Internship Project Report

titled

Raw Material Availability & Planning: Development of a Digital Dashboard for Vessel Tracking

by

Shreya Krishna (VT2017369)

submitted to

TATA STEEL & SNTI

Period of Internship

19th Dec 2017

to

9th Jan 2018

Under Supervision of Project Guide

Mr Divik Gupta (+91-8092089579, divik.gupta@tatasteel.com)

Introduction

All over the world information and communication technologies have a direct impact on the economic development, political organization, and sociocultural value system of a society. The inclusion of satellite aided navigation in transportation is well established worldwide. Air and sea travel has been the main beneficiary of the technique of acquiring accurate position and timing. In recent years, however, satellite navigation has started to expand into other areas such as recreation, security, and emergency response.

The satellite based radio navigation systems provide users of land, sea and air with accurate information of position, time and vessel speed 24 hours-a-day in all weather. These systems generally consist of three segments: space, control and use segment.

Space segment:

This segment is a constellation of certain number of satellites operating in 12 hour orbits at an altitude of 20,183 km. The satellites are positioned in orbital planes each plane equally spaced about the equator and inclined at 55 degrees. The navigational message consist of a 50-bit per second data stream containing information enabling the receiver to perform the computations required for successful navigation. Each satellite has its own unique course acquisition code (C/A) that provides satellite identification for acquisition and tracking by the user. In short the control segment coordinates the movement of all 24 satellites so that at any given time, the precise position of each satellite is known.

Control segment:

The ground control segment consists of a master control center and a number of widely separated monitoring stations. The ground control network tracks the satellites, precisely determines their orbits, and periodically uploads almanac, ephemeris and other data to all satellites for transmission to the user segment. The almanac data tells the GPS receiver where each satellite at any time throughout the day, ephemeris data contains important information such as status of the satellite (healthy or unhealthy) current date, and precise time.

User segment:

The user segment consists of receivers, processors and antennas that allow land, sea or airborne operators to receive the GPS satellite data and compute their precise location and, time. The position of the GPS receiver is determined by geometric intersection of several simultaneous observed ranges from the satellites with known coordinates in space. To decipher the GPS signals, the receiver must perform the following task:

I. Selecting three or more satellites in view
II. Acquiring GPS signals
III. Measuring and tracking
IV. Recovering navigational data

GPS provides two types of service, Standard Positioning Service (SPS) and Precise Positioning Service (PPS). The SPS is a positioning and timing service that is available to all GPS users on a continuous worldwide basis. SPS is provided on the L1 frequency (1575.42MHz), which contains the navigation data message and the SPS code signals. The PPS is a highly accurate military positioning, velocity and timing service which is available to users authorized by the DoD. In addition to the L1 fi-equency, PPS equipped receivers also use the L2 frequency (1227.60MHz) to measure the ionosphere delay

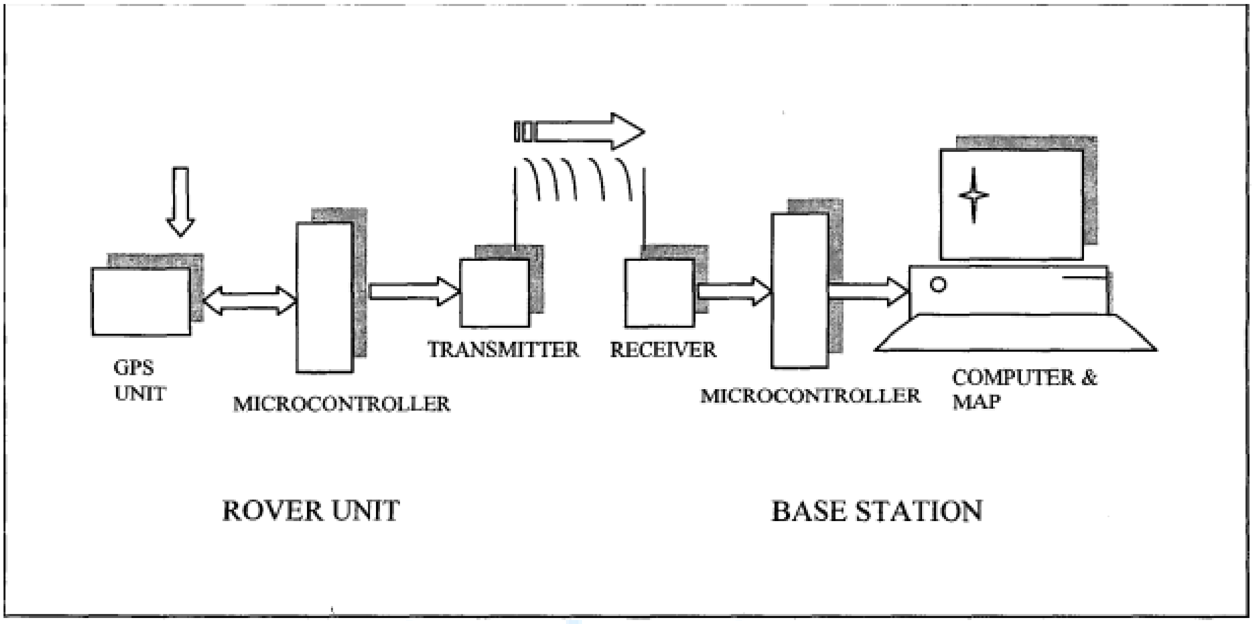


Fig1: Block diagram of the vessel tracking system

The rover unit in the figure 1 is a device which will be able to acquire a vessel's longitude and latitude. Capturing this GPS and then transmitting these will enable system to acquire a vessel's longitude and coordinates for transmittal to a base station at a different location using a radio link. The working of a rover unit is demonstrated in Fig 2.

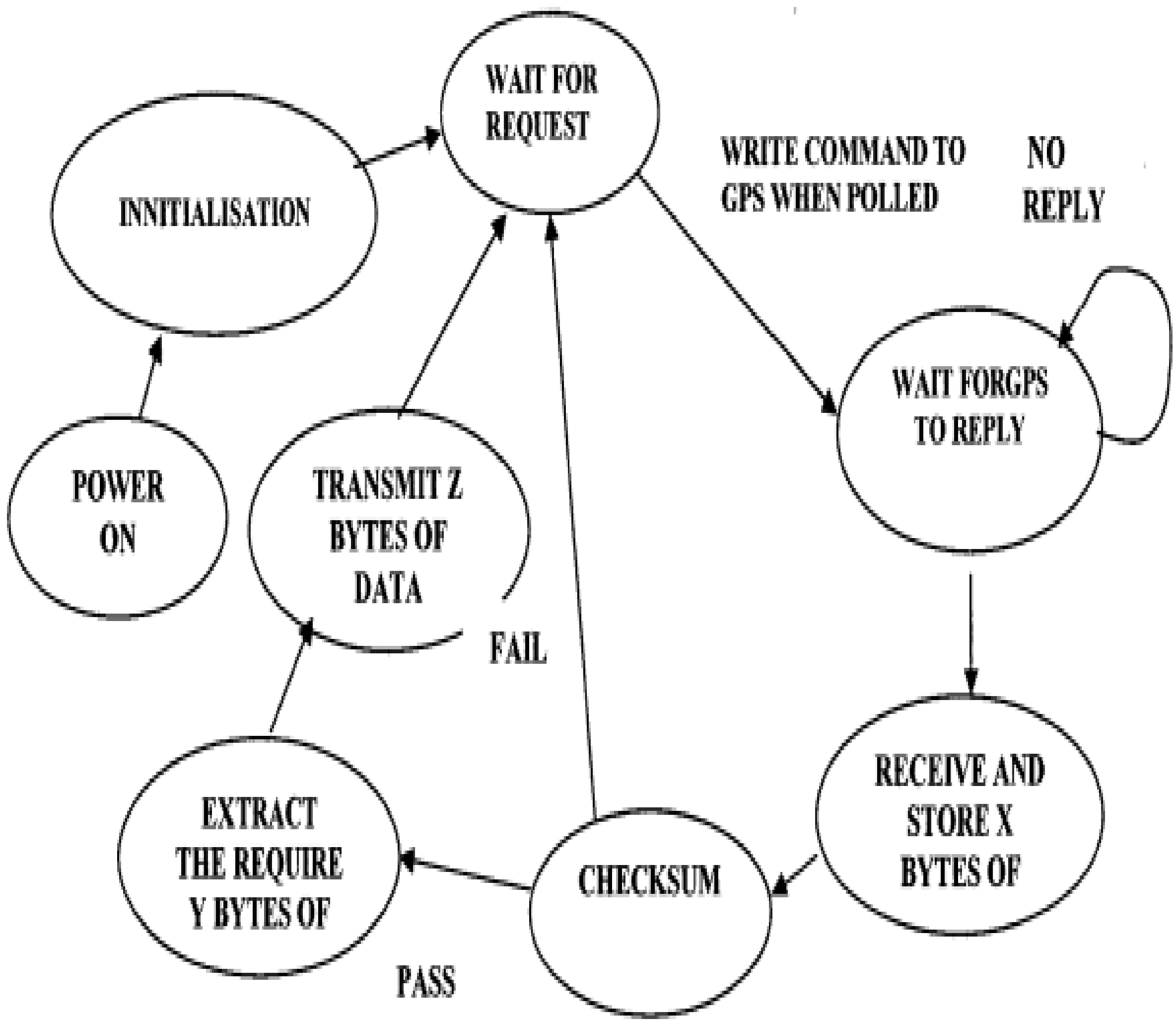


Fig 2: State diagram of the rover unit

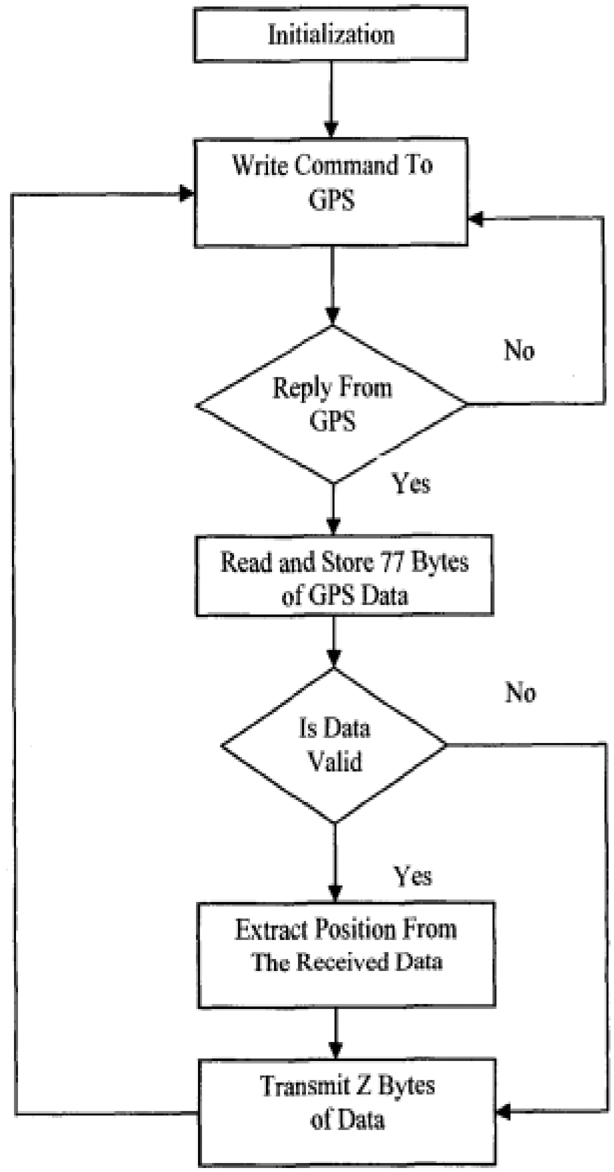


Fig 3: Flowchart of the transmitter unit

The software structure of the system comprise of the transmitter unit and the receiver unit. In the transmitter unit: the software which will govern the operation of the rover unit's microprocessor shall be organized in a series of processes or task shown in figure 3.

There are seven major processes involved, from initialization to the transmission of data to the base station. The microcontroller will poll the GPS unit for new information once every second. Once the command sent to the GPS unit is verified correct data is transferred to the microcontroller. When all the data is received a checksum is undertaken. If the data is perceived valid, the necessary information is extracted and a new checksum is generated for it. This data is then stored in internal RAM. Using Manchester encoding technique, the new data is encoded as it is passed to the RF transmitter.

In the receiver unit: The receiver unit as the responsibility of collecting the transmitted information, processing it and then passing it on to the computer to display position on the map. The information collected by the RF receiver is passed on to the microcontroller. An error check is carried out. If the data is valid, it is store in addressable RAM. Whether checksum fails or not, Z bytes of data in memory are transmitted to the computer by the serial port.

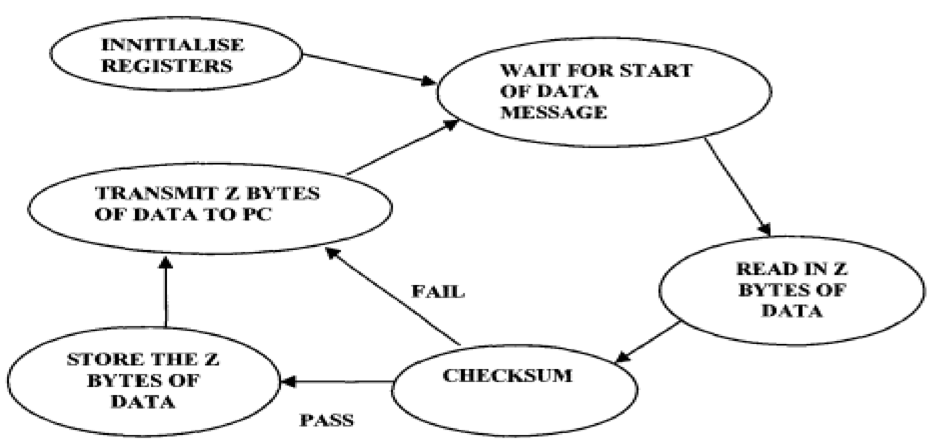
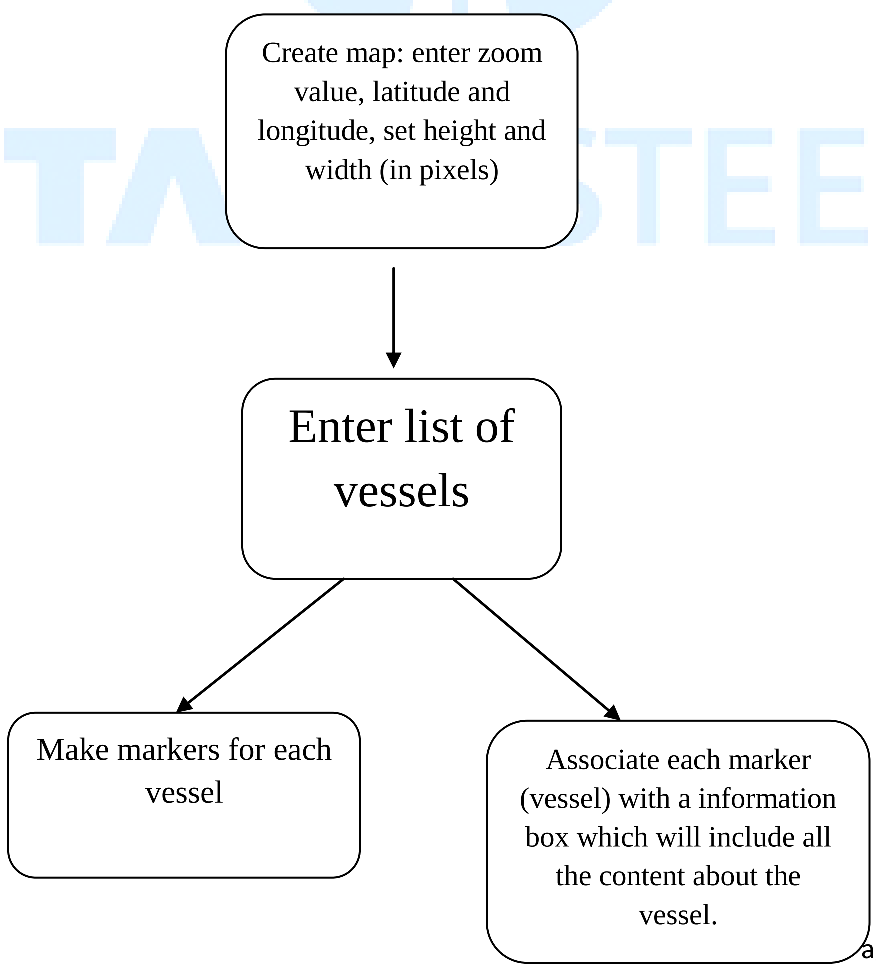


Fig 4: State diagram of receiver unit

Relevance to Tata Steel:

There are several vessels involved in the import raw materials for Tata Steel. These vessels need to be tracked. Their location, status, ports they would be refueled at etc. ought to be updated and kept track of. Location details of the vessels that are received are used to track the vessels. And this is done with the help of a digital dashboard that displays the two dimensional position of the vessel on a map of the area. This dashboard extracts the gathered information and presents on a map of certain area. This dashboard lies in the base station of the system as shown in the Fig 2.

Layout of the Vessel Tracking Dashboard



Proposed Algorithm

a. Give a title name

b. Obtain the API key

c. Create a function initmap

d. Declare a object with parameters containing zoom level and the center of the map(latitude and longitude)

e. Set height and width in pixels

f. Create a function to add vessels and markers

g. Create array to add multiple vessels

h. Create array of objects and pass position dynamically (latitude and longitude)

i. May or may not add custom marker

j. Create object for information window and pass the content as parameters

k. Add a listener. for example: “click”

Features of the Proposed Vessel Tracking System Dashboard:

- Live map that shows all our vessels (ships), load port, refueling port, destination port etc in the ocean using different markers.
- The vessels have color code for different conditions of the vessels. For example: delayed vessels are red. Color coding can also be done according to the type of vessels. For example: tanker, cargo, etc. all have different colors.
- The map shows the current position of the vessels in the ocean.
- The map can be zoomed in and zoomed out and it can also be dragged whichever way user wants to.

- Another feature of this dashboard is the vessel filter.
- The vessel filter is a drop down menu which gives various filter options like, ship type, capacity and current status.
- Any vessel filter that is chosen will function accordingly and show the corresponding vessels on the map.
- There is a port search that will tell all the details of those vessels associated with it.
- Port is a drop down menu with the options of port search, arrivals and departures and expected arrivals of certain ports.
- The dashboard has a mouse hover whose trigger areas are the vessel markers on the map.
- When the mouse pointer hovers over the map a hover box is activated which shows the name, type of load and destination.
- There is a information box associated with every vessel marker.
- This information box pops on the screen when a particular vessel marker is clicked i.e. the information box listens for a click.
- The information box consists of all the different timings it left the load port and all the ports it stopped at and at what time it reached the destination port. It also has all the basic detail about the vessel like the latest positions, past path, draught, load conditions, speed etc. all these details are extracted from the interface.
- There is also an information page that gives a more elaborate, detailed information of vessel details.

Code for the Digital Dashboard

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <meta http-equiv="X-UA-Compatible" content="ie=edge">
  <title>Dashboard</title>
  <style>
  #map{
    height:400px;
    width:100%;
  }
  </style>
</head>
<body>
  <h1>my dashboard</h1>
  <div id="map">


  </div>
  <script>
  function initMap(){
    //map options
```

```
  var options={
    zoom:8,
    center:{lat:22.8046,lng:86.2029}
  }//new map
  var map=new google.maps.Map(document.getElementById('map'),options);
  //add marker
  var marker=new
google.maps.Marker({position:{lat:23.3441,lng:85.3096},map:map});
  var infoWindow=new google.maps.InfoWindow({
    content:"<h1>picked up from the data base</h1>"
  });
  marker.addListener('click',function(){infoWindow.open(map,marker);
  });
 }

addMarker({lat:22.7918,lng:86.1777});
addMarker({lat:23.6693,lng:86.1511});
//add marker function
/*function addMarker(coords){
  var marker=new google.maps.Marker({position:coords,map:map});
}*/
 </script>
```

```
  <script
src="https://maps.googleapis.com/maps/api/js?key=AIzaSyDWkNJMvhPR-
9IyeolBTqpdY9y7lsmJs7U
&callback=initMap"
   async defer></script>
</body>
</html>
```

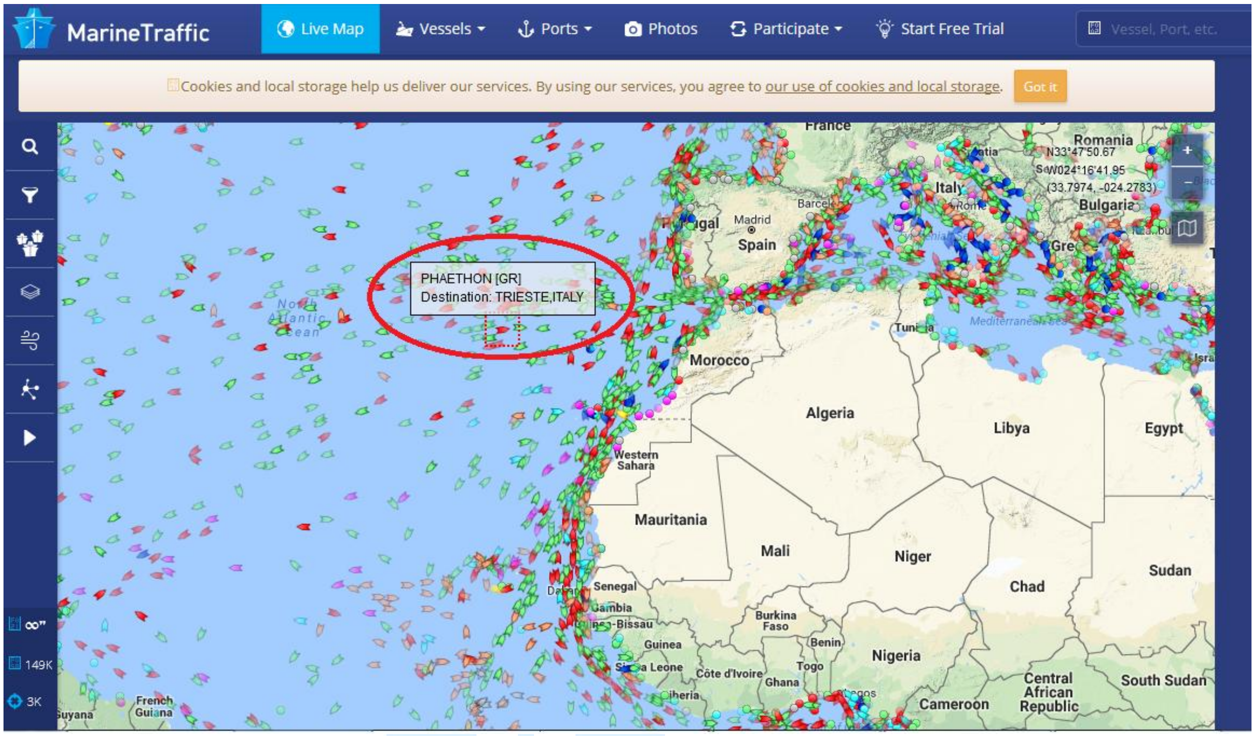


Fig 5. Shows the dashboard with the mouse hover feature

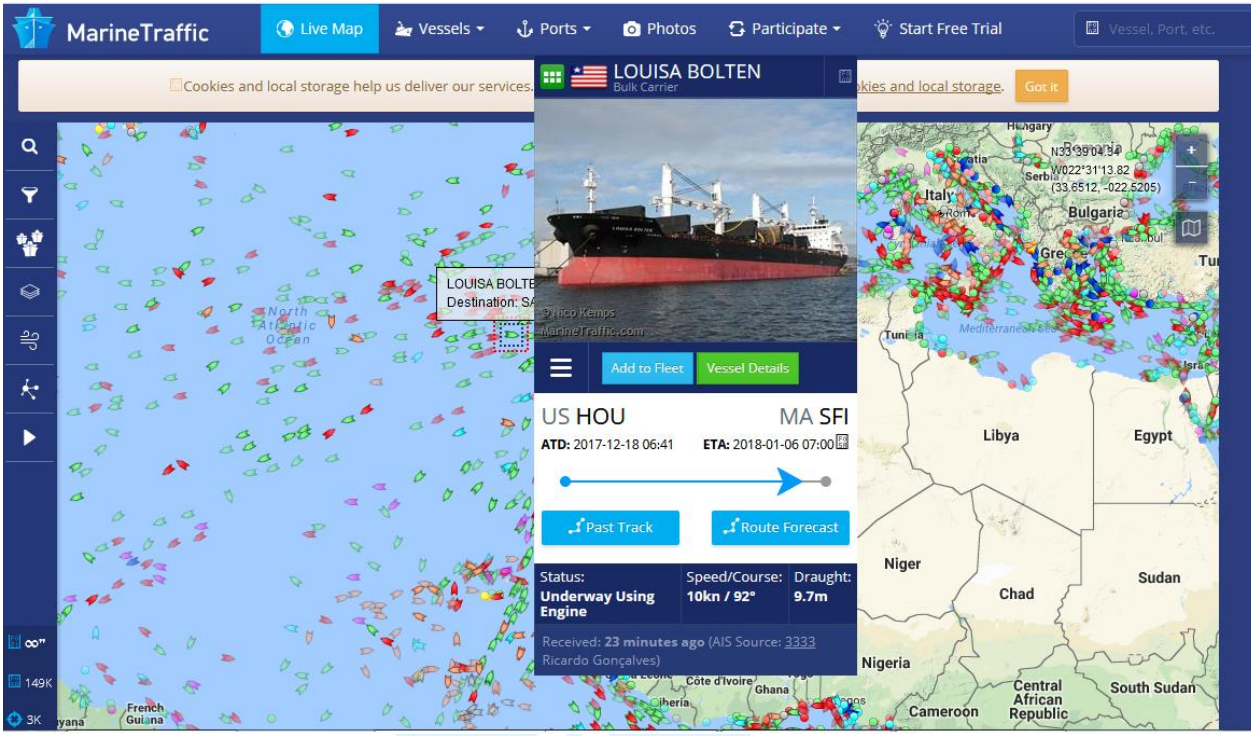


Fig 6. Shows the dashboard with the map with vessels and information window feature