ELE410 prototype’s BLE specification

Object

The ELE410 prototype is a Motion MEMS and environmental sensors Bluetooth Low Energy device.

ELE410 prototype is composed of:

- A mother board, NUCLEO-F401RE, with a button and a LED.
- A sensor daughter board, X-NUCLEO-IKS01A1, with motion MEMS and environmental sensors.
- A BLE daughter board, X-NUCLEO-IDB04A1

It proposes 5 GATT services:

- A LED controler
- A button press counter
- A raw data access to the motion MEMS data
- A raw data access to the environmental sensors
- A motion detection service

This document specifies the behavior expected for this device regarding those services.
It defines its bluetooth configuration, the GATT services, characteristics and the behavior awaited accessing those characteristics.

Device identification

Device name

The device name is used to represent a device after connection. It is accessible through the device name characteristic of the GAP service.
Its size has to be less than 8 bytes. (BlueNRG limitation)
Its format has to be as follows : **teamX** with X your team number in decimal.

Local name

The local name is used in advertising packets to represent the device.
Its format has to be as follows : **ele410_teamX** with X your team number in decimal

Bluetooth Address (MAC address)

Every bluetooth device has a unique MAC address.
You will have to set the MAC address of your device.
Its format has to be as follow : **CC:45:4C:45:00:XX** with XX your team number in hexadecimal (i.e. team 58 will have this MAC address, CC:45:4C:45:00:3A).

Note : the MAC addresses are dealt with in Little endian in the Bluetooth stack and thus in the Bluenrg ACI. Pay attention to the way you see MAC addresses in the code and how you see it displayed by your smartphone.

Device Connectivity

To control and limit discoverability, the discoverability and connectability mode is controlled by the user button.
By default the device is in undirected connectable mode.
A long press on the user button sets for 120 seconds the device in general discoverable mode.
After this time the device is set back to undirected connectable mode.

GATT Services and Characteristics

LED control service

Service description

Description	The LED service's goal is to give the control of the LED.
UUID	afceb8e0-0377-11e0-a5c2-0002a5d5c51b

Characteristics

It is composed of the following GATT characteristic:

The LED characteristic

Description	Reading the value of this characteristic returns the state of the LED (on or off). Writing a value on this characteristic changes the state of the LED (on or off).
UUID	a4c3ffc1-aa17-11e0-5aba-0002a5d5c51b
Properties	Read/Write
Value size	1 byte
Value format	0 represents off state 1 represents on state

Counter service

Service description

Description	The counter service's goal it to give access to a counter value. On start of the firmware, the value of the counter is set to 0. Each time we press the User button, the value of the counter is incremented.
UUID	c609b3c3-09f8-11e7-539a-0002a5d5c51b

Characteristic

It is composed of the following GATT characteristic:

The counter characteristic

Description	Reading the value of this characteristic returns the current value of this counter. Each time the value of the counter changes, a **notify** is sent to the devices that have subscribed to it.
UUID	9ab6739c-0065-11e7-11d7-0002a5d5c51b
Properties	Read/Notify
Value size	2 bytes
Value format	Unsigned little-endian

Accelerometer service

Service description

Description	The accelerometer service's goal is to give access to the data of the accelerometer sensor data.
UUID	02366e80-cf3a-11e1-9ab4-0002a5d5c51b

Characteristic

It is composed of the following GATT characteristic:

The accelerometer characteristic

Description	Reading the value of this characteristic returns the current value of the 3 axes of the accelerometer. Every 500ms a notify is sent with the current data of the accelerometer.
UUID	340a1b80-cf4b-11e1-ac36-0002a5d5c51b
Properties	Read/Notify
Value size	6 bytes
Value format	2 bytes signed little-endian representing the X axis 2 bytes signed little-endian representing the Y axis 2 bytes signed little-endian representing the Z axis

Environmental Sensor service

Service description

Description	The environmental sensor service's goal is to give access to the temperature sensor, the pressure sensor, and the humidity sensor.
UUID	42821a40-e477-11e2-82d0-0002a5d5c51b

Characteristics

It is composed of the following GATT characteristics:

The temperature characteristic

Description	Reading the value of this characteristic returns temperature sensor current value.
UUID	a32e5520-e477-11e2-a9e3-0002a5d5c51b
Properties	Read
Value size	2 bytes
Value format	Signed little-endian

The pressure characteristic

Description	Reading the value of this characteristic returns pressure sensor current value.
UUID	cd20c480-e48b-11e2-840b-0002a5d5c51b
Properties	Read
Value size	3 bytes
Value format	Signed little-endian

The humidity characteristic

Description	Reading the value of this characteristic returns humidity sensor current value.
UUID	01c50b60-e48c-11e2-a073-0002a5d5c51b
Properties	Read
Value size	2 bytes
Value format	Unsigned little-endian

Motion service

The device interprets the raw data of the accelerometer to detects motions.
They are separated into 2 categories, the inclination motions, and the noticeable motions.
The inclinations detections can be on the **left/right** axis, **back/front** axis, or both.

Each inclination has a side, on the left/right axis there is the left side and right side, on the back/front axis there is the back side and front side.

Each inclination has a degree:

- **None:** 0°
- **Medium**: 30°
- **High**: 60°

The noticeable motions are the up motion and the down motion.

NOTE : these detections correspond to those made in “session3 - mems”

Service description

Description	The motion service's goal is to give access to interpreted motion detections
UUID	ac59af24-7819-11e3-9c62-0002a5d5c51b

Characteristics

It is composed of the following GATT characteristics:

The inclination characteristic

Description	Reading the value of this characteristic returns the current inclination of the board. When the board changes to a different inclination a notify is sent with its new inclination.
UUID	53fcb392-1029-11e3-6390-0002a5d5c51b
Properties	Read/Notify
Value size	4 bytes
Value format	byte 1 : left/right axis inclination side (none: 0, left: 1, right: 2) byte 2 : left/right axis inclination degree (none: 0, medium: 1, high: 2) byte 3 : back/front axis inclination side (none: 0, back: 1, front: 2) byte 4 : back/front axis inclination degree (none: 0, medium: 1, high: 2)

The motion characteristic

Description	This characteristic notifies when a new motion has been detected.
UUID	fb35097d-6723-11e3-f456-0002a5d5c51b
Properties	Notify
Value size	1 byte
Value format	0: down 1: up