Call for Mechanical Engineering, Electrical Engineering, and Computer Engineering Senior Design Project Proposals

Objectives: The intent of the senior design course sequence is to teach students how to apply their math, science, and engineering knowledge to solve open-ended problems in response to needs of an external customer. These projects give students an opportunity to learn design philosophies, develop team-based designing skills, gain hands-on experience budgeting time and finances, and become proficient in oral and written communication. Student teams solve meaningful technical problems that require more time and talent than any one individual can contribute. Interdisciplinary projects can be accommodated by a common course structure.

Interdisciplinary Projects: The University of Idaho encourages projects that span engineering disciplines. This gives the students an opportunity to experience the kind of multidisciplinary teamwork that they are likely to encounter in industry. This solicitation is the combined effort of Mechanical Engineering, Electrical Engineering, and Computer Engineering faculty. Some project teams will include students from two or more of these disciplines.

Expectation for Students: The students are expected to have necessary technical knowledge from classes, or be able to acquire it with reasonable effort. Students starting the senior design sequence have just completed their junior classes, and most and have little or no professional industrial experience, although some may have had summer internships. Students can be expected to work on projects from 10 to 15 hours per week. Besides in-class activities, this time includes generating progress reports, preparing for design reviews, and completing formal reports. A common basis will be used to evaluate student performance across all engineering disciplines.

Expectation for Sponsors: Sponsors of senior design projects should have a well-defined product in mind with well-defined requirements and constraints. The scope of projects should be suitable for teams of 3-5 students working steadily for approximately a half-year (21 weeks). Sponsors are expected to provide parts and/or financial support for material consumed in the completing the project, off-campus travel, and a contribution to upkeep of the engineering shop/laboratory infrastructure at the University of Idaho. Sponsors should also provide regular guidance and encouragement to the team so that important design issues can be resolved satisfactorily. Sponsors should not expect students to use personal funds (travel, long distance calls, etc.) to complete the project.

Expectation for Projects: Every effort will be made on the part of our instructional and professional staff to insure a return on investment that meets expectations of sponsoring organizations. However, advising faculty and course instructors will not micro-manage projects, depriving student teams of ownership of project outcomes. In the event that projects are incomplete and customer satisfaction is an issue, student grades will be withheld until an acceptable solution can be produced. In the past this has required some student teams to work into the summer term, deferring start of employment.

Characteristics of a good project

1. Projects have realistic mechanical, electrical, and/or computer-based solutions involving proven technologies.
2. Projects contain multiple components, allowing concurrent design and subsequent integration into a final product with ample time for testing.
3. Projects have multiple solutions that are acceptable to the customer. Building a pre-existing design does not make for a good project.
4. Projects do not require development tools or instrumentation that the College of Engineering does not possess and that the students can access easily.
5. Projects should be comparable to those given to an entry-level engineer.

Projects that involve excessive proprietary material or that are in the critical path of the sponsor's business plan are to be avoided.

Process for Sponsoring ME, EE and COE Senior Design Projects:

1. Submit a brief description to one of the senior design instructors listed below.
   - For mechanical projects: Steve Beyerlein, sbeyer@uidaho.edu
   - For electrical/computer projects: Greg Donohoe , gdonohoe@uidaho.edu
1. The instructors may iterate with sponsors for clarification or redefinition.
2. The instructors review the projects together, select the most appropriate projects, select project teams and orient teams to projects. A typical team has two to four students, and may include some students from two or more of the three participating engineering disciplines.
3. Students submit a design proposal, with work plan and schedule, to the sponsor. This may be iterative until the sponsor, instructor and design team agree on the project outcomes, work plan, and testing requirements.
4. Sponsor agrees to support the proposal and supplies necessary resources.
5. Project work begins
   a. Students submit regular progress reports to sponsor.
   b. Sponsor participates in design reviews and evaluates progress/test results.
   c. Students generate appropriate hardware and documentation.
   d. Students present their completed work at the Design Expo at the end of the spring semester.
   e. Students are done when project deliverables are accepted by the sponsor.

Attachments: Example Project descriptions and specifications

University Of Idaho Senior Design Project

For

Argonne National Laboratory

HEPA Filter Disassembly Station

June 1, 2004

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Scope

Design, fabricate, and test a station capable of disassembling HEPA filters and separating the filter media from the filter frames. This activity must be performed in a remote, hot cell environment.

Background

The HEPA Filter Preparation Station will be located in the Remote Treatment facility processing hot cell. The Station will be used to separate the filter media from the filter frames. The radioactively contaminated HEPA filters are approximately 2 ft X 2 ft X 6 inches or1 ft thick. The frames are either steel or wood, and the media consists of aluminum separators and fiberglass paper. The HEPA Filter Preparation Station consists of a staging area table, and could consist of such equipment as a punch press and die assembly, a size-reducing device, and a receiver-can positioning assembly.

A Radioactively contaminated HEPA filter would be brought into the hot cell, and any external packaging removed. The mechanism such as a punch press assembly would be used to separate the media from the frame. If the filter media contained aluminum separators, the aluminum would be separated from the media, using an automated method to be developed. A size reducing device would then be used to prepare the media for continued processing. The separated HEPA filter frames (and aluminum separators) would be re-sized and placed in the appropriate waste containers.

Design Requirements

The disassembly process should be designed to minimize dust generation and spread of particulate contamination on the filter media.

The disassembly station must be designed to be used in a remote hot cell environment.

The media sizing device must create pieces no larger than 1”x1”.

The process should incorporate automated separation of aluminum separators from the media.

Agriculture Field Sensor Unit Proposal

Project Description
An instrumentation package is needed to provide soil and crop data for closed loop control of a spatially variable center pivot irrigation system. The instrumentation package is to be solar powered and radio linked to a remote receiver for data acquisition and display. An alternate infrared (IR) link for communication with a palm-top or laptop computer is optional. The system must be able to store 12 weeks of environmental data including a time stamp that is Y2K compliant. All data is sampled and stored at a rate of two samples per hour. Fig. 1 illustrates one possible concept of the instrumentation needed for this system.

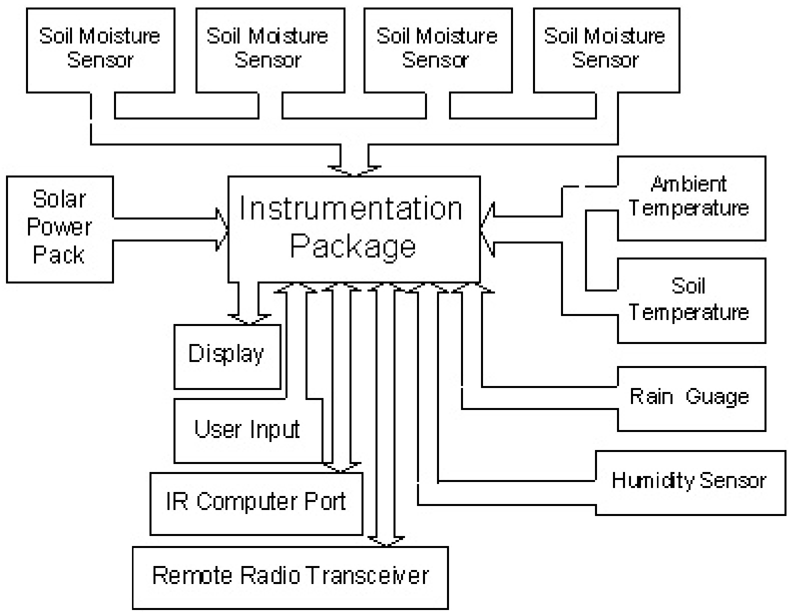

Fig. 1. Block diagram of Agriculture Field Instrument

System Specifications

Environmental:
Operating temperature: -10 to +45 degrees C
Storage temperature: -40 to +85 degrees C
Humidity: 0 - 100% RH

Power:
Solar powered from a 1 watt, 17.5 volt solar panel.
Battery storage with capacity for seven days of normal operation without recharging.

Instrumentation:
Soil moisture:
1 to 4 time domain reflectometry (TDR) soil moisture probes model number CS615.

Frequency range: 400hz to 900hz corresponds to 45% to 5 % volumetric water content

Soil moisture probe impedance: 10K minimum
Soil moisture probe power: 12VDC @ 75ma minimum
Ambient temperature: -20 to +40 degrees C ± 1 degree C.
Ground temperature: 0 to +40 degrees C ± 1 degree C.
Relative Humidity: 10% - 90% rh ± 5%
Rain gauge: Tipping bucket input for dry relay contact with 100ma max contact rating.

Communications:

- Radiometrix RPC UHF radio link
  - Protocol – TBD - proprietary
  - Daughter board component on instrument PCB
- IRDa serial interface @ 9600 BAUD
  - Protocol – TBD – WIN95/98 compatible

User interface:

- Manual Control
  - Menu select control, no numeric input
  - Push button control mounted directly on PCB
  - Operation – TBD
- Computer control
  - Same level of control as manual controls
  - Ability to acquire logged data
  - Ability to set system operational parameters
- LCD display
  - Daughter board component on instrument PCB
  - Menu displays – TBD

Data acquisition:

- All measured variables stored at 15-minute intervals
- 90 day data storage capacity
- Zero power NV memory
- Measurements time stamp for month-day-year-hour-minute
- Real time clock with Y2K compliance

Expansion:

- Four 0-10 volt analog input ports with input impedance 10K ohm or greater.

Packaging (printed circuit board):

- Dimensions: 6x4x3 in. (excluding battery and solar panel)
- Locking keyed connectors
- LCD and RPC plug directly onto PCB