



ELSEVIER

Available online at www.sciencedirect.com**SciVerse ScienceDirect**

Procedia Engineering 15 (2011) 3088 – 3092

**Procedia
Engineering**www.elsevier.com/locate/procedia

Advanced in Control Engineering and Information Science

The Application and Research of navigation-aids inspection and maintenance based on video surveillance

Chen LiPing^a, Peng GuoJun^b, Zhang XingGu^{c,*}^aNavigation College of Jimei University, Xiamen, 361021, China^{bc}Navigation-aids Technology Research Centre of Jimei University, Xiamen, 361021, China

Abstract

To realize automatic management of navigation-aids, this paper presented an idea of navigation-aids inspection using video surveillance technology. It was aimed at solving problems of navigation-aids inspection and maintenance mode. It analyzed the current status of navigation-aids inspection and maintenance in areas, and researched the development and application of video surveillance technology. The results indicated that navigation-aids inspection and maintenance with video surveillance can better improve work efficiency, save costs and protect the quality of navigation-aids service.

© 2011 Published by Elsevier Ltd. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/3.0/).

Selection and/or peer-review under responsibility of [CEIS 2011]

Keywords: navigation-aids; navigation-aids inspection and maintenance; video surveillance; video inspection of navigation-aids

0. Introduction

Navigation-aids is a basic establishment for assisting navigation providing ship location, navigation and other special purposes. In china, what the coastal navigation-aids contains is navigation-aids in the area of Coastal and related land, estuary covered by harbor and exclusive economic region which under the jurisdiction of our country. It is significant part of the main channel and port hub. To ensure regular maritime traffic, navigation-aids is quite necessary. It has considerable significance to water transportation, ocean development, fishery, national defense and safeguard state sovereignty.

Navigation-aids inspection and maintenance is an important work of navigation-aids management. It straightly affects the efficiency of the whole work. Each country, port or beacon management unit has its own work course which plays a certain role in a period. These work courses determine the quality and level of a country or a region to a certain extent.

With the development of water transportation and the increase of various types of navigation aids, the old mode of navigation-aids inspection and maintenance must change to fit the need of prolonging its cycle, on condition that maintenance funds and human resource is limited. With the integration of various advanced technology, such as communication technology, video surveillance and image analysis, a remote and visual mode for navigation-aids inspection is possible. In this

* Corresponding author. Tel: 13656020805;

E-mail address: xszheng@xmu.edu.cn.

way, the efficiency of navigation-aids inspection will be improved and work intensity will be reduced.

1. The status of navigation-aids inspection and maintenance

Navigation-aids inspection and maintenance takes important part in navigation-aids management. To preventive discover and preclude the malfunction of navigation-aids is its main work. Such as: replacing and installing navigation light and green renewable energy, checking, cleaning, maintaining and painting navigation-aids' structures and equipment, measurement of navigation-aids location and technical performance. In a word, the traditional way of navigation-aids inspection has problems as follow:

- Low reliability: the traditional inspection way of navigation-aids is generally management on duty, vehicle inspection and ship or rental boat inspection. All these are manual inspection. In this process, to determine whether navigation-aids drift or navigation light flicker by eyes, to a large extent, depends on the experience of workman. Its reliability cannot be high.
- Poor real-time: regular inspection and maintenance of navigation-aids is the main way in our coastal. So the original inspection mode is difficult to detect failure buoy in real-time, leaving potential accidents to the increasingly busy shipping.
- Low efficiency: every regular inspection needs to check all buoys. Due to the wide distribution of navigation-aids, the aimless inspection has low efficiency.
- High cost: regular inspection will cost a numerous number of costs. For example: the spending of dispatching workman and vehicle, equipment maintenance expense, and so on. And the lack of accurate message about failure buoy also will cause considerable expense of emergent maintenance as regular inspection.
- High risk: there is a certain risk in the way of ship inspection and rental boat inspection, especially sailing at night or with bad weather.

2. Video surveillance technology

With the development of computer, network, chip technology and image processing technology, video surveillance technology has been widely used and developed. According to the development of main equipment, video surveillance can be divided into three stages. One is analog video surveillance phase which begins at 20th century 70 years. Second is the digital video surveillance phase that starts from 20th century 90 years. And the last is intelligent network video surveillance phase rising in recent year. The last phase is based on network, and compression, transmission, storage and playback of digital video is its core. And its characteristic is smart and practical image analysis. All these call a great attention of academia, industry and use department.^[1]

The function of video surveillance is to realize monitoring people and vehicles in real-time by camera and to describe their behavior and events.^[2] Intelligent video monitoring system is composed mainly of IP camera, digital video server, network video recorder, video analysis unit, central management platform, decoding equipment and storage device. It can deal with video information intelligent compared with the old system. And it can analyze video content and realize automatic alarm. Intelligent video monitoring system uses distributed architecture, which build on network without geographical limitation. The realization of it is based on the further analyzing and processing digital image. It's mainly involves two aspects.^[3] First, moving targets are detected and segmented to get its real message. Second, the moving targets which need to deal with are identified, classified and tracked to further process.

After further research and development of video tracking technology in recent years, there is wide application and development in making military missile, visual navigation, intelligent transportation, medical diagnosis, port management and weather analysis.^[4]

3. Video inspection of navigation-aids

3.1 General framework

The system's general framework is shown in figure 1. It contains three parts. They are front data

acquisition, central management platform and storage and display device. Cameras obtain the basic message of navigation-aids and the message delivers to central management server by network. Then it realizes all kinds of remote control by central management server.

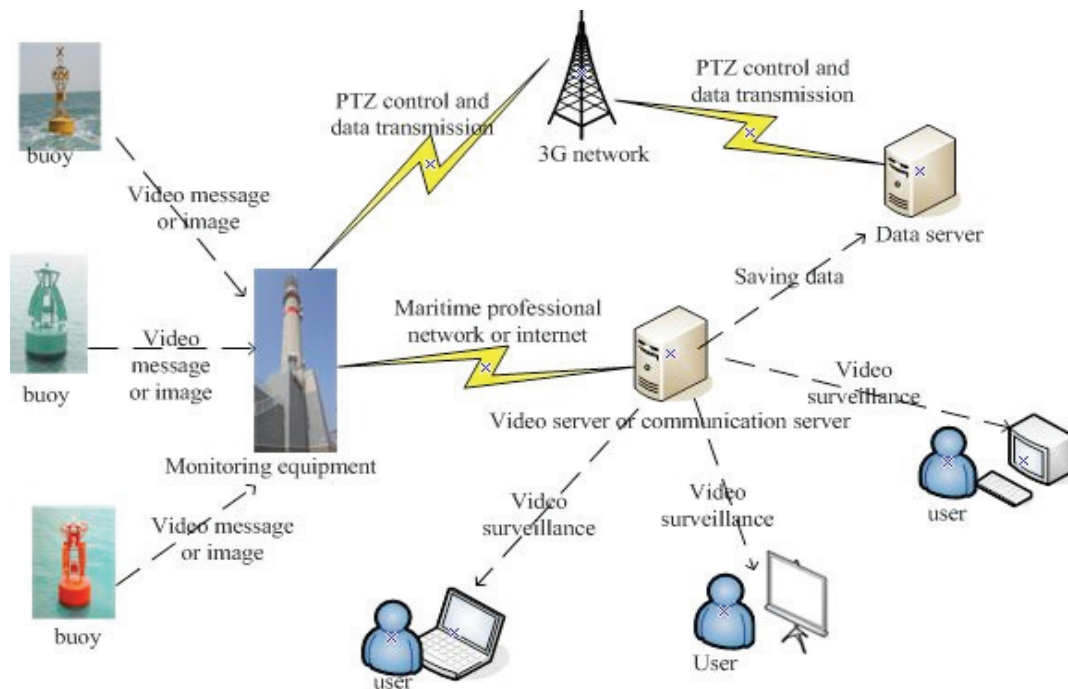


Figure1 The framework of video inspection

To calculate relative distance, direction and horizontal and vertical field of view between aimed navigation-aids and PTZ or camera should based on the latitude and longitude data of navigation-aids by video server or communication server. The results can drive PTZ or camera to locate target navigation-aids. And then, current images and video data of navigation-aids can be obtained and delivered to the server to display. At the same time, video data is saved to video server. The images and video of inspection can help to check whether its appearance, position and light is normal.

3.2 Key technology

Video analysis technology is a technology that can draw and analyze the content of video automatically. Let computer understand video information is its purpose. Its mainly contains six parts, as shown in figure 2:

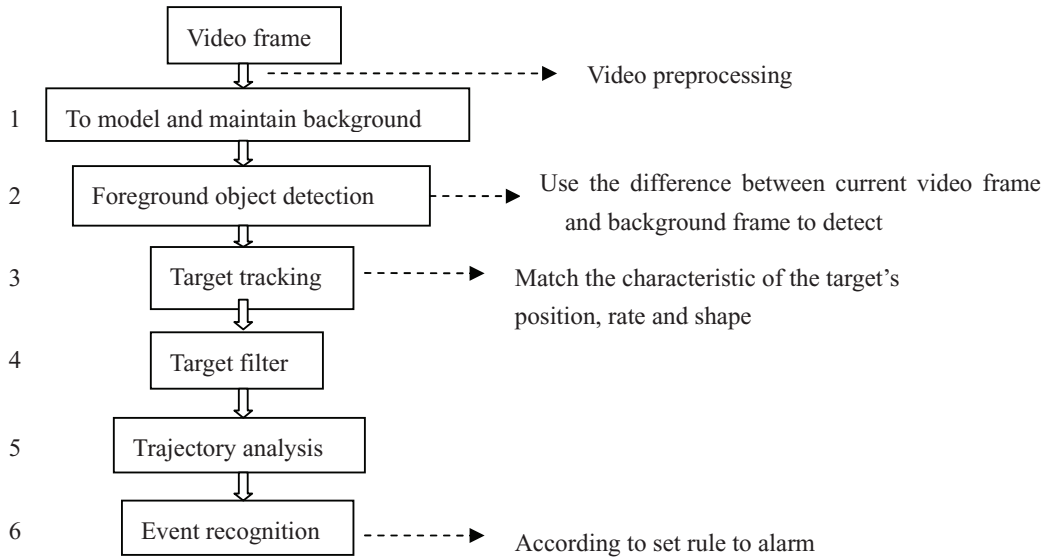


Figure 2 Video analysis technology

- To model and maintain background: Background modeling is background indication of obtained real scene that uses some model. It is not complicated, but to update and maintain the model is quite important and difficult. Background modeling is the foundation of foreground object detection, tracking and recognition. Whether it is good or not directly affects the whole work of analysis.
- Foreground object detection: The purpose of foreground object detection is to draw change region from background. In use of an algorithm for background modeling and subtraction, moving targets can be detected with the difference between current image and background.
- Target tracking: Target tracking is to associate continuous frames with characteristics of position, rate, shape, texture and color essentially. Considering that navigation-aids is the right target to be monitored, an algorithm of tracking based on model is used to realize target tracking.
- Target filter: A database of foreground object is built to compare with the set rule of filter and then deal with interested information. The database contains all kinds of essential information of target, such as position, shape and so on.
- Trajectory analysis: To analyze moving trajectory of tracked target can make its trajectory closer to reality in the way of smooth filter and error correction.
- Event recognition: Compared with set rule of alarm, if a event meets the condition of alarming, then sends alarm information automatically.

3.3 Application analysis

The main task of navigation-aids inspection and maintenance is to discover and exclude failure navigation-aids in prevention. By using video surveillance technology to monitor navigation-aids in real-time can do things as follows:

- Improve the efficiency of navigation-aids inspection and maintenance. In video patrol system, users can customize patrol task, and the system can carry out the task automatically and periodically according to the task's cycle and time. Then alarm if there is something wrong. So the main work will be only to deal with failure navigation-aids.
- Reduce the cost of navigation-aids inspection and maintenance. Monitoring navigation-aids in 24 hours can prolong the cycle of navigation-aids inspection and maintenance. It also will reduce errors in the work. Ship inspection will be on the agenda only when needs. The purpose of inspection is stronger than before.
- Reduce the risk of navigation-aids inspection and maintenance. Real-time monitoring minimizes ship inspection. Only in the condition that there is some failure navigation-aids, workman should be sent. If the weather is bad, the abnormal information of navigation-aids can be published early and then maintain it when the weather be better. In this way, the safety of workman can be improved.

4. conclusion

Traditional inspection model of navigation-aids has many problems, so it needs to change. Video surveillance technology has wide application in fields of traffic monitoring and medical image processing, and so on. But the technology seldom uses in navigation-aids inspection. We can see its advantage. So it is necessary to research and develop a navigation-aids inspection system based on video surveillance technology. The system will contribute to improve the level of navigation-aids management and ensure the reliability of navigation.

References

- [1]Ge Huiming. Design and Implementation of Real-time Moving-object Video Monitoring System[J]. Graduate School of National University of Defense Technology. 2008
- [2] Lijuan Qin. Content-based Automated Video Surveillance[J].Hangzhou: Zhejiang University. 2006
- [3]Liu Jiahua, Huang Jiyin. Research on the application of the new assessment standards in the management of aids to navigation in Shanghai[J].China Maritime Safety,2010:62-64
- [4] D.H.Ballard, C.M.Brown, Computer vision, Prentice-Hall, Englewood Cliffs, New Jersey, 1982
- [5]Xi Shazi. Detail and practice intelligent network video surveillance technology[M]. Beijing: Tsinghua University Press,2010:3-4
- [6]Wang Haiyin, Cheng Yuping. Analyze the defects and solutions of traditional aids to navigation[J]. Engineer and Technology,639-640.
- [7]Lv Wangjin, Zhou Chuanhong. Several attempts to strengthen the management of aids to navigation[J]. Management and Science, 2008:24.