Design and Development of Information Display Systems for Monitoring Overboard

Tadasuke Furuya[1], Atsushi Suzuki[2],
Atsushi Shimamura[2], Takeshi Sakurada[2],
Yoichi Hagiwawa[2], and Takafumi Saito[2]

[1] Tokyo University of Marine Science and Technology,
2-1-6, Etchujima, Koto-ku, Tokyo, Japan
[2] Tokyo University of Agriculture and Technology,
2-24-16 Naka-cho, Koganei-shi, Tokyo, Japan
tfuruya@kaiyodai.ac.jp

Abstract. Recently, the number of incidents that suspicious person boards from a small boat to a boarding ship has increased. In case of a large ship, the number of crew is especially a few against the size of the ship. Under the circumstances, we need a method to easily grasp the state not only monitoring in the bridge but also inspecting inboard and taking a rest.

Keywords: monitoring, overboard.

1 Introduction

A navigator observes the movement of other ship by the naked eye and by using radar equipment's information when own ship is close to other one. Then, the navigator observes the movement of other ship by using the information of AIS (Automatic Identification System) when own ship is far from other one.

However, it is difficult to find a small ship which doesn't install AIS by using radar at nighttime. Especially, it is difficult to set the radar. When the sensitivity is strong, the wave influences the setting of radar. On the other hand, when the sensitivity is not strong, a small boat cannot be found. As a method for maritime surveillance, it has been proposed to use a night vision camera and a thermal infrared camera. By using them, guardians can almost find their objects in the bridge.

In this approach, there is a problem of oversight, because the location and the guardian which check the video are determined. Therefore, we propose an information display system that can watch how the patrol boats move. We just control about 10-inch touch screen PDAs, we can arbitrarily display thermal imaging camera images, infrared images and radar images as we want.

C. Stephanidis (Ed.): Posters, Part I, HCII 2011, CCIS 173, pp. 506–509, 2011.

2 Our System Design

So that the ship shakes in its way, it is difficult to grasp the situation only by a real-time image. Moreover, the camera stabilizer cannot be put up to all cameras. The technique is needed for displaying the existence of the approaching objects, even if there is a shake of the ship. In such an environment, the accuracy of the automatic recognition is not high. The judgment by man is far better than the automatic recognition.

Then, we propose the technique for displaying the existence of the approaching objects. For example, we extract information from the time-line images taken with each camera, generate corrected image at a fixed time and present them. The image that collected this information is called "a gathering image [1][2]". The gathering image is generated by counting the amount of the change in a space of a fixed time and by gathering the large amount of the changes. Showing visualized data that compressed the time-line image data to be able to instantaneously judge makes it possible that a guardian's load reduction and the recognition time.

Image sequence to gathered time will depend on the distance between the object and frame rate. If the object is hidden from the camera's frame due to the large shaking vessel, a discrete track appears that the object is moving. However, because these waves have different movements, it should be readily apparent to monitor. Also, when capturing environment (e.g. at night) you need to select the appropriate equipment. Therefore, the image displayed is selected according to the situation.

The display image is divided into the following two.

- Night: The image that combines thermal imaging cameras and radar images.
- Rain: The image combines infrared images and radar images.

Using a combination images are gathered images. Gathered images are generated from captured images at a specific time interval. That one of a typical surveillance camera generated from the one hour, 10 minutes, and one minute's information. Real-time processing is so difficult. In this case, gathered time is set to a short interval time (e.g. 30 seconds).

In this paper, we report the status of fact, when we set the ship.

3 Experiments

We experimented with assuming suspicious person on board at night. The ship anchored 10 miles from land, are captured in a small boat near the radar. Figure 1 is a block diagram of the experimental environment. The radar images are the data from Automatic Radar Plotting Aids (ARPA). For safety reasons, ARPA can only be provided from the data. Camera control PC is networked. The mobile terminal connects to the control PC using wireless LAN.

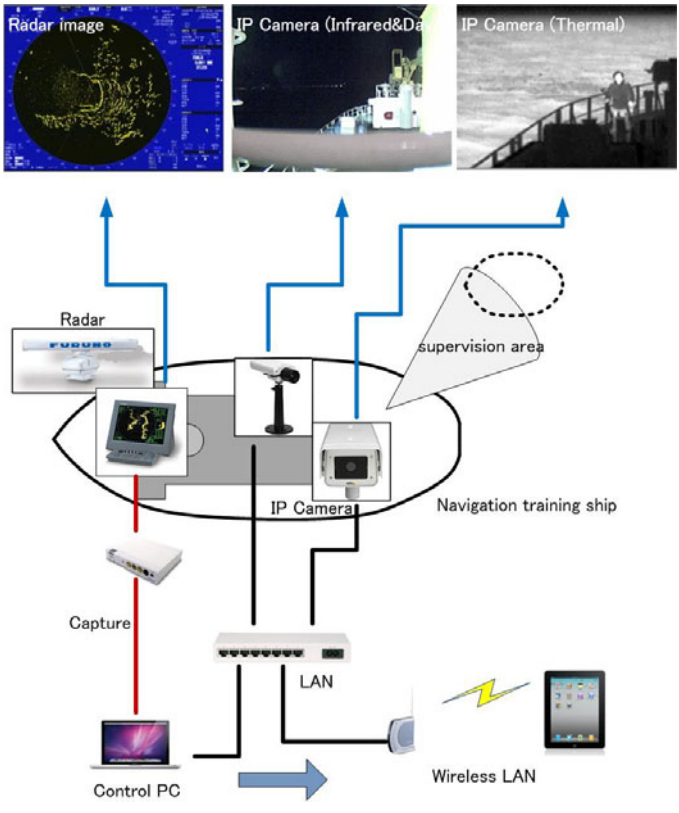

Fig. 1. The block diagram and layout of the system shows. ARPA has made use of the equipment used in practice. A navigation training ship for the experiment using a wired network, wireless network has been installed. ARPA display screen, Infrared & Daylight camera screen, Thermal camera image showing the top of the screen.

4 Result

We experimented with assuming suspicious person on board at night. The ship anchored 10 miles from land, are captured in a small boat near the radar. It put the case that a suspicious person on board the ship from the stern. In this experiment, IP cameras (thermal imaging, infrared imaging) were used. Radar image, thermal imaging, infrared images at night and the gathered images are shown in Fig.2. The two synthetic images (thermal and radar, infrared and radar) were compared. Small boat tracks extraction in radar images alone was difficult. The reason is that it is necessary only to produce images of the radar image to match the aggregate speed of the radar. However, it became possible to easily recognize images by combining the aggregate. The operation of small touch screen mobile device configuration change was difficult. Checking images of the ship is enough while it was moving.

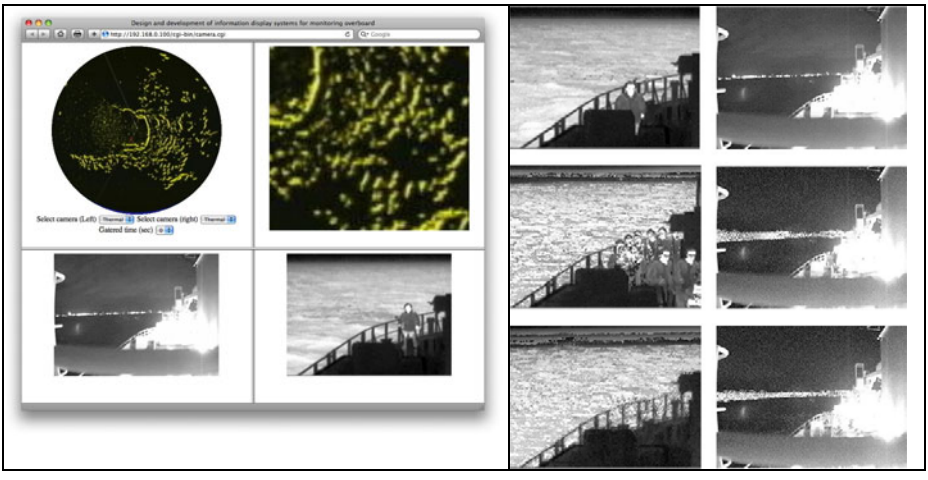

Fig. 2. Left: Display screen showing an Internet browser. ARPA Image (top left).Enlarge image the camera direction (top right). Infrared camera's live image (bottom left).Thermal camera's live image (bottom right). Right: Thermal camera image. The gathered image for 30 seconds. The gathered image for 30 seconds when there was no change. Infrared camera images. The gathered image for 30 seconds. The gathered image for 30 seconds when there was no change.

5 Conclusion

In this paper, we proposed a method to visualize the information in a variety of vessel operation (boarding of suspicious accident). Close object's presence shows in the gathered images that moving object's track can be easily understood. Gathered images of the proposed method are created with gatherers information on a certain time interval after extracting information from an image change in each camera.

This approach can also support the oversight accident. In this experiment, we could not due to the small number of surveillance cameras in one direction only. Next, we installed cameras on both sides, we will be observing the track of a small boat meandering.

References

1. Hirakawa, M., Uchida, K., Yoshitaka, A.: Content-Based Video Retrieval using Mosaic Images. In: Proceedings of 2002 International Symposium on Cyber Worlds: Theory and Practices, pp. 161–167 (2002)
2. Akutsu, W., Furuya, T., Miyamura, H.N., Saito, T.: Hierarchical Image Gathering Technique for Browsing Surveillance Camera Images. In: Smith, M.J., Salvendy, G. (eds.) HCII 2007. LNCS, vol. 4557, pp. 383–390. Springer, Heidelberg (2007)