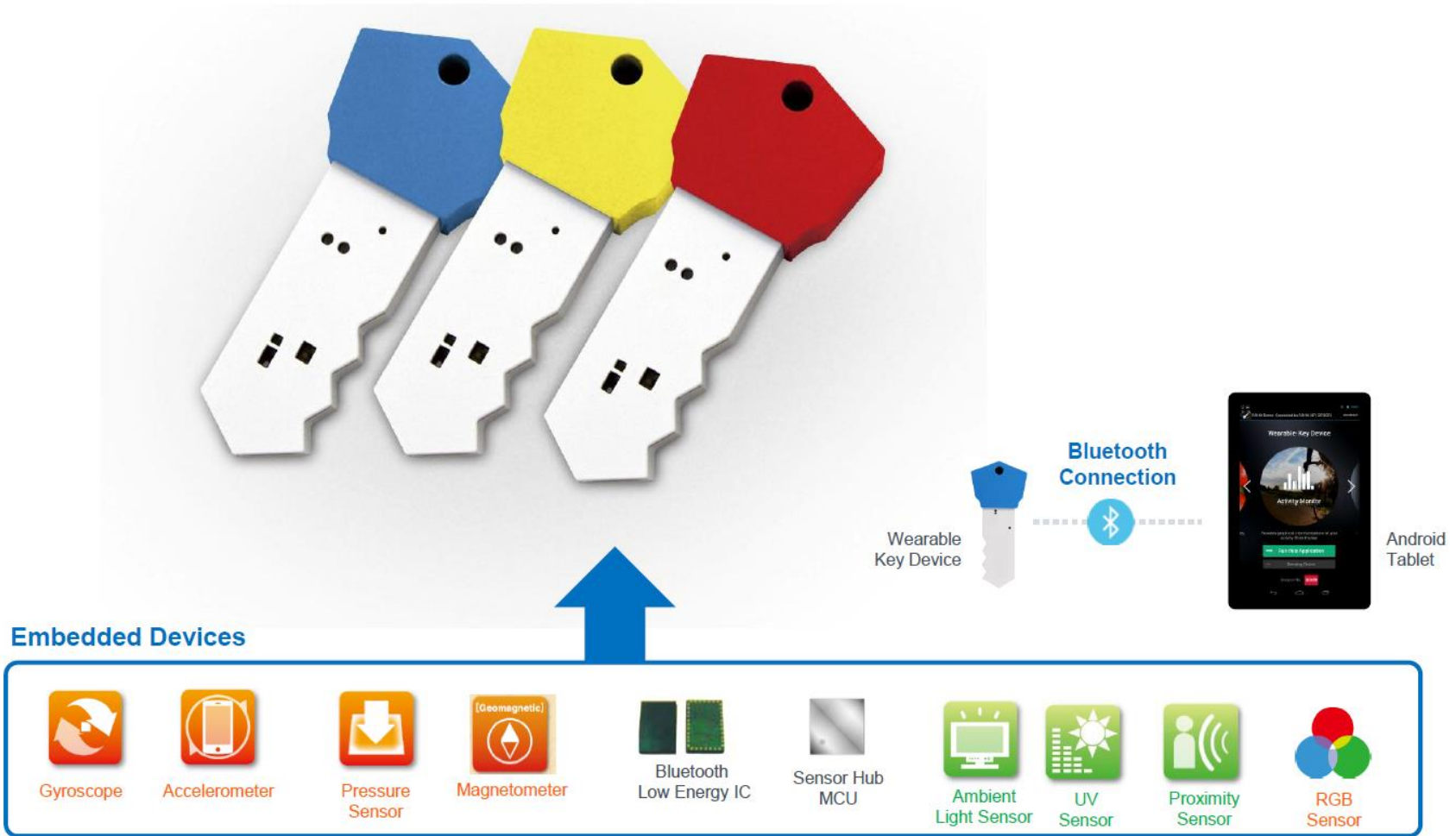




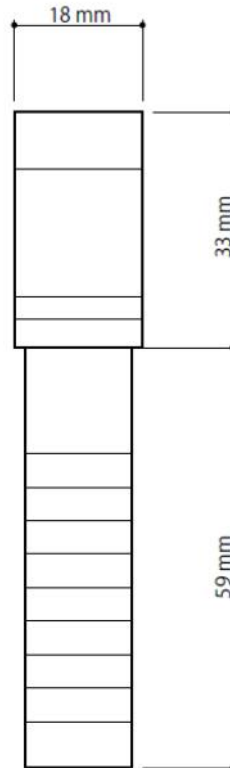
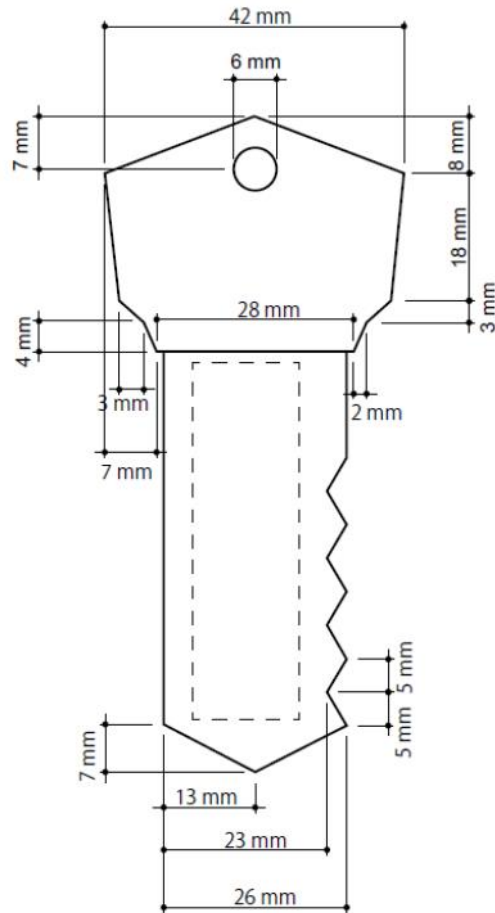
# Wearable Key Device



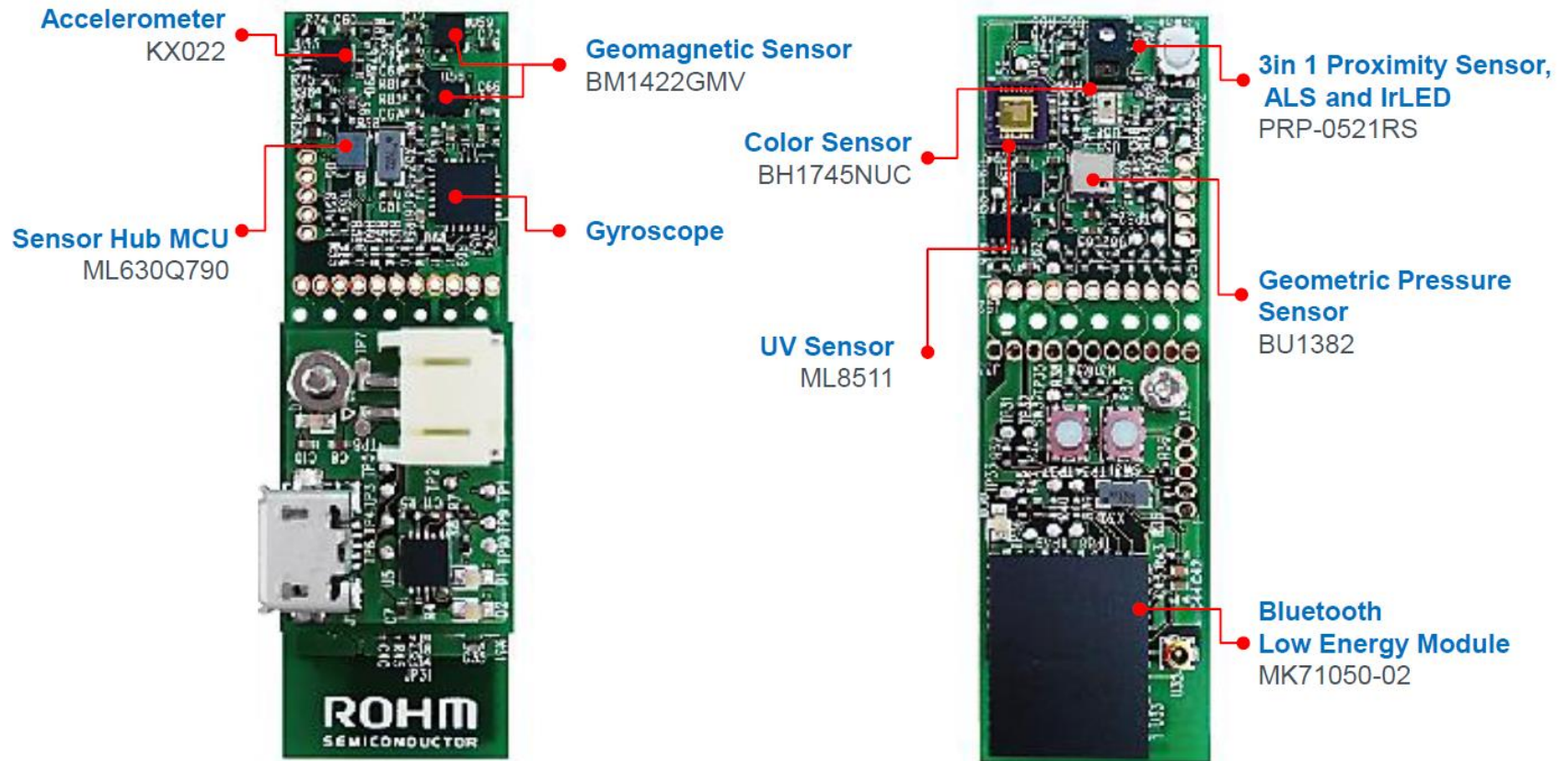
# Device Concept



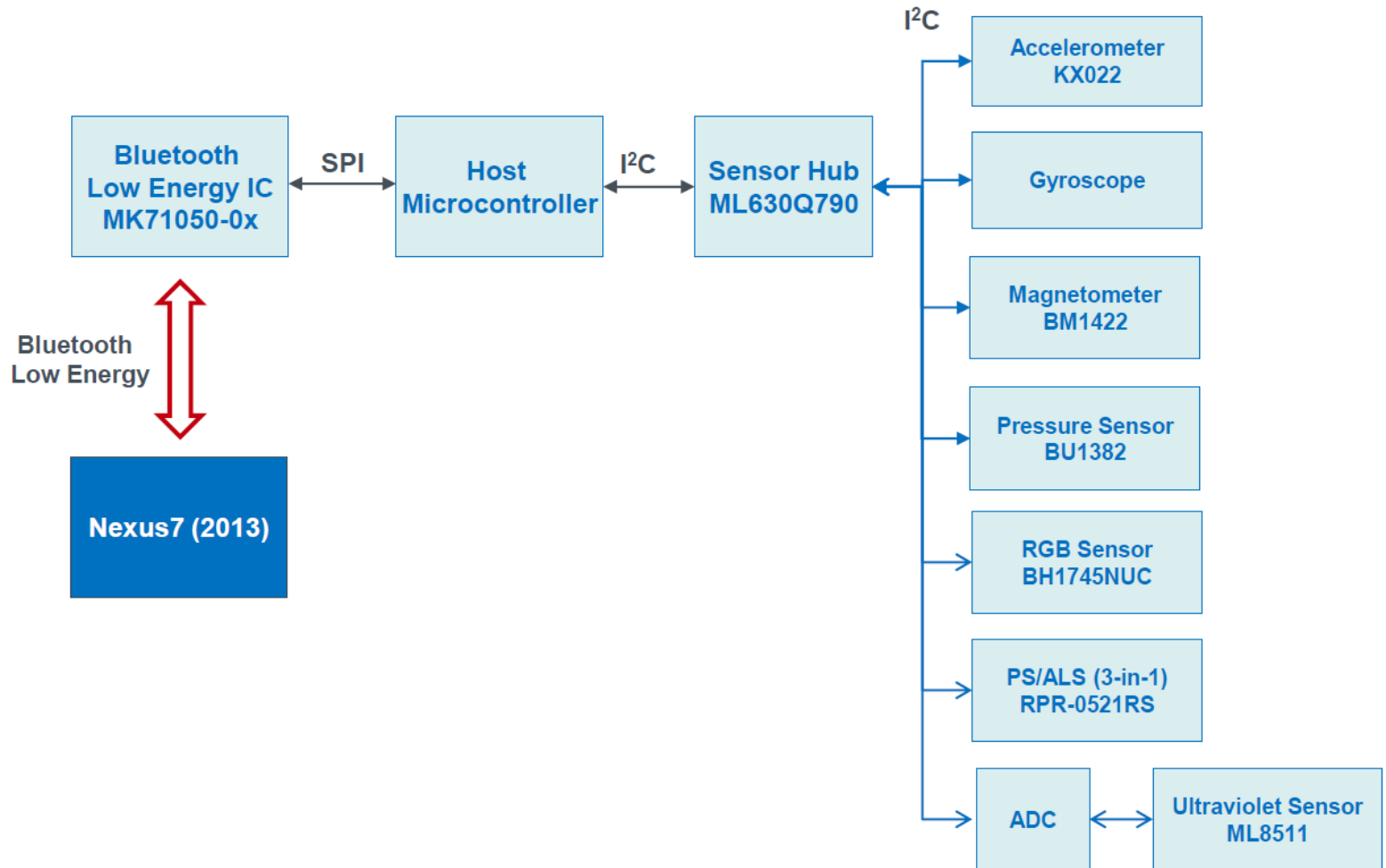
# Key Chassis



# Mounting Board



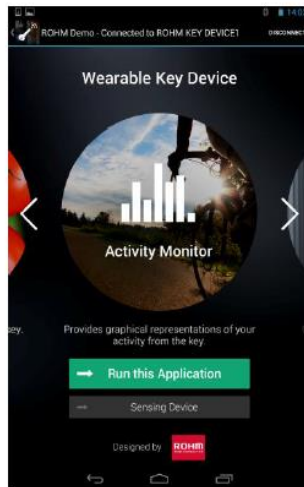
# Block Diagram



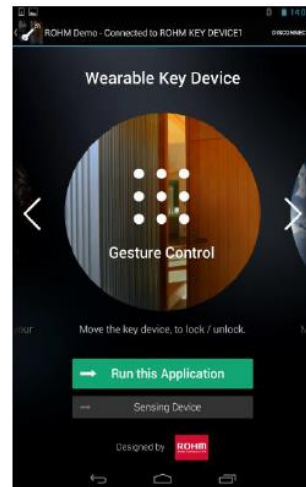
# Display Design

## Main Menu

Change Function with Swiping



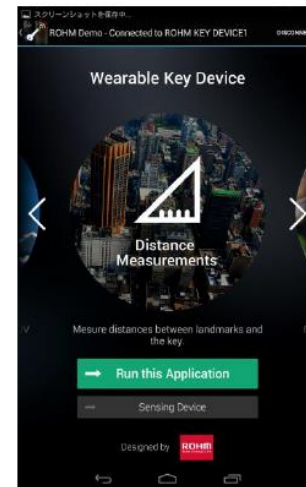
**Activity  
Monitor**



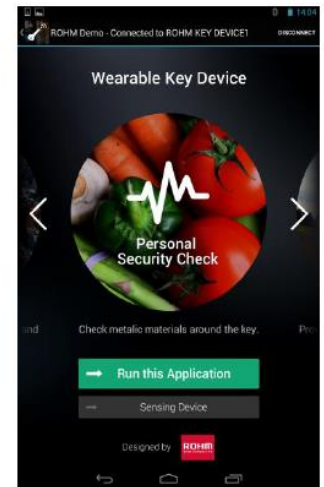
**Gesture  
Control**



**UV  
Monitor**



**Distance  
Measurement**



**Metal  
Detector**



# Application Examples

Accelerometer

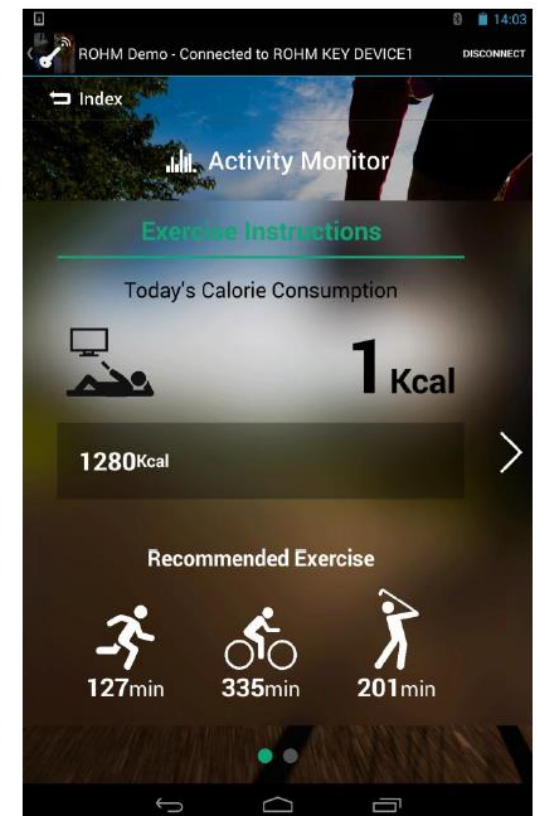
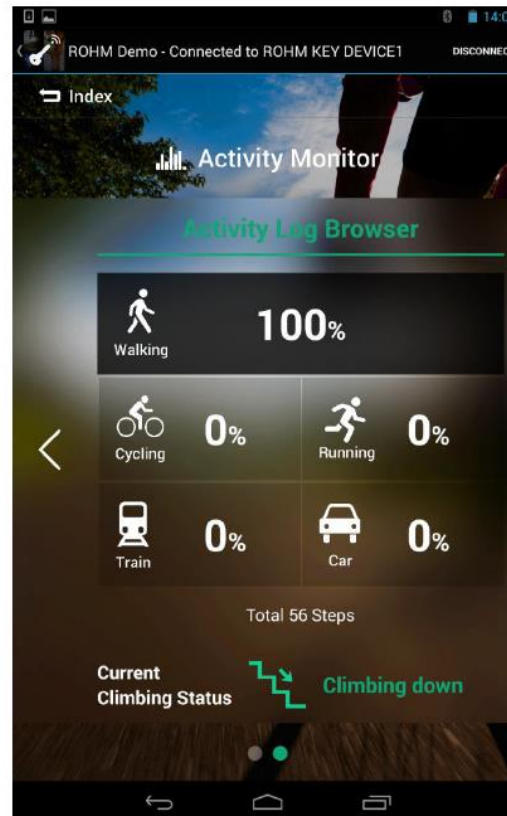
Barometric Pressure Sensor

## Activity Monitor

The lightweight form factor makes carrying effortless and unobtrusive. Not only can it measure calories burned and steps taken to promote better health & fitness, it can even detect when wearers are riding in a vehicle (i.e. bus, train, car) and track time traveled.

In addition, by simply wearing it around the neck or attaching it to a key ring on a belt loop or in a pocket, the device can notify users if they need to ramp up their activity to meet target goals or track progress during an exercise regimen.

Attach to a keychain or wear around your neck

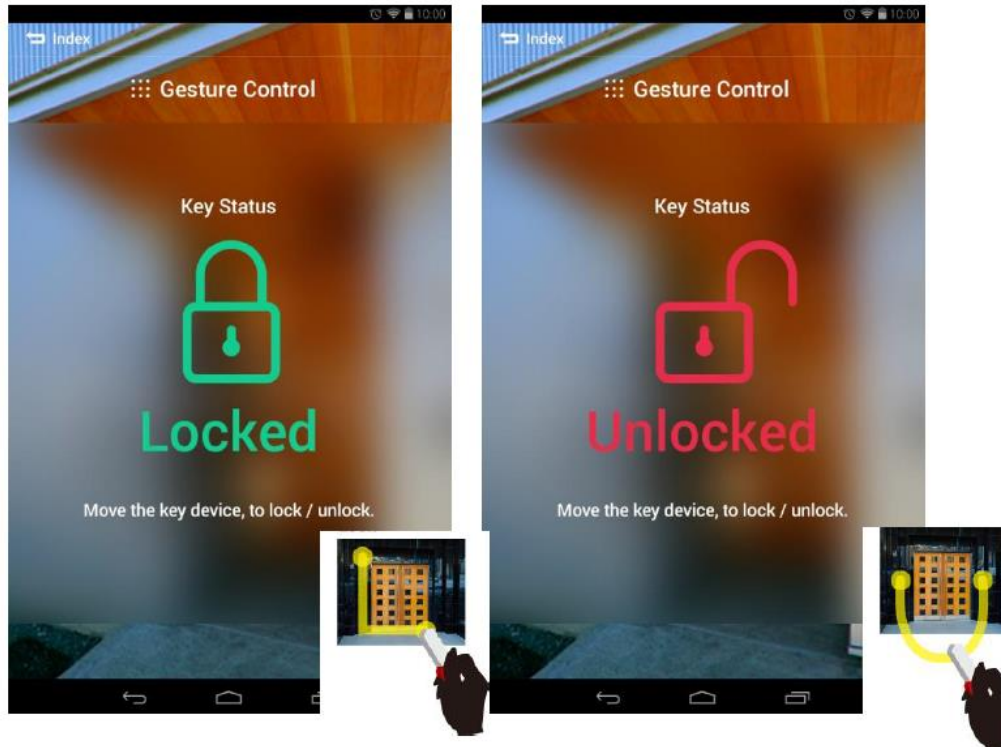


# Application Examples

Accelerometer Gyroscope

## Gesture Control

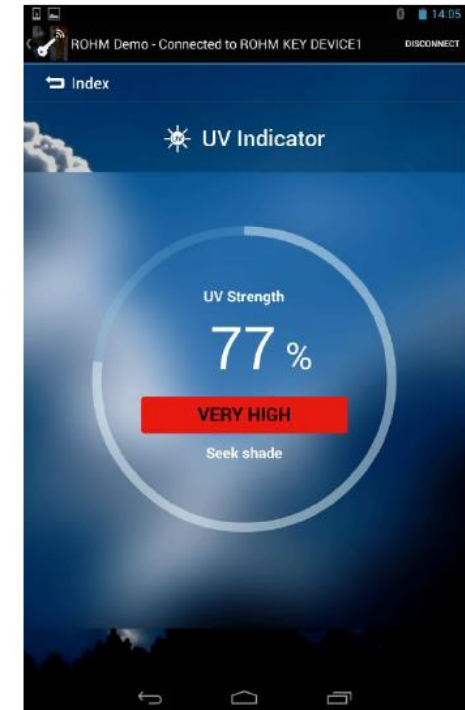
Lock and unlock doors by holding the Wearable Key Device and simply drawing a 'U' or 'L' in the air. Plus, users can verify whether the door is locked using a tablet or smartphone, providing greater security and peace of mind.



UV Sensor

## UV Monitor

Attaching the Wearable Key Device externally makes it possible to measure the amount of UV radiation to prevent sunburn or excessive exposure.



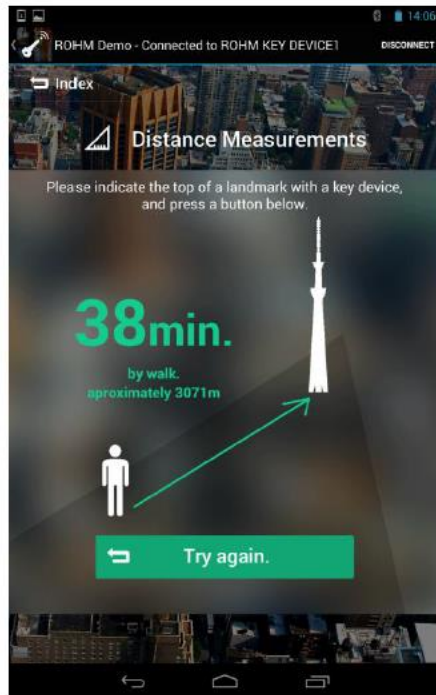


# Application Examples

## Accelerometer

### Distance Measurement

Register a destination building, then point the Wearable Key Device at the top of the building to instantly obtain the distance and approximate walking time



## Magnetometer

### Metal Detector

A high-precision MI sensor is included that can detect foreign metal objects in food and other locations

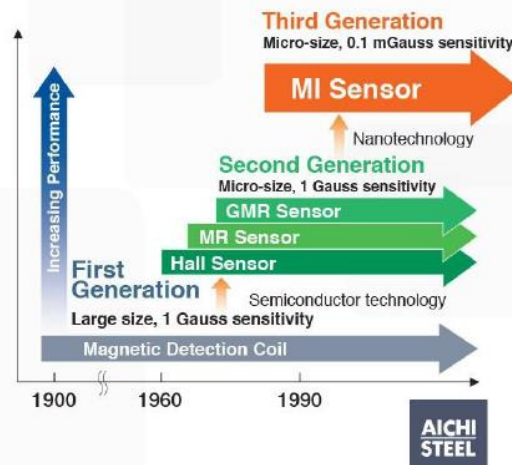


# Embedded Devices

## Magnetometer

### Ultra-High Sensitivity Through Nano-technology

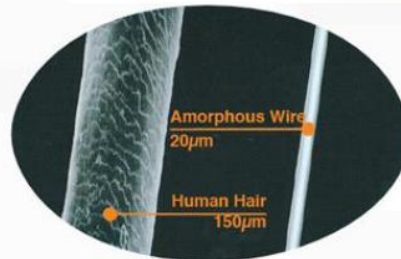
MI sensors can detect minute magnetic fields at the pT (pico Tesla) level – 10,000 times more sensitive than conventional magnetic sensors (i.e. Hall effect).



#### Amorphous Wire

A unique production method is used to create a 20μm amorphous FeCoSiB alloy magnetic wire without a crystalline structure.

Amorphous metal wire exhibits optimally soft magnetic properties and is an ideal material for high sensitivity magnetic sensors.



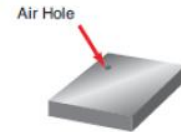
## Barometric Pressure Sensor

### [Features]

- Piezo-resistive MEMS
- Simple MEMS design results in a smaller size

### [Applications]

- Altitude detection (navigation) and weather forecasting (barometric detection) for smartphones and tablets



MEMS is used to detect the difference between atmospheric pressure and vacuum pressure, which is then converted to an electrical signal in order to measure the difference in altitude

# Embedded Devices

## Bluetooth Low Energy IC

### ML7105

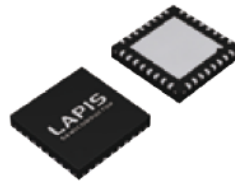
#### 【 Features 】

- Bluetooth® SIG Core Spec v4.0 compliant
- Integrated baseband controller compatible with Bluetooth® LE single mode
- Low power consumption RF block built in

#### 【 Specifications 】

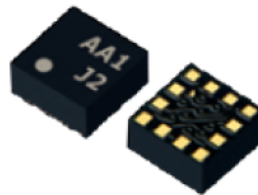
- Supply voltage: 1.6V (1.6V to 3.6V)
- Low current consumption
- Multiple interfaces included
  - SPI (SLAVE) / UART / I<sup>2</sup>C (Master/Slave)
- Compact package

\*Bluetooth® is a registered trademark of Bluetooth SIG, Inc.



## Accelerometer

- Low noise and low power: 0.9uA at standby, 10uA at low resolution, 145uA at high resolution
- Up to 14-bit resolution
- Integrated wake-up function
- 10pin (2x2x0.9mm) and 12pin (3x3x0.9mm) LGA package
- Dual programmable state machines [KXCNL]



## Sensor Hub MCU

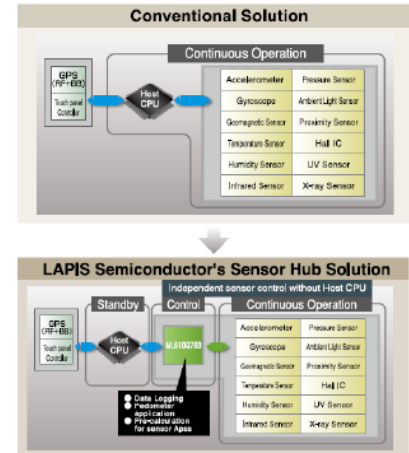
#### 【 Features 】

- Integrated control of multiple sensors in smartphones
- Sample sensor drivers and firmware available
- Sensors separated from main chipset, reducing power consumption considerably
- Equipped with Lapis Semiconductor's original high-performance 8bit RISC Core
- Low power consumption: 0.6uA or less in Halt mode
- Built-in 64KB Flash ROM supports on-board programming

#### 【 Applications 】

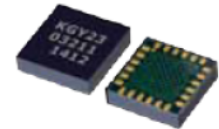
- Smartphones
- Sensor network modules

#### Sample Application: Smartphone



## Gyroscope

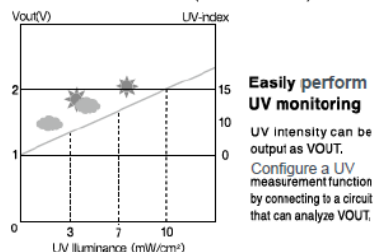
- 3.75mA operating current
- Full-scale range of  $\pm 256$ ,  $\pm 512$ ,  $\pm 1024$ , and  $\pm 2048$  °/sec
- I<sup>2</sup>C or SPI bus communication
- User-definable bandwidth
- Embedded temperature sensor



# Embedded Devices

## UV Sensor

- Optically senses UV rays
- Ensures uniform output voltage by trimming
- Analog voltage output proportional to UV light intensity
- Low current operation (300 $\mu$ A typ.), low standby current (0.1 $\mu$ A typ.)
- Compact, low-profile QFN package (4.0mm x 3.7mm x 0.73mm)
- A TSV-CSP version is currently being developed in an even smaller size (2.1mm x 1.8mm)

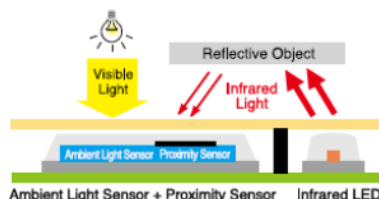


## Proximity Sensor

### ■ Proximity Sensor + Ambient Light Sensor IC

This sensor integrates an LED driver for driving an external infrared LED. Nearby objects are detected by sensing reflected light. An ambient light sensor is also built in for optimizing LCD brightness based on ambient conditions, increasing visibility while minimizing power consumption.

### ■ Optical Proximity Sensor IC - Operating Principle

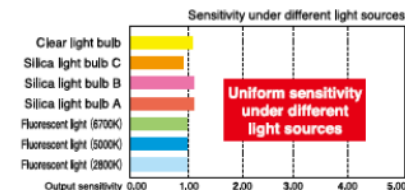


## Ambient Light Sensor

- Analog Current Output Type  
This easy-to-use series features current output with excellent linearity, resulting in a wide brightness range

- 16bit Serial Digital Output Type  
This type outputs data proportional to brightness in 16bit values and readily connects to digital systems via I<sup>2</sup>C bus

### ■ ROHM's Ambient Light Sensor IC



Ensures only a 10% difference in output sensitivity among different light sources

