**ECE Capstone Ideas Fall 2013**

**Security Services - Image Processing**

Security Services expressed an interest in partnering with a group of student to perform image processing. Specifically, they are interested in having the ability to count the number of people entering and leaving busses in the bus depot near the Mary Keyes Residence. As per the closed television policy, everyone viewing security feeds must have a valid police check, which is applicable for all students wishing to complete this capstone. They suggested there were other image processing application once this problem is solved.

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**Facility Services – Block Programming**

Currently the microcontrollers that comprise the BAS on campus are programmed using a language called ‘block programming’. As the name implies, programs are created by connecting different blocks to each other. While this was intended to simplify the coding processing, the employees are finding it cumbersome to use and would prefer the original C syntax. Unfortunately the manufactory no longer supports the preferred syntax and will not provide a method to use it. Facility Services is interested in partnering with a student group to create an interface that would allow them to use their syntax of choice; it could be limited to C or expanded to include C, C++, Java, Python, etc.

**Facility Services – Building Alarm Notification**

Facility Services is receives a large number of building alarms each day. They would like a student team to update the alarm system by collecting all the alarms into a central database and provide a subscription based system whereby employees can subscribe to a set, type or individual alarm by which they would receive a SMS message or email notification.

**Contact**

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**Augmented Reality in ExCEL**

Augmented reality (AR) merges a virtual and real environment to create an enhanced experience. A typical example arises from advertisements where a customer uses an AR application to take a photo of a shoe. This shoe photo then transforms into a virtual three dimensional shore that allows the customer to customize the material, color, size and style. When the customer is satisfied with their selection, they have the option of ordering the physical shoe. Another example can be seen in the Royal Ontario Museum (ROM) dinosaur exhibit, where patrons can use fix-mounted ipads to interact with dinosaur skeletons. See the link for more information - [http://www.rom.on.ca/dinos/](https://univmail.cis.mcmaster.ca/Redirect/www.rom.on.ca/dinos/)

Dr. Tom Doyle suggested that we could use AR to present the sensory information in a new way. Users could take photos in designed area to see the real-time sensor information as well as applicable background information on the system or device. For example, suppose there are identified outlets in a common area of the ExCEL building. When a photo is captured with the correct software, users are shown the waveform, voltage, amperage and relevant wire diagram(s). ‘String’ AR software development kit was used to create the ROM AR exhibit and would be a good starting point - [http://www.poweredbystring.com/product](https://univmail.cis.mcmaster.ca/Redirect/www.poweredbystring.com/product).

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**PV Panel Entire Performance Monitoring**

Dr. Preston, professor in Engineering Physics, is interested in monitoring the entire performance of solar modules that are proposed to go on the roof of ExCEL. One project would involve modifying a solar module to include leads to monitor all solar cells, thermistors on different locations of the solar module to monitor heat throughout the module and embedding a light meter or spectrum analyzer under the module encasing as well as outside to see the difference in light getting through. All these devices must communicate with either an external computer or through the ExCEL Data Historian system.

Contact:

Dr. Preston

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**PV Panel Retrofits to Increase Performance**

Dr. Preston, professor in Engineering Physics, is interested in seeing how modules can be retrofitted to increase performance. In particular adding heating and/or cooling to modules to see how that effects performance. Also surface treatments seeing how that effects heating or spectral absorption. This is a multidisciplinary project applicable to many departments.

Contact:

Dr. Preston

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**Building Sensor Circuitry and Commissioning**

The Algonquin College Center for Construction Excellence was built with hundreds of building sensors for structural, mechanical, and electrical measurements. These sensors have the potential to output more than 1,000 data points (after some interpretation of the output). However, Alex Yang pointed out that many of the sensors have not been calibrated yet and their output is inaccurate. The display systems located throughout the building are not yet linked to the sensor data either. Over the following several semesters, engineering students at Algonquin College will be challenged to figure out how these sensors work, how they can be calibrated, and how to design the display system to show useful data. The task of commissioning the sensors will be a significant one, as the wide variety of sensors will take a large amount of effort to review and understand.

Alex Yang invited McMaster Engineering to contact him at Algonquin College to determine how our Engineering students might be of assistance to Algonquin College in analyzing the circuitry in the commissioning stages. Given the ExCEL building is planning on having a similar number of building sensors, lessons learned on the CCE could be applied to ExCEL.

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**Direct Current Microgrid Components for Maximizing Renewable Generation**

The ExCEL building is proposing to have a DC Microgrid to directly connect DC generation from PV panels to DC building loads, like LED lighting, to avoid the DC to AC and AC to DC conversion losses. However, given the goal of a Net Zero Energy Building, ExCEL will be in a unique position where it will want to send more than half the renewable power it generates in the summer to the AC gird, rather than having expensive seasonal electrical storage. This requires novel electrical control components to vary sending DC power from renewables to either the inverters connected to the AC grid or the buildings DC loads. Students are asked to design the DC microgrid system and the control and protection equipment required for this new functionality.

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