Development of the real-time risk monitoring system for Korean Coastguard

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Abstract

The objective of this research is to develop a model for real-time monitoring system based on risk assessment involved in ferry system of the Port of Incheon, Korea. The system can manage reasonable risks and level of risks and provide a guideline for response risk. The maritime accident and incident risk can be resulted in loss of life, casualties and severe environmental impacts. The question is to measure and estimate the risk of unusual events. The risk management is the process of determining whether an identified risk is acceptable and what action is to be taken to control a risk that have been identified. The regulations and policies for the response are not well prepared for value of risk management. The traditional risk analyses mostly provided only for pre-event and post-event risk analysis rather than real-time basis. The risk analysis model in this research is to develop the pilot system of real-time monitoring system for ferry management in Incheon, Korea. The real-time risk monitoring system would be driven based on the risk assessment model. Identifying vessel and situational attributes that can be used as indicators of risk

is a useful product of this risk assessment tool. The dynamic risk assessment tool combines the system simulation with the accident and incident probability models. This real-time model can be used to assess the adequacy of provisions for passenger and crew safety of Incheon Port in Korea and evaluate the system risk under an assumed scenario associated with risk assessment factors.

1. Introduction

The risk assessment model was developed to integrate expert judgement, system simulation and historical event data. The risk assessment model was to evaluate of overall maritime risk . The real-time monitoring system was developed to monitor real-time maritime risk based on the factors and probabilities from the assessment model. Following figure shows a system development model.(figure 1)

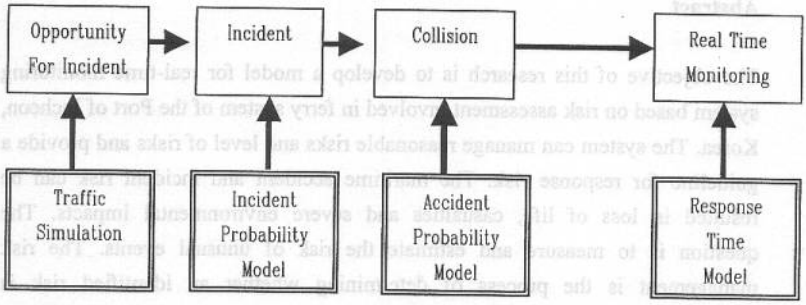


Figure 1. Real-time monitoring system development model

After maritime accident occurs, there is no sufficient implemented system that based on the correspondence and recovery, but there were system research related to prevention and preparation before the accident occurs. To minimize accident probability of vessels, draw out and assess the risk factors
reflect on underwater ferry system, then use the factors and probabilities which can be used to strengthen the security of the ferry movement on the waterway. There have been lack of analysis about the route, weather, and managerial, conditional, operational factors of the ferry operation in Incheon Port. The operational factors were not available enough to research for the time being, those are not included in this analysis.

2. Research Purpose and Scope

Risk management for the ferry is the total behavior that minimize the human and financial loss as sets the contingency plan involving correspondence of organization, recovery strategy for the various risk that could damage the ferry The possibility of incident lead to accident are identified and used to develop probability model with expert judgement. The following table listed variables and values are considered as contributing risk factors to that situation.(Table 1)

Variable Name	Possible Values
Ferry Route	Incheon D/A Routes (14 routes)
Ferry Class	Passenger Vessel, Oil Tankers,
Interacting Vessel Type	Passenger Vessel, Oil Tankers
Proximity of Interacting Vessel	0.5 Km
Wind Speed	5 knots scale
Wind Direction	Along, Side, Against
Visibility	0.5 mile scale

Table 1. Variables and Values of Risk Factors

Risk management system base on the information related to the ferry management

1. Strengthen the utility of the security management system for the ferry movement(The National Maritime Police, the Federation of Shipping Associations)
2. Providing the electronic map information in liaison with the SAR system
3. Creating the effectiveness of information management for the ferry security

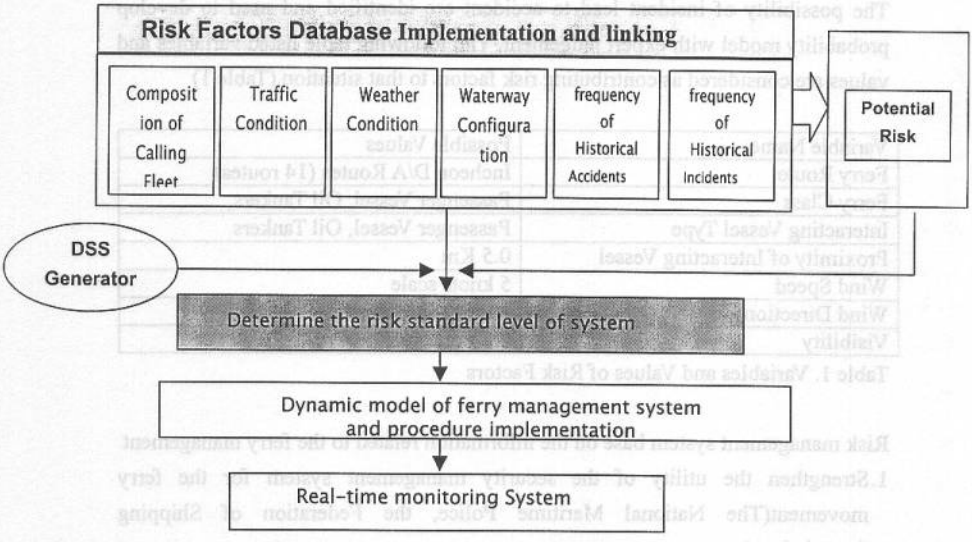
As the implementation of monitoring system that manage the risk through factor analysis related to the coastal area ferry movement, the monitoring system prevent from maritime accident of ferry and response from accident in Incheon coastal area.

The following steps are the development of pilot system for risk management in Incheon Port.

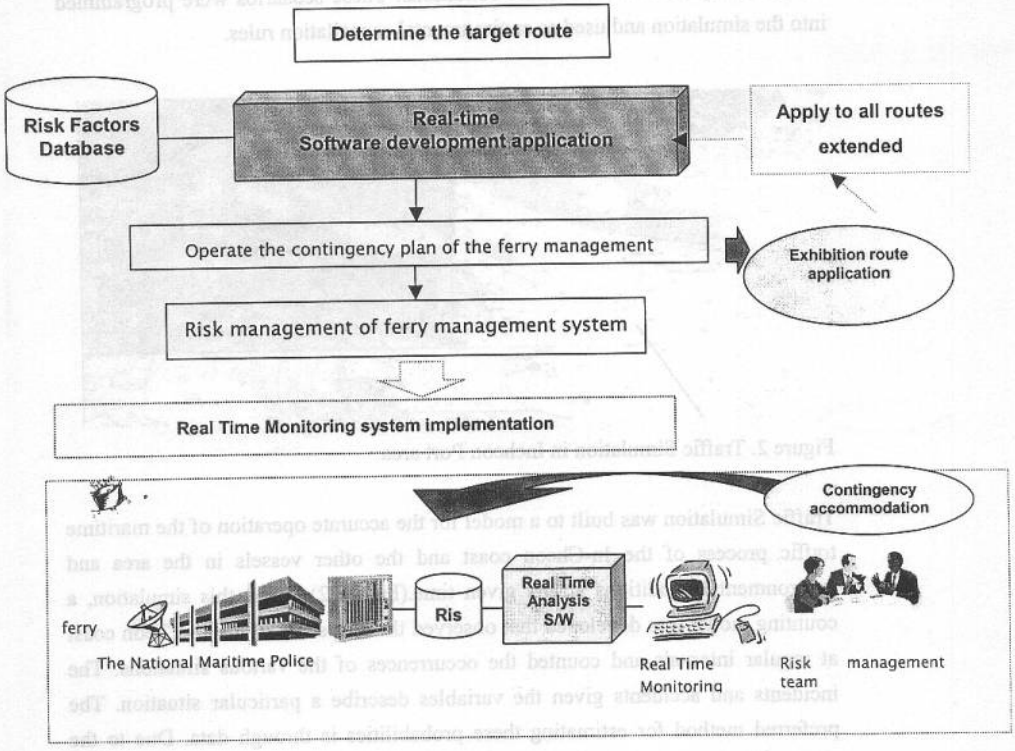
- **Step 1 : Risk Assessment for Decision Making :** Risk assessment based on scenario as the coast area ferry movement related to the risk factors
- **Step 2 : Risk-Reduction Plan Based on Risk Factors :** Set the risk management plan based on the risk factor database

- **Step 3 : Response System Management Using Real-time Monitoring System :** Risk Monitoring System based on risk assessment factors for the ferry using the dynamic simulation model

Step 1, 2 : Risk Assessment and Reduction Plan Based on Factors Database



Step 3 : Real-time monitoring System Software



3. Modeling Ferry Traffic

The movement of the ferry were drawn from the Fall, Spring, and Summer schedules for 1998 and 1999. The classes of ferries used for each ferry schedule were taken 5 classes. The speed of movement of each ferry class was taken from the vessel specifications in conjunction with ferry service rules. Ferry routes were used as inputs to the simulation.

Under certain conditions, scheduled ferry runs may be canceled. The primary cause of cancellations is mechanical problems on the scheduled ferry. The ferry cancellation logs for 1997-1998 were supplied and analyzed to determine a probability of cancellation for each ferry class. The schedule cancellation resulting from mechanical failure was programmed to occur randomly in the simulation in

accordance with the frequencies experienced by the logs. Cancellations can also be caused by the wind and route conditions. These scenarios were programmed into the simulation and used as environmental cancellation rules.

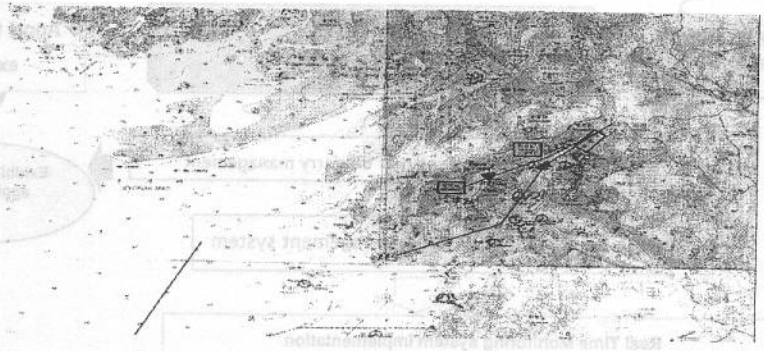


Figure 2. Traffic Simulation in Incheon Port area

Traffic Simulation was built to a model for the accurate operation of the maritime traffic process of the In-Cheon coast and the other vessels in the area and environmental conditions at any given time.(Figure 2) Using this simulation, a counting model was developed that observed the snapshots of the In-Cheon coast at regular intervals and counted the occurrences of the various situations. The incidents and accidents given the variables describe a particular situation. The preferred method for estimating these probabilities is through data. Due to the using of the record of the In-Cheon ferry, there was not enough accident data to effectively estimate the contributions of the variables to parameters of the collision probability model. In addition, typically the level of detail in accident and incident databases does not allow for frequency estimation at the level of details. The expert judgments are obtained from captains, Korean Coast Guard personnel and member of the Korean Pilot Association. This expert judgment was combined with the accident and incident data available and used to model the accident and incident probabilities.

4. Data Collection System

The monitoring system is configured to provide the mariner and vessel fleet operation with real-time displays of all the assets in their network. Archive of each

vessel data is an important factor of the monitoring feature of the system. All positions and messages are recorded for playback data displayed on the maritime electronic charts and terrestrial maps are equipped with multiple window views, zoom in, zoom out features. The data collection system uses Modem, antenna, and GPS which transmits the following data every 15 seconds : 1. Year/Data/Time 2. Vessel I.D 3. Longitude 4. Latitude 5. Speed 6. Wind Speed 7. Wind Direction . An the visibility data is transmitted every 10 minutes. The positional data and environmental data are delivered to headquater office and displayed SAR system with showing name of vessel and symbol indicating direction of graphical format.

The extended line of speed system communicates messages using burst of compressed data at high data rate. The messages are broken into segments and transmitted and reconstructed at the receiver. Each segment are checked correct reception and get acknowledgment by the station. Each segment is held in the base station's main processor until the entire message is together. The installation of weather data and transmission of real-time data on passenger vessel with scheduled route can improve the data quality of weather report and provide real-time monitoring system based on risk assessment model.

The protocols and network software are provided communication throughout the network from 50-100 miles. The auxiliary RS-232 ports are provided for status monitoring and connection to a data terminal or PC for message control and interfacing to other application modules.

The overall system configuration is following diagram (Figure 3)

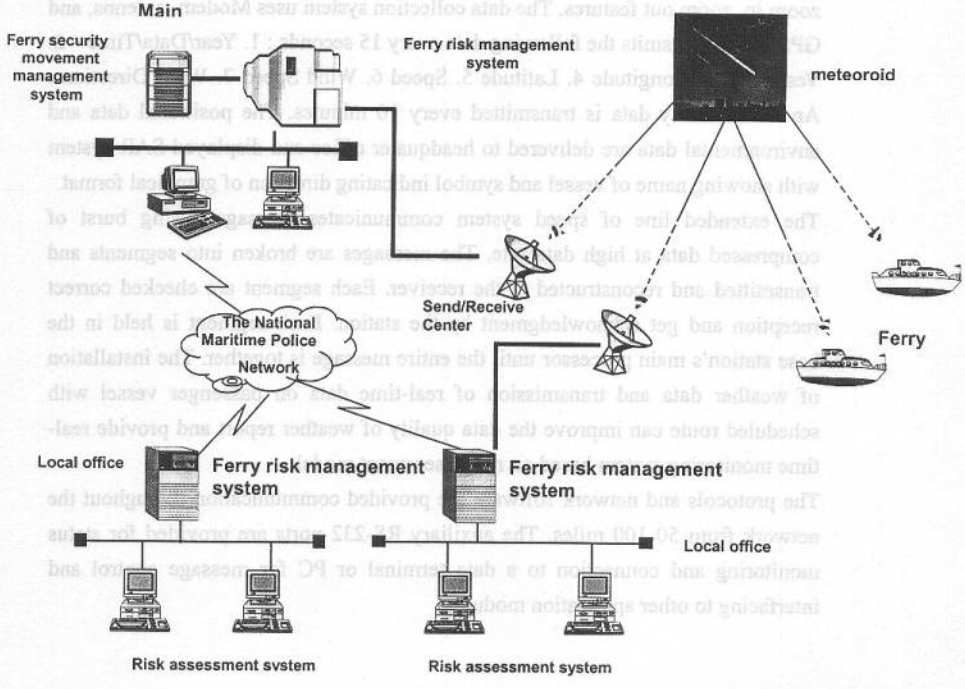


Figure 3. System Configuration

5. Conclusions

The real-time monitoring is to assess the risk factors to prevent and response from the accident and incident of ferries in Incheon coastal area as possible. The purpose of system minimize the damage of accident in coast area, and implement the efficient and cooperative accommodation system. The system provide the operational condition of ferry and technical condition change accompany with the valid security since the nation's trust of risk and security management is advertised what main strategy of the coast area ferry management system of the Korean National Coastguard.

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