THE NEW CHALLENGE IN AUTOMATION PILOTAGE SYSTEM FOR STRINGENT PORT NAVIGATION

Mohd Razali Mahmud
Noorzalianee Ghazali

Institute for Geospatial Science and Technology
Faculty of Geoinformation Science and Engineering
Universiti Teknologi Malaysia
81310 UTM Skudai, Johor
Malaysia
Tel/Fax: 607-5530827
E-mail: razali@fksg.utm.my, and
eg_naz@engineer.com

Abstract

This study is part of the research on integrated port database system that was developed to deal with the inefficiency issues cause from the overlapping task by multi-agency in port area. These agencies carried out several parallel activities in the port area. The main challenge of the study is to ensure the safety of the ships as well as the passenger due to these parallel activities. The regulation that has been set up to overcome the problem sometimes could lead to inefficiency of the port activities such as the delay of departure as well as the berthing. Thus the alternative approach has been tested to overcome the problem. Automation pilotage is one of the approaches that successfully meet the challenge to overcome the problem of pilot incapability to navigate in port area. Current regulation that requires local port pilot to berthing the visiting ship need to be revised sooner as the new alternative of automation berthing system are ready to compete.

Keywords: berthing, port, navigation

1.0 INTRODUCTION

The booming of GPS capability and reliability for the past two decades has brought the new era of modern navigation. Nowadays people are talking about sub-millimetre accuracy compare to centimetre in the past. This also has an impact to hydrography/marine society. Positioning and navigation both in sea and river almost totally dependant on the guidance provided by GPS and DGPS. Unlike wide open seas, navigating at cramp, stringent water area like port and harbour always required more than positioning information but also several other parameter like tidal and waves not to forget the experienced and competency of the pilot to navigate the ship to the berthing area. The study has been carried out in order to find out alternative approach how to accommodate lack of experience and overcome the problems that might cause by the incompetence pilot during navigation in port areas. Basic regulations for port requires local port pilot to be onboard piloting ships for berthing or departure. Though in some cases outsider pilot

can request for exception but they need to apply and go through rigorous procedure. This procedure is to make sure the pilot are competent enough to overcome any difficulties piloting ships in stringent port area.

2.0 SUPPORTIVE NAVIGATION INFORMATION

Parallel activities that happens in coastal area, principally from natural sources like tides, waves, current and wind is the main concern which have resulted in integration of multiple and sometimes conflicting data also scenarios around the coast. Today positioning and navigational in coastal area like port not only concern about crashing into other ship, coral reef or sandbank but it is becoming more stringent with the existing of fibre optic cable, utility cables, gas and oil pipelines also under water indicator equipment like boomer or artificial reef. The existences of these structures were traced in nautical chart also announce in notices for marines for pilot and captain attention. Basic knowledge that needs to be mastered by every pilot before they can make a planning to any port consists of combination of various type of information. General topography and boundaries of the district and a particular knowledge of pilotage area limit as well as depth contours and water channel also alongside berths are compulsory. All this information should be able to extract from nautical chart, notice to mariners and port handbooks. Other information's that also required are channel boundaries, dangers to navigation along with topography around them and also natural marks which can be used to clear them. Anchorages, anchorages limits, prohibited anchorages and recommend beaching areas along with overhead cables, bridges and the clearance under them including a knowledge of the datum from which these clearance are coming from. Positioned of underwater cables and pipelines are not to be excluded. Tides, tidal streams, currents and their direction and velocity throughout the district at all stages of the tide including calculated times and height of tide at principal and secondary ports.

2.1 **Bathymetry**

Bathymetry can be defined as the measurement of the depth of the ocean floor from the water surface. Depth and position of depth that has been synchronies are the basic concept of bathymetry. The idea of bathymetry is to provide image of seabed topography through contour, depth and position. The role that has been played by bathymetry in berthing procedure is to provide the information regarding condition of seabed surface to pilot or navigator. This information does influence a lot in berthing procedure since pilot need to make sure the passage to wharf are safe.

2.2 **Tidal**

As the sun rises in the east and the stars come out at night, ocean waters will regularly rise and fall along the shores and this is known as tidal. Basically, tides are very long-period waves that move through the oceans in response to the forces exerted by the moon and sun. Tides originate in the oceans and progress toward the coastlines where they appear as the regular rise and fall of the sea surface. When the highest part or crest of the wave reaches a particular location, high tide occurs; low tide corresponds to the lowest part of the wave, or its trough. The difference in height between the high tide and the low

tide is called the tidal range. A horizontal movement of water often accompanies the rising and falling of the tide. This is called the tidal current. Berthing and departure of super tank are much related to the calculation of tidal current.

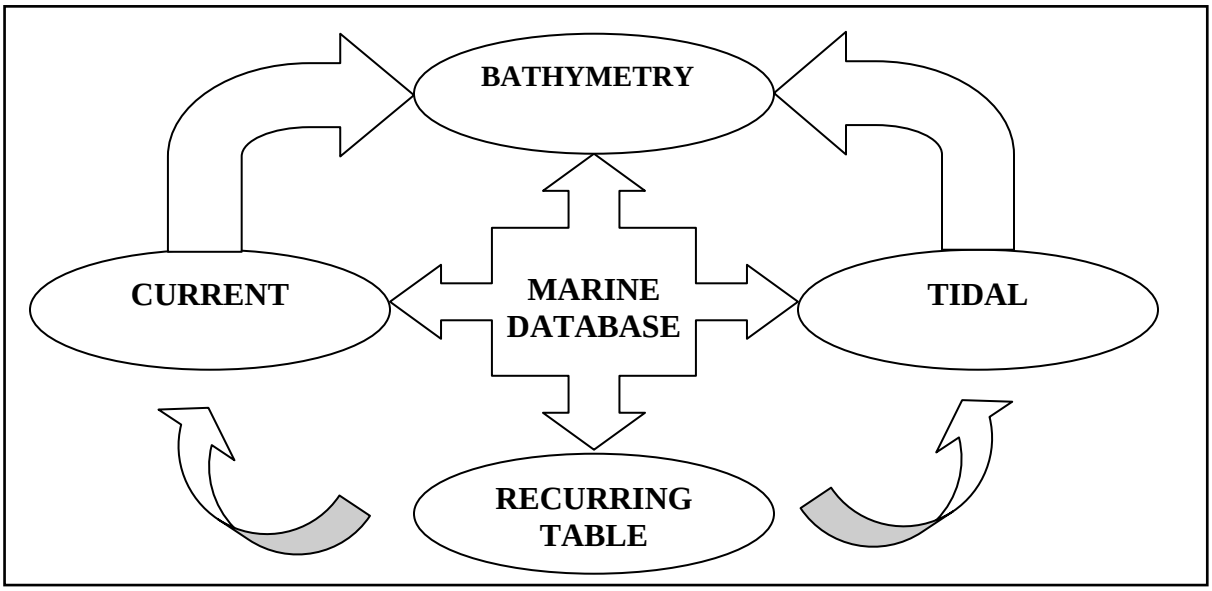
2.3 **Current**

Current is defined as a large mass of continuously moving oceanic water (Greene, 1998). Surface ocean currents are mainly wind-driven and occur in all of the world's oceans. Vertical and ocean-bottom currents are mainly driven by density differences caused by changes in temperature and salinity. Vertical upwelling currents can also be caused by winds "blowing off" a coastline.

3.0 MARINE DATABASE

For this research, marine database consist of compilation of nautical chart, tides table, port handbook and port berthing schedule. These entire elements are packed into one database on the Autodesk Map platform which linked with Microsoft Access. Autodesk Maps represent graphic and Microsoft Access will be medium storing all the attributes. The linkage is predefined and it will continuously connect between object and attribute as long as the link template exist. This situation is important in order to prevent any discrepancy between spatial and attribute data in this database. It is important to maintain the latest information in graphic and attribute to cater the demand in navigation industry. Thus, updating hundreds and thousand compiling data are not an easy task. Dataset must be consistent and precise since the parameter will be used to define the navigation procedure. Bathymetry data will give information on seabed surface through generating the topography from depth sounding. The spatial database will have all the depth point and position loaded into it in order to generate contour and describe the condition of seabed. Tides will be main attribute with table of tide giving a chart of rise and fall of the sea water. Such table is loaded into database without creating any spatial object but it will be much related to bathymetry data through recurring process. As well as tidal, current also relatively cooperate with bathymetry spatial in order to describe the seabed surface.

All these connections are described below:



3.1 **Other Information**

Other than tides, current and nautical chart, there is other information which indirectly related to those three elements. These information are predefined information which are already uploaded into database during preprocess. In other words this information has been implant into the system indirectly. Below are list of information existing in database :

3.1.1 **Dredge Channels**

Consist of length, width and depth of channel and to which datum has been reduced.

3.1.2 **Wharves**

Consist of Max. Disp. in tone, length, depth and height of wharf Above Chart Datum (ACD).

3.1.3 **Dredge Channels**

Consist of length, width and depth of channel and to which datum has been reduced.

4.0 PILOTAGE

Pilotage is the main procedure in this project so every element that exists in these dataset is mainly focusing on important parameter to pilotage procedure. Spatial data will draw the pilotage limit within the port area by using certain coordinate and intersect it with each other. The area constituting the pilotage district comprises all water within the pilotage limit. A part of pilotage limit are pilot boarding ground where the pilot are waiting for tug boat and which is also defined by certain intersect coordinate.

4.1 **Arrival and Departure Procedure**

Arrival procedure is loaded into database on daily basis as soon as every reporting ship sending the **Estimation Time of Arrival (ETA)** due to their planning. Notification shall be given within 7 days in advance and this will give time for operator to load it into the database. The built in function that recurrence in the database will be **Pre Arrival Notification of Security (PANS)** functioning to reminds the pilot to send the PANS to the respective terminal operators at which the ships are due to berth or anchor at least 48 hours before its ETA. Other check lists that are provided by the database consist of arrival notification and procedure for pilot request, notification of arrival/departure to marine department, immigration clearance and health clearance. This checklist is predefined before ships start the passage so this will avoid any missing procedure once the ships are off to sail. Departure procedures will contains pilot request information for departure request which need to be carried out by pilot at least one hour before departure. The check list will highlighted the issue through display at certain period before **Estimation Time of Departure (ETD)** to the pilot. Reminders on port clearance are also included into this check list as well as shifting procedures within pilotage limits.

4.2 **Mandatory Ship Reporting System**

Mandatory Ship Reporting System are applicable whenever vessels entering, leaving and navigating within the Pilotage District. The aim of the reporting system is to ensure the movement of the traffic is monitored so as to enhance navigational safety within the waterway. The coordination of passage and communication can be more transparent through this medium provided Master and Pilot will be alerted with up to date traffic and weather information. In the database, certain point where has been defined as reporting point will pop up a message in buffer 10 metres in order to remind the pilot that they should report to Port Authority when abeam the respective point.

5.0 PASSAGE PLANNING

The handbook information that has been upload to database respective to arrival and departure procedures did contains passage planning information comprising of courses, distances, course alteration point (waypoints) and other navigational safety information for routes that are commonly used under pilotage. The waypoint has been marked in graphic accompanied with rules and regulation in attribute. The table below is an example of passage planning that has been uploaded into the database:

Table 1

Way point	Description	Latitude	Longitude	Course	Dist.	Remarks
01	South pilot boarding ground – NE off Fairway Buoy	2° 50.7'N	101° 15.4'E	000° (T)	0.8'	Vessels are to proceed with extreme caution due to converging and diverging traffic at channel entrance.
02	Off Pintu Gedong Buoy	2° 51.5'N	101° 15.4'E	011° (T)	2.5'	Check vessel drift
03	Off Buas Buas Buoy	2° 54'N	101° 15.95'E	040° (T)	1.5'	Call for tugboat to standby at Bn 27
04	Off Bn 28 (1st Point)	2° 55.1'N	101° 16.85'E	031° (T)	3.8'	Report to Port Klang Traffic on CH 12. Make fast tug between Bn 27 – wharf BO1
05	Off Bn 25 (2nd Point)	2° 58.35'N	101° 18.75'E	031° (T)	3.8'	Report to Port Klang Traffic on completion of berthing.

6.0 CONCLUSION

As a conclusion, current regulation that required local port pilot to berthing the visiting ship is possible to be revised as the new alternative automation berthing system has give another option to cater unfamiliarity behaviour of the visited pilot to the local port.

REFERENCES

Chua, T.E. (1993). "Essential Elements of Integrated Coastal Zone Management". Ocean and Coastal Management". 21(1), 81-109.

Cicin-Sain, B. and Knetch, R.W. (1998). "Integrated Coastal and Ocean Management : Concepts and Practices". Island Press, Washington DC.

Economic Planning Unit (EPU) (1993). "National Conservation Strategy:Volume 2 (Administration)". Kuala Lumpur.

Lim, J. C. (2000). “Pembangunan Pangkalan Data Carta Panduarah Elektronik (ENC) S-57 Edisi 3 Untuk Perairan Malaysia”. Master Thesis. Universiti Teknologi Malaysia

Mazlin, Mokhtar, Sarah Aziz (2003). “Integrated Coastal Zone Management Using the Ecosystems Approach, Some Perceptives In Malaysia”. Ocean and Coastal Management. 46(2003), 407-419.

Mohd Nizam Basiron (1998). “Integrated Coastal Zone Management in Malaysia : A Status Report”. Malaysia Maritime Institute.

Norkhair Ibrahim and Zulkepli Majid (2002). “Prinsip Sistem Maklumat Geografi”. Universiti Teknologi Malaysia.

Taher Buyong and Ghazali Desa (1994). “Prinsip-Prinsip G.I.S”. Short Course Lecture Notes. Universiti Teknologi Malaysia.

Tang, K. M. (2001). “Pembentukan Algoritma Bagi Keperluan DGPS Alat Penerima GPS Kos Rendah Koc C/A”. Master Thesis. Universiti Teknologi Malaysia

Teh, T.S., Lee, S.C. (2001). “Coastal Zone Management Malaysia : National Response Strategies To Climate Change”. Kuala Lumpur. MOSTE 2001. p 423-51.

Wong, C. S. (2004). “The integration of PDA, Emtec GPS Receiver and ARCPAD Software in Mobile Mapping”. Bachelor Thesis. Universiti Teknologi Malaysia