INTEGRATED SYSTEM OF AUTOMATIC IDENTIFICATION SYSTEM (AIS) AND RADAR FOR PORT TRAFFIC MANAGEMENT

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Special dedication to my beloved family

Ayah, Ayu, Nadia and Aboy….

Also my late mother….

Thank you for all support

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ABSTRACT

In Vessel Traffic System (VTS) function, AIS can detect a larger number of targets without considering the shadow effect and can provide more voyage information for port center. For radar system can detect target actively even buoys or rock no matter ship size or fitted equipment. But even radar can detect all targets, it is cannot give full information as AIS. AIS can give full information such as types of ship, size, name, MMSI number and etc. The vessel can be divided into two which is SOLAS and NON SOLAS vessel. SOLAS vessel required fitting AIS in their ship and the NON SOLAS vessel does not required fitted AIS in their vessel such as a fishing boat, leisure boat and navy boat. In effect of that, VTS required to use radar to detect this NON SOLAS vessel. AIS and radar system is very important in the VTS to control ship in and out at the port area. They have to use two different computers, which is one computer for AIS and another computer is for radar systems. In effect of that, the collision might occur due to incorrect judgment from the officer. By integrating AIS and radar, the officer can control port with more accurate and systematic. This project will focus on integration of AIS and Radar for managing the movement of vessels in port for safety purpose by taking Port Tanjung Pelepas (PTP) as a case study.

ABSTRAK

Fungsi AIS di dalam sistem lalulintas kapal (VTS) digunakan untuk mengesan kapal dengan jumlah yang banyak daripada sasaran tanpa mengambil kira kesan bayang-bayang dan juga boleh memberikan maklumat pelayaran yang lebih mendalam kepada pusat pelabuhan. Sistem radar pula dapat mengesan sasaran aktif walaupun pelampung atau batu dan pelbagai jenis dan saiz kapal atau peralatan yang dipasang. Radar boleh mengesan kesemua sasaran, tetapi ia tidak boleh memberikan maklumat yang penuh berbanding maklumat yang diterima daripada AIS. AIS boleh memberikan maklumat lengkap seperti jenis kapal, saiz, nama, nombor MMSI dan lain-lain. Jenis-jenis kapal boleh dibahagikan kepada dua iaitu SOLAS dan BUKAN SOLAS. Kapal jenis SOLAS, memerlukan AIS di dalam kapal dan kapal BUKAN SOLAS tidak memerlukan memasang AIS di dalam kapal mereka seperti bot nelayan, bot riadah dan kapal tentera laut. Oleh demikian, VTS memerlukan radar untuk mengesan kapal BUKAN SOLAS ini. AIS dan sistem radar adalah sangat penting dalam VTS untuk mengawal kapal masuk dan keluar di kawasan pelabuhan. Mereka perlu menggunakan dua komputer yang berbeza, di mana sebuah computer untuk AIS dan sebuah lagi komputer untuk radar. Oleh di sebabkan itu, kemungkinan perlanggaran boleh berlaku akibat kesalahan daripada pihak pelabuhan. Dengan mengintegrasikan AIS dan radar, pegawal pelabuhan boleh mengawal pelabuhan dengan lebih tepat dan sistematik. Projek ini memberi tumpuan kepada integrasi AIS dan Radar untuk menguruskan pergerakan kapal di pelabuhan bagi tujuan keselamatan dengan mengambil Pelabuhan Tanjung Pelepas (PTP) sebagait empat kajian.

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LIST OF ABBREVIATION

AIS	-	Automatic Identification System
IMO	-	International Maritime Organization
SOLAS	-	Safety of Life at Sea
PTP	-	Port Tanjung Pelepas
VTS	-	Vessel Traffic System
kt	-	Knot
MMSI	-	Maritime Mobile Service Identity
LA	-	Latitude
LG	-	Longitude
ARPA	-	Automatic Radar Plotting Aid
SAR	-	Synthetic Aperture Radar
CPA	-	Closest Point Approach
TCPA	-	Time Closest Point Approach

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

As we known, 90 percent of global trade is carried by sea. In effect of that, port area is busiest places for ship loading and unloading cargo. 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.

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).

Even though AIS can give full information to VTS, but still the AIS system cannot replace radar system. Vessel traffic can be divided into two groups which are SOLAS and non SOLAS vessel. The radar is for vessel which is not fitted AIS in their vessel. The benefit of radar system is can detect targets actively even buoys or rock no matter ship size or fitted to any equipment (Bin Lin, Chih Hao Huang, 2006). Even though the radar system can detect all targets, but radar system cannot give full information such as size of ship, name, MMSI and IMO.

Therefore, Port traffic management required to use both of this system to prevent the ship from collision, including a ship colliding with a fishing boat. This is because fishing boats also are using a port area that obstructs ship moving and increases navigation risk. From AIS information, these kinds of situation cannot be found so that Port traffic management officer cannot sound collision warning to the related ships.

In effect of that, it is difficult for port traffic officers to look out AIS and radar system in two different computers at the same time. It is can be attributed to human error on navigational faults due to incorrect judgment of ship movement by the port officer (Bin Lin, Chih Hao Huang, 2006). By integrating of AIS and radar system, it is much easier for port officers to look out and control the situation in the port area. The port area for this project is focus on Port Tanjung Pelepas (PTP), which is located in the Strait of Malacca, which is the most important channel in the world that connecting the Indian Ocean with South China Sea and the Pacific Ocean as shows in figure 1.1.

There were approximately 1500 vessels daily used Strait of Malacca with 32 percent of Liquid bulk, 11 percent of container ships and 42 percent under the Singaporean flag (J.Koto, M.Rashidi and A.Maimun, 2014). PTP is a port for container port and situated on the eastern side of the mouth of the Pulai River in South-West Johor. PTP also has a naturally sheltered deep water port and is near the Malaysia-Singapore Second Crossing (Pelabuhan Tanjung Pelepas, 2009).

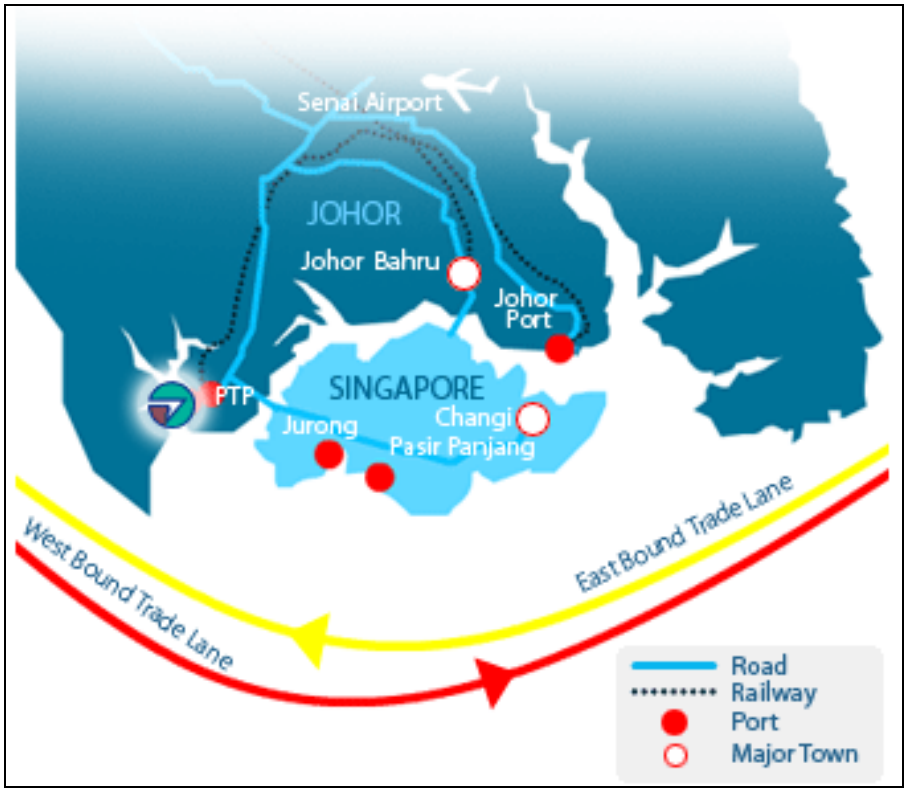

Figure 1.1: Port Tanjung Palepas (Pelabuhan Tanjung Pelepas, 2009)

In 2004, PTP is the largest port in Malaysia and it is becoming the 16th busiest port in the world (Wikipedia, 2014). There are a lot of ships in and out at this port. This port area also is used by small boat such as fishing boat, tug and barge. Because of that, this road is becoming busiest and PTP officer has a responsibility to look out the position of this ship and boat at PTP area. In PTP, they are still using Automatic Identification System (AIS) and radar system with separate computer. Therefore, this study focuses on the combination of AIS and radar system for safety and improvement of vessel movement in and out of the port marine transportation system. In this project also was proposed the system and tested at PTP as a study case.

1.2 PROBLEM STATEMENT

Currently in PTP, VTS offices still used manually to combine data of AIS and Radar. They have a problem to look Radar and AIS at the same time. Sometimes the data might not accurate because of incorrect judgments of ship movement of port surrounding by VTS officer. This study focuses on how to integrate AIS and Radar for managing the vessel movement in port.

1.3 OBJECTIVE

The objectives of this study are as follows:

i. Propose new system by combination AIS and radar systems for safety and improvement of vessel movement in and out of the port marine transportation system.
ii. The propose system will be tested in the PTP as a case study.

1.4 SCOPE OF STUDY

The scopes of this thesis are:

i. The AIS and radar system is used to identify the ship moving in and out at the port.

ii. An analysis of actual vessel data will focus only data which are detected by an AIS receiver installed at Marine Technology Department, Faculty of Mechanical Engineering, UTM Skudai, Johor Bahru, Malaysia.

iii. Radar data also only focus on which detected in the PTP radar system.

iv. The combinations only focus on AIS and radar system which is tested in PTP area.

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