Computer Engineering Capstone Course Project Competition

1. ICOM5047 - Design Project in Computer Engineering

August 23, 2013

This semester, thanks to a donation by the Xerox Corporation to the Capstone Design Course Laboratory, and to incentivize novel project ideas, a project ideas competition has been organized. All the teams where there is at least one computer engineering student registered in the capstone course are required to participate.

The two best projects ideas will be awarded funding for hardware components (electrical, electronic, mechanical, etc.), and software licenses for a value up to $1,000 for the first place, and up to $600 for the second place.

1.1. Conditions of the awards:

1. No cash will be awarded.
2. All purchases will be carried out through and according to the internal procedures established by the University of Puerto Rico.
3. Since the donation was given to the Computer Engineering Capstone Course Laboratory at the University of Puerto Rico, all the components and software purchased with the award money will be the sole property of the Capstone Lab.
4. Intellectual property resulting from any of the projects will be handled according to the policies, regulations and procedures of the University of Puerto Rico.

1.2. Conditions to participate

1. At least one student registered in the course ICOM5047 must be part of the team and contribute to the project with technical knowledge and skills specific to computer engineering.
2. All the teams should submit a one-page executive summary, one page with one-paragraph biosketches of each team member, and one page budget of the components and software requested with a short justification for each item. The documents should use font Times New Roman 12-points, single space; paragraph spacing before: 6 points, and after: 6 points.

1.3. Eligibility

The evaluation of the best project ideas will be conducted by a team of people from local business and industry according to the criteria established for this competition. To be eligible for funding, the winning teams must obtain a grade of 90 or higher in the proposal. The grading of the full proposals will be carried out by the professors of the course according to the criteria in the evaluation forms established for the course.

To avoid any bias in the evaluation of ideas and proposal grading, the two processes will be kept separate at all times. Only when both processes have been concluded, the results will be combined to select the two winning teams.

1.4. Important dates

- Competition officially opens: August 26, 2013
- Deadline to submit executive summary for competition, and final version of the project proposal: September 6, 2013 10:30 AM (GMT – 4).
- Winner selection and announcement: September 13, 2013 during the class period.

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1. ICOM5047 - Design Project in Computer Engineering – The proposal

1.1. Guidelines and hints

The executive summary is normally the last piece of the proposal you write. The first step should be the definition of the problem and writing and refining the problem statement. To that end, thoroughly investigate your project ideas (for an enjoyable video see (News, Deep Dive Part 1 of 3), (News, Deep Dive Part 2 of 3) and (News, Deep Dive Part 3 of 3)). Identify potential users or customers and interview at least some of them; talk to entrepreneurs and business people with experience. Collect as much first-hand practical information about the needs and the problem as possible. Search the web for competitors and similar products. Analyze the information and compare it with your ideas. Do not stick only to one idea; if possible explore several ideas. Analyze your ideas from as many different perspectives as possible; from the user or customer perspective[1]; from the investors point of view or from any stakeholder perspective. Be innovative, think outside the box, but remember to get your feet back on the ground, and be realistic.

Write several problem statements; compare them critically; combine them or select the best one. If possible have someone independent read and criticize your problem statement. Is it easy to understand by a layperson? Is it concise and brief, but accurate? There is a lot of material in the literature and on the Web on how to write effective problem statements. Use all the resources and hints you can get. The problem statement is a crucial part of the executive summary and the proposal, so crucial that some people say a good problem statement is half the problem solution.

Once you have a good problem statement write the objectives of your project. Review the material on Moodle and other resources on the Web about writing project objectives. SMART is an acronym used to describe the minimum set of quality attributes of well-written objectives. SMART stands for Specific, Measurable, Agreed-upon with the customer, Realistic, and Time-bound.

Objectives are a few one-sentence descriptions of what you aim to achieve at the end of the project, and usually start with a verb in infinitive. Each objective comes associated with at least one specific outcome, and outcomes result from achieving the objective. For instance, if your goal is to implement a system for counting defective parts on a conveyor belt, an obvious outcome is a system that does just that. You have also to determine how your project progresses towards objective achievement; for this you need to define metrics that allow you to have data and information as to whether your work is going as planned or need some adjustments. In the previous example, metrics could be associated with the successful implementation of each component of the system, their integration, and testing. You may assign different weights to the implementation of the different components according to the level of complexity. You may

[1] Sometimes the user of a system may be different from the customer, e.g., the users of the ATMs are all those people with debit or credit cards, while the customers are the banks and financial institutions.

define milestones and estimated dates to determine whether your project is on time, or needs some contingency measures. This is what makes an objective measurable.

But your customer or some other stakeholder should agree with the objectives of your project. You do not work in the vacuum; your project has to solve a problem or satisfy a need, present or future. The cell phone development solved at the time the need for mobile communication. People had lived for millennia without such type of communication, but since that invention people have grown up so used to it that many could not imagine a world without a mobile communications device. Those kinds of breakthroughs are very risky and not very common, but when soundly justified make up for the approval of many times costly projects.

The realistic feature of objectives has to do with the availability of resources, *i.e.*, economical, technical, human. When defining your objectives ensure you or your sponsor has the funds necessary for the project. In the capstone course, we have instruments, electronic components and tools, but you must consider whether they are enough and adequate for your project. Also, analyze the expertise of each team member. Have you carried out projects of similar nature in the past? If not, how long would it take to learn what you do not know? Or is there a consultant that can guide you or teach you?

Time is of essence and you have just one academic semester to finish your project. Your project is time-bound, so be realistic and embark on a project that can be achieved within this stringent time limit.

With a sound problem statement and SMART objectives you have paved the way to writing the rest of the proposal and the executive summary. Structure the proposal according to the evaluation form provided for the course. Use the evaluation form as a checklist of all the elements needed, and also for self-evaluation, but do not write separate sections for each item in the evaluation form. Do not abuse or overuse bullet and number lists. Use bullet or number lists only when you really need to list items. Good writing style is fluid and leads the reader smoothly through your arguments, not hopping through bullets.

Finally, something about your readers. Make reading your documents a pleasant experience by taking into consideration who reads it. The executive summary will be read by people not necessarily with a technical background in engineering, but surely business-savvy. Thus, the executive summary must provide just enough technical detail for that person to make an informed decision and to demonstrate that the project is feasible, but the reader of the executive summary will focus more on market potential, competitors, windows of opportunity and financial matters.

The full proposal is normally read by people with technical background, probably colleagues with more experience. They will be able to judge whether your technical decisions are appropriate to solve the problem, if the team is well organized and has the expertise and resources. Do not beat around the bush. Be concise, but provide all the necessary details to convince your readers that your project is worthwhile. You have a limit in the space to explain your project. Use it wisely.

2. Specifications of documents

2.1. For the competition

1. Front matter: one page with institutional information (University of Puerto Rico and all the schools and departments involved, name of the team, title of the project, names and affiliations of the team members, date and names of the professors to whom the proposal is submitted. In the case of interdisciplinary projects the names of the professors supervising the project in other programs or departments must be included.
2. Executive summary: One page
3. Team members' biosketches: one page
4. Hardware and software budget and justification: one page

Number of pages: four

2.2. For the proposal

1. Front matter: one page with institutional information (University of Puerto Rico and all the schools and departments involved, name of the team, title of the project, names and affiliations of the team members, date and names of the professors to whom the proposal is submitted. In the case of interdisciplinary projects the names of the professors supervising the project in other programs or departments must be included.
2. Executive summary: One page.
3. Table of contents.
4. Body of proposal: maximum length 15 pages; this length does not include the bibliographic references or the Gantt Diagram.
5. Bibliographic References
6. Gantt Diagram (separate file in MS Project format, .mpp)
7. Appendices (when necessary)

2.3. Heading, paragraph format and font

Use hierarchical numbering for the headings, just like this document. Use font sizes, bold and italics to make headings noticeable. For the body or normal text use font Times New Roman 12 points, and for the paragraph formatting use spacing 6 points before and after, and single line spacing. The pages of the body of the proposal must be numbered.

2.4. Name and format of files

You may submit files in MS Word format (.doc, or .docx), or in Portable Document Format (.pdf). To avoid confusion among files submitted by different teams, use the following convention:

For the documents for the competition:

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<name of the team>_es_competition
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For the documents in the proposal:

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<name of the team>_proposal
<name of the team>_gantt
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If you have separate files for the appendices use the following convention:

<name of the team>_appendix1

<name of the team>_appendix2

…

Put all these files in a zip archive named:

<name of the team>_proposal_pkg.zip

Example: If your team name were “The A Team” The file names would be:

The_A_Team_es_competition.pdf

The_A_Team_proposal.pdf

The_A_Team_gantt.mpp

The_A_Team_appendix1.pdf

The_A_Team_appendix2.pdf

The zip archive name would be:

The_A_Team_proposal_pkg.zip

As noticed, it is advisable to separate the words in your file names by underscore (“_”). Sometimes Moodle adds the underscores by itself. The use of capital letters in your team name is optional.

Submissions must be via Moodle. Only one submission per team is necessary. Late submissions will not be accepted, so make sure to submit your file ahead of time to avoid any last minute problems with Moodle or Internet.

Good luck!

3. Works Cited

News, ABC. *Deep Dive Part 1 of 3*. 13 July 1999. ABC. 24 August 2013. <http://www.youtube.com/watch?v=JkHOxyafGpE>.

—. *Deep Dive Part 2 of 3*. 13 July 1999. ABC. 24 August 2013. <http://www.youtube.com/watch?v=pVZ8pmkg1do>.

—. *Deep Dive Part 3 of 3*. 13 July 1999. ABC. 24 August 2013. <http://www.youtube.com/watch?v=nyugyrCQTuw>.