



Motion/Orientation Sensors

Sensor Fusion and Modules

Applications and Solutions

Wen Lin

MEMS Marketing Manager

STMicroelectronics

About ST

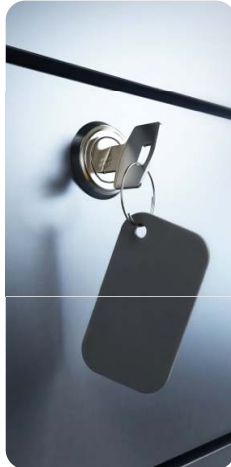
Global semiconductor leader, ~\$US10B annual revenue



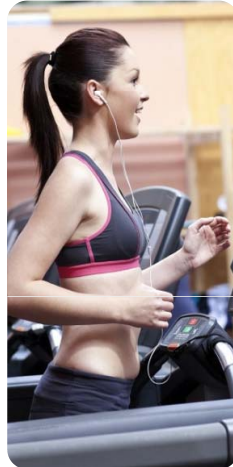
Energy
Management
& Saving



Trust & Data
Security



Healthcare
& Wellness



Smart Consumer
Devices



Target Growth Applications



Products Portfolio

Target Markets



Automotive



Communications



Computer
& Peripherals

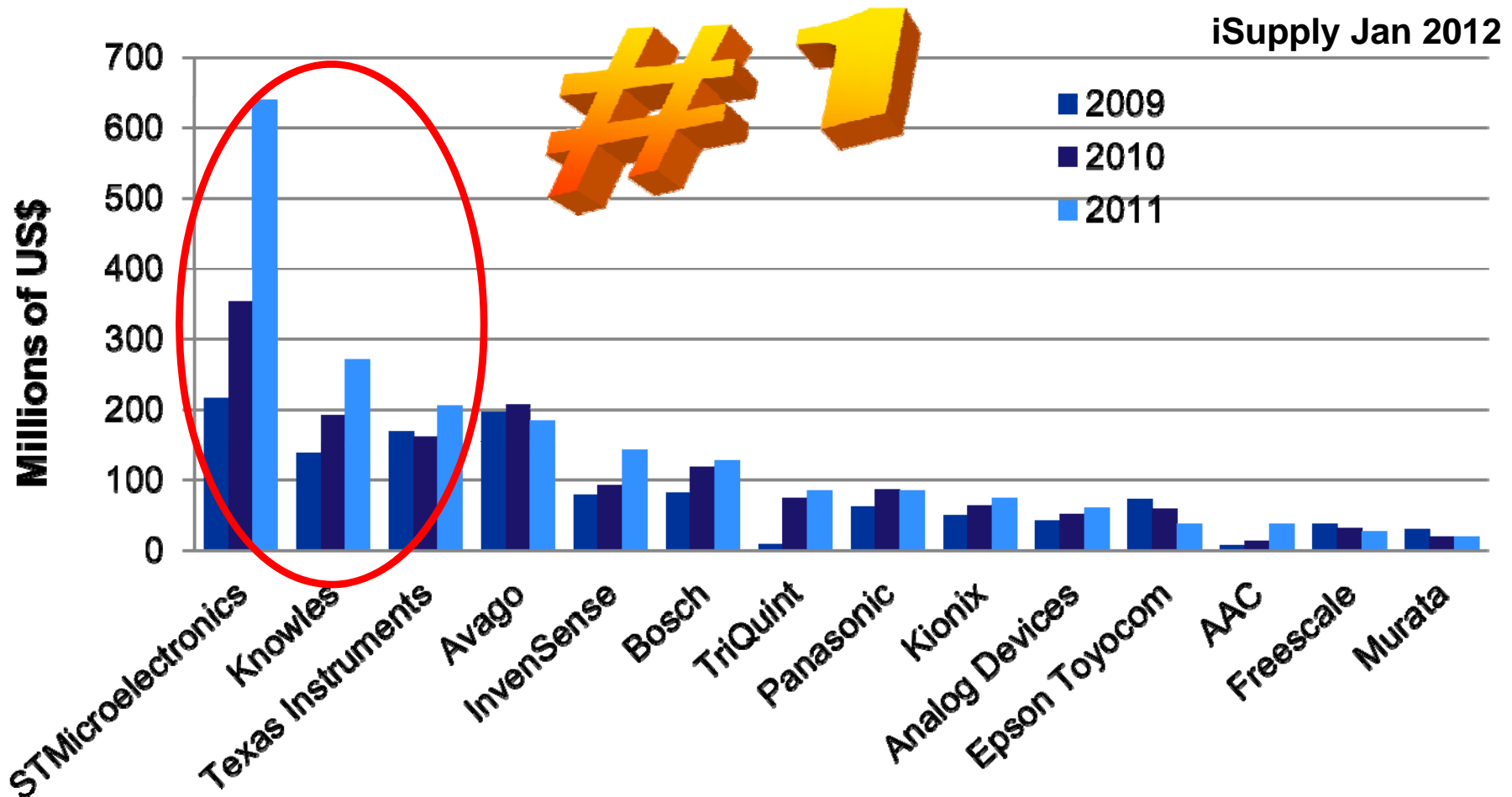


Consumer



Industrial
& Other

Top MEMS Manufacturers for Consumer and Mobile



STMicroelectronics

MKT : + \$420M; ST: + \$300M

Accelerometers, Gyroscopes, Compasses Seen from Outside

2 Bpieces

7x5mm²

5x5mm²

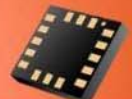
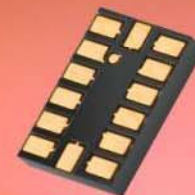
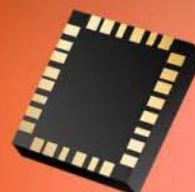
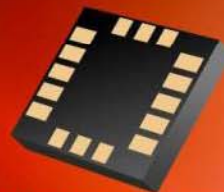
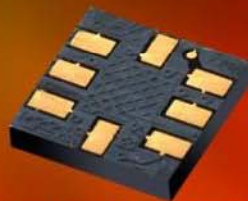
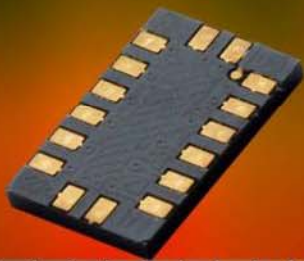
4x5mm²

4x4mm²

3x5mm²

3x3mm²

2x2mm²



1cm

2cm

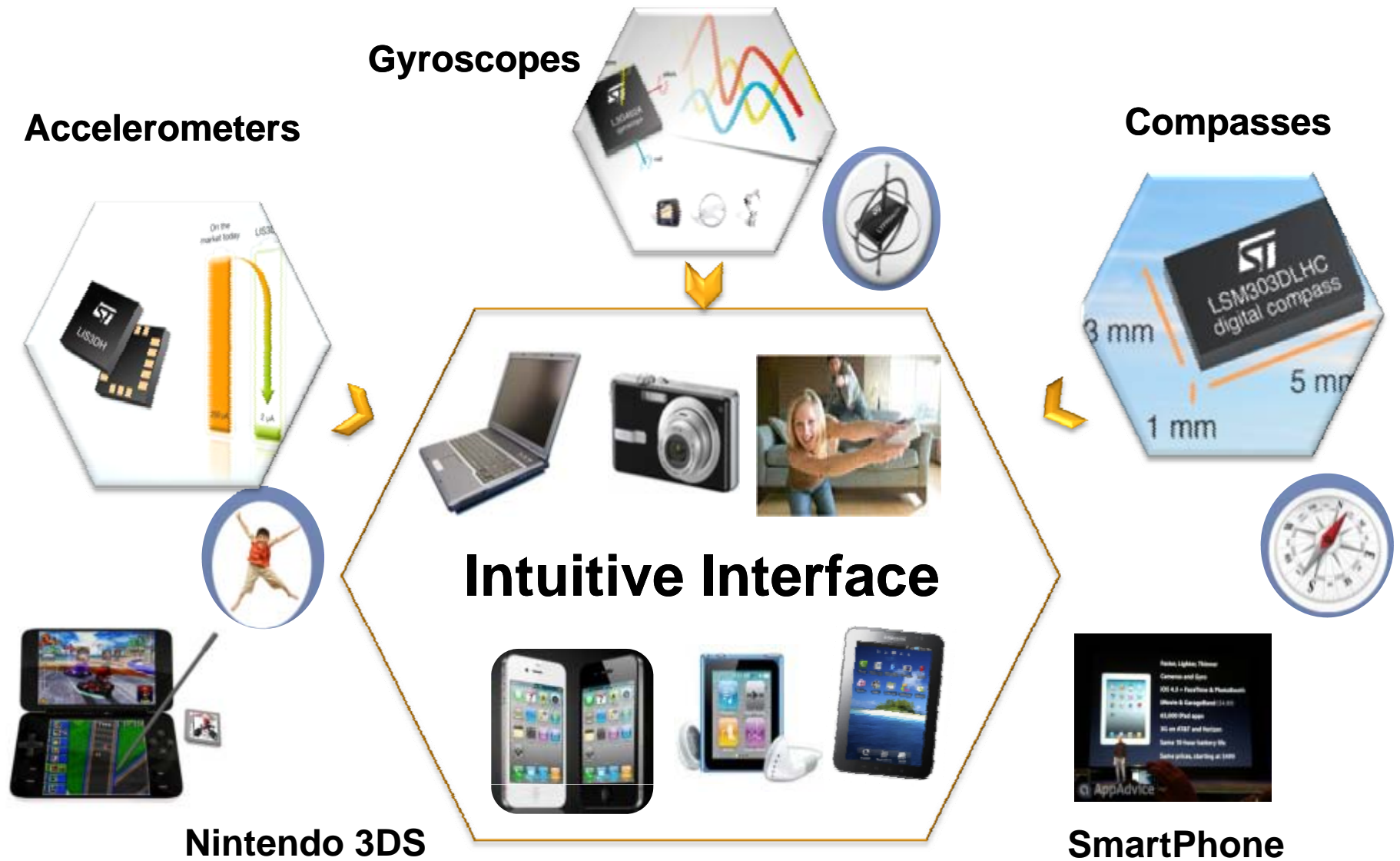
3cm

4cm

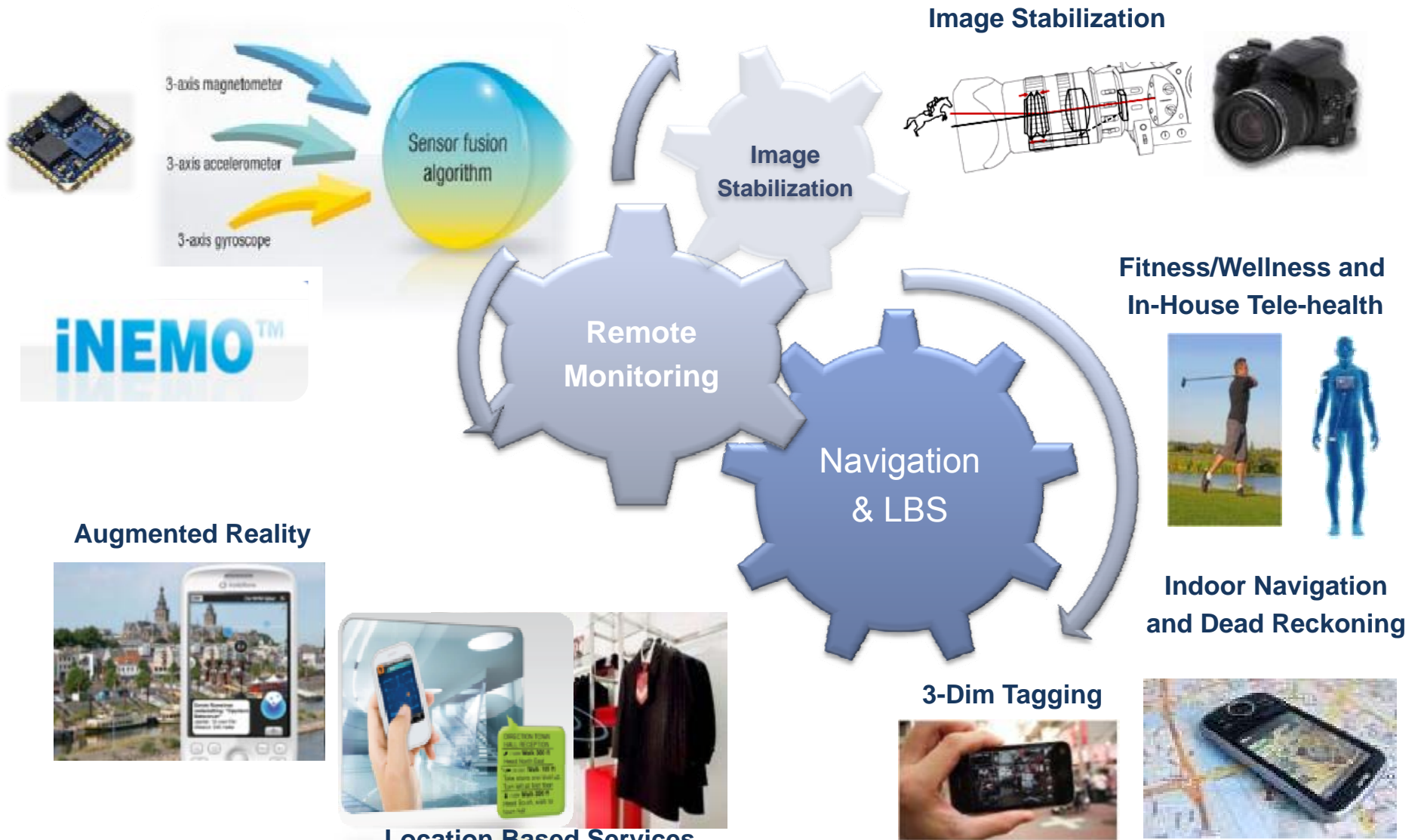
5cm

ST has manufactured more than 2,000M units of Accelerometers, Gyroscopes and Compasses. A robust and scalable manufacturing process is key to sustain the demand of the consumer market

PHASE 1 of MEMS Consumerization Wave



PHASE 2 of MEMS Consumerization Wave



iNEMO™

Augmented Reality



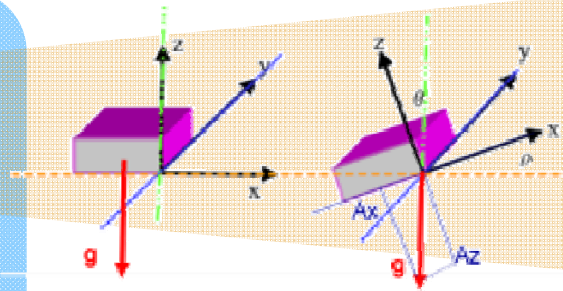
Location Based Services (LBS)

3-Dim Tagging



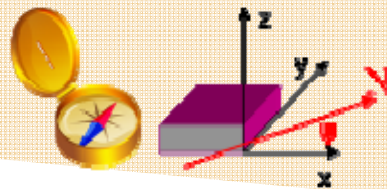
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Multi Sensing



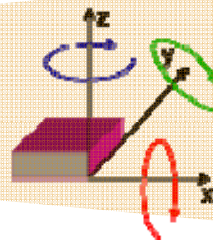
Accelerometer

- Senses the linear acceleration.
- In **static** conditions, the projection of gravity on the three axes allow to compute **tilt angles**



Magnetometer

- Senses the magnetic field.
- In **static** conditions, the projection of geomagnetic field on the three axes allows to compute heading angle



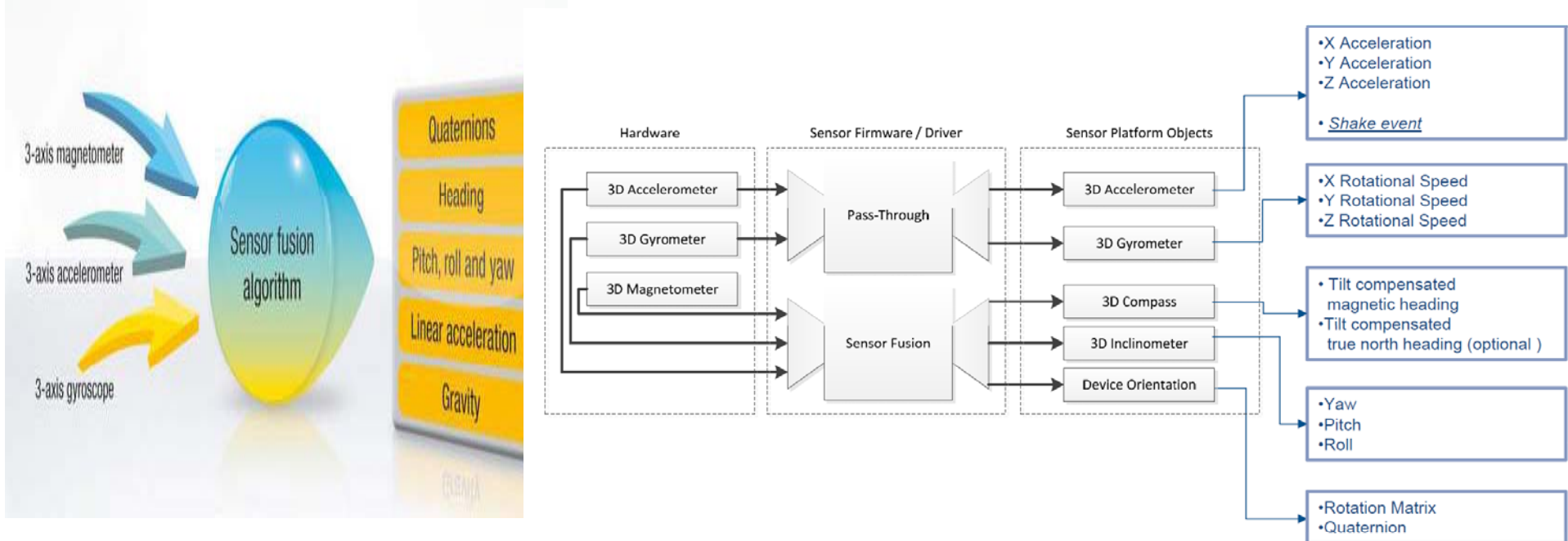
Gyroscope

- Measures the angular rate
- In **dynamic** conditions, the integration of the angular rate along the three axes allow to determine the 3D orientation



Sensor Fusion, iNEMO™ Engine

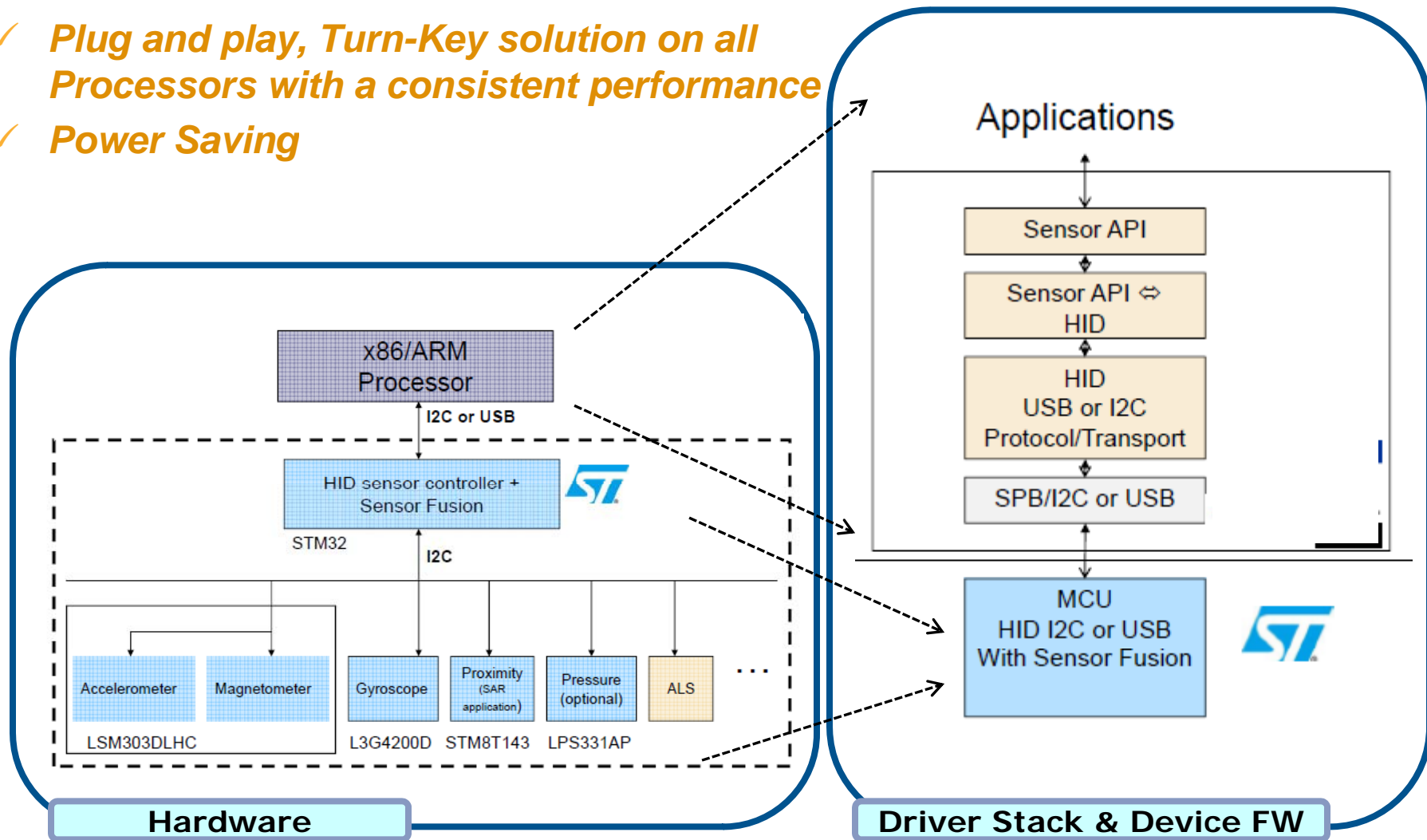
The iNEMO Engine is a *NEW* advanced software engine that fuses accelerometer, gyroscope and magnetometer data to deliver motion sensing information **accurate, reliable** and **easy to integrate** into smart consumer devices



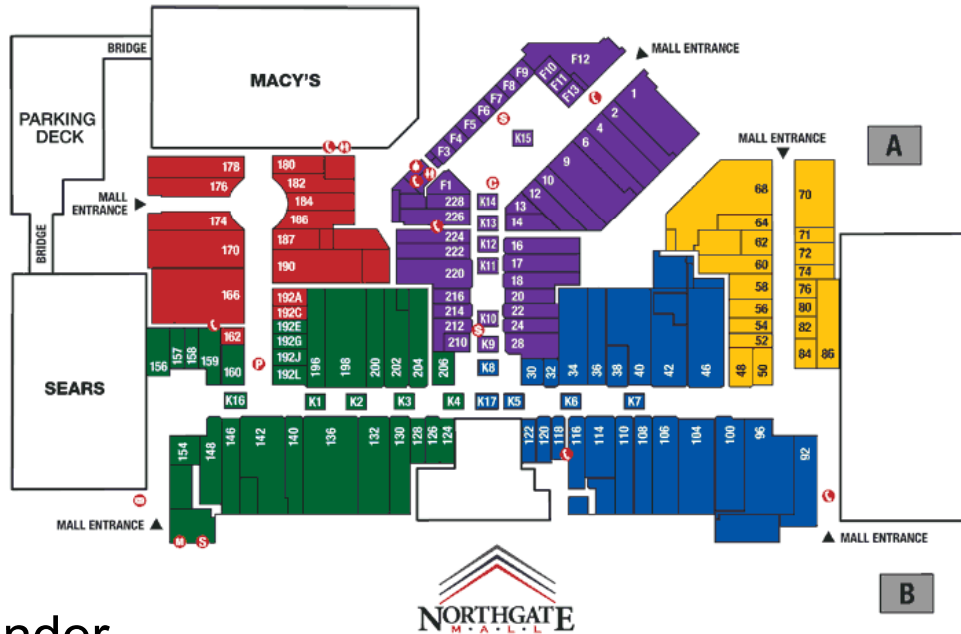
HID Sensor Class Solution



- ✓ *Plug and play, Turn-Key solution on all Processors with a consistent performance*
- ✓ *Power Saving*



Indoor Navigation



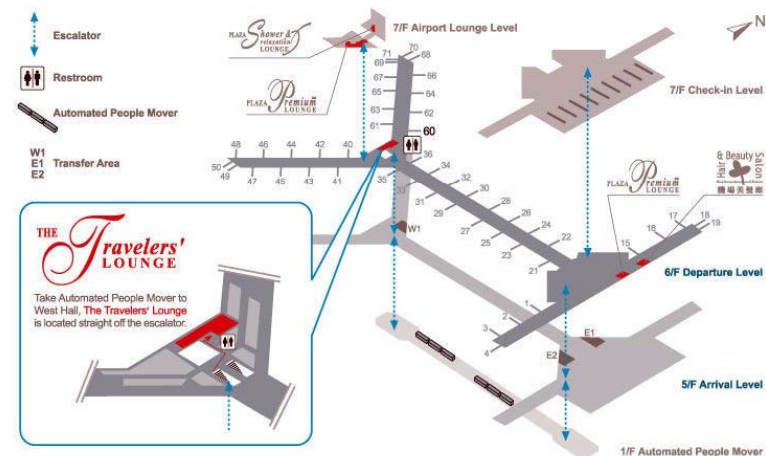
- Convention center
- Corporate campus
- Airport
- Shopping mall
- Grocery store
- Train station
- Offices

Location Finder

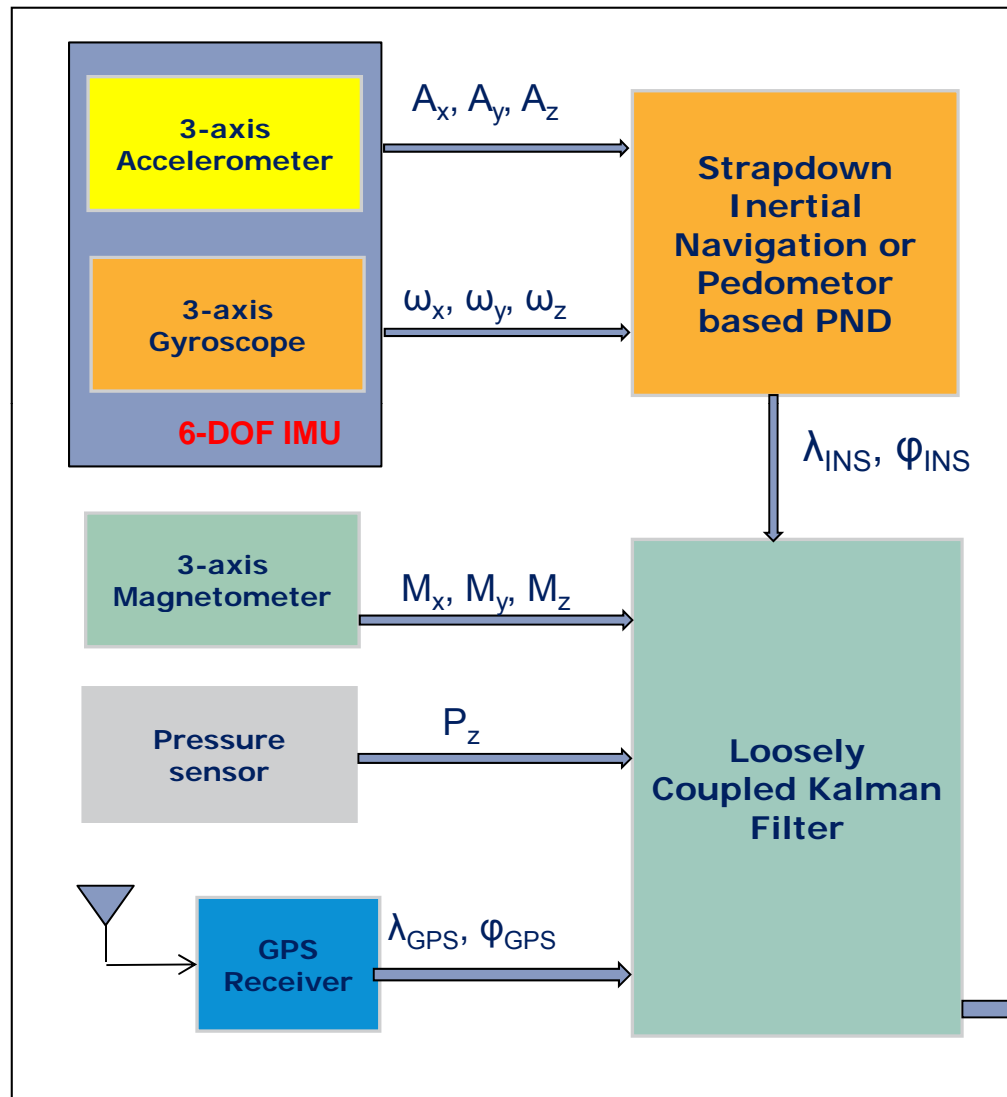
Where am I? Where is the meeting room? Where is my flight? Where is motion gaming showroom?

Property tracking

Security alarm, property is taken out of secure area



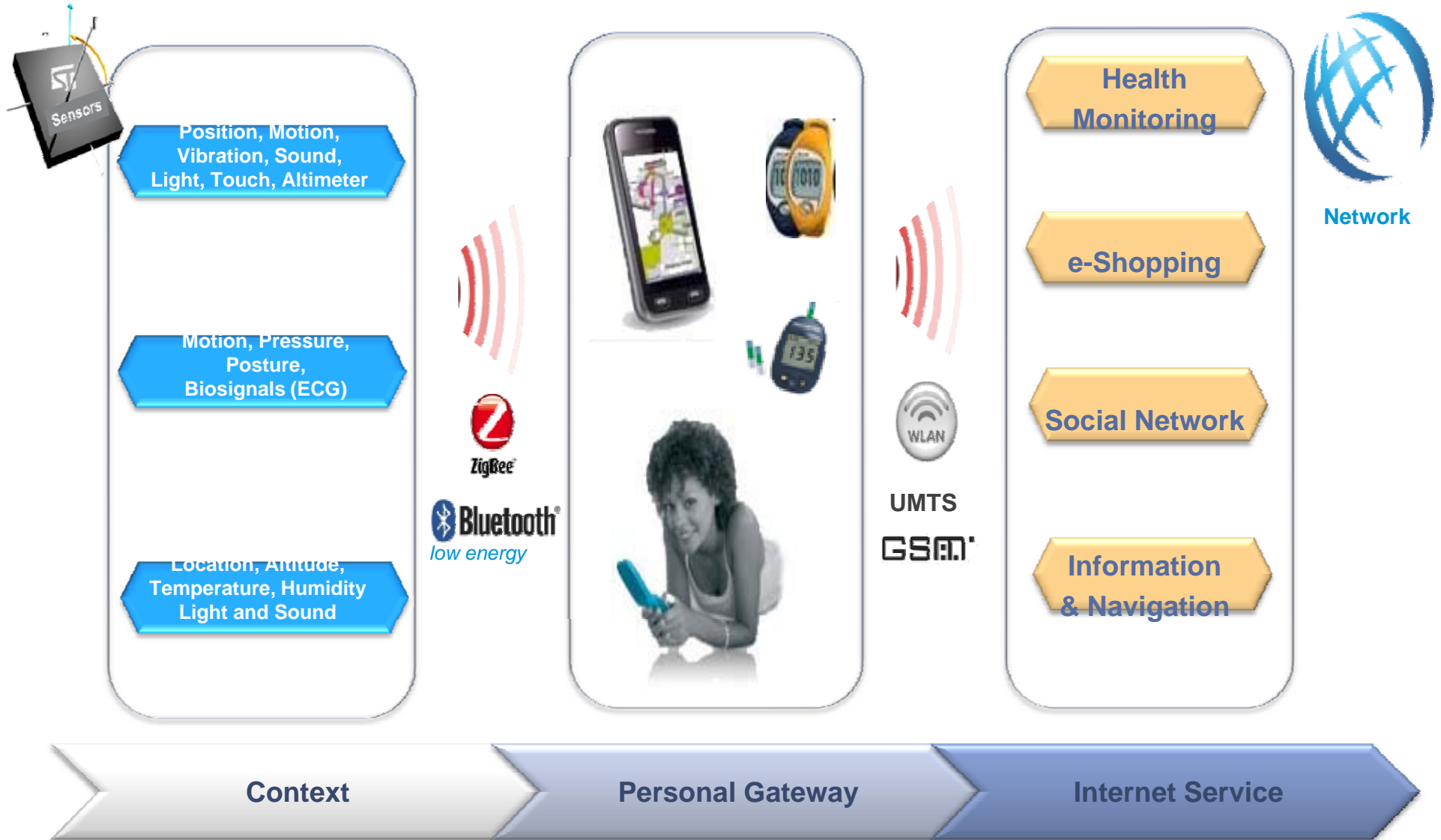
Sensor Fusion – Personal Navigation



- **GPS:** provide initial position, retrieve earth declination angle and calibrate pedometer step length
- **GPS:** can not tell Heading when the object is not moving and is not able to tell small height variation
- **Accelerometer:** Tilt compensated compass and pedometer step detection
- **Gyroscope:** Continue to provide Heading when compass gets disturbed
- **Magnetometer:** calculate magnetic Heading and calibrate gyro sensitivity
- **Pressure sensor:** tell the floor difference for indoor navigation
- **Kalman Filter:** Estimate and compensate gyro long term bias drift, output DR info when GPS is lost

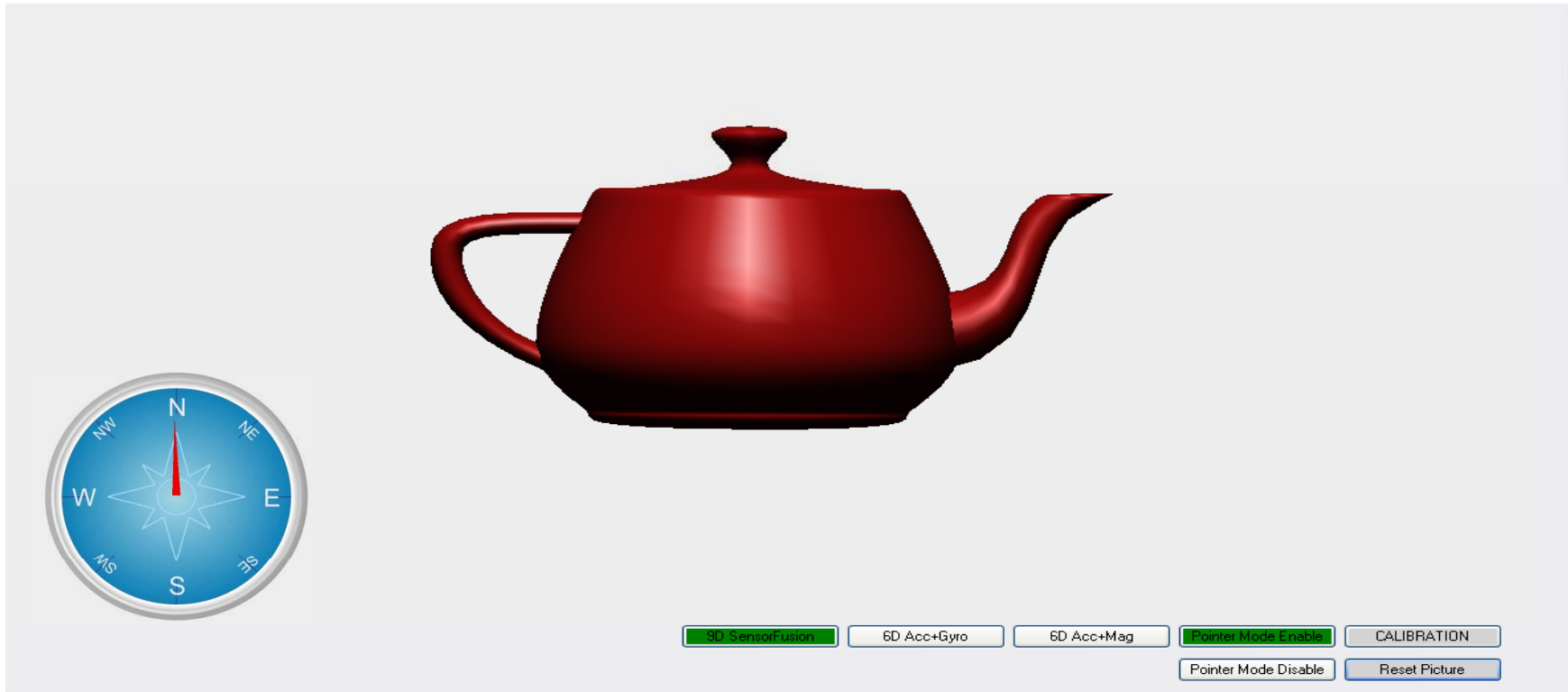
Context Awareness:

Increased Sensing Enables New Internet Services



Demo

Sensor Fusion



- **Sensor Fusion Benefits**
 - Comparing different sensor fusion modes
 - Reduce magnetic anomaly effect

Thank You!

Wen.Lin@st.com

