Faulty Diagnosis of Network Video Surveillance System of X Vocational Education Centre, XI’AN

Junfeng Liu

Department of Economics and Management, Xi’an ShiYou University, Xi’an, China.
Email: liujunfeng98@126.com

Abstract. Aiming at the problems of the projects of government procurement of computer network video surveillance systems in terms of design, construction, management have been existing, this paper would found them through a survey with help of instruments, such as Network Connectivity Tester, etc. diagnosing the faults of the network Video Surveillance System of X vocational education centre in Xi’an. These problems include the faulty of network topology design, not standardized network engineering construction, material use issues and problems of not clear video surveillance images, and the author makes recommendations related to repair of the video surveillance system for accumulating experiences for improving management of government procurement project and raising the quality of network integration construction.

1. Introduction
With the popularization of information technology in education, the coverage of vocational education video surveillance system [1] has become a basic index measuring the conditions of vocational education. In recent years the vocational education centres in Xi’an, china have actively being purchased, and been perfected video network monitoring system, however, the problems being exist should not be ignored.

2. Background and Status of Setting Up the Project of the Network Video Surveillance System of A Vocational Education Center
Since 2010, vocational education institutions, vocational education centres have been installed / improved their own network video surveillance systems based on requirements of the development of educational informatization and the visualization education management, especially for the needs of the campus security management. X vocational education centre in Xi’an is no exception, and applied more than 100,000 Yuan RMB to government for installing a network video surveillance system been bidding by the district government in 2013. The system consisted of 25 network surveillance cameras, two displays (one desktop and one monitor hanging monitor), a 32-channel DVR and four 2T storage drives and a number of coaxial cable wiring configuration, and Figure 1 is the system topology.

It should be noted that there weren’t any network topology diagram and construction drawings about the network video surveillance system until the project of the construction was over. Figure 1 showed the current reality of network video surveillance system based author’s research for the vocational education centre.

The entire network system was a star topology [2-3], each node does not use any signal amplification equipment, and coaxial cable connected directly to the control room. Surveillance cameras were mainly deployed in the South entrance of the campus, the entrances of each of teaching buildings, dormitory, office building and important parts.
Numerous video signal displayed on the screen of the monitor located in guard control room by means of the matrix control, which had captured and transported to television monitoring centre on duty by the cameras, and recorded by DVR. Duty office in control room can shift pictures captured by clicking the mouse and the keyboard for tracking and monitoring, and detect kinds of abnormal situations timely and promptly deal with them. Of course, the case had happened can be reverted by video replay for investigation to find the problem.

The network system is basically stable at the beginning of six months when the system run and server errors didn’t emerged. But errors had been incoming after half a year, so that the winning party in biding, a network monitor installation company didn’t want to continue to maintain the network after two repairs. Furthermore, Vocational Education Centre repaired the networks video surveillance system many times, who hired other companies, such as added to outdoor terminal power box and signal amplifier, replaced part of the video lines, but still to be poor final results. In early 2015, 25 road surveillance cameras, only seven can basically work, but the video image display is very unclear, and the monitoring network basically paralyzed. Up to now, the problem is not resolved and the monitoring network is still in a state of paralysis.

3. Diagnosing the Faults of the Network Video Surveillance System of A Vocational Education Center

Author and a peer who were invited spend one-day on investigating the basically paralyzed video surveillance system of X vocational education center by using network connectivity tester [4-5] and other equipment to troubleshoot and artificial ways. As a result, only 7 of 25 monitoring points can basically work, and others had been paralyzed. The network topology diagrams when the network system was designed and other files such as the project construction drawings, etc. were never exist. There was only one video equipment list by the client. Found the following problems after a survey to a conference room and three school buildings and the surrounding roof:

3.1. Problem of Network Design

First, as routine, the design of video surveillance system of the vocational education center in X district should use to an expanded the star network topology structure [6], complied with GB / T50314-20000 "Intelligent Building Design Standards" and GA / T 367-2001 "video security monitoring system technical requirements" [7], [11] and other national standards. And use more switches at relatively more concentrated nodes, thus, which can guarantee the bandwidth requirements of video signal transmission.

Secondly, there must be some advanced network design and scalability [8-10]. The transmission of network video surveillance systems all used coaxial cable as transmission medium, which is not well to meet more than 300m distance monitoring requirements, and must use a signal amplifier[11] above 200m distance in actual project construction. What’s more, fiber optic backbone network and digital
signal transmission system have high cost-effective. These were not considered in this design, but used analog signal transmission system.

Finally, from an aesthetic perspective, the effect of such construction topology had choose looks messy, meandering wiring harness, and be harmful to troubleshooting during running and bring more trouble of maintenance[12].

In fact, follow-up question also confirmed the failure of the system design.

3.2. Problems of Construction- highly irregular network cabling system

Monitoring network cabled highly irregular, especially the roof horizontal cable to casual. Mainly:

3.2.1. Horizontal cables. Horizontal cables on the roof of buildings wired close to the surface of roofs, and some even ride on the roof ventilation, not for bypass treatment.

Horizontal cables affixed to the roof floor and not fixed, It was approved that hadn’t considered water factor, which can congest on the roof floor and soaked horizontal cabling in long term and caused aging its protective pipeline and rotting cable itself.

3.2.2. Rough construction. The joint of PVC pipelines protecting for cables were loosen and not cemented, and many sockets were joined by just less than 2 CM wide rubberized fabric. The connection had fall off with time gone or soaking rain water, resulting in the PVC pipe watered.

In addition, messy rubberized fabric around, instead of tee and elbow wires (see Figure.2) was used at the points of PVC decomposition and elbow.

The reality is that most of the roof surface of the PVC pipelines had been broken or decay, simply no protection, and even some cable soaked by rain had decayed. There may be a short circuit after the power cord inlet (because there are plants, which need to water regularly on the roof of teaching building. It was clear that was been ignored.)

3.2.3. PVC pipelines for protection Vertical cable were not fixed. PVC pipelines for protection Vertical cable had being swayed in the air, because of not fixed, and it was easy to pull off cable.

3.3. Problems of Construction Material

There was no finding "QIU YEYUAN" brand cable laid by compared with video surveillance equipment list provided from the client. And the construction side of the network video surveillance system did not install 26 special waterproof box listed in the list according to data provided by X vocational education centre.

(1) there were multiple brands Construction video cable, such as "ANJIEDA"," LIANJIAXIANG","ZHONGXING" etc. But no "QIU YEYUAN" brand cable. There were "YANGZHOU XIANLAN" brand power cable and white jacket cables marked with the words "YDO JUETYUAN ", etc. But no "QIU YEYUAN" brand power cable.
(2) The part of lines supplying power for the monitoring cameras was not alone, but shared circuitry with others cameras. No checked whether each one of monitoring cameras was right, since the monitoring network has been basically paralyzed.

3.4. Not Clear Video Picture
No one was clear in existing 7 channels video picture. Monitor picture is not clear for many reasons, including due to strong electric interference, but the main problem is due to the capture and signal transmission. Problems are easy to incur for blurring the image caused by shift the focus, instability, rapid aging and other issues[13], because of Surveillance camera itself performance, coupled with the longer evil outdoor environments, which it affects easily by moisture, vibration, thermal expansion and contraction and other factors.

In addition, as we have been mentioned before, transmission media and devices which can’t meet the requirements criterion have a significant impact on the transmission of video signals. E.g., video cable has poor shielding performance (shielded copper network is not very good quality, or too thin and would not achieve shielding effect), at the same time, this type of video cable wire resistance is too large, resulting in signal greater attenuation. However, the entire video monitoring network does not use any device having a signal relay fun.

Furthermore, the characteristic impedance of the line video is not really 75 Ω and beyond the prescribed parameters will cause the monitor picture is not clear. Various types of cable were found in the project, just cable brands and models mentioned on the list of items were not seen.

3.5. The Diagnosis Conclusion and Repair Recommendations

3.5.1. The diagnosis conclusion. The design of network video surveillance system was lack of advanced and scalability, and network topology structure is irrational. Shoddy construction process had determined the system was a short-lived and there was a uselessness of acceptance of construction from the official.

3.5.2. Repair recommendations. Repairing purposes: video surveillance system repaired running at least 2 years, not any large fault and glitches must be resolved within one day.

Repair works must strictly be abide by the articles of the contract (such as the "QIU YEYUAN" brand of video cable, power line in original contract, etc.), standards of integrated network cabling and other norms, to eliminate the initial engineering problems.

4. The Reflection of Network Video Surveillance System
The problems contained is worthy of thinking in deep, although the project was not the amount.

(1) It is a successful key, that there are a strict quality control in completion and acceptance phase of project, government’ attitude to bidding to organize similar project as a government tender.

(2) The importance of the selection of network systems. Reasonable network system design determines a good performance and quality of the network system projects. The network surveillance system had chosen a poor performance/price analog signal system and unreasonable network topology and inefficient signal transmission system, which doomed to fail from beginning.

(3) It is another successful key the construction side strictly perform the contract and effective supervision of network monitoring systems. Construction process can follow the appropriate construction norms and standards affect the quality and life of the project.

5. Conclusions
We had conclusions by means of network connectivity tester, and other equipment and routine labor inspection to the network video surveillance system of X vocational education center in, Xi'an:

The default mainly due to the unreasonable network architecture design at beginning and irregulars resulted from lack of effective supervision in construction process. There are main problems of unreasonable design to video surveillance network topology structure; construction not meeting the
computer network integrated cabling standards; the lack of construction drawings and defect materials, and so on. Additionally there is lack of supervision during construction process and oversight behavior of final acceptance mapping problems in project management of similar government tender, such as the acceptance of the project organization is not standardized. The project, although the amount is small, is worth pondering and referencing.

6. Acknowledgments
Research was accomplished with the help of Mr. Wu and Dean Wang of a vocational education center in, Xi'an for getting facilitated investigation tools and reliable data. In additionally, it was funded by project of social science, China in 2017, contact number: 17BZZ069.

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