The design of monitoring the systems and information collection of training ship light boat with maritime technical ability

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Abstract: In recent years, as the intensity of training at sea is gradually expanding, the safety hazards brought about in the training process is increasing. In particular, the training of technical skills of sea and its special characteristics determine the training course whether they have outstanding conditions frequency or safety hazards in order to meet the urgent need to deal with inconvenient, difficulty in evaluating the effectiveness of training and other characteristics. Directed by the monitoring system, the correlation technique of the theory studying and the design process, we realized the training environment and boat light boat, reached the individual seat and joined long-range instructing the information such as personnel's body state monitoring at real time, and then the achieved realization of the trains the effect analysis to reach the safety control of the train.

1. Introduction

With the in-depth development of various training, especially the particularity of maritime training leads to the increase of training safety hazards and training risks, which leads to the fear and resistance of some trainees and becomes a key factor restricting the training effect and safety guarantee.

In addition, in the sea skill training, there are a large number of boats dispatched. Under the difficult and high-intensity training, how to ensure the safety control of participating boats, personnel conditions and training process, and how to evaluate the training results have been a long-standing challenge for the training team. Based on the idea of modular integration and using the latest sensor technology, the problem of information data collection and monitoring of training boats is solved. Skills training according to the sea boat information data acquisition and monitoring system, through studying and analyzing monitoring theory, we found abnormal the alarm information immediately, and corresponding treatment measures are taken, personnel organization. When necessary, it can stop training , dispose man overboard, boat lost, seizures, and eliminate potential safety problems according to the plan emergency, which can greatly improve training security.

2. Demand analysis of training information collection and monitoring

The collection and monitoring of information of ships for maritime skills training is mainly used to meet the training needs of training safety management, training effect analysis and training command and control.

2.1 Training safety management

(1) Maritime skills training is the basis of the Marine environment data acquisition, the current can reach the access to historical weather data, listen to the weather forecast, field observation and other methods to solve training site, most depends on the experience, training commander to be accurate in the process of training master training ground temperature, humidity, air pressure, wind direction, wind speed, information flow, flow velocity, water depth and other parameters, Through the analysis of data, make timely adjustment of training plan;

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(2) In the course of maritime training, sudden dense fog often occurs, resulting in the loss of contact with other vessels due to reduced visibility, and the ship's navigation and positioning lack of effective means;

(3) Maritime training process, because some training course of physical demand is higher, especially in the summer training direct sunlight, high temperature, humidity and other factors, which makes students physical strength consumption too fast. Often organization staff only through indirect methods such as asking student body feeling control training rhythm, for sending the energy consumption situation of lack of scientific and effective participant real-time control;

(4) In the course of training, due to wind and wave swing, improper operation, collision accident and other circumstances, the information transmission after people falling into the water is lack of effective means, and the timeliness of rescue is delayed, resulting in increased training risks.

A. Basic Model

General assumptions for missiles fire distribution: the red have k kinds of missile launching platforms, and every kind of missile launching platform can only launch one kind of missile; there are n targets, and the important degree of every target is $W_j, j = 1,2,...n$; The known condition is that the number of guided weapons that the i platform can use is $c_i, i = 1,2,...k$; the damage probability of the missiles from the i platform to the j target is P_{ij}. For convenience, the decision matrix for fire distribution is:

$$\mathrm{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{k1} & x_{k2} & \cdots & x_{kn} \end{bmatrix} \tag{1}$$

In formula (1), x_{ij} means the missile number of the i platform which can be used to attack target j.

The model of this issue can be described like this: the equation solutions X to meet the following objective function and constraint conditions, the objective function:

$$\max F = \sum_{j=1}^{n} w_j \left[1 - \prod_{i=1}^{k} \left(1 - p_{ij}\right)^{x_{ij}} \right] \tag{2}$$

Constraint condition is:

$$\begin{cases} \sum_{j=1}^{n} X_{ij} = c_i, i = 1,2,...,k; \\ X_{ij} \geq 0, i = 1,2,...,k; j = 1,2,...,n \\ X_{ij} \in Z \end{cases} \tag{3}$$

2.2 Training effect analysis

(1) The standards of maritime skills training are mainly achieved through qualitative tests, lacking quantitative analysis means. System needs to solve the problem of training evaluation and software, through the system of the various parameters in the process of training records, combined with statistical analysis theory, through the data contrast, based on the weather and sea condition, classification (for example: to distinguish the windy day, days of stroke, little windy day, etc.) to calculate the trainees of quantitative results, so as to realize the evaluation of teaching effect;

(2) In the current training process, in order to improve trainees' training enthusiasm and training efficiency, various forms of competition will be implemented. In order to ensure a safe and smooth competition process, all boats need to abide by certain rules. The development of the system can solve the information monitoring function in the process of competition, and provide a guarantee for each boat to consciously abide by the rules, so as to improve the authenticity of the competition results.

2.3 Training command and control

(1) The sea after the boat on skills training, will be carried out within a certain range of waters in their training, real time control of the state of the location of each boat organization personnel needs, shore command post leading bodies need to grasp the real-time forces maritime training and ships to sail remote information, so as to realize the real-time control and remote control, especially in the process of sailing rally, Each ship will choose different routes according to the sea conditions, resulting in a wide distribution of ships, distant locations, and lack of effective means of command and control;

(2) During the training, the training team members need to know the formation information and the position information of vessels in other places outside the formation in real time, so as to provide effective means for vessel collision avoidance at sea.

Visible, skills training by sea boats information acquisition and monitoring system is designed, which can realize real-time effective control and control of maritime training situation, effectively predict accidents, prevent the happening of the accident. It occurs when a crisis can improve the effect of timely rescue and rescue, so as to improve the safety of maritime skills training, solve the hot and difficult problem in the field of maritime skills training.

3. Overall structure design of the system

Skill training at sea boat information acquisition and monitoring system is proposed to adopt the individual level, boats, formation and remote level design of the structure is mainly composed of training environment monitoring subsystem, the formation of ship collision avoidance subsystem, boat state and position monitoring subsystem, the personal life parameter detecting and analysis subsystem, remote monitoring platform components, such as its overall structure is shown in Figure 1.

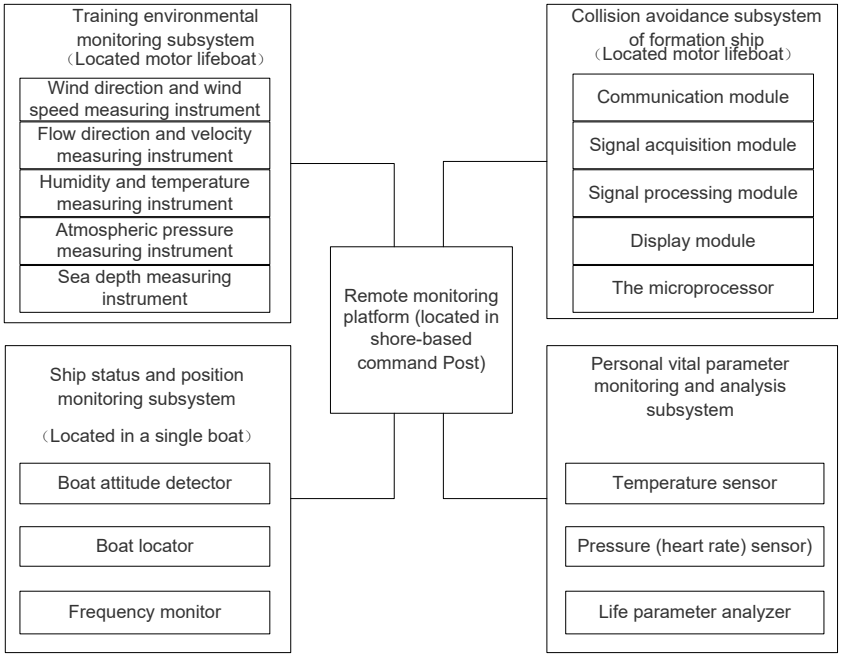

Figure 1: The system overall structure sketch map

In Figure 1, the personal life parameter monitoring and analysis subsystem mainly completes the monitoring and analysis of the physical state of individual trainees, and sends the corresponding information to the ship's status and position monitoring subsystem through wireless mode. During training and operations, each individual is required to carry a personal vital parameter monitoring and analysis subsystem. Therefore, the personal vital parameter monitoring and analysis subsystem must adopt a small and portable structure to ensure the real-time accuracy of information collection

without affecting personal training and facilitate practical use.

The ship status and position monitoring subsystem receives the information from the personal life parameters monitoring and analysis subsystem, and then communicates with the remote monitoring platform through wireless means after summarizing and processing the information appropriately. The collision avoidance subsystem of formation ships requires not only small size but also high information processing speed to ensure the safety of formation training.

4. Systems data transmission technology are with realizing

Due to the special limitation of the Marine training environment, the data transmission mode among the subsystems of the "Marine skills training ship information collection and monitoring system" designed in this paper is mainly wireless transmission. After analysis and demonstration, mobile communication network can meet the data transmission requirements within 1500 meters, mobile, Beidou and other high-power wireless communication can meet the data transmission requirements within dozens of kilometers. Therefore, the project plans to use mobile communication network to realize data transmission between subsystems, which does not require high transmission distance. As for data transmission between subsystems, which requires high transmission distance, high-power wireless communication technologies such as mobile and satellite are planned to be adopted, as shown in Figure 2

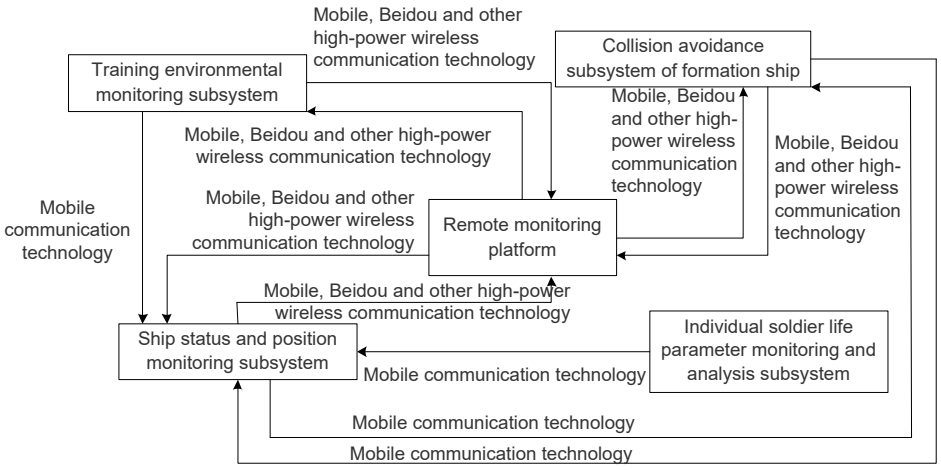

Figure 2: the data transmission technology sketch map between the subsystem

5. Conclusion

This paper studies the relevant technologies of data acquisition and monitoring of the participating boats and personnel in the maritime skill training. Organization personnel can through the remote monitoring platform for the participation boats, personnel to monitor the status and location information, when trainees abnormal body parameters or other emergency, the system can send out alarm information and to determine parameters of the staff, the location of the emergency, facilitate organization personnel timely rescue measures, so as to greatly reduce the incidence of maritime skills training.

The system can not only be used in sea skill training, but also can be used as the auxiliary control system of Marine Corps training at sea to realize the monitoring and guarantee of troop training information, and can be used in the information monitoring of anti-terrorist members of Special Forces and small boat law enforcement. In addition, it can also be popularized and applied to local sailing competitions. For example, the application of boat and personnel monitor to the competition boat can realize the real-time monitoring of boat status, when the emergency situation and foul protest, timely rescue, information assistance, can significantly improve the safety of the competition and arbitration accuracy.

References

[1] WU Qiong. Application Research of Motion Capture Data Assisted Training [D]. Capital Normal University, 2007

[2] NIU Kun. Design and Implementation of Athlete Training Data Acquisition System [D]. Beijing University of Technology, 2007

[3] Lu Wenting. Application of acoustic doppler velocity profiler [J]. Groundwater, 2011,33(6): 158-159

[4] Zhu Weiqing, FENG Lei, WANG Changhong, et al. Chinese Journal of Acoustics, 2007, 32(2): 144-150. (in Chinese)

[5] Su Lina, DONG Jinming, Zhao Qi. Measurement and Control Technology, 2007, 26: 163-165. (in Chinese)

[6] Zhang Huirong, Yuan Zhangxin, Zhang Lizhong. Journal of Shanghai Ship Transport Research Institute, Ministry of Communications, 2001, 24(2): 82-95

[7] CAO Dalao, WANG Yongmei, Wei Ping, et al. Design and Implementation of a New 3-DOF Swing Platform Control System [J]. Journal of Artillery Launch and Control, 2008, 3: 56-59