Innovation with Virtual Instruments and Software in Computer Engineering Education

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Abstract

Teamwork and innovation abilities are critical in the profile of a new engineer. I am conducting an exploratory innovation initiative at the University of Wisconsin-Stout to develop these abilities through project-based courses.

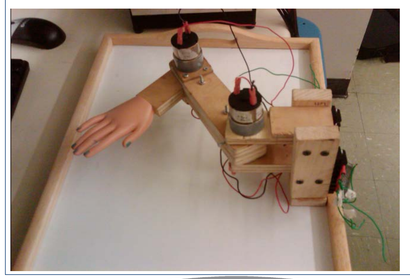
Introduction and Objectives

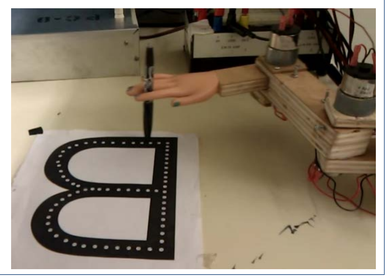
- Apply virtual instruments (VIs), e.g., sensor, analog-to-digital converter, virtual oscilloscope, and software, e.g., NI LabVIEW and MATLAB/Simulink, teaching students design and development of a control system, expanding knowledge base of new technology, and preparing future engineers to face real-world problems.
- Cultivate and strengthen hardware/software & comprehensive application ability, hands-on and innovation abilities, as well as capacities for teamwork, leadership, and employment competitiveness.
- Educational innovation benefits teachers as well. I focus research work on related topics and integrate innovative achievements into student projects.

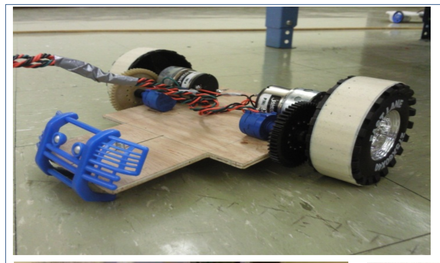
Developmental History of Innovation

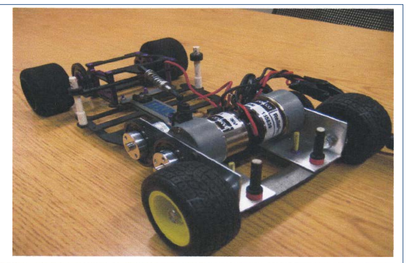
At New Jersey Institute of Technology

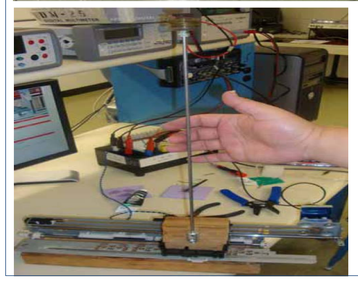
- ECE-439 (Control Systems Laboratory) introduces:
  - Control system design, computer analysis, simulation
  - Analysis tools (MATLAB & NI LabVIEW)
  - Sensors and DC motors
- Student projects based on VIs and software to integrate hands-on experiment with theory includes:
  - Two-link Robotic Arm
  - Real-time control of an Autonomous Robotic Vehicle
  - Inverted Pendulum

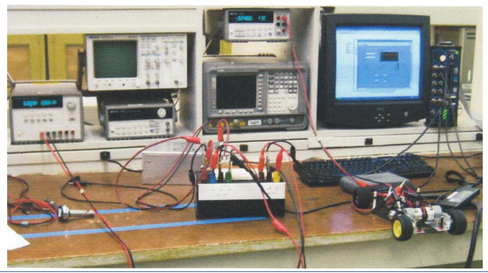








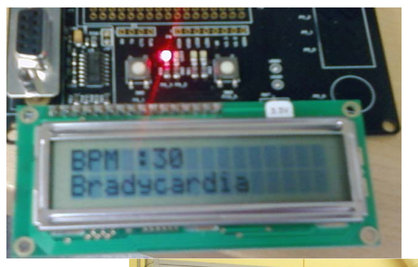


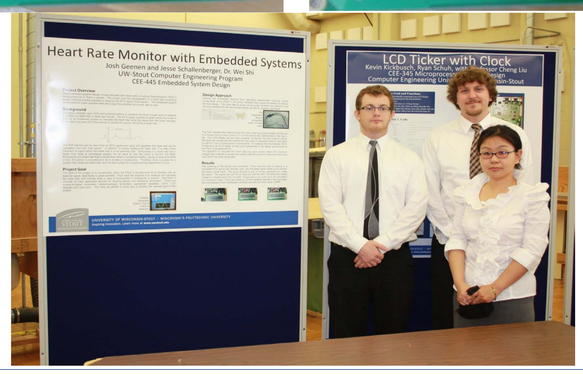


Developmental History of Innovation

At University of Wisconsin-Stout

- CEE-445 (Embedded System Design) is a new senior-level and project-based course. I design my class to be student-centered, interactive, and let them take command of learning.
- Student project - Novel Heart-rate Monitor with Embedded Systems:
  - Through LCD heart rate reading and alarm displays, provides immediate notification of abnormalities in cardiac activity on a monitored patient
  - Easily accessible, portable, and also has the benefits of low cost and low power consumption.





Learning Activities and Materials

CEE-445 Embedded System Design

- Embedded system Interfacing Labs
- Literature survey – topic research
- Competition-based Final Project
- Study group; Self-evaluation
- Engineering Open House Presentation
- Conference Publication

ECE-439 Control Systems Laboratory

- Electro-mechanical Labs
- System Simulation Labs (MATLAB/Simulink/Ansim)
- Data Acquisition Labs (NI LabVIEW)
- Real-time Control of Autonomous Robotic Systems
- Class presentations

Discussion

It has been shown that project-based learning with VIs and software has a great impact on activating student interest and enthusiasm for Computer Engineering. Students are relaxed, involved, pay more attention, and learn better in my class. As an early-career faculty, I plan to establish professional collaborations and develop more industry-relevant projects for my class. I also look forward to improving my ability to communicate with students and stimulate rich self-directed learning environments during the FOEE Workshop.

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