Autonomous Automobiles

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Waymo, according to their website, is Google's "self-driving technology company with the mission to make it safe and easy for everyone to get around—without the need for anyone in the driver's seat." The story begins in 2009, with Google's self-driving car project. This project evolved into the autonomous car company called Waymo. Elizabeth Weise (2017) of USA Today, reports Waymo files a lawsuit against Uber for trade secret misappropriation, patent infringement and unfair competition. Daisuke Wakabayashi (2018) of New York Times reports an Uber self-driving SUV hit and killed Elaine Herzberg, the first pedestrian death by self-driving technology. If Google had an open source mindset towards autonomous driving technology, or if government regulations intervened, perhaps this tragedy could have been avoided and the autonomous automobile industry could be the foreseeable future.

Standardizations are far from seldom in the automotive industry. The Clean Air Act of 1970 brought new emissions and fuel mileage standards. Automotive manufactures needed to reduce emissions without compromising drivability and fuel mileage. To achieve this, engine calibration needs to be precise. Microprocessors have been used in the past, however, they were analog computers and only controlled one engine function.

Today, digital microprocessors are the standard for all computerized engine controls. By 1981, the entire US domestic automotive industry used digital microprocessors. These small, low cost, compact computers are used for their communication speed. One of these computers "controlling functions on an eight-cylinder engine running at 3000 RPM can send the spark timing command to fire a cylinder; reevaluate input information about engine speed, coolant temperature, engine load, barometric pressure, throttle position, air/fuel mixture, spark knock, and vehicle speed; recalculate air/fuel mixture, spark timing, and whether to turn on the EGR

valve, canister purge valve, and the torque converter clutch; and then take a short nap before sending the commands, all before the next cylinder fires." (Hatch, 2012, p. 44).

In 1996, a federal mandate required all vehicles to be equipped with On-Board Diagnostic II (OBD II). Manufactures must use a standard data link connector, give a standard list of diagnostic trouble codes, communicate with a standard communication protocol, define a standard glossary of terms, acronyms, and definitions for call components in the electronic control system and freeze frames operating conditions in memory. Additionally, the system monitored functions such as air-fuel ratio, ignition timing and cold engine operation (Pickerill, 2010, p. 190). One of the most important features of OBD II is the ability to communicate a malfunction of the emissions system. When emission levels reach 1.5 times the standard based on the federal test procedure (FTP) cutoff point for a vehicle, a malfunction indicator lamp (MIL) illumines and a diagnostic trouble code (DTC) is stored (Hatch, 2012, p. 214).

Simple communication protocols existed in the early 1980s. UART (Universal Asynchronous Receive and Transmit) is considered Class A and is relatively slow, however, some applications are still used by this protocol today. Class B (J1850) is faster, Ford and General Motors have their own versions of this protocol. ISO 9141 is similar to UART, however, it works on 12 volts and 0 volts, rather than 5 volts and 0 volts. Japanese manufactures use ISO 9141 for diagnostics only, whereas European manufactures use their version called KWP2000 (Key Word Protocol 2000) (Pickerill, 2010, p. 189).

In 2008, CAN (Controller Area Network) became the standard communication protocol for emissions-related modules in vehicles. CAN is a communication language developed by Bosch in 1984. There are three speeds, or classes, of CAN. Currently, there is no regulation forcing manufactures to use a particular one (Pickerill, 2010, p. 190). In 2011, Bosch began

developing CAN FD (flexible data-rate) (“The basic idea” n.d.). Gary Miller (2013), holder of two automotive electrons patents and a Bachelor of Science in Electrical Engineering, wrote “Automotive Communication Protocols: Preparing for the Future,” and believes CAN FD will become the new protocol in 2020.

Jon Walker (2017) wrote “The Self-Driving Car Timeline – Predictions from the Top 11 Global Automakers.” He ranks self-driving vehicles into five levels. Level 1 automation is small steering or acceleration corrections by the car, everything else is human operated. Level 2 automation is adapted cruise control, or the original Tesla autopilot system, where the car can automatically make corrections but the driver must be behind the wheel. Level 3 automation offers part automation and part human operation, which is why most manufactures are designing the next level. Level 4 automation is when the car drives itself most all the time without human operation. Severe weather would force human operation in this level. Level 5 is complete automation in every and all conditions. Honda, Toyota, Renault-Nissan, Volvo, Hyundai and Daimler expect to have Level 4 self-driving vehicles on the highways in 2020; BMW, Ford and Fiat-Chrysler by 2021.

In the New York Times, an article by John R. Quain (2017), quotes John Wall, a senior vice president at QNX, a vehicle software company, saying, “There is certainly no doubt that many carmakers have expressed the idea that a more standardized platform would be attractive.”

In Arizona, where Elaine Herzberg was stuck by a self-driving Uber, self-driving vehicle regulations are loosely defined. In January 2018, two months before the incident, an article is published by Government Technology quoting Ryan Harding of the Arizona Department of Transpiration, “Because of Arizona’s ‘hands-off’ approach to this field, we don’t require any special permits or reporting requirements of the companies that come here to test. Our goal is

making sure companies developing the technology have a hurdle-free path while ensuring key areas like safety are addressed." (Driverless Cars Hit the Road in Arizona section, para. 1).

Andrew Hawkins (2018) reports this incident comes in the wake of a lawsuit filed in 2017, and settled a year later in February 2018. Uber settled in court with Waymo for alleged trade secret misappropriation, patent infringement and unfair competition. Waymo's claim Uber stole designs and plans after an email containing a drawing of a circuit board was accidently sent to Waymo by a third-party vendor. Anthony Levandowski founded Otto, a self-driving truck company. He also is a former Waymo engineer and stole 14,000 files before leaving. On January 27, 2016; he resigned and on February 1 launched Otto.

Emission regulations set the tone for government intervention in automotive manufacturing. At first, concerns of crankcase gasses being pumped back into the fresh air induction system would hurt engines, instead, engine life doubled (Hatch, 2012, p. 43). Through emission regulations, automotive technology has improved drivability, increased fuel mileage and lowered emission pollution. Kristen Korosec (2017) of The Verge, repots the self-driving vehicle industry is projected to bring $7 trillion by 2050, with 585,00 lives saved between 2035 and 2045.

From Google's Open Source website:

> There are variety of good reasons to release something under an open source license, from more perspectives make better software to establishing a standard.

Conclusion

Automotive manufactures depend on software companies to design autonomous vehicles. Unlike automotive manufactures, most software companies lack experience in the industry. This is partly because the industry is new, and because of the loosely defined regulations of technology, media and communication companies. In the past, software could never kill anyone. With the promise of self-driving vehicle in the coming five years, some type of standardization must take place. Without cooperation between companies or government intervention, it’s a deathly road to self-driving vehicles.

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