

Video Sharing System Based on Wi-Fi Camera

Qidi Lin, Hwei Yu, Jinbin Huang, Weile Liang

Abstract—This paper introduces a video sharing platform based on WiFi, which consists of camera, mobile phone and PC server. This platform can receive wireless signal from the camera and show the live video on the mobile phone captured by camera. In addition, it is able to send commands to camera and control the camera's holder to rotate. The platform can be applied to interactive teaching and dangerous area's monitoring and so on. Testing results show that the platform can share the live video of mobile phone. Furthermore, if the system's PC server and the camera and many mobile phones are connected together, it can transfer photos concurrently.

Keywords—Wifi Camera, Socket, Mobile platform, Video monitoring Remote control

I. INTRODUCTION

VIDEO monitoring system is made up of real-time control system, supervising system and information management system. The real-time system achieves collecting, storing and feedback the real-time data; Monitoring the monitor points all day and switching multiple images at control points are accomplishing by monitoring system; information management system is supposed to realize collecting, receiving, transferring and processing needed information, which is the core of the entire control system. In recent years, the rapid development of computer network and transmission technology, promote the development of video monitoring technology. People's demanding for the efficient and convenient way of life; also make the WiFi technology have great development [1]. The traditional video monitoring system consists of image-collecting system, transmission lines and video monitoring platform. A user be able to monitor and view the saved image on the server via a web-based application from everywhere with password protection [2]. In this module, the technique is chiefly depended on the layout of lines. So, the limitation of the traditional system is following:

- (1) The layout of the transmission lines in some difficult situations is difficult to realize;
- (2) It supports only the local monitoring and the distance of monitoring is limited by length of transmission lines.

At present, with the continuous development of network technology and computer technology application, the market environment is gradually mature and wireless network video monitoring system has also been born, it actually is the combination of monitoring technology and wireless

transmission technology [3]. Wireless network video monitoring system is greatly simplified and improved the video monitoring system in the way of information transmission and speed. Compared with the traditional video monitoring system, wireless network video monitoring system also has many advantages:

- (1) No need transmission line and video data can be transmitted through the 3G/4G, Wi-Fi
- (2) The organization of web is flexible
- (3) The cost of maintenance is low
- (4) Have the ability of remote monitor
- (5) Good scalability and management

II. SYSTEM SOLUTIONS

The system is regard to a wireless network video surveillance system. With an android mobile phone, user can observe the video in real-time, which is captured by a WIFI camera. The system should meet the following target:

- (1) As digital interfaces increasingly mediate our access to information, the design of these interfaces becomes increasingly important [4]. The app uses the interactive mode, and thus it should be user-friendly, flexible to operate, and also, with full personalization.
- (2) Multiple users can simultaneously view the video captured by the WIFI camera.
- (3) Authorized users can send commands to the camera, so that it can gain a better camera angle.

In order to achieve these objectives, we gain a variety of APIs provided by manufacturer, and integrate those we need into a mobile phone—the server phone. The server phone receives the image captured by camera and sends it to the PC server. Then the PC server sends the image to multiple mobile phones which are connected to it. Thus the objective to share video to multiple users has been achieved. To receive the video, users need to install the app developed by us. The app is user-friendly and flexible to operate.

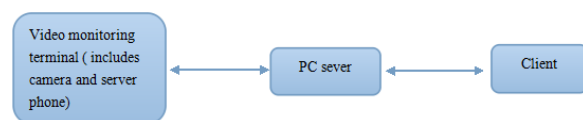


Fig. 1 System structure

According to Fig. 1, the system is deployed to a three-layer structure as Video monitoring terminal—PC Server — Mobile terminal. The video monitoring terminal catches image in real-time, and send it to the server. The PC server grants permission to the client, and send the video data to authorized users, which make it possible.

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III. SYSTEM MODULE DESIGN

The system need to achieve the sharing of video and the interactive control by multiple users. Users can receive the image from the PC server and apply for permission from it, so that they can control the camera.

The system is divided into four modules: camera monitoring module, server phone module, PC server module and client video receiver module [5]. The relationship is like Fig. 2.:

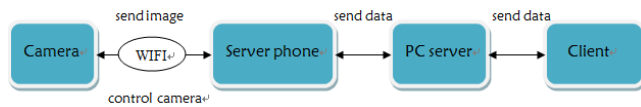


Fig. 2 Relationship of each modules

A. Camera Monitoring Module

As for hardware, among a variety of network cameras, we select an appropriate one that can match the project background. Because the source provided by the manufacturer is different, we have carefully studied the development interfaces and the features that the manufacturer can provide. After we learn the development documents provided by the manufacturer and communicate with them online, we finally select the T7837WIP—an indoor million high-definition network camera, considering its perfect system performance, acquisition performance and network feature. The camera has WIFI module and night vision module, and it can capture image clearly, which basically meet the demand. Most importantly, the API is provided by the manufacturer, and by calling these API, we can get the image from the camera, and control the camera's rotation.

B. Server Phone Module

In this module, we give the SDK provided by manufacturer a secondary development, and install it to the server phone. By reading the documents the manufacturer gives us, we learn the API we need to use: the video capturing API, the level cruise API and the vertical cruise API.

C. PC Server Module

The PC sever module is written in Java. By connecting to the TCP-socket that the server phone creates, the PC server module can call the video capturing API and get the image. Next, it will store that image into the local database, and then take them out and send to the client video receiver module.

D. Client Video Receiver Module

This part is written by us, and it is used to receive and show the video send from the server module. To solve the conflict that created when multiple users try to control the camera at the same time, users can apply for the permission from the PC sever module.

IV. PROGRAMMING

A. The Description of Program

There are three parts in the programming. In the secondary development of the server phone's SDK, we gain the Native

Caller (), which is the API of image capture. We need to send the image to server by connecting socket, and thus we add a thread. In the PC server, we need to receive the image sent by the server phone, and store it into database, as well as show it on the Image Panel. After that, we have to take the image out from the database, and send it to all clients when the connection between the PC server and the client has been set up. In the client, we need to receive and show the image sent by the PC server. To let the client manage to control the camera, we design the mechanism of applying for calls. The client can apply for permission from the PC server, and if it is successful, it can call the camera's API, which makes it possible for client to remote control the camera.

B. The Introduction of Program

Transfer Protocol: In our project, data transmission depends on Socket. TCP is a connection-oriented, reliable transmission protocol. Its working principle is establishing a TCP connection between two programs through a two-way communication for processes. Before data exchange using TCP protocol communications, it must have linked for two processes. [6] To realize data transmission between two devices, we establish a bidirectional connection Socket. The Socket is the encapsulation of TCP/IP protocol, which itself is an API and can be invoked to transfer data. [7]

Image Transmission in Server Phone:

```
NativeCaller.YUV4202RGB565(videodata, rgb, nVideoWidths, nVideoHeights);
```

Native Caller, an API encapsulated by the camera manufacturer to get images from camera, has encapsulated the transfer protocol defined by manufacturer. Images from the camera are encoded into h264 format. After a call of the API, Native Caller, images in h264 format are transferred into YUV format and stored into a Byte array, rgb, which will be put into a buffer area. Then we use the buffer area to create a bitmap, which will be transfer into JPEG format and put into an output-stream. The implementation is shown as follows:

```
ByteBuffer buffer = ByteBuffer.wrap(rgb);
rgb = null;
mBmp = Bitmap.createBitmap(nVideoWidths, nVideoHeights,
    Bitmap.Config.RGB_565);
mBmp.copyPixelsFromBuffer(buffer);
mBmp.compress(CompressFormat.JPEG, 80, output);
```

After that, we create a thread, Socket Thread, to transfer output-stream to the PC Server.

```
public class SocketThread extends Thread
```

The constructor of this class accepts the IP of the Server and the output-stream. When the thread starts, it transfers the output-stream to Server via Socket connection. There is a corresponding thread established in PC Server, which responds for accepting the byte stream and store it into database.

C. The Database

Initially, we store images into memory instead of database. According to our test, however, we found thread blocks when depending on memory. Additionally, data lost when it is taken out of the steam, that means data in stream can be used only once, which relative to that memory cannot hold the data permanently [8]. Therefore, only one user can get the images from Server, against to video sharing. When we take use of database, thread does not block any more and users can share images from database since database holds data in the disk. The PC Server stores images receive from Server Phone into database, which is the MySQL database. The database links to Eclipse in a JDBC way. There is always one record in database, that is to say, the database hold only one image at any time. When there comes a new image, it covers the old one. Then the new image is sent to users. Repeat the above process, a video is shown in users' phones. According to our test, delay of images between camera and users can be neglected, proving that the choice of database is rational. The database is shown as follows, it contains a table, Image, which holds one record to store the newest image received from Server Phone.

	name	image
	image	BLOB
*	INDEX	INDEX

Fig. 3 Table of database

D. The Connection between the Server and the Client

Roughly this part is the same as the part on connection between Server Phone and Server, we are not go into it detail. But we should pay attention that the server needs to know what the client's IP is. Therefore, at the time of a client's initializing, the client should start a thread to obtain its IP and then send it to the server, which we call an IP Thread. And the server needs to record all the IP information and distribute a different word for all the clients. There is a button in client, which is used for applying for the control of the camera through a socket, which encapsulates TCP/IP. And there is another problem which is how to response to the request from a privileged user. Practically, for instance, a teacher is using the system, in which students are clients. Sometimes the teacher needs a specific student to operate the camera and give back a picture that he wants. So the server needs to identify all clients. When a client connects to the server, the client will be given an ID number which is binding to its IP number. The ID will be shown in client's Text View and will be sent to the server at the time of sending a request. As for the server, it'll list all the requests with ID, and then decides if the right of controlling will be given. In the previous situation, a student should tell the teacher what ID is besides click the button of applying when he/she want to supply for the control of the camera. Then the teacher can grant it after looking at the server's display. When the right is given, no more requests will be accepted until it's released.

When a user takes the control of the camera and sends a command to operate the camera, the server will send the command to the Server Phone. The Server Phone call: to realize

horizontal and straight cruise.

```
NativeCaller.PPPPTZControl(strDID,
ContentCommon.CMD_PTZ_LEFT_RIGHT);
```

V. SYSTEM TESTING


First, the IP camera should be plugged. Then connect the camera with router using Ethernet cable. Choose a android mobile phone as the server phone and link to the Local area network. Open the app , entering the Login interface as Fig. 4:



Fig. 4 Log in interface

Click the search box to decide the device and enter the password---"888888".Then clicking connecting button you can find that the state will be online" if the server phone has linked with camera. Touch the button named "Preview mode". The result can be shown as Fig. 5:



Fig. 5 Image of server phone

At the same time, the image in PC server show as:



Fig. 6 PC Server image

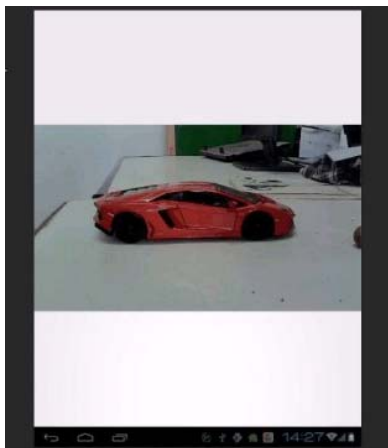


Fig. 7 Client Phone image

Server phone, PC Server, Client phone, their images always keeps consistent. In Client phone, if you touch the image, you can find a button named "apply for permission". Then PC Server will pop a dialog if client click the button and manager can choose whether give the permission to the client to control the camera. If PC servers permit the applying, the Client phone will appear two buttons for vertical and horizontal cruising.

In the final testing, we choose five Client phone link with PC server at the same time. The entire image doesn't be distortion though it suffers many times of transmission. The delay for transmission from Server phone to Client phone keep 0.3s averagely. And the difference of each Client is small. The instruction from Client phone can be performed in less than 0.5s which means we can control the camera keenly. This system's stability is accepted.

VI. CONCLUSION

This system can accept the image from IP camera and display the real-time image in Client phone. The PC Server can deal with applying from Client phone and send instruction to camera and control the rotation of camera in order to attain the best view. If this system is applied in teaching, then all the students present are able to observe real-time images through the phone. This system can also be used in wild filming which is convenient for team researching.

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