# Construction of Digital Communication Platform of Yellow River Culture Based on Multimedia Communication

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**Abstract.** The traditional digital communication platform construction method has a small number of functional nodes and high overall message complexity. In response to this problem, a construction method for the digital communication platform of the Yellow River culture based on multimedia communication is proposed. Transform data work into the development and application of the Yellow River culture, clarify the construction goals of the communication platform, use SBC to describe the platform architecture language, build the platform architecture hierarchy, use multimedia communication technology, allocate multi-point conference control servers, and realize cross-component data communication. And optimize the data storage algorithm. The experimental results show that the digital communication platform effectively reduces the network load of the Yellow River cultural information data transmission, reduces the complexity of message storage, and improves the query rate of information data.

**Keywords:** Multimedia communication · Digitization · Communication platform · Yellow River culture

## 1 Introduction

The Yellow River culture has a profound cultural heritage, but with the advent of the Internet era and the era of digital protection of intangible cultural heritage, the traditional mode of development and inheritance of the Yellow River culture has been unable to meet the cultural absorption needs of the public [1]. Therefore, in order to expand the power and efficiency of cultural communication, it is urgent to carry out the digital communication of culture.

In order to improve the status quo of the inheritance and protection of the Yellow River culture, it is imperative to use the digital communication platform to inherit the Yellow River culture. Through the collection and filing of data, it provides more and more possibilities for the protection, development and inheritance of culture. The popularity of the Internet has laid the foundation for the construction of the platform. The platform can realize the sharing, learning, communication and co construction of resources free of


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charge, break through the limitation of learning time and space, and accurately manage the storage, editing, visualization and other shared resources. It has a strong attraction for young groups and audiences who are interested in intangible cultural heritage. It's a digital broadcasting platform. The participants who actively participate in broadcasting also play an important role in the process of spreading and protecting culture.

Reference [2] applies digital management to cultural communication. This method considers that communication and sharing are the key to the completion of cultural inheritance. Therefore, starting from the form of digital information release, it connects the cultural information in the Internet to complete the construction of cultural information sharing platform. However, the communication efficiency of the platform still needs to be further improved. Reference [3] applies the cultural information transmission code to the design of cultural communication platform, and constructs the risk model of cultural communication from the perspective of communication risk theory. Based on the calculation results of risk model, the information decoding method is used to share and spread culture. But the transmission accuracy of the platform can not meet the demand.

There are three ways of digital protection of cultural works in China, namely, using digital technology to reconstruct the cultural environment, using cultural resources to build a remote sharing platform, and filing and preserving cultural resources in digital media, extending the preservation time of cultural resources through digitization and giving them practical value, and using automated 3D digital virtual machine to research cultural history. At the same time, it analyzes the significance of digital strategy on cultural protection and communication from the perspective of policy. On the basis of the above theory, this paper puts forward the construction of digital communication platform of Yellow River culture based on multimedia communication.

## 2 Construction of Digital Communication Platform of Yellow River Culture Based on Multimedia Communication

### 2.1 Platform Construction Goals

Establish a database of the Yellow River culture that connects the computer and the web, and use the database as the core of the entire digital communication work to transform the data-based work into the development and application of the Yellow River culture, bringing unlimited potential to it. The current development space of the traditional Yellow River cultural industry model is limited, and the main shortcomings are mainly reflected in: the diversified and innovative development mechanism of the Yellow River culture has not yet been formed; the lack of public service platforms that can take into account the protection of the original ecological culture, and the transformation of internationalization and industrialization; Independent innovation and technology development capabilities, and market expansion capabilities are limited, failing to form an influential brand and production base.

In view of the above shortcomings, the platform construction objectives and database platform construction objectives are clarified, and the important information support of digital informatization is provided for related industries based on the needs of the Yellow River cultural industry. Improve and enrich the diversification of the Yellow River

culture industry chain, support the creation and development of the Yellow River culture brand, and build the Yellow River culture service platform for the whole industry [4]. The platform construction is conducive to the popularization, cultural creation, fashion and internationalization of the Yellow River culture. Using the Internet environment and digital technology, we have established an open, shared and interactive experience platform for serving the people and adhering to the people-oriented principle. The inheritance and protection of the Yellow River culture, rooted in all aspects of people's life, realizes the digital protection and international dissemination of the Yellow River culture. To a greater extent, promote the cultural transformation and industrial revitalization of the Yellow River, and realize the national cultural confidence. So far, the Yellow River Cultural digital communication platform construction goal is clear.

## 2.2 Constructing the Digital Communication Platform Architecture of the Yellow River Culture

**Describe the Architecture Language of the Digital Communication Platform**
Use the SBC architecture to describe the architecture language of the digital communication platform. The SBC architecture is an architectural theory that integrates "structural behavior". It has an integrated perspective. This theoretical system can completely describe and express multiple views, and master the backbone of the system. It can use the causal relationship between "structure" and "behavior". Logic formulas, graphical illustrations and other methods are clearly listed, and these relationships are all produced by the interconnection and interaction of "components". SBC architecture has guiding advantages. It is very practical to construct elements and define behavior functions of communication platform through architecture hierarchy diagram, framework diagram, component operation diagram, component connection diagram, structure behavior integration diagram and interaction flow diagram in architecture description language. With the help of architecture hierarchy diagram, structure behavior integration diagram and interaction flow chart, the media composition, function positioning and interactive behavior relationship of the Yellow River culture digital communication platform are constructed respectively. Compared with the non architecture oriented linearity and locality, SBC architecture can comprehensively sort out the "structure" and its corresponding "behavior" of the Yellow River culture digital communication platform, "Structure" can be understood as the internal form formed by all kinds of media, while "behavior" is the corresponding function, role and interactive relationship. Finally, a specific, targeted and interpretable analytic diagram is obtained. Based on this, in the practice of digital communication of the Yellow River culture, corresponding media strategies are formulated, and complementary advantages and multi-directional cooperation are paid attention to, so as to construct a pluralistic and multi-directional communication platform The communication platform system of the body [5]. So far, the description of digital communication platform architecture language is completed.

**Constructing the Architectural Hierarchy of Digital Communication Platform**
The digital communication of Yellow River culture should not only pay attention to the construction of "visual scene", but also pay attention to the construction of "public opinion scene", and build a platform architecture. The "visual scene" is mainly to build

a situation, so that people can experience the Yellow River culture personally, while the "public opinion scene" created by websites and social media can form multiple public opinion fields of the Yellow River culture in the network, so as to form a continuous and extensive information interaction and transmission [6]. The details are shown in Fig. 1.

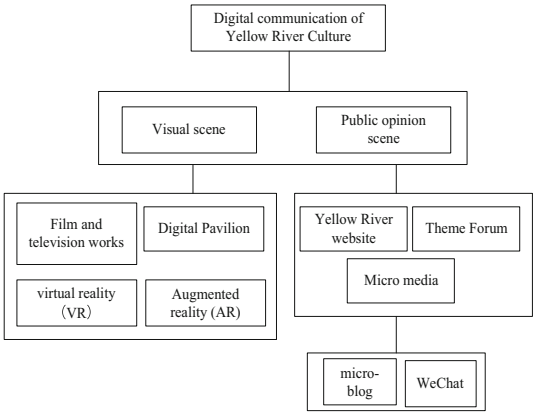


**Fig. 1.** Hierarchy of the communication platform architecture

As shown in the figure above, through the collaborative construction of multiple scenarios and multiple channels, the Yellow River culture has formed a diversified stimulus to the audience, prompting the people to continuously enrich and deepen the cognitive level, and shape a scientific and good cultural communication ecology. The digital communication platform of the Yellow River Culture must integrate its "structure" and "behavior". This is also an important feature that distinguishes the architecture orientation from other methods. After combing the components of the digital communication platform of the Yellow River culture, the "Behavior" refers to the clear positioning and description of functions, thereby enhancing the pertinence and effectiveness of cultural communication, allowing various media to play their strengths in their respective fields, diversifying and co-constructing, forming a three-dimensional red cultural digital communication network ecology. So far, the construction of the digital communication platform architecture has been completed, and the construction of the digital communication platform of the Yellow River Culture has been completed.

### 2.3 Establishing Platform Control Terminal Based on Multimedia Communication

SIP function is added to the platform architecture. By using multimedia communication technology, multipoint conference control server is assigned as the control end of the communication platform to complete the specific media processing. After users register for the digital communication platform, the platform carries out user management, including identity authentication and management. When users want to understand the

Yellow River culture, their SIP requests will be forwarded to the multi-point conference control server by the platform. The multi-point conference control server is used to complete the specific media negotiation. After the media negotiation is completed, the multi-point conference control server passes through xmlr PC interface, which interacts with multimedia communication server, including creating conference room, joining members and other operations. Finally, the media is negotiated through SIP protocol, and RTP transmission channel is established. Subsequent media processing is completed by media server [7]. The overall architecture of the media communication terminal is shown in Fig. 2

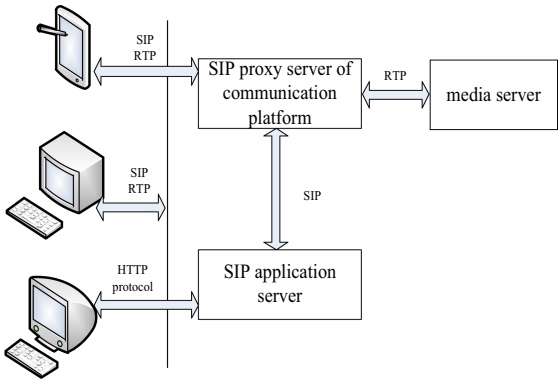


**Fig. 2.** Multimedia communication control terminal

As shown in the figure above, the multipoint conference control server is an important part of the multimedia communication platform. When more than two servers access the platform, the MCU must tandem, distribute and switch each communication signal, and complete the platform control. The MCU functions as a switch. The audio, video, data, signaling and other data of the platform terminal equipment must be processed and connected by the MCU and connected with other MCUs. The MCU separates the information flow of each terminal on the platform., Extract various information such as audio, video, data, signaling, and send different information to different modules for processing, complete audio mixing and switching, video information mixing or switching, data information broadcasting and routing, timing and signaling control, etc. Finally, the processed audio, video, data, and signaling are recombined and sent to each corresponding terminal of the platform [8]. The MCU of the Yellow River Cultural Digital Communication Platform is mainly composed of two parts. The first is terminal control, and the other is media processing. These two parts broaden the media processing capabilities of the digital communication platform, separate media processing from terminal control, and greatly improve The media processing capability of the dissemination platform also reduces the burden of terminal control, and the multipoint conference controller also has functions such as terminal control and management of media servers [9]. So far, the establishment of platform control terminal based on multimedia communication technology is completed.

### 2.4 Optimize the Communication Process of the Digital Communication Platform

SIP communication protocol is used as the transmission control protocol of multimedia communication to optimize the communication process of communication platform. The signaling and media transmission control protocol in the platform are the basis of platform communication development, as shown in Fig. 3

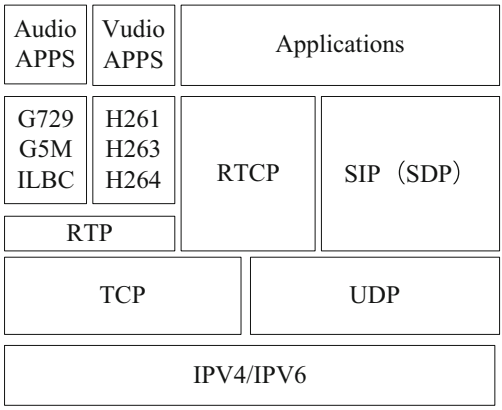


**Fig. 3.** Platform communication protocol and hierarchy

As shown in the figure above, the application of voice and video and SIP protocol is at the top level. SIP protocol can run independently. At the same time, for the convenience of SIP protocol, SDP protocol is used to modify the session attributes of SIP. SDP protocol is used to negotiate the media features in SIP signaling through offer answer mode. SIP signaling completes the establishment of session through UA. When the session is established, voice and video will play an important role The frequency media is encapsulated by RTP protocol, and the appropriate transmission mode is selected to interact on the network. RTCP is used to control RTP, UDP and TCP in transport layer to complete data transmission. At the same time, all the above protocols are located on the network layer. User agent is the logical network endpoint of SIP protocol, which is used to create, send and receive SIP messages, and manage SIP sessions. SIP user agent is divided into user agent client and user agent server. UAC is used to create and send SIP request messages. UAS is used to receive and process messages sent by UAC. The registration server also has a certain positioning ability. It forms a whole with proxy server and positioning server. The proxy server is located in sip on the network Between UAC and UAS, it is used for proxy routing messages between UAC and UAS. The proxy server is also used for routing control check, and the location server is used to store the location information of feedback users, which can be obtained from the registration server and related databases [10]. The LDAP protocol is used to locate the interaction protocol between the server and SIP server. The server accepts SIP requests, but does not send any SIP requests. It maps the original address in the request to an address list and returns it to the platform client. It can also return an empty table to

indicate the rejection of the request. The whole message process is that when receiving the cancel request, the server replies to 200 OK, indicating successful response and response When the SIP transaction ends and a message other than cancel is received, all available routing addresses are replied. So far, the optimization of communication process of digital communication platform is completed.

### 2.5 Constructing Hierarchical Mechanism of SIP Communication Protocol

SIP is a layered protocol. Therefore, it is necessary to build a layered mechanism of SIP communication protocol so that when a function is described by the communication platform, it can easily span multiple components. The SIP protocol of the communication platform is divided into four layers, from top to bottom, they are transaction user layer, transaction layer, transport layer, syntax and coding layer. The SIP entity belongs to the transaction user layer, and the role of this layer is when the transaction user sends a request, It will establish a client transaction instance, transfer the request transmission mechanism, and its IP address and port number. The transaction layer is a basic element in the SIP protocol. From the client transaction to the server transaction request, the transaction layer processes the retransmission request of the application layer, matches the response request, and handles the timeout request of the application service layer. Any UAC request The completed tasks are composed of multiple transactions. The transport layer defines how to communicate requests and send responses between the client and the server on the network. The coding layer is the bottom layer of the SIP protocol to complete SIP protocol requests and response messages. The grammatical structure and analysis of SIP protocol, the message header field of the SIP protocol contains a lot of information in SIP signaling, and there are a total of 44 message header fields, each representing different information. The standard request types of SIP signaling are divided into six categories, which represent different functional descriptions, making it easy for users to distinguish the types of request messages. From the first line of the request message, you can see which type of request message belongs to. The message consists of message type, message network address and SIP version number. The first type of request is INVITE, which is used to invite users or services to join the session. The INVITE message contains a three-way handshake process. First, the client transaction initiates an INVITE request, and then serves. The client transaction returns a response, and finally the client transaction sends an ACK. The hop-by-hop mechanism is used to ensure that each signaling is successfully transmitted to the next hop. The INVITE message body contains SDP information to describe the media information in the SIP signaling.; The second type of request type is REGISTER, which is used by a licensed client to send registration information to the server, including requests for adding, querying, and deleting, so that the client's address can be recognized by the server; the third type of request type is ACK, using In the three-way handshake on the INVITE message, it confirms the INVITE message that has been received. If it is not received, it will cause the retransmission of the INVITE message; the fourth type of request is CANCEL, which is used to cancel a request, but CANCEL cannot be cancelled. End request message; the fifth type of request is BYE. BYE is used to send a request to the server to indicate that the communication platform wants to end the session. The BYE can be initiated by the calling party or the called party, and wait until the BYE request is received. After that, it will stop sending

media streams to the other party; the sixth type of request type is OPTIONS, which contains the information used to request the performance of the SIP server, the methods supported by the SIP server, and the SDP protocol information. Finally, in response to the message sent by the communication platform, when the UAS receives the request information sent by the UAC, it will reply a response status code to the UAC, which is used to express the response to the request message. If you want to distinguish different reply status information, you can use three digit decimal numbers represent different status codes. From 100 to 699, the first digit of the status code indicates the type of the response message. The same first digit indicates that the type of the platform response message is the same. Combine the last two digits. Different response messages can be distinguished. So far, the construction of the layered mechanism of SIP communication protocol is completed.

### 2.6 Data Storage Platform Optimization Algorithm

Optimize the data storage algorithm of the platform, and transmit the stored data through the above communication protocol. Firstly, the routing protocols of the platform are divided into the following three categories: clustering based protocol, geographic location based protocol, and query based protocol. Clustering protocol divides the nodes in the network into multi-point clusters according to geographic location and signal strength, and selects a cluster head node to undertake the task of communication with other clusters, while other nodes in the cluster In order to save energy and wait for cluster head rotation, the non cluster head node has no task and can enter the sleep state. Location based routing protocol requires nodes to know their location information in the sensor network of the platform. The location information is the real geographic location, and it is also the virtual coordinates of the structure. The primary task of the protocol is to locate the node, build the location coordinate system, and then send the data in the network to the destination node. According to the set routing rules, select the next location of the data One hop node, a data centric storage method, uses geographic location information to map event data, and event attributes contain the location information of the collection node. Users can send query packets to network nodes, randomly find targets in network transmission, and find and determine the storage node of information data according to data storage rules. The probability of node $k$ being selected as storage node is as follows:

$$P = \frac{e^{-\lambda|A|}(\lambda|A|)^k}{k!} \tag{1}$$

In the formula, $P$ is the selection probability of nodes in the region, $\lambda$ is the node density, and $A$ is the area of the region. When routing protocol transfers information data for the purpose of data storage, it transfers the data from the source node to the storage node specified by the storage algorithm. Meanwhile, Lushan protocol also undertakes the task of discovering the storage node. According to the geographic mapping table, it maps the data to the geographic location:

$$x_{1i} \to \frac{k_1}{k_2}x_{1k}, \ldots, x_{mi} \to \frac{k_1}{k_2}x_{mk} \tag{2}$$

In the formula, $x_{1k}$ and $x_{mk}$ respectively represent the set of two mapping data tables. At the same time, considering the storage load balance and query path energy efficiency of the platform, the data packet is forwarded to the nearest target location in greedy forwarding mode:

$$P(V_i) = \lambda^{-1}\varsigma \frac{\sum_{i=1}^{m} x_i^2}{m\sum_{i=1}^{n} V_i^2} \frac{n!}{m!(n-1)!} f(V_i, V_k)^{-1} \tag{3}$$

In the formula, $\lambda$ is the forwarding factor and $\varsigma$ is the relative error of data forwarding.

The expected number of hops between neighbor node and target node is calculated:

$$G = \frac{R}{d} \tag{3}$$

In the formula, $G$ is the expected hop number of nodes, $R$ is the transmission range of nodes, and $d$ is the expected distance between any two points in the plane of network abstraction. Finally, the data files generated by the platform are stored in the HDFS file of Hadoop bottom layer, including hfile and Hlog file. Hfile is the data storage format of HBase, which is a binary format file. It is a lightweight packaging for the information data of the Yellow River culture, and Hlog file is used File is the wal storage format in HBase, and its data update is divided into the following processes: the platform client first initiates the operation of data update, encapsulates each operation, and then sends the data packet of information data through RPC remote procedure call. When the data arrives at the terminal, it will be sent to the specified key, and the data will be written into the wal and stored in the corresponding memstore to reach the specified destination After a certain period of time, the written data will be asynchronously persisted to the file, so the optimization of the platform data storage algorithm is completed. So far, we have completed the design of the construction method of the Yellow River culture digital communication platform based on multimedia communication technology.

## 3 Experiment and Analysis

This design method is recorded as experimental group A, and the two traditional digital communication platform construction methods are marked as experimental group B and experimental group C respectively. Comparative experiments are carried out to compare the number of functional nodes and storage methods of the communication platform sensor network Overall message complexity.

### 3.1 Experimental Preparation

According to the construction ideas of the above digital communication platform, the functional structure of the experimental group a communication platform mainly includes three aspects: Yellow River culture school, mass creation space and material

library, highlighting the characteristic functions of personnel training and product innovation of the Yellow River culture. The platform also includes the function of "spreading the Yellow River culture", which helps the public to understand the latest information and information of the Yellow River culture in time Development trends. The digital communication platform of the Yellow River culture mainly includes the following contents: the Yellow River culture school carries out the communication education of the Yellow River culture simultaneously through the experience of online and offline schools, and the classroom includes master lecture, culture class, historical biography and other courses, so as to spread the Yellow River Culture, popularize the Yellow River culture knowledge of the platform readers, and implicitly cultivate the Yellow River culture talents The Yellow River culture school column undertakes the main content of the Yellow River culture autonomous learning section in the digital communication platform, which belongs to the functional characteristics of the platform. The public creative space includes such functional units as interactive communication, inspiration seeking, creative design and employment support. It combines innovation and entrepreneurship to provide a good innovation development space and entrepreneurial development platform for the majority of Yellow River culture lovers. By building an independent digital communication platform, it conforms to the development trend of "mass Entrepreneurship and innovation", and creates a good Yellow River culture environment. The column construction also belongs to the functional characteristics of platform construction. The material library mainly provides the electronic text library, online knowledge test database, video teaching and its materials, appreciation and download of pictures, etc. it is the main sharing column area of the platform, disseminating the latest information of the Yellow River culture, recording the story of the Yellow River culture, and developing innovative works of the Yellow River culture, including furniture, home decoration and clothing. At the same time, it also publicizes and introduces the excellent Yellow River cultural innovation team and R & D products.

The multimedia communication process of experiment group A is as follows: create multimedia communication data packets, obtain media streams through the channels, remove jitter, decapsulate data packets, and decode the media streams to complete the encoding of the media streams and encapsulate them into data packets. And finally send the data out through the channel, and the sent data is the transcoded data. The business starts with the creation of the video decoding end and the encoding end, completes the adjustment of the video resolution, creates a video mixer, mixes the media stream, and finally sends it to the access end of the platform. The initial processing capacity of the media control terminal is shown in the following table (Table 1):

Affirmative simultaneous interpreting of 1000 identical sensor nodes in the communication platform, and making them evenly distributed in the sensing area of the platform, so that all nodes can arrange a square area of 100 m * 100 m. The size of the packet is 70, the size of the query packet is 10, the index information size is 10, and the random location in the sensing monitoring area generates 10 events. Make the data packet larger than the index information size, select the number of hops between the storage node and the ordinary node as 3, and the number of hops between the storage node and the index node as 4.

**Table 1.** Processing capacity allocation of media controller

| Serial number | Object type | Processing capacity |
|---|---|---|
| 1 | 1080P | 800 |
| 2 | 720P | 330 |
| 3 | SD | 160 |
| 4 | CIF | 50 |
| 5 | QVGA | 30 |
| 6 | QCIF | 12 |
| 7 | Audio frequency | 10 |

### 3.2 Experimental Result

In the above experimental environment, the comparative experiments of three groups of digital communication platform were carried out. A total of 100 experiments were carried out, and the average experimental results of 100 experiments were taken for demonstration, so as to improve the reliability of the experimental results.

The comparison results of the number of function nodes are as follows (Table 2):

**Table 2.** Comparison of the number of functional nodes

| Node transmission range/m | Number of functional nodes in group A | Number of functional nodes in group B | Number of functional nodes in group C |
|---|---|---|---|
| 10 | 63 | 45 | 40 |
| 20 | 63 | 46 | 40 |
| 30 | 64 | 48 | 43 |
| 40 | 67 | 48 | 43 |
| 50 | 68 | 48 | 44 |
| 60 | 68 | 49 | 44 |
| 70 | 69 | 52 | 47 |
| 80 | 70 | 54 | 49 |
| 90 | 70 | 54 | 51 |
| 100 | 72 | 57 | 53 |

As shown in the above table, the average number of functional nodes of the experimental group A construction platform is 67.4, and the average number of functional nodes of the experimental group B and the experimental group C are 50.1 and 45.4 respectively. Compared with the experimental group B and the experimental group C, the group A The number of functional nodes increased by 17.3 and 22.0 respectively.

On the basis of the first set of experiments, compare the overall message complexity of the storage methods of the sensor networks of the three groups of communication platforms, and change the average query interval. When the message complexity is smaller, it indicates that the query rate of the communication platform is greater. The comparison results are shown in the following table (Table 3):

**Table 3.** Comparison results of message complexity

| Average query interval/s | Group A message complexity | Group B message complexity | Group C message complexity |
|---|---|---|---|
| 5 | 132 | 156 | 183 |
| 10 | 122 | 163 | 193 |
| 15 | 125 | 160 | 184 |
| 20 | 139 | 163 | 180 |
| 25 | 137 | 152 | 185 |
| 30 | 131 | 169 | 194 |
| 35 | 129 | 162 | 193 |
| 40 | 123 | 163 | 192 |
| 45 | 128 | 160 | 190 |
| 50 | 139 | 163 | 191 |

As shown in the above table, the average message complexity of the experimental group A construction platform is 130.5. The average message complexity of the experimental group B and the experimental group C are 161.1 and 188.5 respectively. Compared with the experimental group B and the experimental group C, A The message complexity of the group platform storage method has been reduced by 30.6 and 58.0 respectively. To sum up, this design method has given full play to the advantages of multimedia communication technology. Compared with the traditional digital communication platform construction method, it has increased the number of functional nodes of the sensor network, including index nodes, storage nodes, and spare nodes, effectively reducing The network load when the platform transmits the Yellow River cultural information data, at the same time, reduces the message complexity of the storage method, increases the query rate of the information data, and improves the competitiveness of the construction platform in the field of Yellow River cultural communication.

## 4 Concluding Remarks

The design method for the Yellow River culture, the construction of a digital communication platform, ease the load of the platform sensor network, improve the query speed of information and data. However, there are still some shortcomings in this research,

which focus on the cross layer design of application layer data storage and network layer routing protocol. In the future research, we will provide different precision and multi-resolution query reply for data query.

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