Requirements and Procedures for the Course Project.

Goal

The objective of the Course Project is to have you design a product that you select. Whenever possible, the functionality of the product should be demonstrated both in simulation and in a working, physical mock-up.

Writing requirements

The written requirements include a Project Proposal, a Progress Report, and a Final Project Report. Details for these are given on their individual pages that follow.

Important Dates

- Project Proposals due Wednesday, Oct. 11 (both sections) in the lab at 6:00pm
- Projects start Oct. 16 (sec. 1) and Oct. 19 (sec. 2)
- Interim Demonstration on Nov. 6 (sec. 1) and November 9 (sec. 2)
- Progress Report due Nov. 14 (sec. 1) and Nov. 17 (sec.2)
- Final Demonstration on Dec. 4 (sec. 1) and Dec. 7 (sec. 2)
- Final Project Reports due Friday, Dec. 8 in my office at 4:00pm

Opportunity

This is your opportunity to propose and implement a project of your own design. Your project should be based on a Motorola microcontroller (M68HC11, M68HC12, and M68332). Your project should use some of the on-chip capabilities of a microcontroller. The project should not be all software or hardware but, rather, a comfortable mixture of both.

You might want to check out the built in Fuzzy Logic capabilities of the M68HC12 or the table interpolation capabilities of the M68332. Tired of brute force control of stepper motors? Then check out the TPU. Need to do something else instead of babysitting for a slow serial transfer? Check out the Queued Serial Module. Here is an opportunity to do compare more than one microcontroller for a given set of tasks. How does the MCU clock speed impact analog-to-digital converter processing in implementing an RMS voltmeter, for example?

Some suggestions

- A temperature controller satisfying more than one criterion
- A working model of an automotive engine controller (cruise controller)
- A functional simulator to test an elevator controller (e.g., for the JEC or CII elevators)
- A model train layout controller
- A Morse code interface (sending and receiving)
- A computer controlled chain of robots

In addition to the standard kind of project, you might elect to develop several introductory lab exercises for the M68HC12 and M68332 microcontrollers. These would build upon preceding M68HC11 lab exercises and emphasize what is new and different.

Constraints

The Motorola microcontrollers are available for you to use in the lab. You have been assigned a protoboard for your use in the lab, also. These cannot be taken from the lab between lab sessions.

The lab does not have a budget for special parts. So, if you need anything not in the lab, you will have to get it yourself. If parts are not available locally, several weeks can elapse between the time you order the parts and when they arrival. This can happen even when you have been told the parts are in stock.

The TAs will do what they can to help you with your project; but they aren't guaranteed to be an expert on your specific project.

Grading

The Course Project represents more than half the course grade. The project grading is broken down further as follows:

- Proposal 5%
- Interim Demonstration 10%
- Progress Report 15%
- Final Demonstration 40%
- Final Project Report 25%
- Post-project clean up 5%

Post-project clean up

Disassemble all components and wires on the protoboard. Return them to where they belong. Be sure to get checked off

Late Reports

Any late reports should be given to the secretary in JEC 6049. A received date stamp will be put on it. A lateness penalty of 5% per day will be assessed against the project grade.

Proposal Memo (5%)

This project will be done by a small team. All team members are expected to contribute to the final product. The total amount of work should be about 50 hours per student. This should be reflected in the Project Proposal

The proposal consists of a brief (cover) memo that states what you have selected for your project. Answer why it is appropriate to the goals of this course. Give a detailed explanation of what you have in mind. Be as specific as you can about what your final product will be. Be sure to think the entire project through. Be realistic.

Proposals that are too vague will not be approved, and cost you lost time. Proposals that do not provide enough challenge will not be approved. If your proposed project is overly difficult, you will be advised but

your project will not be rejected. You will be invited to modify your goals as you see fit to finish within the time constraints given.

Memo Heading

To: Prof. R. P. Kraft
From: (List all the team members)
Subject: (Please be specific, not generic like ”Project Proposal”)
Date: October 13, 1999

First Paragraph Use one or two sentences of introduction to amplify your subject line. Summarize what your project is, why you are proposing it.

Memo Sections

Problem Statement
What is the need or problem you are addressing?
Why is this problem significant?
Who should care about it and why?

Proposed Project, Goals, and Approach
How does your project satisfy the need stated above?
What alternatives might also be considered?
How will you (or the world) benefit from this activity?

Plan of Activities with Deadline (Details in the Attachment)
List any special needs such parts you will be making, borrowing, etc. Put schedule of activities in the Attachment.

Evaluation
How will someone else judge that your project solves the problem you defined?

Attachment A detailed task time-line (Gantt Chart) for the entire project period (Oct. 16-Dec. 8). Tasks need to have the name of who is doing what and the time budget for all tasks and sub-tasks, including part ordering and report writing.

Interim Demonstration (10%)

The interim demonstration will take place in the lab. The TAs and instructor are your primary audience. The purpose of this demonstration is to confirm your project is on track. If it is not, now is the time to revise your project goals.

Your proposed schedule is the one attached to your Project Proposal memo. You should update your task schedule is as necessary to reflect any revised goals, etc. Any delays, advances, or changes from your original proposal need to be explained. Remember the end of the semester does not move! This will be reported in the Interim Progress Report.

Progress Report (15%)

Submit this report in memo format. It should be brief and report on how well your project is going.

Memo Sections

Project and Purpose
Briefly reintroduce your project. Summarize what you are doing, why you are doing it and what your approach is.

Progress Made
What progress have you made so far? How do your activities relate to those in your task time line schedule?

Practical Implications
Will anything need to be adjusted? Do you need to make any changes in your work schedule? Do you need additional parts, etc.?

If you think your work may result in a publishable article (e.g., as an Application Note or a magazine article), indicate where it may be published. This will impact the format of the Final Project Report.

Attachments

Your original Project Proposal including the original task time-line (Gantt Chart) for the entire project period (Oct. 16 - Dec. 8). Attach your revised task tine line for the remaining project period (Nov. 6 or 9 - Dec. 8).

Final Demonstration (40%)

This is the functional day of reckoning. Your product should meet your (revised) objectives. The audience for this demonstration is the class. You will have to prepare a brief oral presentation. You are encouraged to use the studio presentation equipment for your visual aids. The oral presentation is an integral part of the Final Demonstration.

Your project design should be frozen at this point. Any improvement can be suggested in the Final Project Report, but not implemented. (You must stop changing things at some point in time. This is it.)

Final Project Report (25%)

The format of your Final Project Report depends on whether it may be publishable or not. If it is, the format is that of the target publication. If it is not publishable, the format is that of a formal technical report. The basic elements are likely to be the same in both types of document. Just as with a published article, the Final report should reflect the most recent state of the project. Do not include failures, false paths, unless they are germane to the goals of the project.

Format of the Report

Front Matter

Title Page
Place the title one-third of the way from the top – be informative, not clever, with each word a possible keyword

Authors' names go about the middle, class designation and date at the bottom of the title page

Tables of Contents, List of Figures, etc.
List each major section in the Table of Contents
List figure numbers and captions on the List of Figures sheet
List table numbers and caption (on top) in the List of Tables sheet

Abstract
An abstract is a non-linear summary of your report. Be informative. The first sentence can be use to clarify the meaning of the report title. Include the What, Why and How of your project. Finish with a positive conclusion and some supporting data, if available.

Report Body

Introduction
Here is where you put the motivating material from your proposal. Keep this section brief (no more than two pages).

Materials and Methods
What did you use to implement your product? What methods did you use? Report the informed way to get to your final configuration, not the false paths you may have followed. Write this so that one of your classmates could duplicate your work based on your report alone.

Results
What did you accomplish? Take care to state your result precisely. State all significant results. Use data, figures, tables, etc, to support your claims.

Discussion
This is the section where you can explain why your final result was different from your initial goal. Or you can point out where you might take the project given more time, resources, etc.

Back Material

Appendices
This is the appropriate place for details such as testing procedures, software source code listings, hardware drawings and electrical schematics.

References
List any sources of information you referred to in the report.

Bibliography
This is a reading list of sources of background information. You should include URLs in addition to printed material.

Post-project clean up (5%)

This is the easiest 5% you ever earned. Please help get the lab ready for the students who follow. Let's leave the lab and the equipment in it as tidy as we would like to find it.

Project Hardware Available in the Studio

A number of processors, including DSPs, are available in the lab for use with projects. Additionally, a number of peripherals and systems are available such as simple robots, a magnetic stripe card reader, and a barcode reader. The devices and specific details are listed below.

M68HC11 EVB

M68HC12 EVB

M68332 Processor System

Several DSP boards from Analog Devices and Motorola

TeachMover MICROBOT Computer Controlled Robot

Shadow Boxes for shape recognition

American Magnetics Magstripe Card Reader

Hewlett Packard HEDS-300 Digital Bar Code Wand

Fuzzy Logic Controller (available on the 68HC12 through fuzzy logic instructions)

Temperature Sensitive Transistors,

MC146818 Real Time Clock/Calendar chip

Misc. Components (op amps, discrete logic, solid-state relays, small motors, stepper motors,

+5 V, ±12 V Power Supplies

References

M68HC11 Reference Manual, Rev. 3, Motorola (1991).

"Microcomputer Engineering" by Gene H. Miller, Prentice-Hall (1993).

"Lab Manual for Single- and Multiple-Chip Microcomputer Interfacing" by Peter Song and G.J. Lipovski Prentice-Hall (1988); a copy is available in the CML TA cabinet.

"Operation Manual of the Five-Axis Robot Model TCM" by Microbot Inc., Edition 2, (1982). All the information you need to check out the robot and to interface using the serial port connection for the robot's 6502 microprocessor. A copy is available in the studio TA cabinet.

Microprocessor, Microcontroller, and Peripheral Data, Volume II, available in the lab, on pp. 3-1653 to 3-1672. (information about the MC146818)