

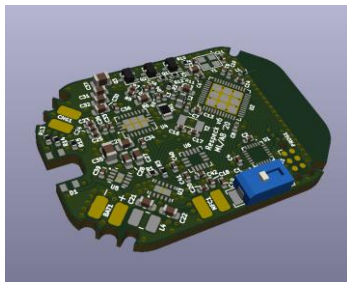
PDIoT 2023

Introduction to Sensor Platforms
for Human Activity Recognition

Sensor Platforms

Respeck

A custom-designed platform to collect human activity and respiratory data



Thingy

A prototyping platform made by Nordic Semiconductor



Both devices are based around the Nordic Semiconductor NRF52 SoC, provide on-board processing and BLE communication

IMU Sensors

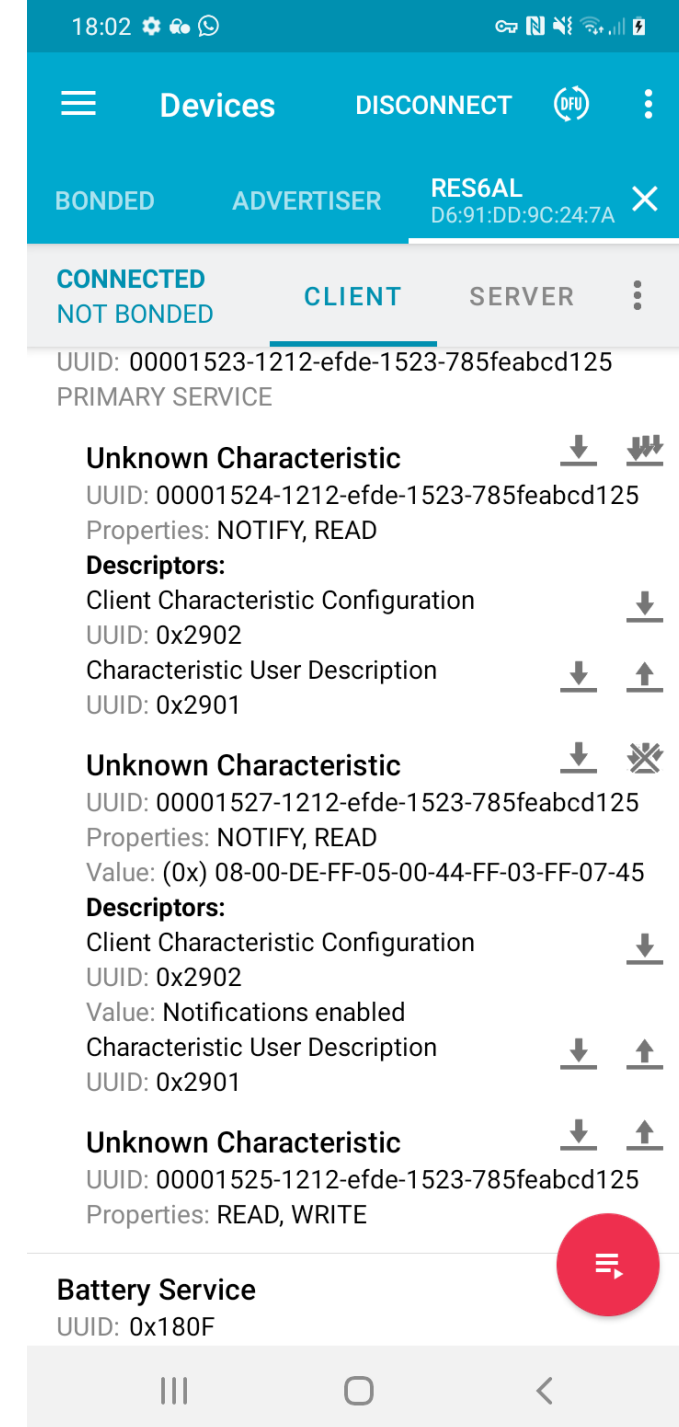
- Both platforms include an InvenSense inertial measurement unit (IMU)
 - 3 axis gyroscope
 - Measures rotational rate
 - High power consumption
 - Cannot detect linear motion
 - Reacts quickly to changes in orientation
 - 3 axis accelerometer
 - Measures linear acceleration and the direction of gravity
 - Low power consumption
 - Useful for determining static orientation
 - Rotation can be detected by tracking changes to the direction of gravity
 - 3 axis magnetometer
 - Measures the magnetic field strength and direction
 - Not recommended to use for PDIoT as the magnetic field will be crazy in the lab!

Bluetooth Low Energy (BLE)

- You can read data from the sensors using BLE
- BLE devices expose services, which contain characteristics
 - Read characteristics to obtain single sensor readings
 - e.g. battery level
 - Notify characteristics to stream data
 - e.g. IMU data
 - Write to characteristics to configure the sensor platform
 - e.g. switch individual sensors on or off
 - control an LED
- BLE can send and receive single bytes or a byte array in each transmission
 - By using a custom packet format, we can send complex data
 - E.g. {timestamp, accel_x, accel_y, accel_z, gyro_x, gyro_y, gyro_x, battery_level}

Android App

- The Nordic NRF Connect app is a good starting point to learn about communicating with BLE devices on Android
- The Thingy has a supporting app, which allows you to configure the sensor platform
- We will provide a data collection app for Coursework 1, which will store data in CSV files for later analysis
- During Coursework 3 you will extend this to perform Human Activity Recognition in real-time



IMU Data Analysis

- Accelerometer and gyroscope data are often complimentary
- Position of accelerometer lines useful to detect posture
- Gyroscope provides cleanest respiratory signal

