

A SYSTEM AND METHOD FOR SATELLITE REMOTE MONITORING OF MARINE BASED ASSETS

Technical Field

[1] The present invention relates to a system and method for satellite remote monitoring of marine based assets.

Background

[2] With the high cost of fuel, it is imperative for marine vessels operators to be efficient in the operational consumption of fuel. Fuel consumption typically vary widely since marine vessels may be operated by different captains at different times. To improve operational efficiency, therefore, there is a need for an accurate and reliable system to monitor the fuel consumption pattern versus operational behaviour. Of equal importance is crew safety. There is a need for a system to monitor and deter against untoward incidences on board. With measures and safeguards to improve their safety, the crew's morale will improve and with it productivity as well.

[3] Another prevalent issue is that of fuel theft on marine vessels. Charterers lose money due to thieves boarding the marine vessel and siphoning off the fuel from the marine vessel. In some cases, these thieves work in cohorts with a rogue member of the crew. Fuel theft can also happen whereby thieves siphon off higher grade fuel replacing the stolen fuel with lower grade fuel (i.e. fuel in a cruder form). There is therefore a need for a reliable monitoring system to detect fuel theft and enable proper measures to deal with such situations as they arise.

[4] The invention as disclosed herein aims to solve the above problems or at least provide a novel system and method for satellite remote monitoring of marine based assets.

Summary of Invention

[5] According to a first aspect of the invention, a system for satellite remote monitoring of a marine vessel is described, the system comprising a satellite network; a central server and a central controller communicatively connected to a satellite terminal, the central controller and the satellite terminal located on the marine vessel. The system further comprises a digital video recorder module for recording and storing digital footage of areas on and proximate the marine vessel, the digital video recorder module adapted to provide the central controller with the digital footage, and a plurality of sensors adapted to provide the central controller with sensor readings. The plurality of sensors comprises at least one fuel volume sensor within a fuel tank on the marine vessel, the at least one fuel volume sensor adapted to provide the sensor readings of fuel volume at a sampling interval; at least one fuel consumption sensor adjacent an inlet and an outlet of a fuel consuming device of the marine vessel, the at least one fuel consumption sensor adapted to provide the sensor readings of fuel consumption at the sampling interval; and at least one fuel density and temperature sensor on the marine vessel, the at least one fuel density and temperature sensor adapted to provide the sensor readings of fuel density and fuel temperature at the sampling interval. Wherein the central server is adapted to determine a drop in fuel volume at the sampling interval and an expected density of the fuel from the fuel temperature, and the central server is further adapted to determine when the drop in fuel volume differs from the fuel consumption beyond a first threshold or when the fuel density differs from the expected density of the fuel beyond a second threshold, the central server triggers an alert having a timestamp to a user; and wherein the central controller is adapted to request and obtain the digital footage over a specific time interval from the digital video recorder module, the specific time interval based on the timestamp of the alert, and send the digital footage via the satellite terminal and the satellite network to the central server.

[6] Preferably, the central controller is integrated with a valve controller on the marine vessel, and the central controller receives a command from the central server

to control the valve controller to close a valve of a piping manifold system connected to the fuel tank.

[7] Preferably, the central controller is further integrated with an on-board ship pump operating system of the marine vessel and the central controller receives a command from the central server to immobilize the fuel consuming device or sound a siren alarm on the marine vessel.

[8] Preferably, the central controller partitions each frame in the digital footage into a plurality of sub-frames before sending the digital footage to the satellite terminal.

[9] Preferably, each of the plurality of the sub-frames is assigned a sub-frame sequence number.

[10] Preferably, the central server receives the plurality of sub-frames and assembles the sub-frames based on the sub-frame sequence number to reform each frame.

[11] Preferably, the central server determines the drop in fuel volume at the sampling interval by comparing the fuel volume at the sampling interval with the fuel volume at a preceding sampling interval.

[12] Preferably, the central controller is adapted to receive positioning information from the satellite terminal at the sampling interval and wherein the central server is adapted to receive the positioning information from the central controller.

[13] Preferably, the system further comprises a web portal which provides the user access to the central server to specify the specific time interval to request the digital footage, and view the sensor readings and digital footage and positioning information.

[14] Preferably, the central server is adapted to obtain the historical sensor readings and positioning information and substantially real time sensor readings and

positioning information from the central controller upon the user's request via the web portal.

[15] Preferably, the alert is a phone call, a text message or an email to a mobile device of the user.

[16] According to a second aspect of the invention, a method for satellite remote monitoring of a marine vessel is described, the method comprising the steps of recording and storing digital footage of areas on and proximate the marine vessel using a digital video recorder module; receiving sensor readings from at least one fuel volume sensor within a fuel tank on the marine vessel, the at least one fuel volume sensor adapted to provide the sensor readings of fuel volume at a sampling interval; receiving sensor readings from at least one fuel consumption sensor adjacent an inlet and an outlet of a fuel consuming device of the marine vessel, the at least one fuel consumption sensor adapted to provide the sensor readings of fuel consumption at the sampling interval; and receiving sensor readings from at least one fuel density and temperature sensor on the marine vessel, the at least one fuel density and temperature sensor adapted to provide the sensor readings of fuel density and fuel temperature at the sampling interval. The method further comprises the steps of sending with a central controller, the sensor readings via a satellite terminal and a satellite network to a central server and determining with the central server a drop in fuel volume at the sampling interval and an expected density of the fuel from the fuel temperature. The method further comprises the steps of triggering with the central server, an alert to a user when the central server has determined that the drop in fuel volume differs from the fuel consumption beyond a first threshold or when the fuel density differs from the expected density of the fuel beyond a second threshold, the alert having a timestamp; obtaining with the central controller, digital footage over a specific time interval from the digital video recorder module, the specific time interval based on the timestamp of the alert; and sending the digital footage from the central controller via the satellite terminal and the satellite network to the central server.

[17] Preferably, the method further comprises the step of sending with the central server, a command to the central controller to control a valve controller on the

marine vessel to close a valve of a piping manifold system connected to the fuel tank.

[18] Preferably, the method further comprises the step of sending with the central server, a command to the central controller to immobilize the fuel consuming device or sound a siren alarm on the marine vessel.

[19] Preferably, the method further comprises the step of partitioning with the central controller, each frame in the digital footage into a plurality of sub-frames before sending the digital footage via the satellite terminal and the satellite network to the central server.

[20] Preferably, each of the plurality of the sub-frames is assigned a sub-frame sequence number.

[21] Preferably, the central server receives the digital footage in the form of the plurality of sub-frames and assembles the sub-frames based on the sub-frame sequence number to reform each frame.

[22] Preferably, the central server determines the drop in fuel volume at the sampling interval by comparing the fuel volume at the sampling interval with the fuel volume at a preceding sampling interval.

[23] Preferably, the method further comprises the steps of receiving positioning information from the satellite terminal at the sampling interval and sending the positioning information from the central controller to the central server.

[24] Preferably, the method further comprises the step of providing a web portal to allow the user access to the central server to specify the specific time interval to request the digital footage, and view the sensor readings and digital footage and positioning information.

[25] Preferably, the method further comprises the step of obtaining historical sensor readings and positioning information and substantially real time sensor

readings and positioning information from the central controller upon the user's request via the web portal.

[26] Preferably, the alert is a phone call, a text message or an email to a mobile device of the user.

[27] The invention will now be described in detail with reference to the accompanying drawings.

Brief Description of Drawings

[28] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the Detailed Description below are incorporated in and form part of the specification, serve to illustrate various embodiments and to explain various principles and advantages in accordance with a present embodiment.

[29] Figure 1 is a schematic representation of a satellite remote monitoring system in accordance with the invention.

[30] Figure 2 is a top view of a marine vessel and shows the locations of the sensors on the marine vessel.

[31] Figures 3 illustrate the arrangement of the fuel consumption sensors and the fuel density and temperature sensors in relation to the fuel consuming devices.

[32] Figure 4 is a top view of a marine vessel and shows the locations of the cameras of the digital video recorder module on the marine vessel.

[33] Figure 5 is a flowchart depicting a method for satellite remote monitoring in accordance with the invention.

[34] Figure 6 shows a graphical representation of the sensor readings as provided by the web portal.

[35] Figure 7 shows historical values of the fuel volume readings as provided by the web portal.

[36] Figure 8 shows historical values of the fuel consumption readings as provided by the web portal.

[37] Figure 9 shows historical values of the fuel temperature readings as provided by the web portal.

[38] Figure 10 shows historical values of the fuel density readings as provided by the web portal.

[39] Figure 11 shows a map view which depicts the voyage of the marine vessel as provided by the web portal.

[40] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been depicted to scale. For example, the dimensions of some of the elements may be exaggerated in respect to other elements to help to improve understanding of the present embodiments.

Detailed Description

[41] The following detailed description is merely exemplary in nature and is not intended to limit the invention or the application and uses of the invention. Furthermore, there is no intention to be bound by any theory presented in the preceding background of the invention or the following detailed description. It is the intent of this invention to present a novel system and method for satellite remote monitoring of marine based assets.

[42] Figure 1 illustrates a satellite remote monitoring system **100** in accordance with the present embodiment. System **100** comprises satellite terminal **101**, central controller **102**, sensors **103** and digital video recorder module **104**.

[43] Figure 2 shows a top view of a marine based asset such as a marine vessel **200**. Marine vessel **200** can have fuel tanks **201** and service tanks **202**. Fuel tanks **201** supply fuel to the service tanks **202**. The fuel in service tanks **202** are then distributed among fuel consuming devices **203**. Fuel consuming devices **203** can be engines or generators. The engines drive marine vessel **200** while the generators supplies electricity to marine vessel **200**.

[44] Referring to figure 2, sensors **103** can be a fuel volume sensor **105** which measures the volume of the fuel in a fuel tank. Fuel volume sensor **105** can be a pressure sensor or a radar sensor. Fuel volume sensor **105** can be placed within the fuel tank. Sensors **103** can also be a fuel consumption sensor **106** which measures the fuel consumption of the fuel consuming devices **203**. Fuel consumption sensor **106** can be a mass flow meter. Fuel consumption sensor **106** can measure the flow rate of the fuel. Fuel consumption sensor **106** can be placed adjacent to the fuel inlet and outlet of the fuel consuming devices **203**. Sensors **103** can also be a fuel density and temperature sensor **107** which measures the density of the fuel and temperature of the fuel. Fuel density and temperature sensor **107** can be a mass flow meter.

[45] As shown in figure 2, fuel volume sensors **105** are placed within fuel tanks **201** and service tanks **202**. Fuel consumption sensors **106** are placed adjacent to the fuel inlet and outlet of the fuel consuming devices **203**. Fuel density and temperature sensors **107** can be placed within fuel tanks **201** and service tanks **202**, and adjacent to the fuel inlet and outlet of the fuel consuming devices **203**.

[46] Figure 3 shows the arrangement of the fuel consumption sensor **106** and fuel density and temperature sensors **107** in relation to fuel consuming devices **203**. Fuel consumption sensors **106** can be placed at the fuel inlet **301** and fuel outlet **302** of fuel consuming devices **203** to measure the fuel entering, and the fuel leaving fuel consuming devices **203**. Subtracting one from the other would provide the fuel consumption for fuel consuming devices **203**.

[47] Digital video recorder module **104** comprises at least one camera **401**. Preferably, digital video recorder module **104** comprises a plurality of cameras **401**. Each camera **401** can be a pan-tilt-zoom camera and can have night vision

capability. The digital footage recorded by each camera **401** is stored in the memory of digital video recorder module **104**. Preferably, digital video recorder module **104** can record up to thirty days of video.

[48] Cameras **401** can be arranged on marine vessel **200** as shown in figure 4, such that cameras **401** are placed in proximity to fuel tanks **201**, service tanks **202**, and fuel consuming devices **203**. Cameras **401** can be placed below deck and record continuous digital footage such that digital footage of the vicinity around fuel tanks **201**, service tanks **202**, and fuel consuming devices **203** are captured. Cameras **401** can also be placed above deck, and at the port and starboard sides of marine vessel **200**. This is to record deck view footage of any vessel or ship that comes into close proximity with the sides of marine vessel **200** (which would normally be the case if thieves wanted to steal the fuel).

[49] Sensors **103** (including fuel volume sensor **105**, fuel consumption sensor **106** and fuel density and temperature sensor **107**) and digital video recorder module **104** can be connected to central controller **102** via standard communication protocols such as modbus, RS485, Ethernet or Profibus or the like. Satellite terminal **101**, central controller **102**, and sensors **103** (including fuel volume sensor **105**, fuel consumption sensor **106** and fuel density and temperature sensor **107**) and digital video recorder module **104**, are all located on board the marine vessel.

[50] System **100** further comprises satellite **108** and earth station **109**. Earth station **109** is communicatively connected to central server **110**. Earth station **109** can be communicatively connected to central server **110** via gateway **111** and internet cloud **112**. Computer devices **113** can access the contents of central server **110**.

[51] Fuel theft is detected in the following manner. In step **501**, at a predetermined sampling interval, fuel volume sensors **105** will send their respective fuel volume readings to central controller **102**. This sampling interval can be every minute.

[52] In step **502**, at a predetermined sampling interval, fuel consumption sensors **106** will send their respective fuel consumption readings to central controller **102**. This sampling interval can be the same sampling interval as described in step **501**.

[53] In step **503**, at a predetermined sampling interval, fuel density and temperature sensors **107** will send their respective fuel density readings and fuel temperature readings to central controller **102**. This sampling interval can be the same sampling interval as described in step **501**.

[54] In step **504**, at a predetermined polling interval, central controller **102** transmits the sensor readings (i.e. fuel volume readings, fuel consumption readings, fuel density readings and fuel temperature readings) via satellite terminal **101** to satellite **108**. The polling interval is longer than the sampling interval. The polling interval can be 10 minutes. As the polling interval is longer than the sampling interval, central controller **102** will have multiple sets of sensor readings. Preferably, central controller **102** transmits only the most recent set of sensor readings at the polling interval. Satellite **108** can be Inmarsat_{TM} satellites or SkyWave_{TM} satellites.

[55] In step **505**, the sensor readings are then sent from satellite **108** to earth station **109** and to central server **110**. The central server **110** can be hosted in any data center or cloud computing service provider. Sat-IP is a protocol and Internet Protocol (IP)-based architecture for receiving and distributing satellite signals. An example of a Sat-IP network is the Inmarsat_{TM} Broadband Global Area Network (BGAN) network. Preferably, the transmission of the sensor readings over the Sat-IP network is encrypted.

[56] In step **506**, central server **110** computes the total drop in fuel volume across fuel tanks **201** and service tanks **202** by comparing the fuel volume readings with the fuel volume readings obtained during the preceding polling interval. Central server **110** computes the total fuel consumption of fuel consuming devices **203**. Central server **110** then compares the total drop in fuel volume with the total fuel consumption.

[57] In step **507**, if central server **110** detects that the total drop in fuel volume differs from the total fuel consumption beyond a predetermined threshold, central server **110** will trigger an alert.

[58] The density of fuel will change when its temperature changes. For a given temperature, the fuel will therefore have an expected density. For example, if the temperature of Marine Gas Oil (MGO) is 15 °C, the expected density of MGO is around 860 kg/m³. In step **508**, central server **110** determines from the fuel temperature readings, the expected density of the fuel. If central server **110** detects that the fuel density readings differs from the expected density of the fuel beyond a predetermined threshold, central server **110** will trigger the alert as this may be an indication that high grade fuel may have been stolen and replaced with lower grade fuel.

[59] The alert can be a phone call to computer device **113** of a user. If the user fails to answer the call within a predetermined number of rings, a record will be logged. This alert can alternatively be in the form of an email message, a text message, a social media message or the like, to computer device **113** of the user. The alert can have a timestamp to indicate the time in which the alert was sent. The content of the message can be that of informing the user that an abnormality has been detected, and for the user to log on to central server **110** via the web portal to view the sensor readings. The content of the message may also include a hyperlink to the web portal.

[60] The alert can also relay various degrees of urgency or magnitude of the fuel theft. For example, if central server **110** detects that the disparity between the total drop in fuel volume across fuel tanks **201** and service tanks **202** and the total fuel consumption by the fuel consuming devices **203** is significantly more than the threshold, central server **110** can issue a critical alert to the user. The criticality can be represented by text or by a colour code e.g. red. The criticality can also be represented by an intrusive phone call to computer device **113** of the user. In another example, if central server **110** detects that the disparity between the total drop in fuel volume across fuel tanks **201** and service tanks **202** and the total fuel consumption by the fuel consuming devices **203** is not significantly more than the

threshold , central server **110** can issue a normal alert to the user. The normalcy can be represented by text or by a colour code. The normalcy can also be represented by a less intrusive form of communication, for example, an email message or a text message to computer device **113** of the user.

[61] In step **509** the user can use the web portal to log on to central server **110** to request for the recorded digital footage over a specific time interval, this specific time interval based on the timestamp of the alert. For example, if the timestamp of the alert was 0600 hours, the user can request for recorded digital footage between the specific time interval of 0530 and 0630 hours. The central server **110** then sends this request to the central controller **102**.

[62] In step **510**, central controller **102** requests and obtains the recorded digital footage over the specific time interval from digital video recorder module **104**, and sends the recorded digital footage via the satellite terminal **101** and Sat-IP network to central server **110**. The user can then view the recorded digital footage on the web portal. In viewing the recorded digital footage, the user can view for himself the fuel theft or at least have recorded evidence of the fuel theft. The web portal also allows the user to view a history of sensor readings.

[63] In an alternative embodiment, instead of requesting for recorded digital footage over a specific time interval or previously recorded digital footage, the user can use the web portal to request for "live" or substantially real time digital footage from central controller **102**. In this embodiment, the user can select any one of the cameras of digital video recorder module **104**, and the digital footage being recorded will be broadcast substantially in real time via the Sat-IP network to the central server **110**. The advantage of this "live" video monitoring is such that the user at the shore office can observe key operation events of the marine vessels such as during bunker fuel transfer, oil rig support etc. This system of live video access will act as a deterrent to fuel theft. It would also promote crew safety and operational efficiency.

[64] In yet another alternative embodiment, satellite terminal **101** provides positioning information of the marine vessel to central controller **102** at a sampling interval. This sampling interval can be the same sampling interval as described in

step **501**. Positioning information can include the Global Positioning Satellite (GPS) coordinates, speed and direction of the marine vessel. At the polling interval in step **505**, central controller **102** sends the positioning information to central server **110**. A user can use the web portal to log on to central server **110** to view the positioning information of the marine vessel.

[65] In yet another alternative embodiment, instead of waiting for central controller **102** to send the sensor readings and positioning information at the polling interval, the user can use the web portal to log on to central server **110** to request for historical sensor readings and positioning information that was obtained at every sampling interval from central controller **102**. The user may do this once he has received the alert as described in steps 507 and steps 508. In a similar vein, the user can also request for substantially real time sensor readings and positioning information using the web portal. Central controller **102** will then obtain the sensor readings from sensors **103** and positioning information from satellite terminal **101**.

[66] Various corrective measures can be taken once fuel theft has been confirmed via the recorded digital footage. For instance, the user can use the web portal to close the valves of the piping manifold system connecting fuel tanks **201** and service tanks **202**. The user does this by using the web portal to send a command from the central server **110** through the Sat-IP network to satellite terminal **101**, and to central controller **102**. Prior customization would have to be performed, to integrate central controller **102** with the valve controller on the on-board ship pump operating system of the marine vessel. But once this is done, central controller **102** would be able to send instructions to the valve controller to close the valves of the piping manifold system connecting fuel tanks **201** and service tanks **202**. Although the example provided herein is of the central server **110** sending commands to the central controller **102** to close the valves of the piping manifold system connecting fuel tanks **201** and service tanks **202**, one skilled in the art would appreciate that the central server **110** can send or issue other commands to the central controller **102** to perform other actions as well. These other actions non-exhaustively include immobilizing the fuel consuming devices **203** and sounding a siren alarm.

[67] The transmission of the recorded digital footage in step **510** is via a Sat-IP network. As subscribing to a dedicated IP bandwidth can be expensive, marine vessels typically use background IP instead when transmitting data. However, as there is no dedicated data channel, the bandwidth when using background IP can be intermittent when there are many other marine vessels in the area. This makes transmission of the recorded digital footage prone to lag and loss or delay of data. To address this problem, before central controller **102** sends the recorded digital footage to satellite terminal **101**, central controller **102** takes each frame in the recorded digital footage, and partitions it into sub-frames. Each sub-frame is assigned a sub-frame sequence number. The sub-frames are then compressed, encrypted and then sent to satellite terminal **101** and over the Sat-IP network (i.e. satellite **108**, earth station **109**, gateway **111** and internet cloud **112**) to central server **110**. Central server **110** then decrypts, un-compresses and assembles the sub-frames based on the sub-frame sequence number to reform the frame. In the event that a sub-frame for a current frame is lost during the data transmission, central server **110** can still assemble the current frame by using the corresponding sub-frame of the previous frame in place of the lost sub-frame.

[68] The web portal provides many functionalities to the user. For example, the web portal can provide a graphical representation of the sensor readings of fuel volume readings, fuel consumption readings, fuel density readings and fuel temperature readings as shown in figure 6. The web portal also allows the user to view historical values of the fuel volume readings (as shown in figure 7), fuel consumption readings (as shown in figure 8), fuel temperature readings (as shown in figure 9) and fuel density readings (as shown in figure 10). The web portal also provides a map view which depicts the voyage of the marine vessel. This is illustrated in figure 11. Each node **1101** in figure 11 represents a polled interval, and the user would be able to view the sensor readings during that polled interval by clicking node **1101**.

[69] One skilled in the art will appreciate that the system described herein can be modified and applied to land based assets as well. These land based assets

include non-exhaustively, mining trucks, excavator or industrial machineries operating in remote locations.

[70] The invention described herein is susceptible to variations, modifications and/or additions other than those specifically described and it is to be understood that the invention includes all such variations, modifications and/or additions which fall within the scope of the following claims.

Claims

1. A system for satellite remote monitoring of a marine vessel comprising:
 - a satellite network;
 - a central server;
 - a central controller communicatively connected to a satellite terminal, the central controller and the satellite terminal located on the marine vessel;
 - a digital video recorder module for recording and storing digital footage of areas on and proximate the marine vessel, the digital video recorder module adapted to provide the central controller with the digital footage;
 - a plurality of sensors adapted to provide the central controller with sensor readings, the plurality of sensors comprising:
 - at least one fuel volume sensor within a fuel tank on the marine vessel, the at least one fuel volume sensor adapted to provide the sensor readings of fuel volume at a sampling interval;
 - at least one fuel consumption sensor adjacent an inlet and an outlet of a fuel consuming device of the marine vessel, the at least one fuel consumption sensor adapted to provide the sensor readings of fuel consumption at the sampling interval;
 - at least one fuel density and temperature sensor on the marine vessel, the at least one fuel density and temperature sensor adapted to provide the sensor readings of fuel density and fuel temperature at the sampling interval; and
 - wherein the central controller is adapted to receive the sensor readings and digital footage and send the sensor readings and digital footage via the satellite terminal and satellite network to the central server; and
 - wherein the central server is adapted to determine a drop in fuel volume at the sampling interval and an expected density of the fuel from the fuel temperature, and the central server is further adapted to determine when the drop in fuel volume differs from the fuel consumption beyond a first threshold or when the fuel density differs from the expected density of the fuel beyond a second threshold, the central server triggers an alert having a timestamp to a user; and
 - wherein the central controller is adapted to request and obtain the digital footage over a specific time interval from the digital video recorder module, the

specific time interval based on the timestamp of the alert, and send the digital footage via the satellite terminal and the satellite network to the central server.

2. The system of claim 1 wherein the central controller is integrated with a valve controller on the marine vessel, and the central controller receives a command from the central server to control the valve controller to close a valve of a piping manifold system connected to the fuel tank.

3. The system of claim 1 or claim 2 wherein the central controller is further integrated with an on-board ship pump operating system of the marine vessel and the central controller receives a command from the central server to immobilize the fuel consuming device or sound a siren alarm on the marine vessel.

4. The system of any one of the preceding claims wherein the central controller partitions each frame in the digital footage into a plurality of sub-frames before sending the digital footage to the satellite terminal.

5. The system of claim 4 wherein each of the plurality of sub-frames is assigned a sub-frame sequence number.

6. The system of claim 5 wherein the central server receives the plurality of sub-frames and assembles the sub-frames based on the sub-frame sequence number to reform each frame.

7. The system of any one of the preceding claims wherein the central server determines the drop in fuel volume at the sampling interval by comparing the fuel volume at the sampling interval with the fuel volume at a preceding sampling interval.

8. The system of any one of the preceding claims wherein the central controller is adapted to receive positioning information from the satellite terminal at the sampling interval and wherein the central server is adapted to receive the positioning information from the central controller.

9. The system of any one of the preceding claims further comprising a web portal which provides the user access to the central server to specify the specific time interval to request the digital footage, and view the sensor readings and digital footage and positioning information.

10. The system of claim 9 wherein the central server is adapted to obtain the historical sensor readings and positioning information and substantially real time sensor readings and positioning information from the central controller upon the user's request via the web portal.

11. The system of any one of the preceding claims wherein the alert is a phone call, a text message or an email to a mobile device of the user.

12. A method for satellite remote monitoring of a marine vessel comprising the steps of :

- recording and storing digital footage of areas on and proximate the marine vessel using a digital video recorder module;

- receiving sensor readings from at least one fuel volume sensor within a fuel tank on the marine vessel, the at least one fuel volume sensor adapted to provide the sensor readings of fuel volume at a sampling interval;

- receiving sensor readings from at least one fuel consumption sensor adjacent an inlet and an outlet of a fuel consuming device of the marine vessel, the at least one fuel consumption sensor adapted to provide the sensor readings of fuel consumption at the sampling interval;

- receiving sensor readings from at least one fuel density and temperature sensor on the marine vessel, the at least one fuel density and temperature sensor adapted to provide the sensor readings of fuel density and fuel temperature at the sampling interval;

- sending with a central controller, the sensor readings via a satellite terminal and a satellite network to a central server;

- determining with the central server a drop in fuel volume at the sampling interval and an expected density of the fuel from the fuel temperature;

triggering with the central server, an alert to a user when the central server has determined that the drop in fuel volume differs from the fuel consumption beyond a first threshold or when the fuel density differs from the expected density of the fuel beyond a second threshold, the alert having a timestamp;

obtaining with the central controller, digital footage over a specific time interval from the digital video recorder module, the specific time interval based on the timestamp of the alert; and

sending the digital footage from the central controller via the satellite terminal and the satellite network to the central server.

13. The method of claim 12 further comprising the step of sending with the central server, a command to the central controller to control a valve controller on the marine vessel to close a valve of a piping manifold system connected to the fuel tank.

14. The method of claim 12 or claim 13 further comprising the step of sending with the central server, a command to the central controller to immobilize the fuel consuming device or sound a siren alarm on the marine vessel.

15. The method of any one of claims 12 to 14 further comprising the step of partitioning with the central controller, each frame in the digital footage into a plurality of sub-frames before sending the digital footage via the satellite terminal and the satellite network to the central server.

16. The method of claim 15 wherein each of the plurality of the sub-frames is assigned a sub-frame sequence number.

17. The method of claim 16 wherein the central server receives the digital footage in the form of the plurality of sub-frames and assembles the sub-frames based on the sub-frame sequence number to reform each frame.

18. The method of any one of claims 12 to 17 wherein the central server determines the drop in fuel volume at the sampling interval by comparing the fuel volume at the sampling interval with the fuel volume at a preceding sampling interval.

19. The method of any one of claims 12 to 18 further comprising the steps of receiving positioning information from the satellite terminal at the sampling interval and sending the positioning information from the central controller to the central server.
20. The method of any one of claims 12 to 19 further comprising the step of providing a web portal to allow the user access to the central server to specify the specific time interval to request the digital footage, and view the sensor readings and digital footage and positioning information.
21. The method of claim 20 further comprising the step of obtaining historical sensor readings and positioning information and substantially real time sensor readings and positioning information from the central controller upon the user's request via the web portal.
22. The method of any one of claims 12 to 21 wherein the alert is a phone call, a text message or an email to a mobile device of the user.