Call for IEEE Real-World Engineering Projects (RWEP):
Discovery-Based Projects for First-Year Students in Electrical Engineering, Computer Engineering, Computer Science, Biomedical Engineering and Electrical Engineering Technology

Program Description

The goal of this program is for IEEE to disseminate high quality, hands-on, team-based projects for the first-year electrical engineering (EE), computer engineering (CE), computer science (CS), electrical engineering technology (EET) and biomedical engineering (BE) classrooms. These hands-on projects are specifically designed to illustrate real-world contemporary problems whose solutions benefit society; consequently, they make EE, CE, CS, EET and BE significantly more relevant to students and provide the students with opportunities to understand how their own future work might help others. Moreover, the projects allow students to discover the importance of EE, CE, CS, EET and BE in solving contemporary problems, and elicit excitement about creative problem solving. The hands-on projects demonstrate how and why underlying principles in EE, CE, CS and EET can be used in solving problems, rather than simply providing recipes for the solution. They are designed to be done by teams of first-year students in a week or two of instruction as part of a typical laboratory-based introductory EE, CE, CS, EET and BE course, **with approximately 7 to 15 contact hours of total instruction, including lecture and laboratory**. The projects are designed by EE, CE, CS, EET and BE experts in such a way that the underlying complex principles and concepts are made tractable for first-year students.

The RWEP program will produce a library of real-world contemporary hands-on projects for use by EE, CE, CS, EET and BE faculty in the first-year curriculum. Incorporating these projects into the first-year curriculum will encourage student learning through participation, increase student retention through satisfaction, and improve student confidence through achievement.

IEEE is issuing this call for projects in order to solicit high quality project submissions. Project submission is a three-stage process. First, the proposer submits a one-page summary abstract. If accepted after review, the proposer is invited to submit a more detailed project proposal. If accepted after review, the proposer is invited to submit a full project for inclusion in the RWEP project library, which will be made available to the public through IEEE's *University Education Portal*.

Once the full project is submitted to IEEE, an award is made to the proposer. The award includes:

a monetary award of $10,000 US.
an invitation to submit the project for presentation at an IEEE-sponsored workshop.
a congratulatory letter.

Eligibility Criteria

To be eligible to apply for this program, a person must be a faculty member who teaches Electrical Engineering, Computer Engineering, Computer Science, Biomedical Engineering and/or Electrical Engineering Technology at a university that grants degrees in EE, CE, CS, BE and/or EET programs.

Special Note for Teams: This call for projects describes a project as a single curriculum module proposed by a single faculty member. However, it is possible for a small team to write a series of (two to four) linked curriculum modules to treat a topic in greater depth. Each team member must meet the eligibility criteria, and each of the modules must be authored by a different team member. Each module in the series must be written as a standalone module that can be taught in one or two weeks in a typical first-year introductory laboratory-based course. Guidelines for content and review criteria for team submissions are the same as for single-author submissions. At the time of submission, the team should indicate that the submission is for a series, and give the titles and order of the modules in the series, so that they can be reviewed as a group. One award will be made per curriculum module, to that module's author.

Additional Information

For further information regarding this program, contact realworldengineering@ieee.org.

Stage One: Abstract Submission

A one-page summary abstract that describes the project must be submitted by March 31, 2010. A proposer may be the lead author on at most one abstract. The abstract must contain the following.

- Project title
- Introduction to the real-world contemporary technical problem solved or illustrated by the project
- Discussion of the benefit of the problem's solution to society
- Description of the hands-on team-based project: what the students will do, what underlying EE, CE, CS, BE and EET principles and concepts they will discover, what problem-solving strategies will be employed and what trade-offs will be observed
- One figure that illustrates the problem and its solution

Since the intended audience is first-year EE, CE, CS, BE and EET students, the projects should be designed such that they are tractable for students who have only an introductory knowledge of calculus and physics. The projects should also be designed for an international audience, and be easily replicated at institutions around the world at reasonable cost. An abstract is either rejected or invited for a project proposal submission; applicants will be notified via email of the review decision by April 30, 2010.

Abstracts should:

- Be no more than one page, using one-inch margins on all sides and single-spaced text in either Times New Roman 12-point font or Arial 11-point font.
- Not cite the proposer's own work, give his/her name, or in any other way indicate his/her identity or the name of his/her institution.
- Be submitted electronically as a PDF file at www.realworldengineering.org on or before March 31, 2010.

Abstract submissions that do not adhere to the requirements will not be reviewed.

Abstracts will be peer-reviewed using a double-blind process. Abstracts will be reviewed based on three criteria: relevance, quality and discovery.

- ***Relevance*****:** Does the proposed project address a problem whose solution benefits society? Is the project presented in the context of a real-world, contemporary application? Are these connections made explicit in the proposed project?
- ***Quality*****:** Is the proposed project described in a straightforward, organized, and complete manner? Are the proposed project description and methods accurate, clear, and concise? Is the proposed project tractable for first-year EE, CE, CS, and EET students? Is the project appropriate for an international audience, and can it be easily replicated at other institutions? Is the project of an appropriate scope to be done within two weeks of instruction?
- ***Discovery*****:** Does the proposed project result in student discovery of an underlying principle or concept in EE, CE, CS, or EET? Does the proposed project illustrate strategies and trade-offs that are important in the engineering problem-solving process?

Stage Two: Project Proposal Submission

Proposers of successful abstracts will be invited to submit a project proposal. A project proposal is an extended version of the abstract. Project proposals must be submitted by June 30, 2010. The project proposal must contain a five to seven page narrative that includes the following:

- Project title.
- Introduction to the real-world contemporary technical problem solved or illustrated by the project, and a clear discussion of the benefit of the problem's solution to society.
- Description of the hands-on, team-based project: what the students will do, what underlying EE, CE, CS, EET principles and concepts they will discover, what problem-solving strategies will be employed and what trade-offs will be observed.
- Details of the hands-on, team-based project: which parts the students will be given and which parts they'll develop themselves, how long it will take for students to complete the project, a brief supply list for preparing each hands-on project "kit", a cost estimate for each kit, and how many students should be on a team.
- Figures that illustrate the problem and its solution.

The proposal should also include two to four PowerPoint slides that demonstrate the key principles and show the basic experimental apparatus.

Since the intended audience is first-year EE, CE, CS, and EET students, the projects should be designed such that they are tractable for students who have only an introductory knowledge of calculus and physics. The projects should also be designed for an international audience, and be easily replicated at institutions around the world at reasonable cost. The projects should be able to be done in no more than two weeks as part of a typical laboratory-based introductory course, **with approximately 7 to 15 contact hours of total instruction, including lecture and laboratory**. A project proposal is either rejected or accepted and invited for full development and inclusion in the project library; applicants will be notified via email of the review decision by August 15, 2010.

Project proposals should:

- Have no more than seven pages of narrative, using one-inch margins on all sides and single-spaced text in Arial 11-point font.
- Contain no more than four PowerPoint slides of standard size, using plain white backgrounds and Arial font 18 point or larger.
- Not cite the proposer's own work, give his/her name, or in any other way indicate his/her identity or the name of his/her institution.
- Be submitted electronically as a single PDF file containing both narrative and PowerPoint slides by June 30, 2010.

Project proposals submissions that do not adhere to the requirements will not be reviewed. Project proposals should carefully address any feedback from the review of the submitted abstract. Details on the electronic submission process will be given to invited proposers. Project proposals will be peer-reviewed using a double-blind process. They will be reviewed based on the same three criteria used for abstract review: relevance, quality and discovery.

Stage Three: Full Project Submission

Proposers invited to submit full projects must do so by November 1, 2010. The project submission must contain the following individual documents:

- A ***background lecture*** (30-40 PowerPoint slides) that motivates and introduces the problem and provides the necessary technical background (for presentation to the students). The impact of the problem's solution on society must be demonstrated and illustrated in the context of a real-world, contemporary application.
- A ***student project assignment*** (2-3 page PDF document) that recaps the problem and details the hands-on project to be conducted (for distribution to the students who would conduct the project). This assignment must detail what the students will do and what they will discover.
- A ***faculty project description*** (3-5 page PDF document) that details the hands-on project (for distribution to the EE, CE, CS, and EET faculty who would use the project in class). This description must include a description of the resources needed to conduct the project and explicit directions on how to build/assemble the system (if applicable). This description must also include the necessary data, code, or other methods for executing the project. Finally, this description must explicitly describe the expected problems, strategies, trade-offs, and results.
- A ***project report solution*** (3 page PDF document) that provides an example to the EE, CE, CS, and EET faculty of a successful, complete, student project report. The sections of the project report include: problem definition, methods, results, and conclusions. The report should include graphs and data (as appropriate), the observed trade-offs, the employed strategies, and what was discovered.
- A ***summary lecture*** (20-30 PowerPoint slides) that reviews the problem, the methods for solving the problem, the trade-offs and strategies involved in the solution, and what was discovered (principles, concepts, etc.; this is for presentation to the students). The summary lecture should conclude with the reconsideration of the real-world application and its benefit to society.

The project title should appear at the beginning of each document.

Full projects should:

- Use PowerPoint slides of standard size, using plain white backgrounds and Arial font 18 point or larger.
- Have one-inch margins on all sides of text pages, and use Arial 11-point font.

Full projects should carefully address any feedback from the review of the submitted abstract and project proposal. Details on the electronic submission process will be given to invited proposers.

Upon acceptance, the proposer (now awardee) will be awarded:

- a monetary award of $10,000 US.
- an invitation to submit the project for presentation at an IEEE-sponsored workshop.
- a congratulatory letter; an awardee may choose for the letter to be copied to her/his Department Head and/or Dean.

The award is contingent upon the awardee:

signing a copyright agreement giving IEEE full rights to the submitted project materials;

- submitting any additional project material information needed for complete and proper execution of the project (e.g., data files, software code), and making any modifications required to the project to finalize it for posting on the public RWEP portal;
- submitting a 3-5 slide overview of the project for outreach/advertising purposes; and,
- working with IEEE staff to adapt the project into a lesson plan for use in IEEE's *Teacher In-Service Program*.