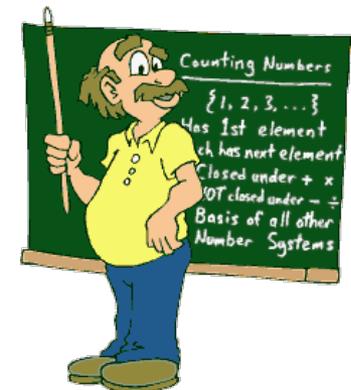iha.dk

SW-AMS
Applied Microcontroller Systems
(5 ECTS , Forår, E / SW)

Course Overview

SW-AMS: Motivation

- Microcontrollers are widely used as <u>controlling elements in embedded systems</u>.

- This course teaches <u>relatively advanced aspects</u> in developing microcontroller based systems.

- The course gives the necessary basic knowledge for further qualified work in embedded development teams – doing <u>hardware close programming</u> / <u>software close hardware</u>.

Learning Objectives

- Use In Circuit debug tools (JTAG ICE).

- Implement drivers, dealing with time critical parameters.

- Implement Boot Loaders for updating microcontroller firmware.

- Use operating systems for microcontrollers (Free RTOS).

- Use SD cards as external flash memory.

- WEB-enable a microcontroller.

- Use USB to interface a microcontroller.

- Use microcontroller knowledge in a **final mini project (☺).**

7-8 weeks	6-7 weeks
Lessons + LABs	AMS project

Course Schedule (2022)

Week	Date	Topic	Other on class activities
1	2. February	Introduction and Hands On (lesson + LAB1) JTAG debugging (LAB2)	
2	9. February	Alphanumeric Display Driver (introduction + LAB3) If time for it: Start next topic (Graphic Display driver)	Comments on JTAG debugging
3	16. February	Graphic Display Driver (lesson + LAB3a)	Discussing the LAB3 solution
4	23. February	Introducing Boot Loading (lesson) Boot Loading (LAB6)	
5	2. March	Introducing FreeRTOS (lesson) FreeRTOS (LAB7)	Discussing the LAB3a solution
6	9. March	Finish LAB6 and LAB7. Starting the project work.	Discussing the LAB6 solution
7	16. March	Applied USB (lesson, part 4). Applied USB (LAB8)	Discussing the LAB7 solution
8	23. March	SD card driver (lesson) SD card driver (LAB9)	Discussing the LAB8 solution
9	30. March	WEB enabling (Wifi) (LAB11)	Discussing the LAB9 solution
10	6. April	Optional: Touch Screen Driver (LAB10). Project work.	Discussing the LAB11 solution
11	20. April	Project work.	
12	27. April	Project work.	
13	4. May	Project work.	
14	11. May	Project work.	
-	1. June	Deadline: Project Report Hand in (using AU Digital exam)	
-	20.-21. June	Exams	

Contents

- Atmel AVR 8 bit controllers / (+ other controllers).

- AVR GCC C-compiler (Atmel Studio 7) for LABs.

- JTAG ICE (In Circuit Debugging tool).

- Bus timing (eg. interfacing LCD displays).

- Boot Loading.

- SD Cards (raw data + FAT).

- WEB enable a microcontroller (client side).

- Embedded RTOS ("Free RTOS").

- USB interfacing (protocol).

- (Intercomponent busses (eg. SPI and I2C)).

- <u>Microcontroller mini project</u> (½ half the course): Students own proposals !

ASE "Embedded Stock"

Link til Embedded Stock

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Oral examination

- Project demonstration (whole group) on video uploaded as an appendix to the report.
- Individual oral examinations based on the project work (report + video).
- Individual marks.
- External examiner.

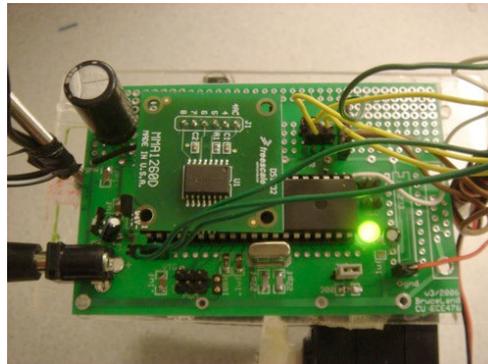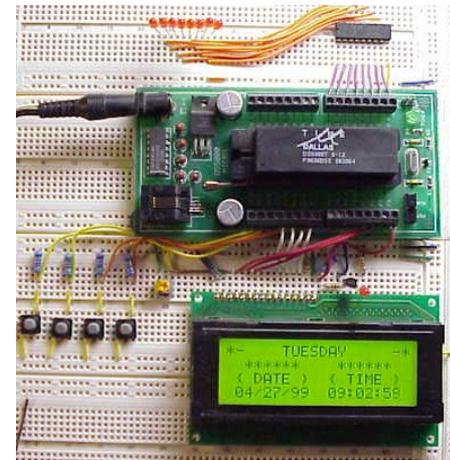iha.dk
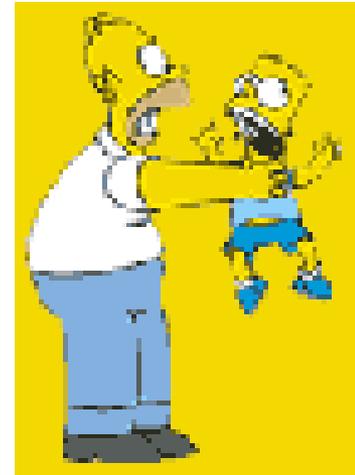
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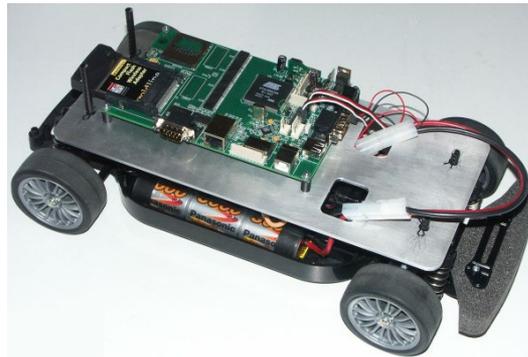
Project examples (prior AMS course) (1)

- Motor cycle Cruiser.
- Weather station with humidity sensor.
- Digital barometer.
- Decoder for the DCF77 radio signal (Frankfurt).
- Bar code reader.
- Boot loading.
- PC controlled voltmeter.
- IrDA communication for cellular phones.
- SMS interface via GSM modem.
- MIDI player.
- B&O/Philips IR -> Playstation 2.
- Digital Equalizer.
- Project with MCP2510 CAN controller.

Project examples (prior AMS course) (2)

- CAN controller.
- USB and microcontrollers (theoretical project).
- Magnetic card reader.
- Ping-pong game with graphic display.
- Weight scale with counting feature.
- Alarm Clock playing tunes.
- Driver for SJA1000 CAN controller.
- MIDI Controller for controlling guitar effects.
- Robotic vacuum cleaner.
- Project with DS18S20 temperature sensor.
- Motor Control using PWM.
- Controller for solar collector.
- Datalogger with MMC flash card.
- Info system using digital speech.

Project examples (prior AMS course) (3)

- DCF77 synchronized watch.
- Watch with calendar (+ temperature measurements).
- Electronic weathercock (wind speed og direction).
- Thermostat with alarm function.
- Game with graphic display.
- Embedded WEB server.
- Pump Controller.
- Controller for softdrink machine.
- General purpose IO card with ADC.
- PacMan game with graphic display.
- IrDA communication between AVR Boards.
- Weather station controlled by SMS.
- Boot Loader.
- GPS receiver.

Project examples (prior AMS course) (4)

- Channel Selector with Spectrum Analyzer.
- Interface for IDE disks.
- Light sensitive robot.
- GSM modem with SMS.
- Greenhouse Controller.
- Robot Car.
- Voltmeter with graphic display.
- Weather station with GSM-I.F.
- Traffic-speed measurer.
- Weather station with Real Time Clock.
- Fan Controller.
- Controller for steam locomotive.
- Mobile robot.

Project examples (prior AMS course) (5)

- LED watch.
- GSM/GPS burglar alarm.
- Temperature-measurer with SMS interface.
- Thermostat with SMS interface.
- SMS transmitter/receiver.
- P-NET slave using Mega16.
- Car Computer.
- USB interface.

- Etc, etc, etc and etc…..

Lecturer

Henning Hargaard

Room 204 (Edison)

hh@ece.au.dk

Further questions ?
Feel free to send me an email – or come and ask questions at the workshop ☺

That's it

Q: Why do Java developers wear glasses?

A: Because they don't C#!