Architectures for Embedded Systems

Information transfer techniques Polling, Interrupts and Direct Memory Access Laboratory assignment

Arnaldo S. R. Oliveira

Academic year 2024/25

Universidade de Aveiro – Dep. de Eletrónica, Telecomunicações e Informática

Outline

Analysis of Examples

- (Simple) polling
- Interrupt
- Memory copy
  - Basic software loop
  - Optimized software version
  - Asynchronous memory copy

Lab assignment

Analysis of Examples on Information Transfer Techniques

- Study and test “as is” the following examples provided:
  - Polling vs. Interrupt
    - “simple-poll” – simple polling example (“while” vs. “if” statements)
    - “polling” – polling interleaved with useful work (overhead measurement)
    - “interrupt” – use of an interrupt to optimize the previous case (polling)
  - Software vs. DMA copy of large buffer
    - “swloopcopy” – full software-based solution
    - “cmemcopy” – C “memcpy” optimized version of the previous example
    - “asyncmemcpy” – asynchronous version of the memory copy based on the “Asynchronous Memory Copy” driver (GDMA abstracted) – https://docs.espressif.com/projects/esp-idf/en/v5.4/esp32c3/api-reference/system/async_memcpy.html

Laboratory Assignment

- Create a new project to implement and test a DMA-based memory copy function (low-level usage of the GDMA)
  - Use the information provided in Chapter 2 – GDMA Controller (GDMA) – of the document “ESP32-C3 Technical Reference Manual” available on the course website
  - This assignment must be submitted on the course website before the next lab session – depending on the practical class (P1, P2 or P3)
  - The skeleton of the code and the measurement of the execution must follow the same approach used in the “swloopcopy”, “cmemcopy” and “asyncmemcpy” examples
  - The assessment will be based on the:
    - Elegance and readability of the solution
    - Measured performance (accurate execution time)
    - Submission time in the course website

Final Remarks

- At the end of this week, you should be familiar with the three data transfer techniques:
  - Polling
  - Interrupts
  - Direct Memory Access

... including their usage, programming, pros and cons.