2020 Auto Sensor Vision

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Abstract

iSuppli examines the major trends affecting the automotive market over the next decade and assesses the potential impact for the sensor supply chain. Along with a historical perspective of the development of sensor implementation, fresh examples are given for the major domain subsectors—in powertrain management, for safety systems like ESC and in the cabin (body domain) to illustrate the next decade of sensor development in the vehicle.

1 Introduction

The automotive practice of iSuppli has recently undertaken a long-term examination of electronics trends as a result of changing architectures. In this article, iSuppli dusts off its crystal ball to look at the 2020 car and what it will mean for MEMS and related sensors. Here are some of the highlights with a focus on sensors. Three major driving forces will dramatically drive innovation in automobiles for at least the next two decades:

▸ “Green” issues will force the car industry to improve the efficiency of combustion engines (less CO₂ and less fuel used per mile). Related to this is the emergence in the public consciousness of the electric vehicle, for which the 2009 Frankfurt Automotive Show played no small part, with a host of new vehicle announcements coming from many major OEMs.

▸ The high cost of automotive-related accidents — both in terms of lives lost and overall economic costs — are driving new systems for accident mitigation, causing a refinement and improvement in existing driver assist systems.

▸ Automotive mobile connectivity (i.e. communication links) will foster huge innovation in new services and applications, benefiting customers through engine and chassis software updates, new maps, vehicle-to-vehicle communication, etc.

Much of this innovation will be handled by embedded software as hardware (ECU and associated electronic components) becomes more generic and its functionality can be programmed. The next generation of ECU system configura-
tion has been developed by several European automotive suppliers (AUTOSAR), and will help speed this revolution across OEMs. As a result, existing systems will become more intelligent and have the potential to be updated during the life of the car. Hardware, in general, will be changed less and less.

2 Sensor Overview

But how will this trend impact sensor hardware? Today, as many as 150 different sensors — at least 30 of which are MEMS — can be found in high-end vehicles, distributed in as many as 70 different ECUs containing other electronic ICs like interface drivers and microprocessors. Having reached its peak, the number of ECUs is now set to decline. In comparison, the number of sensors has not crested, but growth in the number of new sensor-related applications has slowed down considerably. With hindsight, a large number of sensor applications — estimated to be around 30 to 35 — were already realized in production prior to 2000. In fact, the use of sensors started almost two decades ago — as early as the 1980s in the powertrain as air pressure and exhaust gas sensors were introduced to manage the combustion feedback loop, and in the 1990s with accelerometers for airbag systems. Other systems, such as radar, also originated around this time (1995) in luxury-class vehicles like the Mercedes S-Class. New solutions are now sought to lower costs to below $100 (for example, using SiGe radar chips) and allow wider adoption in this sector. An overview of sensor adoption — past, present, and future — is given in Table 1. A further uptake of sensors has taken place during the current decade, especially in chassis and safety applications like electronic stability control systems (ESC), tire pressure monitoring systems (TPMS), and active suspension (in the luxury segment).

ESC and TPMS are mandated technologies in the North American (U.S. and Canada) and European markets from 2012, and ESC continues to grow organically worldwide as a must-have safety feature. Both TPMS and ESC systems employ multiple sensors:

- **ESC** = typically a 2-axis accelerometer and single-axis yaw rate sensor, 1.2 pressure sensors in the brake modulator (on average), 4 wheel-speed sensors and one precision angular sensor in the steering (magnetic, optical, etc).

- **An average of 4.5 pressure sensors is used in direct TPMS systems. For historical market reasons direct TPMS make up close to 100% of the U.S. market today. Due to the tougher environmentally-driven specifications for TPMS in Europe this market will also amount to close to 100% direct systems [1] when these systems are phased in on new 2012 series and 2014 on all new vehicles in Europe.