Was Sensoren dem IoT alles offenbaren könn(t)en

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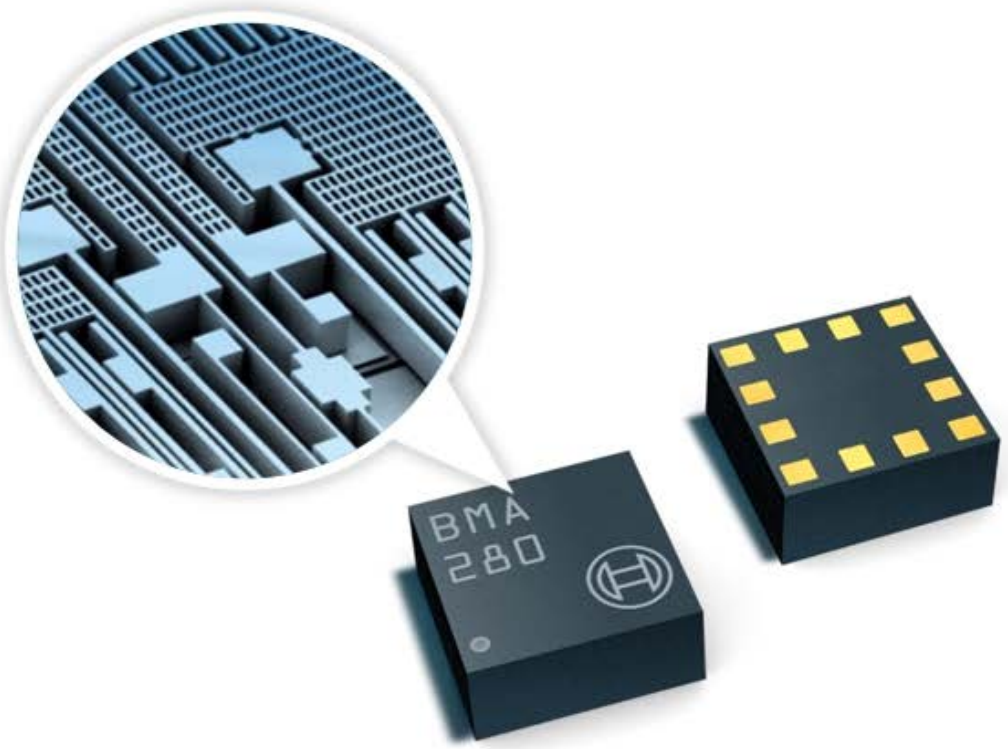
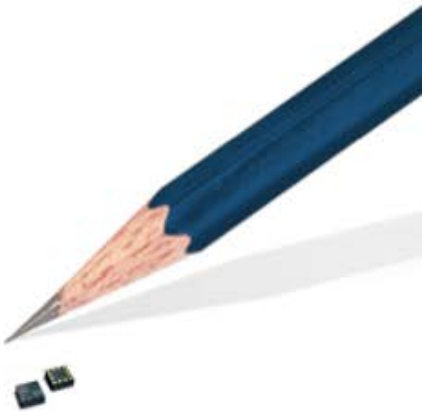
Leibniz Konferenz
LOKALISIERUNGTECHNIKEN FÜR IoT,
TELEMATIK UND INDUSTRIE 4.0

BOSCH

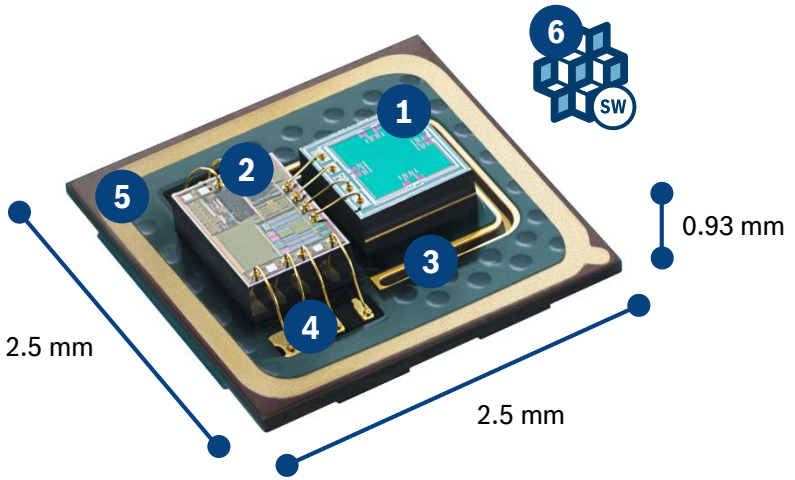
Was sind MEMS Sensoren?
Micro-**E**lectro-**M**echanical **S**ystems





What are MEMS?
Micro-Electro-Mechanical Systems

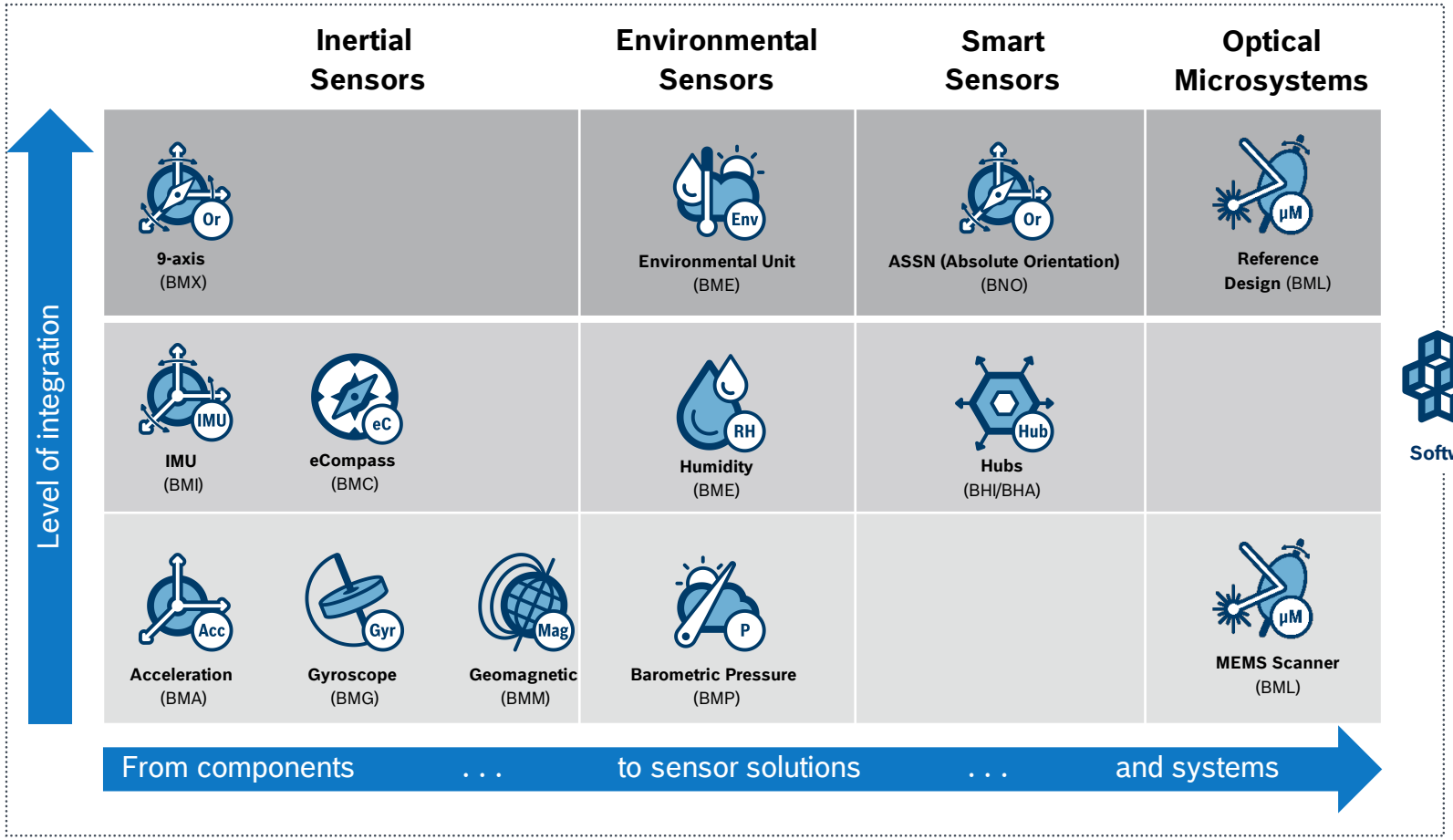
- MEMS are miniature systems that combine tiny mechanical structures with electronic circuits. Typical individual structures have a size of a few µm.
- The MEMS sensor element is usually packaged together with an ASIC and made into one unit, e.g. into an LGA package.



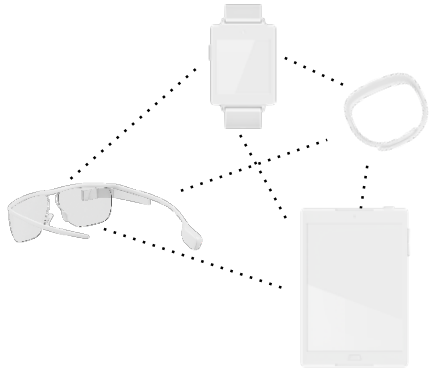
1. MEMS
2. ASIC
3. Decoupling unit
4. Bonding wires
5. Printed circuit board (PCB)
6. Software

Package/ Encapsulation

Bosch Sensortec is a full-portfolio provider



How did MEMS develop?
Waves of MEMS sensor proliferation



3rd wave

Internet of Things (IoT)

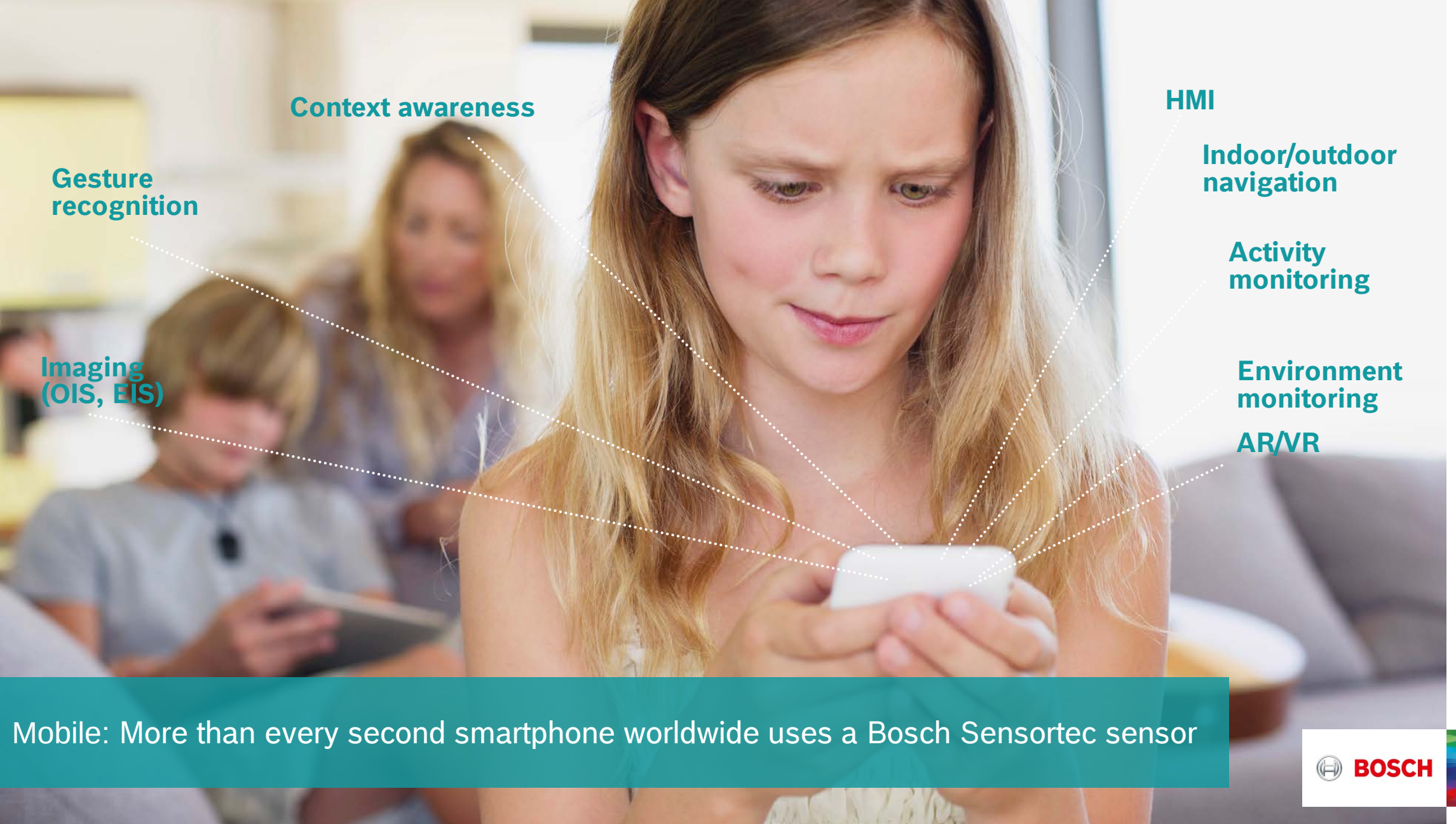
2nd wave

Consumer Electronics

1st wave

Automotive

1990 2000 2010 2020



Mobile: More than every second smartphone worldwide uses a Bosch Sensortec sensor

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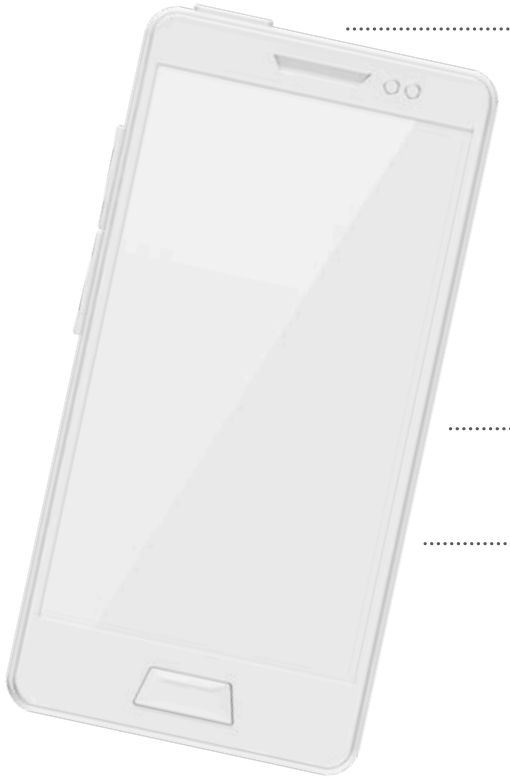
Sensors as Source for Data in Consumer Devices
Main driver for CE MEMS



User interface
- Tap control
- Gaming input
- Menu navigation
- Voice/speech recognition
- Gesture gecognition

Motion detection
- Step counting
- Activity monitoring
- Power management

Pedestrian navigation
- Speed and distance estimation
- Altitude detection
- Location based services

Position detection
- Upside down
- Portrait/landscape
- Free speech profile

MEMS: enabler for intuitive and realistic HMI realization

Data Fusion and Machine Learning

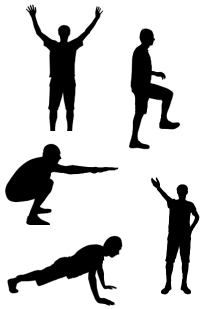
Use case self-learning algorithms for adaptation to individual user

Sensor data

Learn movement in real-time

Exact “fingerprint”

“Fingerprint” (ID) of the movement

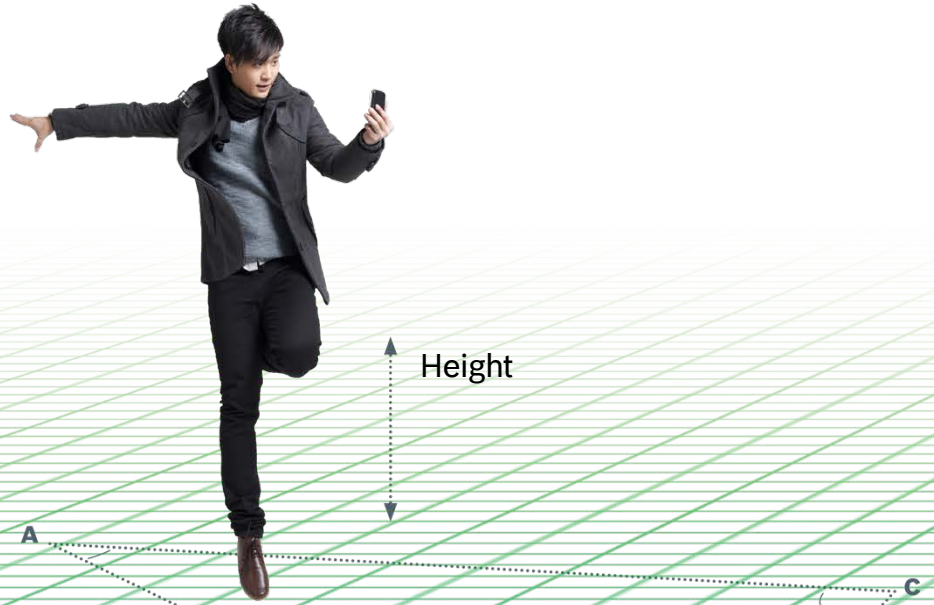


Sensor data

Detect matching “fingerprint”

- Output recognized activity
- Compute meta data (e.g. repeated cycles)

Indoor navigation – inertial and pressure sensors



Sensors & Functions

- Gyroscope
- Geomagnetic
- Acceleration
- Barometric air pressure
- Low power consumption

Applications

- Step counter and dynamic orientation
- Path integration
- Pedestrian dead reckoning

Benefits

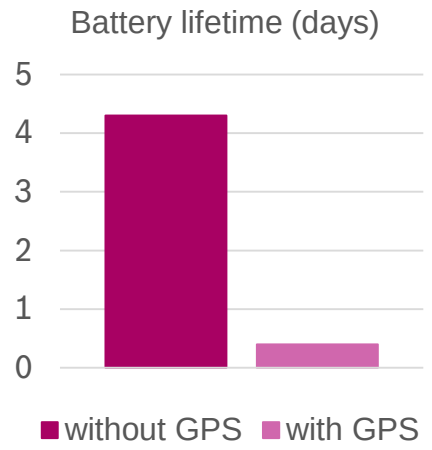
Navigation in shopping malls, public areas, parking structures, etc.

Why not rely on GPS?
Use case ‘position tracking/navigation’ – at ultra-low power

Problems with GPS only

- Unreliable signal
- Consumes a lot of battery power, very critical in wearables due to small batteries

- Result:
  - frequent charging
  - unstable navigation

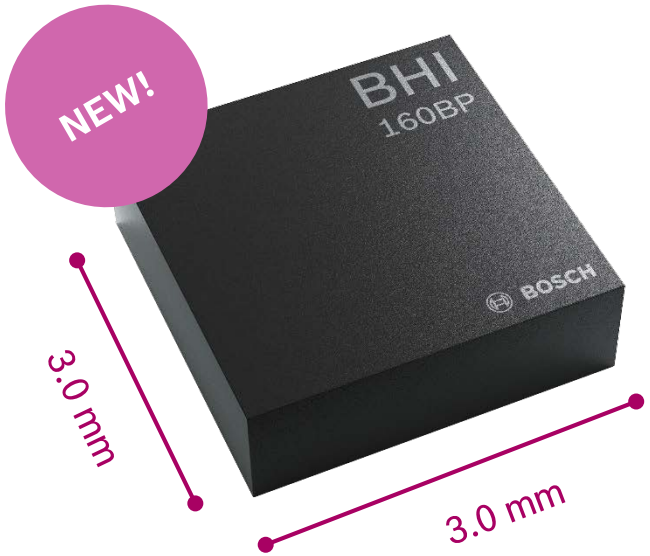


Solution: GPS + Smart Sensors

- Smart Sensors calculate the user’s relative location based on inertial data
- Re-calibrate every few minutes to obtain the absolute position provided by the GPS module

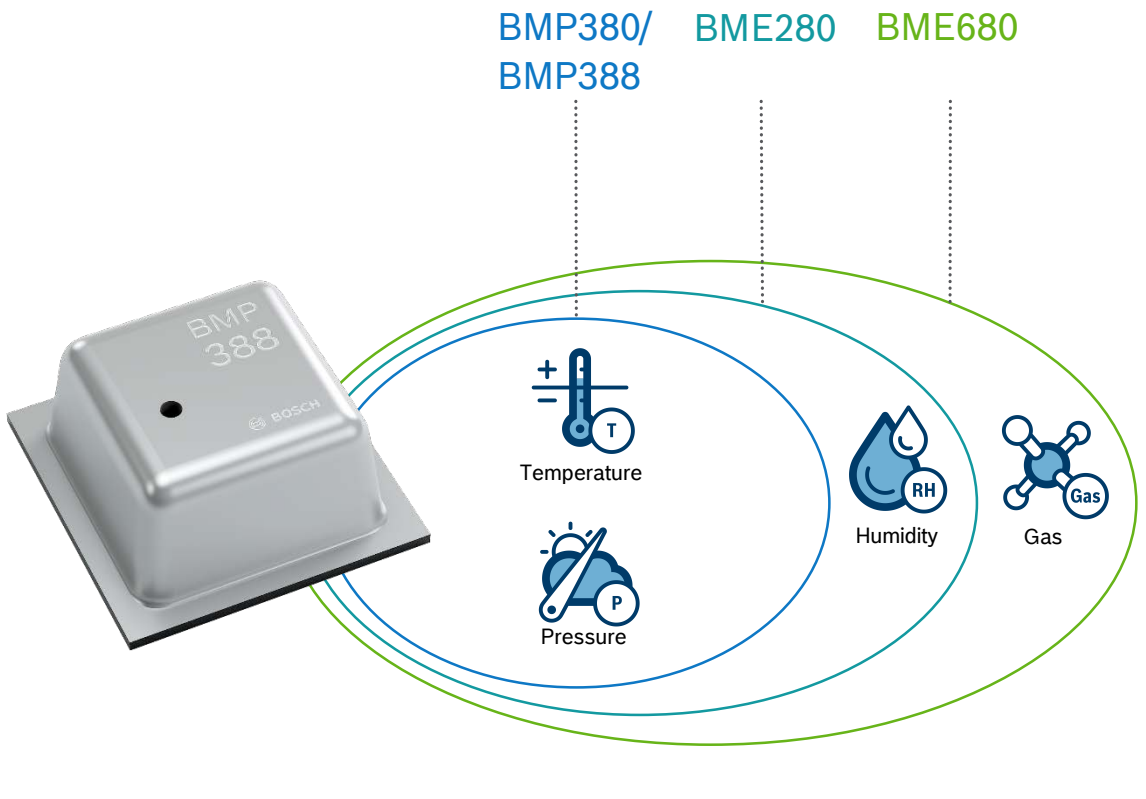
- Benefit:
  - Saving up to 80% battery as GPS can be kept in sleep mode
  - More stable navigation as Smart Sensors compensate lost GPS signal: enabling always-on position tracking

BHI160BP
Ultra-low power Position Tracking Smart Sensor



- Combines a 6-axis IMU with an **ultra-low power, high performance** co-processor
- Ultra-low power position tracking reduces system power consumption **by up to 80%**
- Consumes only **1.3 mA** in active operation
- Seamless and **more reliable** localization than GPS-only solutions
- **Wide range of features** like 3D orientation, activity- and gesture recognition, step counting
- Ideally suited for **wearable devices** such as smartwatches, fitness trackers and hearables

Environmental sensors
Fast innovation in environmental sensing



New drivers for new applications

Quantify yourself

- Well-being recommendations
- Personalized environment
- Sport and fitness monitoring

Personalized control

- Environmental monitoring
- Personal weather forecast
- Home automation

Environmental measurement

- Barometric pressure
- Humidity
- Temperature
- Gas / indoor air quality

Environmental sensing
Why is it important?

Humans:

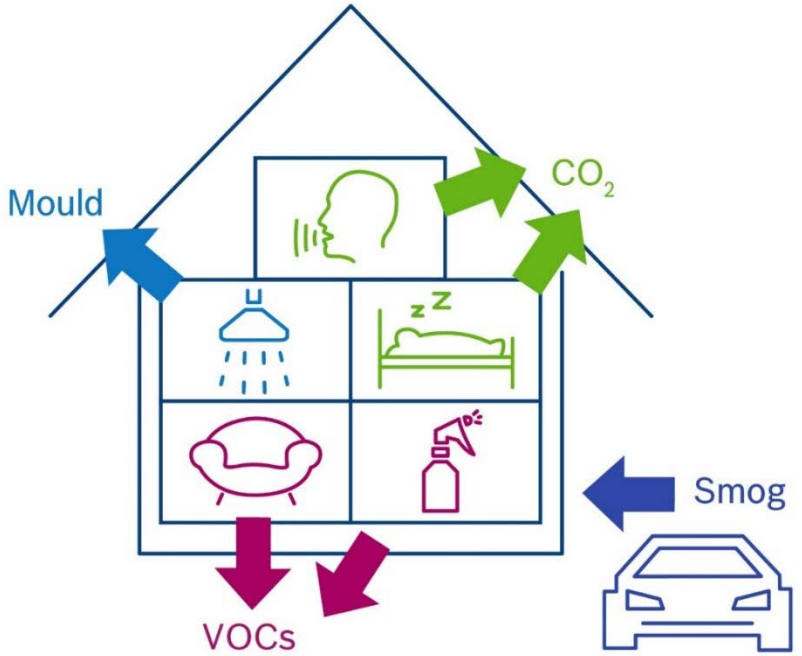
- Stay 90% of their life inside buildings
- 1/3 of their live in sleeping rooms
- Breath in more than 10.000 liters per day of air

VOCs (volatile organic compounds):

- Are part of indoor air that humans breath
- Are the major source for bad indoor air quality

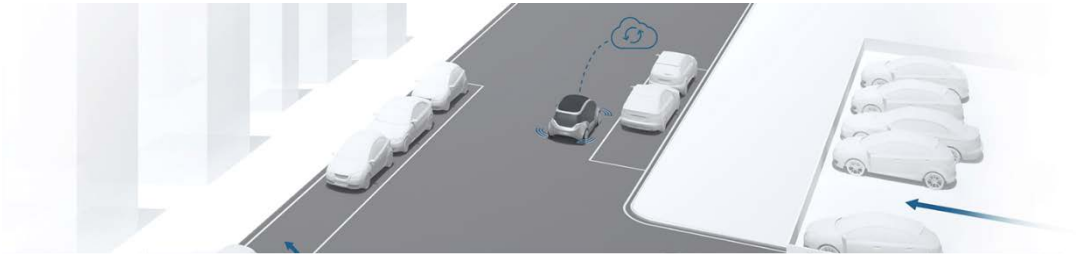
Indoor air quality:

- Impacts health and well-being
- Influences personal productivity



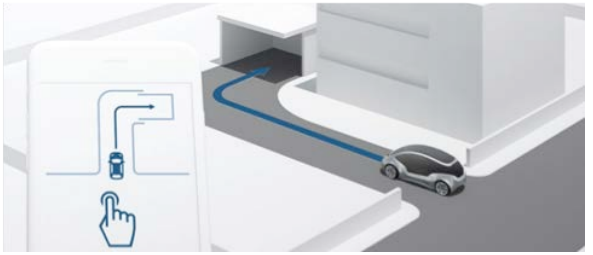
BME680 measures the air quality to improve health and well-being

Bosch – technology to enhance quality of life
A new parking experience



with automated and connected parking solutions

For the future of parking, Bosch combines connected and automated technology to form a complete, convenient service that lets vehicles park in parking garages fully automatically.



- Parking made easy: support when looking for a parking space and when entering and exiting it
- Bosch parking solutions improve convenience, safety, and efficiency when parking
- Parking space information from the cloud means that drivers always know where there's an empty space
- Automated park assists make parking space entry/exit easier

+ 60 hours

of free time: reduced parking search times can save each driver over 60 hours per year

– CO_2

thanks to reduced parking search traffic with Bosch parking solutions


SENSING OUR
WORLD
THANK
YOU
BOSCH