TEXAS A&M UNIVERSITY
CPSC 483: COMPUTER SYSTEM DESIGN
SPRING 2004

CRITICAL DESIGN REVIEW

The Critical Design Review (CDR) defines a transition between the design stage of your project and the implementation/integration stages. In a typical project, all decisions have been made at this point concerning *what will be built and how it will be tested*.

The objective of the CDR is to present a complete design of the system, an implementation plan and validation/testing procedures. A successful CDR presentation and report will have the following components:

- Brief review of the project, including problem background, needs statement, goals and objectives, literature survey, design constraints, and alternative solutions considered
- Proposed design containing
    - ***System block diagram*** with a functional description of parts and interfaces
    - ***Complete specifications*** and detailed design of each subsystem, including
        - Circuit and logic diagrams
        - Interfaces and pin-outs
        - Timing diagrams and waveforms
        - Software processes with their inputs and outputs
        - Complete parts list
- Updated validation/testing procedures
- Updated detailed schedule with planned deliverables
- Updated division of labor and responsibilities
- Brief review of engineering standards: economic, societal, safety and environmental analysis
- Test results and demo of completed parts of the system at the time of the CDR. Demos can be videotaped with the assistance of the TAs using the camcorder in the lab. A TV/VCR will be available in the classroom during presentations.

TERMS AND DEFINITIONS

Problem background: Describe the general scope of your project, and the specific problem that your project is addressing. Go from general (e.g., search and rescue robotics) to specific (e.g., GPS navigation). In most of the senior design projects, the problem background is an area of research or an application domain within computer engineering.

Needs statement: After you have described the problem background, it is time to define a specific need that your project will address. Articulate the need as an expression of dissatisfaction with the current situation.

Goal and objectives: The *goal* is a brief, general, and ideal response to the needs statement. How are you going to satisfy this need? The goal statement is so ideal that it would be difficult to decide when it was achieved. It rather establishes a general direction for the design mission. In contrast, the *objectives* (there will likely be more than one) are quantifiable expectations of performance. The objectives should also include a description of the conditions under which a design must perform. Specifying the operating conditions will allow you to evaluate the performance of different design options under comparable conditions.

Literature and technical survey. Describe prior research and development efforts that are specifically related to your problem, your needs statement, and your goals and objectives. This is not meant to be a comprehensive survey of an engineering discipline, but a concise overview of the most significant results that are tightly related to your project.

Design constraints and feasibility. Describe the constraints (e.g., technical, physical, economical, temporal) that you have to work with. In many cases, your needs statement will have already identified some of the constraints that your design will have to meet. Assess the extent to which your project objectives can be accomplished.

Evaluation of alternative solutions. This is a critical aspect of your project. For any goal there are likely many alternative solutions. In most cases, the alternative solutions will emerge from your literature and technical survey. What you have to do here is analyze the pros and cons of each of these solutions (and hopefully additional solutions you come up with), and justify your decision to opt for a particular solution.

Proposed design. Once you have identified a solution that addresses the needs of the project, it is time to present the specifics of your design. This includes, but is not limited to, techniques (e.g., algorithms, devices), parts (e.g., hardware, software), and the "glue logic" that will make the *system* work. Your proposed design should build support for the *feasibility* of your project.

Approach for design validation. This is a very simple but important aspect of your project. How will you test that your system does what it was designed to do? Does it solve the stated need? The validation tests should be consistent with the conditions under which your design must perform, as stated in the project objectives.

Itemized budget. Detailed budget of all costs expected to be incurred during the project (e.g., parts, fabrication services).

Schedule of tasks, Pert and Gantt charts. Break down the project into clearly identified sub-tasks, analyze dependencies among them, identify critical paths, and design a feasible schedule for accomplishing these tasks.

Project management and team work. Briefly list the qualifications of the team members and decide who will be the lead person for each of the different areas in the project (e.g., embedded software, sensors, signal processing, communications, etc.) Describe the mechanisms that will

be used to manage the project as a team, such as brainstorming sessions, keeping track of progress on every task, etc.

Economic analysis. Some economic issues were already considered during the analysis of constraints and the itemized budget. Here you provide a further economic analysis, were your system to become a commercial product:

- Economical viability: potential marketability of the system, expected volume production costs (as opposed to prototyping costs)
- Sustainability: Are system parts available from more than one vendor? What maintenance and support will the product require?
- Manufacturability: What is the effect of component tolerances on system performance?, worst-case analysis, expected production yield, testability and compliance to regulations (e.g., FCC)

Societal, safety and environmental analysis. What is the potential impact of your project to society, both beneficial (e.g., quality of life), and detrimental (e.g., loss of privacy)? What are the safety precautions that you have to take when working on the project (e.g., personal injuries, damage to the equipment/facilities)? What is the potential environmental impact of your project (e.g., contamination) and how will you minimize it?

CRITICAL DESIGN REVIEW EVALUATION FORM

PRESENTATION	1	2	3	4	5
Did the speakers make an initial connection with the audience and generate interaction throughout the presentation (eye contact, questions, etc.)?					
Was there a balance between high–level motivational material and technical detail?					
Did the slides present material in an interesting, informative, and professional manner with an appropriate level of detail on each slide?					
Did the presenters appear to be spontaneous and fluid, avoiding the use of distracting mannerisms and colloquialisms?					
Did the presenters use the allotted time wisely?					
TECHNICAL	1	2	3	4	5
Was the problem clearly stated and requirements identified?					
Were the requirements converted to a testable specification?					
Were design alternatives considered along with the rationale for choosing between alternatives?					
Was the system-level functional description well thought-out?					
Are there enough detailed designs for each system component and their interfaces to support the feasibility of the project?					
Was a timeline presented and supporting evidence of effective project planning?					
Was the test plan well developed?					
Was there evidence of effective teaming?					
Were environmental and health/safety concerns addressed?					
Were social, political, and ethical concerns addressed?					
Were manufacturability, sustainability, and economics addressed?					
Was there a vision for how the resulting product would be effectively demonstrated?					

Evaluation scale: 1 (not at all) $\rightarrow$ 5 (very much)