Situational Simulation Teaching System of Information Literacy Education Based on Mobile Terminal

Xin Wang[1(✉)] and Fan Lv[2]

[1] Shandong Institute of Commerce and Technology, Jinan 250103, China
wangxin220106@163.com
[2] Sanmenxia Polytechnic, Sanmexia 472000, China

Abstract. The traditional situation simulation teaching system has the problems of high space limitation and low response rate, which affect the teaching effect of information literacy education. Therefore, this paper proposes a scenario simulation teaching system for information literacy education based on mobile terminals. Analyze the teaching needs of mobile terminal applications, achieve information compression of information literacy education through DSP chips, and design the microprocessor core module to achieve the scene simulation teaching environment of information literacy education; Adjust the teaching content by calculating the feedback index of teaching effect. After setting the data table format of the system storage simulation scene, the software part is transplanted to complete the system design. The experimental results show that the response time of the designed teaching system is less than 2S, and the information literacy ability of students can be improved. The scene simulation teaching effect of information literacy education is good.

Keywords: Mobile terminal · Information literacy education · Scenario simulation · Teaching system · Teaching feedback

1 Introduction

The information society constantly puts forward new and higher requirements for everyone's information literacy ability. Information literacy has become a necessary basic literacy and key variable for people's survival, learning and development. With the development of educational informatization and the rapid development of mobile terminal technology, many schools have applied mobile terminals in Classroom Teaching [1]. Schools in many areas have achieved certain results in using mobile terminals in classroom teaching, which not only improves the efficiency of classroom teaching, but also greatly mobilizes students' learning enthusiasm. Mobile learning is carried out with the help of mobile devices and mobile communication, which is not limited by place and time. It combines mobile computing and digital learning. It is a new digital learning mode. Using mobile terminals for learning has the characteristics of learning materials

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that can be obtained anytime and anywhere, efficient resource search ability and flexible interaction. In recent years, teaching methods or teaching models have become a research hotspot in the field of information literacy education. Many novel and effective teaching methods have attracted the attention of researchers. The first threshold that information literacy teaching should lead learners through is to establish this belief: the mastery of knowledge is a process of constant conviction. Whether it is relatively stable or violently changing knowledge, its degree of certainty should be expressed as a subjective probability distribution, rather than all right or all wrong, so as to leave room for the creation of knowledge. In view of the complex picture of the interaction between information, the main content of the information literacy teaching actually carried out at present is to train students how to effectively reveal the interrelations created by predecessors under specific problem situations [2]. The research objects of information literacy education abroad mainly include teachers, subject librarians and students. The objects of information literacy education in Colleges and universities are not limited to college students, but also teachers engaged in professional knowledge and quality education. Teachers' information literacy has a very important impact on students' education.

Jia Xiaoting and others designed a multimedia based mobile terminal remote education security monitoring system [3]. The hardware design of the system was realized through Mina network framework equipment, usbssc32 channel steering gear control board, Ethernet dfrduino w 2100 expansion board and remote monitoring camera; The software part of the system is composed of webcam XP software and Dr positioning and tracking software. Use multimedia technology to realize the safe interaction of mobile terminal education monitoring system. This method can improve the accuracy of the monitoring system, but the monitoring response delay is too long.

In view of the above problems, this paper designs a situational simulation teaching system for information literacy education based on mobile terminals, which can effectively improve the teaching effect of the situational simulation teaching system for information literacy education by calculating the feedback index of teaching effect and adjusting the teaching content.

2 Hardware Design of Situational Simulation Teaching System for Information Literacy Education Based on Mobile Terminal

The hardware of situational simulation teaching system for information literacy education based on mobile terminal is mainly composed of network server, single chip microcomputer, teacher end, network camera and student mobile phone. The hardware framework of the teaching system is shown in Fig. 1 below.

It can be seen from the analysis of Fig. 1 that the hardware of the scene simulation teaching system is composed of wireless network communication interface, Ethernet interface, mobile terminal, camera and power module. The camera collects the interactive scene information in the scene simulation teaching, supplies power to the system through the power module, and connects the mobile terminal through the wireless network communication interface and Ethernet interface to ensure the transmission and feedback of information and the stable operation of the packaging system [4].

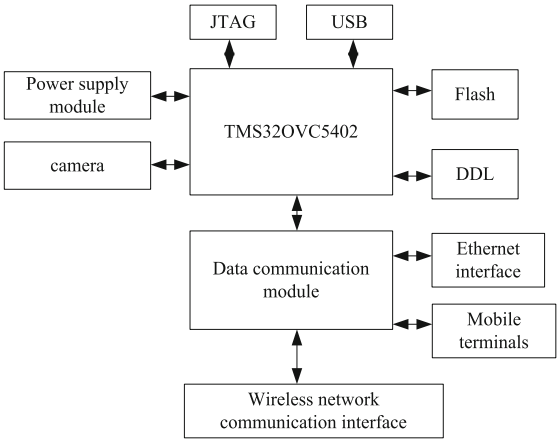

Fig. 1. Hardware framework of scenario simulation teaching system

The hardware design of situational simulation teaching system mainly includes clock power module design, A/D and D/A conversion module of voice signal, McBSP interface design of multi-channel buffer serial port between PCM CODEC and DSP, extended memory design, interface design of network adapter and DSP, etc. The mobile terminal interacts with the server through the mobile Internet, which can be composed of WIFI, 4G, 3G or 2G networks, or directly connected to the network teaching system server group in the school through the switch and wireless routing in the school. The transmission speed, quality and delay of different networks are also different [5]. Therefore, in order to reduce the impact of different networks on student client programs, this paper adopts thread pool technology, which minimizes the overhead of resources through the use of multithreading, so as to reduce the adverse impact of network congestion on the graphical interface.

2.1 Microprocessor Core Module Design

According to the performance analysis of digital multimedia terminal system and considering the cost performance of the system, the microprocessor selects DSP high-speed digital signal processing chip TMS320VC5402. The serial processing between the DSP chip and the DSP chip contains a multi-channel buffer to realize the communication between the DSP and the DSP decoder. As an external UO device of DSP, network adapter realizes the design of network architecture. The processing chip includes 8/16 bit SRAM/NOR flash interface, 16 bit SDRAM interface, hardware NAND flash controller, support NAND flash self starting 10 m/100 M adaptive Ethernet MAC, support RMII interface 64 K byte high-speed on-chip SRAM USB1.1 Device, and the full speed can reach 12 mbps. Its on-chip DPLL supports a variety of power consumption modes, such as idle, slow, normal and sleep.

Most peripherals in the system are connected to the system by I/O port, so it is necessary to allocate the I/O end of each module reasonably. The function of UART (serial port) is to realize asynchronous transmission, that is, data transmission with

another asynchronous communication transceiver according to the set baud rate without clock synchronization. UART shall send or receive signals that meet RS-232 protocol bit by bit according to user configuration information. The system has four serial ports, in which serial ports 0 and L are level converted through MAX232, serial ports 2 and 3 are directly led out through TTL, and the level conversion chip max3221 is used. The definition of serial port pin is shown in Table 1 [6].

Table 1. Definition of max3221 chip serial port pin

Serial number	Definition	Working level
RXD	Receive data	1
TXD	Send data	1
GND	Logically	0

In order to meet the real-time requirements of audio and video data transmission used in the teaching process, the transmission layer protocol of the equipment selects UDP protocol, that is, connectionless data transmission, while the application layer protocol adopts Real-time Transmission Protocol RTP protocol. After the audio and video encoded data is generated (TS stream), the data type is analyzed by the data type parser, the serial number generator generates the serial number of the packet data, generates the time stamp according to the system time, and then generates the synchronization source identifier according to the identification ID of the sender, then inserts the information obtained in the above process into the frame header of the RTP message, and fills the data part into the payload of the RTP message, Finally, it is encapsulated by UDP and transmitted to the network. The microprocessor must select the appropriate packet length according to the actual network situation to control the transmission of teaching data resources.

2.2 Communication Interface Design

The mobile terminal connects to the Internet through the wireless network provided by the operator, interacts with the server of the system, and performs operations such as login or file download; At the same time, the administrator can connect to the Internet through the personal computer and manage the files stored on the server through the browser. In consideration of compatibility and universality, this design uses HTTP protocol to realize the communication between mobile client program and server. This is because HTTP protocol is a protocol with perfect performance and function, and has been widely used; Secondly, the mobile terminal device can well support the protocol; Here, the use of HTTP protocol makes the upper program not care what kind of mobile Internet the lower layer uses to communicate, that is, for the upper program, HTTP protocol makes the lower communication technology transparent; Finally, HTTP protocol supports firewall traversal, which makes HTTP protocol applicable to more complex network environments. In HTTP communication, the communication between the client

and the server adopts the mode of request response, that is, after the client establishes a connection with the server, if the client needs a service, it will first send the service request to the server, and then the server will process the request according to the content of the request, and send the processing result to the client after processing [7].

The network interface adopts the chip DM9161E of DAVICOM Company, which is a high-performance network physical layer transceiver. It adopts RMII interface and realizes 10 M/100 Mbps adaptive network port with the MAC controller inside the processor. The main clock required by the system is determined by Provided by an external 50 MHz crystal oscillator. As a device (USB DEVICE) control module defined in the USB protocol, the USBD module is responsible for communicating with the host defined in the USB protocol, completing the processing process specified in the protocol, and completing the data transmission between the chip and the USB host controller through the USB protocol.

In the teaching system, the pins related to the processor: VDD_USB needs to be connected to the 3.3 V logic power supply, VSS_USB needs to be connected to the logic ground, and the other data differential transmission signals D+ and D− are directly connected to the connector of the USB DEVICE. At the same time, in order to realize the stable transmission of data, it is necessary to add an appropriate matching resistance near the USB DEVICE interface. In addition, in order to realize the full-speed operation of USB DEVICE, the D+ pin needs to add a 1.5 K pull-up resistor to 3.3 V.

In this design, a complete information transfer process is divided into four stages: connection establishment, service request sending, response information return and connection closing. For the server, there is an HTTP resident program running on it, which is responsible for responding to client service requests and feeding back the processing results to the client. On the client side, it can send service requests to the server at any time, and these requests can be authentication requests, query requests, function requests, and so on.

On the basis of the hardware framework designed above, the software part of the teaching system is designed to realize the function of situational simulation teaching.

3 Software Part Design of Information Literacy Education Scenario Simulation Teaching System Based on Mobile Terminal

3.1 The Setting of Teaching Content of Information Literacy Education Simulation Scenarios

Different from traditional classroom teaching and online online education, mobile terminals are lighter and more portable, and mobile services are more personalized, so that mobile learning further extends the time dimension of traditional teaching. Students can use fragmented time to conduct MOOC and micro-lectures. Independent study, even scattered time can “turn waste into treasure”. In the environment of mobile learning, the content and form of learning have also changed. The information literacy education that students need to learn is no longer just the basic knowledge and skills of information literacy such as basic information awareness, information processing, and information

utilization, but adapting to modern information. Information identification ability, information retrieval ability, information utilization ability and information sharing ability required by technology [8].

As the object of simulation, information literacy application scenarios are relatively limited, and a scenario and problem background can be described in different scenarios. When conducting information literacy education simulation scenarios, the following points need to be observed:

First, the main body is the student, and the teacher is the organizer and guide. Second, the specific teaching content, the actual situation of the students, and the social reality are the basis for creating situational simulation activities. Third, simulation activities simulate the environment, process and factors of the occurrence and development of things in life or work scenarios. Fourth, students experience, solve problems, and complete tasks to recognize, experience and perceive in the scenario simulation activities; and in the discussion and analysis after the activity, they jointly explore their emotions, attitudes, value orientations and attitudes towards people, things and things. Problem-solving strategies, which enable students to understand knowledge, touch emotions, expand their thinking, and explore appropriate methods and techniques for dealing with problems.

Figure 2 shows the process of students using mobile terminals to conduct information literacy education scenario simulation teaching.

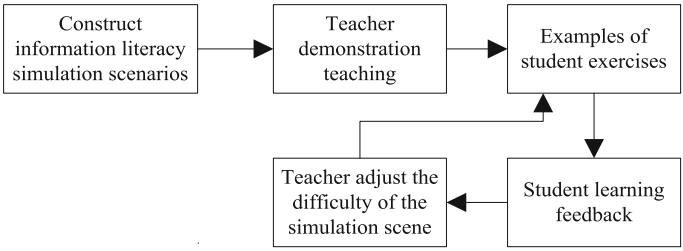

Fig. 2. The situational simulation teaching process of information literacy education

Mobile search is the first and most important part of acquiring mobile information. Training and teaching to improve the mobile search ability of college students should become the primary task of college students' mobile information education. In the teaching process, mobile search should be included in the focus of mobile information literacy education, so as to cultivate students' mobile search knowledge and improve mobile search ability. With the rapid development of information technology in the mobile information environment, the application of voice search makes the search no longer a simple text input of keywords or topics, but a simpler, faster and more direct voice input. By setting information retrieval requirements in different information search scenarios. Students complete the learning of the corresponding teaching content in a given scenario.

3.2 Calculation of Feedback Indicators for Teaching Effect in Simulated Scenarios

By strengthening the evaluation, sharing and feedback mechanism of students, it can improve the enthusiasm and participation of students to join mobile learning, so as to improve the teaching quality of college students' mobile information literacy education. In the process of using the teaching system for teaching, in addition to the statistics of the students' attendance rate, task completion rate and completion quality through the system background, the camera of the mobile terminal device can also be used to count the status of the students experiencing the situational simulation teaching, so as to facilitate timely adjustment of teaching plans and teaching content [9]. The feedback indicators of simulated situational teaching effect studied in this paper are mainly composed of the following contents:

3.2.1 Head Posture Acquisition

Read the head gesture recognition statistical result file, you can get the number of students looking at the teaching surface of the mobile terminal at each time point. Comparing the number of students looking at the mobile teaching display screen at each time point with the total number of attendance, the ratio of the number of students looking at the mobile teaching display screen at each time point can be obtained. The formula for calculating the correctness rate of head posture during literacy education scenario simulation teaching is as follows:

$$D=\frac{100\sum_{i=1}^{n} N_k/N_r}{n} \tag{1}$$

Among them, N_k is the number of students looking at the mobile teaching screen; N_r is the actual number of participants in the course; n is the number of times looking at the mobile teaching screen.

3.2.2 Expression Recognition

Read the expression recognition statistical result file, you can get the number of students who are recognized as listening expressions at each time point. Comparing the number of students who were identified as attentively listening to the total number of attendance, the ratio of the number of students who were attentively listening at each time point was obtained. Assuming that the number of serious listening times is measured, take the average value of all the listening time points in the class, and calculate it on a 100-point scale. The formula for calculating the expression seriousness rate is as follows:

$$R=\frac{100\sum\limits_{i=1}^{n} N_t/N_r}{n} \tag{2}$$

Among them, N_t is the number of people who listened carefully.

3.2.3 Head Up Rate Identification

Read the header recognition statistical result file, and compare the number of headers at each time point with the total number of attendees to obtain the header rate at each time point. Assuming that the class is raised n times and the number of heads is N_h, the average of all head-up time points in the class is taken and calculated on a 100-point scale. The head-up rate indicator is:

$$H = \frac{100 \sum_{i=1}^{n} N_h / N_r}{n} \tag{3}$$

3.2.4 Calculation of Hand Raising Rate

Read the number of people who have raised their hands each time in the human body gesture recognition statistical result file, and compare the number of people who raised their hands each time with the total number of attendance to get the j hand-raising rate U_j. Assuming that m times of hand-raising in class are measured, the average of all hand-raising time points in the class is taken and calculated on a 100-point scale. The score of the hand-raising rate indicator is:

$$U = \frac{100 \sum_{j=1}^{m} U_j}{m} \tag{4}$$

According to the above indicators, in the current teaching process, the learning status of students using mobile terminals to learn the content of information literacy education can be obtained. According to the comprehensive average of the scores of each index, evaluate whether the current teaching content and simulated teaching scenarios can mobilize students' enthusiasm for learning, so as to obtain teaching feedback information.

3.3 Database Design

Each functional module of the teaching system involves a large number of data processing, and data processing is an essential part of any management information system. The design of the system data architecture is actually the design of the data table according to the business requirements. According to the analysis of the main business process, the main data tables involved in the system include: teaching resource information data table, simulated scene information data table, interactive information data table, and teaching feedback information data table. The following Table 2 is the main content of each data table of the system database [10].

The teaching scenarios and teaching contents used in the simulated scenario teaching of information literacy education are stored in the database according to the data table. During teaching, the corresponding simulated scene information can be extracted according to the design of the teaching content for teaching assistance.

Table 2. Database part data table

Field name	Types of	Whether the primary key (foreign key)	Illustrate
ID	int	Primary key	Simulation teaching resource ID number
Name	nchar		name
MakerID	int	Foreign key	Resource producer ID
ResTypeID	int	Foreign key	Resource Type ID
SubjectID	int	Foreign key	Scene type
Abstract	text		Introduction to Simulation Scenarios
QuestionTag	nchar		Question label
StudentID	int		Student ID number
IfAnswer	bool		Have you answered
If Response	bool		Whether to give feedback to students
HardLevel	int		Content difficulty

After the software part designed above is loaded on the system hardware framework, the design of the mobile terminal-based information literacy education scenario simulation teaching system is completed.

4 Test Experiment

The realization of the system is based on the design scheme of the system. Before the actual application of the system, it is necessary to conduct all aspects of performance testing and research on the system.

4.1 Experimental Content

Functional testing is to verify whether the user requirements are realized and whether the system functions conform to the functions of the design content. Therefore, the response rate and packet loss rate of the system in this paper are tested. At the same time, in order to test the actual application of the system, students of different grades in a university were selected to use the system to study, and the students' information literacy ability was improved before and after using the system. Under the guidance of experts in relevant fields, this evaluation adopts a scoring system to obtain corresponding data.

4.2 Experimental Results

4.2.1 Response Rate Comparison

Table 3 below shows the comparison of the response rates of the augmented reality system, the multimedia system and the method in this paper under different response requests.

Table 3. Comparison of system response rates

System requests/103 times	System response time/s		
	Design system	Augmented reality system	Multimedia system
100	1.23	6.3	33.9
150	1.41	8.9	36.2
200	1.49	12.3	39.0
250	1.53	16.8	42.8
300	1.55	22.9	48.3
350	1.58	32.0	52.3
400	1.64	38.0	58.1
500	1.70	59.7	69.2

By analyzing the data in Table 3, it can be seen that when the number of system requests is 300 × 103 times, the system response time of the design system is 1.55 s, the system response time of the augmented reality system is 22.9 s, and the system response time of the multimedia system is 48.3 s; The overall analysis shows that the response time of the teaching system designed in this paper is less than 2.0 s under different service requests, which meets the technical index requirements of the current teaching activities.

4.2.2 Comparison of Packet Loss Rate

Table 4 below shows the comparison of data transmission packet loss rate of augmented reality system, multimedia system and the method in this paper under different response requests.

By analyzing the data in Table 4, it can be seen that when the number of system requests is 100 × 103 times, the data transmission packet loss rate of the designed system is 0.20%, the data transmission packet loss rate of the augmented reality system is 8.2%, and the data transmission packet loss rate of the multimedia system is 6.9%; The overall analysis shows that the packet loss rate of data transmission of the teaching system designed in this paper is less than 0.55% under different service requests, which meets the technical index requirements of the current teaching activities.

Table 4. Comparison of packet loss rate of system data transmission

System requests/103 times	System data transmission packet loss rate/%		
	Design system	Augmented reality system	Multimedia system
100	0.20	8.2	6.9
150	0.25	12.5	8.2
200	0.32	16.2	18.3
250	0.39	18.9	22.7
300	0.43	20.0	18.0
350	0.47	26.5	28.2
400	0.48	29.3	26.0
500	0.55	32.1	32.3

4.2.3 Comparison of Students' Information Literacy Ability

Figure 3 below shows the comparison of the improvement of students' information literacy ability after using the system to teach information literacy-related content.

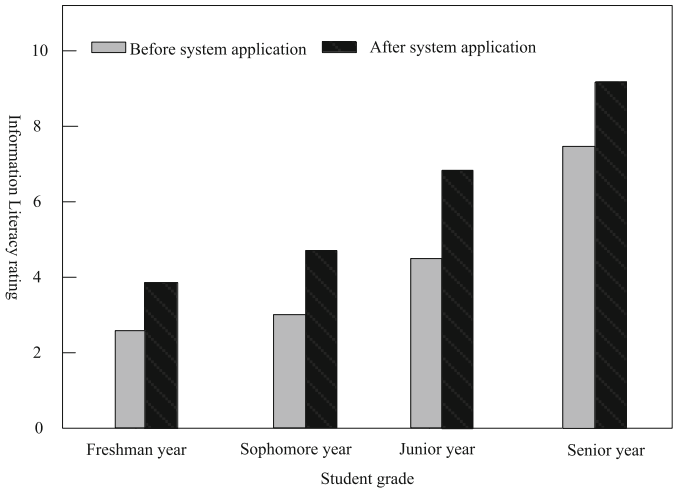

Fig. 3. Comparison of the improvement of students' information literacy ability

Analysis of the information in Fig. 3 shows that after using the system in this paper to study, the students' information literacy ability has been improved to varying degrees, with a minimum improvement of 17.5%, which has a good practical application effect.

4.2.4 Evaluation Results of Students' Information Literacy

The teaching system designed in this paper is compared with the actual application effect of the traditional information literacy education teaching system. 200 students are randomly selected from each grade in colleges and universities, and 800 students are divided into experimental group and control group according to grade. The students in the experimental group used the teaching system designed in this paper when receiving information literacy education, while the students in the control group used the traditional information literacy education teaching system. In addition to the differences in the teaching system used by all students participating in this system application effect comparison test, the factors that interfere with the assessment of students' information literacy level, such as the composition of the teaching staff, teaching content, and plans, remain the same. Before and after the students in the experimental group and the control group applied the teaching system, the distribution of the number of students in different levels of the information literacy assessment in each group was used as an analysis index to compare the actual effects of the two teaching systems applied to teaching. The information literacy of the students in the experimental group and the control group was evaluated by professional experts by scoring and formulating test papers. Among them, the full score of the scoring system is 100 points, and the full score of the test paper is 100 points. The students' information literacy assessment level scores are calculated by weighting. 70 points are the qualified line for information literacy, 85 points are the good line for information literacy, and students higher than 85 points are rated as excellent in information literacy. Tables 5 and 6 below show the comparison results of the actual effects of the systems when different teaching systems are used for information literacy education.

Table 5. Information literacy assessment results of students in the control group

Grade	Forward			Back		
	Excellent	Good	Qualified	Excellent	Good	Qualified
1	8	21	71	10	27	63
2	10	16	74	15	20	65
3	7	18	75	16	24	60
4	10	27	63	17	31	52

Analyzing the data in Table 5 and Table 6 respectively, it can be seen that the use of the teaching system in information literacy education can improve the information literacy level of students of different grades to a certain extent, that is, in the process of information literacy education, the use of the teaching system to assist It can improve the effectiveness of information literacy education. Comparing and analyzing the data in Tables 5 and 6, it can be seen that in the process of information literacy education, using the teaching system designed in this paper, the number of students whose information literacy assessment level has reached excellent and good is significantly more than the results of students' information literacy assessment after using the traditional teaching

Table 6. The results of the information literacy assessment of the students in the experimental group

Grade	Forward			Back		
	Excellent	Good	Qualified	Excellent	Good	Qualified
1	9	19	72	20	54	26
2	11	18	71	24	56	20
3	10	22	68	22	48	30
4	12	28	60	17	31	52

system.. It shows that in the teaching process, using the teaching system designed in this paper can obtain better information literacy education effect, that is, the practical application effect of the system in this paper.

In summary, the mobile terminal-based information literacy education scenario simulation teaching system designed in this paper is suitable for schools to carry out teaching activities. Can meet the teaching needs of the school.

5 Concluding Remarks

With the development of big data, blockchain, artificial intelligence and other fields and their application in real life, the society's demand for high-level talents with information literacy has surged. Information literacy education is the best way to achieve lifelong education and create a learning society. The importance cannot be ignored. With the development of computer-assisted teaching, information literacy has gradually become the focus of user education. Strengthening the education of students' information literacy and improving their information literacy ability is of great practical significance for the future career development of students. It is also the realistic requirement of the information society for education and meets the needs of national development for high-quality and high-quality talents. At present, many regions are also actively promoting the use of mobile terminals, and using mobile terminals to carry out teaching activities can reduce the time and space limitations of traditional teaching systems. Modern mobile terminal technology has made rapid progress. With the reduction of terminal cost and the improvement of technology, the functions are more perfect, and various products are flooding the market. This paper designs a situational simulation teaching system for information literacy education based on mobile terminals, and verifies the feasibility of practical application of the designed system by means of system testing.

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