

Smartphone Sensing: What Sensors Would we Like to Have in the Future Smartphones ?

Dr. Sergey Y. Yurish

International Frequency Sensor Association (IFSA),
Technology Assistance BCNA 2010, S.L.
Barcelona, Spain



Outline



- 1 Modern Market
- 2 Sensors in Smartphones:
State-of-the-art
- 3 How to make smartphones
even more smarter ?
- 4 Conclusions

Outline



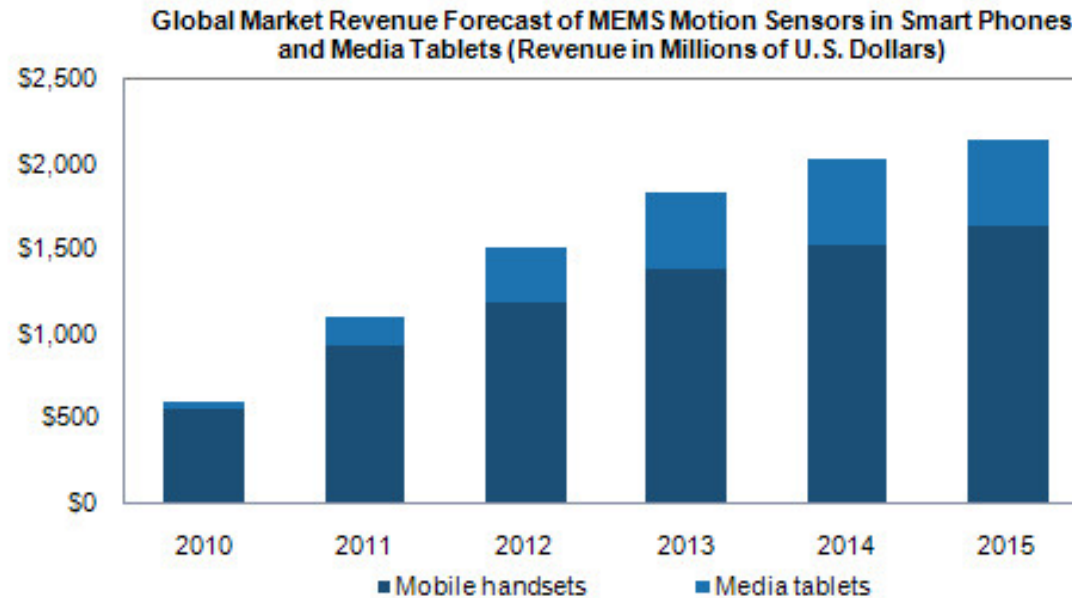
- 1 Modern Market
- 2 Sensors in Smartphones: State-of-the-art
- 3 How to make smartphones even more smarter ?
- 4 Conclusions

Modern Market



- MEMS & sensors for cell phones, expanding from \$ 3.5 bn in 2009 to \$ 7.9 bn in 2015 (*Yole Developpement*)
- Smartphone sensors to be \$ 6 bn business by 2016 (*Juniper Research*)
- 44 % of the mobile phones will be smartphones in 2015

Motion Sensor Market for Smartphones and Tablets

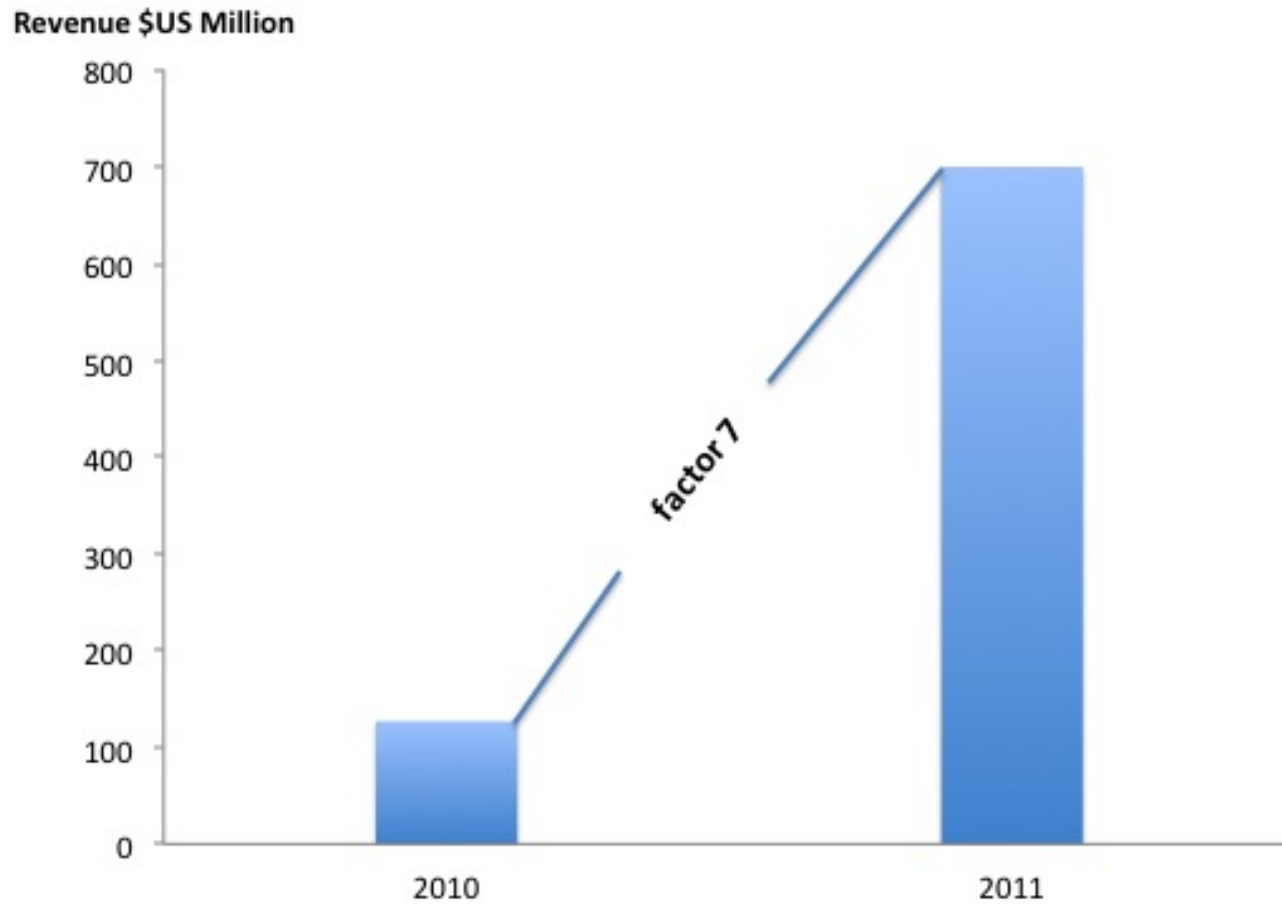


Source: IHS iSuppli September 2011

Global revenue for motion sensor in smartphones and tablets will expand to \$ US 2.1 billion in 2015 with a 25.3 % CAGR, up from \$1.19 billion in 2011 (*IHS iSuppli*).

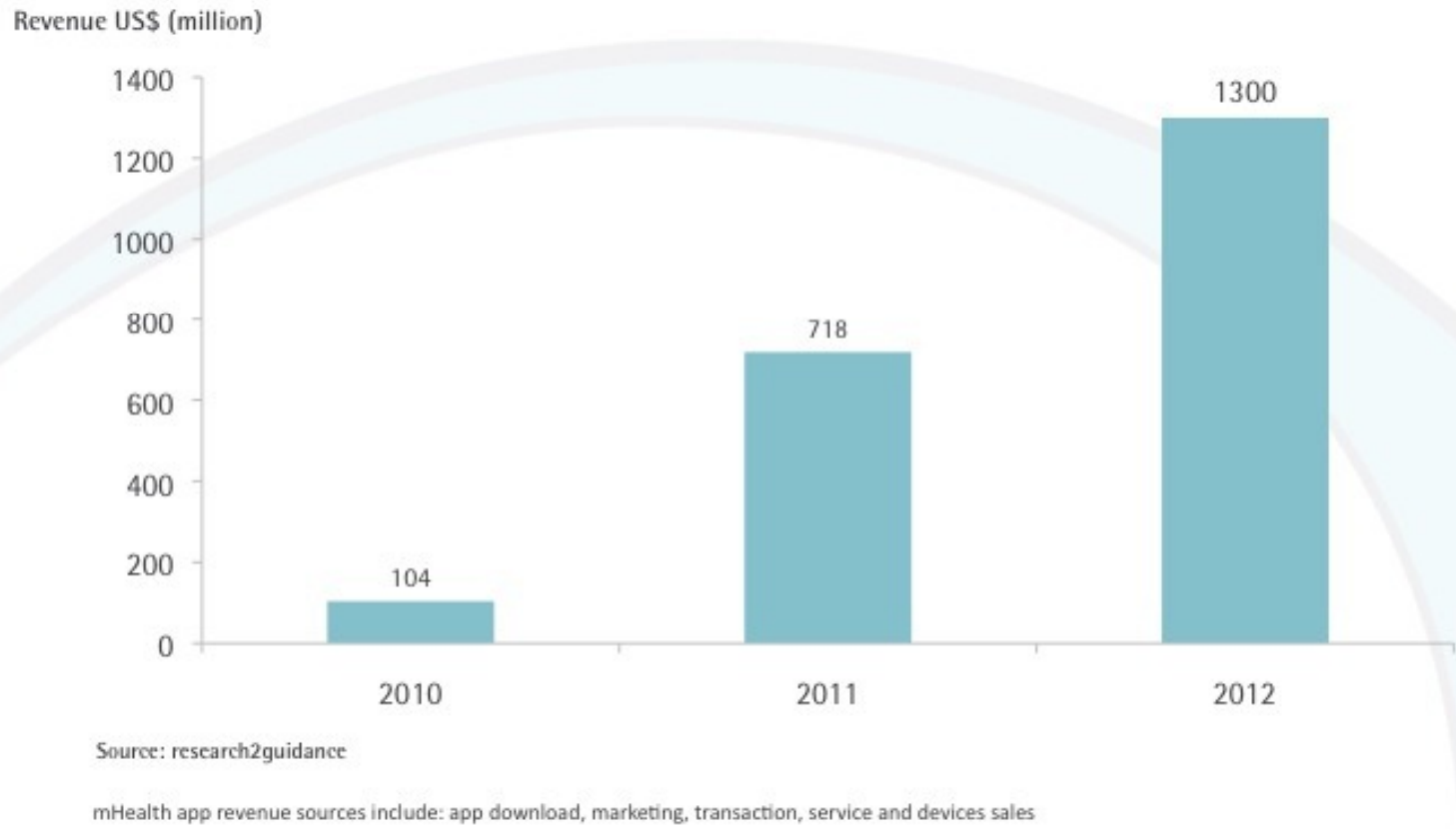
Healthcare Applications

Global smartphone mHealth app market 2011



Healthcare Applications (cont.)

Global revenue for mobile healthcare applications in 2012

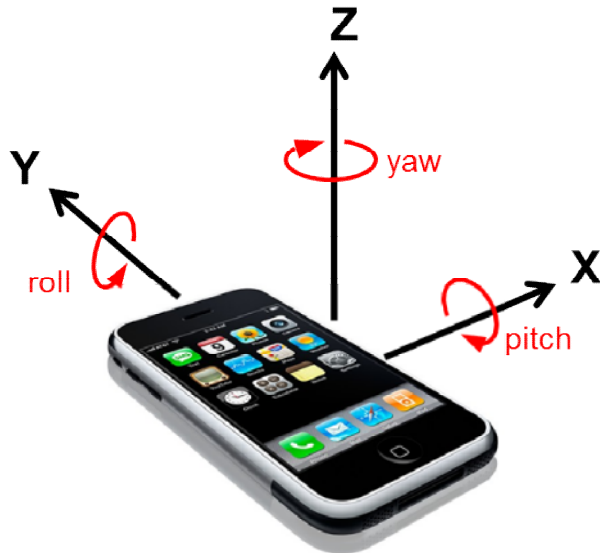


Outline



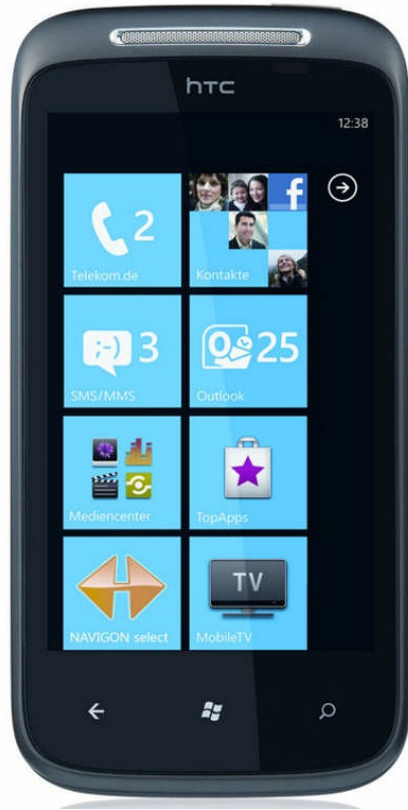
- 1 Modern Market
- 2 Sensors in Smartphones:
State-of-the-art
- 3 How to make smartphones
even more smarter ?
- 4 Conclusions

MEMS Motion Sensor Category



- Accelerometers
- Gyroscopes
- 3-axis magnetometers
- Pressure sensors

Today's "must-have" Sensor Category



**Ambient
light**

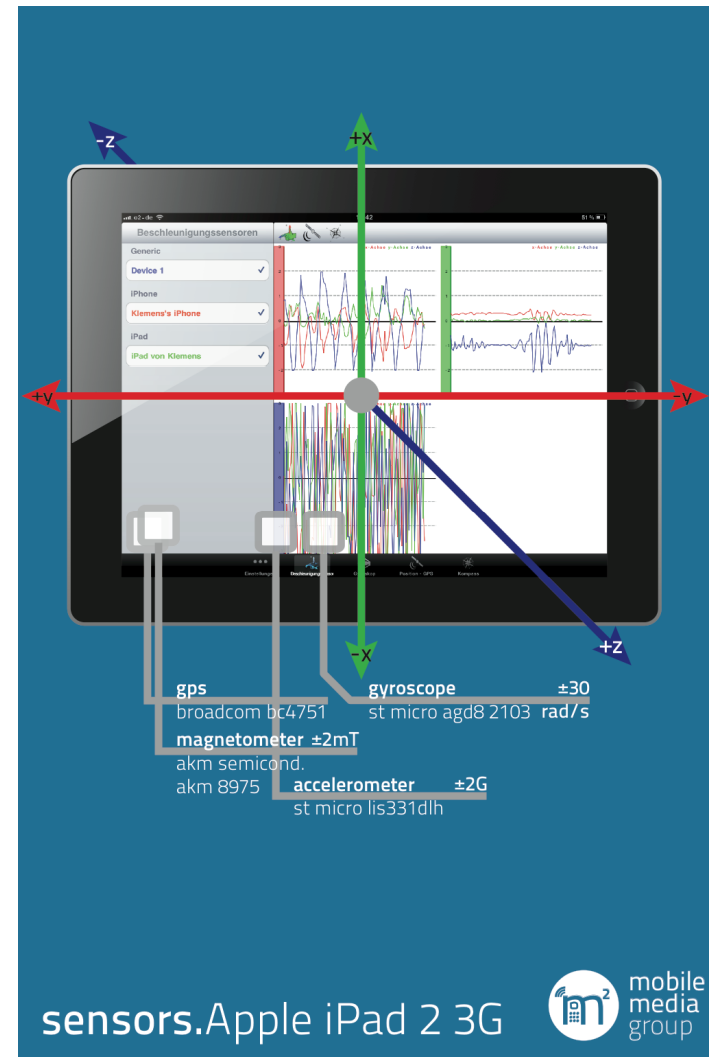
Proximity

Accelerometer

Gyroscope

Magnetometer

Applications



Sensors Polls and Surveys

Survey 2012: What Sensors are Needed in a Mobile Phone ?

Sensors in Mobile Phone

What sensors are needed in a mobile phone ?

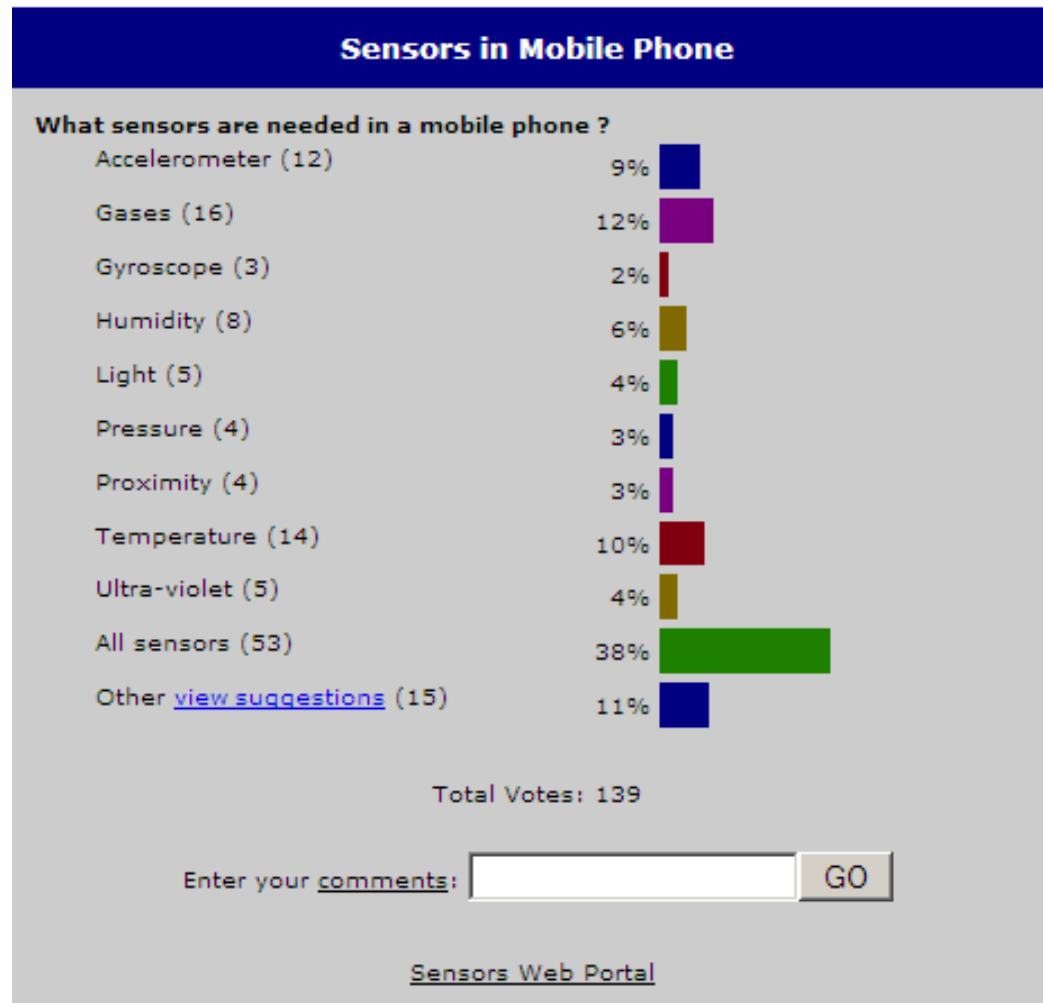
- Accelerometer
- Gases
- Gyroscope
- Humidity
- Light
- Pressure
- Proximity
- Temperature
- Ultra-violet
- All sensors
- Other

Submit Vote

[view results](#)

 freepolls.com

Survey Results (August 2012)



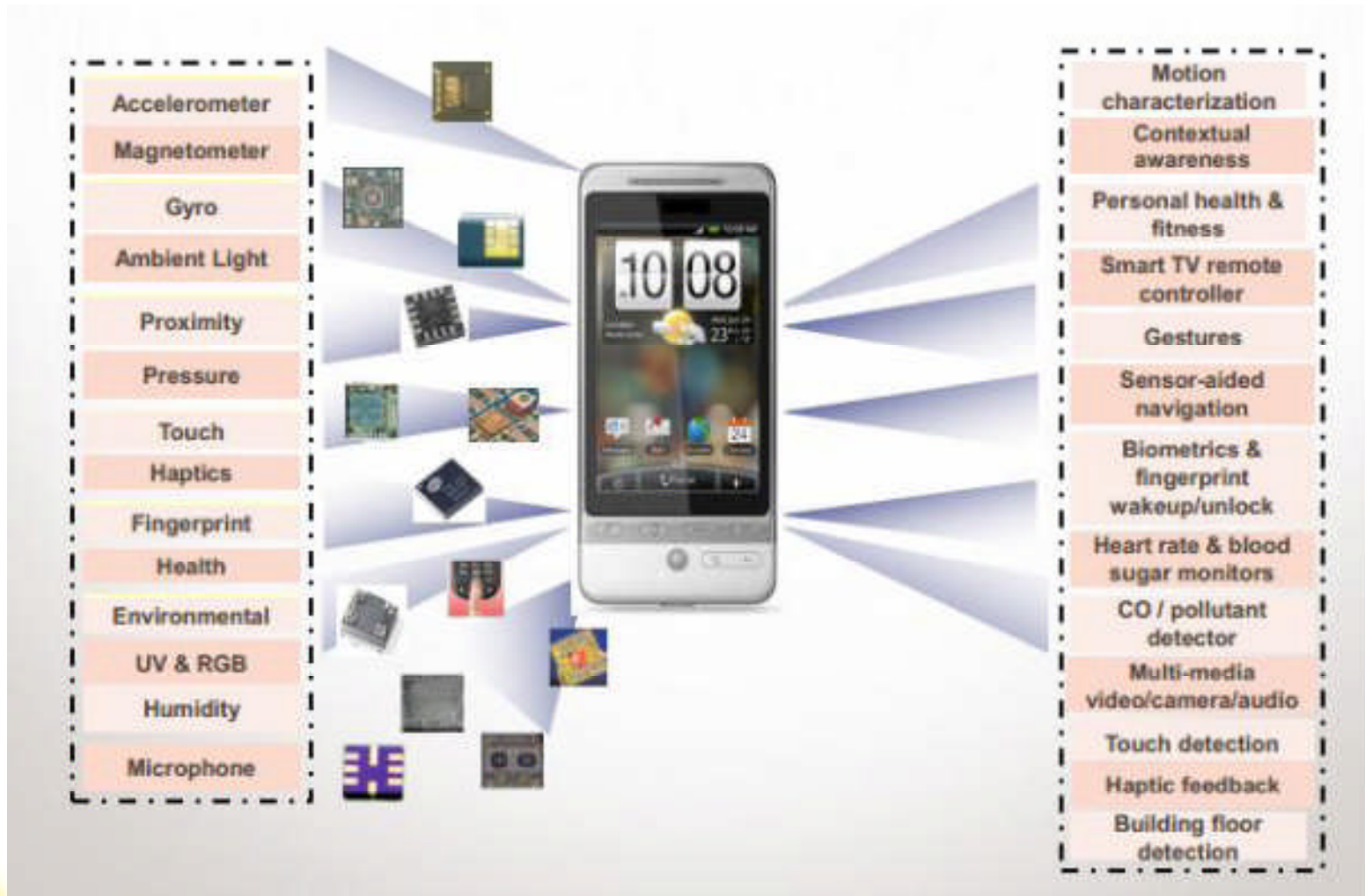
Sensors Web Portal, 139 respondents, August 2012
(<http://www.sensorsportal.com/HTML/Polls.htm>)

Other Sensor Suggestions

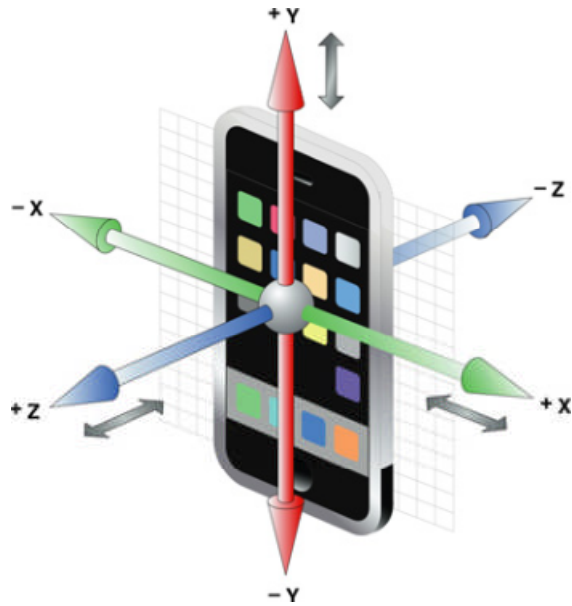


- Magnetic
- Altitude
- Radiation (dosimeter)
- Air quality
- Alcohol detector
- Glucose
- Breath analysis

Sensors Trends for Smartphones



Smartphone Sensors



- Internal (built-in)
- External (wire and wireless)

iCelsius RH - Temperature & Humidity Sensor



- Temperature range -40° to +120° C
- Accuracy ± 0.5 °C, 0-100 % RH+2%

iCelsius
CERTIFIED

Made for



iPod

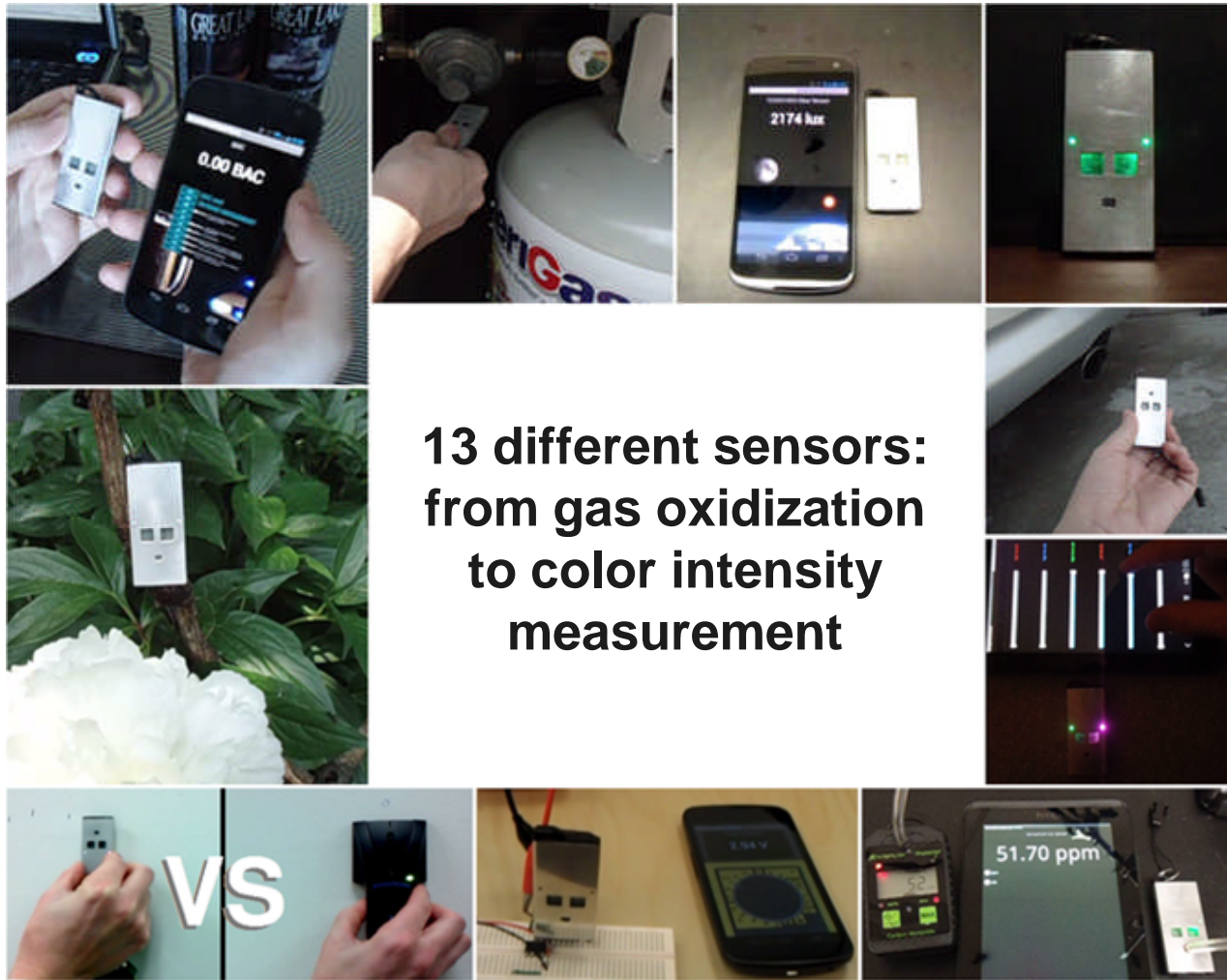


iPhone



iPad

Sensordrone



<http://www.sensorcon.com/sensordrone/>

pH Sensor for Smartphones



PH-1 pH Meter
for iPhone and iPad

<http://www.sensorex.com/>



UV Sensor for Android



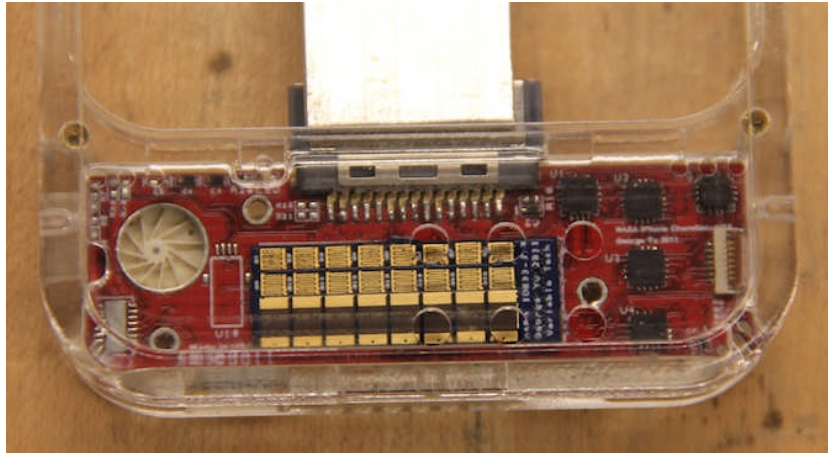
<http://mobile.mit.edu/>

Glucose Sensor for the iPhone



iBGStar from *Sanofi-Aventis*

Chemical Sensors for Smartphone (Gizmodo)

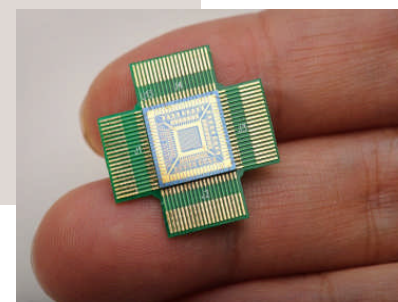


Postage-sized chip with 32
nanosensor bars

- Carbon monoxide
- Chlorine
- Ammonia
- Methane
- Blood sugar
- etc.



Chemical Sensing Prototype for iPhone



Array of Sensors for Healthcare



- One-lead ECG
- Body temperature
- Blood glucose
- Heart rate
- Blood oxygen saturation
- Body fat percentage
- Stress levels

<http://www.sensorcon.com/sensordrone/>

Radiation Sensors (Dosimeters)



Dosimeter-Radiometer (Do-Ra)

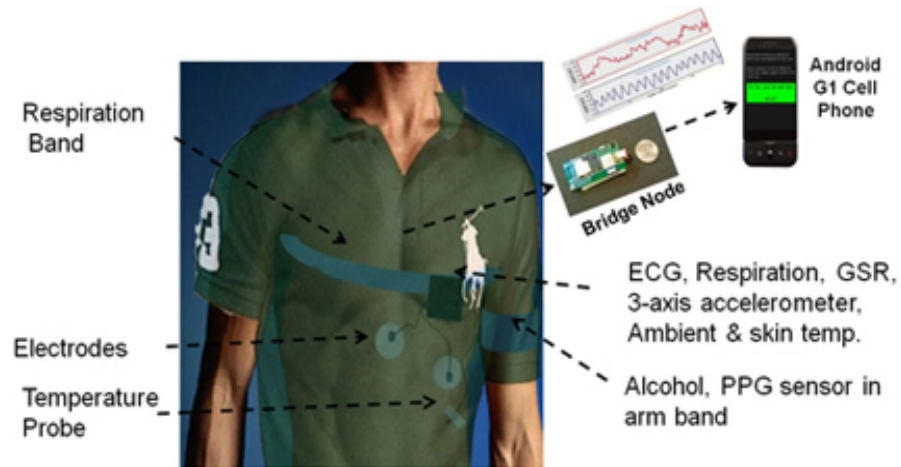


<http://intersofteurasia.ru>

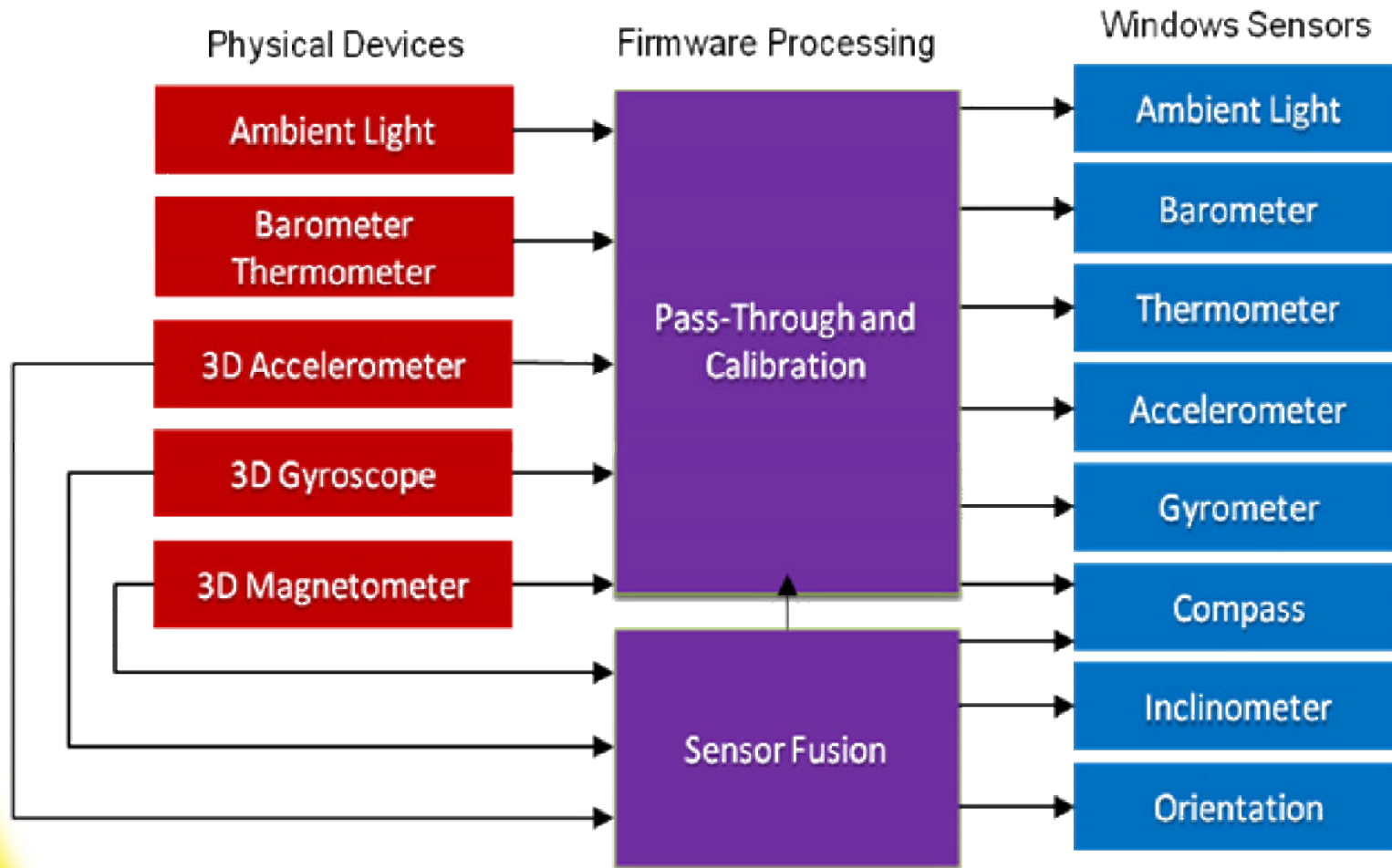
The Evolution of Devices Do-Ra



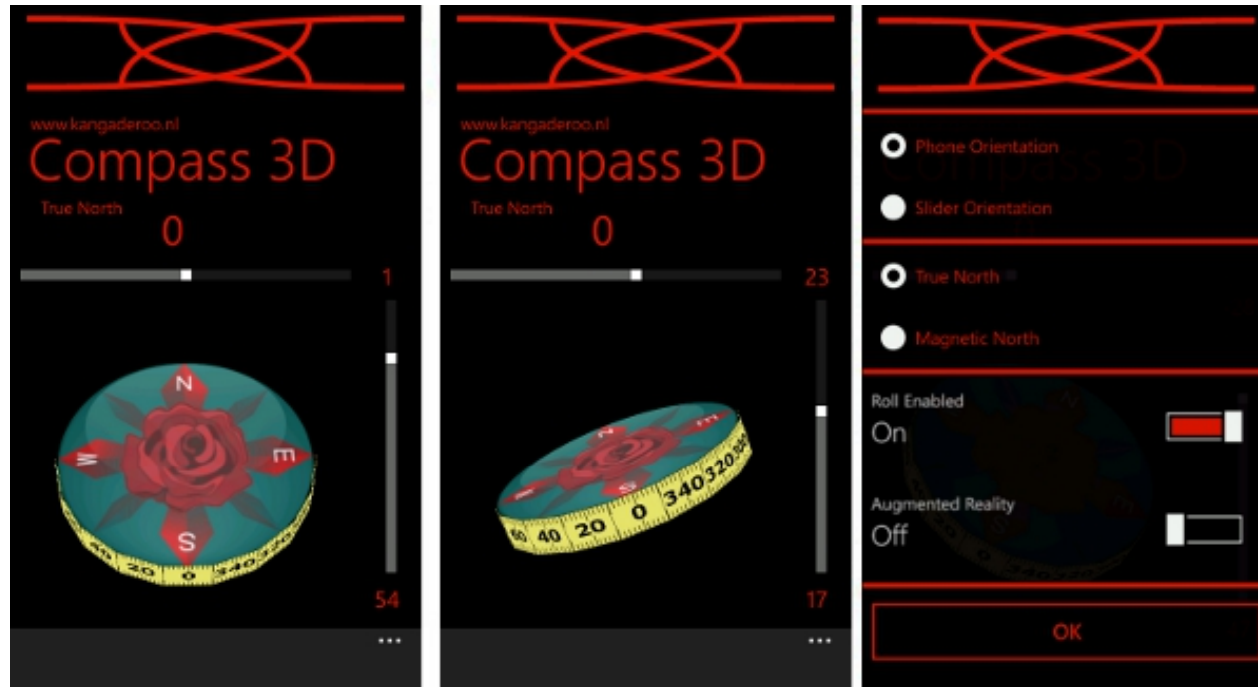
Wearable Sensors



Sensor Data Flow



Compass3D for Windows Phone 7



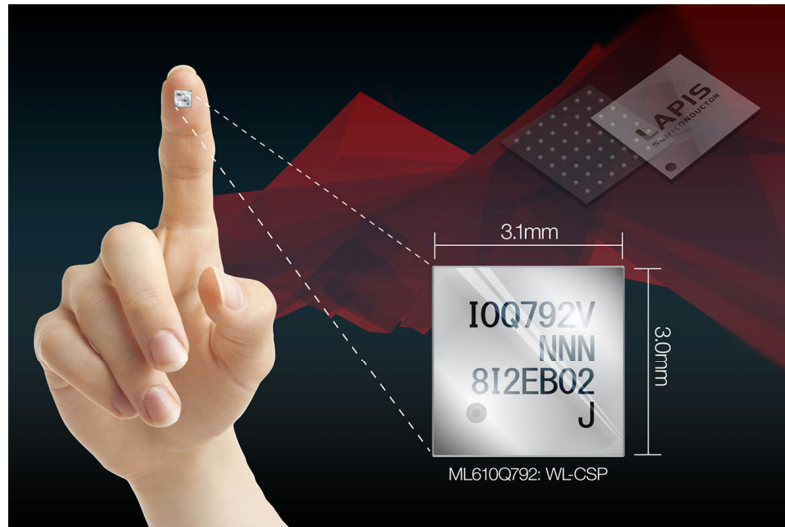
- Visual representation of phones internal sensors
- Magnetic sensor is used for compass function
- Accelerometer is used to support the 3D view

Outline



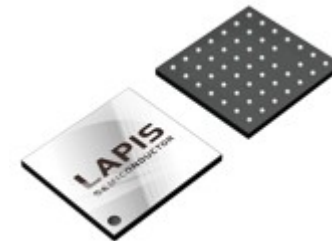
- 1 Modern Market
- 2 Sensors in Smartphones:
State-of-the-art
- 3 How to make smartphones
even more smarter ?
- 4 Conclusions

Sensor Hub Microcontroller for Smartphones



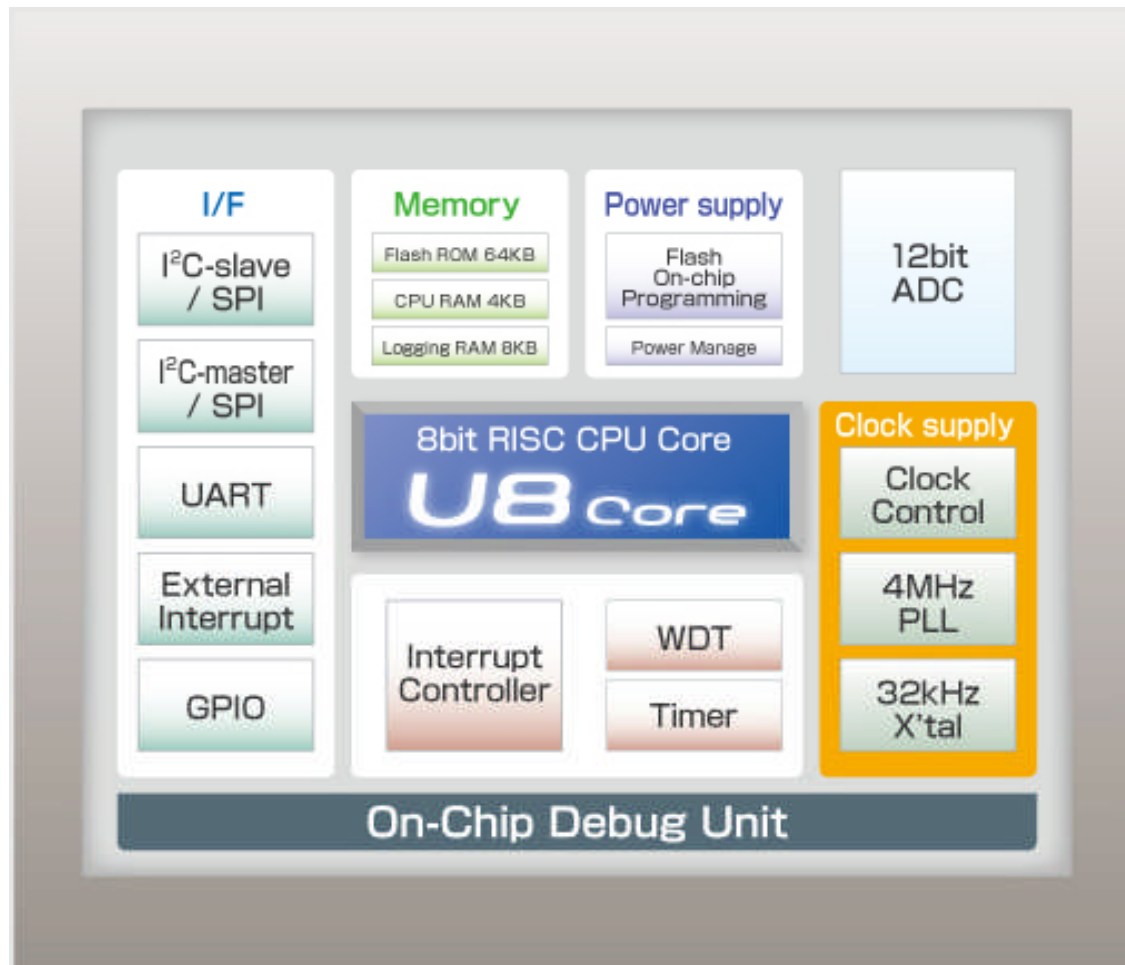
- 8-bit RISC core
- 0.6 μ A power consumption in HALT mode
- 64 KB Flash ROM
- Android drivers under development

ML610Q792 - industry's smallest microcontroller
(48-pin 3.1 mm x 3.0 mm WL-CSP)

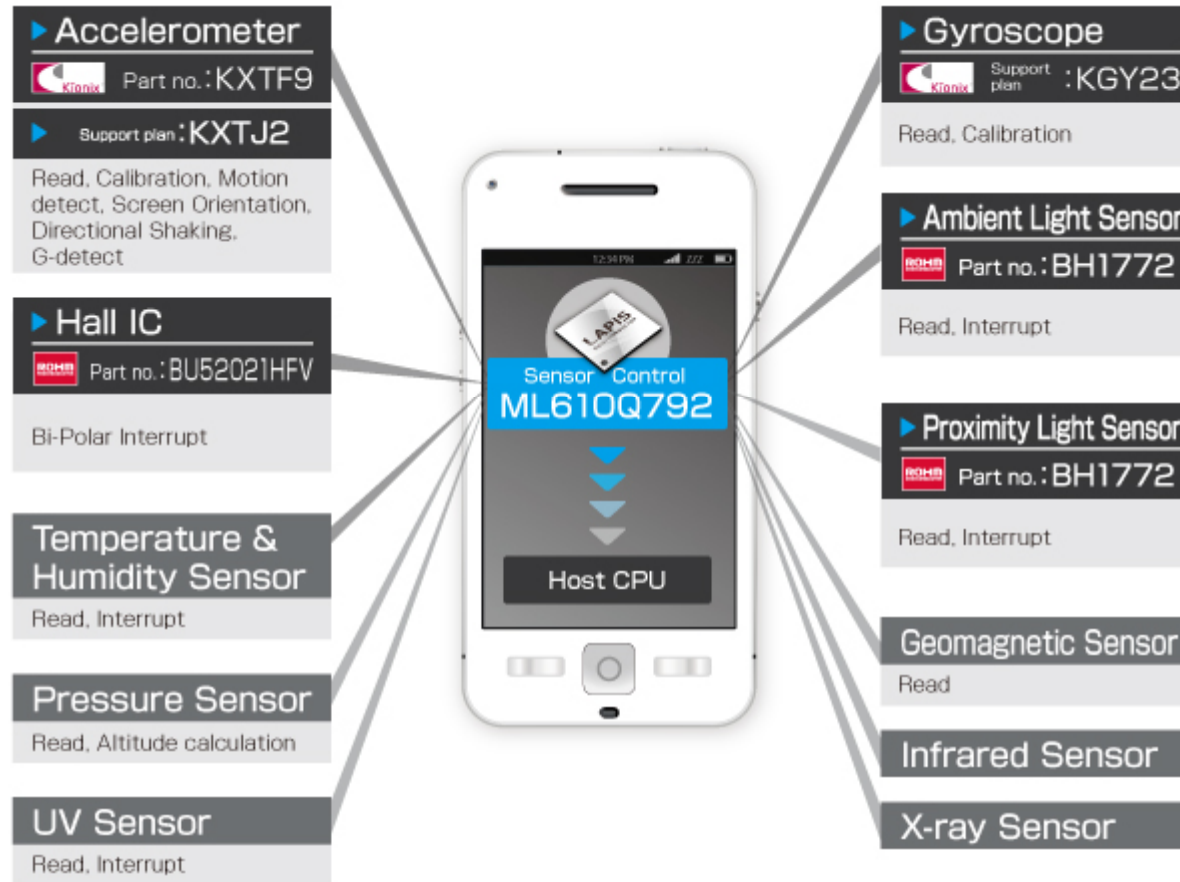


LAPIS
SEMICONDUCTOR

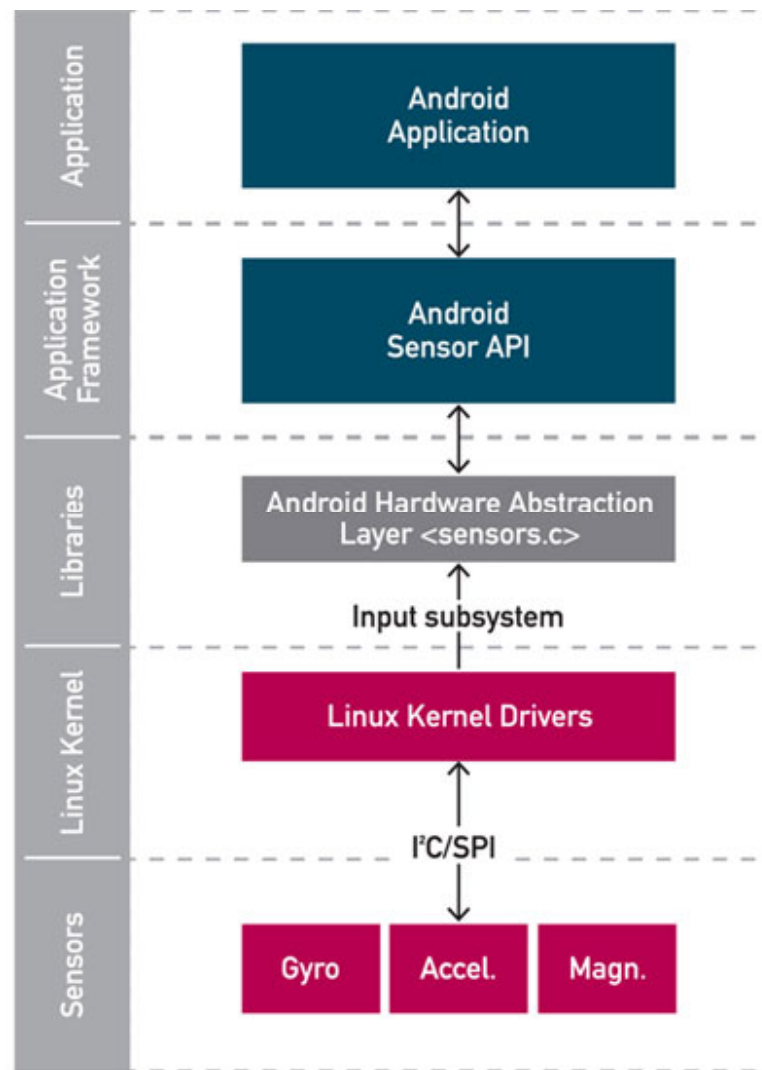
ML610Q792 Block Diagram



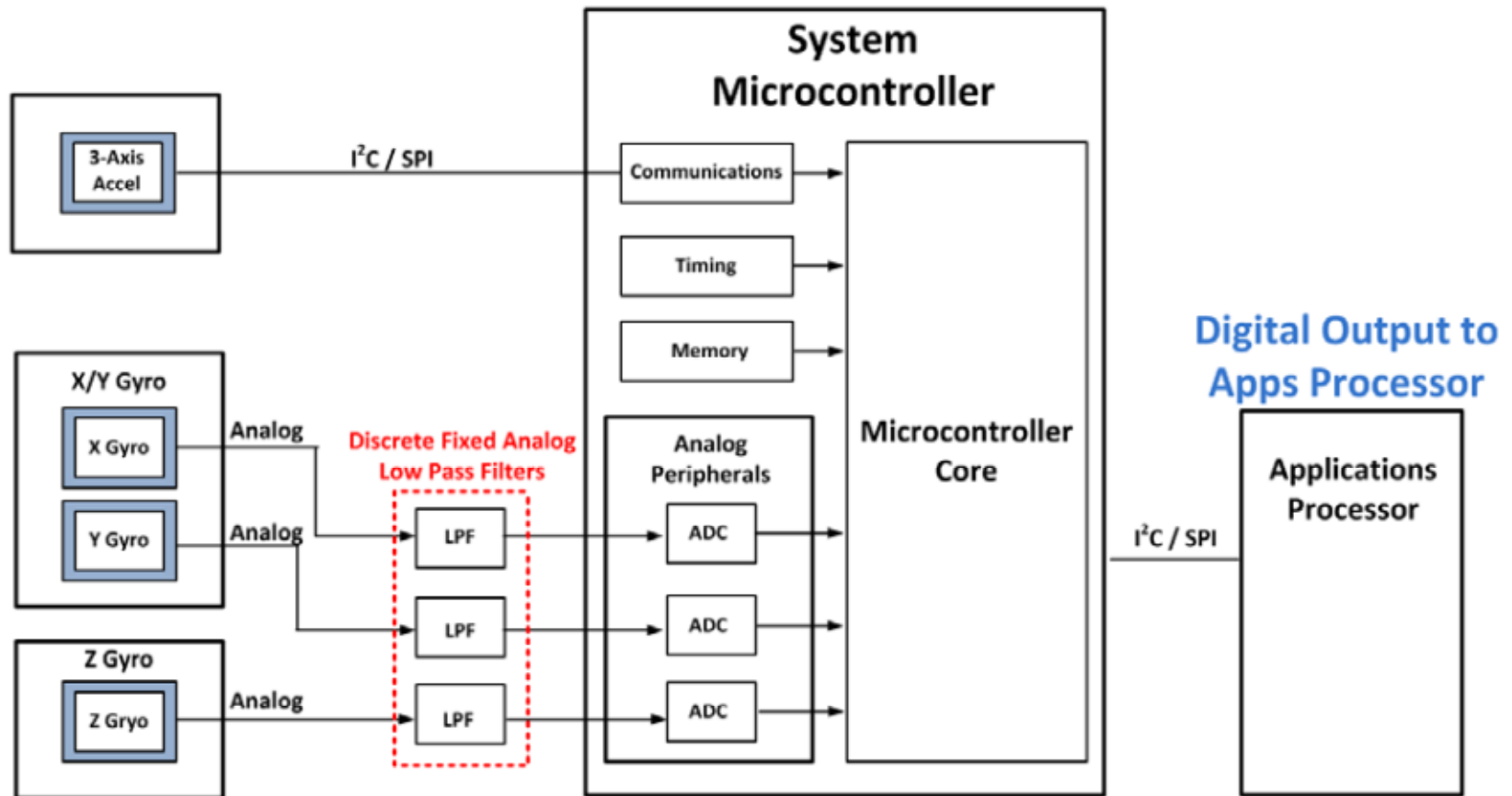
ML610Q792 Sensors Compatibility (Drivers and Firmware)



Android Sensor Software Stack



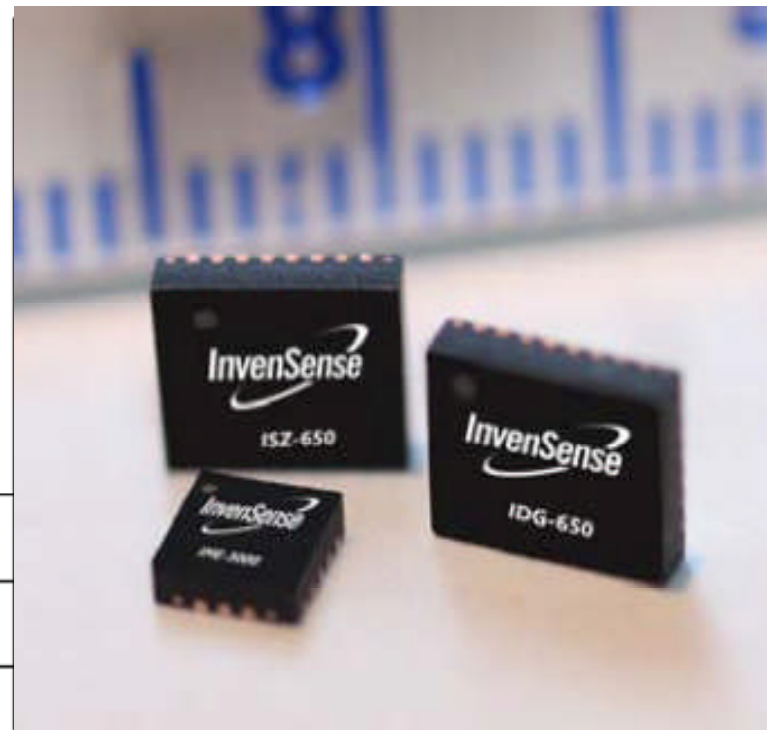
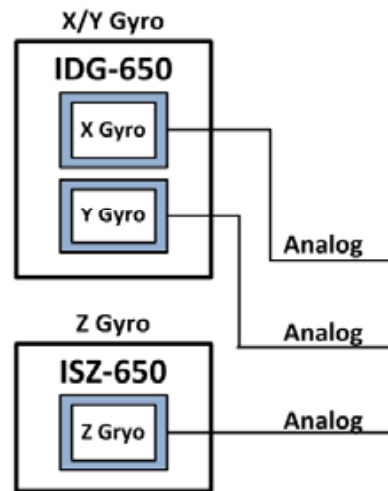
6-Axis Motion Processing Solution (I)



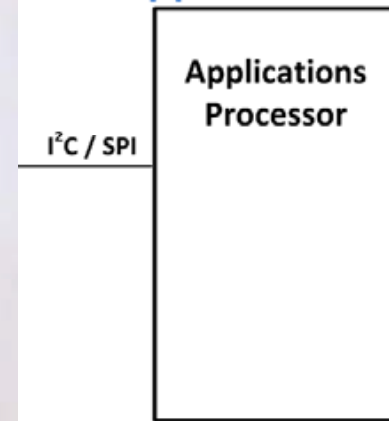
Selection and integration of MEMS-based motion processing in consumer apps, by Steve Nasiri, David Sachs and Michael Maia, *InvenSense, Inc.*

6-Axis Motion Processing Solution (II)

Analog Gyros

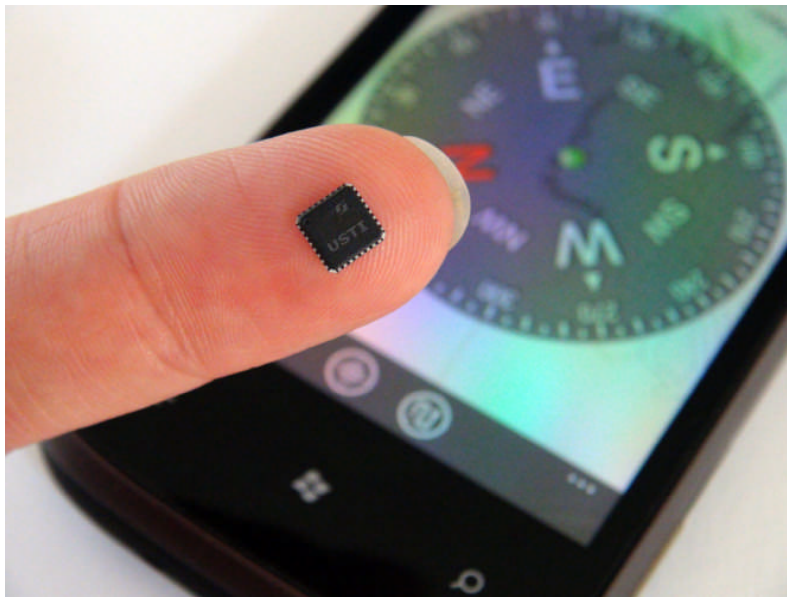


Digital Output to Apps Processor



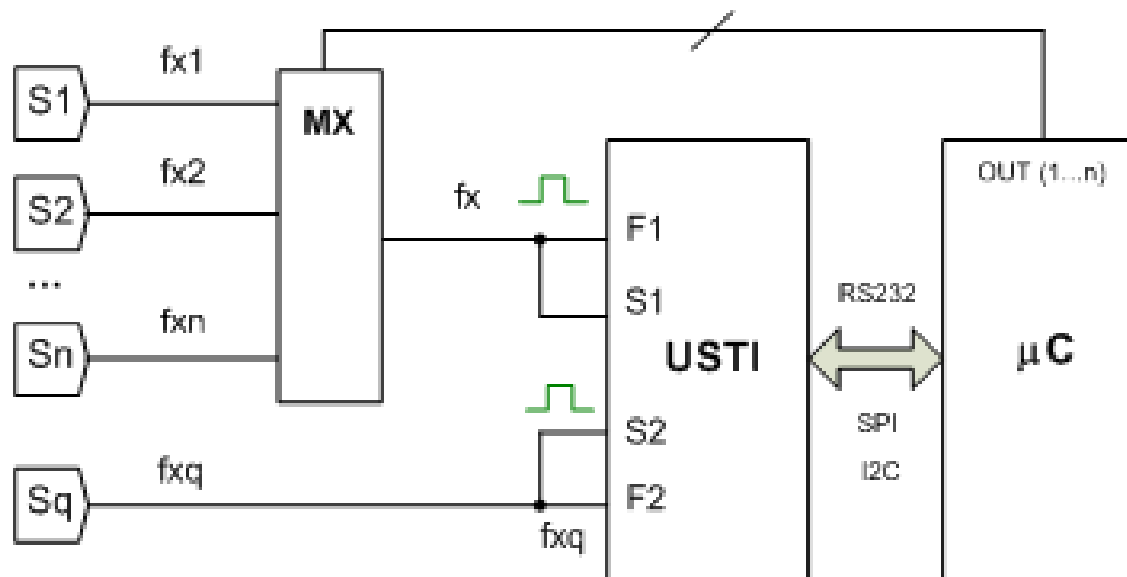
Selection and integration of MEMS-based motion processing in consumer apps, by Steve Nasiri, David Sachs and Michael Maia, *InvenSense, Inc.*

Universal Sensors & Transducers Interface (USTI)



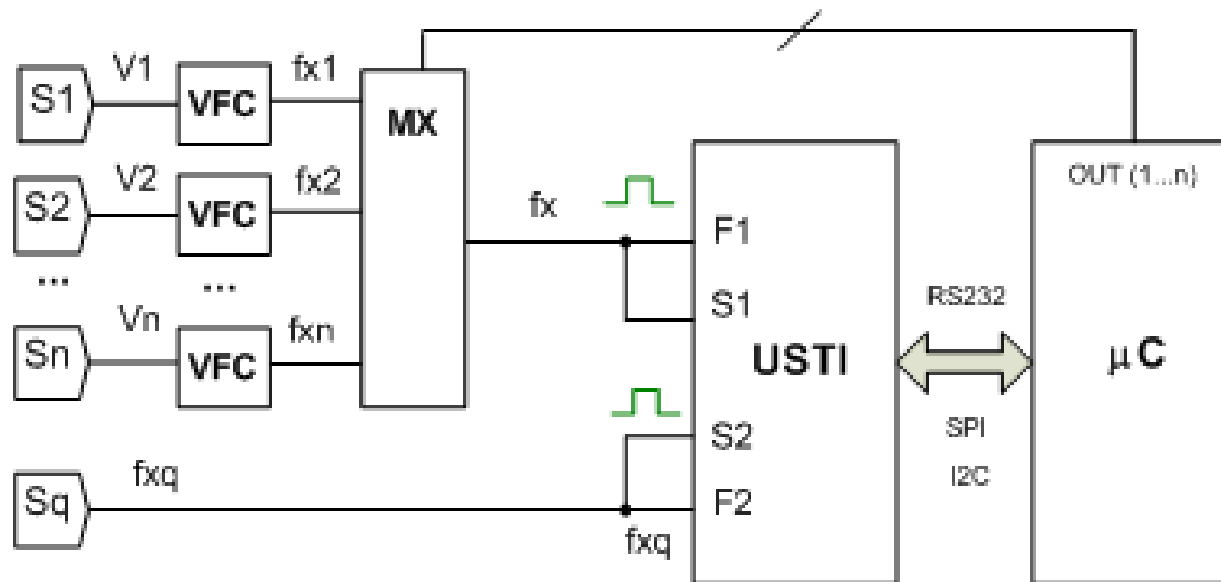
- Can measure all frequency-time parameters of signal
- High accuracy
- Wide frequency range
- I2C, SPI and RS232
- 2-channel + sensing element
- Active supply current < 12 mA
- 5 x 5 mm MLF package
- 4 x 4 mm MLF package is coming soon

Multisensor System for Smartphones

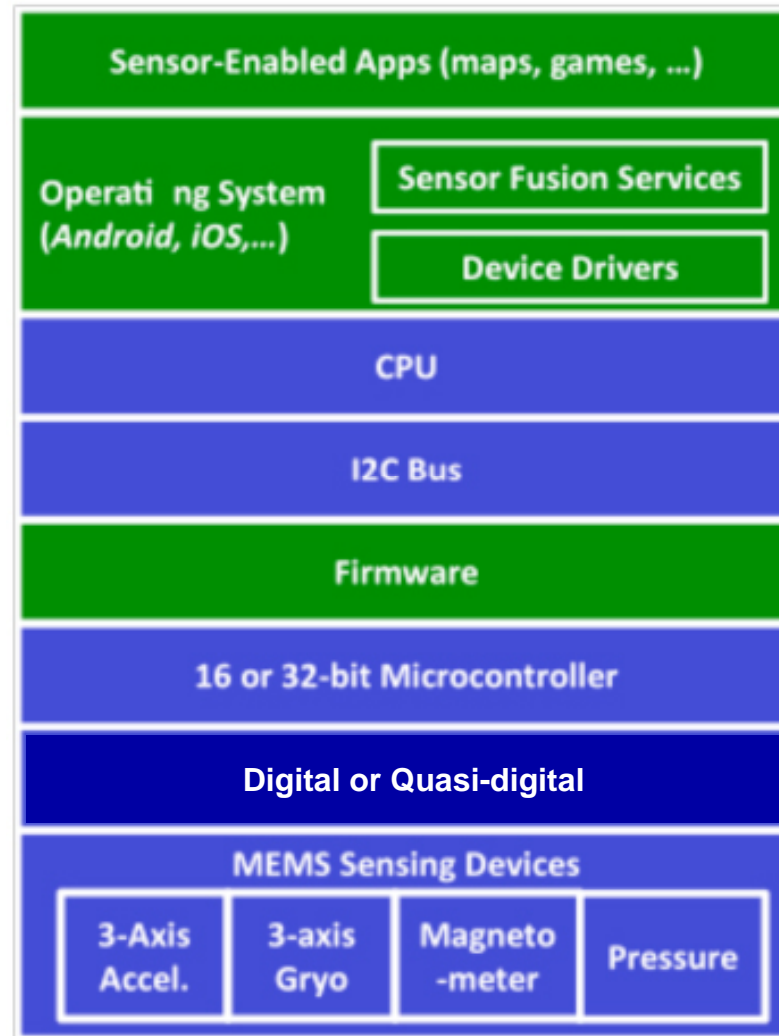


+ capacitive (C_x), resistive (R_x) or resistive bridge (B_x) sensing element

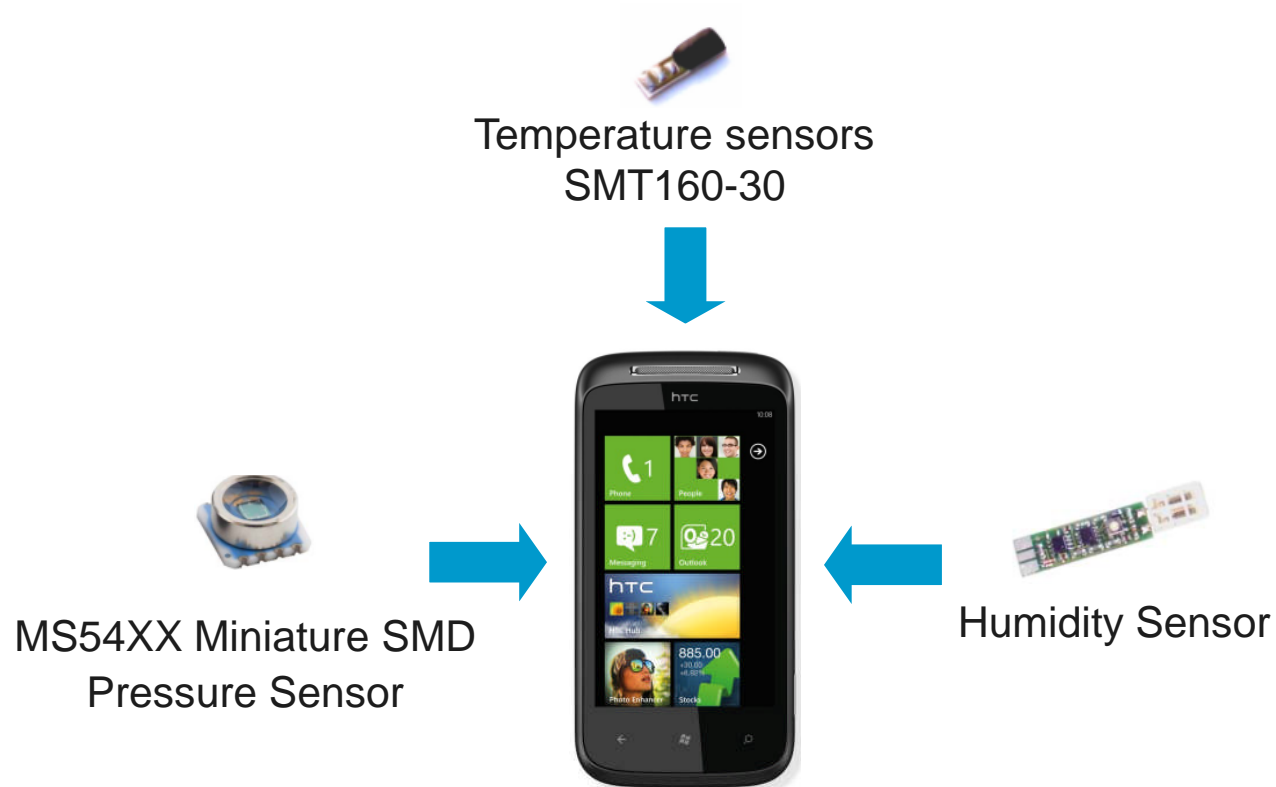
Analog Sensors Interfacing



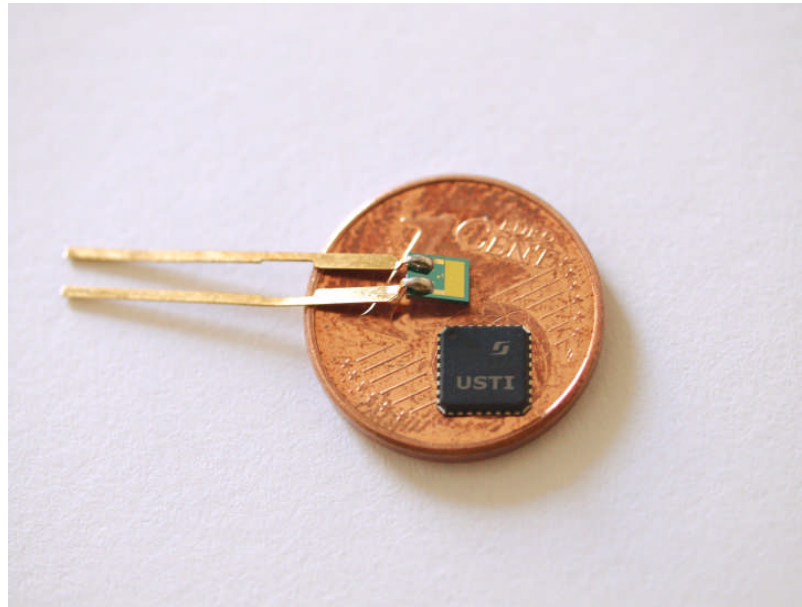
Software and Hardware Layers in Smartphones



Smartphone based Weather Station



Capacitive Humidity Sensor



Conclusions



- More sensors in smartphones - is better
- There are no significant technical or technological problems for this
- Main problem is a 'market problem'
- Quasi-digital sensors are more attractive for application in smartphones due to easy system integration and advantages

Contact



Technology Assistance BCNA 2010, S.L.

Parc UPC-PMT, Edificio RDIT-K2M

C/ Esteve Terradas, 1

08860 Castelldefels (Barcelona), Spain

Tel.: +34 93 413 7941

E-mail: syurish@techassist2010.com

Web: <http://www.techassist2010.com>

Twitter: <http://twitter.com/techassist2010>

Questions & Answers

