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Development of Automatic Identification System in Strait of Batam-Singapore

Jaswar Koto,[a,b,*] and Nur Aireen Amran,[a]

[a)]*Faculty of Mechanical Engineering, Universiti Teknologi Malaysia (UTM), 81310, UTM Johor Bahru,*
[b)]*Ocean and Aerospace Research Institute, Indonesia*

*Corresponding author: jaswar.koto@gmail.com and jaswar@utm.my

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ABSTRACT

In Vessel Traffic System (VTS), AIS can detect a larger number of targets without considering the shadow effect and can provide more voyage information for port center. AIS can give full information such as types of ship, size, name, MMSI number and etc. AIS system is very important in the VTS to control ship in and out at the port area. This paper discussed on development of AIS system. The system was applied for safety purpose by taking ship tracking in Strait of Batam-Singapore.

KEYWORDS: *Port Traffic Management; Automatic Identification System.*

NOMENCLATURE

AIS	*Automatic Identification System*
VTS	*Vessel Traffic System*
MMSI	*Maritime Mobile Service Identity*
IMO	*International Maritime Organization*

1.0 INTRODUCTION

The port traffic management required to control ship in and out at port area to prevent from the collision occur. In vessel traffic management (VTS), they are using AIS or known as an Automatic Identification System and radar system to control ship in and out at the port area. The function of AIS is used to identify and locating the vessel by electronic exchange data either with nearby ships or VTS stations. Besides that, AIS also can detect a larger number of targets without considering the shadow effect and can provide more voyage information for Port traffic Management. Therefore, the port traffic management required to use AIS to prevent the ship from collision, including a ship colliding with a fishing boat

AIS has been complied with safety and security regulation, functioning as collision avoidance, vessel traffic services, maritime security, aids to navigation, search and rescue and accident investigation. In 2002, IMO, have made compulsory of AIS for most of larger commercial ship in which ships over 300 gross tonnage engaged on international voyages and cargo ships over 500 gross tonnage not engaged on international voyage and passenger ship irrespective of size (IMO, 1998).

Currently, Joint International Research Center has developed AIS system in the Indonesia Malaysia as shown Figure.1. This paper was focused on the strait of Batam-Singapore stations.

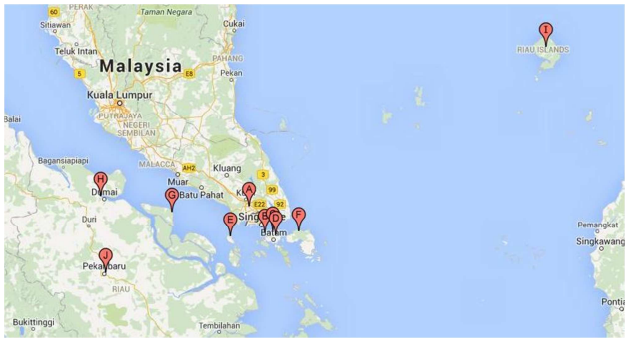

Figure 1: Distribution of Station Receivers in Indonesia and Malaysia.

In this research, data was extracted from the AIS station of Joint International Research Center on Safety Navigation. They have seven locations of AIS which is station A (P23, UTM), station B (Belakang Padang), station C (Batu Ampar), station D (Politek Batam), station E (Karimun), station F (Bintan) and station G (Bengkalis).

2.0 AUTOMATIC IDENTIFICATION SYSTEM

The AIS is the system used for tracking, identification and navigation of the vessel in the ocean and for maritime navigation safety and security. The requirement for AIS is outlined in Subparagraph 2.4 of Regulation 19 of Chapter V of SOLAS (the International Convention for Safety of Life at Sea) (IMO, 2002). In 2002, IMO, have made mandatory for all new ships include passenger ship, tankers and other ships of 300 tons during international voyages. In 2008, the system have been fully implemented and AIS also compulsory for all ships of 500 tons or more national voyage. Most of the mandates are focused on commercial ship. In May 2014, all EU fishing boats over 16 m must have Class A of AIS. Approximately 250 000 vessels have fitted AIS transceiver of some types. It is shown that, AIS is becoming compulsory for all types of ship.

Theoretically, the system is capable of handling over 2000 reports per minutes and updates every two seconds (Maciej, 2010). The AIS used digital Very High Frequency (VHF) radio signal which is automatically communicated vessel information such as speed, vessel identity, position between AIS vessels and coastal authorities. The VHF range is typically for ship to ship communication and for ship to shore communication. The effective coverage of AIS is below 40 nautical miles (Bin Lin, 2006). Even it is fully area coverage, but it is only visible if the ship has fitted the AIS.

AIS can be classified into six types which is Class A, Class B, Base station, Aids to navigation (AtoN), Search and Rescue Transponder (SART) and Specialist AIS Transponder. In this project more focus on AIS Class A. Class A is vessel that AIS transceiver operated using self-organized time division multiple access (SOTDMA) and it is required to IMO/SOLAS commercial ship. Class B is a vessel that AIS transceiver operated by using Carrier Sense Time Division Multiple Access (CSTDMA) or SOTDMA. This class does not meet the SOLAS standard, but does meet ISAF OSR Cat 1 and 2 requirement and receiver only (IMO, 1998).

The AIS class A will give information every 2 to 10 seconds while underway an every 3 minutes while anchoring. The information includes (Maciej, 2010):

i. MMSI number
ii. Navigation status (as defined by COLREGS " at anchor"," under way using engine", " not under command")
iii. Rate of turn – right or left, 0 to 720 degrees per minutes
iv. Speed over ground – 1/10 knot resolution from 0 to 102 knots
v. Position accuracy
vi. Longitude and Latitude
vii. Course over ground
viii. True heading
ix. Time stamps

In addition, the information will be given by AIS Class A every 6 minutes includes:

i. MMSI number
ii. IMO number
iii. Radio call sign
iv. Name of ship
v. Dimensions of ship
vi. Reference point location
vii. Types of position fixing devices
viii. Draught of ship
ix. Destinations
x. Estimated time of Arrival at destination

Figure 2 shows the example of information in the AIS system. Although there are many advantages using AIS such as accurate ship position, automatic and prompt update, and good quality during weather but still have a disadvantage. One of it is AIS just can detect only ship that has an AIS system only. So when have a ship or boat such as fishing boat which is does not fit with AIS cannot be detected by AIS. Another problem is that ship equipment in conjunction with AIS such as GPS or gyro compass has a trouble. The information delivered to port management and other ships incorrect and inaccurate. In effect of that, radar system still using in port system to identify boat that does not have AIS.

Index	Time	MSSI	Lat.	Long.	Speed	Course	Heading	Distance
2125	2005/01/28 09:00:00	1130504	121.778	25.149	0	0	511	0.549295003
2124	2005/01/28 09:00:00	215300000	121.724	252.0	12	51	130	3.9665911.6
2128	2005/01/28 09:00:00	309764000	121.617	25.368	16	269	227	15.86499307
2126	2005/01/28 09:00:00	351056000	121.752	25.148	0	178	241	1.063393154
2127	2005/01/28 09:00:00	352388000	121.752	25.145	0	284	274	1.116407184

Figure 2: Example of sorts AIS information on the observation.

3.0 DEVELOPMENT OF AIS SYSTEM IN STRAIT BATAM-SINGAPORE

The AIS system consists of an antenna, AIS receiver CYPHO-150, TP-Link and Personal Computer (PC) computer as shown in Figure 3.

Figure 3: Development of AIS System.

This AIS Marine Safety and Environment simulation was developed using Microsoft Visual Basic 2010 as showed in Figure 4. The primary data of ships which is obtained from AIS receiver was consists of date, time, MMSI number, IMO number and position of the ship (longitude and latitude). The data collected from AIS receiver is simultaneously stored and update in a hard disk on the PC. Ships details such as names of ships, types of vessel, and other data was extracted from free ship database such as Marine Traffic and Vessel Tracker. The raw data was recorded in every one minute which depends on setting up.

Figure 4: The AIS Marine Safety and Environment Simulation

Firstly in this safety and environment system is choosing the location of AIS. Then, the file is uploaded from AIS to the server and required to select port serial and period with connect to server. The period is the data was save depend on setting up either one minutes, five minutes, ten minutes or one hours. In control panel, it is required to select the location and types of map. It has several types of mapping such as roadmap, satellite, terrain and hybrid.

This system can be used for navigation tracking and collision prevention using GPS and AIS. The marine navigation tracking system will show the position of a ship on the map which is linked to a Google map and denoted with yellow color as show in figure 5. The full detail of ship can be identified in the ship database.

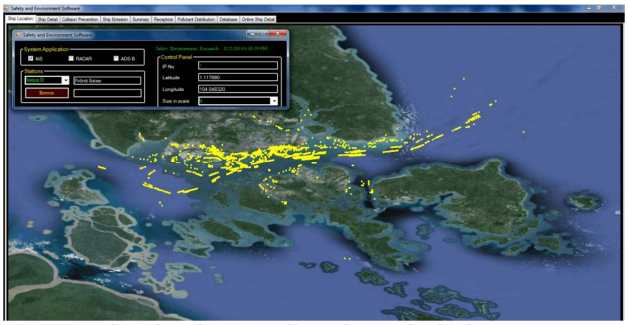

Figure 5: Ship distribution collected at Politeknik Batam station, Indonesia.

The AIS system he been testing at the Strait between Batam, Indonesia and Singapore as shown in Figure 5. It will show the position of ship with the color based on the types of ship. The map used links to a Google map. From here, a number of ships passed through can be calculated. Figures 6 - 11 showed the number of ships passed through, ship hourly passed through and ship distribution the strait between Batam and Singapore.

Figure.6: Onboard tracking ships in Batam-Singapore region.

Figure.7: Actual distance between ship to ship in Batam-Singapore region.

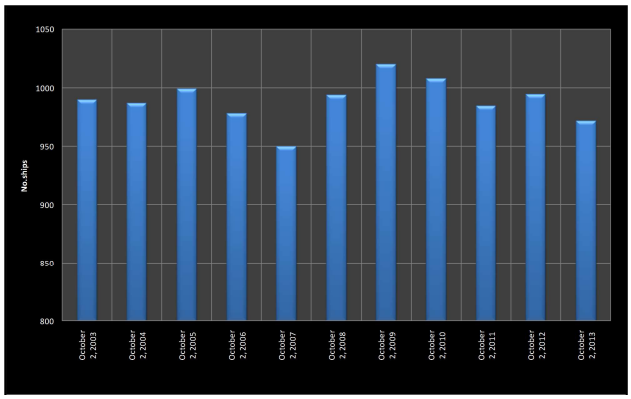

Figure.8: Number of ships passed through the strait between Batam and Singapore.

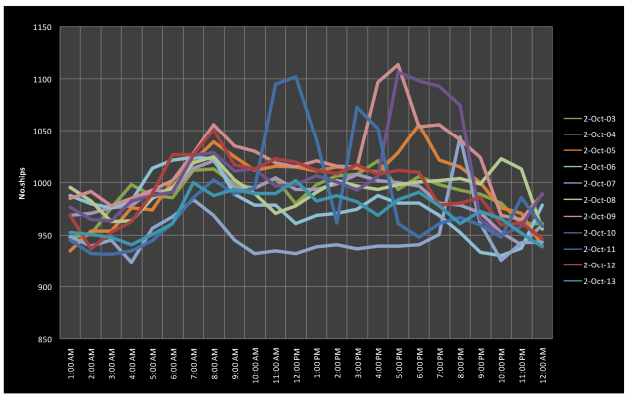

Figure.9: Number of ships hourly passed through the strait between Batam and Singapore.

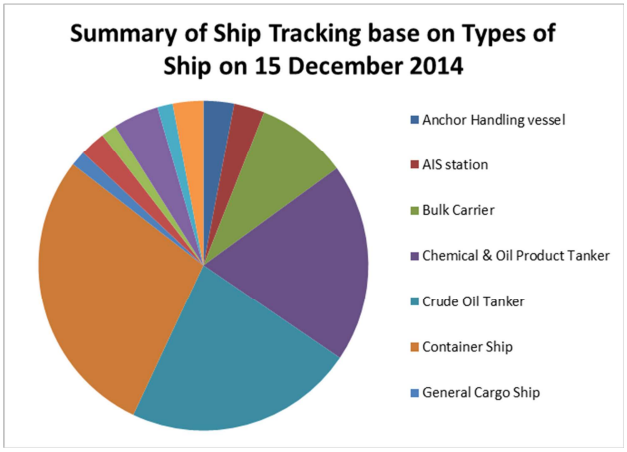

Figure.10: Ship tracking base on type of ship.

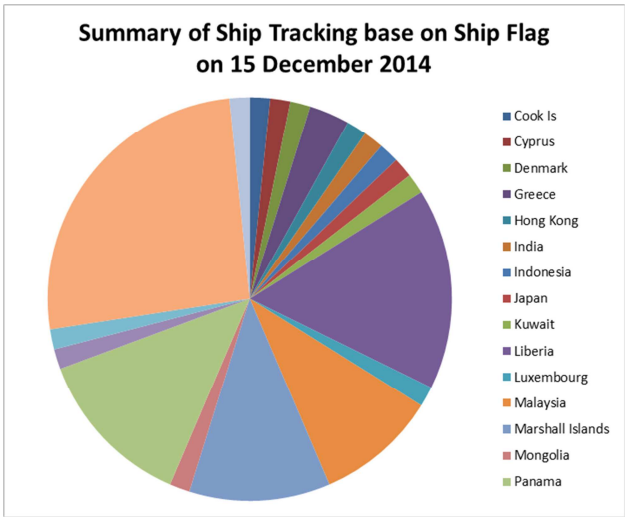

Figure.11: Ship tracking base on ship flag.

4.0 CONCLUSION

The AIS system is very important in the port traffic management. It is because the AIS system can give accurate position detected target ships. The development of AIS system in strait of Batam-Singapore has been tested. The results of testing showed that the AIS system could be applied to real vessel traffic management operation system.

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