# FUNCTIONAL SAFETY WILL PROTECT PASSENGERS IN AUTONOMOUS CARS

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NEWSLETTER SIGN-UP

**The same processing elements built into industrial machinery, robots and drones will help keep passengers safe in autonomous cars.**

When people think about autonomous cars, their most pressing concern is safety.

A 2016 MIT study found that nearly half of people say they would *never* purchase a fully autonomous vehicle. Among their reasons: They don't trust that autonomous vehicles will be safe. The wonder: Computers glitch all the time. What happens when the driver behind the wheel is digital rather than physical?

Here's a fact that might calm some nerves: Unlike human drivers, computer drivers will be able to recognize mistakes before even making them.

Known as "functional safety," this capability is one of the underlying principles that make autonomous driving more safe than manual driving, according Riccardo Mariani, chief functional safety technologist in Intel's Internet of Things Group.

"Autonomous vehicles make decisions independently of humans," said Mariani. "That's why it's vital to architect functional safety from day zero."

Scientist uses tech to build functional safety into autonomous cars

Functional safety is built into autonomous cars from day zero.

The designers and engineers behind countless everyday objects employ functional safety to protect consumers from glitches of all sorts, according to Mariani. It keeps stoves and furnaces from getting so hot they start fires; it keeps automatic doors from slamming shut when people walk through; it turns off the lawnmower when it tips over.

"It's not just what is visible — it's what is invisible," Mariani said about safety features.

In autonomous vehicles, functional safety will ensure that the car brakes when there's a cat in the middle of the road, but not when there's a piece of trash blowing across it, Mariani said. It makes certain that the car doesn't speed up instead of slow down in a traffic jam, or suddenly go into parking mode when driving on the highway.

It's like the airbags in a traditional vehicle, Mariani said. "You don't want the airbag to explode in your face if there is not an accident."

## Banishing Bugs

Computer software on average contains anywhere from 15 to 50 bugs or errors, per 1,000 lines of code.

Modern cars — including semi-autonomous and fully autonomous vehicles — each have hundreds of millions of lines of code controlling everything from braking and accelerating to steering and signaling.

What cautious consumers might not realize, however, is that human drivers also have bugs.

In fact, human error causes 94 percent of serious car crashes, according to the National Highway Traffic Safety Administration (NHTSA), which says autonomous vehicles could save the lives of more than 30,000 Americans who die in motor vehicle crashes every year.

For that reason, it argues, safety isn't why people should put the brakes on autonomous driving — rather, it's the reason to step on the gas.

Like NHTSA, automakers are accelerating toward autonomy. And with manufacturers such as Ford and BMW promising to have fully autonomous vehicles ready by 2021, skittish consumers may have to get comfortable sitting in the backseat sooner than they think.

"When you have an electronic system, you want it to do what you expect it to do," Mariani said.

"So, you put intelligence inside it that helps it understand, 'Oh, I'm getting ill, and since I'm getting ill, either I'm going to shut down or I'm going to do something else.' Autonomous cars will save a lot of lives if we keep them safe so they can accomplish their mission."

## Holistic Safety

What makes functional safety so effective in autonomous vehicles, Mariani said, is that it takes a holistic approach to occupant protection.

Functional safety in autonomous cars means cars sense objects

Autonomous cars continuously self-test to ensure their systems are functioning properly.

Consider a house that's located on a fault line, for example. If it's designed and built from the ground up with seismic reinforcements spanning the entire structure, it will likely stand up to earthquakes. However, if protective measures are applied piecemeal post-construction, it probably won't.

The same principle holds true in autonomous vehicles, which are strong because safety is baked into them. It's part of the cake, not the icing, Mariani said.

Although automakers employ rigorous testing to debug vehicle hardware and software in the first place, incorporating functional safety into self-driving cars from day zero means is imperative. In addition to adopting a specific lifecycle that follows each step of hardware and software development, vehicles need to be equipped with mechanisms that perpetually self-test to ensure they're working properly even during random failures.

"Functional safety in hardware and software is necessary because it provides the foundation of safety. But it is not sufficient by itself," Mariani said.

"We must add on top a multi-agent safety that can determine the kind of maneuvers the car will make and the kind of sensing errors that could lead to accidents."

Autonomous cars uses functional safety sensors to park

Functional safety ensures autonomous cars will perform correctly when parking.

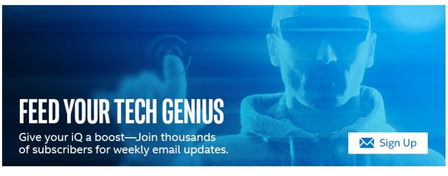
International Auto industry standards dictate that fully autonomous vehicles must detect or safely manage 99 percent of faults that could even *potentially* threaten occupants' safety, according to Mariani, a key author of the ISO 26262 standard related to functional safety.

"It is about ensuring we can control the gap between the reality designed by engineers and the ultimate reality," he said.

The most important question about future cars isn't: Who will be driving? Rather, it's: Will they keep people safe?

Thanks to functional safety and multi-agent safety, Mariani said, consumers can feel confident that they will.

*Editor's note: Read more stories about Autonomous Driving and learn about Intel technologies driving Autonomous Driving innovation.*

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