

Use of ISP1880 Accelerometer-Magnetometer, Temperature and Barometer Sensor



Application Note AN181105

Introduction

Scope

This application note describes how to set up a Sensor demonstration with ISP1880 Sensors Board that will send data via the Bluetooth link to a Master Emulator or to an Android Device.

Two types of demonstration are presented. The first one is directly executable with hardware and software provided in the Development Kit using Master Control Panel application or “nRF Connect” application for Smartphone.

The second demonstration requires the use of an Android Device. The Android application is available on the Play Store.

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1. Hardware Description

ISP1880 Sensor Board has dimensions of 32 x 26.5 mm² and encloses:

- ✚ ISP1807-LR BLE module.
- ✚ ST Micro LPS22HB barometer sensor.
- ✚ ST Micro LSM9DS1 accelerometer / magnetometer / gyroscope sensor.
- ✚ Sensirion Humidity / Temperature sensor
- ✚ Jtag footprint for the programming
- ✚ USB female connector
- ✚ CR2032 battery holder
- ✚ Software to read/drive the sensors.

ISP1807-LR module is based on nRF52840 Nordic Semiconductor 2.4GHz wireless System on Chip (SoC) integrating a 2.4 GHz transceiver, a 32-bit ARM Cortex™-M4F CPU, a 1 MB flash memory, a 256 kB RAM and analog and digital peripherals.

It can support BLE, ANT/ANT+ and a range of proprietary 2.4 GHz protocols, such as Gazell from Nordic Semiconductor.

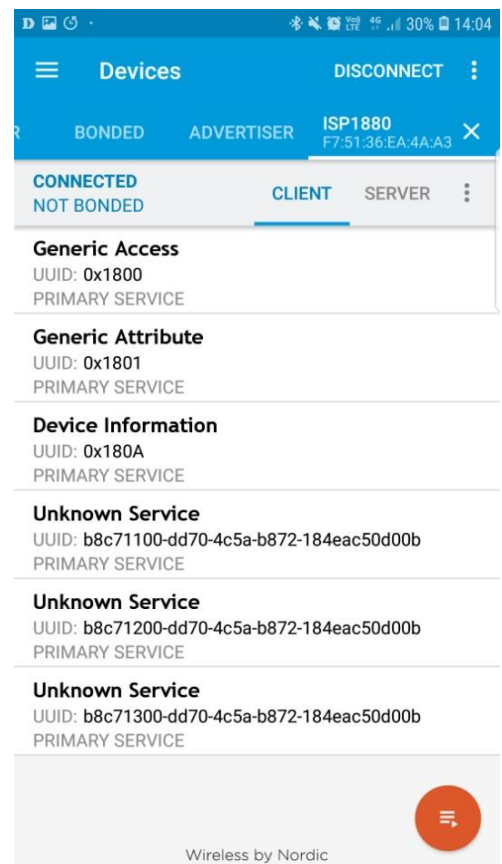
Fully qualified BLE stacks for nRF52840 are implemented in the S140 SoftDevices which can be freely downloaded. ISP1807 can then be used in Bluetooth Central, Peripheral, Observer or Broadcaster role with up to 20 connections and for both ends of other proprietary protocols. nRF52840 platform also provides extensive software support for ANT and THREAD applications.

Ultra-low power consumption and advanced power management enables battery lifetimes up to several years on a coin cell battery. Even though its very small size 8 x 8 x 1.0 mm, the module integrates decoupling capacitors, 32 MHz and 32.768 kHz crystals, load capacitors, DC-DC converter, RF matching circuit and antenna in addition to the wireless SoC.

2. Demonstration with Nordic Application “nRF Connect”

1. Download and install “nRF Connect” application available on the App Store (for iOS devices) and on the Play Store (for Android devices).
2. Place the CR2032 lithium battery into ISP1880 battery holder.
3. Launch “nRF Connect” application.
4. Scan and research the ISP1880 Sensor
5. Connect the device.
6. Once you are connected to the sensor, you can read the information related to the sensors by selecting the corresponding UUID (Universally Unique Identifier), for example:
 - a. UUID starting by *b8c71100* ... is related to the BLE configuration (connection interval, name of the device ...)
 - b. UUID starting by *b8c71200* ... is related to the environmental sensors: humidity, pressure and temperature
 - c. UUID starting by *b8c71300* ... is related to the motion sensor: accelerometer

Please refer to next pages for more information on the BLE services.
7. To switch off ISP1880 Sensor Board, remove battery.



Configuration Service

Base UUID: b8c7XXXX-dd70-4c5a-b872-184eac50d00b

General configuration Service UUID: 1100

Configuration stored in flash

Name	UUID	Type	Size	Description
Device name	1101	Write/Read	Max 10 bytes	Device name as ASCII string.
Advertising param	1102	Write/Read	3 bytes	Advertising parameters (in units): uint16_t - Adv interval in ms (unit 0.625 ms) min 32 -> 20 ms max 8000 -> 5 s uint8_t - Adv timeout in s (unit 1 s) min 0 -> 0 s max 180 s -> 3 min
Connection param	1103	Write/Read	8 bytes	Connection parameters: uint16_t - Min conninterval (unit 1.25 ms) min 6 -> 7.5 ms max 3200 -> 4 s uint16_t - Max conninterval (unit 1.25 ms) Same as above. uint16_t - Slave latency Range 0-499 uint16_t - Supervision timeout Min 10 -> 100 ms Max 3200 -> 32 s

Environment Sensors Service

Base UUID: b8c7XXXX-dd70-4c5a-b872-184eac50d00b

General configuration Service UUID: 1200

Configuration stored in flash

Name	UUID	Type	Size	Description
Configuration	1201	Write/Read	6 bytes	Configure sensor timings: uint16_t - Temperature interval in ms (100 ms - 5000 ms). uint16_t - Pressure interval in ms (50 ms - 5000 ms). uint16_t - Humidity interval in ms (100 ms - 5000 ms)

Name	UUID	Type	Size	Description
Temperature	1202	Notify	4 bytes	Temperature in Celsius. Single Precision Floating-Point format
Pressure	1203	Notify	4 bytes	Pressure in hPa. Single Precision Floating-Point format
Humidity	1204	Notify	4 bytes	Relative humidity in %. Single Precision Floating-Point format

Motion Service

Base UUID: b8c7XXXX-dd70-4c5a-b872-184eac50d00b

General configuration Service UUID: 1300

Configuration stored in flash

Name	UUID	Type	Size	Description
Configuration	1301	Write/Read	2 bytes	uint16_t - interval in ms (50 ms - 5 s)
Gravity vector	1302	Notify	12 bytes	Attitude represented by a gravity vector: float - x float - y float - z
Angular rotation vector	1303	Notify	12 bytes	Attitude represented by an angular rotation vector: float - x float - y float - z
Magnetization vector	1304	Notify	12 bytes	Attitude represented by a magnetization vector: float - x float - y float - z
Quaternion	1305	Notify	16 bytes	Attitude represented with quaternions: float - w float - x float - y float - z
Euler	1306	Notify	12 bytes	Attitude represented in Euler angles (16Q16 fixed point) float - roll [degrees] float - pitch [degrees] float - yaw [degrees]
Rotation matrix	1307	Notify	18 bytes	Attitude in rotation matrix : float - 3 x 3 matrix
Heading	1308	Notify	4 bytes	Heading : float - Heading [degrees]

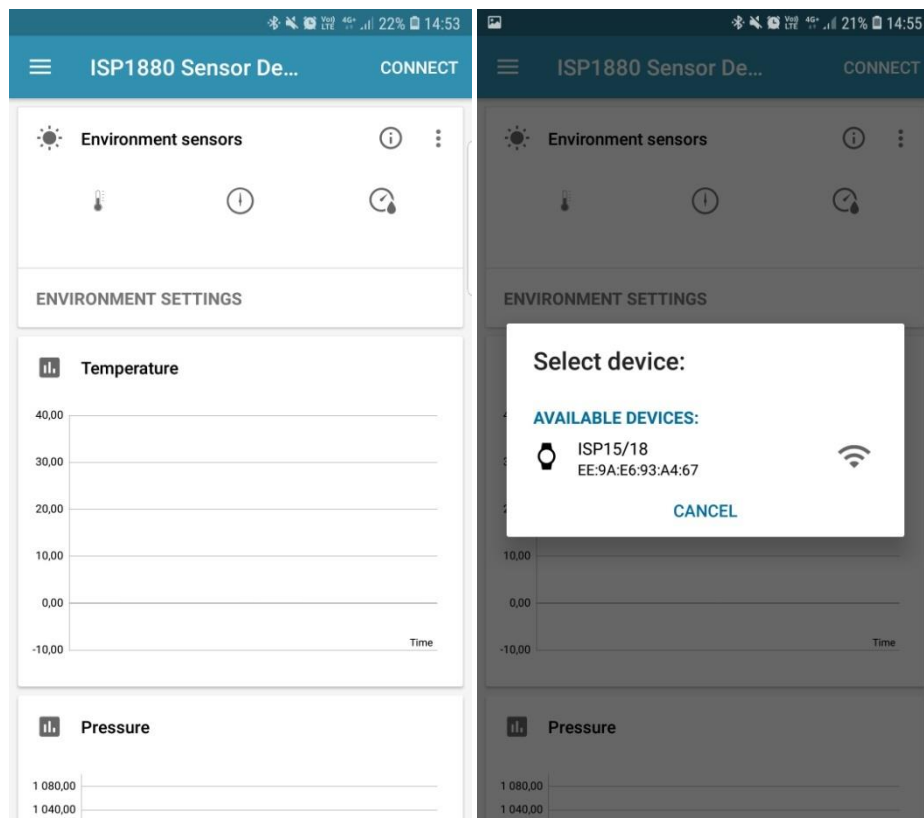
3. Demonstration with Android Device

An App is available for Android Devices. The android App is a demonstration App that is provided “as is” in order to demonstrate the Smart Bluetooth sensor node.

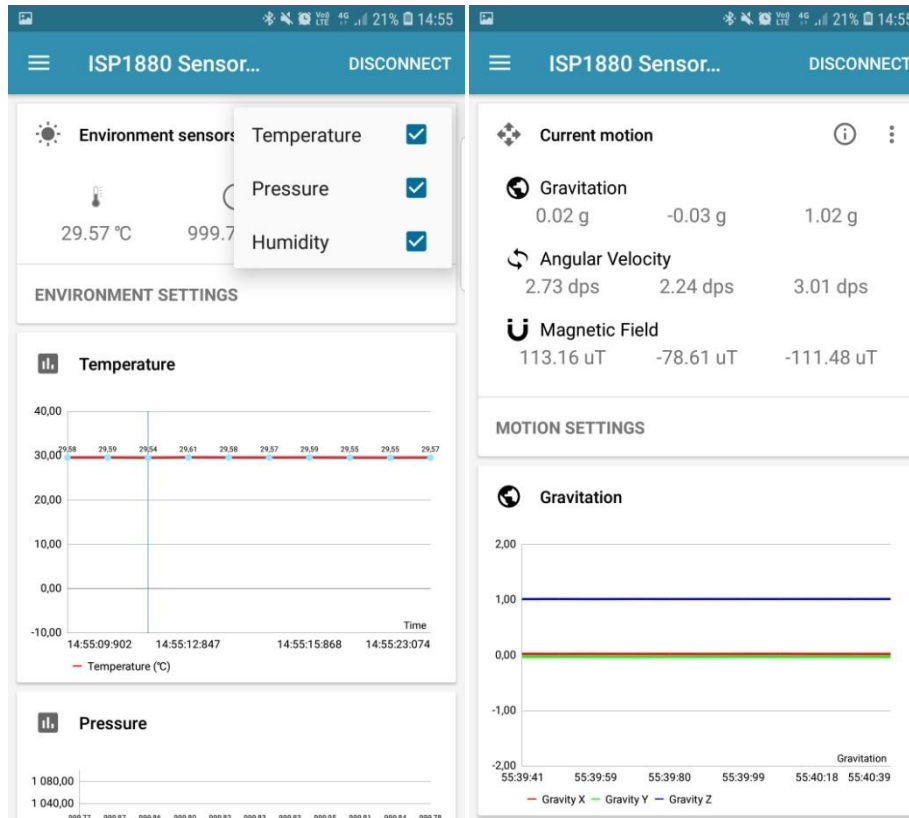
Make sure your Android device is compatible with Bluetooth 4.0 (Android v4.3 at least).

After the “sip sensor” application is downloaded and installed (you need to validate the permission during the installation) you should see the application on your Android device. Then you will be able to set up the application demonstration as follows:

1. Place the CR2032 lithium battery into the battery holder.
2. Start “Sensor” application on your Android, click Connect and select your Sensor Board (ISP1880)



3. For the environmental sensors, you have the information on the main screen of the app.



4. For the motion sensor, click on the top left part of the screen to move to the motion sensor. A calibration phase is needed to ensure a good motion. We invite you to rotate the ISP1880 Sensor Board. Then you can move the sensor on all the direction you want to see the plane moving in real time.

