

Research and application of wireless sensor network technology or positioning technology in engineering ship monitoring system

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Abstract: This paper takes intelligent water transport as the research direction, studies the positioning technology based on WSN engineering ship monitor system, takes intelligent water transportation as the research direction, takes the Guangxi port and Xijiang river ships and dangerous goods ships as the applied research objects, takes Beidou high precision positioning technology and "Internet plus" technology as the key technologies, so as to solve the problems of ship transportation and safety monitoring and improve the port. Aiming at the efficiency of shipping supervision and the prevention of passenger and freight traffic accidents on water, this paper focuses on the realization of intelligent monitoring and management of ship basin transportation, safety warning management of dangerous goods ships and ferry safety monitoring and management.

1. Introduction

With the increasingly busy port business, the flow of maritime traffic is gradually increasing, and the density of ships is correspondingly increasing. The accuracy of track prediction arrangement of VTS system is of great significance to ensure the safe driving of ships in real time and reduce maritime traffic accidents [1 ~ 2]. At present, there are many prediction methods for ship trajectory model. For example, reference [3] proposes a prediction analysis method for AIS data of VTS system based on Kalman filter, which can realize the smooth estimation of ship trajectory model combined with least square method; reference [4] improves the basic algorithm Kalman filter process on the basis of reference [3], which improves the accuracy of ship trajectory model estimation. In reference [5], the competitive neural network is used as the prediction algorithm tool to realize the high-precision prediction of ship trajectory based on the real-time prediction of ship navigation state. The application of intelligent technology is an important means to realize the transformation of traditional industries in China. The BeiDou Navigation Satellite System (BDS) and the Internet plus technology are the important measures to realize the intelligent transformation in traditional industries. On this basis, the demand of water transportation industry to realize intelligent transportation is increasing. How to realize transportation intelligent management and safety intelligent monitoring management has become the key problem to be solved.

2. Problem model

China's self-developed "Beidou satellite navigation and positioning system" has produced significant social benefits in forest fire prevention, water conservancy and flood control, transportation and other civil and military fields [1], and in China's hydrological monitoring, geological exploration, meteorological prediction, marine observation, disaster information, rescue and dispatching, production safety monitoring, agricultural production moisture monitoring, dangerous goods storage and transportation monitoring, etc. They have played an important role in all aspects. It can be seen that Beidou satellite navigation and positioning system is gradually integrated into people's life, and has been innovated and applied in various traditional industries, gradually forming the application development mode of "Beidou + traditional industries". The development of China's Internet has evolved from the initial era of portal, game and search to people's deep application of the Internet for information acquisition, release and interaction. Chinese enterprises have gradually evolved into general-purpose Internet application enterprises [3].

At present, China's Internet has entered the era of Internet plus. Based on the application of mobile Internet, cloud computing and big data technology, the Internet has entered [4] system in the commercial ecosystem, forming the "Internet plus" traditional industry mode, and applying it in the fields of transportation, agriculture, industry, finance, transportation, tourism and so on, and gradually realizing the traditional industry's innovation drive to the intelligent industry. Dynamic development. Ship transportation is the most important mode of transportation in water transportation industry from the beginning to the present. The development of water transportation mainly focuses on passenger transport, cargo source, ship, port, channel and so on.

China's water transportation has gone through the brilliant 600 years ago, the decline of Ming and Qing Dynasties, the revival after the founding of new China, and the growth since the reform and opening up, forming its tortuous upward development path [5]. At present, the development of water transportation industry is facing the challenge of intelligent technology system reform. The traditional transportation management mode has been unable to meet the current demand of intelligent water transportation. The future development direction of water transportation will focus on the intelligent ship, intelligent channel, intelligent port and intelligent maritime supervision.

3. Positioning technology in engineering ship monitoring system based on WSN

3.1 Research ideas

This article focuses on the Internet plus Beidou high precision positioning technology, joint video surveillance technology and GIS (Geographic Information). The purpose is to build a platform suitable for ship transportation and safety monitoring management, and realize the application of Beidou high-precision positioning technology in ship basin transportation monitoring management, dangerous goods ship safety early warning management and ferry safety monitoring management through the combination of software and hardware. The preliminary architecture of the platform is shown in Figure 1.

The construction ideas of the platform are as follows.

(1) The platform mainly provides services for the relevant management departments of Guangxi port and shipping transportation, and meets the comprehensive needs of the relevant management departments for the transportation monitoring and safety management of ships in the Xijiang River Basin.

(2) Through the research and construction of big data service system, access to the data of management department, complete the interconnection between cross region, cross department, cross government enterprise and cross business data.

(3) The platform is built on the basis of meeting the user's demand for intelligent management, relying on the high-precision shipborne Beidou terminal with sub meter positioning to complete the accurate positioning of ships, and combined with cameras and multi-sensor equipment to complete the safety monitoring and management of ships, dangerous goods ships and ferries in the Xijiang River Basin.

3.2 High precision positioning and ship basin transportation monitoring management

The ship basin monitoring management is carried out by the relevant port and shipping management departments through the monitoring center and monitoring management platform (as shown in Figure 2).

With the monitoring platform as the software support, the shipborne Beidou terminal as the hardware support, and the GIS electronic map as the information display support, the wireless ad hoc network is constructed to form the monitoring special network, and the video monitoring nodes are arranged for the channel, port and other monitoring points to realize the transportation supervision and management of the ship basin.

(1) Combined with camera, high-precision shipborne Beidou terminal and sensor equipment, the accurate data acquisition in the process of shipping is completed, and 3G / 4G / WiFi and other transmission networks are used to complete the data transmission.

(2) The collected data such as ship distribution, navigation, ship location and transportation route are accurately displayed on the GIS electronic map.

(3) By clicking the GIS electronic map on the platform system, the management personnel will directly display the position information and navigation situation of the ship in a certain area, so that the management personnel can timely find out whether the ship is running normally. If it deviates from the established track, the platform will automatically respond and send a reminder message to the ship pilot.

3.3 High precision positioning and dangerous goods ship safety early warning management

To study the safety monitoring and management of all dangerous goods transport ships entering the network.

(1) The ship is equipped with a gravity sensor to monitor the weight of the oil in real time. With the liquid level increase and decrease sensor, the ship can detect the oil leakage and dangerous goods leakage in real time.

(2) Ships, main channels and dangerous goods terminals are equipped with video monitoring equipment to realize the whole process monitoring of dangerous goods transportation, loading and unloading.

(3) Through the high-precision shipborne Beidou terminal, multi-sensor equipment and camera video equipment, the position, external environment and internal environment data, Captain / crew behavior data, cargo status data and danger signals of dangerous goods ships are collected. According to the monitoring data index, the danger signals and safety hidden dangers are analyzed and judged, and the risk of ship transportation is raised in advance Pre warning.

(4) The early warning data is transmitted to the monitoring center through 3G / 4G / WiFi and other data transmission methods. The platform receives the early warning information to make emergency response, and plans the emergency route according to the accurate position of the dangerous goods ship collected by the front-end high-precision shipborne Beidou terminal.

3.4 High precision positioning and ferry safety monitoring management

The video safety monitoring system of ferry is constructed, and the safety monitoring management of ferry and passenger ferry is completed jointly with video equipment.

(1) Taking the mobility monitoring mode as the access point, the camera is installed in the designated area of the ferry terminal, and the video server and camera are installed on the ship. The front-end video acquisition subsystem of the ferry video security monitoring system and the monitoring center jointly complete the real-time video monitoring of the operation of the Guangxi ferry terminal, the ferry navigation trajectory, the ferry inclination angle and the passenger safety management monitor.

(2) Using video monitoring and Beidou high-precision positioning fusion application real-time monitoring and accurate positioning of the ship's geographical location, through the wireless video transmission technology to transmit all the monitoring data and video images back to the management platform of the monitoring center, the monitoring center can timely watch the real situation of the scene through the on-site ship wireless video, so as to realize real-time monitoring. The average positioning error and mean square error are shown in Figure 1 and Figure 2.

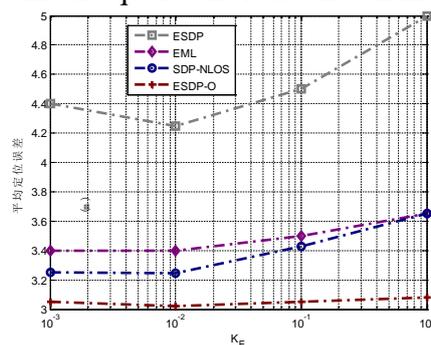


Figure 1. Average positioning error

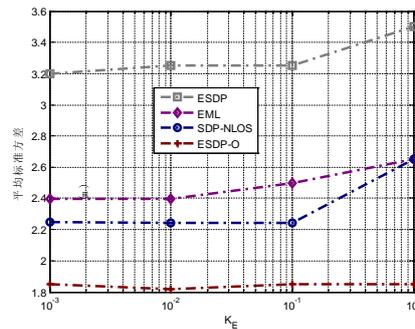


Figure 2. Mean positioning standard deviation

4. Benefit analysis

The research and application of Beidou high-precision positioning technology in the water transportation industry will effectively promote the development of "Beidou + water transportation industry" with Guangxi as the demonstration area, and will gradually drive the development of the national Beidou industry in the future. (1) Improve the efficiency of management supervision. The application of the research results effectively breaks the traditional ship supervision mode, enhances the management of shipping market, ferry, ship, etc. by port and shipping management department, and improves the supervision efficiency of port and shipping management department and the management level of enterprises. (2) Cost saving. Using video monitoring and Beidou high-precision positioning fusion application, realize the real-time monitoring of ferry and ship transportation, reduce the management times of management personnel, reduce the investment of human resources and time, and save labor costs, transportation and travel costs. (3) Reduce the accident rate. The application of Beidou high-precision positioning technology in ship transportation management can accurately locate and track the navigation situation of dangerous goods ships, and provide intelligent monitoring and early warning means for potential hazards such as oil leakage, fire and leakage of dangerous goods in the transportation process, which helps to reduce the leakage, explosion, pollution, fire and other accidents that may occur in the transportation of dangerous goods on water.

5. Conclusion

To sum up, the research and application of Beidou high-precision positioning technology and its series of research results in the water transport industry provide intelligent monitoring and management means for the port and shipping management departments, and effectively promote the development of Beidou industrial chain. The future will be Internet plus Beidou high.

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