Step 5: Build an IOT system

Target description
This tutorial shows how to program and use the Bluetooth interface to perform data communication in between the STM32L4 Discovery kit IoT node (B-L475E-IOT01A) and an Android application running on a mobile.
After this tutorial, you will be able to build an IoT system, control it from your mobile monitoring sensors and collect data.

Prerequisites
Previous steps:
- Step 3: UART and new board introduction
- Step 4: Use of sensors on B-L475E-IOT01A

Hardware
- STM32L4 Discovery kit IoT node (B-L475E-IOT01A ), available on www.st.com/en/evaluation-tools/b-l475e-iot01a.html
- Standard-A-to-Micro-B USB cable

Literature
- UM1873: Getting started with the X-CUBE-BLE1 Bluetooth Low Energy software expansion for STM32Cube
- UM2153: Discovery kit for IoT node, multi-channel communication with STM32L4
- Getting started with STM32L475 Discovery kit for IoT Node: www.youtube.com/watch?v=6eUgqxjBL_wI
The purpose of this section is to explain step-by-step how to reuse one of the applications part of the STM32CubeL4 MCU package to create a communication channel in between the IoT board emulating an heart rate monitor and a mobile on which the data are displayed via an android application.

1: Select a working project from the STM32Cube package

The start point is the STM32L4_IOT_HR project in the STM32CubeL4 MCU package. By default this package is located in the STM32Cube repository:

(C:\Users\user_name\STM32Cube\Repository\STM32Cube_FW_L4_V1.11.0).

- Select the Applications developed for the B-L475E-IOT1A board.
- Select the the HeartRate application in the BLE directory
- Select the STM32L4_IOT_HR project developed with SW4STM32 IDE
- Here is the .project file defining the project hierarchy

We then need to import the current project developed for the SW4STM32 IDE Into the TrueSTUDIO IDE.
2: Migrate a project from SW4STM32 to TrueSTUDIO IDE

- Click on the `.project` file to open it. The following message pops up.

![Project converter](image)

- The project STM32L4_IOT_HR was converted without problems. Some manual configuration may still be required.

- Click on OK and a new message confirms the success of the conversion.

- Click on OK and the TrueSTUDIO workspace opens.

![TrueSTUDIO workspace](image)
Select the STM32L4_IOT_HR project

Click on the Build button to rebuild the project.

Be sure the Debug probe parameter is set to ST-LINK in the Debug Configurations window that pops up when clicking on the Configure Debug button. Otherwise the code is not properly downloaded on the board.

Click on the Debug button to run the software.

TrueSTUDIO opens the Debug perspective. Click on the Resume button to execute the code.
3: Install the Android application on a mobile
To interact with the IoT board, an Android application has to be installed on a mobile. The STM32 BLE Profiles application is a companion tool to show in a human readable form all notifications coming from Bluetooth Low Energy (BLE) devices implementing some peripheral profiles.

4: Connect to the IoT node
- Go the Google Play store and install the “STM32 BLE Profiles” application on your mobile.
- Once installed, simply launch the STM32 BLE Profiles application. The application scans the network and displays a list of discovered BLE devices (Here the HeartRateSensor device).

- Establish a Bluetooth connection with the B-L475E-IOT1A board selecting the HR_L475_IoT device from the discovered devices list. It can take a while to get the connection established.
- The following screenshot shows the successful pairing with a health thermometer sensor

- Once connected, select the Hear Rate profile among the BLE profiles proposed.
The application starts to display the heart rate data sent by the IoT connected device, which acts as a peripheral. In this example, the data are generated on the B-L475E-IOT1A board via a formula and do not reflect the data from a real sensor.

Now you are able to:

- Build your own IoT system to get values from an peripheral device and display them on your mobile
- Regenerate a project from one of the various applications available in the STM32Cube package