EMBEDTEK

A Path to Migration: In-vehicle Image Processor

Vehicles create a brutal environment for computers and electronics. Temperature swings are extreme — an outside temperature of 90 degrees can quickly turn to 140 degrees inside a vehicle within an hour. Computer systems endure constant vibration while vehicles are in motion, along with bumps, sudden stops, and tight turns. Size and placement of the system can leave it vulnerable to damage as objects are moved in and out of the vehicle.

An original equipment manufacturer (OEM) approached EmbedTek to develop a more ergonomic, durable, high-performance image processor that would live and operate inside the trunk of a vehicle. The challenge didn't stop there. The new processor module needed to be flexible enough to both improve an existing product offering and simplify a planned migration to the next generation of camera systems. Our team of engineers designed a solution that outperformed the existing system, reduced costs, and optimized the manufacturing and migration process.

Migration Plan

When we first engaged with our customer, they had only recently begun thinking about how they would go about updating their existing product to accommodate for ongoing innovations in camera technology. This was a particularly complicated endeavor because of the proprietary components involved, including cabling and connectors.

EmbedTek recommended they focus on the processor, not the camera. The migration from the first generation to next generation would only be possible if the processor was able to accommodate a significant upgrade to the technology of its attached components.

We developed a custom printed circuit board (PCB) with complex software that eliminated the need for proprietary data capture components, cables, and connectors. The overall system is a more reliable product in a smaller footprint than before and will cost less to manufacture.

Our design approach provides a path to the next generation camera with the added benefits of longer and simpler cable runs. It also allows us to replace just the processor module with the existing cameras they had already deployed.

Result

Immediate improved existing end user experience due to the ability to conduct field retrofits and sell newly manufactured systems without changing the nature of the video stream. When the next generation camera is available, a simple change can be made in the manufacturing process to enable the future architecture.

Technical Exploration

The final design would have to take into account variables, such as:

- Inrush current surges from the battery
- Ingress of water and contaminants
- Power management
- Power distribution
- Secure mounting approaches
- Interface
- Cabling and connectors

In order to provide compatibility with the existing design and support vehicles currently in the field, we developed the concept for and designed a board that would accept the input of the current installed cameras while also supporting the next generation cameras utilizing a different interface. This provides them the ability to take immediate advantage of the improved performance and reliability of our improved system while eliminating the need for a new system to support future cameras.

We conducted a technical exploration and feasibility studies to determine how to balance protection and durability with the high-performance capability our customer was looking for. The final product would have to withstand weather and climate anywhere – from near arctic in winter to Saudi Arabia in summer. Extensive testing was completed to model the environment of a vehicle trunk.

Technical Considerations

The final design would have to take into account variables, such as:

- Inrush current surges from the battery
- Ingress of water and contaminants
- Power management
- Power distribution
- Secure mounting approaches
- Interface
- Cabling and connectors

Knowing the customer had a major technological upgrade planned for components attached to the processor, our research also needed to demonstrate the progression of technology. Whatever we suggested to retrofit the first generation processor needed to support the next generation of the OEM product.

Result

Proof of concepts showed we could achieve a powerful compact and durable computer that could be used in any way a mobile computer is needed. EmbedTek presented a path to improve the reliability of the existing customer's product, increase data transmission speeds, lower the cost by eliminating proprietary cabling and components, and position the manufacturing process to easily transition to the next generation of the technology.

Compact Design

As a vehicle-based product, durability, size and mounting were critical constraints. Engineering design including a custom printed circuit board (PCB) eliminated the need for additional components, cables, and connectors, reducing the overall volume of the unit by 50%. The PCB also provided better management of power distribution and allowed for delivery of custom display features. Various mounting options were designed to improve adaptability and stability. Longer cable runs and more cost-efficient connectors improved reliability by reducing noise and signal loss.

Result

A less expensive, more reliable, and durable design that is equipped to adapt to the fast pace of innovation in camera technology. The higher performance image processing and analytics increases the revenue as it is now able to capture more accurate information at higher vehicle speeds. End users are also happier with a lower failure rate.

Our customer told us it is very rare for every department to have a positive experience with a technology partner like they did with EmbedTek. Several additional projects are currently in the works.

EmbedTek designs, invents, and manufactures computers, software, sensors, cameras, and displays for original equipment manufacturers. Our systems improve the quality of imaging in healthcare, simulation programs in the military, video analytics in security, and much more. Throw any challenge at us, from demanding environment and ergonomic requirements to High Level Assembly and nonstandard I/O. We'll evaluate it, carefully attack it, and solve it.