Runaway acceleration

John Dunn - May 14, 2019

Editor's note: I have known John Dunn for many years. We were on the IEEE Long Island NY Executive Committee together. John is a long time engineer/consultant with many, many years of experience; check out the Living Analog blog for proof of his expertise. This is a very controversial topic and John’s experience below got him thinking about the electronics that could be a possible cause of this event. Even if it turns out not to be the case, he brings up a valid point. Please read on. — Steve Taranovich

I have a 2006 Toyota Camry that has twice gone into runaway acceleration. The events each began instantly and then stopped. I think I know why it happened.

Tracing the car’s wiring diagram, I looked at the throttle position sensor, which is really just a potentiometer whose rotating shaft is mechanically coupled to the gas pedal. As the gas pedal is depressed by the driver's foot, the slider moves up toward the rail voltage and an increased voltage gets fed to a control module input. which I have called the sense voltage. The higher that sense voltage becomes, the higher the engine speed becomes.
The danger in Figure 1 is that if the circuit path from the low end of the throttle position sensor to the car frame opens up as from a cracked harness wire or cracked connector pin or within the sensor itself, the sense voltage will instantly rise up to the rail voltage and the engine will instantly go into runaway acceleration. Again, runaway acceleration has happened twice to my own car. A break in that one single wire can turn the car into a runaway missile.

The first time this happened was when I was exiting from a parkway. When this happened the second time in my driveway, my tachometer dial went way up into the "red" zone, well above 6000
RPM as I threw the gearshift into park. After the engine slowed down again, I tried to get the engine up to that RPM by depressing the gas pedal all the way down with my foot but I couldn't depress the pedal far enough down to get the engine to go above 4000 RPM.

That means to me that what happened in those two incidents was not the result of an improperly positioned floor mat, even though that had been the argument which Toyota had advanced in court and which was, in my opinion, improperly accepted by that court in Toyota's favor.

The problem of one broken wire is a single point failure, much like the issue of a single point failure on the MCAS system on the Boeing 737 MAX8 aircraft and much like the use of single chamber master brake cylinders in automobiles built prior to 1967. In today's world, cars are required by law to have dual master brake cylinders and I assert that there is an equivalent duality imperative regarding throttle control.
In the revisions of Figure 2, an opened return wire, either one, running from the low end of the throttle sensor to the car frame would be ohmmeter detected without the loss of throttle control. An alarm signal (the check engine light) could be generated, unintended acceleration would not occur and lives would be saved.

Does this or something like it have any chance of becoming a requirement by law?
John Dunn is an electronics consultant, and a graduate of The Polytechnic Institute of Brooklyn (BSEE) and of New York University (MSEE).

Related articles:

- Toyota's killer firmware: Bad design and its consequences
- Toyota fined for accelerator pedal sticking, April 5, 2010
- NHTSA-NASA reports show that Toyota electronics are deficient---Can lead to unintended acceleration
- NASA Report: NHTSA
- NHTSA scraps proposal to prevent unintended acceleration
- Toyota may settle unintended acceleration cases
- Toyota pays $1.2B to settle DOJ probe
- Autonomous vehicles: The electronics road to making them safe
- Future functionality and safety of the automobile with more MEMS and sensors