



WIMOTO – BLE SMART DEVICE USER GUIDE – VER 0.3.0

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1 Introduction

Wimoto is developing a smart device which integrates many sensors for BLE climate profile (temperature, humidity, light level), Grow profile (light, temperature, soil moisture) and Sentry profile (passive infrared, accelerometer), Thermo profile (probe (NT) C temperature, thermopile temperature) and Water Profile (water presence, water level) on Nordic semiconductor nrf51822 based hardware platform. This device can be configured and managed by corresponding app on mobile devices like iPhone, Android and a proprietary gateway.

This release contains both the Climate, Grow, Water and Thermo profiles and the driver codes for TMP102, TMP006, ISL29023, HTU21D, MMA7660FC sensor module driver codes. Driver codes for analog sensors such as soil moisture, water level and probe temperature level sensors are also included.

This document provides details on how to get the source code working on the target hardware. This also provides details on how the source code is organized and what is to be done in case of any problems.

2 Initial Setup

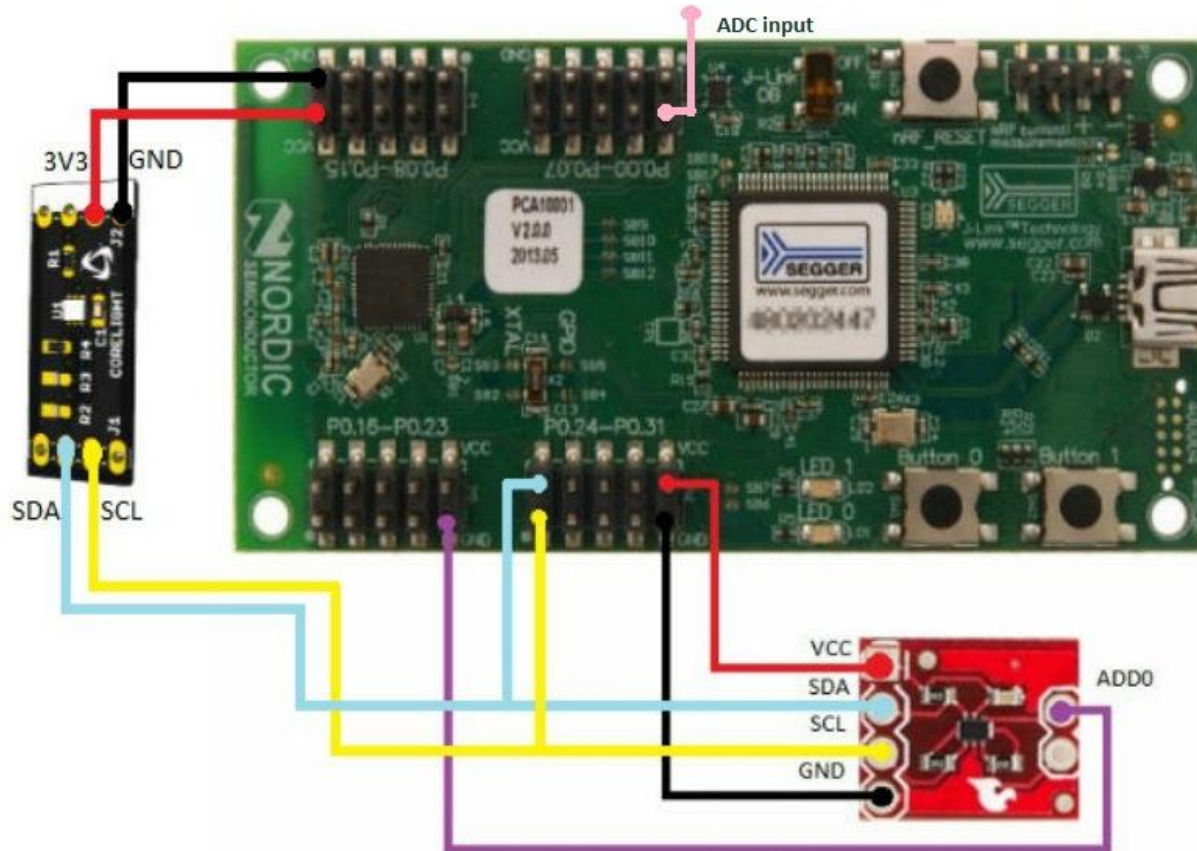
- Download the code from the folder WimotoBle
- Install the required software.
 - Keil uVision
 - J-Link drivers for JTAG interface.
 - nRF51822 software
 - nRFgo Studio
 - nRF51 Software Development Kit (SDK)
 - S110 nRF51822 Soft Device
 - Master Control Panel
- Copy the folder ble_wimoto_clim_app / ble_wimoto_grow_app / ble_wimoto_water_app / ble_wimoto_thermo_app to the nrf51822\Board\pca10001\ble folder in the nrf51_sdk directory.
- Open the project in Keil uVision.
- Build the project.

3 Hardware Setup

3.1 Climate Profile

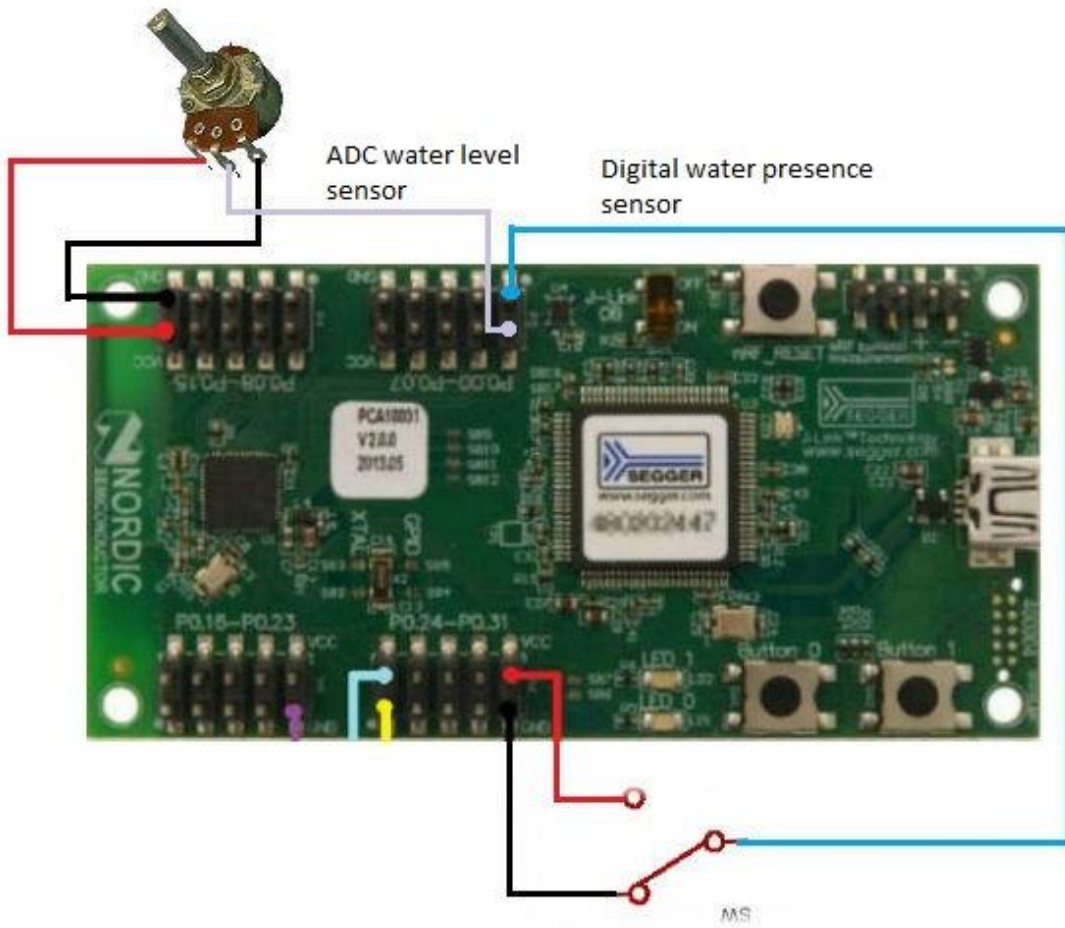
Note: Since the HTU21D temperature and humidity sensor was not available, climate profile was not tested with sensors. However the embedded code was tested using hard coded values and the results were as expected and found to be working properly

3.2 Grow Profile



- Interface the TMP102 module, ISL29023 module and analogue Soil Moisture sensor with nRF51822 Evaluation Kit board as shown below
- Power up the board from USB attached to Windows PC.
- Do-not connect nRF51822 Development Dongle while programming nRF51822 Evaluation Kit board
- Download the hex file created to the evaluation board.

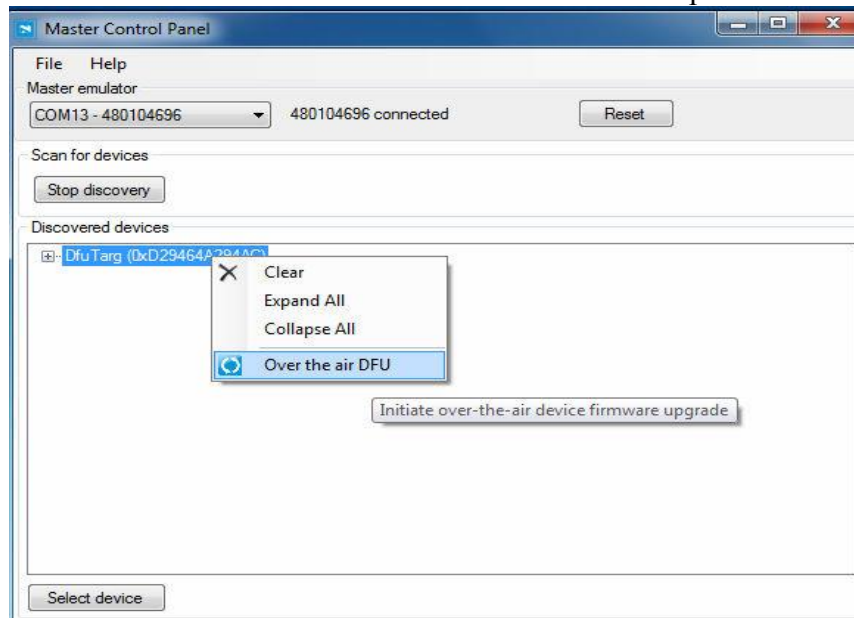
3.3 Water Profile



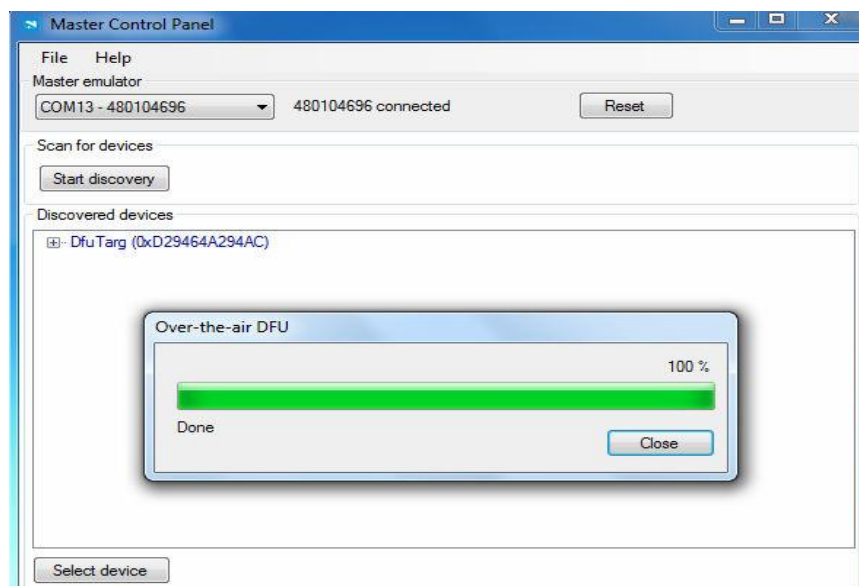
- Interface the sensors for the Water profile
- Power up the board from USB attached to Windows PC.
- Do-not connect nRF51822 Development Dongle while programming nRF51822 Evaluation Kit board
- Download the hex file created to the evaluation board.

3.4 Bootloader

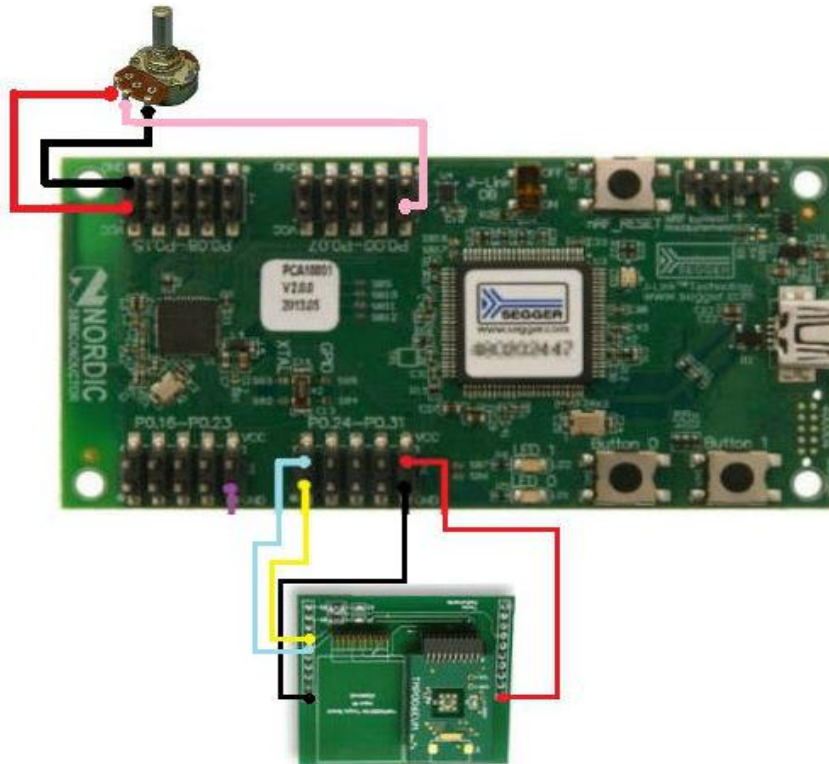
- Power up the board from USB attached to Windows PC.
- Do-not connect nRF51822 Development Dongle while programming nRF51822 Evaluation Kit board
- Download the hex file created to the evaluation board
- For DFU right click on the master and select the option “Over the air DFU” , then from the new window select the ‘hex’ file of the new firmware to be uploaded



- After 100% done response close the DFU window and start the discovery so the Master Control Panel shows the new image updated



3.5 Thermo Profile



- Interface the sensors for the Thermo profile
- Power up the board from USB attached to Windows PC.
- Do-not connect nRF51822 Development Dongle while programming nRF51822 Evaluation Kit board
- Download the hex file created to the evaluation board.

4 Execution

4.1 Climate Profile

- Connect the nRF51822 Development Dongle to USB of the PC. Power up the evaluation board.
- Open the Master Control Panel version 3.5 in PC.(Provides the API for device firmware update)
- From the option 'Master Emulator', select the segger serial number of the development dongle and click 'Start Discovery'.
- Master control panel will show the grow profile alarm service continuously
- To connect to the alarm service, select the device Wimoto_Clim and click 'Select device'.
- Click 'Service discovery'. All the characteristics in the service will be displayed. Click 'Enable services'.
- In the first primary service will Uuid 1523, six characteristic fields will be displayed.
 - Uuid 1524 - Current Temperature
 - Uuid 1525 - Temperature low value(for the alarm)
 - Uuid 1526 - Temperature high value
 - Uuid 1527 - Temperature Alarm set
 - Uuid 1528 - Temperature Alarm
- In the second primary service will Uuid 1529, five characteristic fields will be displayed.
 - Uuid 1530 - Current Light level
 - Uuid 1531 - Light level low value (for the alarm)
 - Uuid 1532 - Light level high value
 - Uuid 1533 - Light level Alarm set
 - Uuid 1534 - Light level Alarm
- In the third primary service will Uuid 1535, five characteristic fields will be displayed.
 - Uuid 1536 - Current Humidity level
 - Uuid 1537 - Humidity low value (for the alarm)
 - Uuid 1538 - Humidity high value
 - Uuid 1539 - Humidity Alarm set
 - Uuid 1540 - Humidity Alarm
- In the fourth primary service with UUID 1900, the Data logger service is advertised. It contains three characteristic fields.
 - Uuid 1901 - Characteristics to enable data logger service(En)
 - Uuid 1902 - The data characteristics which is the actual data received from the peripheral device.(D)
 - Uuid 1903 - The characteristics to start downloading data from the peripheral device(Do)
- In the fifth primary service will Uuid 1560, two characteristic fields will be displayed.
 - Uuid 1561 - Device Firmware Update Mode Set (DFU)
 - Uuid 1562 - Switch Mode Set
- The High and Low values for checking alarm condition in Temperature low/high, Light level low/high and Humidity low/high values can be set by, clicking on the

corresponding characteristic field (UUID), enter a new value in the “**value box**” shown below the characteristics and click on 'Send update'

- To set alarm, change the Alarm set value (UUID 1527-temperature/1533-light level/1539-humidity) to 01. If the current value read from the sensor is less than the low value, the Alarm field to the corresponding service (UUID 1528-temperature/1534-light level/1540-humidity) will show 0x01. If the value read from the sensor is greater than the high value, the alarm field will show 0x02.
- To turn off the alarm, update the Alarm set field to 0x00 of the corresponding services.
- To go to the Broadcast mode, set Mode Switch set value to 0x01 (UUID 1562) in Device management service and click 'disconnect', click 'back' and start discovery by clicking 'start discovery'.
- To go to the Device Firmware Update mode, set DFU Mode set value to 0x01 (UUID 1562) in Device management service and click 'disconnect', click 'back' and start discovery by clicking 'start discovery'. Then the bootloader gets loaded and by right clicking in the panel select the option “Over the air DFU” and browse for the new firmware to be loaded and update. The new firmware is the ‘hex’ file found in the ‘build’ folder of corresponding project. After 100% completion message the new firmware gets loaded on the device
- In the temperature broadcast, the service data with UUID 1523 shows the current temperature and UUID 1529 shows the current light level and UUID 1535 shows current humidity value.
- The embedded application code stays in the Broadcast mode until a power on reset or software reset is incurred

Data Logger Service

- To enable data logger service, set the characteristics 1901(En) to 0x01. The application will start logging data to the flash. To download data from the peripheral, set the characteristics 1903(Do) to 0x01. The application will stop data logging and starts to send data to the connected central device. The data field is an unsigned integer array of size 16. The data format is as given below. Currently the time stamp is hardcoded to 2013-11-21 11:50:00, since the real time clock is not yet realized.

The 1st 2 bytes contains the year.

The 3rd byte contains the month.

The 4th byte contains day.

The 5th and 6th byte contains Hour.

The 7th byte contains Minutes.

The 8th byte contains Seconds.

The 9th and 10th bytes contains the temperature.

The 11th and 12th bytes contains light level.

The last 4 bytes contains the humidity level.

An example of the data array received in master control panel is 07DD0B15000B32000101020200000055 which is arranged as shown below

07DD	0B 15	000B	32 00	0101	0202	00000055
↓	↓	↓	↓	↓	↓	↓
2013	11	21	11	50 00	temperature	light level
(Time stamp)						Humidity Level

○

4.2 Grow Profile

- Connect the nRF51822 Development Dongle to USB of the PC. Power up the evaluation board.
- Open the Master Control Panel in PC.
- From the option 'Master Emulator', select the segger serial number of the development dongle and click 'Start Discovery'.
- Master control panel will show the grow profile alarm service continuously
- To connect to the alarm service, select the device Wimoto_Clim and click 'Select device'.
- Click 'Service discovery'. All the characteristics in the service will be displayed. Click 'Enable services'.
- In the first primary service with Uuid 1523, six characteristic fields will be displayed.
 - Uuid 1524 - Current Temperature
 - Uuid 1525 - Temperature low value(for the alarm)
 - Uuid 1526 - Temperature high value
 - Uuid 1527 - Temperature Alarm set
 - Uuid 1528 - Temperature Alarm
 - Uuid 1555 - Mode Switch set
- In the second primary service with Uuid 1529, five characteristic fields will be displayed.
 - Uuid 1530 - Current Light level
 - Uuid 1531 - Light level low value (for the alarm)
 - Uuid 1532 - Light level high value
 - Uuid 1533 - Light level Alarm set
 - Uuid 1534 - Light level Alarm
- In the third primary service with Uuid 1550, five characteristic fields will be displayed.
 - Uuid 1551 - Current soil moisture level
 - Uuid 1552 - Soil moisture low value (for the alarm)
 - Uuid 1553 - Soil moisture high value
 - Uuid 1554 - Soil moisture Alarm set
 - Uuid 1555 - Soil moisture Alarm
- In the fourth primary service with UUID 1900, the Data logger service is advertised. It contains three characteristic fields.
 - Uuid 1901 - Characteristics to enable data logger service(En)
 - Uuid 1902 - The data characteristics which is the actual data received from the

peripheral device.(D)

Uuid 1903 - The characteristics to start downloading data from the peripheral device(Do)

- In the fifth primary service with Uuid 1560, two characteristic fields will be displayed.
 - Uuid 1561 - Device Firmware Update Mode Set (DFU)
 - Uuid 1562 - Switch Mode Set
- The High and Low values for checking alarm condition in Temperature low/high, Light level low/high and Soil moisture low/high values can be set by, clicking on the corresponding characteristic field (UUID), enter a new value in the “**value box**” shown below the characteristics and click on 'Send update'
- To set alarm, change the Alarm set value (UUID 1527-temperature/1533-light level/1554-soil moisture) to 01. If the current value read from the sensor is less than the low value, the Alarm field to the corresponding service (UUID 1528-temperature/1534-light level/1555-soil moisture) will show 0x01. If the value read from the sensor is greater than the high value, the alarm field will show 0x02.
- To turn off the alarm, update the Alarm set field to 0x00 of the corresponding services.
- To go to the Broadcast mode, set Mode Switch set value to 0x01 (UUID 1562) in Device management service and click 'disconnect', click 'back' and start discovery by clicking 'start discovery'.
- To go to the Device Firmware Update mode, set DFU Mode set value to 0x01 (UUID 1562) in Device management service and click 'disconnect', click 'back' and start discovery by clicking 'start discovery'. Then the DFU image gets loaded and by right clicking in the panel select the option “Over the air DFU” and browse for the firmware to be loaded and update. After 100% completion message the new firmware gets loaded on the device
- In the broadcast service, the service data with UUID 1523 shows the current temperature and UUID 1529 shows the current light level and UUID 1550 shows current humidity value.
- The embedded application code stays in the Broadcast mode until a power on reset or software reset is incurred

Data Logger Service

- To enable data logger service, set the characteristics 1901(En) to 0x01. The application will start logging data to the flash. To download data from the peripheral, set the characteristics 1903(Do) to 0x01. The application will stop data logging and starts to send data to the connected central device. The data field is an unsigned integer array of size 16. The data format is as given below. Currently the time stamp is hardcoded to 2013-11-21 11:50:00, since the real time clock is not yet realized.

The 1st 2 bytes contains the year.

The 3rd byte contains the month.

The 4th byte contains day.

The 5th and 6th byte contains Hour.

The 7th byte contains Minutes.

The 8th byte contains Seconds.

The 9th and 10th byte contains the temperature.

The 11th and 12th byte contains light level.
The last 4 bytes contains the soil moisture level.

An example of the data array received in master control panel is 07DD0B15000B32000101020200000003 which is arranged as shown below

07DD	0B	15	000B	32	00	0101	0202	00000003
↓	↓	↓	↓	↓	↓	↓	↓	↓
2013	11	21	11	50	00	temperature	light level	soil moisture level
(Time stamp)								

4.3 Water Profile

- Connect the nRF51822 Development Dongle to USB of the PC. Power up the evaluation board.
- Open the Master Control Panel in PC.
- From the option 'Master Emulator', select the segger serial number of the development dongle and click 'Start Discovery'.
- Master control panel will show the Water profile alarm service continuously
- To connect to the alarm service, select the device Wimoto_Water and click 'Select device'.
- Click 'Service discovery'. All the characteristics in the service will be displayed. Click 'Enable services'.
- In the first primary service will Uuid 1573, six characteristic fields will be displayed.
 - Uuid 1574. - Current Water Presence
 - Uuid 1575 - Water Presence Alarm Set
 - Uuid 1576 - Water Presence Alarm
- In the second primary service will Uuid 1580, five characteristic fields will be displayed.
 - Uuid 1581 - Current Water level
 - Uuid 1582 - Water level low value (for the alarm)
 - Uuid 1583 - Water level high value
 - Uuid 1584 - Water level Alarm set
 - Uuid 1585 - Water level Alarm
 - Uuid 1586 - Mode Switch set
- The High and Low values for checking alarm condition in Water level low/high values can be set by, clicking on the corresponding characteristic field (UUID), enter a new value in the “**value box**” shown below the characteristics and click on 'Send update'
- To set alarm, change the Alarm set value (UUID 1575-water presence/ UUID 1584 water level) to 01. If the current value read from the sensor is less than the low value, the Alarm field to the corresponding service (UUID 1528-temperature) will show 0x01. If the value read from the sensor is greater than the high value, the alarm field will show 0x02.
- To turn off the alarm, update the Alarm set field to 0x00 of the corresponding services.
- To go to the Broadcast mode, set Mode Switch in Water level service to 0x01 (UUID 1586) and click 'disconnect', click 'back' and start discovery by clicking 'start discovery'.
- In the broadcast service, the service data with UUID 1573 shows the current water presence and UUID 1580 shows the current water level.
- The embedded application code stays in the Broadcast mode until a power on reset or software reset is incurred

4.4 Thermo Profile

- Connect the nRF51822 Development Dongle to USB of the PC. Power up the evaluation board.
- Open the Master Control Panel in PC.
- From the option 'Master Emulator', select the segger serial number of the development dongle and click 'Start Discovery'.
- Master control panel will show the grow profile alarm service continuously
- To connect to the alarm service, select the device Wimoto_Thermo and click 'Select device'.
- Click 'Service discovery'. All the characteristics in the service will be displayed. Click 'Enable services'.
- In the first primary service will Uuid 1593, six characteristic fields will be displayed.
 - Uuid 1594 - Current Thermopile Temperature (TE)
 - Uuid 1595 - Thermopile Temperature low value (for the alarm) (L)
 - Uuid 1596 - Thermopile Temperature high value (H)
 - Uuid 1597 - Thermopile Temperature Alarm set (S)
 - Uuid 1598 - Thermopile Temperature Alarm (A)
 - Uuid 1599 - Mode Switch set (M)
- In the second primary service will Uuid 1563, five characteristic fields will be displayed.
 - Uuid 1564 - Current Probe Temperature level (PT)
 - Uuid 1565 - Probe Temperature level low value (for the alarm) (L)
 - Uuid 1566 - Probe Temperature level high value (H)
 - Uuid 1567 - Probe Temperature level Alarm set (A)
 - Uuid 1568 - Probe Temperature level Alarm (M)
- The High and Low values for checking alarm condition in Thermopile Temperature low/high, Probe Temperature level low/high values can be set by, clicking on the corresponding characteristic field (UUID), enter a new value in the “**value box**” shown below the characteristics and click on 'Send update'
- To set alarm, change the Alarm set value (UUID 1598- Thermopile Temperature /1567- Probe Temperature) to 01. If the current value read from the sensor is less than the low value, the Alarm field to the corresponding service (UUID 1599- Thermopile Temperature /1568- Probe Temperature) will show 0x01. If the value read from the sensor is greater than the high value, the alarm field will show 0x02.
- To turn off the alarm, update the Alarm set field to 0x00 of the corresponding services.
- To go to the Broadcast mode, set Mode Switch set value to 0x01 (UUID 1599) and click 'disconnect', click 'back' and start discovery by clicking 'start discovery' .
- In the temperature broadcast, the service data with UUID 1594 shows the Current Thermopile Temperature and UUID 1564 Current Probe Temperature level
- The embedded application code stays in the Broadcast mode until a power on reset or software reset is incurred

5 Known Issues

No known issues currently.

6 Debugging

If the Master Control panel (MCP) is not detecting the development dongle when both the dongle and evaluation board are connected to the PC, close the Master Control panel first. Then unplug both the boards. Then plug only the development dongle and open MCP. The MCP will now detect the dongle.