Embedded Real Time Systems

PRACTICAL EXERCISE - FINAL EXAM

Embedded Real Time Systems

FINAL EXAM

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 : 15.07.2015 - 14:30
- Exam Venue: TBD

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Embedded Real Time Systems

PRACTICAL EXERCISE

Exercise Goals

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

Exercise Goals

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

Exercise Requirements

- Provide a UML HSM Model for a reactive system

- Provide QM Active Object Implementation for the assigned applcation:
  - Oven Control
  - Bomb5
  - Calculator
  - Coffee Clock and Alarm

- Adapt Implementation BSP to reflect input/out specifics

BSP Extensions

- Implement ISR Driver for Timer
  - Interface to QF Scheduler
- Implement ISR Driver for AD
  - Interface to QF Event Queue
- Extern INT Driver (Button on board)
  - Interface to QF Event Queue
- RTC Clock
  - Interface to QF Event Queue
- NOTE: Button / RTC Drivers are in Repo Tree under Hardware

Exercise Environement

- HW
  - MCB 2300
  - RAM Implementation
- SW
  - µVison 4
  - Templates - µVision Projects:
    - History
    - Comp
    - Bomb4
    - Calc

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4 Teams @ 4 Participants

- Team Calc
- Team Oven

- Team Bomb5
- Team Coffee Alarm

Application - Oven Control

- Use µVision „history" project as Template

- Create UML Active Object Model

- Required Functionality

  – Set desired temperature

    • Use AC/DC wheel

  – Simulate temperture increase / decrease

    • Use AC/CD Wheel

  – Alarm Function when temperture exceeds critical

    • Use LED / Speaker as warning annunciators

  – Simulate Door open – shut to stop –start heading

  – Actual temperature setting on LCD

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Application - Bomb5

- Use µVision „bomb4" project as Template

- Create Active Object UML Model

- Required Functionality

  - Set Time via RTC (driver provided)

    - Show time in LCD – e.g., first row

  - Set up – down via AC/DC Wheel

  - Arm with Ext int button (driver provided)

    - Display countdown o

      - LCD – e.g, second row

      - LED – increment illumination proportional to time left

  - Disarm with int button

Application - Calc

- Use µVision „calc" project as Template

- Create UML Active Object MOdel

- Required Functionality

  - Use Serial Input for

    - Operands and Operator

  - Clear / Clear Error via AC/DC Wheel

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Application - Coffee

- Use µVision „comp" project as Template

- Create UML Model

- Required Functionality

  - Enable delay actioned Brew Start

  - Provide Water-overflow Protectio

    - Create User Interface via combinations of

      - Ext INT Button

      - AC/CD Wheel

    - RTC to set actual time (driver provided)

    - USE Int button to navigate Menue

      - Set Time-of-day via RTC

      - Set Brew Strength

      - Set Start Time for Brew

    - Use AC/DC Wheel to set:

      - „brew" strength

        » LED to show strength – 2 weak – 4 medium – 6

  - Use Int button to simulate – removal of pot

Top Level

- If Necessary or where appropriate
- Implement Application Specific Handling for
  - QF_Cleanup
  - QF_OnStartup
  - QF_OnIdle

Presentation

- Presentation scheduled for: 08.07.2013
- Each Team / Person present
  - UML Model
  - BSP Extentions / Adaptions
  - Code running on target HW
- Timeframe: 15 to 20 min
- Discussion