C-40: SimSYS: A Game Development Platform for SE/Sys Educational Games

Team based research and development of a serious game development platform for software and systems engineering education. The project involves game and software engineering activities including technical (requirements engineering, architecture, OO design, use of patterns, development adhering to coding standards, effective use of components/libraries, testing, documentation, configuration management) and soft-skills (communication, demonstrations/walkthroughs, time management, professional development).

The game development platform is composed of a collection of modules (tools) that include a Game Play Engine, Semi-automated Intelligent Game Generator, as well as an Automated Assessment and Adaptation tool. Teams will extend an existing module with additional features using an agile development methodology.

This is a challenging project that is well-suited for students with a strong interest in game engineering and software engineering; students will learn and apply valuable skills and tools widely used in industry.

Sponsors: Kendra M.L. Cooper
Faculty Advisors: Dr. Dennis Brylow

C-43: Software Defined Networking

Software Defined Networking is one of the hottest topics in Information Technology and Data Centers today. Right now it's in its infancy and while the standards are there the ecosystem of Applications to control network traffic in a meaningful way aren't quite there. Did I mention there's a competition for a cash prize?

From the Extreme/US Ignite Challenge:

- These applications may not only solve today's complex business and IT challenges but also provide an experience not readily available on today's commercial Internet such as:
- Higher reliability for controlling remote vehicles, robotics, farm automation, home dialysis machines, etc.
- Higher security for medical records or financial transactions, etc.
- Lower latency for applications which want to respond to the user in perceptually real-time
- Applications that use SDN to perform functions such as multi-way video distribution or multi-way sensor aggregation.
What skills are you looking for?

Open Source Interest, Python Programming, Interest in networking or queuing theory, Control Systems Design, Security Research

Sponsors: Mark Scheuber (mscheube@extremenetworks.com), Extreme Networks
Faculty Advisors: Dr. George Corliss
Links:

http://www.opendaylight.org/
http://www.sdncentral.com/sdn-use-cases/
http://www.noxrepo.org/

C-44: Test Site Management Tool

The goal of this project is to create a web application for the Metasys release and deployment team to manage Alpha and Beta test sites for their software. Alpha and Beta testing is critical to catching any bugs and required enhancements before the final product is released for consumption. The release and deployment team manages a long list of alpha and beta site candidates and must determine which selection of candidates provides the most coverage for the software before each release. Currently this selection process is very manual and time consuming.

We are looking for an application in which test site candidates submit their site profiles indicating which features and devices they can test, among other information. The application should provide a mechanism for ranking and comparing candidates to best meet the testing criteria. It is important that the application be geared towards future Metasys releases; in other words, the ability to add new items to feature and device lists should be straightforward (just one example).

C# is preferred.

Sponsors: Francisco Hurtado (Francisco.Hurtado@jci.com), Johnson Controls Inc.
Faculty Advisor: Dr. Chandana Tamma

C-47: Exploring Computer Science: Redesigning a High School Curriculum Module

Development of an alternative module to replace the current ECS robotics module. Design and implementation of both hardware and software are required for this project (object-oriented design, user interface design, thorough documentation, circuit board design and production), as
are less technical elements (writing proposals, making presentations, interacting with teachers and students to improve design).

The course is based around the Arduino Leonardo and a custom circuit-board "shield" bearing peripherals controlled by a custom block-based programming language. Both the language and the shield require work from the team. Students will write code in this language and deploy their programs directly onto the Arduino.

This project requires a combination of technical and soft skills and is well-suited to students who wish to see their work benefit high school STEM education, especially in traditionally underrepresented areas.

Sponsors: The National Science Foundation, The Marquette Center For Teaching & Learning
Faculty Advisors: Dr. Dennis Brylow

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C-48: Limo App

The goal of this project is to create an app that will be used by Marquette students to put in requests for LIMOs without having to call the dispatcher. The app will have the ability to see the number of seats available in each LIMO in use. The students will be able to see how many other people requested a ride, and where they requested a ride from. GPS will be used to track the LIMO’s location so students can always see where all the limos are whenever they are in service regardless if they requested a ride. This is one of the most important aspects because students can just look at their phone and see all the LIMOs on campus and flag down a LIMO without requesting one. This app will be designed to increase the efficiency of the limos for the students and the LIMOs.

Faculty Advisors: Dr. Marek Trawicki

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E-53: Smartphone-Based Embedded Control Interface for Values

Pentair is committed to continue to drive the industry with newest innovations in water treatment, which encompass smart technological advancements geared toward improving ease-of-use for customers and reducing environmental footprint. These innovations add to the full scope of Pentair’s product capabilities across residential, commercial and industrial applications.

Valve and Filtration controls are used in water softening and filtration applications to program valves (type, configuration, and system/user settings), drive water flow, monitor system/sensors status, display alarms/alerts, and interface with users. Some of our electronics controls use
LCD/Segment displays while others use Touchscreen displays and they are used across several Commercial and Residential valves.

For the residential space, Pentair has concentrated on developments in its valve and filtration lines and simplified its product selection process within them. The recently launched 5800 valve features the XTR2 controller with one of the largest color touchscreen displays in the industry. The controller is also simple, intuitive and reliable. In addition, the modularity of the valve allows for several electronic options, including the LXT, SXT and XTR2 to be offered on one valve resulting in lower carrying costs for customers.

Now, we are ready to tackle the demand for versatility around how users interface with our systems.

This project has an ambitious goal to develop a Smart Phone-based control interface for one of our latest valve control designs. Students will have the opportunity to use their creativity to design and develop the user interface for a water treatment valve operating off of a smart phone app. The smart phone application will be used to program parameters into the water treatment control and analyze diagnostic data obtained from the water treatment control. Students will also identify applicable communications technologies to transmit commands and data, and will develop a cost effective and reliable method for the water treatment control and smart phone to communicate. This includes performing the necessary hardware and software modifications to implement the smart-phone app user-interface within the valve controller, and development and test the smart-phone app that drives it all.

Sponsors: Andrew Lindgren (Andrew.Lindgren@Pentair.com), Senior Electrical Engineer, Pentair Water Purification (Brookfield/Glendale, WI)

Faculty Advisors: Dr. Marek Trawicki

Links:

http://www.youtube.com/watch?v=sfeeEFz18H4&index=2&list=PLHrKPWSPE2qBSqCeV0iSUUq0fIN-IGKjG
E-54: Tiny Low GPM Filtration Flow Meter

Pentair is committed to continue to drive the industry with newest innovations in water treatment, which encompass smart technological advancements geared toward improving ease-of-use for customers and reducing environmental footprint. Point-of-Use (POU) systems may use some of the same technologies as Whole House solutions, such as sediment filters, activated carbon filters or reverse osmosis, but instead of treating the water coming into the entire house, POU devices only treat the water designated for a particular tap or use. We offer a variety of turn-key systems that can be used for numerous water filtration applications at the point-of-use (POU) giving you safe clean water, ranging from basic taste and odor systems to fully listed NSF systems carrying health related claims (such as RO systems engineered to produce high-purity/great-tasting water by reducing dissolved minerals, bacteria and organic impurities).

POU systems are used in kitchens, water coolers, coffee makers, soda machines, ice machines, etc. POU systems can filter out bad tastes, colors or odors, which pose no health risk but still affect the water quality; this will improve the flavor of water used for drinking and cooking. Many POU devices also reduce health-related contaminants such as lead, arsenic and volatile organic chemicals (VOCs); this makes the water safer to drink and cook with. Water Flow meters provides a high-efficiency method of monitoring water usage and initiating timely regenerations to maintain system efficiency and optimize performance; the results are salt, water, and energy savings.

This project has an ambitious goal to develop a Small Low-Cost Slow flow meter (for POU drinking water systems) that can register between 0.25-1.5 gpm (gallons per minute) at a +/-10% accuracy (or better), and does not restrict water flow. Students will be required to identify available technologies for this application, assist in defining best cost-effective solution for our intended use, implement the chosen design, create prototypes, develop the design documentation and testing methods needed, and prove the design will be effective for the intended-use.

**Sponsors:** Andrew Lindgren ([Andrew.Lindgren@Pentair.com](mailto:Andrew.Lindgren@Pentair.com)), Senior Electrical Engineer, Pentair Water Purification (Brookfield/Glendale, WI)

**Faculty Advisors:** Dr. Marek Trawicki

**Links:**

E-56: eLIMO

Over five years, 52 Senior Design students have converted one of the old gasoline-powered LIMO vans to all electric power, and the van was returned to service in the LIMO fleet. eLIMO has a range of 50+ miles and its cost of operation is estimated to be less than 20% of the cost of operating a conventional gas-powered LIMO. While the eLIMO has worked, currently it is not operational. This year's team needs to isolate and retal several electrical, mechanical, and software problems. Then, there are many opportunities for improvement including little things such as a charging indicator, to more aggressive subsystems such as full regenerative braking, dashboard control redesign, or data collection and analysis. Our goal is to refine the shuttle van into a more user-friendly EV that requires less additional training to operate.


Sponsors: Dr. George Corliss
Faculty Advisors: Dr. George Corliss

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E-57: MU-L8 (em•u•late) Humanoid Robot

The MU-L8 humanoid robot platform has been designed and built by Marquette engineers in the Humanoid Engineering and Intelligent Robotics Lab since 2013. The platform is currently focused on RoboCup Teen-Size autonomous soccer with the long-term goal of creating low-cost humanoid robots that can assist in household activities and education in the near future. Dr. Andrew Williams aims to start selling MU-L8 models to other RoboCup teams to broaden the
field of competition and support Marquette’s RoboCup team. Depending on the size and diversity of the design team, they may select any or all of the following improvements in order to make the platform more robust:

- Mechanical/aesthetic design of 3D-printed limbs, head, and torso
- Reliable power distribution between servo motors, microcontroller, and computing components
- Networking between computing components
- Ease of user operation and maintenance of the robot from turning the robot on and off to replacing motors, limbs, and batteries.

The MU-L8 platform is a system that requires multidisciplinary teamwork in the areas of mechanical design, hardware-software interface, and user experience design.

Sponsors: Dr. Andrew Williams  
Faculty Advisors: Dr. Chandana Tamma

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**E-58: Homebrew Scanning Tunneling Microscope (STM)**

A scanning tunneling microscope (STM) is an instrument for imaging conductive surfaces with atomic resolution. Unlike other microscopes (optical and scanning electron microscope), which use lenses to collect wave to image a surface, an STM uses a metal tip as a lens collect electron tunneling current (quantum tunneling) to image a surface. When a conducting (or metallic) tip is brought to a conducting surface, an electrical bias (typically voltage) applied between the tip and surface allows electron tunnel through between them. The tunneling current is a function of the tip position over the surface, the applied bias, and the local density of electrons (density of states). The tip scans across the surface and electronics (current amplifier and controlling circuits) continuously monitoring the tunneling current. By measuring and evaluating the tunneling current at each point during scanning, an image with atomic resolution can be constructed.

Home brewing an STM can be a challenging, as it requires extremely clean and stable surfaces, sharp tips, excellent vibration control, and sophisticated electronics. However, a good team can build it.

The goal of this project is to build an STM and present an image of mica surface with atomic resolution at the end of the project. To achieve the goal, this project needs

- Two students, who is familiar with building and testing electronic circuits
- Two students, who is familiar with software to interface between the electronics and hardware, and data processing)
- One student, who is familiar with hardware

All members will be involving all process of an STM building process. The team will meet once a week with the advisor for discussions and progress updates.
Sponsors: Dr. Chung Hoon Lee  
Faculty Advisors: Dr. Chung Hoon Lee

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E-59: Direct Supply TELS and Google Glass System

Direct Supply TELS is a mobile and web-based Senior Living building management system that helps reduce downtime, secure warranty fulfillment and increase compliance. Our product allows building maintenance staff to track and manage critical equipment, schedule preventive maintenance procedures, ensure warranty use and help ensure Life Safety Code compliance. TELS also allows this level of integration across many facilities. For our users in the field, the TELS mobile app is a key piece of equipment in their daily activities. With QR labels on most of their major equipment, maintenance professionals can use the TELS app to scan assets and track maintenance activities in a central repository.

Direct Supply is interested in how the introduction of hands free devices like Google Glass can change the way our users interact with our products. The ability to use their hands while receiving critical information could change the way facility maintenance operates and ultimately save money for Senior Care and other facilities around the world.

The goal of this project would be to take some of the core functionality from our mobile apps and transition them to a Google Glass optimized system. This would include, but not be limited to, the viewing of daily tasks, scanning of assets with the integrated camera, the display of asset information, verbal navigation of the app, and real time notifications. Full requirements will be identified between Direct Supply and the Marquette Senior Design Team.

Sponsors: Justin Smith (justin.smith@directsupply.com), Direct Supply Inc.  
Faculty Advisors: Dr. Chandana Tamma  
Links:  
https://www.tels.net/TELSLogin/default.aspx

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E-61: Cubesat Satellite

The Marquette College of Engineering is building its first satellite, Golden Eagle 1 (GE1). GE1 is a 10cm cube, also known as a CubeSat, which will be launched into low Earth orbit with the primary mission objectives of collecting and transmitting images from an onboard camera back to Earth, testing the student-designed hardware, and establishing a presence of Marquette University in space.

Our CubeSat, Golden Eagle 1, is a perfect example of a multidisciplinary engineering project. Electrical aspects of the project include communication, power, and the camera payload systems. Mechanically, the CubeSat requires a lightweight structure that can withstand the extreme
environments in space. Computer engineers are also very much needed to implement the onboard software. Students who join the senior design team will join with the already established MUSE team and will design a specific element of the overall satellite.

The delivery of our satellite to the contractor launch integration site launch is May 1st, 2015. Meaning we have to have the CubeSat tested, assembled, and shipped to NASA by May 1st.

See YouTube and Facebook for more information.

Sponsors: Marquette University, College of Engineering
Faculty Advisors: Dr. George Corliss
Links:


http://fox6now.com/2014/02/19/nasa-selects-marquette-satellite-to-launch-into-space/