Major Project

The goal of this course is for students to learn the design process by going through a major design experience. The designs will be implemented in hardware, so during the first part of the semester the hardware and software tools are introduces using small projects. As in any professional environment, the design process must be documented. To prepare for this, three of the small projects require documantation.Once the students have the nessesary tools for implementation, the design process begins.

A design generally has the following steps:

- Problem Statement
- Methods for solving the problem
- Evaluating different solutions
- Selecting a solution
- Simulation
- Implementation

A design starts with a problem statement. Once the problem is defined, methods for solving it are investigated. This involves a literature review to see what others have done. Next, the method for solving the problem is defined. Since design problems are nesessarily open ended, or have no single solution, the strengths and weaknesses of each solution need to be evaluated in deciding which to use. Finally, the solution is simulated then implemented. The first implementation will be in software, or a simulation, and finally an implementation in hardware. The order of these steps is generally as shown above, but exceptions are common. There are times, for example, when a simulation will give insight into the problem, and change the selected solution.

Each step is described in greater detail below.

Initial Problem Statement

The initial problem statement informs the professor of the project selected by the group. The first step is to sit down and discuss possible projects. Since it involves work over a major part of a semester, select a project that is interesting to you. Next, investigate the project or projects that seem interesting. Read one or two articles on each topic. This makes the selection process easier, and gives ideas on possible ways to attack the problem. When you tentatively have selected a project, discuss it with the professor. Once a final decision for a project has been made, write a short report, not more than two pages, describing the problem selected, at least two possible methods of solution, and at least two references.

To Do:

- Make a list of interesting projects
- Investigate each project reading one or two aricles on each subject

- Select a project
- Discuss the project with the professor
- Write a short report

Literature Review

You are becoming an expert in the project you have chosen. To find out what others have done, what methods exist of attacking the problem, and to know what the state of the art is, you must read. Find out all you can about your topic. Read the journals and periodicals in the library. The best place to start is probably the IEEE journals stored on CD-ROM. Using this, you can enter a keyword or keywords, and see all related articles. Once you find a good paper, use its bibliography to find other papers on the same topic. Also, there is a lot of information on the Web. Once you find a good Web article, make a copy and save it on your computer. Web pages are constatnly changing, so you must include a copy of any web page used in the final report.

Once you have all your articles, the literature review will consist of the reference with a short description, highlighting the points important to your project.

Ex.

R. Rogers, J. Arnold, M. Cavenor, and J. Richards, "Lossless compression of AVIRIS data: Comparison of methods and instrument contraints," *AVIRIS workshop proceedings*, June 1-5, 1992.

This article presents several lossless compression methods based on differential pulse code modulation. Both spatial and spectral prediction is discussed, and results presented. An upper bound on compression comes from the inherent noise in the sensors, which is presented here as 5 or 6 bits at some wavelengths.

To Do:

- Make a list of things to do and do them

Updated Problem Statement and Procedure

This report should have three parts: A problem statement, a background section summarizing what others have done and how they have attacked the problem, and the procedure.

Describe your problem in detail. Include: Why is what you are doing difficult? What obstacles will you have to overcome? Next, describe what others have done. Having completed the literature review, you know what others have done, what the state of the art is, and what are the methods for attacking the problem. Now is the time to decide how you will attack the problem. This depends not only on which is 'best', but which is best for the equipment you have available. Once your reader has a clear idea of what you are proposing to do, describe how you will solve the problem. Write a genral theoretical

solution first, then how to implement this solution in hardware. Include how you will test your idea in Matlab, then how you will transport this solution to the DSP board.

To Do:

- Make a list of things to do and do them

Matlab Implementation

Writing is done for the moment, and you now have to implement what you have been thinking about. Matlab is generally too slow to be used in real time processing, but is great for simulations. Implement what you described in the updated problem statement and procedure. Design is a lot art, and can be constantly changing. If your design must change from what you have described in your procedure, it is fine, but it must be explained in the final report.

To Do:

- Make a list of things to do and do them

Hardware Implementation

Here the problem gets even more interesting. Real time implementations have many considerations that are not necessary for simulations in matlab. You not only have the constraint of time, but of memory also. Make the best of what you have. Again, designs may change. If you have done a good job in the review and procedure phase, any changes should be minor.

To Do:

- Make a list of things to do and do them

Final Report

The final report must have the following parts:

Problem Statement
Literature Review
Implementation Procedure
Results

The first three parts have been written previously, and can be included with minor modifications. If any change in procedure has ocurred, it must be explained. The results section is the only new part. In this part explain how the implementation worked. Were there problems? How were they overcome? If another group decides to do a similar project next semester, what suggestions do you have?

To Do:

- Make a list of things to do and do them