COMPETITIVENESS
OF THE EU IN ELECTRONIC
COMPONENTS AND SYSTEMS

DR. STEFAN FINKBEINER
CEO, BOSCH SENSORTEC
CHAIRMAN, EPOSS
INTRODUCTION – STEFAN FINKBEINER

- Born in 1966 in Freudenstadt, Germany
- PhD in Physics in 1995
- Joined the Robert Bosch GmbH in 1995
- More than 20 years of experience with sensors
- Appointed as CEO of Bosch Sensortec in 2012
- Married, 3 children
- EPoSS chairman since January 2018
SEN SORS – W ORLD LEADING H IGH TEC H FROM EU

TOP10 MEMS sensor suppliers

Source: Yole 2017

International supply chain

Multitude of MEMS sensors

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EPOSS – THE EUROPEAN TECHNOLOGY PLATFORM ON SMART SYSTEMS INTEGRATION

- Group of major industrial companies and research organisations from more than 20 EU states.
- Industry-driven policy initiative, defining R&D and innovation needs as well as policy requirements related to Smart Systems Integration and integrated Micro- and Nanosystems.

INDUSTRIAL

- Smart systems for robots in collaborative environments (Bosch)

MEDICAL

- Intraocular pressure measurement device (Sensimed STM)

AUTOMOTIVE

- Advanced driver assistance systems (Bosch)

ENVIRONMENTAL

- Semiconductor gas sensor (FhG IPM)
MEMS SENSOR PROLIFERATION

1st wave
Automotive

2nd wave
Consumer Electronics

3rd wave
IoT

1990 2000 2010 2020
The anti-skidding system ESP® saves thousands of lives each year – enabled by MEMS sensors.

Industrialization of MEMS technology was driven by automotive applications.
SECOND WAVE: CONSUMER ELECTRONICS
MEMS TECHNOLOGY INNOVATION

Size / power
Continuing shrinking of sensor size and power consumption (e.g. accelerometer)

Integration / μC + software
Multi-axis sensors + μC + SW in single combo packages (e.g. motion / orientation)

New measurants
Rise / emergence of novel sensor clusters (T, p, H, ...)(e.g. environmental cluster)

MEMS technology is ready for IoT
THIRD WAVE: INTERNET OF THINGS

- Parking spot detection
- Sleep monitoring
- Intrusion detection
- Indoor/outdoor navigation
- Asset tracking
- Indoor air quality
- Augmented reality
- Step counting
- Calorie tracking
- Image stabilization
- Indoor/outdoor navigation
- Step counting
- Calorie tracking
- Image stabilization

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WHAT ARE SMART SENSORS?

- HW and SW in one package:
  - 6-axis IMU
  - + microcontroller
  - + embedded software

- Ideally suited for always-on applications such as activity- and gesture recognition and step counting

- Enables embedded machine learning algorithms

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1. MEMS accelerometer
2. MEMS gyroscope
3. ASIC
4. Microcontroller

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MEMS IN A SENSOR NETWORK: FUNCTIONALITY AND CHALLENGES

Sensor (in fixed or mobile device)

IoT node

Data collection and distribution

• Connectivity
• Security and privacy provisioning
• Low latency data transmission

Sensing and pre-processing

• Small size
• Ultra-low power
• Autonomous functionality through smart algorithms / local intelligence / AI

Router / edge device

Cloud / backend

Sensor

Big Data

• Data collection and storage
• Complex data processing (sensors and other devices)
• Added value through swarm intelligence

IoT node

• Connectivity
• Security and privacy provisioning
• Low latency data transmission

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SELF-LEARNING ALGORITHMS ON SMART SENSORS

Sensor data → Learn movement in real-time → Exact ID

→ ID of the movement

Sensor data → Detect matching ID

- Output recognized activity
- Compute meta data (e.g. repeated cycles)
SMART SENSOR NODES – A COMPLEX DESIGN CHALLENGE

- Sensors, microcontroller and connectivity define a Smart System
- Smart Systems combine different functionalities to an autonomous IoT node

- Sensors
- Microcontroller
- Embedded SW/Algorithms/AI
- Power management unit
- Connectivity
European sensor technology defies the US and Asian dominance in semiconductors.

System integration requires investments in hardware, software and cloud technology:

- leverage the competitive advantage at a system level.
Thank you!
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