Embedded Real Time Systems

PRACTICAL EXERCISE + FINAL EXAM

HOCHSCHULE
FÜR ANGEWANDTE
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FINAL EXAM

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Preparation Guidlines

- Exam Basis
  - Slide Set entitled
    - EVENT DRIVEN PROGRAMMING PRÜFUNGSÜBERSICHT
  - Circa 20 Questions as per topics in Slide Set
  - Time Frame: 90 Min.
- Exam Date : TBA
- Exam Venue: TBA

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PRACTICAL EXERCISE

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Exercise Goals

- Demonstrate on Resource Constrained Device
  - OO Prinicples Applied to C /ASM Environment
    - Encapsulation
    - Inheiritance
    - Polymorphism
  - Execution Control via RT Framework
    - Capture
    - Dispatch
    - Control
- Use of UML State Charts

Exercise Requirements

- Each Team will be assigned a project
- Create an UML HSM Model for the assigned project
- Program an QM Active Object implementation for the assigned applcation:
- Adapt Implementation bsp to reflect event driven input/out specifics

Exercise Environement

- HW
  - MCB 2300 - RAM
  - Srf06eb-cc2358
- SW
  - µVison 4
  - QEP / QF
- Templates
  - History
  - Comp
  - Bomb4
  - Calc

Project Assignments- TBD

- Group 1
  - Kevin Beck
  - Graf Daniel
  - Diez Dimitrie
- Group 2
  - Marcel Schmalzl
  - Stephan Ploederl
  - Michael Stefan Kraus
- Group 3
  - Ludwig Wagner
  - Jakob Schuster
  - Kai Löhr
  - Wolfgang Reiter
- Group 4
  - Dennis Schock
  - Alexander Schuhmann
  - Maximilian Pachl
- Group 5
  - Florian Neuner
  - Müller Peter
  - Zarwel Rene
  - Wilhelm Andreas
- Group 6
  - Maximilian Peter Oeckler
  - Alexandra Vogel
  - Reinbold Manuel
  - Fabian Uhlmann

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Project - Oven Control

- Project Goals:
  - Model a protoype of an industrial control architecture for a commerical oven
- Functionality:
  - Temperature control
  - Oven Door open/closed state control
  - Audible alarm signals
  - Display in real time of temp, and door state

Project - Oven Control

- Use µVision „history“ project as Template to model and implement an Oven Control system that has this functionality:
  - Temperature Control – Use MCB2300 AD/DC
    - State Set temperature within 0-350 Degrees
    - State Simulate heating / cooling
    - State Show actual temp on LCD
  - Alarm Functions Use MCB2300 buzzer
    - Sound audio when temperature exceeds critical value
    - Use LED as warning annunciators as temp approaches critical value
  - Door Functions - Use MCB2300 Int0 Button
    - shut to stop
    - –tart heading
  - Debug Info:_ use RS2323

Project - Bomb5

- Project Goals:
  - Extend the course state machine example bomb
  - Model state machine as Active Object
  - Replace RS232 keyboard input with Interrupt driven perpherials on MCB2300

Project - Bomb5

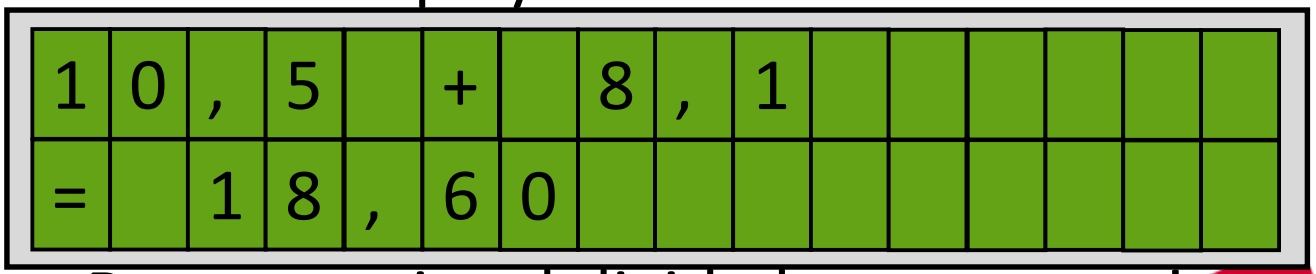
- Use µVision „bomb4“ project as template to implement an advanced detonation device with these functions:
- Setting
  - Integrate the RTC (driver provided) to show:
    - Current time, year, date, month on LCD
  - Set Countdown (UP / DOWN) via AC/DC (AD)
    - Display current countdown value on LCD
- Arming
  - Arm / Disarm with int0 button (driver provided)
    - Display countdown value on LCD
    - Correlate LED to countdown
      - On ARM – light up all LEDs
      - As countdowm progresses – extinguish an led
  - Simulate BOOM with buzzer

Project - Calc

- Project Goals:
  - Implement a Pocket Calcuator
  - Model state machine as Active Object
  - Replace RS232 keyboard input with Interrupt driven perpherials on MCB2300

Project - Calc

- Use µVision „calc“ project as Template
- UML Model Calc in calcuml.jpg as HSM base
- Required Functionality
  - Use Serial Input as number padfor
    - Operands and Operator
  - Clear / Clear Error via AC/DC Wheel
  - Use LCD for Display:



  - Use Buzzer to signal divide by zero error!

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Project - Coffee

- Two Versions – MC2300 – Srf60eb
- Project Goals:
  - Model as an Active Object a consumer friendly Coffee Maker
  - Functionality:
    - Develop a multi – stage menu to control
      - Display of current time (RTC)
      - Time to start brewing
      - Brew Strength
    - Control Pot State – in / out

Application - Coffee –MCB2300

- Use µVision „comp“ project as template to implement a coffee maker with these functions:
  - Clock: Integrate the RTC (driver provided) to show:
    - Current time, year, date, month on LCD
  - Brewing – Control Menu
    - INT0 Button
      - Set Time-of-day via RTC
      - Set Brew Strength
      - Set Start Time for Brew
      - Simulate Removal of Pot to stop brewing
  - Use AC/DC Wheel to set:
    - „brew“ strength
      - LED to show strength – 2 weak – 4 medium – 6

Application - Coffee - Srf06eb

- Use µVision „comp“ project in conjunction with the bomb1 port to the Srf06eb as templates to implement a coffee maker with these functions:
  - Clock: Develop a RTC – Hint: See Sleep Timer in CC2538 Manual
    - Current time, year, date, month on LCD
  - Brewing – Control Menu
    - Display on Srf06EB LCD
    - Use Up/Down/Side / SelectButtons to navigate menue
      - Set Time-of-day via RTC
      - Set Brew Strength
      - Set Start Time for Brew
      - LED red for Brew active
    - Use light sensor to simulate Pot in-out state – Toggel Red LED
  - Use AC/DC Wheel to set:
    - „brew“ strength

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Presentation

- Presentation scheduled for: TBA
- Each Team / Person present
  - UML Model
  - BSP Extentions / Adaptions
  - Code running on target HW
- Timeframe: 15 to 20 min
- Discussion