

Microprocessor System Design Using Coldfire Embedded Processor

Proposal

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Objectives

- Create a new lab manual for CPSC 462 – Microcomputer Systems based on the MCF5206e processor/evaluation board.
- Research, design and test approximately 8 new labs.
- Provide a set of labs comparable to industry standards and a step above what is currently available.



Deliverables

The following is a list of our proposed labs:

- Introduction to the Coldfire embedded processor
- Assembly Programming on the Coldfire processor
- Integration between C and Assembly
- Memory Interface
- Serial Communication
- Keypad/LCD
- DMA - Interrupts
- Digital/Analog and Analog/Digital Integration
- Bonus Labs (time permitting)



Lab 1: Introduction to the Coldfire embedded processor

The Motorola MCF5206e Coldfire Processor/Evaluation Board used for designing microcomputer systems for data acquisition and industrial controls. In this lab, you will learn the basics of how to interface with the MCF5206e by transmitting files and downloading logs of terminal output.

Lab 2: Assembly Programming on the Coldfire processor

This lab will introduce you to some of the basics of assembly language programming on the MCF5206e microprocessor. We will be consulting the *Motorola MCF5206 Programmer's Reference Guide* for specific assembly language instructions.



Lab 3: Integration between C and Assembly

Write a C program, that calls subroutines written in assembly.

Lab 4: Memory Interface

Using multiple SRAM chips, this lab will build and implement a memory decoder to access external memory.



Lab 5: DMA

Using the memory created in the memory interface lab, they will create a RAM disk and show that they read and write from it.

Lab 6: Keypad/LCD

A 4x4 button keypad will be used to provide a password with a 4-bit keypad data signal. This will depict which key has been pressed as well as generate an interrupt preempting our CPU to read and respond to the 4-bit control signal. An LED will be used to display whether access has been granted or denied.



Lab 7: Serial Communication

Demonstrate two-way communication between the MCF5206e and the PC.

Lab 8: Digital/Analog and Analog/Digital Integration

The purpose of the A/D Subsystem is to obtain an analog signal from a microphone, digitize the analog signal, and provide the digitized audio to be received by the M5206eLITE board for storage and playback. The purpose of the D/A Subsystem is to take digital inputs from the evaluation board, convert this digital signal to analog and send the analog signal to a speaker for playback of the original audio signal obtained by the A/D Subsystem.



Ideas for Bonus Labs

(Time Permitting)

The bonus labs will tie in previous assignments into a larger project. For example, a security system or phone bank.



Background

The current use of hardware and software in the CPSC 462 labs includes the following:

- 68040 Processor
- MVME 162 Embedded Controller Board
- PC's w/ Serial Interface
- Integrated 162bug Debugger



Why do we need new 462 labs?

- Current Condition of Hardware
- Obsolete Hardware
- Advancement of New Technology



Benefits of New 462 Labs

- Improved Clarity and Documentation.
- New Hardware and Technology
- Reference Manual for TA/Instructor



Background con't

The new labs will be using the following hardware and software:

- MCF5206e Coldfire Processor/Evaluation Board
- PC's w/ Serial Interface
- C Compiler (Green Hill)
- Integrated Debugger
- FPGA's, IC's, etc.



Why use the Coldfire Processor?

- Compatibility with the current CPSC 462 textbook
- Very cost efficient
- Much lower learning curve than the other products available.



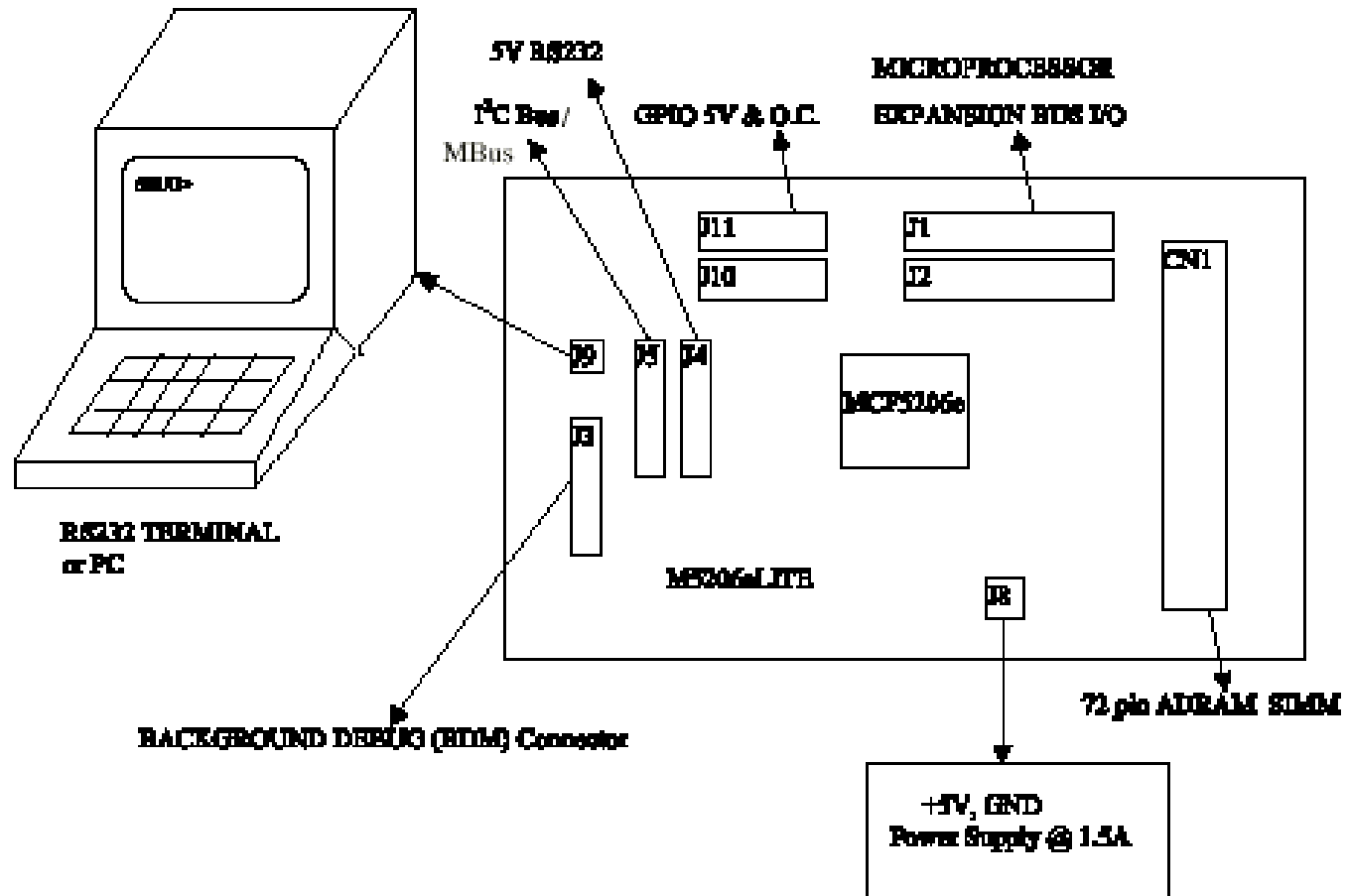
Previous Experience

Last semester PDACS 2 group used the Coldfire Processor/Evaluation Board in their project. They determined:

- Best available compiler was the Green Hill Compiler/Development Kit.
- There is not a readily available connector to interface with the J1 and J2 connectors.

Unless we can obtain the correct connector in a timely fashion, we will use last semester's handmade ribbon cable.

PC to MCF5206e Processor Connection





Team Member Responsibilities

We have revolving responsibilities for each team member. For any given week, we have the following roles:

- Document Writer
- Technical Researcher/Project Coordinator
- Hardware Engineer
- Software Engineer



Implementation Schedule

Week	Date	Task
1	1/18/00 - 1/21/00	Research and Develop Proposal
2	1/24/00 - 1/28/00	Research and Develop Proposal
3	1/31/00 - 2/3/00	Prepare Proposal
	2/4/00	Present Proposal
4	2/7/00 - 2/10/00	Familiarize with Hardware/Software
		Obtain Equipment and Licenses
5	2/14/00 - 2/16/00	Research and Develop Lab 1
	2/15/00	Bi-Weekly Report Due
	2/17/00	Write and Test Lab 1
6	2/21/00 - 2/23/00	Research and Develop Lab 2
	2/24/00	Write and Test Lab 2
7	2/28/00 - 3/1/00	Research and Develop Lab 3
	2/29/00	Bi-Weekly Report Due
	3/2/00	Prepare Mid-Term Presentation
		Write and Test Lab 3

Schedule con't

Week	Date	Task
8	3/6/00 - 3/8/00	Research and Develop Lab 4
	3/7/00	Mid-Term Presentation
	3/9/00	Write and Test Lab 4
9	3/13/00 - 3/17/00	Spring Break
10	3/20/00 - 3/22/00	Research and Develop Lab 5
	3/23/00	Write and Test Lab 5
11	3/27/00 - 3/29/00	Research and Develop Lab 6
	3/28/00	Bi-Weekly Report Due
	3/30/00	Write and Test Lab 6
12	4/3/00 - 4/5/00	Research and Develop Lab 7
	4/6/00	Write and Test Lab 7
13	4/10/00 - 4/12/00	Research and Develop Lab 8
	4/11/00	Bi-Weekly Report Due
	4/13/00	Write and Test Lab 8
14	4/17/00 - 4/21/00	Prepare Final Presentation and Demo
15	4/24/00 - 4/28/00	Prepare Final Presentation and Demo
16	5/1/00 - 5/4/00	Present Final Demo



Preliminary Testing

When we have completed the final report for each lab, we will work through the lab from start to finish. This will help to locate any problems that future students might incur. We will provide documentation on the problems that we incurred and what solution was found. Once Dr. Mahapatra has approved each lab, it will be tested for completeness.



Completeness Testing

We intend to use the current CPSC 462 class to test and evaluate each of our labs. We would like to provide them with the labs as they are finished to obtain feedback on its completeness and clarity.



Hardware/Software Percentages

Hardware 60%

Software 40%

The intent is to have students prepared for the CPSC 483 design class.



Cost

MCF5206e Coldfire Processor/ Evaluation Board	\$200.00
Green Hill Compiler License	<u>FREE *</u>
TOTAL	\$200.00

* Evaluation License – Actual License \$500.00



References

- <http://www.cs.tamu.edu/course-info/cpsc483/common/99c/g4/g4.html>
- http://www.sdsmt.edu/syseng/ceng/courses/ceng442/COLDFIRE/cf_slides.html
- <http://www.calm.hw.ac.uk/davidf/coldfire>
- “MCF5206 Coldfire Users Manual”; Motorola
- “MCF5200 Coldfire Programmer’s Reference Manual; Motorola
- <http://www.mot.com>
- <http://www.boondog.com>
- Clements, Alan. “Microprocessor Systems Design,” Third Edition, PWS Publishing Company, 1997.