



# Advanced Internet/IoT Technologies

## Bosch Sensortec—IoT Innovation Challenge

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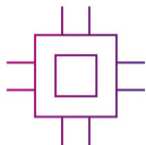
April 7, 2021

# History Lesson: What is Bosch Sensortec?

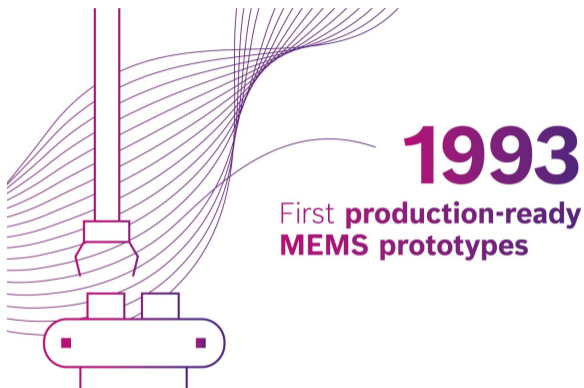
<https://www.bosch.com/stories/bosch-mems-sensor-applications/>

**1970**

Start of  
**MEMS** research



- ▶ Bosch begins research into MEMS (Microelectromechanical systems)
- ▶ Develop pressure sensors for engine management



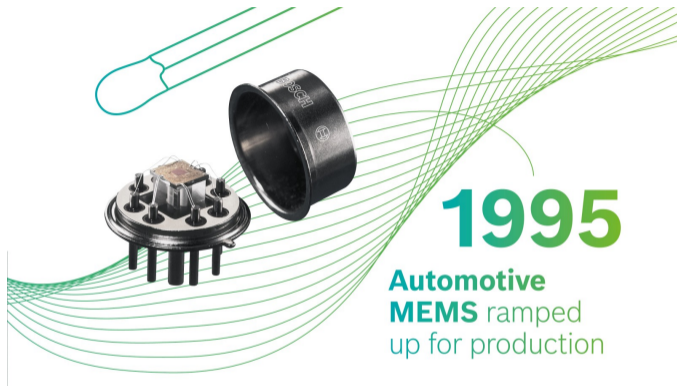
- ▶ After 6 years in development: first production-ready MEMS prototypes

## 1994

A breakthrough  
in **surface  
micromachining**



- ▶ Bosch scientists advance state of the art in surface micromachining
- ▶ Gateway technology for Bosch's entry into MEMS sensor business



- ▶ Mass-production of automotive MEMS
- ▶ First sensors gage pressure and acceleration

# 1998

**First MEMS-driven  
yaw-rate sensor**



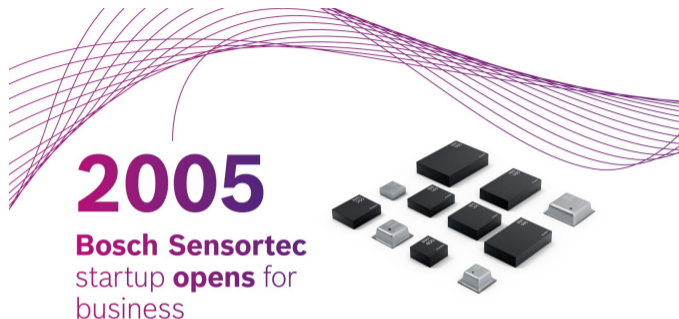
A pre-MEMS  
yaw-rate sensor



MEMS  
yaw-rate sensor

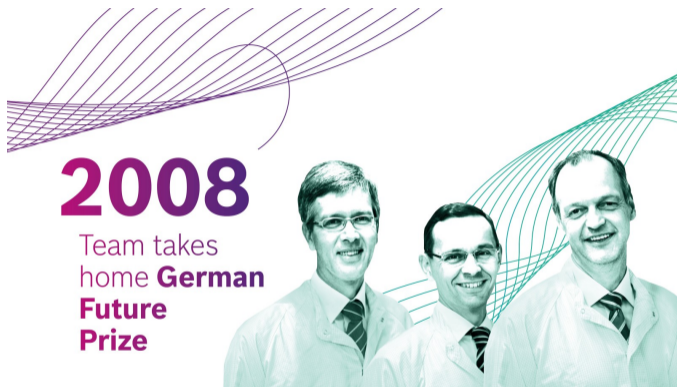


- ▶ Bosch begins production of first MEMS yaw-rate sensor for ESP®
- ▶ Bestseller and lifesaver for countless drivers

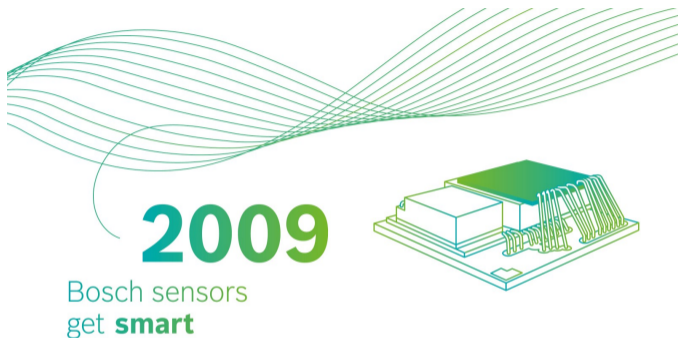


- ▶ Bosch Sensortec set up to introduce MEMS to consumer electronics market
- ▶ Fully owned subsidiary of Robert Bosch GmbH





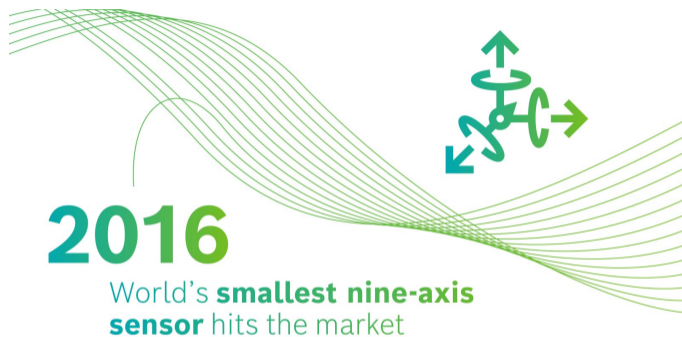
- ▶ 2008 German Future Prize for innovative manufacturing processes
- ▶ Project: *Smart sensors conquer consumer electronics, industry, and medicine*



2009

Bosch sensors  
get **smart**

- ▶ Equipped with integrated microcontroller (in green)
- ▶ First sensors to process motion signals autonomously



- ▶ Bosch launches world's smallest nine-axis sensor for consumer applications
- ▶ Minimum power to enable longer lifetime for battery-powered devices

# Where do MEMS sensors work?



## + **Transportation**

Road traffic applications



## + **Smart homes**

Home applications



## + **Entertainment**

Applications for gaming fun



## + **Personal assistants**

Applications for people on the move



## + **Manufacturing**

Applications for companies

A photograph of two men sitting in office chairs, facing each other and fist-bumping. The man on the left is Black with short curly hair, wearing a light grey hoodie and a black watch. The man on the right is white with short brown hair, wearing a brown and white plaid shirt. They are both smiling. The background shows a large window with a view of a parking lot with several cars. A green rectangular box with white text is overlaid on the top center of the image.

BOSCH SENSORTEC  
**IOT INNOVATION  
CHALLENGE**

The Bosch Sensortec IoT Innovation Challenge is a unique online competition where student teams combine hardware and software tools to develop fascinating sensor-based IoT solutions.

# IoT Innovation Challenge

- ▶ Solution-oriented & digital innovation challenge for students
- ▶ 4.5 month duration (April–September)
- ▶ Organizer: Robert Bosch GmbH, Bosch Sensortec GmbH, VDE/VDI Society for Microelectronics, Microsystems and Precision Engineering (GMM)
- ▶ Part of MikroSystemTechnik (MST) Kongress 2021

<https://www.bosch-sensortec.com/about-us/events/iot-innovation-challenge/>

# Motto: IoT—Invented for Life

## Focus Areas



+ Consumer Electronics



+ Air Quality



+ Smart Building & Home Applications



+ Fitness & Well-being

## Focus Area: Consumer Electronics



- ▶ Equipping consumer devices (e.g., smartphones, hearables, wearables) with senses (hearing, sight, touch)
- ▶ Innovative solutions that make devices smart & energy efficient
- ▶ Accelerometers, gyroscopes and barometric pressure sensors



## Focus Area: Air Quality



- ▶ Poor air quality can greatly impact our health and well-being
- ▶ Two important indicators for air pollution measurement are small particulate matters (PM) of 2.5 microns or less (PM<sub>2.5</sub>) and volatile organic compounds (VOCs)
- ▶ Gas sensor within the BME680 can detect a broad range of gases such as volatile organic compounds (VOC) in order to measure air quality for personal well-being
- ▶ Which applications come to your mind that could help improve air quality?

# Focus Area: Smart Building & Home Applications



- ▶ Smart home technology is changing the way we live, infusing new levels of convenience, security, control & efficiency in our lives
- ▶ We manage heating, venting & air conditioning from distance via smartphones or home automation control
- ▶ For reliable and accurate operation, precise and low-power measurement of motion and environmental data is needed
- ▶ We encourage you to submit your ideas for innovative technologies enabling new applications to make our homes a better place to live

## Focus Area: Fitness & Well-being



- ▶ Sensing solutions accompany people in their daily lives e.g. setting alarms, navigating through cities & buildings, tracking fitness and health
- ▶ Smart fitness wear improves the efficiency of our workouts by measuring our speed and calorie consumption
- ▶ All these wearable applications have one thing in common: they are enabled by almost invisible MEMS sensors. We are looking for sensor-based solutions that improve fitness and well-being

# Prizes

**1,500 €**

1st winner

**1,000 €**

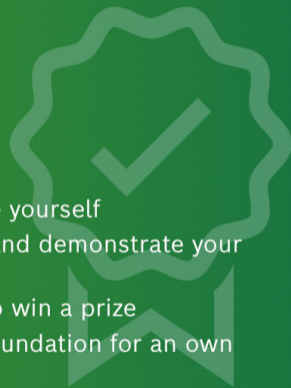
2nd winner

**500 €**

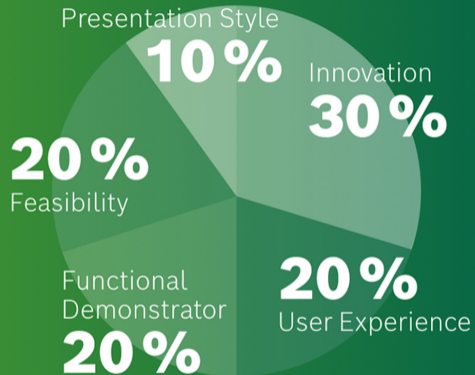
3rd winner

# Benefits

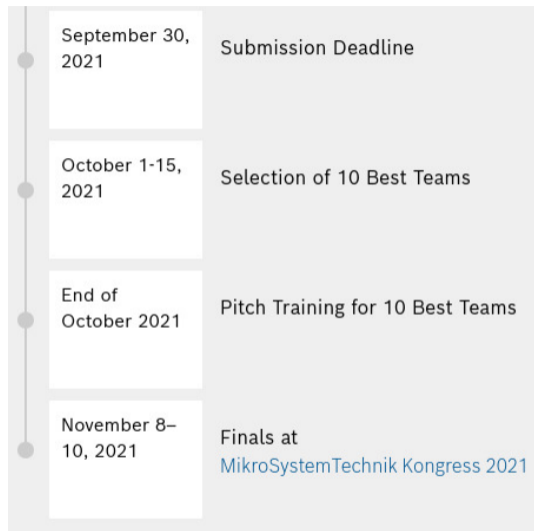
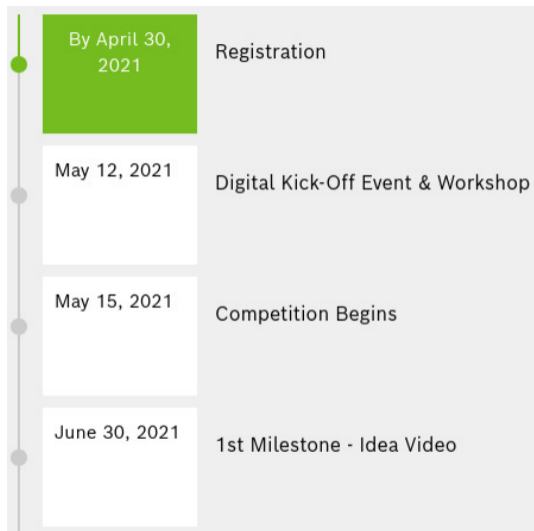
- ✓ Network with peers and industry professionals
- ✓ Add Value to your CV
- ✓ Boost your career
- ✓ Learn about product development
- ✓ Challenge yourself
- ✓ Develop and demonstrate your skills
- ✓ Chance to win a prize
- ✓ Lay the foundation for an own start-up



# Judging Criteria



# Timeline



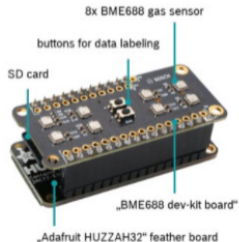
# Hardware Starter Kit



## Arduino Development Board

- Sensors on the board: [BH1260AP](#), [BMM150](#), [BMP390L](#), [BME688](#)
- Mounting options: SMT / Thru-hole (Breadboard)
- Processor: nRF52832 (Cortex M4F, 512K Flash, 64KB RAM)
- Portability: Ultra small: ~18mm x 22mm, Options to use batteries (Li-po), NVM Flash (data-logging, configuration parameters, etc)
- Software: Arduino IDE – Open source environment, PnP (Arduino's ESLOV abstraction)
- Connectivity: BLE (nRF52832 u-blox module, ANNA-B112), ESLOV (Arduino PnP and daisy-chaining interface)

Or similar development board. Final product specifications to be confirmed.



## BME688 Development Kit

- “BME688 dev-kit board”(ordering code 0330.EKB.016), which is an Adafruit feather compatible shield (see <https://www.adafruit.com/feather>)
- “Adafruit HUZZAH32” feather board with an ESP32 MCU (see <https://www.adafruit.com/product/3591>)
- MicroSD card for data storage
- CR1220 coin cell battery for the real-time clock

[More information about setting up the BME688 Development Kit](#)



## Software

Q: Are there any restrictions on using a number of pre-built libraries?

A: There is no restriction to use any language, technology stack, or libraries. You can use any of them to create your solution.

Q: How is the environment? Will you provide any IDE to work on ideas?

A: You can use the Arduino IDE – open source environment and PnP (Arduino's ESLOV abstraction).



<https://www.riot-os.org/>

## Our Roadmap

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Week Number	Topic
14	<b>today!</b>
15	Form teams (2–5 members per team) Think about IoT solutions Brief hands-on IPv6 assignment
16	Pitch ideas and discuss feasibility
17	Register to IoT Challenge (latest) Brief hands-on RIOT introduction
⋮	⋮

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Questions?