SMARTPHONE INNOVATION IGNITES IOT CREATIVITY

SMARTPHONE INNOVATION IGNITES

BRIAN DERRICK, VICE PRESIDENT CORPORATE MARKETING
AND GENERAL MANAGER, MENTOR GRAPHICS

Mentor Graphics®

W H I T E P A P E R

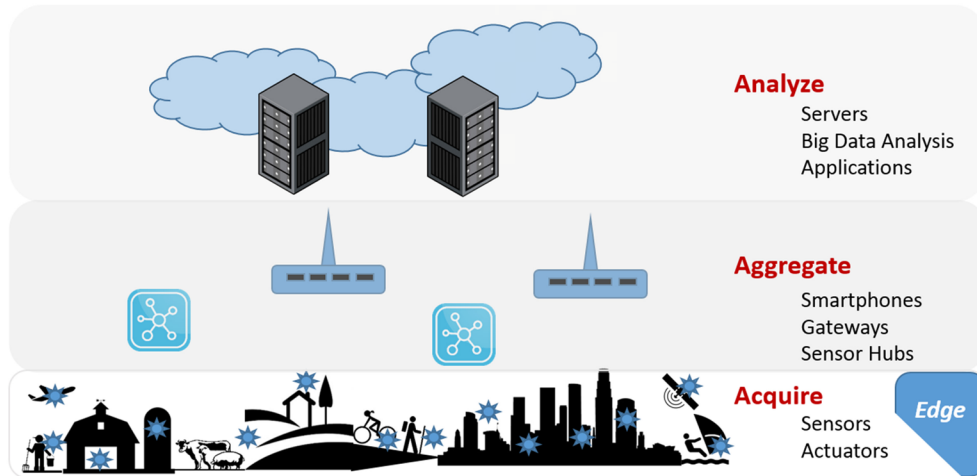A M S   D E S I G N   &   V E R I F I C A T I O N

The unrelenting drive to add more sensor-based features at a lower cost in smartphones has opened up opportunities for companies large and small to create innovative IoT edge products. With close to 15 billion MEMS-based sensors shipped in 2015 (expanding to 30 billion by 2020) at an average selling price of $1 (Yole Développement "Status of the MEMS Industry report for 2015"), many design teams are creating sophisticated sensor-based products.

For example, advanced technology drones, created by DIY experimenters or teams at small companies, can take full advantage of cheap smartphone sensors to create flight control, autopilot, navigation, and imaging systems. Hobbyists can now create inexpensive drones that rival those created by the military industry, sans weaponry, of course! New startups are forming every day, such as Chirp Microsystems Inc. which offers a low-power, ultrasonic gesture recognition technology for use in mobile and wearable devices. Small groups within large companies are developing innovative technology, such as the team of IC designers at Google that created a contact lens containing a sensor that measures glucose levels in tears, to improve diabetes treatments.

6-Axis MEMS Accelerometer
6-Axis Gyroscope
Barometric Pressure Sensor
3-Axis Compass
Proximity Sensor
Hall Effect Sensor
12 MP CMOS Imager

A new breed of designers has arrived that is leveraging the advances in sensing technology to build the intelligent systems at the edge of the IoT. These systems play in every space: on your body, at home, the car or bus that you take to work, and the cities, factories, office buildings, or farms that you work. The energy that you consume and how you travel, by air, land, or sea, all have IoT edge solutions being developed. And, space probes, telescopes, and satellites explore the far edges of the universe. It's no surprise that the new breed of designers are not only taking advantage of rapidly-evolving sensing technology, but they are tapping into cheap computational capacity and networking to develop and deploy IoT devices for some of the largest new markets in high-tech, consumer, and manufacturing.

While the media presents us with stories of big data, analytics, deep learning, and non-stop discussions about the cloud, none of those headlines would be possible without these IoT edge devices out in the real world, collecting and processing data in the new world of edge computing. Some estimates state that 95-99 percent of IoT data will soon be acquired, analyzed, and acted upon at the edge. The widely-dispersed edge of the IoT and the thousands of small, innovative design teams working there are enabling the rapid development of the IoT.

Analyze
Servers
Big Data Analysis
Applications

Aggregate
Smartphones
Gateways
Sensor Hubs

Acquire
Sensors
Actuators

Edge

Who are the new breed of designers? They work in small teams, collaborate online, and they require affordable design tools that are easy to and quickly produce results. Their goal is to deliver a functioning device to their stakeholders while spending as little money as possible to get there. Many work for companies that don't have millions of dollars for traditional design tools, don't have the time or desire to deal with the overhead of a central CAD department, work in a small company with very limited resources, or are one of the many new startups in this space. These teams all have one thing in common: they require the capability to develop a proof-of-concept for system validation in order to capitalize on this enormous opportunity. Even with the huge potential, the edge is very cost-sensitive, requiring a very low-cost proof-of-concept. Design teams rapidly implement solutions using affordable, integrated tool flows that allow them to quickly develop all the pieces needed for the intelligent sensor: sensing elements, analog circuit interfaces, analog-to-digital logic, digital logic, software, and unique form-factor PCBs, all at a low cost compared to traditional IC and systems design.

However, low cost does not mean simple. Edge sensors are increasingly complex and a system in their own right that performs self-testing, self-calibration, and that adapts as their environment changes. These systems control processes, direct other intelligent sensors, and of course, send data to the cloud.

Design teams take advantage of IP from vendors, leverage low-cost embedded software development tools and real-time operating systems, and utilize low-volume wafer runs using multi-project wafer options provided by foundries.

Life on the edge of IoT is where creativity knows no bounds. The teams may be small, but this sensor-driven design environment is extremely complex. Small teams need big knowledge in order to drive intelligent, high-value devices to the IoT edge. They work in the digital, analog, RF, MEMS, and networking domains. In addition to all the complicated electronic design issues, they deal with multi-physics analysis due to the varied environments that the devices operate, taking into consideration temperature, vibration, and pressure. Power consumption and clever power utilization are key criteria, as power is scarce in many edge applications. This complex development environment is driving exciting innovation from sensor and IC vendors, design automation solution providers, IP creators, and fabrication companies.

To respond to the requirements of this new breed of designers, an innovative ecosystem is emerging to create new product offerings and use models that are not solely based on multi-million dollar, custom ASIC projects, central design teams, or classic IC companies.

Design automation providers are offering new hardware, embedded software, simulation, and PCB tooling solutions. IP vendors are creating new ways for designers to initially access IP for free or at low cost. Foundries are establishing programs for low volume fabrication and refreshing older technology nodes to support leading-edge IoT design. And companies are inventing new ways to package ICs and electronic products.

The emerging IoT designers are out there creating products you don't even know you want or need yet, devices that will soon be adding value to your life and improving our planet, while creating the next wave in markets. Join us in this new series of blogs as we explore the world of IoT and its amazing possibilities to change industries and the way we live our lives.

To learn more about the new breed of designers, see the whitepaper here.

Experience Tanner AMS

Virtual Lab - Immediate access from any current PC web browser

Test-drive Tanner Tools and discover the power of its complete IC design flow, including schematic capture, analog simulation, physical layout, and verification.

Try Tanner Tools Now

For the latest product information, call us or visit: **www.mentor.com**