner of instruction. This paper laid forth a computerized evaluation approach to satisfy the goals of the new educational reform, which included managing the servers and the client using scalable computing. Students may see the evaluation results and judge the teacher's performance using this approach. In reality, teachers see students' insights and the level of dedication from both themselves and their students. Using the shared foundation type of the Website and virtual servers, it is a realistic computer training assessment system. This process improves computing-related speed, allows for real teacher-student communication, and decreases customer-server shuttered duplicate information. foundation for an evaluation is substantially more important and dependable.

$$\sum_{z=1}^{p}(b_p - e_1)||s_p|| > e_2 \sum_{k=1}^{Q} ||v_b - 1|| + ||\alpha - er|| \tag{3.11}$$

This equation is in agreement with the suggested approach since it highlights (IMTTS) may optimize student performance measures $((b_p - e_1)$ and system parameters (s_p). To improve the tailored learning experience (e_2), the AI algorithms examine these measures and strike a balance between engagement factors$(v_b - 1)$ and the distribution of resources (α). This method of dynamic adjustment enhances scalability er and instructional management by keeping the system flexible to individual demands.

$$|\rho_\pi(v^* - (s_f)T^{u+1})| = |(u+1) - (c_f(v^1))| \tag{3.12}$$

This equation shows (IMTTS) dynamically adjusts student performance (ρ_π) and system feedback (v^*), which is in line with the suggested strategy s_f. Maintaining a balance between these elements T^{u+1}, the AI algorithms

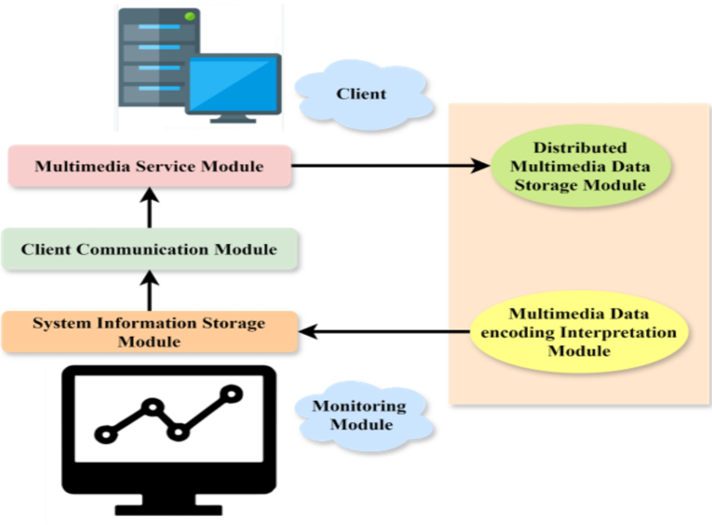

Fig. 3.5: Educational multimedia video system employing scalable computing

optimize the teaching process, making sure that each student's learning experience $(c_f(v^1))$ is customized to their specific requirements.

3.3. Contribution 3: Comprehensive Simulation and evaluation. By altering the fundamental foundation of outdated systems to enhance production efficiency, Online Plus aims to integrate the Website's user-friendly and varied advantages for e-learning with scalable computing. Virtual reality technology is a simulation model that can imitate real-world environments. The disparity in pedagogical approaches between students and teachers may be narrowed.

Figure 3.5 shows a multimedia service architecture that aims to improve client interactions and data management. The system's fundamental components are modularly organized, with the Multimedia Service Module serving as the first point of contact for the system's primary multimedia services. To guarantee smooth data transmission between the system and the clients, this module communicates with the Client Communication Module. Important system data is saved by the System Information Storage Module, which also provides general functioning support. Important parts include the Multimedia Data Encoding Interpretation Module for processing and interpreting multimedia data for different uses, and the Distributed Multimedia Data Storage Module for managing data distribution over the network. A Monitoring Module also keeps an eye on how well the system is doing, making sure it's reliable and efficient. A scalable and effective multimedia service platform is made possible by this design, which allows for rapid client connection, thorough system monitoring, and strong multimedia data management.

$$\sum_{k=1}^{D}\int_{f}^{s-1}(\alpha_{jp}-v_s-1)=(e_yp-dz(p+1t)) \tag{3.13}$$

Within the (IMTTS), the equation indicates the optimization of student engagement metrics $\alpha_j p$ and system parameters $(v_s), e_y p$, which corresponds with the suggested technique $dz(p+1t)$. To guarantee tailored educational experiences, the AI-powered system makes use of these parameters to adapt pedagogical approaches f and resource distribution in real-time $s-1$.

$$\int_{f}^{r}(p-1)=\int_{w}^{2}(Z(p,wq)-1)-\left(\int_{2}^{w}(er_{u-1}+(se_{wq}))\right) \tag{3.14}$$

By showing (IMTTS) optimizes parameters for learning (p, wq) and engagement metrics $(er_(u-1)+(se_w q))$, equation 14 is used with the suggested technique $er_(u-1)+(se_w q)$. To guarantee effective use of resources

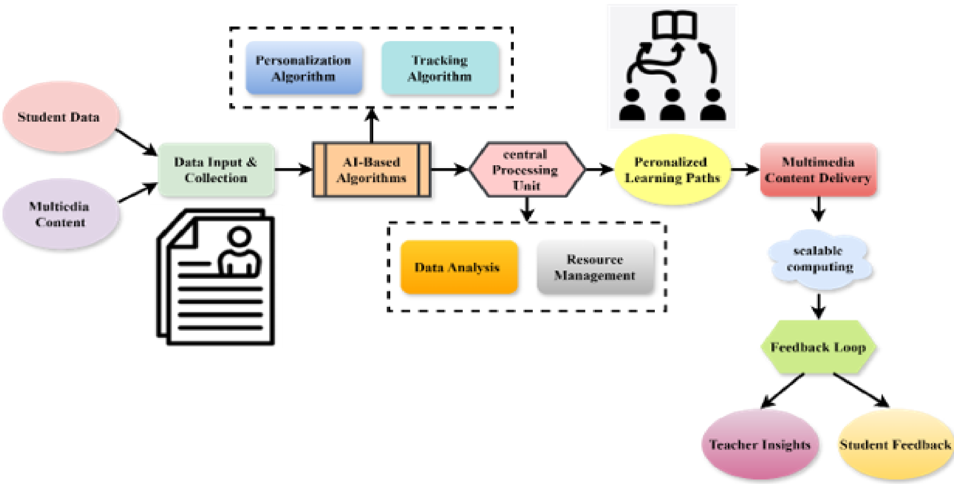

Fig. 3.6: Process flow of IMTTS

and tailored learning experiences, the AI algorithms included in IMTTS continuously modify instructional approaches according to these factors.

$$\sum_{p=1}^{S}(b_k - q) = \int_{\forall}^{1}(s_e(u-1) + |w_p dz > a|) - (dz - 1p) \tag{3.15}$$

The equation that represents the equilibrium of the (IMTTS) learning engagement metrics $(s_e(u-1))$ and system parameters $(w_p dz > a)$. The educational system becomes more efficient $b_k - q$and flexible as a result of this dynamic adjustment $dz - 1p$, which allows for individualized learning experiences and the fulfillment of varied classroom demands.

Figure 3.6 shows a multimedia learning platform that is customized for each student by using the algorithms and data analysis. The first step is to gather student information and media files, which will be input into the Data Input & Collection module. A central Processing Unit processes this data using AI-based algorithms, such as tracking and personalization algorithms. To improve education, this technology creates Personalized Learning Paths that cater to each student's unique requirements. The platform uses scalable computing to handle fluctuating needs and guarantees effective delivery of multimedia content. The Data Analysis and Resource Management modules enhance the system's performance by optimizing the allocation of resources. To make sure the system is successful and adaptable, feedback loops that include teacher insights and student feedback constantly update it. Learning may be made more responsive and tailored to each student's specific needs using this holistic approach, which strives to enhance educational results.

$$||\forall_d(q + (e_s t - pl)) = S_w(\frac{1}{t_0}) + \int_{\partial}^{1}(\forall_{sw-1}) - (k = 1, P, ...M) \tag{3.16}$$

The efficiency of (IMTTS) is determined by the equation that balances engagement metrics $(e_s t - pl)$, parameters of learning $(\forall_d)$, and system $(S_w(1/to))$. To maximize resource management and provide personalized learning experiences, AI algorithms minimize these variables $(\forall_(sw-1))$. Overall educational results are improved and the system's responsiveness and scalability are boosted by this dynamic balancing $k = 1, P, ..M$ denotes the analysis of student engagement

$$\int_{\forall}^{1}(s_f) - (v^+)s - dp = \int_{\alpha}^{1}(Kp - kjy)\partial - (d_f + up) \tag{3.17}$$

In the (IMTTS), the equation shows suggested technique fits in with student performance $((s_f) - (v^+))$, system feedback (dp), and dynamic adjustments $(Kp - kjy)$. This keeps the system flexible enough ∂ to meet the demands of each student, allowing for effective $d_f + up$ and efficient administration of education on analysis of sustainable education management.

$$(z^+(s_f)p - 1) = c_2|f - 1|s_f(p - q) + (f^{+L-(MP)}) \tag{3.18}$$

The equation represents the optimization of the (IMTTS) and its performance measures $(z^+(s_f)p - 1)$, is used in the system. The settings are constantly adjusted c_2 by the AI algorithms to improve educational results $(f - 1)$, while still maintaining individualized learning routes $p - q$. The system's ability to respond to and satisfy the requirements of various students is enhanced by maintaining a balance between criticism, performance $f^{+L-(MP)}$, and allocating resources on analysis of resource allocation for cost-effective.

$$(lp - 1)r = (e_{w-1} - 1)q^*, \ \ \alpha_p < 3(1 - mp) \tag{3.19}$$

Last equation shows student performance (lp), engagement metrics $(e_{w-1} - 1)$, and its parameters (1-mp). This adaptive modification enhances the system's responsiveness α_p and scalability 1-mp, making it better able to meet the demands of a wide range of students and maximize learning results for the analysis of individualized learning environments.

$$||v^+||Q_p - (l - 1) > \left(2c_2 - (\frac{1}{k - 1})\right) - (S_{w+1} - (pj - l)) \tag{3.20}$$

This equation agrees with the suggested approach as it depicts the harmony in (IMTTS) between the variables S_{w+1}, which are system parameters $1/(k-1)$, and student performance metrics $(2c_2)$. This equilibrium improves the system's responsiveness and flexibility $pj - l$, which in turn meets the demands of various students and leads to better educational results Q_p on Analysis of student performance.

The goal of this paper is to improve multimedia learning environments via the application of artificial intelligence systems. These systems are able to store, aggregate, and organize AI data pertaining to multimedia learning by using data warehouse technology from scalable computing. The use of AI in the classroom paves the way for more thorough evaluations of classroom dynamics, which in turn promotes more long-term, fruitful approaches to education. A great way to get students more invested in what they're learning is to support the creation of multimedia teaching models. An example of how AI might build long-term educational systems and boost efficiency in the classroom is the ecological approach to teaching that has been suggested.

4. Result and discussion. By using AI, IMTTS improves student engagement, tailors learning experiences to individual needs, and maximizes the use of educational resources. Using massive amounts of data on how students engage with multimedia material, IMTTS develops individualised lesson plans, changes up its approach to instruction, and keeps students engaged with it all via immediate feedback. Its scalable design allows it to handle diverse user requests and enormous datasets with ease.

4.1. Dataset Description. Questionnaires were used for data collection. The research at Nottingham Trent International College provides the basis of this. The purpose of this study is to provide researchers with a tool to better understand how students manage their time. Dataset details include students' ages, sexes, countries, study programs, attendance, grades, and language course grades [26]. There is also a representation of the students' responses to the questions that dealt with time management skills.

4.2. Analysis of Student Engagement. In enhance student engagement, the IMTTS employs AI-based algorithms to meticulously track and analyse students' interactions with multimedia content. After reviewing a student's academic performance, hobbies, and habits, the IMTTS system develops a personalized learning plan. With this targeted approach, which accounts for different learning styles (as shown in equation (16), education has the potential to be more engaging and beneficial. Students are more engaged and motivated when teachers utilize the system's results to enhance their teaching approaches. Adapting multimedia material in real-time according to user input ensures that the information remains current and captivating. Also, even when demand is great, IMTTS remains responsive and performs effectively because to its scalability, which

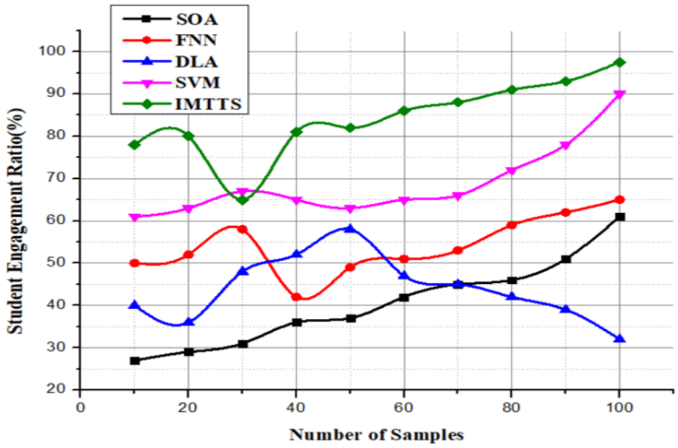

Fig. 4.1: The graph of student engagement ratio

Table 4.1: The sustainable education management

Number of Samples	SOA	FNN	DLA	SVM	IMTTS
10	77.5	31.2	40	52.1	80
20	79.2	34.8	45.5	57.2	80.9
30	71.4	40.8	49.8	50.2	84.4
40	69.5	56.5	42.2	49.9	80.8
50	77.3	70	39.1	41.7	88.3
60	79.3	67.1	41.3	43.8	89.9
70	70.1	73.5	48.8	54.2	90.7
80	62.7	69.2	52.3	68.2	95.8
90	60.8	70.4	57.3	66.7	90.4
100	69	80	61	72.3	99.2

allows it to effortlessly manage massive datasets and a significant number of users. Extensive simulation testing has shown that the system can adapt to the evolving needs of modern education, increase student engagement, and give credible recommendations for solving current educational challenges. Figure 4.1 shows that when using the IMTTS, the student engagement ratio is improved by 97.52%.

4.3. Analysis of Sustainable Education Management. To promote sustainable education management, the IMTTS is crucial since it integrates insights generated by AI with efficient resource use. IMTTS aids institutions in making the most of their resources by continuously monitoring and analysing all educational activities. There would be reduced wastage and better use of resources as a result of this. Through the implementation of personalized learning plans that are designed to align with each student's specific needs and areas of interest, educational resources may be more effectively used.

Sustainable education management also includes responding to fluctuating demand and adjusting to new classroom settings. IMTTS's scalable computing capabilities allow it to handle enormous datasets and diverse

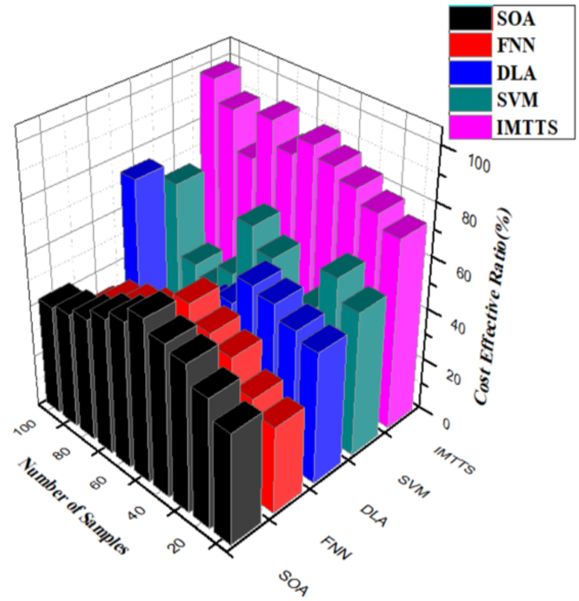

Fig. 4.2: The graphical representation of resource alllocation for cost-effective

client requests with ease. In order to ensure sustainability in the long run, IMTTS provides administrators with comprehensive data analysis so they may make informed decisions. The IMTTS is useful for spotting trends and improvement opportunities. Table 4.1 shows that this approach not only improves educational outcomes, but also helps construct an educational infrastructure that is better suited to deal with future challenges.

4.4. Analysis of Resource Allocation for Cost-Effective. The AI, IMTTS optimizes the use and distribution of instructional materials, leading to more efficient use of funds and better overall management of schools' budgets. A previous equation is used to extract the appropriate resources for different learning and teaching scenarios, which is then utilized by the IMTTS system to make sure that resources are deployed where they can have the greatest effect. Save money you don't need by spending it wisely and making the most of what you have. Administrators are able to make informed decisions on budgeting and procurement with the help of real-time data on resource usage provided by IMTTS, which helps to optimize efficiency and avoid over-purchasing. The system may tailor learning paths to each student's needs by using the most relevant resources, which further improves cost efficiency. Ultimately, educational administration may choose to use IMTTS due to its scalability, which allows it to adjust to evolving demands without increasing costs. This kind of resource allocation is smart and helps educational activities run more smoothly and cheaply. The cost-effective ratio increases by 98.23% in the IMTTS, as shown in figure 4.2.

4.5. Analysis of Individualized Learning Environments. The AI powered insights employed by the IMTTS make each student's educational experience unique with respect to learning environments issues. Equation 19 describes how the system tracks students' interaction with multimedia content giving them scores; then based on these scores, the program proceeds to adjust the teaching materials. By appropriate instruction strategies according specific emotional states of students their learning styles or interest areas a student-centred approach improves educational outcomes.

With the help of IMTTS system, teachers can create more customizable and supportive learning environment in classrooms instantly. This would be more interesting and fun for students when content is changed to match their growth. The scalable architecture of IMTTS allows continuous delivery of highly personalized experiences even in massive educational environments. In view of Figure 4.2, this approach towards individualized learning environments may enhance accessibility, engagement and value of education for everyone.

Table 4.2: Individualized learning environments

Number of Samples	SOA	FNN	DLA	SVM	IMTTS
10	67.5	41.2	30	32.1	70
20	69.2	44.8	35.5	37.2	70.9
30	61.4	50.8	39.8	30.2	74.4
40	79.5	66.5	42.2	39.9	80.8
50	67.3	80	39.1	41.7	84.3
60	69.3	67.1	41.3	43.8	88.9
70	60.1	73.5	48.8	54.2	90.7
80	52.7	69.2	52.3	58.2	91.8
90	60.8	70.4	57.3	66.7	83.4
100	69	80	61	72.3	99.2

4.6. Analysis of Student Performance. The IMTTS algorithm offered a complex structure for monitoring student progress using the DA and AI. Students' interaction with multimedia in collecting extensive data on several performance metrics like understanding, engagement, and growth is monitored by how IMTTS are presented in Equation 20.

The teachers employed a hands-on approach to know the student's strengths and areas of development byanalyzing data patterns. The support of real-time feedback from the system facilitated timely intervention. Based on the needs of every student, individualized care was provided by IMTTS.

By monitoring evolutions over time, IMTTS supports predicting outcomes and curriculum planning. Through effective performance analysis methods, IMTTS ensures the optimal balance of challenge and support the students receive. It will enable differentiated instruction. This method facilitates the academic achievement of the whole class and individual students. The teachers employ the insightsto help make classrooms more effective and responsive. This will enhance the outcomes and performances of the students. 97.2% improvement in the student performance ratio is presented in Figure 4.3.

In summary, by integrating AI-driven insights, IMTTS revolutionizes education by making learning more personalized, improving resource management, and increasing student engagement. Education benefits from its scalable data processing, personalized learning settings, and real-time feedback capabilities, leading to better management in the long run.

For various educational activities, effectively managing various resources is significant. Digital content, instructional tools, storage capacity, network bandwidth, and user access were included in these resources. AI optimized resource allocation by analyzing consumption patterns, predicting future needs, and dynamic adjustment of resource distribution. The system runs at its highest possible efficiency and offersall vital instructional materials and services with no additional costs;the users must identify all.

Improving educational results and financial sustainability are the main objectives of this study. This objective can be achieved by developing a more efficient, scalable, and responsive multimedia teaching environment via the automation and refinement of resource management. Computerized essential procedures like content management, resource allocation, and user customization by applying AI enhance scalability in this study. Based on the method, the system can manage more users and larger data sets with minimal or no human involvement.This keeps the system's performance and cost-effectiveness in check and ensures it can handle additional institutions, students, and instructors as it expands. The system considers each student's unique requirements and preferences when recommending multimedia content like interactive films and lan-

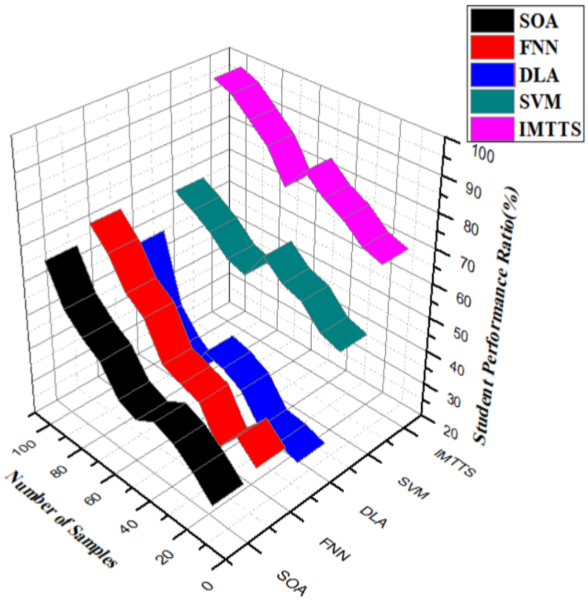

Fig. 4.3: The graphical illustration of student performance

guage exercises. When students' attention decreases during a lecture, AI-powered applications use computer vision to detect it and propose interactive teaching techniques. Resource allocation occurs in real-time to make the most of available supplies. For example, Virtual Reality headsets are distributed for group activities. After each lesson, comprehensive analytics on student understanding of the material are produced, allowing for real-time modifications to pedagogical approaches, bettering learning results and the effectiveness of resource management.

5. Conclusion. IMTTS presents a multimedia education system that fully utilizes the benefits of artificial intelligence technology. In terms of higher education, its system is very secure, very responsive, and can significantly increase the system's operational speed. On the other hand, research on knowledge representation and base organization is lacking in the higher education system, with only the student model, teacher model, teaching strategy, and intelligent teaching inference engine receiving much attention. The thorough research on knowledgebase structure in the future study, paying close attention to the development and maintenance of student-specific knowledge trees. The effectiveness of the higher education system is further validated by applying the system to specific application projects. The intelligent teaching system and the views of both instructors and students on a specific school's online course selection system form the basis of this paper's instance. More than 60% of professors and students preferred the online course selection system that relies on AI and computer technology, according to the study material, which first examines and presents the contemporary intelligent online course selection system. The AI- and computer-based intelligent education system that polls students' preferences. According to the poll, both instructors and students have a strong preference for the current intelligent teaching approach, but not all are satisfied. This demonstrates that there is room for more development and refinement in the system. More innovative research methodologies are still required, and the research presented in this publication is still inadequate.

REFERENCES

[1] Sun, Z., Anbarasan, M., & Praveen Kumar, D. J. C. I. (2021). Design of online intelligent English teaching platform based on artificial intelligence techniques. Computational Intelligence, 37(3), 1166-1180.

[2] Zhang, W., Shankar, A., & Antonidoss, A. (2022). Modern art education and teaching based on artificial intelligence. Journal of Interconnection Networks, 22(Supp01), 2141005.
[3] He, C., & Sun, B. (2021). Application of artificial intelligence technology in computer aided art teaching. Computer-Aided Design and Applications, 18(S4), 118-129.
[4] Huang, S. (2021). Design and development of educational robot teaching resources using artificial intelligence technology. International Journal of Emerging Technologies in Learning, 15(5).
[5] Gong, Y. (2021). Application of virtual reality teaching method and artificial intelligence technology in digital media art creation. Ecological Informatics, 63, 101304.
[6] Su, J., & Zhong, Y. (2022). Artificial Intelligence (AI) in early childhood education: Curriculum design and future directions. Computers and Education: Artificial Intelligence, 3, 100072.
[7] Luhadia, G., Joshi, A. D., Vijayarajan, V., & Vinoth Kumar, V. (2023, April). Fusion of Variational Autoencoder-Generative Adversarial Networks and Siamese Neural Networks for Face Matching. In International Conference on Frontiers of Intelligent Computing: Theory and Applications (pp. 231-241). Singapore: Springer Nature Singapore.
[8] Rong, L. (2021). [Retracted] Design of Ideological and Political Multimedia Network Teaching Resources Integration System Based on Wireless Network. Scientific Programming, 2021(1), 4293771.
[9] Huang, J., Saleh, S., & Liu, Y. (2021). A review on artificial intelligence in education. Academic Journal of Interdisciplinary Studies, 10(3).
[10] Ruiz-Rojas, L. I., Acosta-Vargas, P., De-Moreta-Llovet, J., & Gonzalez-Rodriguez, M. (2023). Empowering education with generative artificial intelligence tools: Approach with an instructional design matrix. Sustainability, 15(15), 11524.
[11] Yang, H., Shankar, A., & Velliangiri, S. (2022). Artificial intelligence-enabled interactive system modeling for teaching and learning based on cognitive web services. International Journal of e-Collaboration (IJeC), 19(2), 1-18.
[12] Borah, N., Baruah, U., Thylore Ramakrishna, M., Kumar, V. V., Dorai, D. R., & Rajkumar Annad, J. (2023). Efficient Assamese Word Recognition for Societal Empowerment: A Comparative Feature-Based Analysis. IEEE Access, 11, 82302-82326.
[13] Barakina, E. Y., Popova, A. V., Gorokhova, S. S., & Voskovskaya, A. S. (2021). Digital Technologies and Artificial Intelligence Technologies in Education. European Journal of Contemporary Education, 10(2), 285-296.
[14] Putra, A. E., Rukun, K., Irfan, D., Munawir, K., Usmi, F., & Jaafar, A. (2020). Designing and developing artificial intelligence applications troubleshooting computers as learning aids. Asian Social Science and Humanities Research Journal (ASHREJ), 2(1), 38-44.
[15] Umamaheswaran, S., Lakshmanan, R., Vinothkumar, V., Arvind, K. S., & Nagarajan, S. (2020). New and robust composite micro structure descriptor (CMSD) for CBIR. International Journal of Speech Technology, 23, 243-249.
[16] Li, H., Zhang, H., & Zhao, Y. (2021). Design of computer-aided teaching network management system for college physical education. Computer-Aided Design and Applications, 18(S4), 152-162.
[17] Munir, H., Vogel, B., & Jacobsson, A. (2022). Artificial intelligence and machine learning approaches in digital education: A systematic revision. Information, 13(4), 203.
[18] Venkatesan, V. K., Ramakrishna, M. T., Batyuk, A., Barna, A., & Havrysh, B. (2023). High-Performance Artificial Intelligence Recommendation of Quality Research Papers Using Effective Collaborative Approach. Systems, 11(2), 81.
[19] Chiu, T. K. (2021). A holistic approach to the design of artificial intelligence (AI) education for K-12 schools. TechTrends, 65(5), 796-807.
[20] Kumar, D., Swathi, P., Jahangir, A., Sah, N. K., & Vinothkumar, V. (2021). Intelligent speech processing technique for suspicious voice call identification using adaptive machine learning approach. In Handbook of Research on Innovations and Applications of AI, IoT, and Cognitive Technologies (pp. 372-380). IGI Global.
[21] Liu, Y. (2020). Design and implementation of multimedia teaching platform based on SOA architecture. Multimedia Tools and Applications, 79, 10899-10914.
[22] Mahesh, T. R., Vinoth Kumar, V., Vivek, V., Karthick Raghunath, K. M., & Sindhu Madhuri, G. (2024). Early predictive model for breast cancer classification using blended ensemble learning. International Journal of System Assurance Engineering and Management, 15(1), 188-197.
[23] Medichalam, K., Vijayarajan, V., Kumar, V. V., Iyer, I. M., Vanukuri, Y. K., Prasath, V. B. S., & Swapna, B. (2023). Trustworthy Artificial Intelligence and Automatic Morse Code Based Communication Recognition with Eye Tracking. Journal of Mobile Multimedia, 19(06), 1439–1462.
[24] Hao, K. (2020). Multimedia English teaching analysis based on deep learning speech enhancement algorithm and robust expression positioning. Journal of Intelligent & Fuzzy Systems, 39(2), 1779-1791.
[25] Quan, Z., & Pu, L. (2023). An improved accurate classification method for online education resources based on support vector machine (SVM): Algorithm and experiment. Education and information technologies, 28(7), 8097-8111.
[26] Kaggle, https://www.kaggle.com/datasets/xiaowenlimarketing/international-student-time-management
[27] Liu, X., & Yao, R. (2023). Design of visual communication teaching system based on artificial intelligence and CAD technology. Computer-Aided Design and Applications, 20(S10), 90-101.
[28] Li, P., Ning, Y., & Fang, H. (2023). Artificial intelligence translation under the influence of multimedia teaching to study English learning mode. International Journal of Electrical Engineering & Education, 60(2suppl), 325-338.
[29] Cui, Q. (2023). Multimedia teaching for applied linguistic smart education system. International Journal of Human–Computer Interaction, 39(1), 272-281.
[30] Zheng, W. (2024). Intelligent e-learning design for art courses based on adaptive learning algorithms and artificial intelligence. Entertainment Computing, 50, 100713.
[31] Cheng, S., Yang, Q., & Luo, H. (2024). Design of neural network-based online teaching interactive system in the context of multimedia-assisted teaching. Informatica, 48(7).

[32] AlShaikh, R., Al-Malki, N., & Almasre, M. (2024). The implementation of the cognitive theory of multimedia learning in the design and evaluation of an AI educational video assistant utilizing large language models. Heliyon, 10(3).
[33] Zhang, X., Sun, J., & Deng, Y. (2023). Design and application of intelligent classroom for English language and literature based on artificial intelligence technology. Applied Artificial Intelligence, 37(1), 2216051.
[34] Sajja, R., Sermet, Y., Cikmaz, M., Cwiertny, D., & Demir, I. (2024). Artificial intelligence-enabled intelligent assistant for personalized and adaptive learning in higher education. Information, 15(10), 596.
[35] Mariyanti, T. (2023). Development of mobile learning applications for Android based on artificial intelligence. International Transactions on Artificial Intelligence, 1(2), 230-235.
[36] Yu, X., Ma, N., Zheng, L., Wang, L., & Wang, K. (2023). Developments and applications of artificial intelligence in music education. Technologies, 11(2), 42.

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