Sensors – Where to from Here?

The sensor world has seen an unprecedented growth explosion in the past few years and there are no signs indicating that the growth will slow down in the near term. Not surprisingly, the growth is fueled by many digital trends including the Internet of Things, consumer products, autonomous systems, etc. The growth is also being accelerated due to dramatic reductions in ASP of sensors which has hastened the use of sensors in all things digital. Looking over the horizon, analysts see several factors as critical drivers of the sensor market. Growth forecasts (CAGR: 2015 to 2021) for the key sensor types are summarized in the figure below.
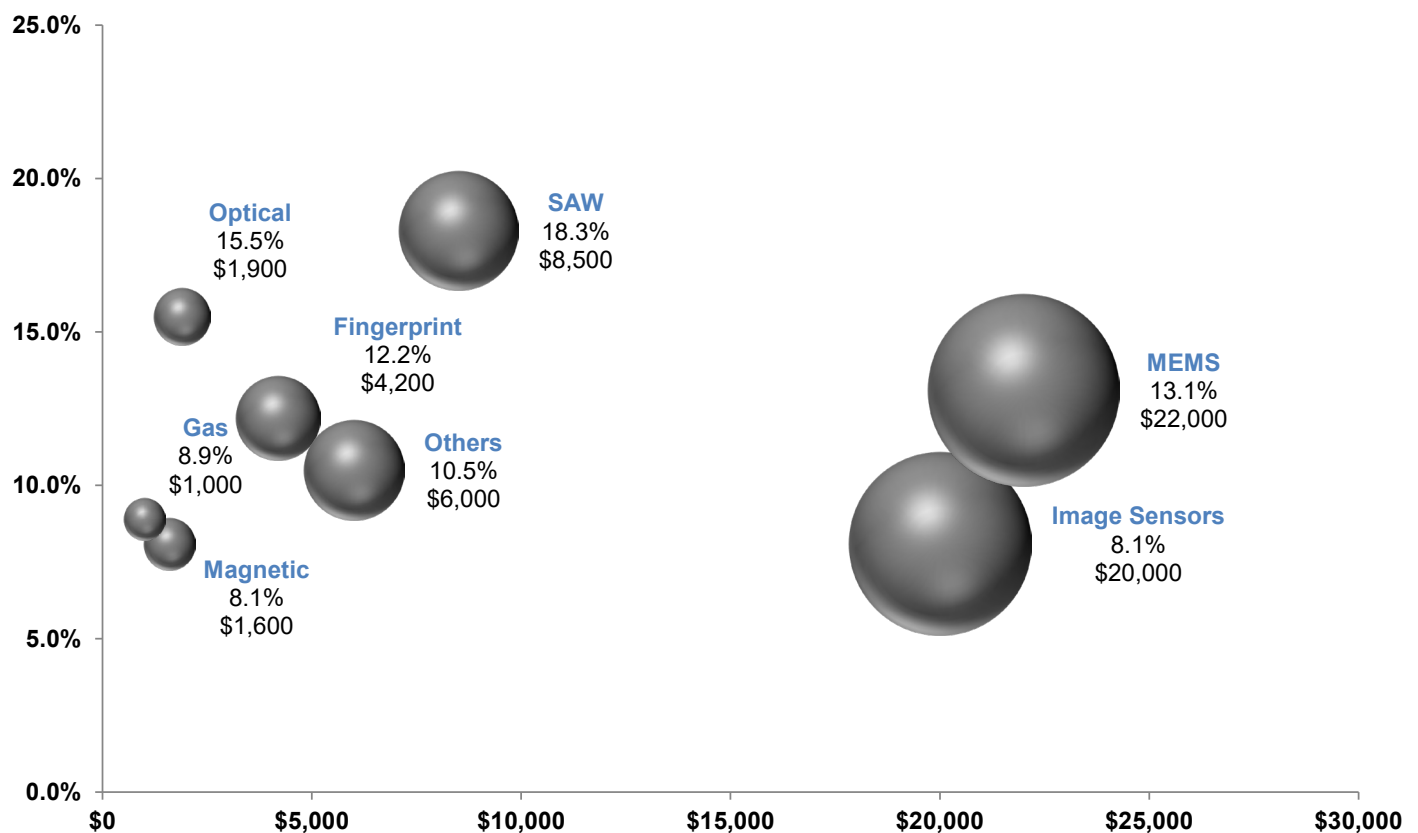

Figure 1: CAGR (2015-2021) and Market Size by Sensor Type

Overall sensor annual growth rate for 2015 – 2021 period is estimated at about 12%, making it one of the fastest growing sectors in the semiconductor market. SAW, Optical, and Fingerprint sensors are emerging as the fastest growing parts of the market, while MEMS and Image Sensors constitute the bulk of the market. With the total market to be in the $43B range in 2017, it is anticipated that more players will emerge to cater to niche needs and larger players will further consolidate their positions.

Key Enablers for Sensor Proliferation :

Sensor use and application is being accelerated by fundamental advances in hardware and software technologies. A key trend is that devices are increasingly being equipped with many sensors and real-time processing of sensor input is requiring sophisticated software algorithms. Among the enablers of the increased sensor use in traditional and industrial applications are:

> **Sensor hardware innovations**
  - Integrated sensing units for multi-sensing environments
  - Miniaturization resulting in fast response times, reduced cost, lower power consumption and physically compatibility in more applications
  - Development of new manufacturing techniques like silicon micromachining provide low-cost reliable sensors
  - Improved signal processing capabilities that allow even weak sensor data to be interpreted accurately
> **Wireless communication**
  - Increasing adoption of wireless networks in commercial and industrial applications enables greater flexibility with sensor placement, easier upgrades to legacy equipment and reduced cost
  - Emergence of LPWAN (LoRA, LTE CAT-M1/NB-IoT, and Sigfox) and mesh technologies for reliable, low-cost, long-range monitoring of remote assets and operating conditions
> **Software and infrastructure**
  - Tighter integration of hardware and software capabilities to correctly interpret sensor data
  - Ready availability of the cloud infrastructure and platforms to store and analyze sensor data from several sources and convert to actionable insights
  - Increasing availability of new algorithms for machine learning, machine vision and other complex sensor data analysis like 3D object detection
> **Availability in a variety of form-factors**
  - Wide range of sensors available from basic component/chip-level to modules with integrated wireless capabilities to packaged off-the-shelf products
  - Easy-to-integrate sensors at various levels in the design or deployment stages by OEMs and System Integrators
> **New business models**
  - New business models that add services revenues by reducing operating expenses, maximizing asset utilization, and improving productivity all require sensors to be added to systems

New Usage of Sensors in Commercial and Industrial Applications

Given the enablers outlined above, sensors are finding widespread adoption in a variety of new applications. The table summarizes key applications, use cases and the sensors that are finding use.

Applications	Use Cases	Types of Sensors Required
Machine condition monitoring	Preventive maintenance, Asset optimization	Vibration, acceleration, noise, temperature, particles, current
Asset health monitoring	Shock and impact monitoring, Event logging for fixed and mobile applications, Safety	Shock, vibration, acceleration, tilt, rotation
Machine vision	Factory automation, Pattern and gesture recognition	CMOS image sensor, Optical sensors
Environmental sensing in homes, factories, and smart cities	Safety and health, Asset health, Insurance	Gas, Pressure, Particle, Humidity, Temperature, Audio, ALS, UV
Radar in industrial applications	Longer-range motion sensing, Tank level meters, Street lighting	Radar, PIR motion sensor, ultrasonic liquid sensor, flow sensors, leak detection
Biometric sensing	Access control, Security	Fingerprint, IRIS, voice, face recognition
Robotics	Autonomous operation, Object and gesture recognition, Voice recognition	Acceleration, presence movement, optical, image, audio
3D sensing	Facial/pattern recognition, 3D positioning sensing, Gesture recognition, 3D endoscopy	Optical, CMOS image sensors, TOF based depth sensors
Highly-precise geo location tracker	Asset tracking and management	Proximity, Position, Presence detection
Light and spectral	Paper-like displays, Color matching, Food analysis	Optical, image sensors, environmental sensors, color sensor
Security	Tamper detection, safety	Motion detection, door contact sensors, proximity sensor

Table 1: New and Emerging Applications based on Sensors

Summary

Emerging applications and the sensor technologies themselves are evolving towards higher sophistication. Simultaneous developments both on the hardware and software fronts are making new innovations in sensing. The world market for sensors is expanding at a frenetic pace and the technological innovation is likely to make this pace diverse and full of business opportunity.

Arrow Electronics is one of the industry's largest source for sensors. From plug-and-play sensors to sensor components, Arrow offers sensor solutions from leading manufacturers including Analog Devices, ST Microelectronics, Murata, TE Connectivity, ON Semi, Honeywell, Bosch, AMS and many more.

References

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www.arrow.com/IoT

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