



# Embedded Systems Lab 4 - HS 2020

18.11.2020

Roman Trüb

# Lab structure

- **Goal of today's lab:**

- Write and combine FreeRTOS tasks to build a FreeRTOS application.

- **Agenda:**

- Wednesday 16:15 - 18:00 Introduction (recorded)  
Q & A
- Friday 16:15 - 18:00 Q & A

- **Available assistants:**

- Roman Trüb - TA
- Michael Lustenberger - SA

## Lab structure

- **Interactions:**

- **Exercise Zoom:** Questions can be asked throughout the lab in this room by raising your hand. Please feel free to write in the chat in case we oversee your question.
- **Help Zoom:** A student assistants is available throughout the session for 1-on-1 meetings under the Zoom Meeting ID [917 6971 5701](#).
- **Matrix Chatroom:** Questions that are relevant for everyone can be asked in the Matrix chatroom where the responsible assistants can answer as quickly as possible.

- **NOTE:** Due to the latest COVID-19 rules by ETH Zurich we do **no longer** offer in-person support at ETZ D96.

# Goals

- Write FreeRTOS task from scratch
- Combine multiple FreeRTOS tasks using queues
- Understand interrupt handling in FreeRTOS
- Build an **interactive acceleration sensor application**

## Introductory questions - Question 1

**What are possible reasons that a task with highest priority in FreeRTOS is currently not executed (assuming that there is only single task with highest priority and that FreeRTOS is configured such that preemption is active)?**

- ☐ The state of a task with lower priority changed to "Ready"
- ☐ The task with highest priority performed a blocking read on an empty queue
- ☐ The task with highest priority called `vTaskDelay()`

## Introductory questions - Question 1

**What are possible reasons that a task with highest priority in FreeRTOS is currently not executed (assuming that there is only single task with highest priority and that FreeRTOS is configured such that preemption is active)?**

- X** The state of a task with lower priority changed to "Ready"
- ✓ The task with highest priority performed a blocking read on an empty queue
- ✓ The task with highest priority called `vTaskDelay()`

## Introductory questions - Question 2

**In the template of Lab 4, is FreeRTOS configured to use preemption?**

**Hint: Have a look at the defines in `FreeRTOSConfig.h`.**

☐ Yes

☐ No

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**Hint: Have a look at the defines in `FreeRTOSConfig.h`.**

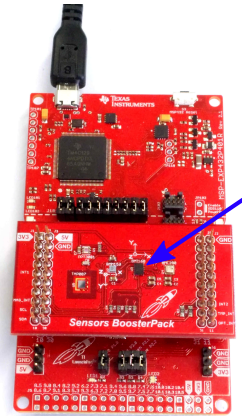
✓ Yes

✗ No



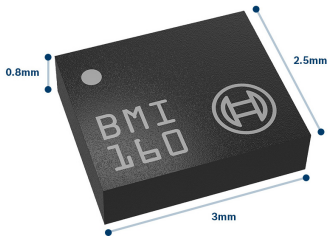
# Sensors BoosterPack

- Connect the two boards correctly
  - **Orientation of text should match!** Otherwise they can be damaged!
  - **Press firmly** to connect the two boards. The program will not work with a bad connection.



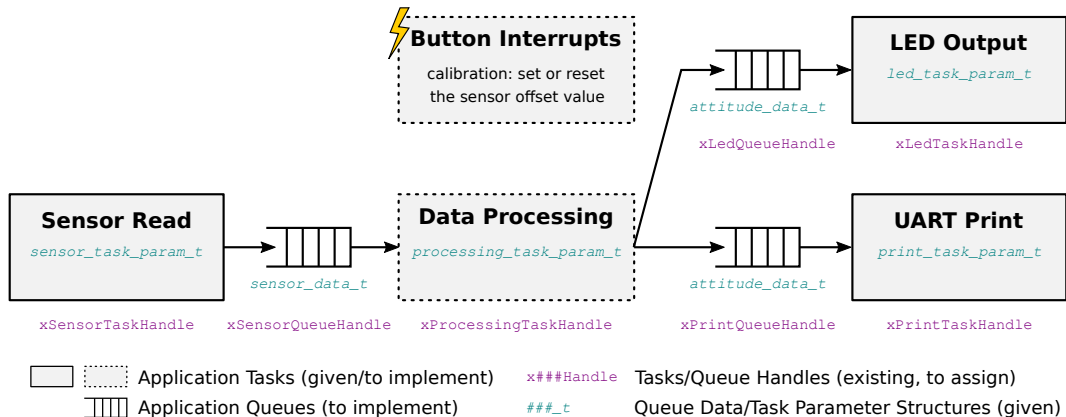
# Acceleration Sensor / Gyroscope

- Bosch BMI160 inertial measurement unit
  - **Acceleration Sensor:** Provides 3D acceleration measurements
  - **Gyroscope Sensor:** Provides attitude (tilting) relative to the gravitational acceleration vector
  - BMI160 Sensor provides no information about horizontal orientation (no compass)

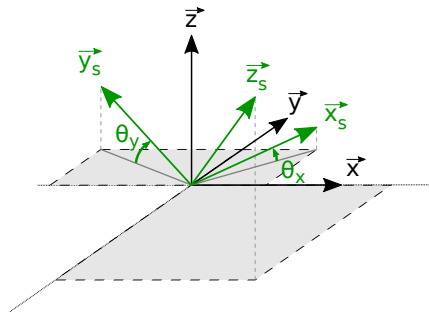


[https://www.bosch-sensortec.com/bst/products/all\\_products/bmi160](https://www.bosch-sensortec.com/bst/products/all_products/bmi160)

# Application Overview



# Coordinate System



# Tasks

- Task 1: Connect FreeRTOS Tasks
- Task 2: Implement Processing Task
- Task 3: Interrupts in FreeRTOS [optional]

### Return the LaunchPads!

LaunchPads and Sensors BoosterPacks  
will be collected **at the exam** and at  
additional dates in February 2021.

Please check the [website](#) for more details.

## Introduction is over

- The assistants are now available **until 18:00** to answer questions.
  - **Zoom:** Either ask in this channel or use the Zoom Meeting ID [917 6971 5701](#) to talk individually with an assistant.
  - **Matrix-Chatroom:** Ask a question in the chatroom so other students can also profit from the response (or respond even quicker!)
  - **Email:** For individual questions, you can also reach me under [rtrueb@ethz.ch](mailto:rtrueb@ethz.ch).
- On **Friday from 16:15 - 18:00**, we will also be available for questions.

**Happy coding!**

# Feel free to ask questions!

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**Happy coding!**



## Questions?

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