Embedded Systems Lab 1 - HS 2020
30.9.2020

Zhongnan Qu

Lab structure

- **Goal of today's lab:**
  - Get to know the MSP-EXP432P401.
- **Agenda:**
  - Wednesday 16:15 - 18:00 Introduction (recorded) and questions
  - Friday 16:15 - 18:00 Questions & Answers
- **Available assistants:**
  - Zhongnan Qu - TA
  - Adrian Schneebeli - SA
  - Francesca Marsicano - 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:** Student assistants are 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.
  - **In-person:** Students can come to ETZ D96 to ask questions in person.

Goals of this Lab

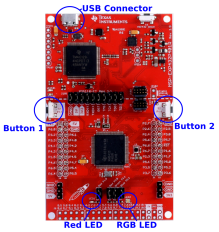
- Learn how to use registers for configuration
- Get to know and use library functions
- Implement simple GPIO with peripherals
- Understand and implement polling
- Establish a simple UART communication

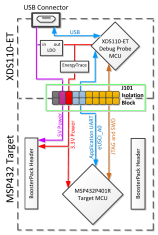
Workspace and IDE

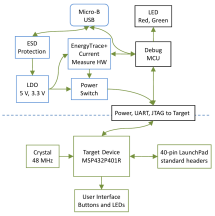
- Code Composer Studio
- One-Click Project Build
  - Compiling all files
  - Linking & generate executable
  - Flash device
- TI resources integrated
- Debug integration
  - Communication with Debug-Chip
  - Control Execution
  - Monitor Target

MSP-EXP432P401R LaunchPad Development Kit

- XDS110-ET debug probe
- Simple Peripherals







MSP-432P401R

- Low Power Mixed Signal Microprocessor
- 32-Bit ARM Cortex M4F CPU
- 256 KB of flash main memory, 16 KB of information memory, up to 64 KB of SRAM and 32 KB of ROM
- Flexible Clocking
- Several Timing Units (Timers, PWM, Capture and Compare, ...)
- Serial Communication Interfaces (UART, I2C, SPI,...).

Embedded Systems Documentation

Different Documents
- Datasheets
- Users Guide & Application Notes
- Technical Reference Manual
- Erratas
- Schematics

Different components & sources
- Microprocessor IP suppliers i. e. Arm
- Microprocessor Manufacturer i. e. Texas Instruments (TI)
- Hardware Boards Dcoumentation Manufacturer, i. e. Texas Instruments (TI)
- Extension Peripherals, i. e. Bosch
- Software Manufacturer, i. e. TI

Terminology

- Bare-Metal
- Watchdog Timer
- General Purpose Input Output (GPIO)
- Polling

Some small tips...

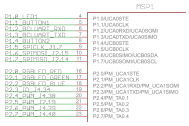
- ☑ Avoid hardcoded values in code → Use defines
- ☑ Always check Compiler/Console Output
- ☑ Carefully read Error/Warning Messages
- ☑ Consult documentation
- ☑ The community is your friend (i. e Manufacturer Forum, Stackoverflow, etc.)

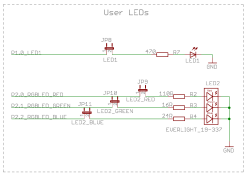
Clicker Questions

On Page 4 of Lab1 handout pdf

To which GPIO Port are the *LED1* and *LED2* connected?

(c) Port 1 & Port 2





Using `C`, which of the following operation allows toggling of the LSB of an 8-bit integer *X*?

(a) *X* ^ 1 **(XOR)**

X	*Y*	*Z*
0	0	0
0	1	1
1	0	1
1	1	0

What is the declaration of the function `I2C_initSlave()`?

(d) `void I2C_initSlave( uint32_t moduleInstance, uint_fast16_t slaveAddress, uint_fast8_t slaveAddressOffset, uint32_t slaveOwnAddressEnable )`

- DriversLib User Manual Page 160
- Section 12.6.3.14

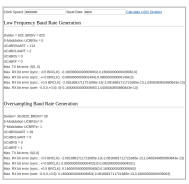
12.6.3.14 void I2C_initSlave (uint32_t *moduleInstance*, uint_fast16_t *slaveAddress*, uint_fast8_t *slaveAddressOffset*, uint32_t *slaveOwnAddressEnable*)

Initializes the I2C Slave block.

What is the Universal Asynchronous Receiver Transmitter (UART) module baud rate divider (`BRDIV`) for a baud rate of 4800 at low frequency baud rate generation, using the default setting of `SMCLK` as Clock Source?

(b) 625

- Get operating frequency SMCLK
  - LaunchPad User Guide Page 14
  - Section 2.6
  - Table 2
  - BEWARE: Clock source can be changed & tuned
- Enter parameters in Website Calculator



Which of the following statements is *not* zero, when for the pins 5 *or* 7 of Port 2 the primary or tertiary module function is enabled?

(c) `HWREG8(0x40004C00 + 0x0B) & 0xA0`

1. Check how to set `PxSEL1` and `PxSEL0` for primary or teritary module function
   - Technical Reference Manual on page 501 in table 10 – 2
   - `PxSEL0` is set (*non-zero*) in both cases
2. Identify the base address range of the port modules
   - Datasheet Table 6 – 21
   - Base address = `0x40004C00`
   - offset for `P2SEL0` = `0x0B`
3. Identify the bitmask for the register read out
   - Technical Reference Manual, section 10.4.7 on page 519
   - Only considering the bits `P2SEL0.5` and `P2SEL0.7`
   - Bitmask is *0xA0*

ETH zürich

Introduction is over. Feel free to ask questions!

- 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 `zhongnanqu@ethz.ch`.
- On **Friday from 16:15 - 18:00**, we will also be available for questions.

Happy coding!

ETH zürich

Questions?

Zhongnan Qu
ETZ G76
+41 44 632 70 21
zhongnanqu@ethz.ch