ISBN 978-952-5726-06-0
Proceedings of the 2009 International Workshop on Information Security and Application (IWISA 2009)
Qingdao, China, November 21-22, 2009

Research of Event-based Emergency Video Surveillance System

Xiao-Yun Xiong [1], Bing Wang [2], and De-Xing Wang [2]
[1] School of computer engineering of Qingdao Technological University, Qingdao, China
Email: xxyqd @126.com
[2] Institute of modern communication technology Research of Qingdao Technological University, Qingdao, China
Email: easydoor@126.com, wdxlg@126.com

***Abstract*—Because of traditional Video Surveillance System to accurately reflect the dynamics of the scene of the incident image information, it has been widely used in disposal of the emergency. In this paper, the question of the traditional Video Surveillance System applied to disposal of the emergency has been analyzed in-depth and studied, the design and key technologies of the Event-based Emergency Video Surveillance System with GIS as platform has been put forward from the perspective of the practical application, which combined with Video Surveillance System and GIS geographic analysis technology, and applied to Qingdao Public Safety Emergency Video Surveillance System. It provides an effective program for fast, complete control of the scene of emergency information to enhance the efficiency of the disposal of emergency.**

***Index Terms*—video surveillance, emergency, GIS, event**

I. INTRODUCTION

Because of a large population and serious shortage of the police force in China, for improving the public safety prevention ability effectively, dealing with all kinds of unexpected events, improving the ability of government to guarantee the public safety and disposal the public emergency, preventing and reducing public emergency and damage caused by it to the maximal degree, "The National Public Emergency General Emergency Plan" was formally promulgated in early 2006 in China. Therefore how to disposal public emergency become the research hot spot in each big city quickly. During the process of disposal emergent events, it is importance for dealing with emergent events quickly, to understand the emergent event types, surrounding environment of disaster scene, periphery traffic condition and inhabitant distribution, and the development trend of emergent event etc. The real-time video surveillance signal of disaster scene and its periphery can provide abundant, visual and reliable information for emergency commanding and decision-making.

At present, the Emergency Video Surveillance System composed of public safety video surveillance system built by public security departments and security video surveillance system built by every social department in China. The Emergency Video Surveillance System as a function module or subsystem of Emergency Response Command System is a relatively independent system. It has implemented integrated video resource sharing, unified management and control. Such a system, resource management for video are mostly based on the construction unit or division to monitor area，however, it adopts the management model of Suitable for day-to-day monitoring and management, departments can authorize access to all resources in an integrated video surveillance system, and choice of a single camera to conduct an independent control. It can't be achieved on a controlled camera associated. Such unified management and separate control model can't meet the requirements of emergency incident decision-makers needing to obtain the video resources of the scene of the incident quickly and accurately in time of emergency incidents, especially in the condition of large number of video resources, event development and changes of circumstances quickly.

Without changing the existing Video Surveillance System hardware structure and organization model, this paper presents a Event-based Emergency Video Surveillance System program with GIS as platform. This system related locations and events to the surveillance cameras through the GIS platform, achieved the objectives of quick organizations, related and centralized controlling of resources at the scene video from the massive video surveillance resources, and switching hot video resources quickly, so as to enhance the leadership decision-making command and handle emergencies efficiency.

II. EMERGENCY VIDEO SURVEILLANCE SYSTEM

The disposal process of emergency events includes two components of the disaster development model: mitigation and rescue. Mitigation is to take action to eliminate or reduce the level of incidents of harm, in fact, is a control process. In the event of unexpected incidents and caused a certain amount of disaster, relief is organization of rescue forces at all levels, provide timely and effective disaster relief for affected people with search and rescue, communications, medical equipment. In these two segments, the time is always an important factor. The disposal of the emergency event is a race against time process. In the early stages of the disposal of the emergency incident, if the timely and effective corresponding measures have been taken, it may be caused by sudden loss of the incident down to a relatively low level, which will also directly affect the cost of rescue and efficiency.

In that case, how this can be a timely and effective manner to contain the emergency development? Real-time emergency information at the scene of the video surveillance is the most intuitive, and reliable information, which reflect the developments in a timely manner and the process of change. Therefore, during the disposal of the emergency incident, the wealth of video resources is particularly important. With the safety city's building, video surveillance in cities in the amount of resources increased sharply, to monitor the location of cameras around the city is all important public places, be it airports, subway stations, entertainment venues, bus, district, or in the street, have installed surveillance cameras. In China, large and medium-sized cities plan or have already installed cameras to monitor more than 200,000, the number in the last decade, will increase. Therefore, in the emergency video surveillance systems, video resources is no longer a problem, the problem is how to efficiently organize and manage the rapid expansion of the number of video resources.

We know that the unexpected incident occurred at a time and locations are random, the occurrence process is dynamic. Organization quickly and effectively dispose of the concerns of emergency events surveillance video content from the mass video data, and carrying out hot video switching according to incident rapid development and changes, so that decision-makers will be able to grasp the development of the case from the perspective of macro-and micro-two. It becomes one of the main concerns in disposal of the emergency event.

III. EVENT-BASED EMERGENCY VIDEO SURVEILLANCE SYSTEM

A. The software architecture of Event-based Emergency video surveillance system

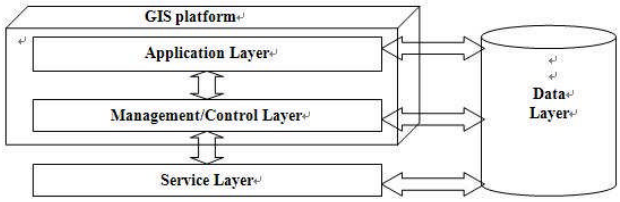

Figure 1. Emergency Video Surveillance System software architecture

Emergency events in the process of disposal, is the core of decision-makers concerned about the incidents themselves. The decision-makers must do is commanding the mitigation and rescue based on events. Only grasping the information and its development trend of the incident scene quickly, it will be possible to make a scientific decision-making and improve the efficiency of the disposal of the emergency incident. All events are related to location information; all the mitigation and rescue deployment also involves a large number of geo-spatial data.

Therefore, a video surveillance system implementation is proposed in this paper. With GIS as a platform, it uses GIS to manage data and visual output. Powerful GIS spatial data search capabilities and quick response feature also makes the rapid organization of event-related video information be possible. Its software architecture is shown as Figure 1.

Application Layer: it is a video client system built on GIS platform for the realization of the on-demand video, video front-end device control, the local recording of video signal, as well as the video signal output of the request of the soft matrix.

Management/Control Layer: it is the core component of Video Surveillance System, mainly responsible for the management of the user's authority, dealing with the video request and control information from the client, a reasonable allocation of equipment and scheduling.

Service layer: it is the component of video Surveillance System for providing video streaming service, mainly responsible for the store and forward of video stream. It sends the scheduling instructions to video stream through the service control layer.

Data layers: it is the entire system basis, is a unity and organization of the centralized management platform for business data (including of GIS spatial data). It can provide standardized, high-performance data services for the management / control layer and service layer, to achieve full sharing of business data.

In this system, the application layer, management/control layer, service layer and data layer is logically independent of each other. Incidents and Emergency which is closely related to the camera are stored in the data layer, including: the installation location and mounting height, the focus of monitoring objectives, the scope of monitoring, as well as the different preset position corresponding to the target monitor. This information will be effective in the best way to show video images of the incident location information, which is suitable for monitoring point of view, the appropriate multiple of the zoom, clear, accurate delivery of the objectives within the scope of monitoring real-time video images.

First of all, the user propose the organization method of emergency video through the application layer, that is, using point, line and surface approach to organize the on-demand emergency video in the electronic map. These requests will be sent to the data layer and be matched with the monitoring objectives of camera, then transmit the on-demand emergency video images associated with these camera's PTZ control commands to the application layer. Since the video front-end cameras integrated into the Emergency Video Surveillance System are different in model, manufacturer and control protocol, so in addition to the application layer is responsible for sending video-on-demand request for different front-end camera, It must translate the control command of different type of camera into the corresponding control protocol command, and sent to the emergency video network. After receiving the machine PTZ control command and video on-demand instruction, the camera will be adjusted to the requested monitoring objectives and the scope of monitoring, and then sent the on-demand video stream to the service layer. The service layer provides the store and forward of video stream for different on-demand user.

B. The disposal process of Emergency incidents in the Event-based Emergency Surveillance System

In the intelligent Monitoring System, all front-end video camera information must be marked accurately in the electronic map. In addition, cameras need to collect the following information: the installation location, the maintenance department, focusing on monitoring objectives, monitoring the scope, as well as corresponding to different preset position of the monitoring objectives.

Normally, video client can be use as the common video surveillance system, depending on the focus of interest and concern, to monitor different locations on-demand video, and to separate PTZ control. When the emergency incidents happened, the decision-makers can organize the video resources based on emergency event by marking point, line and plane in the electronic map as follows.

Figure 2. Determine the Organization's way of video monitoring images in the electronic map

Figure 3. The display output of video client software for Video images associated.

If decision-makers mark a point of the accident in the electronic map, first, the GIS will determine the number of video cameras that can observe the situation of the accident in accordance with the location selected in the map; and then sent equipment control commands to the management / control layer, for all the selected camera surveillance targeting the accident point to the location. It can achieve by the way of matching preset position's monitoring objectives, or by the way of GIS's location calculating function to determine the horizontal and vertical angle of camera; Finally, all the selected video signal will be displayed on the video client in 6, 8 or 16 images of the former, or switched to the TV wall. By this way, decision makers don't have to find the camera in accordance with the accident, and then separately perform video on-demand, separately perform the PTZ control, and separately adjust the camera observing the target state and observation. He only needs to mark the accident location or traffic lines, or the region want to monitor in the electronic map. The Event-based Emergency Video Surveillance System will automatically take those on-demand cameras images which can monitor designated point, lines or region to the desktop. System can also switch quickly to hot spots video resource. The video signal of display output can be switched quickly to a particular line on the rescue to monitor traffic conditions image from the accident site to monitor the image. The making decision-makers can understand the macro to the scene of the accident, the surrounding environment as well as the status of all rescue and evacuation routes quickly and in real time, in order to effectively control the development of accident and rescue organizations to save valuable time.

CONCLUSION AND ACKNOWLEDGMENT

During the disposal process of the emergency event, the time is the first element. Emergency scene, waiting for rescue personnel space environment has been in a dynamic change. Therefore building a event-based video surveillance system on GIS platform is proposed to access the real-time video data of accident scene fast and efficiently, to reduce the human and property losses. It laid the foundation for the emergency command decision-making system.

In this paper, the Qingdao Municipal projects "Qingdao Public Safety Emergency Command System" have been of support. Event-based Emergency Video Surveillance System has been applied to Qingdao Emergency Video System project, it already put into use with satisfactory results during the Qingdao Olympic Regatta. And this paper had been funded by science and technology innovation project of Qingdao Science and Technology Bureau (Item Number: 06-2-2-9-jch).

REFERENCES

[1] Akazawa, Y., Okada, Y, Niijima, K., Real-time motion capture system using one video camera based on color and edge distribution, Recent Advances in Circuits, Systems and Signal Processing, pp. 368-373, 2002.

[2] Kimata, H. , Kitahara, M., Kamikura, K., Yashima, Y., Freeviewpoint video communication using multi-view video coding, NTT Technical Review, Vol 2(8), pp. 21-26, 2004.

[3] Iannizzotto, G., Vita, L., On-line object tracking for colour video analysis, Real-Time imaging, Vol 8(2), pp. 145-155, 2002.

[4] Cerveri, P. , Pedotti, A., Borghese, N. A., Combined evolution strategies for dynamic calibration of video-based measurement systems, IEEE Transactions on Evolutionary Computation, Vol 2(3), pp. 271-282, 2001.
[5] Montoya, L., Geo-data acquisition through mobile GIS and digital video: An urban disaster management perspective, Environmental Modelling and Software, Vol 18(10), pp. 869-876, 2003.
[6] Hwang, T-H., Choi, K-H., Joo, I-H., Lee, J-H, MPEG-7 Metadata for Video-Based GIS Applications, International Geoscience and Remote Sensing Symposium 2003, Vol 6, pp. 3641-3643, 2003.
[7] Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, Geographical Information systems, Volume 1, Principles and Technical Issues, Second Edition, Publishing House of Electronics Industry, 2004.
[8] Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, Geographical Information systems, Volume 2, Management Issues and Applications, Second Edition, Publishing House of Electronics Industry, 2004.
[9] Xiao-yun Xiong, De-xing Wang, Video Real-Time Position Approach based on GIS and its Applications in Monitoring Systems of Disaster Prevention, Proceedings of the 3rd International Conference on Impulsive Dynamic Systems and Applications, 2006.