Mapping Market Trajectories: Where Sensors in the Industrial Internet Will Take Off

In our previous article examining sensors and the Industrial Internet of Things (IIoT), we identified the key IIoT sensing requirements (e.g., cost, power consumption, reliability, security) and the companies we expect to assume leadership positions in delivering them, from today's big conglomerates to entrepreneurial sensor startups. Here we expand the view to examine the end markets in which these capabilities are coalescing, and thus define the real opportunities for the IIoT.

Defining IIoT End Markets: Who's In, Who's Out

We begin by narrowing the “Industrial Internet” to sectors that are specifically business-to-business plays: factory automation, electricity grid, building automation, oil and gas industry, and transportation encompassing rail, roads, and aerospace (but not general consumer automotive). At their core, they all share an increasing need for rugged networks that connect complex machines with the purpose of enhancing efficiency, profitability, and safety.

Not all those markets represent significant opportunities for sensor suppliers, however, most especially in the short-term view. Sensors are generally inexpensive devices, usually a few dollars except in rare specialized applications (an oil moisture sensor in the electricity grid can run in the thousands of dollars). Thus, for sensor revenue generation to add up to large amounts, three criteria must be met: a large addressable market, and openness to both deployment of advanced automation technology and Internet connectivity.

Where it Starts: Building Automation

Those three criteria seem to be converging first in the building automation market. The addressable market is huge with vast numbers of buildings constructed every year; building owners are increasingly savvy enough to see the efficiencies and profitability from upgrading their building automation systems; and the Internet is already fairly well established.

The "intelligent building" concept has been around for decades, though it hasn’t really taking off as promised. Yet more than 90% of what we define as Industrial Internet sensor revenues currently come from the automation of commercial and industrial buildings, through a range of sensors that is well-understood: for example, thermal, gas/humidity, airflow and pressure sensors for climate control, and occupancy/motion sensors for smart lighting.

Our thinking is that new functionalities will be automated and integrated into a single network and management system. Energy cost savings can be improved significantly with real-time management of HVAC and lighting. The "green building" trend likely also will be a driver, as new kinds of heat sensors may be needed to meet net-zero energy (NZE) requirements with additional sensors to support automatic shading and venting. We also expect IIoT functionality will quickly extend to monitoring for carbon monoxide and carbon dioxide, and in certain circumstance to radiation sensors.

E-sales@nanomarkets.net | T-804-938-0030 | I-www.nanomarkets.net
PO Box 3840 Glen Allen, VA 23058

What's Next: Factory Automation

Next-generation factory automation is another area that has been hashed about for years, and we share some skepticism about how rapidly Industrial Internet-style automation will take off in the factory. Nevertheless, we believe that the factory automation segment will indeed increase, as genuine Industrial Internets are built beyond the intranets that currently dominate the sector.

Within another three years or so (by 2018) we expect more widespread use of the Internet on the factory floor, and the benefits of automation to be more broadly available to medium-sized factories -- which means the addressable market and the penetration of the kind of sensors will increase substantially. Eventually we envision factories connected up with wholesale and warehouse locations across multiple geographies, evolving from providing information on the current condition of equipment and detecting faults and failures to much broader issues of inventory management and production management strategy. The German Government's "Industry 4.0" project is indicative of these goals; in the U.S. there is a similar initiative led by the Smart Manufacturing Leadership Coalition.

Coming Up: A Truly Smart Energy Grid

NanoMarkets defines the "smart grid" as upgrading the traditional electricity grid to meet 21st-Century energy needs, adding intelligence to the network to integrate and streamline various aspects of energy generation, transmission, and delivery. We recently published a report outlining the smart grid market and opportunities therein for sensors and sensor suppliers.

Problematically, the electricity industry has always relied on private networks for telecommunications and has traditionally been skeptical about the Internet. Almost inevitably this will have to change. Most immediately, there is a requirement for distribution automation and a simultaneous requirement for sensors for enabling applications such as substation automation, feeder automation, and load balancing. Next-generation SCADA opportunities also translate into a need for sophisticated, advanced and real-time sensing devices that can be deployed in the energy chain.

Examples of sensor-enabled "smart grids" are already being developed, but opportunities for deploying sensors across the grid are not equal. The use of IP protocols in automated metering is a place to start, and we think the Internet will quickly become ubiquitous in the worldwide electrical power industry, especially as legacy transformers and other equipment are replaced by newer gear. At the same time, however, we believe that broader deployment of Industrial Internet sensors in the electricity grid will be held back somewhat by user skepticism with regard to the reliability, latency, and security that factories and power grids demand.

Oil & Gas: Shifting Needs Define Expansion

The oil and gas industry has long monitored physical assets such as remote onshore and offshore drilling rigs with free-standing sensors. Through automation, oil industry executives see a way to reduce costs and downtime and also to increase safety, from smarter selection of well locations with better output to reduced effluent.

E-sales@nanomarkets.net | T-804-938-0030 | I-www.nanomarkets.net
PO Box 3840 Glen Allen, VA 23058

Sensor requirements have become more complex and demanding as these assets themselves have become more complex, shifting from drilling rigs to pipeline systems that stretch from coast to coast. Aging pipeline is a fact of life (much of it in the U.S. is decades-old) and operators are increasingly taking measures to ensure safety, so more and better safety and status monitoring sensors are required. Moreover, the search for hydrocarbons is increasingly in remote areas, enhancing the need for network monitoring. Add to this a growing need to deploy sensors to support enhanced environmental monitoring, new drilling processes, regulatory requirements, and reservoir management.

There are real opportunities here for sensing devices. As mentioned above, the volumes might be low but the profits can be high due to specialized functions. The pipeline segment alone is a major part of the addressable market here, and appears to be going through a period of major expansion: from shale gas development in the U.S. to Europe mulling a possible phase-out of nuclear power to rapidly increasing consumption in Asia-Pacific and the Middle East. SCADA deployment in this industry, and how SCADA firms have begun embracing the Internet, may provide some indication of how the Industrial Internet sensor business will evolve here over the next eight years.

Stuck in the Slow Lane: Transportation and the IIOT

We define transportation in an IIoT context as sensors for more infrastructural installations: aviation, smart roads and rails, and the transport that runs on them (e.g. buses and trains). Automation has already gone quite a long way in these areas, but true Industrial Internet in the transportation context, fully automated using Internet protocols, has a long way to go.

We see the most immediate opportunity for IIoT sensing in the aerospace segment. Sensors integrated into aircraft in an IIoT context include monitoring and optimizing jet engine performance levels and guaranteeing equipment service levels. For now, though, we see the main driver in improved fuel economy. One calculation suggests a 1% reduction in jet fuel could save $30 billion over 15 years -- those are the types of results that spur adoption. To the extent that such economies can be proved through an Industrial Internet context, deployment will happen much sooner rather than later.

For terrestrial transportation, the IIoT and opportunities for sensors is a much more distant opportunity. Many toll roads now implement RFID-based payment schemes to speed up traffic, but we are at least 10-20 years from what most would define as smart vehicles and smart roads, such as driverless vehicles directed around with minimal human direction. Another example is smart locomotives and railroads to improve traffic management, maintenance, and safety. Today a locomotive can contain as many as 250 sensors, but most rolling stock has far fewer sensors, so the overall number of IIoT sensors in that sector are likely to be low and likely won't ramp up for years due to fiscal and other reasons.

Perhaps the most "industrial" transportation concept is sensors scattered to monitor conditions on bridges, road surfaces, and tunnels. Projects targeting each of these have been deployed in many regions -- just not yet in volumes definable as a significant end-market opportunity.

Our Forecasts: Sensors in the IIoT

Below is our summary of forecasts for sensors in the Industrial Internet today and looking out into 2019 and 2021, broken out by end-user sector. Note the spike in growth toward the end of our forecast period, as some of the IIOT usage cases we describe above finally start to materialize in a significant way. For now and the next several years, however, the building, factory, and electricity sectors will rule the landscape.

Forecasts of Industrial Internet Sensors by Industry ($ Million)			
	2014	**2019**	**2021**
Total Value of II sensors market for Factory Automation	179.81	1,462.67	3,135.63
Total Value of II sensors market for Industrial & Commercial Buildings	7,493.20	12,330.98	13,959.52
Total Value of II sensors market for Electricity	539.82	6,307.25	12,848.59
Total Value of II sensors market for Oil & Gas	0.02	4.26	22.35
Total Value of Industrial Internet sensors market for Transportation	0.4	6.26	12,870.94
Total Value of Industrial Internet Sensor market	**8,213.25**	**20,111.41**	**29,988.34**

From the NanoMarkets report, "Markets for Sensors in the Industrial Internet"