Local Situational Awareness Rearview case

For many years, Local Situation Awareness (LSA) solutions consisted of simple analogue video with one or more cameras displayed in a mosaic layout or switching between camera views. One of the main disadvantages was lacking an overall view of the complete situation, especially knowing where a camera was located. That's why Esterline decided to take LSA into the digital age and use the additional benefits modern visualization technology offers.

Operational requirements

Two main objectives with this system:
- For the driver: to drive in reverse gear and have full visibility of the rear side of the vehicle
- For the commander: to assess potential threats before opening/closing the back door and releasing the troops out of the vehicle

Esterline advanced digital solution

Based on digitizing all camera sources, routing the information over the network and applying video processing techniques to enhance situation awareness around the vehicle.

Rear camera unit
CPI 101
Visualization network
Power 28 V DC
DPI 101
Display
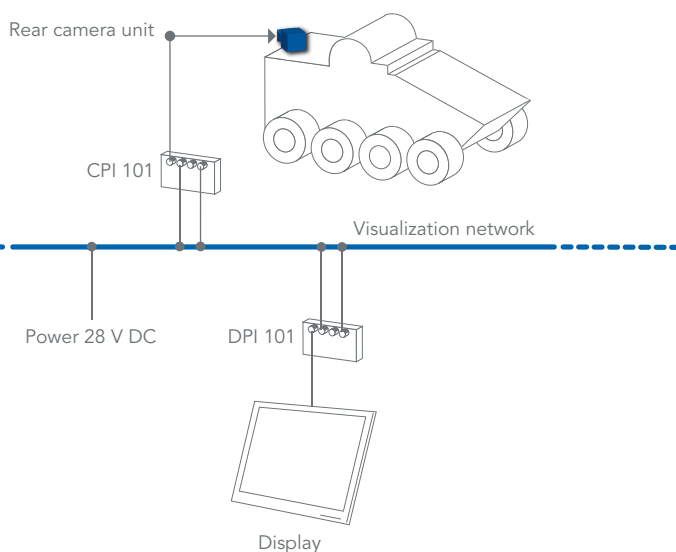
The Camera Processing unit (CPI) is used to interface 3 cameras to the video network. Local pre-processing is added onto the raw video. Communication with the cameras can also be included as well as supplying power to the cameras box.

The Display Processing Units (DPI) can be connected to the network for interfacing to the display. This unit selects the video signals to be displayed and composes different perspectives. Interaction with the user is possible with button or touchscreen feedback.

The CPI and DPI units as shown on the figure above can be part of a larger LSA video network (see panoramic case) or can be combined in a small standalone system.

Esterline LSA features & benefits

1. Compatibility through open standards
Esterline open system is compliant with all the required standards (DEF-STAN-0082) for Ethernet video network systems. The system can capture camera sources of up to SXGA resolution. Display outputs are standard DVI-D formats, supporting different resolutions (e.g. Vesa XGA/SXGA for the DPI unit). To manage bandwidth across the network, we use JPEG 2000 compression and standard IEEE Ethernet protocols (IGMP, RSTP,…).

2. Higher image quality
Panoramic stitching allows the user to combine two camera images into a wide field of view in one single image. A nearview image from a 3rd camera can be added to this composition to create a view from the ground immediately behind the vehicle to the horizon in one single image.
Multiband blending can be done to improve image quality and offset brightness differences between both cameras.
Contrast enhancement can be done to improve image quality.

3. Stitching & image blending for high quality viewing
The images coming from adjacent cameras (with minimum parallax) and viewing the same scenery can be stitched seamlessly to each other. Smooth transients between different camera images are created using blending function compensations.

4. Motion detection to automatically alert on threats

In a stationary situation, a motion detection algorithm can be used to detect threats, even when a camera image is not used for displaying. User alerts can be generated, thus allowing multiple actions to be defined. Automatic image switching or overlay windows can be added to inform the user and/or exported to other equipment. The LSA system can track the detected objects. Detection parameters can be changed to fine-tune the sensitivity of the function and avoid false alerts related to noise and small local motions (e.g. the waving leaves of a tree).

5. Image stabilization for better assessment while driving

When driving, cameras tend to vibrate and the image becomes unstable and/or blurred. Esterline LSA system provides cost-effective solutions to cope with that issue.

6. Image fusion for enhanced image quality

Images coming from Infrared cameras and daylight cameras can be superimposed to create one image with higher readability, especially at dusk, dawn or in smoking conditions. The Esterline solution can match image sizes and position them to improve the fused image quality.

Not visible person in the woods

Not visible plastic object

Fusion image bring the two object visible
Example of a fusion of a day camera + IR camera

But, as in the above situation and even during normal daylight conditions, to obtain a full view on what is out there, both images will be required.

7. Expandability

The Esterline LSA network solution is not limited to a fixed number of dedicated components. More interfaces can be added, including cameras or displays, to expand the functionality.

8. Redundancy

The Esterline LSA network solution can be configured into a ring network. Standard Ethernet protocols are used to prevent loops in the video flow and allow automatic rerouting of the streaming data in case one of the connections fails.

9. Possibility to apply rapid recognition techniques

Easy and real-time interaction with the user can be done with a display touchscreen to select camera images or zoom in on a region of interest (ROI). A motion detection algorithm can be added, thus allowing to detect, track and visualize any motion. Information about a detected object can also be made available for external equipment.

Configuration Management

For System Integrators, Esterline provides an open platform with a software suite. This user-friendly software tool allows the user to create perspective layouts.

A typical RearView perspective example is shown below.

CAMERA 1 (LEFT 55°) CAMERA 2 (RIGHT 55°)

CAMERA 3 (NEARVIEW)
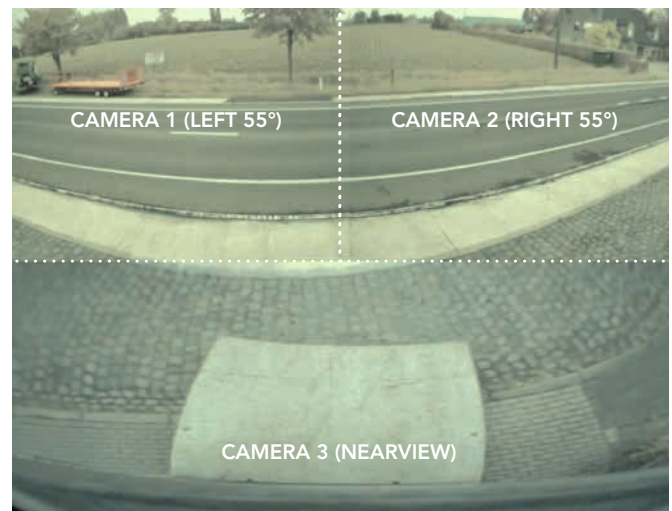
A typical rearview perspective example with 3 cameras

This tool enables the customer to easily define and organize the perspective layouts. Final project results are then uploaded into the LSA system. Multi-perspective compositions can be checked and selected with different input tools: display buttons, touch screen or customer application software to switch between the different perspectives.