

An Intelligent Network Video Chat System Based on VNN Platform

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Abstract—The epidemic of novel coronavirus pneumonia (COVID-19) has spread worldwide, which greatly affected people's daily life, study and office. Especially the distance education needs better video communication software. Among them, video chat technology is the key technology. At present, there are a large number of video chat systems in the market. Based on the analysis of the technical background of video chat system, this paper proposes a new P2P video chat system design, aiming at the problem of unstable video communication in the current video chat system. Based on VNN technology, this paper presents the logic and model design of P2P video chat system, including login and call model, and analyzes its workflow. Finally, the prototype system of video chat room is realized. The video communication of the system is smooth and the picture quality is good. Next, we will use the technology in the research and development of distance education system, which can be applied in the teaching of colleges and universities.

Keywords-VNN; P2P; Video Chat; COVID-19

I. INTRODUCTION

A novel coronavirus pneumonia outbreak in early 2020 was affecting the heartstrings of China's 1 billion 400 million people. Affected by the novel coronavirus pneumonia epidemic, coincides with the Spring Festival holiday, enterprises have responded to the national policy to cope with the epidemic, and extend the time of resumption after the holiday. In order to avoid cross infection in the process of return / work, many enterprises advocate the humanized office mode - "remote office". According to the analysis of China Research Institute of PricewaterhouseCoopers, the demand for online office is driven by the exogenous of the new crown epidemic, and the nature of the demand is emerging, and the office mode is expected to start to be reconstructed. In the short term, online office and cloud video with advantages of mobility and convenience will be accepted by more people; in the long term, online office system and cloud video conference service will be widely used in more fields. In the epidemic environment, traditional office methods are limited, and enterprises have moved to online office, and all kinds of online office platforms have been expanded urgently.

In order to avoid the crowd infection under the new crown epidemic, the traditional office building office mode is limited. In order to ensure the normal operation of the

company, the enterprise transferred to online office mode. At the same time, online office and other measures have also been encouraged and supported by the government. A large number of enterprises have responded to the new model, allowing employees to work online at home and realize remote office, which will greatly stimulate the demand for online office and other products.

At present, there are many video chat software^[1-5] in the market, and the technology is basically mature. However, after testing and research, it is found that the effect of video communication in the video chat system is not stable, except for the influence factors of network bandwidth and video compression coding technology^[6-9], mainly because there is no real point-to-point communication, and there are certain defects in penetrating the proxy or firewall. If the client has public IP, or both ends of the communication are in the same agent or firewall, their video communication will be more smooth and effective; otherwise, the quality will be poor, or even unable to communicate, because at this time, the data is transferred through the server, and the bearing capacity of the server is limited. P2P technology is a popular network application technology^[10], and it has been widely and well applied in video service^[11,12]. From the practical application, in order to achieve a stable P2P video chat effect, we must find a way to realize the penetration function of proxy or firewall, and truly realize the point-to-point communication of video data.

VNN (virtual native network), which means "virtual local network" in Chinese, provides interworking services for any two machines connected to the Internet^[13,14]. VNN connected machines are just like in the same LAN. Even if these machines do not have public network addresses, they are all in private networks. Applications that break through the IPv4 address limit can be connected transparently through the end-to-end network, through NAT or proxy servers or different fire walls. Therefore, the point-to-point communication between any two computers on the Internet can be realized by VNN technology.

Based on the above analysis, this paper proposes a P2P video chat system based on VNN platform. In this system, as the text chat and SMS sending functions have been basically improved, video communication is the focus of research. This paper analyzes the logic design and module design of the system, combines the characteristics of VNN technology, realizes a P2P video chat prototype, and improves the stability of video communication on the Internet.

II. LOGIC DESIGN OF SYSTEM

For video chat system, there is a login interface. In the login registration interface, the user is required to enter the user name and password correctly. Only legitimate users can enter the video chat room. The login authentication includes "modify data", "change password", "retrieve password", "user registration" and other functions. Video chat needs point-to-point transmission of video data, and the key to realize the technology is to determine the location of both sides of video chat. The design flow of video chat communication is shown in Figure 1.

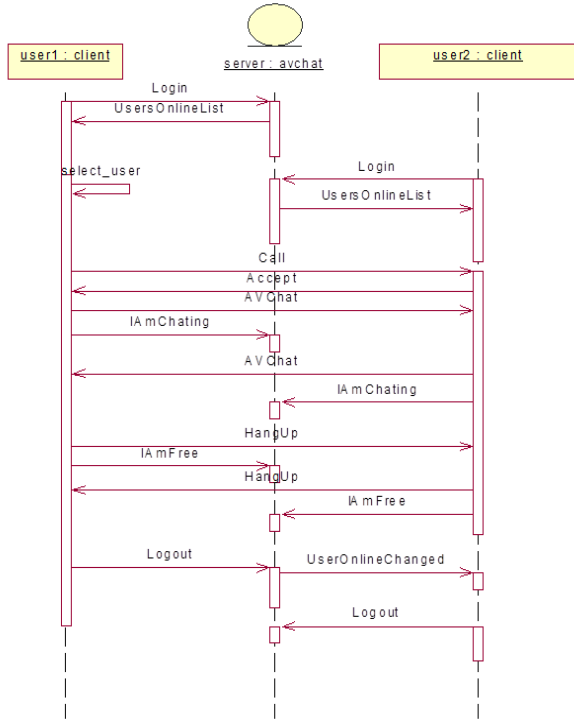


Figure 1. Sequence graph of logic design to video chat

III. MODULE DESIGN OF SYSTEM

The video chat system based on VNN platform has many functional modules, including login module and call module.

A. Login module

The login module mainly completes the process of users logging into the video chat server. This is the user's entrance to the video chat room. In this module, first of all, we need to do some initialization work for the video chat system, and need to record some basic information of users and analyze the characteristics of the network. The initialization work includes the initialization of VNN platform and the initialization of video services.

The function of the module is to provide a login interface where the user can input the user name and password. At the same time, it should also have the functions of registration, password retrieval, data modification, etc. If the user logs in

successfully, the user should be allowed to enter the video chat system. Otherwise, the user is required to log in or register again.

There are two main performance modules: initialization of VNN platform and initialization of conf service. When the user logs in to the server, he / she should obtain the access information of the user, and make sure that the user works under the proxy or behind the firewall or NAT. If so, initialize the VNN platform and create the VNN adapter. If not, use the adapter of the local machine instead of initializing the VNN platform. Then, we need to initialize conf to initialize the preparations for video chat, which can also be put into the call module.

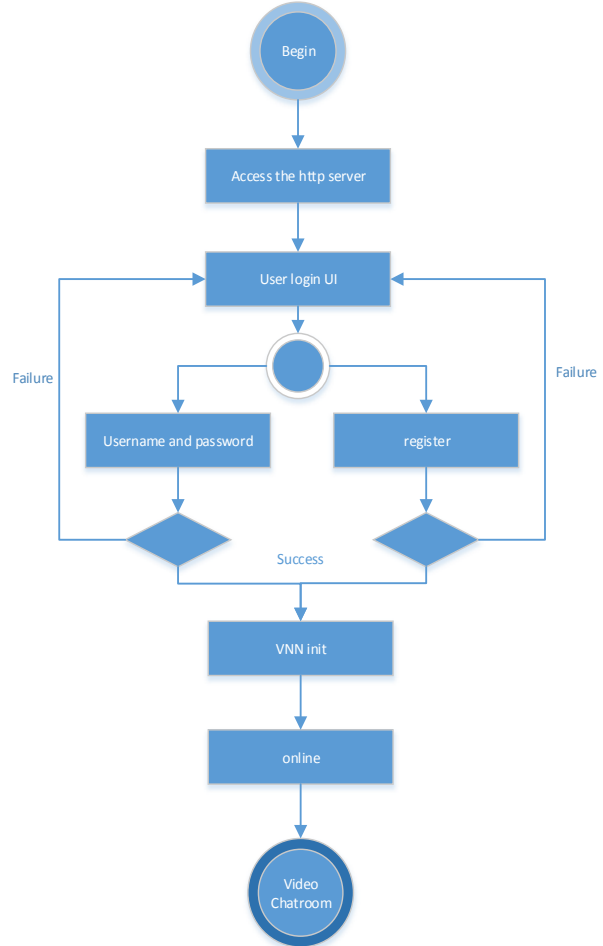


Figure 2. Activity chart of login module

The input items of the module are user name and password, which implies the user's machine information and network path. The output of the module includes the IP of the adapter of VNN platform, the IP of the local network card of the user, the IP of the network card of the user agent, as well as the information of whether the user has successfully logged in, whether it is online, whether it is in video chat, etc. These entries are required to be written to the server database after login according to the user login.

According to the above analysis, the flow chart (i.e. activity chart) of login module is given, as shown in Figure 2.

B. Call module

The login module mainly completes the process of establishing video connection, video chat and closing video service. In this module, the first step is to determine the video chat object, make the video connection request, then establish the video connection, carry on the video chat service, and carry on the video chat communication. Its characteristic is based on the VNN platform, which can quickly establish the video connection.

The function of the module is that after users click the video chat object in the online user list, click the call button in the chat room interface to send a video chat request to the video chat object. If the other party rejects the video request, it will return that the video chat request is rejected. If the other party accepts, then both parties can establish video connection and conduct video voice communication. As long as one party clicks the hang up button, the video connection will be closed. Both sides quit video chat at the same time.

The input item of the module is the name of the online user to be called by the user, which contains the proxy IP address (PIP), local IP address (LIP), VNN virtual network card IP (VIP) and other information of both users. Among them, if the user is not under any proxy, its proxy IP address is 0.0.0.0.

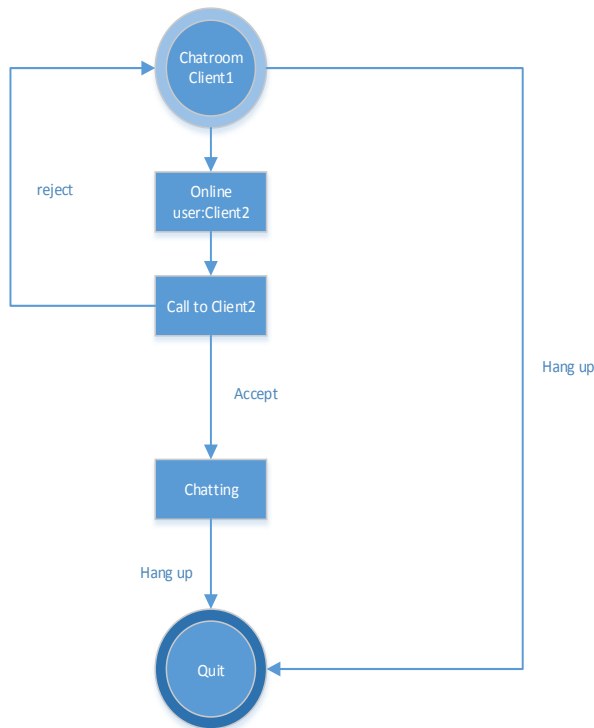


Figure 3. Activity chart of login module

If the call request is established, that is to say, the other party accepts the call request, then it is necessary to record their information in the database, such as video chat, etc.;

once they hang up the video connection, modify the information to video chat idle.

According to the above analysis, the flow chart (i.e. activity chart) of the call module is given, as shown in Figure 3.

The situations that need special explanation are virtual call to and auto accept. This kind of situation mainly exists in that the client 1 that sends the call has the real IP (Internet IP) while the called client 2 is behind the proxy or firewall. In this case, the IP address of VNN platform can also be used for normal calls. However, in order to reduce the access to the server of VNN platform, virtual calls are used: first, the caller client1 sends information to the web server to call the caller of client2, which is recorded in the database of the caller of client2 (client1 < client2), from the server to the caller of The caller, client2, sends this message and asks whether to accept it. If it does, client2 will send a call to client1. When client1 receives such an implicit call, it will automatically accept it. Thus, a video connection is established. No matter whether Client2 accepts the virtual call or not, it will send information to the server, indicating that it has processed the situation (Client1 called to Client2) recorded in the database of Client2, that is, it modifies the database to delete the record. The purpose of recording the information is to view the information when the server push technology sends the text message to the client, so as to start the virtual request.

IV. EXPERIMENT RESULT

Microsoft Visual Studio. Net2015 is used as the main programming environment for developing video chat system. It is debugged and run on the machine equipped with. Net framework. The specific parameters of the experimental environment are shown in Table 1.

TABLE I. PARAMETERS OF EXPERIMENTAL ENVIRONMENT

Item	Value
Server operating system	Windows 2016 Server
CPU	AMD 4Core 2.8GHz
Memory	4G DDR
Graphics card	NVIDIA Geforce 9400 GT
Programing language	C# 2015+ASP.NET4.0
COM mechanism	VC++60
Communication platform	VNN

Using C # and asp.net programming language to code, an asp.net web application is established. Based on VC6.0 development environment, VNN technology and underlying communication platform, two client COM components (ActiveX control) are designed and implemented by using COM programming mechanism: login.ocx and callto.ocx. As invisible controls, they are embedded in asp.net web application, calling their methods, properties or triggering their events when necessary, to achieve the functions

required by login module and call module. By compiling and debugging the control and asp.net web application program, a video chat web server is established. The registered users can enter the video chat room for video voice communication by visiting the server.

The prototype of the video chat system is shown in Figure 4. Due to the copyright and portrait rights involved, part of the content of the head portrait is hidden.



Figure 4. The prototype of the video chat system

After joint debugging and testing, the prototype of P2P video chat room based on VNN platform has achieved the function of P2P video chat, and the video is relatively smooth, and the call effect is good.

For the purpose of practicality, through the analysis of the current situation of video chat system technology, based on VNN platform, this paper proposes a design method of P2P video chat system, focusing on the design of its login module and call module, and analyzes the logic flow of this module, and finally realizes a prototype of BS mode video chat room.

V. CONCLUSION

From the test results, based on VNN platform chat room, video call quality is relatively good, smooth communication. No matter chat parties are in any corner of the Internet, they can call conveniently and quickly, realize P2P video chat function, break through the restriction of firewall and proxy server, and lay the foundation for the next step to expand the wide application of video chat room.

It has been a long time since the start of school in 2020. Due to the epidemic, many school students are using distance learning for teaching and learning. To carry out distance education, of course, we cannot do without video chat system, HD video server and other equipment, which also directly affects the development and progress of video chat technology. The research of video chat system based on VNN can be used in distance education.

In today's world, with the rapid development of science and technology, the knowledge-based economy is on the rise, and the competition for national strength is becoming

increasingly fierce. In the 21st century, people's demand for education is increasing. As a new education mode, modern distance education is an important means to improve the scientific and cultural quality of the whole nation, to promote the reform of educational thoughts, contents and methods, to promote the modernization of education, and to meet the growing demand of lifelong learning of the society. The implementation of modern distance education project is also an effective way to speed up the development of education and improve the scientific and cultural level of the whole nation under the condition of the shortage of educational resources in China.

Novel coronavirus pneumonia epidemic background^[15-18], the digital transformation of China's society makes the development of video communication system become a very important technology. The video chat system we developed also connects any two friends through video call. They can be engaged in individual work and public relations work of technology companies, and they can choose to work at home.

Therefore, our next research direction is to solve the current problems of video system in distance education, improve the efficiency of video communication of the system, and launch the application of video chat system based on VNN platform.

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