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Research Article

English Cross-Cultural Communication Teaching Based on Intelligent Image Sensor

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English cross-cultural communication is crucial in global trade, technology circulation, and cultural exchange, because not only is the difference between different cultures in language, but the knowledge requirements for cross-cultural communication are even higher. However, in the decades of English teaching development, is still difficult for the research on cross-cultural communication teaching to get rid of the test-taking mode, which makes it difficult for most people to apply it to real life after learning English. In order to solve the problem that English learning is not thorough enough in cross-cultural communication and lacks practicality, this paper starts with the selection of intelligent image sensors, based on CMOS image sensors, sets the sensor parameters and characteristics, and builds multimedia teaching equipment at the same time. Through these methods, it forms an English teaching system for cross-cultural communication and proposes classroom teaching procedures and methods. After four months of teaching experiments with this system, the educated students have made remarkable progress in cross-cultural communication. They have improved to varying degrees in four aspects: cross-cultural communication skills, mastery of cultural knowledge, accuracy of English expression, and ability to adapt to cultural situations. Among them, the accuracy of English expression improved the most in different cultures, and the average score increased by 16 points. In terms of comprehensive performance, the average level of students improved by 17% from preexperiment to postexperiment. Therefore, the teaching system in this paper can help students to have better performance in cross-cultural English communication.

1. Introduction

With the development of globalization, English teaching has maintained a hot state all over the world. In recent decades, there has been an endless stream of methodologies and research results on English teaching. Also because of the popularity of English in the world, the results of different methods of English teaching can be tested. As an important part of English use, cross-cultural communication is a key point in English learning. However, because of the large scope involved and the complex content, it cannot play a good teaching effect. Most of the people who learn English only use it in exams, and they still cannot apply it in practice after many years of study. Intercultural communication in English plays a vital role in global communication. In business negotiation, good communication can facilitate the conclusion of business and drive the development of trade. When communicating with units in different countries, good communication can also promote friendship and increase cooperation between the two parties. Good English intercultural communication skills are also conducive to personal study and work development. It can help people better integrate into the local environment when they travel to other countries, while improving their academic performance and career development. Therefore, in English teaching, the teaching and receiving of cross-cultural communication content is particularly important.

As the universal language in the world, English teaching problems and methods have been widely concerned. In English teaching, cross-cultural communication teaching is a very important part, because it is related to the practical application of English in daily life. Hartle et al. put forward a multimodal awareness and ability communication method in the English language teaching in the workplace they founded [1]. The method they proposed is very helpful for adults to conduct cross-cultural communication in English, but the content is more professional and only suitable for some groups of people. Akalu investigated the impact of situation-specific task-based language teaching methods on students' oral communicative competence [2]. His research played a substantial role in helping students' English communication, but it was only applicable to students in lower grades and is not comprehensive enough. Shan conducted an empirical study on the college English teaching model based on cross-cultural communication and proposed that the mastery and understanding of cultural background and cultural elements can help improve the teaching effect of college English [3]. His method has good results, but the background knowledge that needs to be mastered is too complicated, which is not conducive to practical operation. Rongjuan took the construction of the teaching subject communication system as a breakthrough and constructed the English professional translation teaching communication system [4]. His method opened up a new breakthrough for cross-cultural communication in English, but it involved too much professional knowledge, which was not conducive to promotion. Balahovskaya proposed a teaching method to develop effective intercultural communication skills through ESP textbook learning [5]. His teaching method is a good blend of textbooks and daily communication, but communication scenarios are not suitable for all situations and there is still a lot of room for improvement.

Image sensors are used more and more widely in all aspects of daily life, especially in some modern multimedia devices. Nie analyzed the effect of analog accumulator performance in CMOS TDI image sensor, and his improved accumulator can be applied to high-order image sensor [6]. His research is very novel, but the operation is too complicated for practical use. Fu developed a system improvement algorithm based on image sensor [7]. He applied the research of intelligent image sensor to real life, but the research is not comprehensive enough, and the scope of application is relatively small. Lee et al. improved the performance of traditional image sensors, making it meet the requirements of high resolution and high compression ratio of images in hardware design [8]. His research has added a lot of help to the application of image sensors, but the hardware requirements are also relatively high, resulting in higher costs. Jiaju and Eric introduced a new quantum image sensor with CMOS compatibility [9]. Their research opened up new possibilities for the application of image sensors, but whether it can be widely used in practice needs to be further explored.

To sum up, different English teaching systems have their own drawbacks, and excellent intelligent image sensors can be used in the construction of some teaching systems. The innovation of this paper is to use CMOS image sensor to construct an English cross-cultural communication teaching system. Compared with other teaching systems, this system has unique advantages, especially suitable for the teaching of cross-cultural communication. It can record, store, and transmit the simulated exercises of students in different cultures and exchange them through the network to achieve a more authentic cross-cultural practice effect and promote the development of students' English communication skills.

2. Construction Method of the Cross-Cultural English Teaching System

2.1. Introduction and Selection of Intelligent Image Sensors. With the continuous development of the digital age, image and video capture methods have become diverse and advanced. However, any multimedia that needs to collect real-life information and output it as images or videos cannot do without image sensors [10]. The image sensor converts the optical information we see into electronic signals and transfers them to the computer and determines the quality of the entire image acquisition system. According to the different components, it can be divided into two types: CCD image sensor and CMOS image sensor. CMOS image sensor (CIS, CMOS image sensor) is the main semiconductor device used in the manufacture of digital cameras. CIS can convert detected optical signals or electromagnetic radiation into electrical signals, thereby restoring the original image information. In recent years, CMOS image sensors have made major breakthroughs in resolution, sensitivity, signal-to-noise ratio, power consumption, and integration, rapidly replacing CCD image sensors. It has become an important part of image recognition, video transmission, and other fields [11]. The CMOS image sensor architecture is shown in Figure 1.

As shown in Figure 1, the structure of a CMOS image sensor mainly includes a photodetector, a gain controller, an analog-to-digital converter, and the like. The photodetector converts the incident light into photogenerated charges, which are then digitized by a variable gain amplifier and ADC. Before the 1990s, CCD image sensor has always occupied the mainstream of the market, because it has the characteristics of low noise and high resolution, but its disadvantage is that the cost is too high and the process is complicated [12]. After the 1990s, with the continuous development of science and technology, image sensors have gradually become intelligent, and with the maturity of lithography technology, CMOS image sensors were born [13]. Its high integration, low power consumption, low cost, and other advantages have gradually squeezed the market share of CCD image sensors. Although CCD sensors are still used in a large number of systems due to historical technology and other reasons, CMOS has tied the usage rate of CCDs in just over a decade. Figure 2 is the market share of CMOS and CCD.

According to Figure 2, it comprehensively analyzes the current status of the use of intelligent image sensors and their advantages and disadvantages, combined with the needs of this paper. In this paper, a CMOS image sensor is used, and a solution of multimedia English cross-cultural teaching system based on CMOS image sensor is proposed. The system needs to implement the following functions: Supporting various types of image sensors; supporting multichannel ultra-high-definition video parallel capture and playback; supporting integration with multimedia

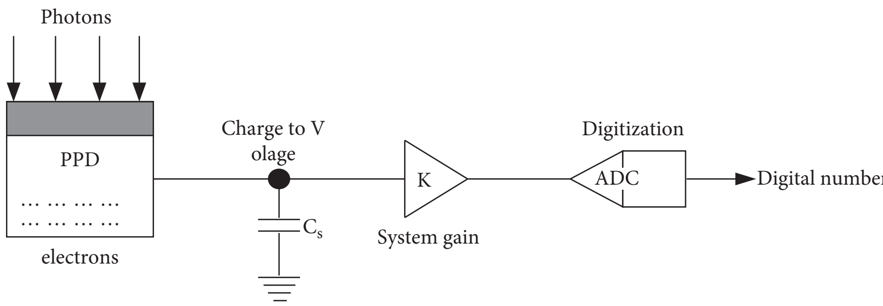


Figure 1: CMOS image sensor architecture.

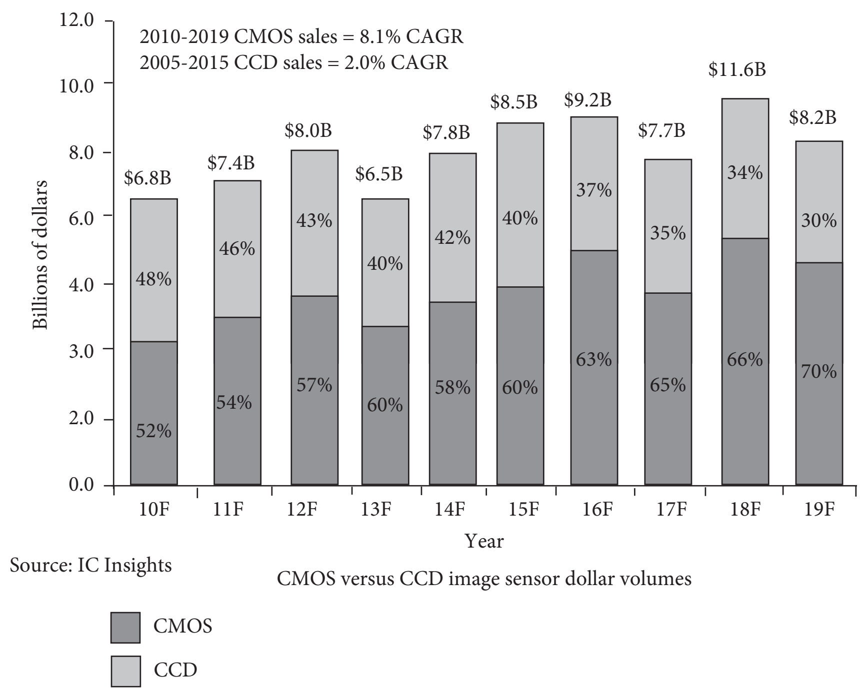


Figure 2: Market share of CMOS and CCD image sensors.

teaching system; supporting long-distance transmission of uncompressed ultra-high-definition video; supporting local and remote video real-time display; supporting video frame storage; supporting remote control hardware platform.

According to the above functional requirements, system requirements, and performance indicators, the hardware platform of this paper designs 4-channel image sensor interfaces. Image sensor interfaces are mainly divided into two categories: DVP interface and MIPI CSI-2 interface. The DVP interface is a traditional interface, and the data is output in parallel. Due to its limitations in signal integrity, it is difficult to transmit high-speed data, and it is mainly used in low-resolution image sensors [14]. The MIPI CSI-2 interface is an interface developed by the MIPI Alliance for mobile embedded devices, and the data is output in a differential serial manner. Compared with DVP interface, it has the characteristics of less interface, fast transmission speed, and strong anti-interference performance. It is widely used in high-resolution CMOS image sensors [15]. Therefore, this system selects MIPI CSI-2 interface as the acquisition interface. It also divides the hardware platform of the CMOS sensor teaching system into six parts: acquisition module, control module, core processor module, display module, cache module, and communication module. The connection relationship between the modules is shown in Figure 3.

As shown in Figure 3, the working process of the system is designed as follows: the core processor receives and parses the instructions of the upper computer, thereby controlling the working mode of the image sensor. Its acquisition module realizes the parallel acquisition of multichannel ultra-high-definition video and stores the data in the cache module. After processing, it is divided into two channels; one is output through the display module and displayed in real time at the local end; the other way is transmitted to the host computer through the communication module, and the remote real-time display and storage are realized by the host computer program [16].

In order to enhance the flexibility of the system, the hardware system is planned to be composed of two printed circuit boards, the sensor daughter board and the core

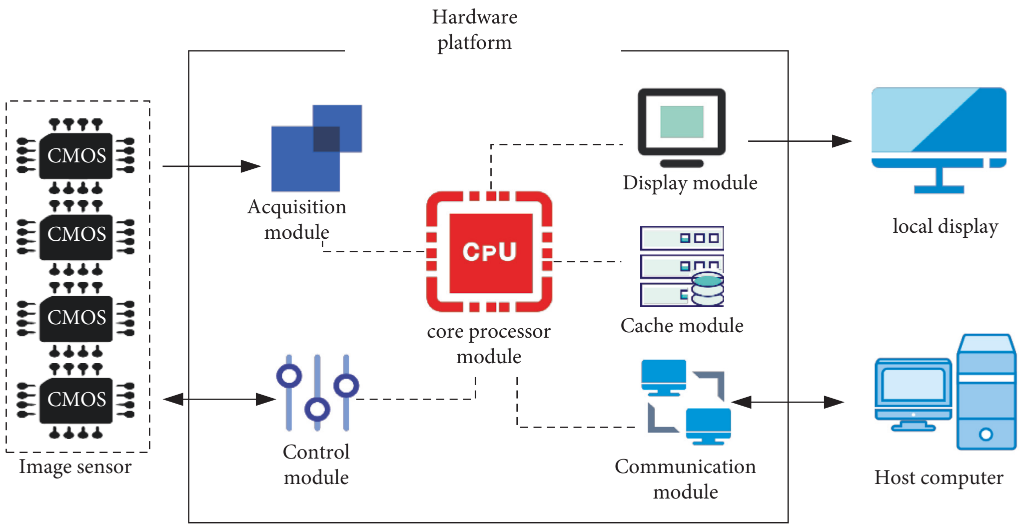


FIGURE 3: Schematic diagram of the connection of each functional module of the system.

processing board. It designs the image sensor and its required power supply on the sensor daughter board and designs the core processor and other peripheral modules on the core processing board. This makes it possible to support multiple types of image sensors by replacing different sensor daughter boards [17]. In order to simplify the power design of the system, the hardware platform provides an external power interface from the core processing board and supplies power to the daughter board. After it determines the processor architecture, it considers other peripheral modules and software architecture. Figure 4 is the software architecture based on the CMOS sensor.

2.2. CMOS Image Sensor Characteristics and Parameter Settings. This section introduces the characteristics and parameter settings of the CMOS image sensor, so as to facilitate the further construction of the English cross-cultural communication teaching system. The first thing to cover is quantum efficiency. Quantum efficiency is a very important parameter of CMOS image sensors, which characterizes the ratio of the number of electrons collected by the photodiode to the number of photons incident on the surface of the diode during the exposure time. Its expression is as follows:

$$\mathrm{QE}(\lambda) = \frac{\mu_e}{\mu_p}, \tag{1}$$

where μ_e and μ_p represent the number of electrons collected by the pixel and the number of photons incident on the surface of the pixel, respectively. When photons are incident on and absorbed by the PPD surface, free charge carriers, or electron holes, are generated.

Another important parameter of an image sensor is the spectral responsivity, which characterizes the amount of photocurrent that a unit incident photon of a specific energy can generate. SR also depends on the incident light energy and incident light wavelength. Its expression is shown in formula (2), and the unit is A/W:

$$\mathrm{SR} = \frac{\mathrm{QE}\cdot\lambda\cdot \mathrm{q}}{\mathrm{hc}}, \tag{2}$$

where λ is the wavelength of incident light in nm, q is the amount of electron charge, h is Planck's constant, and c is the speed of light. The calculation formulas of these three are as follows:

$$\begin{aligned} \mathrm{q} &= 1.602\times 10^{-19}\,[C],\\ \mathrm{h} &= 6.626\times 10^{-34}\,[J\cdot s],\\ \mathrm{c} &= 2.99792\times 10^{8}\,[m/s]. \end{aligned} \tag{3}$$

When the photodiode is operating in the integrating mode, the expression for the full well capacity can be derived as follows:

$$\mathrm{FWC} = \frac{1}{\mathrm{q}}\int V_{res}\cdot V_{PPD}\mathrm{d}v, \tag{4}$$

V_{res} is the reset voltage of the photodiode, i_{pj} is the photocurrent, q is the amount of electron charge, and C_{PPD} is the junction capacitance of the clamped photodiode. V_{PPD} is the output voltage of the clamped photodiode, and $V_{\mathrm{PPD(min)}}$ is the minimum voltage of the output of the clamped photodiode.

Conversion gain (CVF, Charge-to-Voltage Factor) is also known as charge-to-voltage conversion ratio. It is defined as the ratio of the pixel output voltage to the number of electrons produced by the pixel. Conversion gain is also an important parameter of CMOS image sensors. The linearity, uniformity, and noise of pixels are all related to CVF [18]. CVF can be divided into outer conversion gain and inner conversion gain. The mean-variance curve can be used to determine the CVF, that is, using the physical principle that Photo Shot Noise (PSN) is proportional to the square root of the signal level, and its slope is the CVF. Its expression is as follows:

$$\mathrm{CVF} = \frac{\mathrm{V}_{\mathrm{signal}}}{\mu_e}, \tag{5}$$

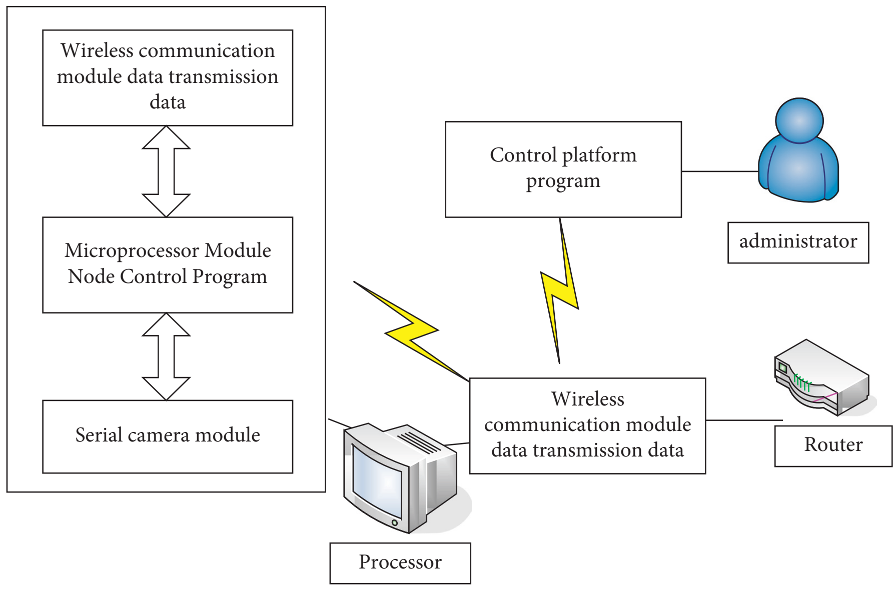


Figure 4: Software architecture of the CMOS sensor.

where V_{signal} is the pixel output voltage, and μ_e is the number of photogenerated electrons.

One of the most important technical parameters of an image sensor is dynamic range (DR). It is defined as the ratio between the number of electrons stored when the pixel is saturated and the number of noise electrons in the pixel when there is no light [19]. The number of electrons that can be stored when a general pixel is saturated is called the full well capacity (FWC, Full Well Capacity) of the pixel. The formula for calculating dynamic range is

$$\mathrm{DR} = 20\log\left(\frac{N_{sat}}{N_{dark}}\right), \tag{6}$$

where N_{sat} is the number of electrons that can be stored when the pixel is saturated, and N_{dark} is the number of pixel noise electrons when there is no light. There are two ways to improve the dynamic range of the image sensor, such as increasing the full well capacity of the pixel or finding ways to reduce the noise level of the pixel.

In the design process of CMOS integrated circuits, another performance parameter with the highest frequency mentioned is the signal-to-noise ratio (SNR). It describes the ratio between the maximum signal power and noise power of a system [20]. In a CMOS image sensor, the maximum signal-to-noise ratio is obtained when the photodiode in the pixel is saturated, and the expression for the signal-to-noise ratio is

$$\mathrm{SNR} = 20\log\left(\frac{N_{signal}}{N_{noise}}\right)[dB], \tag{7}$$

where N_{signal} is the number of signal electrons in the pixel and N_{noise} is the number of noise electrons. In a 4T APS pixel, the photodiode and floating node FD need to be reset before each frame of pixel integration, and then the voltage is sampled into the corresponding sampling capacitor, which generates reset noise. During sampling, the reset transistor is treated as a switch, so the reset noise is calculated as

$$\mathrm{V}_{\mathrm{noise}}, RMS = \sqrt{kT/C_{pD}}. \tag{8}$$

The correlated double sampling technique is used to sample the reset voltage before the charge transfer, and the signal voltage is sampled after the charge transfer, and the difference between the two is the effective optical signal voltage. Since both reset voltage and signal voltage contain reset noise, it can be eliminated by CDS technology. Its simplified model is

$$\overline{\mathrm{V}}^2_{\mathrm{noise}} = \frac{K}{C_{ox}W\mathrm{L}} \times \frac{1}{\mathrm{f}}. \tag{9}$$

K is a parameter related to the process, C_{ox} is the gate capacitance of the transistor, and W and L are the size of the transistor. It can be seen from the formula that as the transistor size becomes smaller, the flicker noise becomes larger and larger. Similarly, flicker noise can also be eliminated by the correlated double sampling technique.

In addition to the above parameter characteristics, the power supply voltage is also an issue that needs to be considered. For the DC/DC power supply, the switching frequency of the power supply chip needs to be determined first. The higher the switching frequency, the smaller the power supply ripple, and the smaller the value of the inductance and the capacitance, which is beneficial to reduce the circuit size and production cost. However, as the switching frequency increases, the switching losses will increase, resulting in a decrease in power efficiency [21]. After calculation, the minimum value of inductance is 1.17 μh. In this system, the value of inductance is 2.2 μh. The specific operation is as follows:

$$L_{min} = \frac{1}{I_{IND(ripple)} \times f_{sw}} \times \frac{\left(V_{IN(\max)} - V_{OUT}\right) \times V_{OUT}}{V_{IN(\max)}}. \quad (10)$$

In the formula, V_{OUT} is the equivalent series resistance of the capacitor. In the design, multiple ceramic capacitors are usually connected in parallel in order to increase the capacitance of the output capacitor and reduce the equivalent series resistance of the capacitor, thereby reducing the power supply ripple.

$$\Delta V_{OUT(ripple)} = ESR \times I_{IND(ripple)},$$
$$\Delta V_{OUT2(ripple)} = \frac{1}{c} \times \int I_{IND} dt = I_{IND(ripple)} \times \frac{1}{8fc}. \quad (11)$$

The determination of the sensor node sensing model is a prerequisite for the research of sensor network data acquisition technology. The node-aware model contains node physical coordinates and spatial geometry models. Different sensor node models correspond to sensor nodes with different functional uses in practical applications, that is, corresponding to different practical problems of sensor networks. Accurate and reasonable sensor node model plays an important and prerequisite role in the research of wireless sensor network data acquisition technology, which is related to whether the algorithm is feasible or not. With the rapid development of sensing technology and the demand for comprehensive acquisition of information in the monitoring area, sensors based on directed perception models, such as photographic sensors, video sensors, infrared sensors, and other new sensors, have come out one after another. In the 0-1 sensing model, as long as the monitoring target is within the sensing range of the node, it will be detected with a probability of "1." Within the range of the node's perception capability, the node's perception of the monitoring target has nothing to do with the distance between the target and the node. Therefore, the probability formula of the 0-1 perception model is as follows:

$$f(d(p,z)) = \{1 \text{ d}(p,z) \le R_p,$$
$$ECC = \frac{2I(A,B)}{H(A) + H(B)}. \quad (12)$$

R_p is the sensing radius of the image sensor node, and the sensing radius of each node is fixed. The 0-1 perception model is mostly used in the analysis of sensor network problems in ideal scenarios. However, in practical applications, the perception ability of nodes is affected by many unavoidable objective factors. The monitoring target within the sensing range of the node is not 100% able to be monitored. In order to incorporate objective factors into the establishment of the node model, the node's exponential perception model appears. In the exponential perception model, the perception quality of a node decreases exponentially with the increase of the distance between the monitoring target and the node. As shown in formulas (13) and (14), the probability that a target point z within the sensing range of the node is detected by the sensor node p is

$$f(d(p,z)) = e^{-\alpha d(p,z)}, \quad (13)$$

$$H(A,B) = \left(1 - \frac{1}{2}ECC\right)(H(A) + H(B)). \quad (14)$$

In the above formula, α is the parameter that the perception ability weakens with distance, and $d(p,z)$ is the distance from the sensor node p to the monitoring target point z. For another part of the nodes, within the sensing range of the node, the sensing ability does not all show an exponential decay trend with the change of distance. Instead, when the distance between the monitoring target and the node is less than a certain fixed value, the target is covered with probability "1." When the size of the distance between the target and the node is between a certain fixed value and the perception range, the node perception ability is distributed in an exponential model [22]. The exponential perception model that conforms to the above description node is as follows:

$$f(d(p,z)) = \left(R_p - R_u\right) \pm d(p,z),$$
$$P_{jk} = \frac{\text{Area}(C_i) \cap \text{Area}\left(C_j\right)}{\text{Area}(C_o)}. \quad (15)$$

This section briefly introduces the characteristic parameters of CMOS, common circuit architectures of image sensors, and imaging principles. It focuses on the working principle and timing of 4T pixels and the composition of digital pixel sensors widely used in the industry. Next, it will discuss how to build the teaching system required in this paper based on this sensor.

2.3. Construction of the Cross-Cultural Communication English Teaching System. This section mainly introduces how the CMOS-based multimedia teaching environment is applied to the cross-cultural communication teaching system. The biggest feature of this system is that after students have completed the cross-cultural communication situational practice, they can use the high-resolution and high-speed transmission characteristics of CMOS to store the situational practice video for backup. Therefore, students from different cultures can use these videos for situational cultural communication exercises.

After the basic configuration of the CMOS sensor in the previous section, it is necessary to configure the digital teaching classroom of the school. Its software environment is mainly composed of resource platform, interactive application, operation platform, remote login access, intelligent system, and so on. These software environments are jointly used for English cross-cultural communication situational teaching, a vivid and rich virtual learning environment, and teaching resources based on the Internet. Figure 5 is a comprehensive topological diagram.

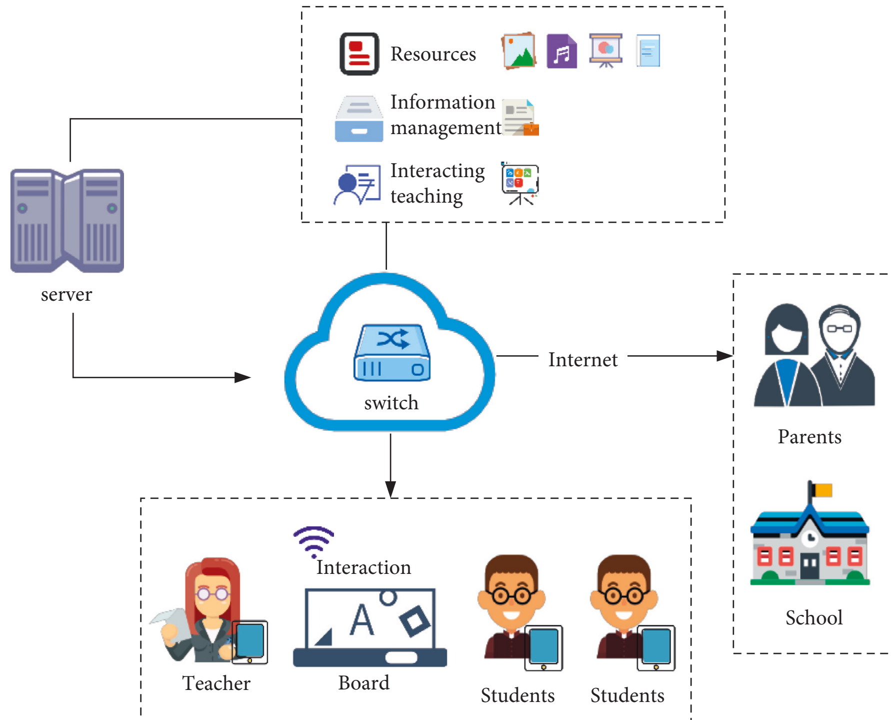


Figure 5: Comprehensive topography of cross-cultural communication English teaching classroom.

As shown in Figure 5, the teaching system has a dynamic test feedback function based on the IRS (Intelligent Room System), which can integrate classroom teaching, interactive exercises, activity display, teaching evaluation, and other links. It conducts real-time automatic evaluation of students' performance under English situational teaching and generates evaluation reports. Digital classrooms provide teachers and students with information-based means to assist teachers and students in teaching and learning. For teachers, digital classrooms can help teachers to prepare lessons before class, teach during class, and evaluate after class and provide personalized guidance to students. Digital classrooms can help them prepare for class preparation, with interactive practice in class, and expand and consolidate after class. For students, students can realize online and offline blended learning by integrating resources and improve their comprehensive English language ability in different situations.

Digital classroom is different from traditional classroom, and the teaching process of digital classroom is often carried out in dedicated classrooms. In a new environment, students consciously integrate into an "English Corner" style "new situation" from the ideological aspect, which creates conditions for "immersive" English learning. It also provides ideological preparation and psychological basis for the development of English situational teaching. At the same time, the round table seating is convenient for group cooperation and English situational dialogue and communication.

After discussing the feasibility of carrying out English situational teaching in the cross-cultural communicative English teaching system and the convergence point between the two, the following will be based on the typical characteristics of digital classrooms and different classifications of situational teaching. It details the methods of creating English teaching situations in the classroom and designs a complete English classroom teaching process. This paper extracts digital means such as cloud resources, media information, interactive platforms, virtual learning tools, and intelligent systems in the system, gives full play to the advantages of classrooms in the creation of cross-cultural situations, and develops situational teaching application design.

2.3.1. Relying on Cloud Resources to Create an Intuitive Situation. Intuitive situations usually refer to situations that students can accept at a glance that conform to their own cognitive habits and ways of thinking. The more intuitive, vivid, and specific the situation created by the teacher is, the more natural and willing the students will express in the situation. Students have a strong desire for exploration, curiosity, and imitation. Therefore, situations that are close to students' direct experience, knowledge, and cognitive levels can directly trigger different sensory feelings and stimulate students to learn. In turn, it enriches students' experience and knowledge and promotes the materialization of abstract knowledge. The classroom of this teaching system effectively integrates basic elements such as image, sound, animation, etc., which provides a guarantee for the construction of image and interesting situation. The use of a variety of effective tools is enough to attract students' attention. With these characteristics, students can actively and effectively accept new knowledge. The artistic and practical teaching situation can give students a friendly feeling, so that students can relax their guard and devote themselves to it. The use of digital means provides a strong guarantee for the intuitive situation and at the same time can further create a situation suitable for students' learning. These digital means all play a role in rendering and contrasting the creation of intuitive situations [23].

2.3.2. Presenting the Problem Situation and Practice with the Help of Media Information. Using the resources in the digital classroom to create problem situations related to the text content can arouse students' desire to explore. At the same time, teachers can guide students to communicate more clearly and cultivate students' habit of observing and thinking diligently by using pictures that are suitable for the language environment and have imagination space in the classroom. In addition, students are exposed to problem situations, and they are constantly experiencing the process of discovering, analyzing, and solving problems. The creation of problem situations helps students to construct the meaning of the knowledge they have learned based on their existing cognitive structure and life experience. Being contextually driven not only helps with practice, but also helps develop students' problem awareness. Therefore, the creation of problem situations should be based on specific learning content and teaching tasks, activate students' desire for knowledge, and try to solve problems through their own efforts and group cooperation. Usually, there are two ways to create problem situations: teachers' questioning and guidance and students' active construction. Teachers set problem situations, let students solve their doubts with doubts about the text, and complete assimilation and adaptation in the construction of knowledge. The big problem situation created by the teacher can run through the classroom and play a leading role, so that students can perceive the text content as a whole [24]. The small problem situation set in the middle of the class is the interpretation of the big situation. It continuously asks questions through the interaction between teachers and students, and students and students, answers several small situations of problems, and then solves the large situation of problems.

3. Effect Experiment of the Cross-Cultural Communication Teaching System

After completing the construction and description of the cross-cultural communication English teaching system based on CMOS intelligent sensor, this section will use the system to carry out teaching experiments and test the experimental results. The teaching system will use self-designed hardware and software, and the performance indicators are shown in Table 1.

Table 1: System performance indicators.

System metrics	Description
Video resolution	3840 ∗ 2160 30fps
Number of image sensors	4
Video capture interface and rate	4 lanes' MIPI-PHY interface, 1.5 Gbps/lane
Local cache capacity	4 Gb
Native display resolution	1920 ∗ 1080 30 fps
Maximum transmission bandwidth	20 Gb
Transmission distance	Over 1 km

Due to the particularity of education, the content of education cannot be completed in one class, and the effect of teaching cannot be seen after a few classes, so the experimental duration is set to 4 months in total. Among them, the first month is the stage node for testing the experimental effect, and the total effect after the experiment is after three months. The experimental site is a high school in China (hereinafter referred to as J school), and the course content refers to cross-cultural communication in high school English.

The steps in the class are mainly divided into the following steps, namely, situation rendering, warm-up introduction, problem-driven, independent cooperation, interactive practice, real-time display, expansion of situation, innovative application, wisdom summary, shared homework, etc. It highlights the learning styles of students' autonomy, cooperation, and inquiry in the classroom and promotes students to learn and use language in the context. Figure 6 is the flow of classroom experiment teaching content.

As shown in Figure 6, in the classroom, teachers will introduce the form of situational communication mode according to the learning content, designer-student dialogues, watching videos, etc. It allows students to have a general understanding of the learning content of this lesson, generate positive emotional experience, and integrate into the classroom easily and naturally. It is necessary to create an interesting situation in the introduction link, hold students tightly, and guide students to participate in classroom learning. Therefore, teachers should set the beginning cleverly, get the first move, and use a short period of time to let students enter the best situation. After the introduction, multimedia is used to bring into the cultural scene, and questions are thrown to let the students think, and then the students can cooperate with each other. Students work and practice with each other while thinking for themselves and then recreate cultural scenarios to simulate and summarize. The whole process will be recorded by the system and transmitted for the exchange of students of the target communication culture to further deepen the effect of cross-cultural communication, which is beneficial to students of different cultures on both sides.

The experiment and comparison of the cross-cultural communication teaching system are as follows.

(1) Comparison of Effects between Cross-Cultural Teaching System Based on CMOS Sensor and Traditional Teaching Mode. This section compares the teaching effect of the designed cross-cultural communication teaching system based on CMOS smart sensor with the traditional teaching method. Under the traditional teaching method, the teacher usually explains the content of the book in chapters according to the cross-cultural communication and guides

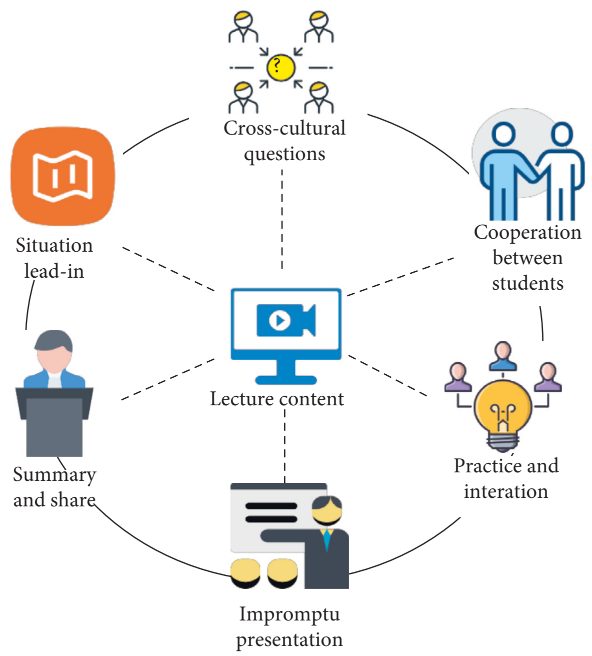


Figure 6: Classroom teaching content and experiment flow.

the students to practice at the same time. The advantage of this teaching method is that all the content can be learned with precision, and students can enhance their cultural knowledge and vocabulary if they have strong learning ability. However, the disadvantage of this model is that it cannot comprehensively mobilize all students to learn and improve overall performance, and it is also difficult for students to apply what they have learned to practical scenarios. The system in this paper has the transmission function of high-definition video, which can compare the real video of different cultures to let students apply the knowledge on the spot. Table 2 shows the specific criteria judged in this experiment.

As shown in Table 2, the comparison with traditional teaching is mainly carried out from four dimensions: cross-cultural dialogue comprehension, oral expression, cross-cultural writing, and cross-cultural background article reading. This experiment is divided into two stages. The first stage is based on a total of 30 lessons a month and is conducted in two classes in J school. Class A adopts the traditional mode of teaching, and cCass B adopts the teaching method of this article. The second stage is the total effect of using different teaching effects after 3 months. After the experiment, a unified test standard was adopted to test the two classes, and the average score was taken for comparison. Figure 7 is the experimental result.

As can be seen from Figure 7, the first stage, that is, after the one-month course is over, the gap between the two classes is not large. However, the B class of the systematic teaching method in this paper still slightly exceeds the A class of the traditional teaching method. Class B is 4, 5, 6, and 3 points higher than the average score of Class A in the four criteria of cross-cultural dialogue comprehension, oral expression, cross-cultural writing, and cross-cultural background article reading. But when the experiment went to the second stage, that is, at the end of 4 months, the average score of Class B in the four modules was 10, 13, 9, and 8 points higher than that of Class A, respectively. It can be said that, compared with the traditional teaching method, the teaching under the cross-cultural communication teaching system based on CMOS intelligent sensor has better effect.

(2) Comparison of Students' Knowledge Mastery under the Cross-Cultural Teaching System Based on CMOS Sensors. After the comparison with the traditional teaching mode is completed, this section will compare the students' knowledge mastery under the systematic teaching of this article from the perspective of the students themselves. The comparison and reference standards are consistent with the above and still start from four aspects: intercultural dialogue understanding, oral expression, cross-cultural writing, and cross-cultural background article reading. In this experiment, the students of Class B are divided into two groups to obtain a comparison of their mastery degrees during the 4-month teaching process. Table 3 shows the average initial assessment scores of the two groups of students in the four experimental modules.

From Table 3, the initial assessment level of these two groups of students can be obtained, and most of them are at the middle level. The level of the reading module of cross-cultural background articles is slightly lower, and the basic level of the remaining modules is evenly distributed in the class. After understanding their initial assessment level, the next step is to conduct further knowledge mastery comparison experiments. The experimental results are shown in Figure 8.

As shown in Figure 8, after all the teaching courses are completed, it can be found that, within 4 months, the two groups of students have made significant progress in cross-cultural communication under the teaching design of this paper, especially the second group. The second group's mastery of the four modules: Intercultural Dialogue Comprehension, Oral Expression, Intercultural Writing, and Intercultural Background Article Reading, increased by 15.3%, 23.4%, 26.7%, and 17.5%, respectively. Although the improvement in mastery of the first group was not large, it still improved compared to the initial situation. This shows that the system in this paper is helpful for students to master the knowledge of cross-cultural communication.

(3) Comparison of Students' Progress under the Cross-Cultural Teaching System Based on CMOS Sensors. As we all know, English is a subject that can promote each other with other subjects or other aspects. The study of intercultural communication teaching is also the study of English teaching in essence, and its study can also promote the growth of other English knowledge. Therefore, this section starts from the students' progress to study whether students can make progress after 4 months of experimentation. The improvement standards of the students in this section of the experimental evaluation mainly lie in three aspects: grammar, vocabulary, and pronunciation. It also divides students into 2 groups. It counts their initial situation before the formal experiment starts and uses the evaluation module of

Table 2: Comparison of experimental evaluation standards with traditional teaching.

	Dialogue understanding	Oral expression	Cross-cultural writing	Cross-cultural reading
90–100	Full comprehension	Fluent expression	Complete and unmistakable	Full comprehension
70–80	Good comprehension with few mistakes	Nearly fluent expression	Logically clear and complete	Good comprehension with few misunderstandings
60–70	Medium comprehension	Medium expression	Average writing	Medium comprehension
Below 60	Very poor command with lots of mistakes	Stuttered expression	Chaotic and logically wrong	Very poor command with lots of mistakes

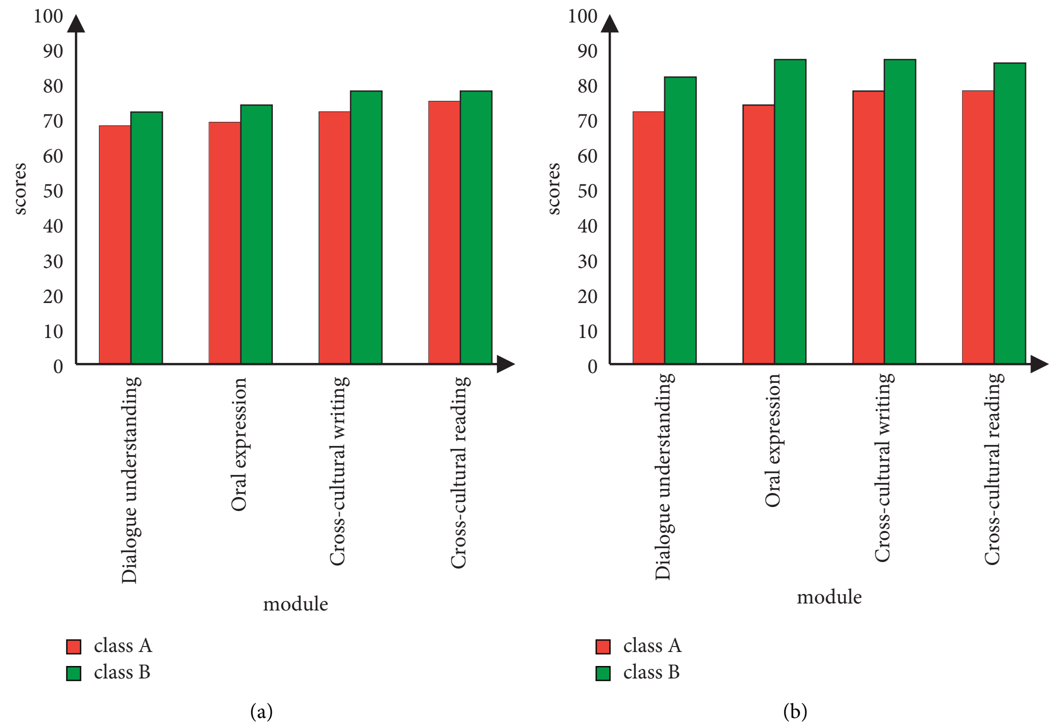


Figure 7: Comparison of experimental results between the teaching system in this paper and the traditional teaching. (a) Stage 1. (b) Stage 2.

Table 3: The average initial assessment scores of the two groups of students in the four modules.

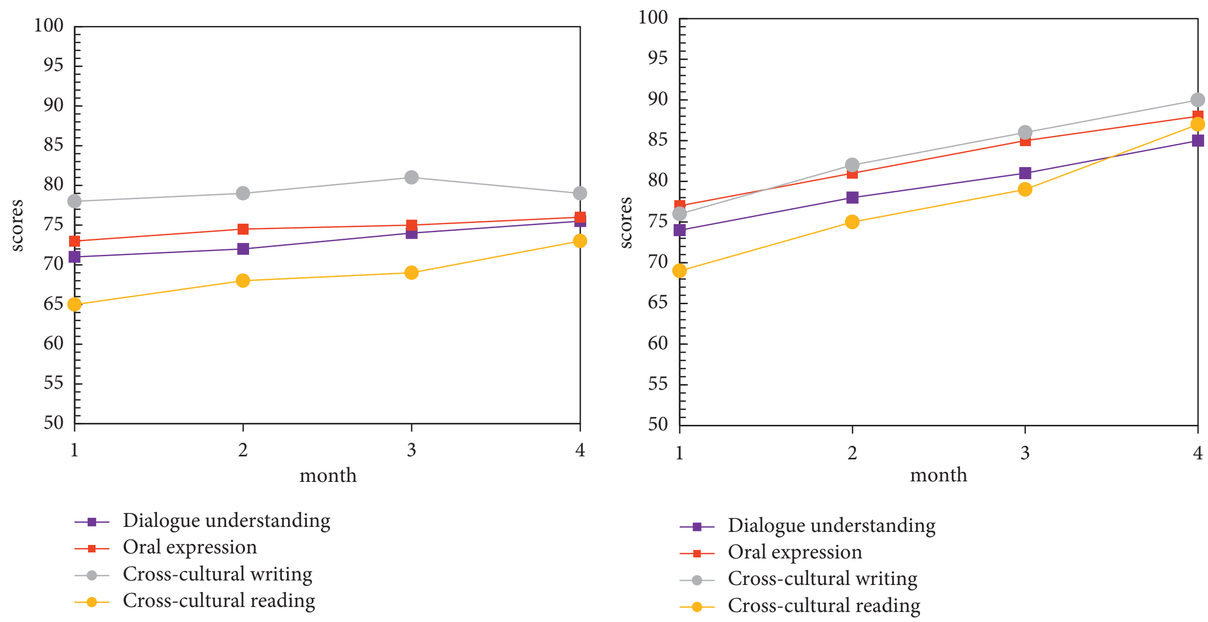
	Group 1	Group 2
Dialogue understanding	71	74
Oral expression	73	77
Cross-cultural writing	78	76
Cross-cultural reading	65	69

this teaching system to score. Table 4 shows the average scores of the two groups of students in terms of grammar, vocabulary, and pronunciation.

As can be seen from Table 4, the two groups of students are also similar in terms of grammar, vocabulary, and pronunciation, and the average score is in the middle. In addition to the weak vocabulary, the other two aspects are relatively average. After mastering the average situation of the two groups of students, the next step is to analyze their experimental results. Figure 9 is a graph of students' progress comparison results.

As shown in Figure 9, after the 4-month experiment, the same two groups of students have made significant progress in cross-cultural communication under the instructional design of this paper, and the improvement in the first group is greater than that in the second group. The progress of the first group in terms of grammar, vocabulary, and pronunciation reached 14.1%, 19.5%, and 21.6% respectively. Although the improvement in mastery was not large, the second group had a higher initial score, so it also had a good experimental result. Both results show that this teaching system has played a role in promoting the progress of students in English learning.

(4) Experimental Results of Students' Practical Application of Cross-Cultural Communication. The communicative situation refers to the specific situation in which the communicative subject engages in verbal communicative activities, including factors such as time, place, topic, method, and communicative object. The instrumental characteristics of English subject emphasize the practicality of communication and also emphasize that English learning should be realized through communicative activities in different contexts.

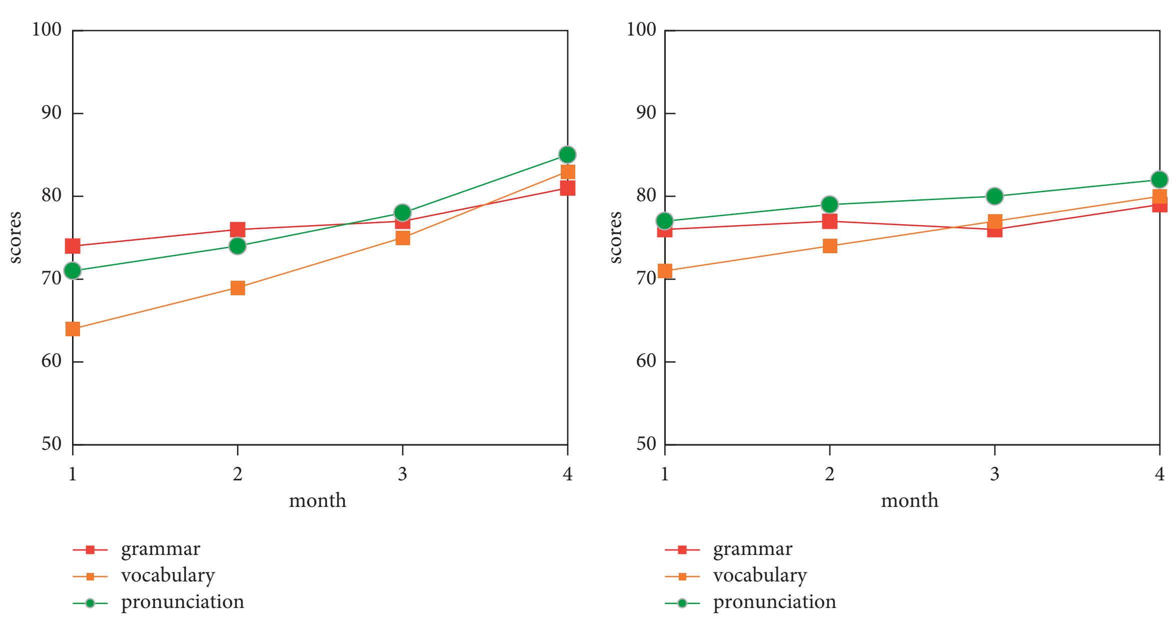


(a) (b)

Figure 8: Comparison of students' knowledge mastery under the cross-cultural teaching system based on CMOS sensors. (a) Performance of group 1 in 4 months. (b) Performance of group 2 in 4 months.

Table 4: The average scores of the two groups of students in the initial situation of the three aspects tested.

	Group 1	Group 2
Grammar	74	76
Vocabulary	64	71
Pronunciation	71	77



(a) (b)

Figure 9: Comparison of students' progress under the cross-cultural teaching system based on CMOS sensors. (a) Group 1 in 4 months. (b) Group 2 in 4 months.

Table 5: Scores of students' practical application of cross-cultural communication before the experiment.

	Average score of the experiment class
Intercultural skills	65
Knowledge mastery	58
Expression accuracy	62
Cultural adaptation	71

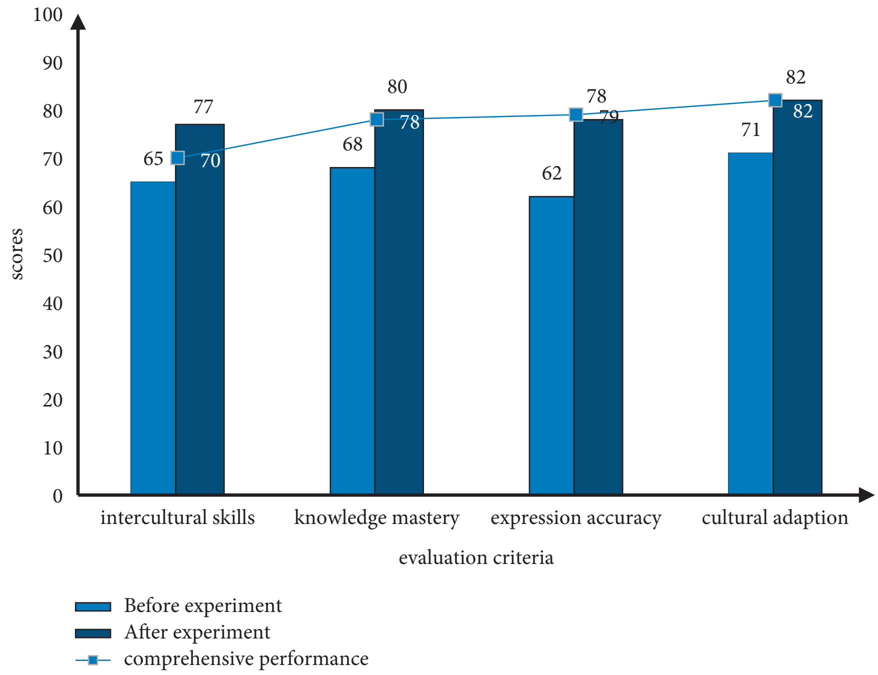


Figure 10: Results of students' practical application of cross-cultural English communication.

Therefore, at the end, this paper will test whether students can apply what they have learned to practice. The English communication teaching system has many information tools and digital means for creating communication situations. By creating a realistic situation close to the students' actual life, it can practice English more truly and effectively and realize the transfer of knowledge and the communicative function of English. In the classroom, students can use the interaction function of human-computer software to carry out free English conversations, which not only improves students' participation and enthusiasm, but also trains students' language knowledge transfer ability. Students can choose different man-machine dialogue modes according to the types of supporting textbooks, interesting scenes, and teaching-editing dialogues. In the process of man-machine dialogue, students not only exercise their oral expression skills, but also effectively practice their English listening skills. Through the training of listening and speaking skills, students can master knowledge points and improve their comprehensive language application ability, which is also helpful for the cultivation of students' core literacy of English subjects.

In addition to human-computer software interaction, there is also human-computer media interaction. Human-computer media interaction refers to the interpersonal communication between teachers and students, students and students, by means of the media such as transferring equipment or software. This paper provides different learning forms for English learning, including online human-computer interaction, offline peer communication, etc. This blended learning can achieve low cost and high benefit. The use of network technology, artificial intelligence technology, and rich media technology in the classroom has become more intelligent, providing English learners with different communication situations. In this system, students realize the English communication between people with the help of the communication situation created by digital media and cultivate students' ability to construct knowledge and solve problems in different situations.

After 4 months of experimentation of the teaching system in this paper, by means of the teaching software of this system and the cultural reality communication of students of different cultures in the network environment, the comparison of the results of students' actual application of cross-cultural communication is obtained. It will then evaluate students' practical application results from four aspects: intercultural communication ability, cultural knowledge mastery, English expression accuracy, and cultural situation adaptability. It uses the evaluation mode of this system to conduct experiments and scores on students' practical application ability before the experiment. The results are shown in Table 5.

It can be seen from Table 5 that the students' practical application level of cross-cultural communication is not high. Among the four aspects, the mastery of cultural knowledge is particularly lacking, and the average score does not even exceed the passing level. The average score for adaptability to cultural situations is high, but only at 71. It can be seen that these are the weaknesses of the students.

In the previous sections, we have conducted various experiments on students, and finally we will count the results of practical application of students in the cross-cultural communication teaching system based on CMOS intelligent image sensor. Figure 10 shows the experimental results of students' practical application of cross-cultural English communication.

As can be seen from Figure 10, under the teaching system designed in this paper, students have made significant progress in four aspects: cross-cultural communication ability, cultural knowledge mastery, English expression accuracy, and cultural situation adaptability. They improved by 12, 12, 16, and 11 points, respectively. Among them, the accuracy of English expression improved the most in different cultures. In terms of comprehensive performance, the experimental teaching courses have steadily improved within four months, and the average level has increased by 17% from before the experiment to after the experiment. It can be seen that the teaching system designed in this paper can help students better learn the knowledge of cross-cultural English communication.

4. Conclusions

This paper started with the introduction and the configuration of the intelligent image sensor and selected the CMOS sensor as the basis to construct a multimedia English teaching system after comparing several different image sensors in the market. The article proved the CMOS sensor is specially suitable for the system building of the learning of English cross-cultural communication. Apart from building this teaching system, the author also demonstrated the process of how to teach through this system in digital class. The author adopted his methods in various experimental researches to verify their correctness and acquired the result that his approach is physical. The biggest characteristic of this teaching system is that it can store videos of the practicing process of students from different culture. By doing that, students from different culture can switch their practicing process through Internet and hence gain real conversations from another culture to better study cross-cultural communication. Due to the limited length of the article, the author cannot describe the system construction and method application in more detail. In the future, the author looks forward to designing a better system with a more precise method and conducting more experiments to provide a better reference for English teaching.

Data Availability

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

Conflicts of Interest

The author declares no conflicts of interest.

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