



# **Chairperson's Summary**

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The 23rd World Micromachine Summit (MMS2017) was held in Barcelona, Spain, during the period 15-17 May 2017. The Summit was attended by delegates from 21 countries and supranational regions from across the world. This Summit edition was organized by Centre Nacional de Microelectrònica (IMB-CNM-CSIC) in Barcelona, Spain.

The Summit's objective was to discuss recent activities and trends in national and international cooperation between universities, research institutions and industrial companies that are active in the fields of Smart Systems, MEMS & Nanotech and Micromachine technology, and to foster the exchange between international regions.

The summit started with country/regional reviews of news and main activities and tendencies in Smart Systems and MEMS-Micromachines research and industrial activity. A special focus was put in Smart Systems Applications. The delegates presented an overview of the actions being made in each region to create and expand new Infrastructure, networks and clusters and to set-up new initiatives by National Authorities and Industry in support of the growth of the activity in the field, both in the research and commercial arenas. There is common agreement that Micro and Nanotechnologies are really Key Enabling Technologies (KET's) that may have a direct impact on the development of new products and new solutions to Societal Challenges. The increasing number of start-ups and small companies being born worldwide in the last year in the field of Smart Systems and Micro&Nano components is a good key indicator of activity.

In the different sessions of the Summit, interesting state of the art technologies and developments for many applications were presented by the delegates, paying special attention on Health and Wearables, Food and Environment, Safety and Security, Industry 4.0, Digital Society, and Internet of Things (IoT). IoT was seen by many of the delegates as the 3<sup>rd</sup> wave of proliferation of MEMS sensors after Automotive and Consumer Electronics.

In addition, the Special Topic of this year "Smart Systems for Smart Cities applications" was addressed in different sessions and round tables with systems integrators, end users and urban decision makers. Recent demographic studies point to the fact that half of the world population live in cities of more of 300.000 inhabitants (>70% by 2050). In a decade a quarter of the population will live in 600 cities producing 60% of the world GDP. Currently there are 25 cities with more than 10 million people. Cities of any order occupy just 3% of the Earth's land, but account for 60-80% of energy consumption and 75% of carbon emissions. Another recent study in Europe has identified 33 areas of 1 km<sup>2</sup> with more than 40,000 inhabitants. Non-surprisingly, the United Nations has included in its Sustainable Development Goals one dedicated to Sustainable Cities and Communities. Such sustainability will demand some smartness arising from the data treatment of a huge amount of key parameters coming from sensors and multi-sensing systems deployed in various application scenarios in the cities. Smart Cities are multidimensional cases as they cover not only big cities, but also particular areas or small cities that may have different priorities or needs. The concept of Smart Cities also takes into account specificities of Smart Quarters, Smart Buildings or Smart Homes, with the aim of not only addressing urban infrastructure and environmental issues but also for having a more citizen-centered vision. Rapid urbanization, demographic and social change, resources scarcity and climate change put significant pressure on city systems, services and on

citizens. In this direction concepts such as Smart Health, Smart Security, and even aspects related to the Smart Governance should be also considered as priorities for the Smart Sensor applications, for a better quality of life of people.

Delegates concluded that today there is already enough technology for addressing the challenges of the most popular deployments of Smart Cities, such as for urban mobility and smart parking, intelligent environmental control, Smart Grid and efficient lighting, water supply infrastructure and smart metering, management of ventilation and alarms in buildings, smart POI, etc... MEMS and Nano technologies are crucial for achieving the required performances of such implementations in terms of low cost, low power consumption for higher autonomy, small form factor for massive deployment but discreetly, versatility and reliability. Smart Cities have the particularity that citizens themselves can play a role in sensing and data collection distributed schemes as carriers of smartphones acting as ubiquitous nodes.

In digitization scenarios a physical and digital layer need to concur in order to obtain a complete solution. While focus is usually put nowadays in data processing, knowledge extraction and data interface (Big Data, Artificial Intelligence, Augmented Reality...), the physical layer remains almost invisible and it is often taken for granted. However, hardware challenges have been indeed identified for the future of Smart Cities in particular, and IoT in general, in order to accomplish the “everything connected in real time everywhere” scenario. For instance, the need of trillions of sensors, at adequate cost and autonomy and with the required technical specifications. Another challenge is also the availability of enough communication bandwidth for the transmission of vast amounts of data. This will probably require the integration of more intelligence at the point of measurement for saving data transmission. Development of ultra-low power microprocessors will be paramount for both reducing the energy budget of data centers supporting Cloud services, but also for edge-of-the-cloud processing enabling a first data digestion at the sensor node.

The Summit ended with visits to facilities in the Barcelona area, namely Hewlett Packard World R&D Center for 3D Printing, Bioengineering Institute of Catalonia (IBEC) and the 22@ BCN Innovation District.

And with the wish to meet again in Buenos Aires next edition to share experiences in the field of Smart Systems and Micromachines for the Food and Environment sectors.

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MMS2017 Organizers

Barcelona