Smart Classroom High-Quality Recording System Solution
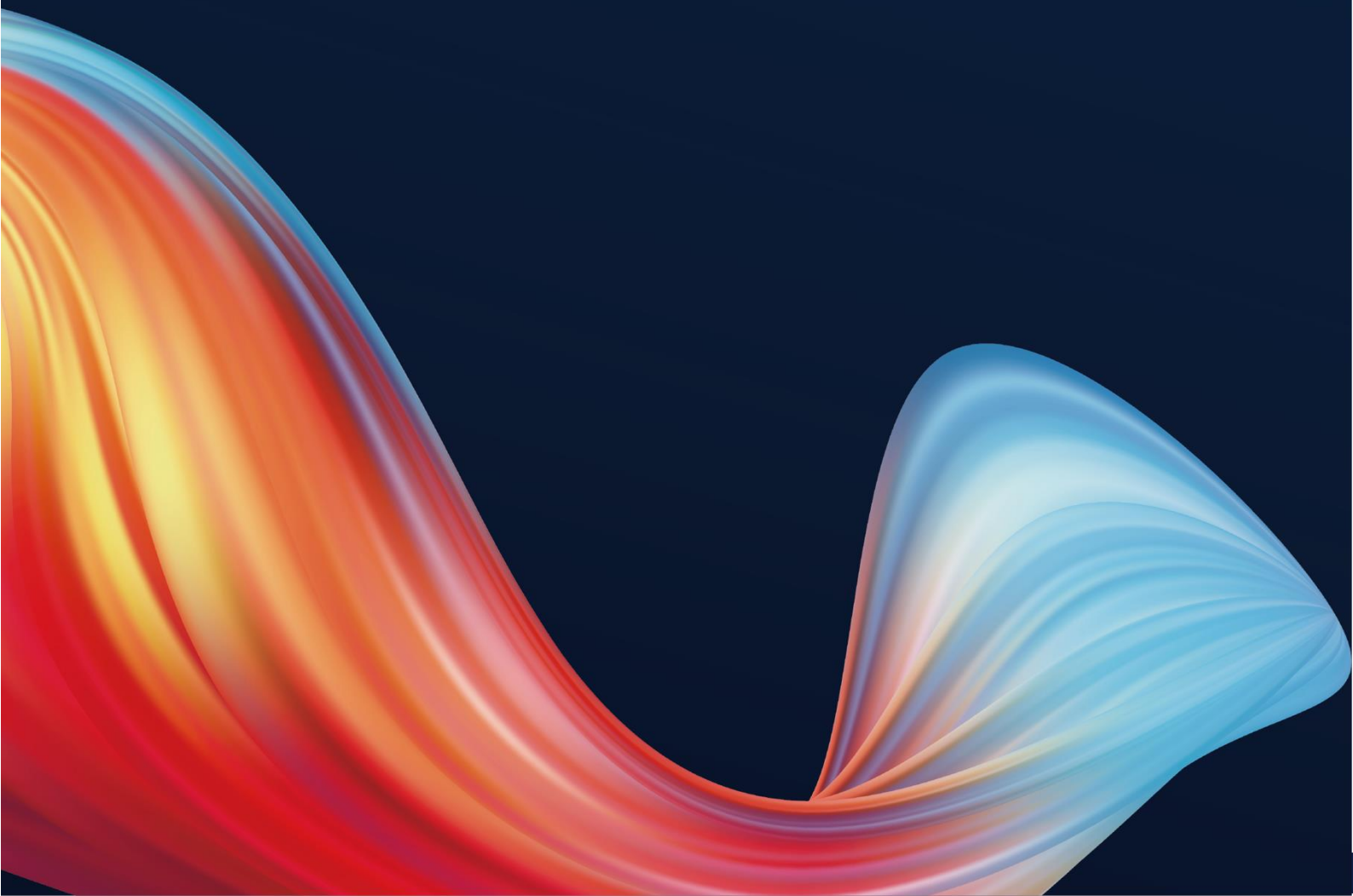
CONTENT

1 Background

1.1 Development background

Facing the development requirements of high-quality education in the new era, promoting the deep integration of information technology and education and teaching, realizing the digital transformation of education and teaching, and the construction and iteration of new education infrastructure are the key construction needs of the current education system.

Based on the above policy requirements, based on the transformation of education informatization and the needs of high-quality and balanced development, our company designed and built the "Smart Boutique Recording System Construction and Application Solution" to build a digital education platform and intelligent education space Support schools to carry out education and teaching applications, promote the integrated development of online and offline, and provide objective big data on teaching and learning conditions to support accurate teaching and research applications, providing effective tools for improving the ability and quality of teachers, promoting the construction of teacher teams and improving quality and efficiency.

2 Scheme design

2.1 Design Structure

2.1.1 Construction of education informatization

The design of this scheme intends to use information equipment to realize classroom empowerment, realize the modernization of traditional classrooms through the construction of information recording and broadcasting system, and create a curriculum construction space environment for users to meet the needs of online course resource production. And strive to conveniently complete the recording and production of online course resources without affecting teachers' teaching to the

greatest extent, and ensure the quality of courses from the dimensions of complete content, picture quality, sound quality, etc., to meet the high-quality and convenient construction needs of school-based online course resources.

At the same time, a video resource management application platform is built to automatically archive and publish high-quality online course resources produced by course construction space recording and broadcasting equipment, so as to facilitate the construction of teaching resource libraries. And realize the one-stop online course construction application from pre-class recording appointment, in-class automatic excellent course recording, and automatic archiving and sharing after class, and normalized and high-quality service users to build school-based online course resources.

2.1.2　AI empowers accurate teaching and research applications

Teaching and research is to discuss and research on the problems that arise in the teaching process and excellent teaching experience methods, aiming to solve problems and summarize excellent experience to improve teachers' teaching ability. However, in traditional teaching and research activities, the judgment and evaluation of the effectiveness of teaching mode and teaching methods are mostly subjective judgments, and it is difficult to carry out overall linkage, quantitative qualitative, objective and comprehensive classroom analysis, resulting in difficulty in meeting the professional development of teachers in the new era and the precise training reform required by the "Strong Teacher Plan".

This program builds an interactive teaching and research system for the region through information equipment, realizes interactive teaching, teaching and research applications through Internet/education network links, realizes online sharing of high-quality teacher resources, and comprehensively promotes the balanced development and quality improvement of educational resources.

At the same time, it can expand the application of A I technology to completely collect teacher behavior, student behavior, interactive behavior and other data and classroom voice data in the classroom teaching process, and analyze and research the data through advanced classroom teaching behavior analysis models at home and

abroad, so as to realize the scientific, intelligent and objective analysis of classroom teaching behavior data.

Through the collection support of multi-dimensional complete classroom data provided by the A I system, a normalized analysis model is established for each teaching dimension, and "S-T teaching behavior analysis", "teacher-student interaction index" and "RT-CH" are provided   Multi-dimensional analysis data such as "teacher patrol trajectory" and "classroom focus curve" help users objectively reflect the classroom situation and locate details, so as to accurately locate teaching problems according to teachers' needs, sort out excellent teaching methods, and carry out highly targeted and effective teaching and research activities. At the same time, according to the education and teaching methodology, the evaluation standards are set up, and the machine algorithm is automatically identified, discriminated and analyzed to fully ensure the objectivity and science of the data, and also facilitate the qualitative and quantitative comparison between multiple classes to ensure the accuracy and effectiveness of teaching and research activities.

2.2 Overall architecture

Based on the construction of information technology system and network communication link, this plan completes the "Internet +" education application system that connects the top and bottom, creates a new model of high-quality and balanced development of regional "Internet +" education, and builds "everyone can learn, everywhere can learn, and can learn at any time" A new environment of informatization of education.

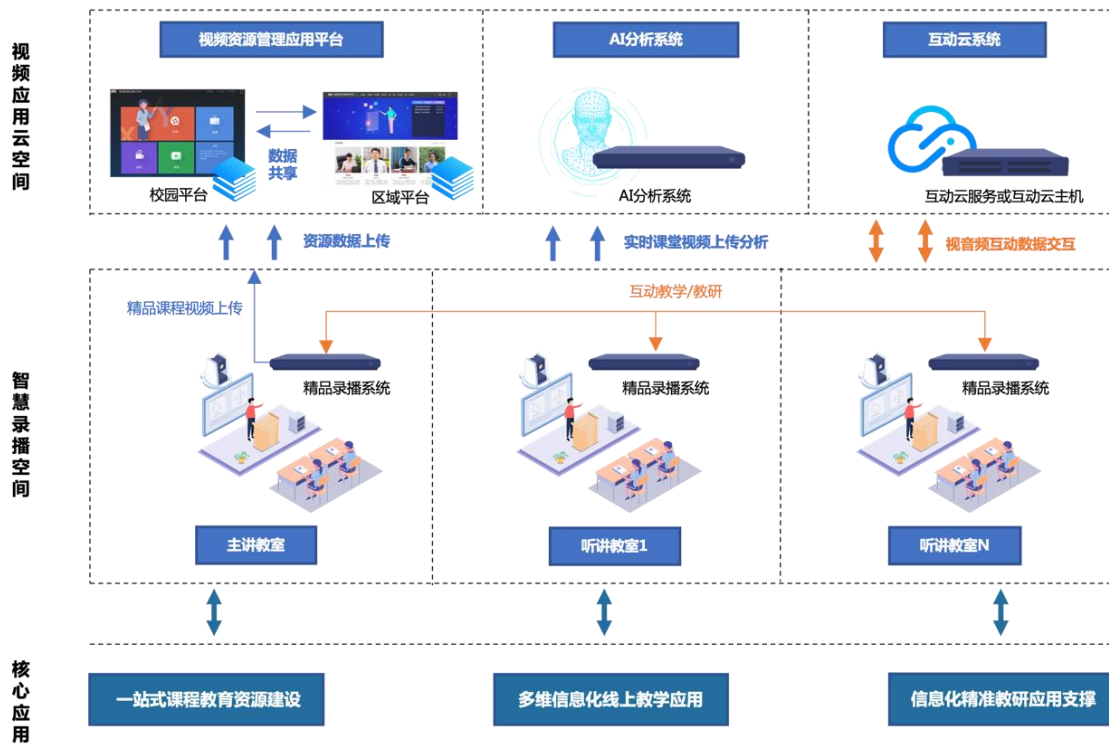The overall system architecture topology is as follows:

Figure1Overall system architecture diagram

With the help of the information quality recording system, the traditional classroom is modernized to create a **smart quality teaching space**. The space focuses on the collection, recording and transmission of the core content of classroom teaching, and forms high-quality online course resources in the classroom teaching process for archiving and sharing in one stop, so as to realize the convenient normalization and application of high-quality school demonstration courses and other education and teaching digital resources. At the same time, it supports connecting cross-school and cross-campus remote classrooms, synchronously sharing the teaching reality of the main teachers, real-time interaction between teachers and students, effectively taking into account the learning situation of students in multilateral classrooms, and creating a "face-to-face" "special classroom" interactive teaching mode.

And build **an A I** analysis **system** on demand, expand Ai analysis capabilities, realize the hardware support of information teaching, teaching and research by introducing advanced teaching and learning terminal products, accurately identify teachers' teaching behavior, student learning behavior, and With data as the core, build teaching and learning big data analysis capabilities, and promote the overall education and teaching development of schools (regions).

At the same time, it will build **a cloud space for** teaching applications, effectively connect the physical teaching space of various schools in the region, support full-scene teaching, teaching and research applications, and students' ubiquitous learning activities, realize the sustainable sharing of high-quality educational resources, promote the deep integration of education informatization, and promote the professional development of teachers.

At the same time, in the face of the actual teaching, teaching and research, conference and other remote scenario application needs, an **interactive cloud system** with strong network adaptability is built on demand to ensure the convenient development of regional remote video and audio interaction.

2.3 Construction of smart boutique teaching space

The construction of smart high-quality teaching space is the basis of the entire system design, and the hardware support for video recording needs is created by building a high-quality recording and broadcasting system in the classroom, so as to realize the full-scene recording and preservation of the classroom teaching process, and realize the convenient construction of high-quality teaching resources.

Before class, teachers make course recording appointments through the resource management platform, and issue notices to the recording teaching space, so that users can plan in advance according to the school's course arrangement, make online course resource construction plans, and realize the   recording and archiving of course resources after the completion of teachers' teaching.

During the class, the teacher "one-click" turns on the classroom recording, conducts high-definition shooting of the teaching process through the recording system, and completes the automatic tracking and switching recording of various classroom signals such as "teacher teaching close-up", "teaching panorama", "student close-up", "student panorama", "computer courseware signal", etc., to ensure high-quality and scenario-based recording of effective classroom teaching links without affecting teachers' normal teaching, realize the normalization and high quality of online course construction and application, and quickly build school-based digital course resources.

After class, the digital course resources constructed by the recording and broadcasting system can be quickly copied through a U disk or automatically uploaded to the resource management application platform, so as to realize the convenient co-construction and sharing of high-quality courses.

2.3.1　High-definition high-quality recording teaching space design

The high-definition high-quality recording teaching space is positioned for the production of high-quality teaching resources, and the system adopts high-performance concept design to fully ensure the integrity, high-definition and fluency of the system video, and is widely adapted to the teaching recording and interactive application of the school's multimedia classroom, open classroom and ordinary classroom.

Figure2Illustration of the design of high-definition high-quality recording teaching space

The high-definition high-quality recording and broadcasting teaching space is designed around the high-definition high-quality recording host as the core, and realizes the application of core functions such as video and audio recording, live broadcast, and interaction. At the same time, it is supplemented by Ai intelligent video tracking system, interactive intelligent teaching screen display system, high-fidelity audio acquisition/sound reinforcement system, etc. to create a digital intelligent teaching environment.

The HD recording host adopts the international advanced H.265/H.264 High Profile video codec protocol to achieve 1080P HD video recording, interaction and live broadcast effects. Support the access coding of multiple video signals such as cameras and computers to ensure the full access and recording of teachers' screens, student screens, and computer courseware screens in the classroom teaching process. AAC advanced audio coding format is adopted to ensure the high-quality effect of audio capture.

The host has a built-in image tracking and analysis system, and with the A i intelligent video tracking system, it can automatically analyze and track the behavior of teachers and students, and automatically complete the screen switching according to the preset logic to achieve automatic tracking and recording, without the need to configure the tracking host separately. Truly and completely restore the teaching situation of teachers' explanations, students' listening to lectures, and asking questions.

The host supports standard H.323\SIP video and audio communication protocols and RTSP and RTMP standard streaming media protocols, which is convenient for standard docking applications.

The high-quality recording system can provide a variety of construction solutions according to the application needs:

(1) Four-camera solution: realize the automatic tracking and recording of "teacher close-up, teacher panorama, student close-up, student panorama, computer courseware";

(2) Five-camera solution: realize the automatic tracking and recording of "teacher close-up, teacher panorama, student close-up, student panorama, teacher board book, computer courseware".

2.3.2 Ai intelligent video tracking system

The AI-video tracking system consists of multiple AI-PTZ cameras. Our company innovatively puts the AI algorithm in front to the PTZ camera, and the camera automatically analyzes and matches the tracking strategy according to the captured image to complete the automatic tracking of teachers and students, and the feedback recording host is linked to complete the screen switching of teacher panorama, teacher close-up, student panorama and student close-up. So as to complete the

complete scene of classroom teacher and student behavior, automatic tracking and collection.

The advanced AI intelligent technology is used to adjust and update the video acquisition system, and in the face of the need to add positioning and analysis equipment, weak product adjustment force, poor adaptability of the use environment and other deficiencies in the early intelligent image recognition and tracking application based on image changes, the optimization and improvement is carried out, and the application experience of the product is comprehensively improved. The system mainly has the following characteristics:

- Screen acquisition, scene analysis, and policy tracking are all independently realized by the AI camera, without the need for additional tracking host or even any positioning auxiliary products, making the equipment simpler and more convenient for deployment and operation;

- Based on the AI algorithm, the tracking logic using teacher and student mode is automatically selected according to the deployment location and method, and the appropriate screen tracking and collection is completed without too much setting and product matching scores;

- Intelligent learning analysis of teaching scenes based on Ai ability, accurate determination of teacher behavior and student behavior to trigger automatic tracking, and the way of identifying character scenes according to artificial algorithms greatly improves the misjudgment problems caused by other objects in the classroom such as doors, windows, curtains, lights and shadows in traditional image recognition technology, and greatly improves the accuracy of automatic tracking and switching of the screen to reduce the requirements for the classroom environment;

- The AI camera supports intelligent identification and locking of tracking objects, which greatly avoids the phenomenon of multiple people appearing in the picture and causing tracking inaccuracy; At the same time, it supports

lost patrol, and personnel can reappear in the picture within a certain period of time after tracking is lost, and can continue to track, effectively adapting to the application of patrol habits in different classrooms in classroom teaching.

2.3.3 Interactive intelligent teaching screen display system

The interactive intelligent screen display system deploys screen display products such as intelligent interactive all-in-one machine or smart blackboard to display teacher courseware data and classroom teaching software application support, and at the same time the courseware materials are synchronously transmitted to the recording host and sent remotely, so as to achieve the effect of the same class in different places.

The on-screen display system adopts high-precision recognition technology and supports multi-touch to restore a natural writing experience for teachers. At the same time, it adopts a 4Kultra-high-definition anti-blue screen to allow students to see more clearly and protect their eyes; The system is equipped with a shortcut toolbar design to realize the quick call of classroom teaching software, making it easier and more convenient for teachers to teach. And with wireless screen transmission ability, effectively improve the efficiency of classroom teaching, discussion and display.

Figure3Illustration of the on-screen display system

Starting from helping teachers to take good lessons, the interactive intelligent teaching screen display system is designed around one-stop lesson preparation and intelligent teaching applications. By providing lesson preparation resources and lesson preparation tools, it helps teachers use information technology to prepare lessons and design rich and excellent interactive courseware. In class, teachers can quickly call teaching tools to change the original dull classroom and make the teaching process more attractive; At the same time, visual class management software can be used to improve student participation, so that students' praise results are more visualized, and students' classroom performance is digitalized. Improve the classroom experience for teachers and students through a class-to-class approach.

2.3.4   High-fidelity audio capture/sound reinforcement system

Six high-fidelity directional microphones are evenly hoisted and deployed to realize the sound collection of the classroom, and the microphone collection sound is processed by the professional audio processor for denoising, mixing, echo cancellation, etc., and output to the recording host and video files for mixed encoding to generate standard MP4 files for storage.

In order to ensure the clear fidelity of the audio, the design uses the audio processor and the built-in audio processing algorithm for recording to create a high-fidelity audio system. The system realizes audio processing applications such as noise suppression (A NC), echo cancellation (A EC), and automatic gain (AGC) for classroom audio to ensure audio in recording, live broadcasting, and interactive states Effect.
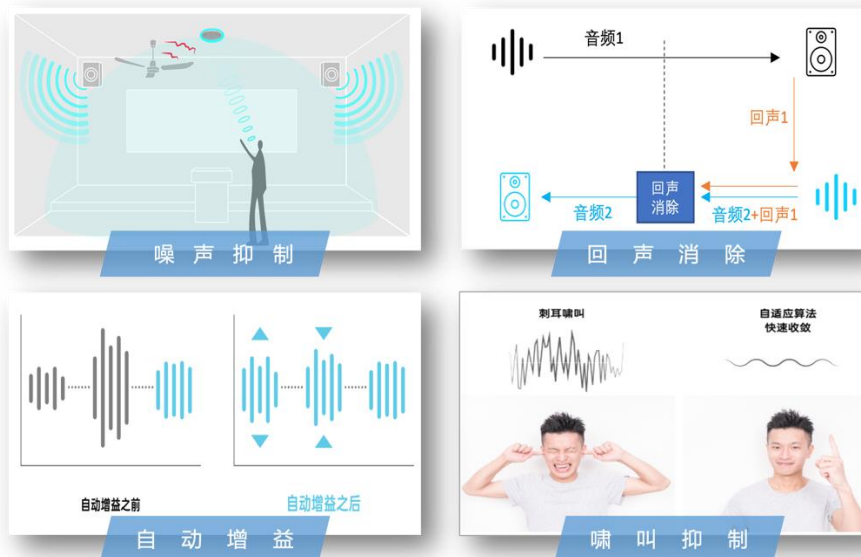

Figure4Audio processing capabilities

- Noise suppression (ANC): Ambient noise will be collected by the microphone along with the speaker's voice, and even in a well-decorated indoor environment, there will be a variety of noises such as fans, air conditioners, people moving, table and chair contact, etc. The system has a built-in automatic noise reduction algorithm, which can effectively identify and suppress the noise signal in the collected sound signal, and effectively eliminate the noise before output sound reinforcement.

- Echo Cancellation (AEC): In the process of AV interactive teaching in local classrooms and remote classrooms, it often occurs due to improper audio system settings After the voice of the speech in this classroom is played in the remote classroom sound reinforcement, it is collected and transmitted back through the remote classroom microphone and transmitted back to the local hearing, resulting in a poor sound effect experience of both parties. The

system of this scheme can compare the audio signal collected with the signal waveform output by the sound reinforcement at the previous moment, so as to identify the echo signal with the same waveform and filter, so as to achieve the effect of eliminating the echo and ensuring the clear fidelity of the audio.

- Automatic gain (AGC): The system has a built-in intelligent gain adjustment function, regardless of the sound source sound, the audio system will automatically adjust to the predetermined gain range for output after acquisition, and can maintain the overall sound reinforcement balance of the classroom, ensuring that the listener's listening sense is balanced and comfortable under the condition of different teachers' voice sizes.

- Howling suppression: The howling phenomenon is caused by the continuous cycle of "acquisition-amplification output" of the same sound signal between the pickup and sound reinforcement system, and the occurrence of the howling phenomenon represents that the overall sound field stability of the environment is broken and can no longer be used normally. The built-in acoustic noise suppression function of the audio processor can identify and eliminate the feedback signal repeatedly collected after output sound reinforcement, effectively avoiding the occurrence of acoustic noise and ensuring the stable availability of the system as a whole.

At the same time, the audio processor has built-in professional power amplifier function, and the classroom sound amplification can be completed by directly connecting the speaker equipment, which is simpler and more convenient to deploy, and the effect is high-quality and fidelity.

2.4 AI analysis system construction

Introduce an AI system with various artificial intelligence capabilities such as skeletal behavior recognition, face feature recognition, expression recognition, speech recognition, etc., to realize the intelligent recognition and

analysis of various teaching behaviors, student behaviors, and interactive behaviors in the classroom teaching process, and convert them into various teaching and learning data such as classroom teacher and student teaching behavior, classroom concentration, teacher trajectory, knowledge points and other teaching and learning data through advanced teaching models at home and abroad, so as to provide objective and complete classroom data for teaching, research and management.

In terms of application, through the collection support of multi-dimensional complete classroom data provided by the A I system, a normalized analysis model is established for each teaching dimension, and "S-T teaching behavior analysis", "teacher-student interaction index" and "RT-CH" are provided   Multi-dimensional analysis data such as "teacher patrol trajectory" and "classroom focus curve" help users objectively reflect the classroom situation and locate details, so as to accurately locate teaching problems according to teachers' needs, sort out excellent teaching methods, and carry out highly targeted and effective teaching and research activities.

The AI analysis system can be transformed into a multi-dimensionalA-I capability, and the contents that can be built are:

1. Create a smart recording space with A-I capabilities.

    Method 1: Build a smart teaching space with a high-quality recording host with built-in AI analysis capabilities as the core, and use the AI speech analysis host for the overall view of the classroom Frequency + speech analysis;

    The second method is to upgrade the classroom by adding an AI intelligent analysis host with built-in A I video + speech analysis capabilities to realize the AI of the classroom   Pedagogical analysis.

2. Build a real-time attendance analysis system to audit real-time attendance data output capabilities. Real-time statistics of the attendance of classroom personnel in each class, and can be pushed to each system for extended use

as needed.

2.4.1　AI. Smart recording space construction

Build an AI smart recording space to realize classroom resource recording, automatic screen tracking, remote teaching interaction, real-time teaching live broadcast, classroom video analysis and other functions Create an informatized classroom environment that integrates the co-construction and sharing of high-quality resources, and the application of AI empowerment and precision teaching and research.

2.4.1.1　Construction method

Method 1: Select a smart recording host with built-in Ai function, and configure anAI-speech analysis host to achieve speech analysis linkage. The overall construction structure is as follows:
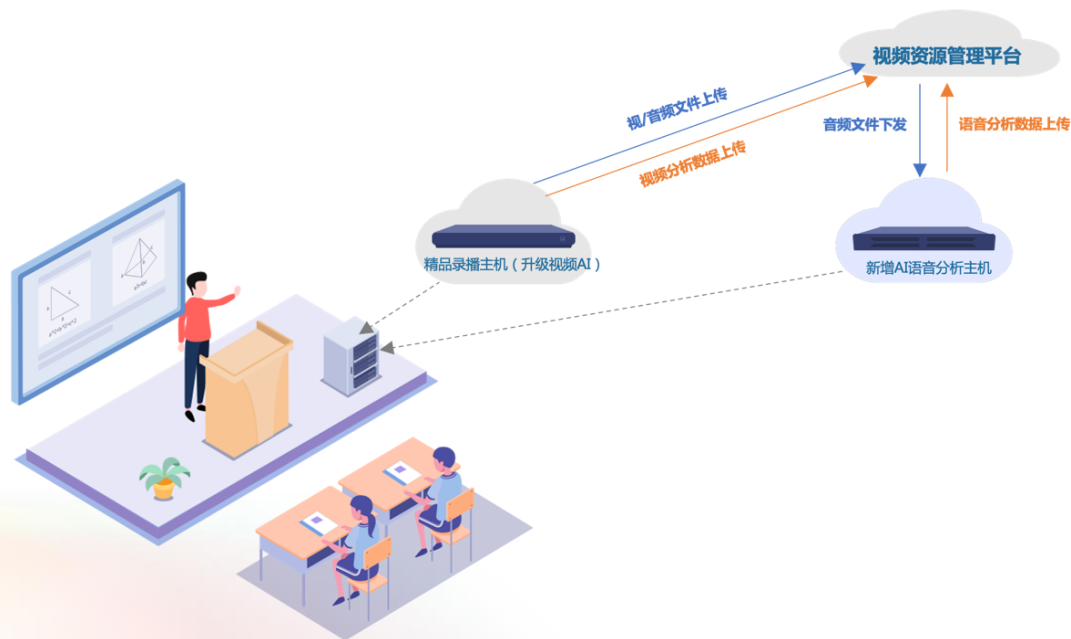

Figure5Schematic 1 of the AI analysis capability solution

The built-in AI function of the recording host completes the data collection and analysis of teacher behavior, student behavior, interactive behavior and other behaviors in the classroom teaching process, and objectively and completely reflects the real classroom teaching situation and learning situation;

At the same time, the speech analysis host completes the comprehensive recognition of speech and semantics of classroom teaching interaction, which realizes the functions of knowledge point keyword recognition extraction, frequency statistics, time markers and other functions for teaching and research, and can convert the audio in the teaching process into text records for preservation. Provide objective data support for teachers' teaching review and teaching and research.

Method 2: By adding an AI intelligent analysis host with built-in A I video + speech analysis capabilities, the overall video + speech analysis application of classroom data is realized.

While retaining the original classroom interactive recording system, the AI analysis host is deployed to enable it. The interactive recording system records and saves the AV data streams required for AI analysis in the form of multi-stream recording, and then transmits the AV data to the AI analysis host through the network and platform to realize classroom data analysis, without changing the original equipment and application habits, effectively realizing product recycling and complete realization of A I. Empowering teaching and learning situation analysis ability.

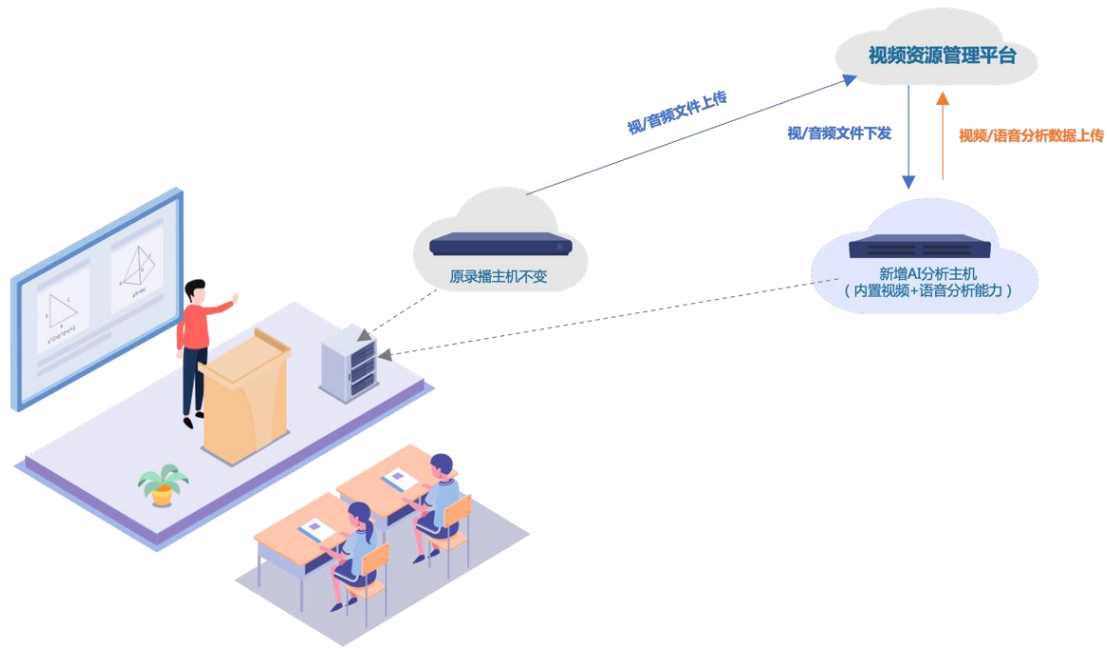The overall construction structure is as follows:

Figure6 Illustration 2 of the AI analysis capability solution

2.4.1.2 Feature implementation

Classroom teaching behavior is an important part of education and teaching, in the context of education informatization environment, to promote the professional development of education and teaching, the analysis and research of classroom teaching behavior data is indispensable, and the integrity of classroom data identification and collection is particularly important. Under the traditional scheme, manual methods are mainly used to record video statistics, which consumes labor and is difficult to improve efficiency, increasing the burden of teachers. With the development of information technology, the recording of objective classroom data through artificial intelligence has become the mainstream, and the machine can effectively improve the efficiency of data output and effectively reduce the workload of teachers while completing the accurate and complete collection of data according to the set standards.

- Through the A-I analysis of the complete classroom video, the overall number of class members is counted to complete the attendance record of the whole class, and the statistics of the number of late arrivals and early departures in the classroom are automatically filed to the

classroom analysis data according to the class time, which is convenient for student management;

- As the main core content of classroom teaching, teacher and student behavior is closely related to teaching behavior data. Through the video analysis function, the accurate collection of classroom teacher and student behavior data, including teacher behavior (lecture, guidance, board book, playback courseware), student behavior (display report, discussion), interactive behavior (teacher-student interaction, student-student interaction), etc.;

- The classroom teaching process is a unified situation, and the students' movements and expressions should be in a basically unified state during the teaching process of most courses. The system's recognition of students' movements and expressions in the overall classroom, combined with the comprehensive analysis of classroom recording videos and classroom teacher and student behavior data, can reflect students' classroom concentration, form changes in classroom concentration curves, and reflect classroom teaching effects.

- Through AI, the teacher's location data in the teaching process is automatically recognized, which is convenient to realize the teaching habits of teachers, and can also reflect whether teachers improve students' attention through patrols.

- Through the recognition and analysis of classroom voice data, feedback on whether the focus of classroom teaching is deviated through the number of occurrences of keywords in classroom knowledge points; Feedback whether the classroom violates the law through the appearance of sensitive words to achieve classroom management; And can realize classroom voice transcription to form a transcript of classroom teaching.

Through the AI system, the complete collection of multi-dimensional data in

the classroom is realized, which provides basic output support for the application of education, teaching, research and management.

2.4.2 A real-time attendance system construction

The attendance of personnel has always been an important concern of classroom teaching management and teaching and research analysis, and the traditional way of manual attendance check-in or roll call often increases the workload of teachers and occupies classroom teaching time, and data is difficult to archive management and retrospective application, which can only play a role in students' supervision Provide support services for teaching and research analysis and education quality improvement.

Through the development of information technology, this solution can be combined with the application of smart attendance host to complete classroom automation without inductive attendance. Using the classroom recording system to configure camera shooting data, real-time identification and analysis to count the overall number of people in the classroom, and output attendance data output such as the number of expected arrivals, actual arrivals, late arrivals, and early departures according to the statistical analysis of lesson sessions, teachers can grasp students' attendance information in real time and macro, and effectively maintain the school's teaching order and teaching quality.

The construction architecture of the real-time attendance system is shown in the figure below
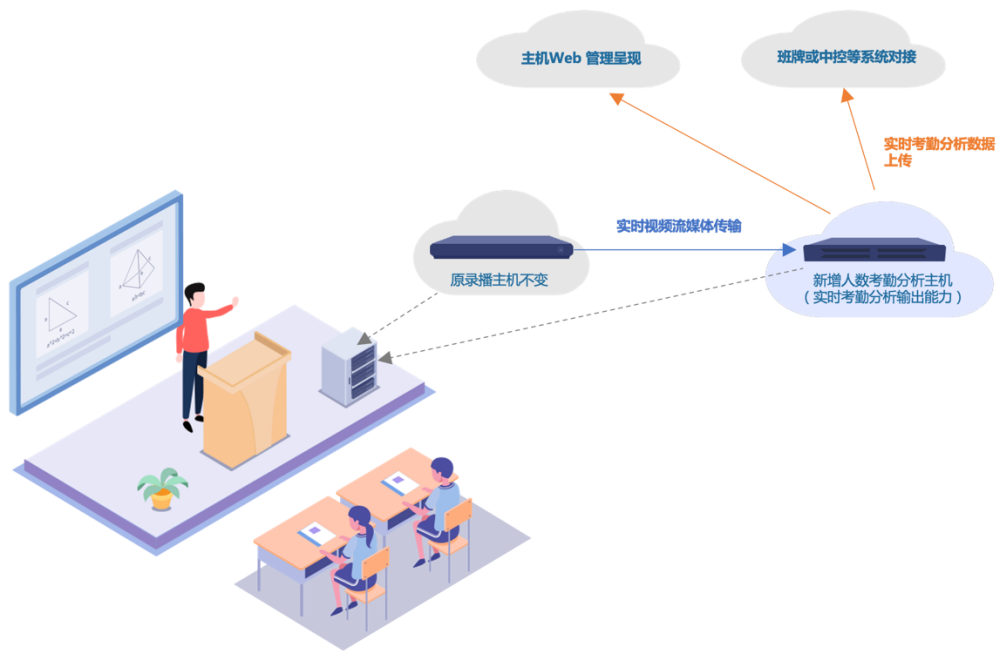
Figure7Illustration of AI's real-time attendance capability

2.4.2.1 Feature implementation

The AI attendance system collects classroom screen data in real time during class for A i recognition attendance analysis, relies on human skeletal features and facial features to establish artificial intelligence algorithm models, accurately identifies the overall number of people and changes in the classroom, and completes attendance analysis data. The main functional implementation applications are:

- Based on video streaming media, the overall real-time attendance of personnel is realized, and the number of people is recognized based on skeletal characteristics, effectively avoiding the interference of other large objects in the classroom, and accurately identifying the overall number of personnel;

- Based on facial features, different people are distinguished, and personnel can still be recognized as the same person when they leave the camera shooting screen and re-enter in a short period of time, and the attendance data can still be maintained accurately when they adapt to situations such as temporary departure or occlusion in the middle. And in order to avoid face privacy infringement and potential risk of user information leakage,

attendance only does statistical analysis of personnel data in the overall dimension, and the face features and data do not match the actual information of the person, that is, there is no need for users to enter face data, nor do they retain the identified face feature data;

- Real-time examination analysis data output, support through standard interfaces to third-party systems, such as docking electronic class card system, real-time display of class current personnel data; Docking with the central control system, realize automatic switching and size adjustment control of lighting, air conditioning and other people according to the number of people.

2.5 Teaching application cloud space construction

The construction of the teaching application cloud space is based on the core of the video resource application cloud platform to meet the archiving application sharing and AI data application sharing of high-quality online course resources 。 The construction of video resource application platform is divided into campus-level platform and regional-level platform construction according to the user-level structure, so as to meet the application needs of school users for information teaching and regional education bureau/e-education museum users to achieve regional high-quality resource sharing and promote regional education balance.

Build a school-level resource management application platform for schools, establish a seamless docking mechanism between the recording host of each recording classroom and the video resource application cloud platform, and automatically push video resources to the platform during the idle time of the recording system through agreement negotiation, and the platform automatically classifies and archives videos by grade and subject according to the definition information of the video. At the same time, the platform provides applications such as on-demand and video albums for teachers and students.

And docking with the AI system, archiving and presenting all kinds of

classroom teaching situation and learning situation analysis data, including teacher teaching behavior, student behavior, concentration, speech speed, keywords and other classroom analysis data, associated classroom records to provide users with accurate and objective teaching data, assist in carrying out precision teaching and research activities to improve teachers' capabilities, and promote the professional development of teachers. So as to improve the quality of teaching and learning on campus.

When conditions permit, build a regional-level resource management application platform for regional education bureaus/e-education halls, connect the platforms of schools under their jurisdiction through regional platforms, gather high-quality online course resources of various schools for live/on-demand sharing, and also provide regional-level educational applications such as classrooms of famous teachers/famous schools to meet the application needs of promoting regional education balance and teacher teaching and research improvement.

Figure8Schematic representation of the platform functions of the video resource application platform

2.6 Interactive cloud system construction

AV Interactive Cloud supports hybrid cloud deployment mode (hardware and software local deployment and cloud service mode), and local hardware and device deployment in the school, and all AVA interactive products support AVA interactive cloud and localized private interactive cloud system to carry out AV interactive applications. Compatible with third-party interactive recording, office computers,

Android mobile phones and other access methods. The interactive cloud supports multi-level hybrid deployment of public and private clouds, and supports 1080P HD audio and video interaction. Support H.265 advanced encoding and compression technology, occupying lower bandwidth under the same interactive picture quality; Under the same code stream conditions, the interactive picture quality is more delicate, which fully guarantees the true restoration of the video during the interaction process.

Through the construction of interactive cloud, it provides audio and video service support capabilities with large-scale, high-concurrency, low-latency, and rapidly expanding coverage areas, and provides video and audio interactive support for teaching and research linkage and teaching systems in the group.

Figure9: Schematic of the interactive cloud system architecture

3 Program features

3.1 Overall attendance management that does not involve student information

In the context of the increasing popularity of AI attendance methods on campus, the confidentiality and privacy of students' facial information has also been discussed. Traditional solutions are accurate to the individual's attendance method, and it is often inevitable that it is necessary to collect and enter students' face data into the database and store it, and associate students' personal information, and it is difficult to ensure students' privacy and data security.

This program adopts the overall number counting method, takes the class as the dimension for attendance management, and provides class attendance data for teachers. Face recognition only distinguishes between different personnel and does not correspond to any student information, and does not store it in the warehouse, so as to avoid the risk of student information leakage and privacy infringement.

3.2 Multi-dimensional objective data analysis of classroom teaching

It has multi-dimensional classroom teaching model analysis data export such as "S-T", "RT-CH", teacher-student interaction index, teacher trajectory, speech speed, student concentration, class attendance, etc., providing scientific, objective and accurate analysis data support for education teaching and research management applications.

3.3 All-scenario resource construction application mode

It not only focuses on the construction of online course resources, but also meets the actual needs of teachers, and creates a full-scenario resource construction application model covering pre-class resource construction planning and reservation,

convenient and high-quality construction of in-class course resources, and automatic aggregation, archiving and release of after-class resources, so as to reduce the application operation burden of teaching teachers in an all-round way.

3.4 Lightweight edgeAI-tracking implementation

The automatic tracking algorithm is integrated in the front-end camera, and the camera automatically selects the teacher or student tracking strategy according to the actual deployment method, and completes the scene automatic tracking and shooting, without the need to distinguish between the teacher type or the student type of camera.

The Ai tracking capability is dropped to the edge of the system (camera), and there is no need to add additional auxiliary equipment such as tracking host and positioning analysis, and the on-site AI picture tracking can be easily completed It greatly guarantees the screen processing effect and reduces the difficulty of construction and maintenance.

4 List of core devices

serial number	Product name	Model	remark
First, the platform layer			
1	Video resource platform	Regional Edition, Campus Edition, Full Connectivity	(on demand)
Second, the front-end classroom			
1	HD recording console	AE-A6N and (built-in version Ai).	(on demand)
2	Intelligent analysis host	IAH-SV20	
3	Intelligent speech analysis host	IAH-SA50	
4	Intelligent number attendance host	IAH-AT30	

Note: This list only describes the core equipment, the specific list and **decoration deployment and auxiliary material selection please refer to the nail plate list or the pre-sales configuration plan list.**