

FIELD

This invention relates to video surveillance, playback and exploitation of image data at a base control station.

BACKGROUND OF THE INVENTION

1. The effectiveness of unmanned surface vessels(USV) depends almost entirely on the data it sends to the shore control station or a mother vessel or both. The shore control station operator makes decisions based on the received data especially images from an Electro-Optical Camera or other main visual system or sensor onboard the USV. This operator may also control more than 1 USV in a given area of surveillance and therefore needs to effectively deal with multiple sources of information at the control station.
2. Traditionally imagery from one or more cameras are seen as soon as it is received in real or near real time at the monitoring station and stored on a recording medium for later playback. Unless an operator is paying constant attention to this received imagery on the base station display, it is possible that events of interest might be missed. If it is suspected that an event of interest may have been missed, the operator will then need to quickly scroll or playback images to check if this was the case. Normally playback of the main EO imagery is done as part of post mission analysis by using a playback feature that is found in dedicated EO display terminals. This requires going into the storage medium where the folder is kept and stepping through the frames slowly. Current methods of playback are deemed inadequate. In the case of a USV shore control operator, delays in getting a playback of a scene may have serious implications as the USV tasking may have to be altered in response.
3. The invention creates a playback mode for quick recall of images from a USV and also provides the base operator with the tools to tag the image for post mission analysis and reporting.

BRIEF DESCRIPTION OF THE INVENTION

4. The present invention relates to how imagery from a USV that arrives at a shore or mother ship control station, are managed. Imagery from the USV are sent as coded digitized data, and time stamped to the shore base monitoring station where these are stored into different folders in a digital storage medium according to the source of the image. A copy of the image may also be immediately displayed on various display windows on the station so that an operator can see all the images at once. The USV'S electro-optic (EO) camera is normally the main source of imagery intelligence for decision making because it is day and night capable, and can also be panned, tilted and zoomed. This camera is normally on the Main window on the console and is the one that the operator usually looks at.
5. Due to the importance of the EO camera image, special focus is needed to ensure that key events are not easily missed. Like land based camera systems, cameras at sea can be used for automatic

image detection to detect a vessel or object that was previously not there. However, after the presence of an object or vessel is known, it is more difficult to use automatic detection technologies to be alerted of activities onboard the vessel. This is because of the motion of the object being viewed and the USV itself are influenced by sea conditions. The sea itself presents an ever changing image to a camera making it hard to tell what exactly has changed between one scene and the next. Even with good camera hardware and software stabilization, applying automatic detection is hard for image collected at sea. For example, the action of a man on the deck of a vessel throwing something into the water is not easily picked up using automatic detection software because of differential visual situations like day or night, rain, rough seas etc. False alarms tend to cause such automatic detection software to be set aside in operations. Hence, the operator will rely on his own observation to detect events of interest.

6. When the operator suspects he may have missed an event a few seconds earlier, the manner of retrieving the images must be fast. Playback on the same display as the real time EO imagery means that more recent images that have just appeared on the display will also be missed by the operator while he is reviewing images from playback.
7. In this invention, a Replay window is created and is preferably located next to the main EO display window. By selecting the source of imagery to appear on the Replay window, recent images from this source are then shown in a Film Strip window normally found at the base of the Main and Replay display. The Film Strip approach is to show up several recent images that offers a chance that the operator may notice an event of interest based on the difference in the images. The Main window, Replay window and Film Strip are all found on the display part of the monitor station where operator intervention is best optimized.
8. Forward and backward arrows located on the Film Strip enable the operator to move the image record forward or backwards to view images. The replayed image is then also shown on the Replay display window and by moving the arrows, the Replay window shows the images like a fast forward or backward in a normal tape recorder. This provides the operator with additional perspective of the changing image scene.
9. When a replayed image is interesting, the operator can tag that image by typing remarks in the tag field that appears when the Tag icon on the Replay window is pressed. The image source, time and the remarks are then stored for ease of future recall in a Tag Folder in the storage medium.
10. To recall the tagged images, the operator calls up the tag search function and types a date period or a keyword and a table of the associated images are called up with respective thumbnails. By placing a mouse over the thumbnail causes the full size of the Tagged image to be seen on the Replay window.

BRIEF DESCRIPTION OF THE DRAWINGS

11. An example of the invention will now be described with reference to the accompanying drawings.

Fig 1 shows imagery and data from the USV going to a shore and/or mothership control station via RF means. The control station comprising of at least a computer processing unit, storage medium for the imagery received and one or more display monitors.

Fig 2 shows a plurality of windows on a display monitor that comprises at least a Main image window, a Replay window, a Film Strip window and other image windows that show images from other cameras onboard the USV as may be desired.

Fig 3 shows the process where images received from the USV are placed in the storage medium in folders and one of the folder images is selected to be displayed on the Main display and the same or another image folder is selected for the Replay window. The Film Strip view is immediately populated by several images of the Replay window starting with the most current real time image of that selected folder. Tagged images of the Replay window are sent to a Tagged image folder for further analysis and reporting.

Fig 4 shows that the interactive nature of the Replay window wherein an operator can choose to tag, search or download images from the Replay window.

Fig 5 illustrates the interactive nature of the Replay window wherein the operator now chooses to search and list those images that have been tagged and stored

Fig 6 shows that expansion of the thumbnail image to a bigger image

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

12. An exemplary embodiment of a preferred form of the invention will now be described with reference to Fig 1 to 6.
13. As shown in Fig 1, most base monitoring console have a generic layout that comprises a processing unit, one or more displays that reveal a plurality of windows that can be distributed on the displays to suit each user's requirements.
14. As shown in Fig 2, the key components of a base monitoring console display 10 comprises a Main window 25, a Replay window 20, a Film Strip window 15. The layout depicted in Fig 2 may also take other forms as determined by the user. The Film Strip 15 will be occasionally accessed by the console operator to check whether or not he has missed any image of interest.
15. In the preferred embodiment, images received from the USV at the base station are immediately stored in the storage medium under different folders 30 where each folder describes a particular device that was the source of that image data. The images are time stamped, encoded, and digitized. An operator selects the image to display in the Film Strip window 15 by choosing from a menu of devices 35 that is found in a pop up window next to the Film Strip 15. By selecting the device or source, the Film Strip 15 will be populated by immediate past images from the source stored in the storage medium. The latest image 16 in Fig 2 on the Film Strip 15 will be on the right hand side and the images prior to that will fill the frames to the left of the latest image. Two arrows shown in Fig 2 18 and 19 allow the manipulation of the stored images. By moving the left arrow 18 the operator can examine older images from the storage medium. By pressing the right arrow 19, the images that are of later time can be seen until it reaches the latest image received from the USV. When the arrows are not manipulated for a duration of over 5 seconds, the Film Strip window 15 will reset itself to show the latest images of the selected device 35.
16. The Replay Window 20 will always show the image 16 of the Film Strip window 15, and when the arrows 18, 19 are manipulated by pressing either one of the arrows to cause the image to run, the Replay window 20 will show a virtual animated video. The running video is another tool that the operator uses to spot differences image to image of the image source that is chosen.
17. When the operator sees an image on the Replay window 20 that is of interest, he can tag that image. As shown in Fig 4, the operator activates tagging by pressing the icon 21 on the Replay window 20. When icon 21 is pressed, a pop up menu 23 is displayed. This menu will show tools like Tag 26, Search 27 and Download 28 and others 29. When the Tag 26 is selected, a field 22 is shown on the Replay window 20. Data can be entered into this field to highlight significant observations. This can then be saved by pressing the save button 31. A copy of the tagged image and the fields that are entered 22, time and keywords entered into the field are then saved in a tagged image folder 33 in the storage medium. When the saved button 31 is pressed, the field 22 will disappear from the Replay window 20 until it is activated again by depressing the button 21.

18. When the button 21 is pressed and the Search 27 field is selected in the pop up menu 23, the field 22 will appear on the Replay window 20. The operator can then type a keyword to search the tagged folder 33 for images that have the keyword. The results of that search are then displayed in the Replay window 20 which is replaced by Fig 5 24. The window 24 will contain fields like date, time, source, key and a thumbnail 36 of the tagged image that responds to the keyword used in the search. The operator can mouse over the thumbnail 36 to reveal a larger tagged image 32 which will be shown over the table in the Replay window 20. The expanded image disappears when the mouse is no longer over any of the thumbnails. By placing the mouse over the window 24, it is possible to scroll through the contents of the search by moving the scroll button of the mouse. When the scroll stops, the data shown in the window 24 will be that of the listings at that point in time. When the mouse is moved off the window 24 and left outside for 5 seconds, the data in the window will return to the top listing of the initial search that was initiated. By pressing the button icon 21 again, the search will be stopped and the Replay window 20 will revert to the image frame last seen in the Film Strip window 15.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of rapid playback, analysis and tagging of image or other data received at the shore or base control station or at a mothership when such data or image is sent from an unmanned surface vessel.
2. The method in Claim 1 wherein a shore monitoring station consists of at least a display that comprises a Main window, Replay window and a Film Strip window in addition to a computer processor and storage medium
3. The method in the preceding claims where the Main window is used to display the source image of interest to the operator while the Replay window is set close to the Main window for easy review and comparison with the Main window images.
4. The method of Claim 1 and 2 where the Film Strip window source is selectable by the operator and always shows 4 or more frames of images that were stored in the storage media with the most recent image being the image on the right most frame.
5. The method of Claim 4 where arrows are used to enable the operator to scroll forward and backwards between images of the Film Strip and for the most recent image found on the right most frame of the Film Strip to be displayed on the Replay window.
6. The method of the preceding claim where the effect of rapid movement of the Film Strip arrows is to create a video like animation in the Replay window for enhanced operator appreciation.

7. The method of Claim 4 through 6 wherein the Film Strip reverts to the latest images of the selected source when the arrows are not selected for over 5 seconds or any other time interval.
8. The method of Claim 1 through 3 where an image of interest in the Replay window may be tagged for future review and analysis by a soft button found on the Replay window and subsequently saved to a tagged image folder.
9. The method of the preceding claim where the soft button is also used to select functions notably tagging, searching and downloading of tagged images that are kept in a tagged image folder in the storage medium.
10. The method of Claim 1, 8 and 9 where the Replay window is also used to show the results of the search conducted of tagged images and the results are displayed in the form of a table with attributes such as date, time, keyword and thumbnail image
11. The method of the preceding claim where the use of a mouse over the image thumbnail in the tabulated search returns enables the expanded image of the thumbnail to be shown over the tabulated form and to disappear when the mouse is no longer over the thumbnail.
12. The method of the preceding claim where a mouse placed over the tabulated form allows the scroll wheel of the mouse to be used to scroll through the tabulated data and to return to the top of the tabulated data listing once the mouse is moved out of the table.