LAB#3 GUIDE

Rapid Wireless Sensing enabled by NXP's latest MCX W23 wireless MCU and Low-Power Pressure Sensors

Hands-on Lab#3 Guide

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Hands-On Lab#3 Overview:

Tamper detection using low-power pressure sensor:
Securing Your Assets with MCXW23 Wireless MCU

Brief Description

This example uses **FRDM-MCXW23** and **MPL3115** pressure sensor (using sensor expansion board) to demonstrate autonomous detection of tampering/theft/abuse on device using low-power wakeup on change in pressure and transmit ALERT message via BLE wireless UART.

Details

The core idea is to leverage advanced sensor technology to protect or secure assets. For example, in industrial environment for pressure sensitive seals on containers, valves and control panels. In food, pharmaceutical and chemical industries for pressure sensitive labels. In home, building environment for pressure tampering on water/gas meters, HVACs etc.

Solution

This example demonstrates ease-of-enablement using NXP's FRDM-MCXW23 and sensors development ecosystem to accelerate prototyping for your multiple such applications.

The **Lab#3** solution comprises of

- **MCX W23** for transmitting tamper detection alerts via BLE.
- Absolute pressure, altimeter sensor **MPL3115A2** for detecting change in pressure/altitude.

Recommended Sensors

MPL3115A2S: Absolute Pressure/Altimeter Sensor

The **MPL3115A2s** is a compact, **piezoresistive, absolute pressure sensor** with an I2C digital interface. MPL3115A2 has a **wide operating range of 20 kPa to 110 kPa**. It has multiple user programmable modes such as power saving, interrupt, and autonomous data acquisition modes, including programmed acquisition cycle timing, and poll-only modes.

Features:

- **Pressure resolution: 1.5 Pa.**
- **Guaranteed drift over time (<20 Pa) for use in** "pseudo differential mode"
- Pressure ranges: **20 – 110 kPa** and **50-150 kPa.**
- **1.95 V to 3.6 V** supply voltage
- I²C digital interface
- Interrupt driven events.
- 32-Sample FIFO
- **Low power down to 8µA**

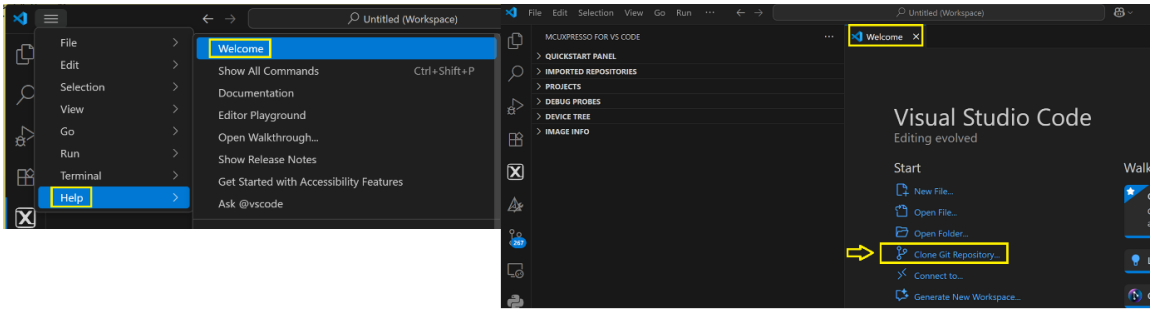
Target Applications:

- Altimeters/navigation systems
- Weather station equipment
- Health/Activity Monitors
- Smart Inhalers
- Oxygen Concentrators
- Ventilation system

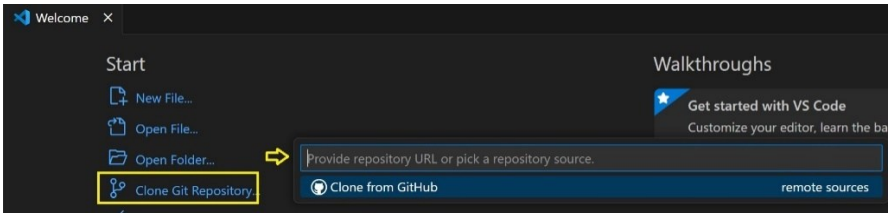
Get Hands-on Workshop Lab Examples from ACH

Note: If you have completed Lab#1 & #2, you can skip steps 1) to 6) and start from 7).

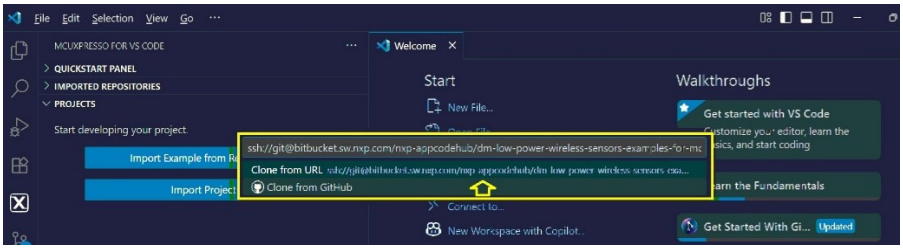
1) Open VS Code and select "Clone Git Repository" option on the “Welcome” page. Find the “Welcome” page under “Help” tab.



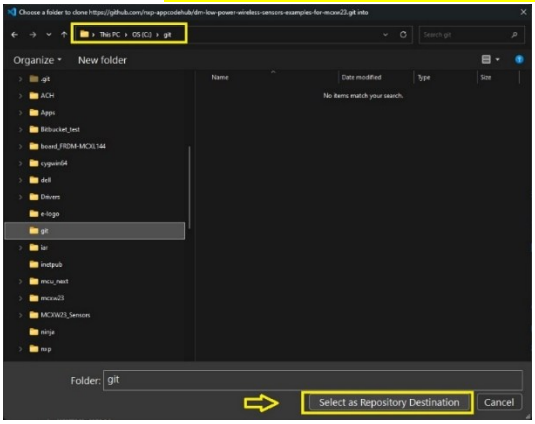
2) VS Code will open a pop-up to allow you to enter the Git repository URL.



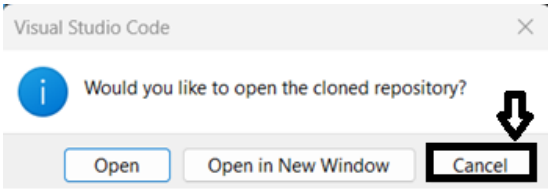
3) Copy the ACH gihub URL:"https://github.com/nxp-appcodehub/dm-low-power-wireless-sensors-examples-for-mcxw23.git" and select the the "Clone from URL" option.



4) It will ask for local destination directory where you would like to save the cloned repository, create a "git" folder under C: drive and select that folder.

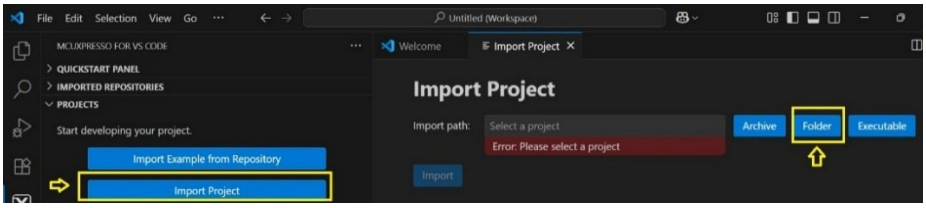


5) VS Code will ask whether you would like to open the cloned repository. Click on Cancel.

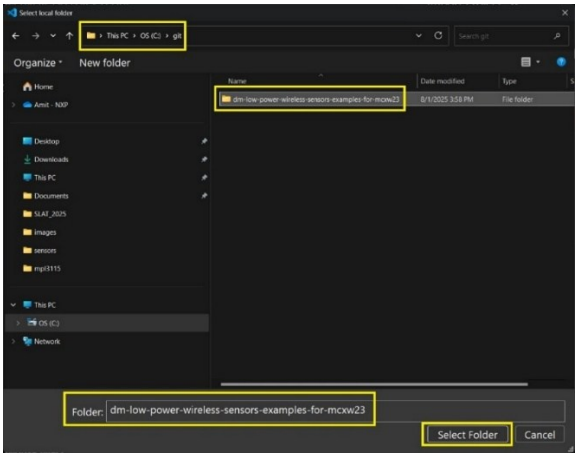


6) VS Code will clone the repository into the destination folder i.e. C:\git directory.

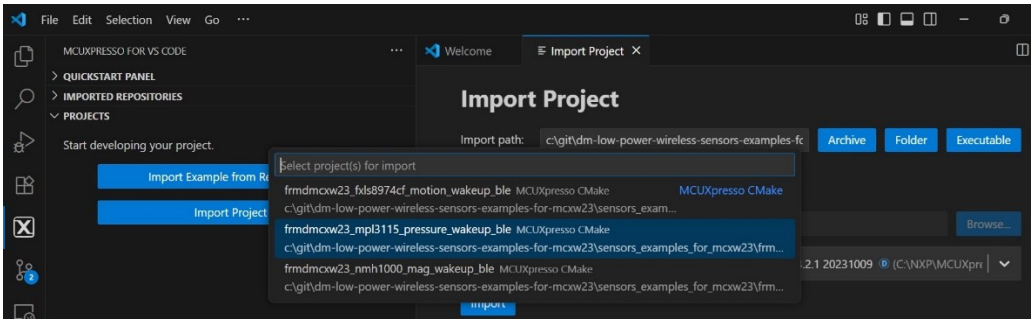
7) Click on "Import Project(s)" to start importing the chosen ACH project(s).



8) Select the cloned repository destination folder i.e. "C:/git/dm-low-power-wireless-sensors-examples-for-mcxw23".



9) Import Lab#2 "frmdmcxw23_mpl3115_pressure_wakeup_ble" project into VS code workspace:



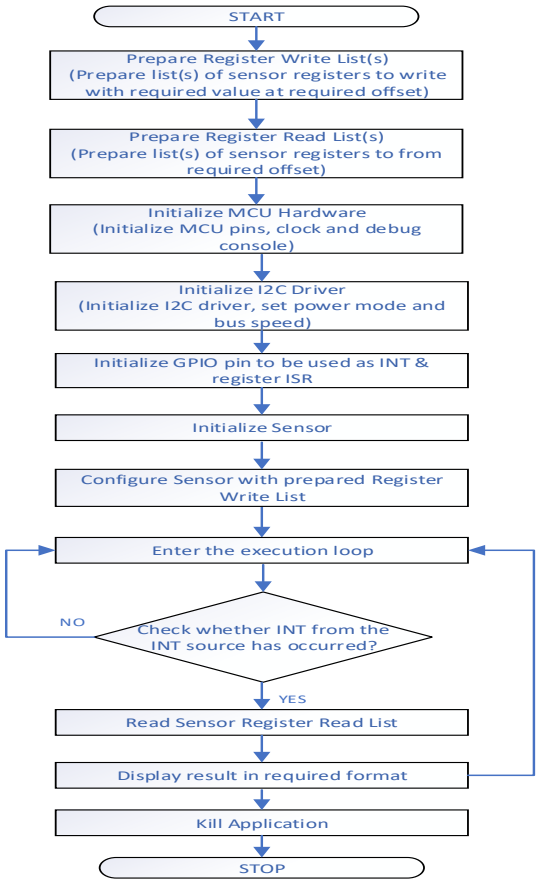
10) Select the toolchain version: ARM GNU Toolchain.

11) The selected "frmdmcxw23_mpl3115_pressure_wakeup_ble" project is now imported on the VS Code workspace.

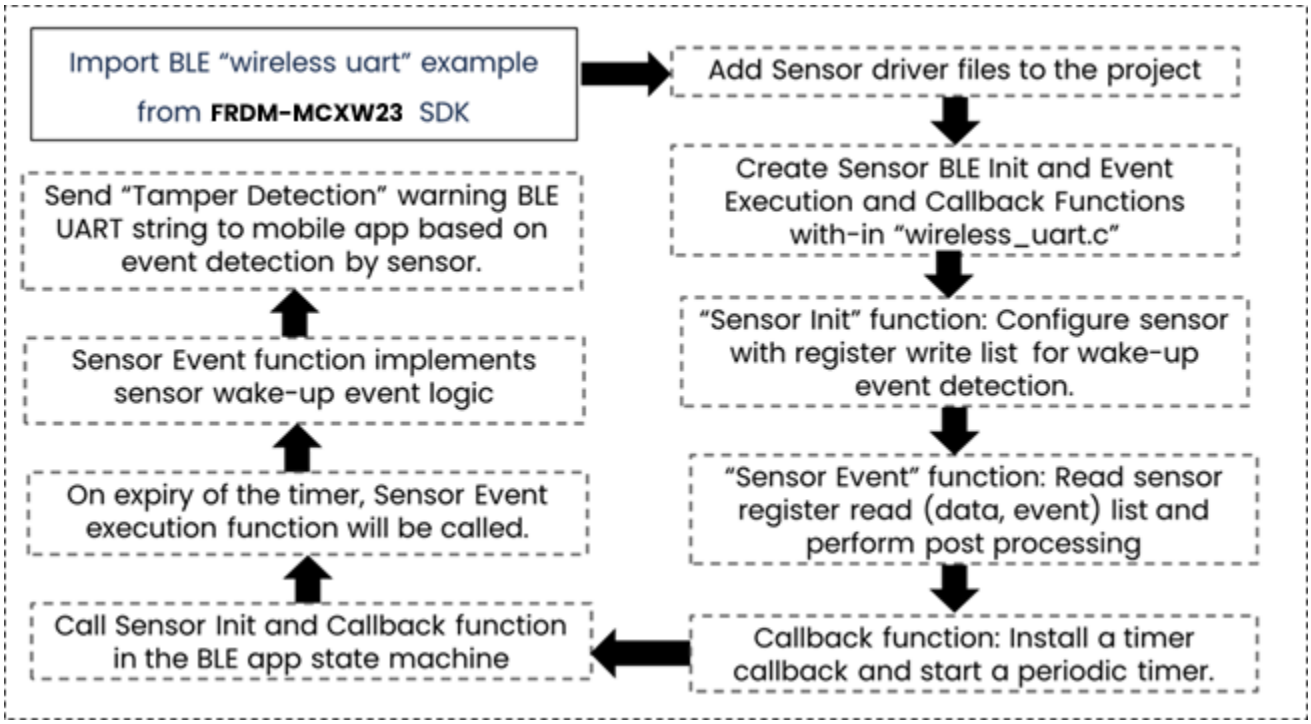
Code Walkthrough

Typical ISSDK example code flow:

1) Prepare register write list.
2) Prepare register read list.
3) Initialize MCU Hardware (Pins, Clock etc.)
4) Initialize COMM (I2C, SPI) driver
5) Initialize GPIO pin to be user as INT and register ISR.
6) Initialize Sensor, read WHOAMI
7) Configure Sensor with prepared register write list
8) Enter execution loop:
    i. Check whether interrupt source has occurred.
    ii. If yes, then read register read list
    iii. Display result or upload into TSA table
    iv. Execute post processing or other functions.



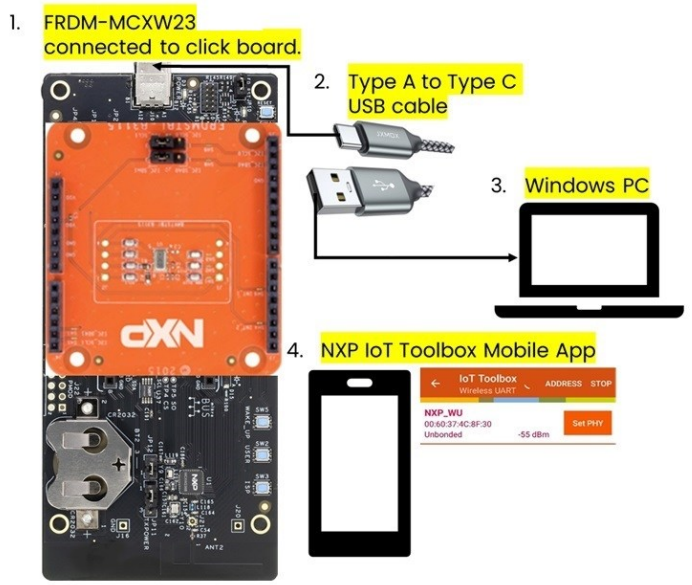
Learn how to convert SDK wireless example to wireless sensing example:



Compile Project:

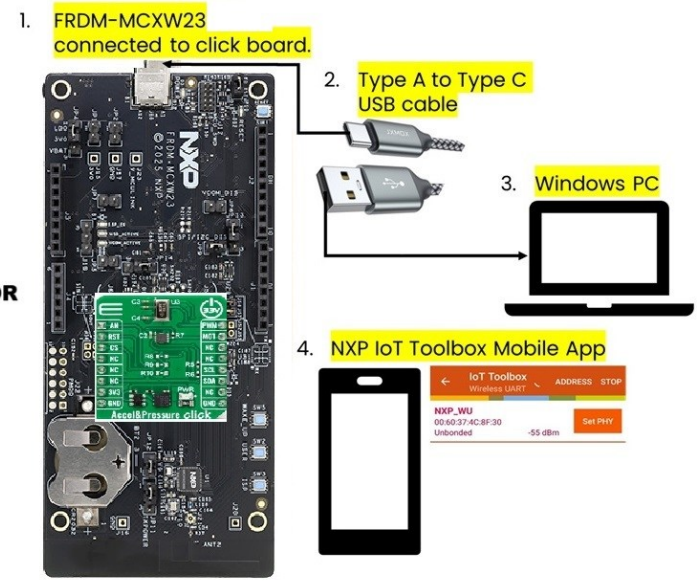
DO IT YOURSELF

Connect HW:



Hardware Setup With FRDMSTBC-P3115 Shield Board

OR



Hardware Setup With AccelPressure Click Board

For FRDMSTBC-P3115 board, perform following HW settings:

Connect J7 and J8 pins 1-2 on FRDM-STBC-P3115 shield board.

Program the target Board:

DO IT YOURSELF

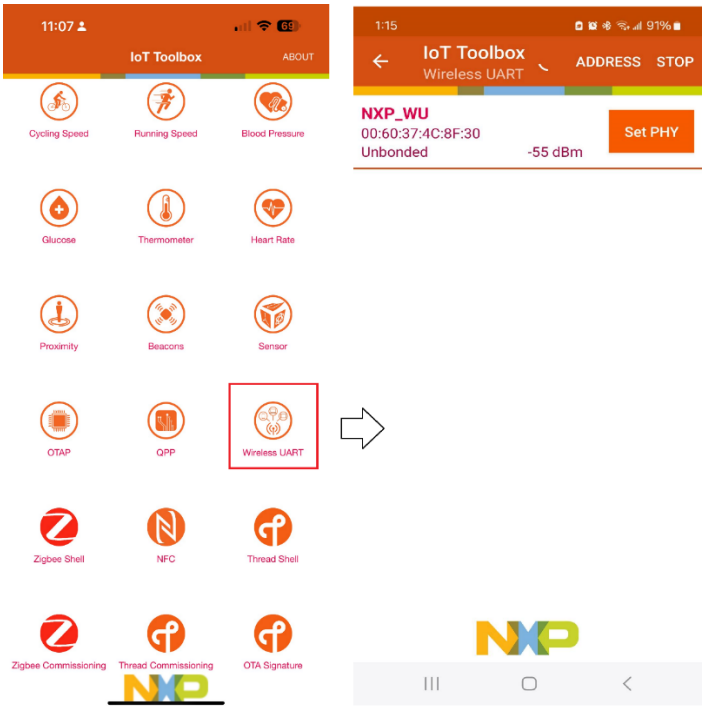
Start Advertising:

DO IT YOURSELF

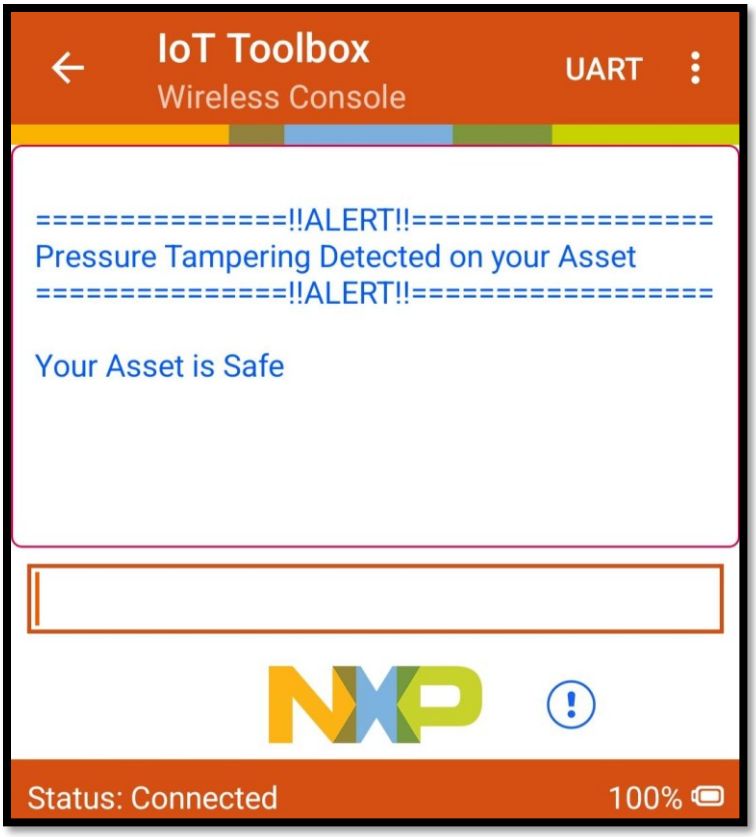
Run NXP IoT Toolbox App on your mobile:

1) Open the installed NXP IoT Toolbox (available from Play Store and App Store) on your cell phone.
2) **Make sure on your mobile phone following setting is set:**

   Bluetooth connection is ON, and the location is ON.
3) Inside the application, click on the Wireless UART widget. Scan should start automatically.
4) When a device called NXP_P0 or <your_id> appears, click on it. Your phone should now be connecting to the board.



5) When you press/apply pressure (keep pressing) using your index finger to the MPL3115 sensor (available on FRDMSTBC-P3115 shield board connected to FRDM-MCXW23) to show pressure tampering, MPL3115 sensor detects change in pressure and wake-up
6) At that point, you will see Wireless UART app showing ALERT message as shown below:



7) FRDM-MCXW23 board will also show "RED" LED status. The "RED" LED status will continuously remain ON till pressure tampering is detected.

8) After the app status shows “Your Asset is Safe”, you will see “RED” LED turned OFF, at this point try putting pressure again to detect tampering.

Congratulation on successfully completing Hands-On Lab3

Congratulations!
You successfully completed the Hands-On Lab#3

Appendix

Revision History

Revision	Date	Description	Author
1.0	08/19/25	Creation	Amit Purohit