

First name, Last name :

## Lab2 Real-Time Operating Systems for sensors and actuators

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You will have to answer on the statement to questions R1, R2, ...  
You will have to write, test and provide the codes C1, C2, ...

Follow installation procedure (Appendix 1) to install Zephyr.

The objective of this lab is to implement the behavior of the previous lab but using the RTOS Zephyr.

Documentation about Zephyr 3.5.0 is available at <https://docs.zephyrproject.org/3.5.0/>.

### 1) Create Tasks

**R1. Recall the parameters of the Zephyr tasks creation macro `K_THREAD_DEFINE()`.**

**What is the difference between `K_THREAD_DEFINE()` and `k_thread_create()` ?**

Name	Description	Type

### 2) Communication and synchronisation services

**R2. Cite the different services under Zephyr.**

Service	Communication or Synchronisation

### 3) A first code with the RTOS

**C1. Adapt the code of the template to create a communication between 2 tasks, the first one sends the value of a counter then waits for a certain delay D1, the second one shows the received value on the 7-segment displays then waits for another delay D2.**

**R3. Explain your choice of communication service.**

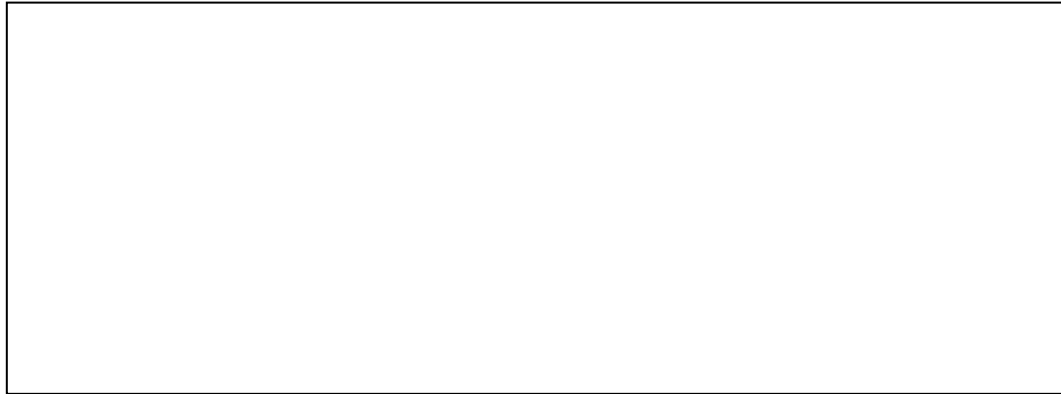
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**C2. Take the code from the 1<sup>st</sup> lab (reflex test) and convert it to Zephyr multitasking code.**

To do so, you must first :

- Identify the necessary tasks (3 minimum).
- Set priorities
- Define the necessary IPC services
- Use the `k_uptime_get()` function to read time instead of `HAL_GetTick()`.

**R4. Draw the Diagram of communications between tasks and ISR, naming the tasks according to their priority (T1, T2, T12...).**



Test the code

#### 4) Monitoring the execution

**C3. Add a thread analyzer to your application in order to collect runtime statistics.**

**R5. Note the information obtained with the measurement task.**

Task	Total CPU cycles	CPU %	Free stack	Used stack

**R6. Find the ROM and RAM usage with the help of the `rom_report` and `ram_report` build targets. What can be optimized in order to reduce the memory footprint?**