Title: A Method and System For The Automatic Scheduling of Bunkering of Marine Ships in Singapore

Background

Currently before a marine ship arrives at a port in Singapore, it will be contacted by bunker suppliers to sell bunker fuel to it. Once the deal is done, the ship owner/manager will contact the shipping agent to inform them of the company that is supplying the bunker fuel to the ship. The shipping agent will also be informed by the ship owner/manager which bunker surveyor they are using to monitor the bunkering activity. On the day of the bunkering, the shipping agent will be notified by the bunker craft operator of the exact time of the bunkering activity and the bunker barge that will be handling the bunkering. The exact time is correlated to the arrival of the marine ship at the port (ETA) and the availability of the bunker craft. There is a tremendous amount of communications via mobile phone or emails to get this information to all the 5 parties, namely bunker supplier, bunker craft operator, surveryor, shipping agent and ship owner. With the app, the various parties' information are in sync. This allows the bunker craft operator which is the bottle neck in the bunkering activity to keep track of the utilisation of their fleet of bunker crafts and solicit additional business should there be empty slots in the bunkering schedule. It should also lessen or eliminate the demurrage charges incurred by the bunker craft operators for not being able to service the marine ships on time. Should there be disputes, the various parties are able to record comments on the app which could then be used to provide background information for later arbitration.

Summary of the invention

The present invention relates to a method of performing an automatic bunker scheduling system. The method is a computer program running on a remote server. The bunker scheduling system collects inputs from the users via the mobile or web application. It then automatically schedules the barges of the bunker craft operator to the ships that the bunker craft operator is supposed to service, base on

- the ETA (estimated time of arrival) of the ships,
- the availability of the barges
- the time taken to service the ships which is automatically calculated base on the distance that the barge needs to travel to service the ship, the speed of the barge, the mass flow meter used and quantity of fuel ordered. The barge with the shortest servicing time and shortest wait time will be scheduled to the ship where possible.
- whether there is leftover fuel on the barge.

The application can be used by 5 different types of users: bunker craft operator, bunker supplier, shipping agents, bunker surveyor and ship owner/manager to monitor and track the bunkering activity. Most of the controlling actions are done by the application of the bunker craft operator user. The other users uses the application as a monitoring and record tool. It also helps the different parties to increase their business volume as the barges are efficiently deployed and it is possible to foresee bottlenecks in bunkering so that extra barges can be roped in where needed.

Brief description of drawings

FIG. 1 is a block diagram of an exemplary network architecture in which the bunker scheduling
system can be implemented.

Fig 2 illustrate the composition of the cloud server. The server 101 comprises:

- a database
- a AIS information engine which is responsible for the collection and storage of ships AIS information in the database
- a user query engine handling all queries from user via REST API.
- an data engine that handles all requests or storage of data from the user query engine
- a scheduling system which schedules all the applicable ships on ships page of all users
- web application running as another user interface for users.

Fig 3 lists some of the user application pages found on the mobile and web application, though they are not limited to these pages only.

Fig 4 is an exemplary user interface for user registration on the mobile or web application

Fig 5 is an exemplary user interface for application login page on the mobile or web application

Fig 6 is an exemplary user interface for application user company page on the mobile or web application

Fig 7 is an exemplary user interface for application profile page on the mobile or web application

Fig 8 is an exemplary user interface for application barge page on the mobile or web application

Fig 9 is an exemplary user interface for application ships page on the mobile or web application

Fig 10 is an exemplary user interface for application schedule page on the mobile or web application

Fig 11 is an exemplary user interface for application history page on the mobile or web application

Detailed Description of the bunker scheduling system

1. The server in Fig 2 handles the collection of ships' AIS information for ships bound for Singapore on the current day and in the next 3 days. The ship's data collected are:
    a) Name
    b) IMO (International Maritimie Organisation) number which is a unique number identifying the ship
    c) MMSI (Maritime Mobile Service Identity) number which is another unique number identifying the AIS system of the ship
    d) ETA (estimated time of arrival) in Singapore
    e) Flag which define the country which the ship is registered

f) Coordinates of the ship which define the ship's current position

The information is then stored in the cloud database and retrieved when requested by the web application or mobile application,

2. The user interface for accessing the bunker scheduling system is a mobile and web application. The features are similar for both applications but the appearance are not similar due to the difference in screen size. The following are some of the pages available for use on the application to facilitate the usage of the system
   a) The user registration page (Fig 4) for new users to register in order to be able to login to the application.
   b) The administration page for administering the users of the application. Only an admin user can access this page. This page is only available for web application
   c) The user company page (Fig 6) which will list the user company name and type of company. There are 5 types of users: barge operator, bunker supplier, bunker surveyor, shipping agent and ship owner.
   d) The profile page (Fig 7) contains the name, contact number and password of the user which can be changed.
   e) The barge page (Fig 8) lists all the barges that are involved in the servicing of the ships. For the barge operator, the barge page contains a list of all the barges managed by the barge operator. The barge page also contains buttons to view the map positions of the barges and ships that are to be serviced by the 4 types of users. The barge page of the agent, bunker supplier, bunker surveyor and ship owner will contain a list of all the barges that the agent/supplier/surveyor/owner will have to deal with as their ships are being serviced. Eg: Bunker craft operator has 5 barges. He will see these 5 barges on the barge page. Agent1 is servicing 5 ships: shipA, shipB, shipC, shipD, shipE. Agent1 will see the barges that are servicing these 5 ships. Similarly for bunker surveyor, Surveyor1. If Surveyor1 is servicing shipF,shipG, shipH, shipI , then he will see the barges servicing these 4 ships on the barge page. Similarly for bunker supplier and ship owner.
      For the bunker craft operator, there is an add button to allow the barge company to add the barge from the total barge list to their management on the barge page. Once a barge has been added by a barge company, it can no longer be added by another barge company as the barge can only be used by one company at all times. It can be used by another company if the barge is deleted by the current company. The barge company and bunker craft operator company are synonymous. There is no add button on the barge page of the agent, surveyor, supplier and owner users. These users can only see the barges that are scheduled with the ships under their management.
   f) The ships page (Fig 9) contains the list of ships to be serviced by the 5 types of users: owner, barge operator, agent, bunker supplier and bunker surveyor currently. There is an add button to add the ships to be serviced by the users. A ship that is serviced by one type of user, cannot be serviced by another user of the same type. A marine ship will have only one barge operator, one bunker supplier, one shipping agent, one bunker surveyor and one owner. Another barge operator or bunker supplier or shipping agent or bunker surveyor, cannot service the same ship. These are checks provided by the system to prevent duplicate entry.
   g) The schedule page (Fig 10) contains all the ships that are automatically or manually scheduled. The first listing is auto scheduling. Scheduling only takes place for the ships of the bunker craft operator. There is a button to override the scheduling with a manual selection. There is a service button on the schedule page which should be clicked when the servicing of the ships begins.. Automatic scheduling is based on the following criteria:
      i. Minimal wait time for the ships i.e. ships with earlier ETA (estimated time of arrival) will be serviced first before ships with later ETA.

ii. Amount of and type of fuel already on the barge before scheduling.
iii. The barge assigned will be selected based on the shortest distance to the fuel terminal. The water around Singapore are divided into 4 regions. The ships and barges in the same region are assigned to each other if possible.
iv. The total time taken by each barge consists of the preparation and fueling time. Preparation time is automatically calculated base on the distance of the barge and ship assigned to the oil terminal and the average speed of the barge. Fueling time is calculated based on the mass flow meter and the quantity of fuel ordered. With these automatic calculation of the time taken, it is possible to determine the number of barges that are busy and the number of free barges if any. It is also possible to see any bottleneck in the performance of bunker delivery so that preventive actions like chartering another barge can be done to prevent demurrage costs. Or it is possible to seek new business opportunities if there are available barges.
v. There is a manual override of the automatic scheduling should the user wish to do so.

The schedule page of agent/supplier/surveyor/owner will reflect the scheduled times of their ships. These users see the scheduled information but are not able to influence the scheduling.
There is a comment button on the schedule page which enables each user to enter their comments during scheduling.
After the ships have been serviced, they will be removed from the schedule page and ships page, and transferred to the history page.

h) The history page (Fig 11) will list all the ships serviced by the user company . This page is also good for accounting purposes as it lists all the business done by the user company. There is a comment button on the history page which will show the comments entered while the ships are being serviced in the schedule page. It is possible to edit comments in the schedule page but not in the history page.

i) For the web application, the barge page, schedule page and history page is downloadable in pdf format.
j) There is an upload page for populating the entries to the ships and schedule page conveniently.

Claims:

1. A bunker scheduling system which is a barge and ship scheduling computer program implementing methods comprising:
    a. A list of user queries residing on a remote server, which enables a user accessing it via a mobile or web user interface to be able to obtain information which is then displayed on the user devices.
    b. A list of database queries residing on a remote server, which is used to support the user queries in terms of providing information from or storing information to the database
    c. A scheduling system residing on the remote server, which automatically matches the optimum barge to the ship base on the criteria of
        i. ETA (estimated time of arrival) of the ship at the port
        ii. distance between the barge and ship,
        iii. fuel on the barge
        iv. the automatic determination of the time taken for the barge to load the fuel and reach the ship base on the distance between the barge and the oil terminals and the distance between the ship and oil terminal and the average speed of the barge.
        v. the automatic determination of the time taken to refuel the ship base on the mass flowrate meter input of the barge and the quantity of fuel ordered.
    d. A manual override to the scheduling system listed in (c) whereby the barge can be manually selected and it is possible to change the time taken after servicing of the ship has started.
    e. A mobile and web application which is the user interface between the users and the computer program residing on the server.
    f. There are 5 types of users of the scheduling system. They are bunker craft operator (also known as barge operator), bunker supplier, agent, surveyor, and owner (ship owner or manager). Each type of users can only see the ships, barges, ships schedule and the history of all the ships handled by them and not those of other users.

2. The mobile and web application in claim 1 are similar in most features except the display due to the difference in the screen size of the devices used. The mobile application can be run on a mobile phone or tablet. The web application can be run using a browser accessing a secure url. The devices used for web application can be a personal computer or mobile tablet.
3. The mobile and web application in claim 1 contains a registration page to register new users.
4. The mobile and web application in claim 1 contains a user company page which lists the name of the company the login user is associated with.
5. The mobile and web application in claim 1 has a profile page which contains the name of the user, phone number and a secure password which can all be changed in the profile page
6. The mobile and web application in claim 1 contains a barge page which display the barges that are associated with them. For the bunker craft operator, it contains the list of barges owned or managed by the barge company. For the agent, surveyor, supplier and owner user, it contains the list of barges which is servicing the ships on the ships page. There are map buttons which enable the display of the position on google map, of the barges on barge page and ships on the ships page
7. The mobile and web application in claim 1 contains a ships page which display a list of ships which the 5 types of users are servicing or managing. Each ship contains the type of fuel and amount of fuel the ship will be fuel with. If the ship has 0 quantity of fuel, it will not be scheduled. New ships can be added to the ships page via an excel sheet uploading or via the application.
8. The mobile and web application in claim 1 contains a schedule page which display a list of ships that are scheduled automatically by the remote server using the criteria in

claim 1. The bunker craft scheduled can be changed using manual override via a button. There is a comment button in the schedule page which opens to a dialog box which allows the entry of comments which can only be seen by their own company.

9. The mobile and web application in claim 1 contains a history page which display a list of ships, the barges servicing the ships, the ETA, service time and quantity and type of fuel that are being fuelled. Each company will have their own history list which represents the business done by each company.