Architectures for Embedded Systems

Power Management
ESP32 Low Power Modes
Laboratory assignments

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Outline

Power management

- General concepts
- ESP32 modes

Lab assignments

- Exploring ESP32 power modes and TC74 sensor standby features

Questions for Discussion

- Why is power management critical in modern computing and embedded systems?
- How is the power consumption affected by the supply voltage and operating frequency of the system?
- Which power modes are predefined in ESP32 and the corresponding features?
- How is a reduced power management mode entered in ESP32?
- What are the typical wake-up sources in ESP32?

Sources of Information

- ESP32-C3 Technical Reference Manual, Chapter 9 (Low-power Management)

- ESP32 Sleep Modes (API description)

https://docs.espressif.com/projects/esp-idf/en/v5.4/esp32c3/api-reference/system/sleep_modes.html

- Examples

C:\Espressif\frameworks\esp-idf-v5.4\examples\system\light_sleep\

C:\Espressif\frameworks\esp-idf-v5.4\examples\system\deep_sleep\

C:\Espressif\frameworks\esp-idf-v5.4\examples\system\deep_sleep_wake_stub\

Laboratory Assignments

- Based on the TC74Demo application provided and the ESP32 sleep modes examples, develop several systems that:
  - gets the temperature every 3 seconds and outputs it to the terminal
  - and, in separate programs, exhibit each of the following behaviors:
  1. remains in the active mode between temperature readings
  2. enters the light sleep mode between temperature readings
  3. enters the deep sleep mode between temperature readings
  - repeats points 2 and 3, exploring the standby mode of the TC74 sensor

  For each of the programs developed, compare the consumption with the baseline (no ESP32 sleep) – with the help of USB power meter

Final Remarks

- At the end of this week, you should be familiar with the:
  - Microcontroller power management basics
  - ESP32 power modes and software API usage