SuperTest – helping Peloton enhance 'big-rig' safety and fuel efficiency

California based Peloton Technology, a world leader in automated vehicle technology, knows the importance of software system safety. It's deploying advanced vehicle-to-vehicle communication and control technologies to platoon one truck behind another at a constant distance of around 65 feet (20 meters), without relying on the rear truck driver's reaction times to avert collisions if the front truck needs to brake suddenly or an overtaking vehicle cuts in.

The benefit of platooning is simple: slipstreaming one truck behind another reduces both truck's fuel consumption by a combined figure of around 7%. For a trucking industry that spends upwards of 80 billion dollars a year on fuel in the US alone, that amounts to spectacular savings. But as Peloton's VP of Marketing Rod McLane points out, when it comes to market acceptance, it all starts with safety.

"At the separation distances we're talking about, if the front truck encounters something and brakes, the rear truck needs to brake within about a tenth of a second, much faster than the rear truck driver can react," says Rod. "By linking the trucks electronically to achieve short separation distances and synchronized acceleration and braking, we're not only improving fuel economy, we're also improving the safety of truck platooning."

Peloton's technology doesn't equate to autonomous driving, because both truck drivers remain in full control of their vehicle's steering. Instead, it taps into the front truck's engine ECU (Electronic Control Unit) and braking ECU, and relays relevant commands via a dedicated short-range communications (DSRC) channel to the rear truck's engine and braking ECUs. Combined with the trucks' forward-facing radars, this allows automatic platooning at the required separation distances. The DSRC also includes a video channel so that the rear driver can see what the front driver sees, and an encrypted audio channel so that the two truck drivers can talk to one another.

To ensure functional safety, the Peloton system includes a dedicated Hercules™ Arm® Cortex®-R MCU, which monitors all safety-critical communications and commands. It's here that Peloton has enlisted Solid Sands' SuperTest compiler test and validation suite to ensure that software development and implementation of the MCU's embedded code meets the internationally recognized ISO 26262 functional safety standard for road vehicles.

"Because our systems tightly integrate with the trucks' existing cruise control and collision avoidance systems, we work very closely with the OEM truck suppliers and tier-1 component suppliers to ensure safety of the overall system and make sure that everyone is comfortable with what we are doing," says Rod. "It therefore makes sense to adhere to ISO 26262, which is the industry standard for best practice in safety-critical automotive applications."

According to Todd Klaus, Principal Software Engineer at Peloton, ISO 26262 compliance made SuperTest and its associated qualification suite a clear winner for validating the GCC compiler that his team is using to develop embedded code for the Hercules safety MCU at the core of its system.

"One of our main concerns was validating the GCC C++11 compiler against the relevant ISO language standards," commented Todd. "SuperTest offers us a huge and very rich test suite that we can run against the compiler to verify that it does meet those language standards, giving us the assurance that our C++ code will behave the way it should. GCC comes with its own test suites, but it's not by any means certified for automotive use or guaranteed to meet the standard in all areas. SuperTest shows us where the shortcomings are, so we can modify our code review standards to avoid those situations. It pushes the boundaries of the compiler to show us where the holes are."

For Todd, it's also important that SuperTest's test suites run directly on the target hardware.

"We not only want to verify that the front end of the compiler is parsing and interpreting code correctly. It's also important that the back end is producing code that runs correctly on the ARM processor we've selected. So we deploy the code directly to a development board that contains the target safety monitor chip. Although it does mean that the testing takes more time, it's worth it because of the confidence it gives us that the entire tool chain is being validated, which is one of the key requirements of ISO 26262."

Peloton

COMPANY PROFILE

Peloton is a connected and automated vehicle technology company dedicated to improving the safety and efficiency of U.S. and global freight transportation. Backed by ten Fortune Global 500 companies, Silicon Valley-based Peloton partners with customers to deliver innovative tools that save fuel, avoid crashes, and improve operational insight through connectivity, automation and advanced data analytics. Peloton's flagship driver-assistive platooning system links the active safety systems of pairs of trucks, enhances driver teamwork, and connects trucks to a cloud- based Network Operations Center which limits platooning to appropriate roads and conditions. Peloton solutions also improve the safety of individual trucks by requiring best-in-class collision avoidance systems and other safety features that are active both in and out of platoon.

Solid Sands

Solid Sands is based in Amsterdam, the Netherlands. Our mission is to put quality into C. We do that by improving the quality of C and C++ compilers, libraries and analysis tools, and their safe and secure use, with the best possible test and validation suite.
With SuperTest, Solid Sands serves its customers to achieve the software quality level required by the ISO language and functional safety standards. With our history in compiler development, our knowledge of past, current and upcoming versions of the C and C++ standards, new analysis and optimizations techniques and new use cases, Solid Sands stays at the fore-front of tools testing and validation.

SOLID SANDS
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for C and C++ compiler and library testing,
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Postbus 7897 | 1008 AB AMSTERDAM | The Netherlands | www.solidsands.nl