Research on Key Technology for Real-time Video Transmission

Linying Geng, Llfu Pan, Yonggui Yu, Dengwei Chen, Zehong Wu
China Luoyang Experiment Center of Electronic Equipment, 471023, China

Keywords: image, optical transmission network, loss of frame, band width, countermeasure

Abstract. Image transmission is an important way to check how the tasks are progressed, which is also an important step of communication guarantee. In this paper, by studying the cases encountered by communication guarantee and by the analyzing real-time video transmission (real-time video transmission relies on optical transmission network), it talked about the countermeasures used to solve the failures. This paper has an actual application value for communication guarantee.

1 Introduction

Today, there are thousands of commanding measures while real-time image is just like a "clairvoyant". Once image transmission suffers a failure, the commander will be adversely affected when checking how the tasks are progressed at different spots. If the commander is adversely affected, the time spent in delivering orders and feedback will be lengthened. For the implementation of communication guarantee, the research on real-time image transmission is quite weak. This paper mainly studies the failures suffered by real-time image transmission and the countermeasures to solve these failures.

2 Networking mode for real-time video transmission

Video transmission, relying on SDH optical transmission network, consists of a series of devices like image coder, image decoder, video optical transceiver, image shunt, integrated service terminal, switch and camera etc. Case: Fig. 1 real-time video images transmitted to the commander

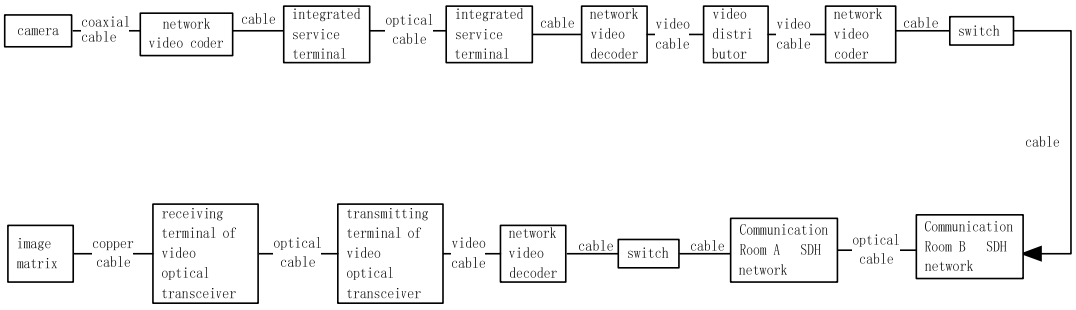

Fig. 1 Real-time Video Image Network

When there is failure, it is not only to check that whether the wire connection between equipment is normal or not but also check that whether the optical transmission network can work normally or not.

3 Typical failures

3.1 No image on the monitor

3.1.1 Solutions for wiring failures and failures suffered by image decoder, image coder, image video optical transceiver etc.

(1) Change the coaxial line connected with image decoder and image coder.

(2) Use the computer to test image decoder and image coder; if there is an abnormality, change the image decoder and image coder;

(3) Transmission terminal and receiving terminal of video optical transceiver are in failure. If port no problem, change the video optical transceiver;

(4) The television for monitoring is not under TV mode or the monitor is broken, then adjust or change the monitor;

(5) Check that whether the indicator light of switch; if the light is not on, change the internet access or change the switch [1].

3.1.2 There are no image display causes and solutions in the camera

(1) First, check that whether the power is connected; if yes, check that whether the voltage and current comply with the camera;

(2) Check that whether the lens aperture on the camera is opened or not (normally, the failure is resulted in by that lens aperture is closed); if automatic lens aperture is connected, check that whether the video or DC drive is correctly docked with the camera control lines;

(3) Coaxial cable and BNC connector are not well connected, or there is an open circuit or short circuit;

(4) The camera has a problem etc.

3.1.3 Reasons for no image by optical transmission and solutions

(1) First, check that whether the connection of power, optical cable, transmission terminal of video optical transceiver and receiving terminal of video optical transceiver; if the connection is in good conditions, check that whether the power-supply voltage and current comply with relevant requirements[1];

(2) There is no video input signal at the transmission terminal of optical video transceiver. Check the video input process at the transmission terminal: cut off the video signal and input the video signal to the monitor [1] via video coaxial cables; if there is an image, it means that video optical transceiver is in failure, just change a new one.

(3) Receiving terminal of video optical transceiver is in failure.

(4) The monitor is in failure. If there is no problem suffered by transmission terminal and receiving terminal of video optical transceiver, the connection with monitor is right but the screen is still black, change the monitor.

3.2 Snowflake on images

All the images are covered with snowflakes. Two reasons:

3.2.1 Snowflake is resulted in by optical transmission, here below are the reasons and solutions:

(1) Receiving terminal of optical transceiver. First, measure the optical power received by the optical receiver by an optical power meter. If optical power is satisfied but light cannot be normally received, it needs to change the optical receiver;

(2) Transmission terminal of optical transceiver. If the optical power received by optical receiver is lower than the standard value, use an optical power meter to check the output optical power at the transmission terminal; if the output optical power is low, change the transmission terminal [2];

(3) Optical connector. If the output optical power of optical receiver is in normal conditions, there is a failure on the optical connector. Clean the optical connector or change it.

(4) The transmission distance is too long or the consumption of optical fiber is too much, it is necessary to increase the optical amplifier.

3.2.2 Snowflake is resulted in by transmission media (coaxial cable), reasons and solutions

(1) At the monitoring spot, the scenery has a low illuminance, which makes the video signal range shrunk;

(2) The monitor has a quality issue;

(3) The route followed by video transmission is not good, which makes the video signal weaken and weaken; so finally, the video signal range is shrunk [2];

(4) The welding to plugs and charges equipped on the video cables is not good.

Solution: high-quality video device and video transmission wire shall be used to make sure the range of video signals complies with the requirement.

3.3 Graininess on images

The images on the monitor are covered with graininess. Normally, the graininess only slightly hides the images. However, synchronization will be severely damaged and the images cannot be read.

Reasons: around the spots under supervision, there is a strong electromagnetic interference. If so, check the environment around the monitoring system. Solutions: strengthen the shielding to the video equipment like the camera; have good grounding to the connectors and plugs on the video cables.

3.4 Large-area reticulation on images

If the images on the monitor are covered with large-area reticulation, images' quality will be greatly lowered; or even all the images will be damaged, which makes there is no image and no synchronized signal.

Reasons for large-are reticulation and low-quality images:

(1) Normally, the BNC connector is not in good conditions or other video connectors are not well connected;

(2) When paving cables, the external shielding for the cables are damaged by corrosive liquid, gas or rodents;

(3) The cable plug is not well connected with video device etc.

Solutions: carefully check the connectors one by one; re-weld the bad connections.

3.5 Trailers and burrs on the images; or images are not true and synchronized

It shall be caused by the following reasons:

(1) Welding on BNC plug is not well connected, or there is an open circuit or short circuit.

(2) There is no synchronization of the display or the camera; or the voltage of the camera is too low (10V or less for 12VDC voltage)

(3) There is a quality issue suffered by optical transmission device.

Solution: find out the reason by substitution method. Do modifications until the transmission lines are able to satisfy relevant requirements.

4 Case analysis

During communication guarantee, an image gets frame loss or the image is covered with black bars or mosaic or the image is delayed. After a detailed analysis and study, it is concluded that the image (hereafter referred to as a1) is transferred from spot a to spot c via communication room b. At the same time, at spot a, there are another 2 images to be transferred to spot c via communication room b. a1 will be directly sent to the image matrix via spot c while the other two images shall be decoded and re-coded at spot c; then the two images will be sent to the command office via SDH optical transmission network. The two images can be normally transferred at high quality. a1 uses codec 1. Refer to Fig. 2 for the transfer:

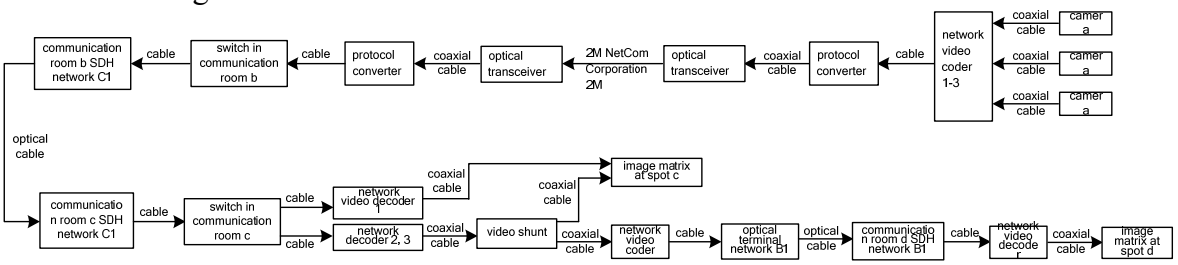

Fig. 2 Connection among Transmission Devices

4.1 Reason analysis and judgment

If there is a failure, measures shall be taken according to the troubleshooting on real-time video transmission:

(1) Check that whether the power is well connected; check that the power voltage and current satisfy the camera requirements;

(2) Check the optical power at the receiving terminal of optical transceiver by an optical power meter, if the optical power is normal, change the receiving terminal; if the problem is still there, we can make sure that the transmission terminal and receiving terminal of optical transceiver are not in trouble; and we can make sure that the cables accessing to the transmission terminal and receiving terminal are not in trouble either[3];

(3) Check IP address of network coder and network decoder by a computer; if it is found that there is frame loss when coding and decoding, change the decoder and coder; if frame loss is still there, we can make sure that the decoder and coder are in normal conditions;

(4) Check that whether the coaxial cables and BNC connector are in good conditions, whether there is an open circuit or short circuit; if it is found that there is no abnormality;

(5) Check the cables connecting with switch, network decoder, protocol converter and network coder; if it is found that there is no abnormality;

(6) Since there is an interference resulted in by electromagnetic spectrum, start it up in the early morning or at break time, if there is still frame loss.

(7) Testing the optical transmission network, it is found that everything is normal.

(8) Carefully check the connection, finding that after passing the switch, the three images will connect with the distribution frame of optical transmission network in communication room b; then the signal from optical transmission network in communication room c will connect with the switch; then the signals will be given to the 3 decoders. There might be a problem suffered by the network access of the distribution frame, so change the network access. However, the problem is still there;

(9) At the network access of the optical transmission network, the bandwidth is 30M. In order to reduce the jam, network access and bandwidth shall be increased.

4.2 Solutions and improvements

For the distribution frame of optical transmission network from communication room b to communication room c, more network accesses shall be added and the bandwidth shall be added (from 30M to 60M) too. Then the whole network will be changed. Refer to Fig. 3 for the connections of the whole network:

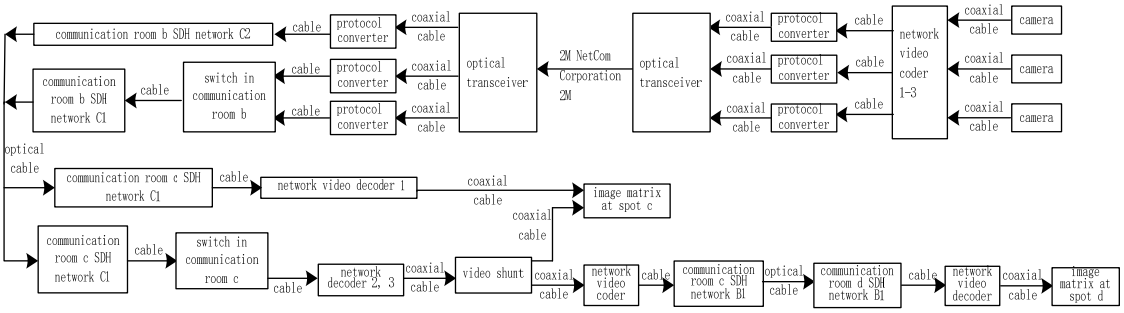

Fig. 3 Existing Image Transmission Network

According to Fig. 3, we can see that this networking is able to protect the images from suffering the frame loss, mosaic and delay when multiple videos are being transmitted at the same time. In Fig. 2, there is only one network access C1, the images transferred from switch in communication room b are only supported by 30M, so there is a jam. In Fig. 3, there is an additional network access C2, then connect C2 with network video decoder 1 to transfer the images to the image matrix. From the change, we can say that when being transferred via optical cables after the video signals are compressed according to video compression standard, the quality of these images shall be guaranteed[4] by enough bandwidth (normally, different images have different requirements on the bandwidth). If the bandwidth is too narrow, the images will not be clear or even there will be

mosaic or delay[5]. After the network is changed, the image quality can be highly guaranteed; what's more, resource waste can be avoided. That is the communication will be smoother and better.

5 Conclusion

This paper introduces the troubleshooting for the real-time video transmission and this paper studies a case to prove that the image transmission shall be well guaranteed by sufficient bandwidth when the video signals are transmitted via optical cables after being compressed and coded according to the video compression standard.

Reference

[1] Gong Zhongmei Failures and Troubleshooting for Cable TV Video Monitoring System China New Technologies and Products, Period 23 in 2009.

[2] Chen Zhongxin Analysis on Common Failures of Video Monitoring System at Taolinkou Reservoir Urban Construction Theoretical Research (Electronic), Period 29, 2013

[3] Luo Bin. Laying and Maintenance of Optical Cable Lines in Prefecture-level Cable Television. China Cable Television. Period 5, 2001

[4] Yan Hongli Distributed Monitoring System for Highway Shandong University 2005

[5] Zhang Zhiqiang, Zhao Qiwen Design and Implementation of Video Monitoring System for Highway Liaoning Transportation Science & Technology Period 5, 2005