

## Autonomous Systems Lab (ASL) M.Eng and Undergraduate Project Openings for Fall 2013

The Autonomous Systems Lab seeks a small group of students (undergrad and/or MEng) across different departments to work with our PhD students on robotics applications and research. Details on the project descriptions, application process, and additional notes are given below.



Segway RMP50/50XL outdoor robot fleet, equipped with Septentrio GPS, 180 deg FOV SICK and 270 deg FOV Hokuyo Lidar, Mimo touchscreen interfaces, 3x Firefly Cameras, onboard IMU, mobile WiFi, custom electronics and mounting hardware.

### Notes:

-Undergraduate students are expected to sign up for 3-4 credits of (...ECE/MAE/CS Independent study courses) during the semester, and thus commit at least 9-12 hours per week in the ASL. A commitment of two semesters or a summer and a semester is desired.

-M.Eng students are expected to sign up for 3-4 credits of (...ECE/MAE/CS M.Eng Project Courses) during the semester, and thus commit at least 12 hours per week in the ASL. Unless student is graduating in January 2014, M.Eng projects are expected to continue into the Spring 2014 semester.

### How to apply:

1. Go to [cornell-asl.org](http://cornell-asl.org) and download an application form from the front page
2. Scan and e-mail your **completed application and your resume/CV** with the subject line : "[Fall 2013 ASL application] <Your Name>, Project <Project Number> ," where <Your Name> is your name and <Project Number> is the number of the project listed below. Please send your application and resume/CV to one of the following people:  
Professor Mark Campbell, [mc288@cornell.edu](mailto:mc288@cornell.edu)  
Mark McClelland, [mjm496@cornell.edu](mailto:mjm496@cornell.edu)  
Nisar Ahmed, [nra6@cornell.edu](mailto:nra6@cornell.edu)

## Specific Projects:

1. **1 MAE student:** mechanical design, fabrication and testing for outdoor Segway robots

**Description:** Student will work with another member of the lab to design, machine, build, test, and document various mechanical components for our outdoor Segway platforms (pictured above), which includes: robot chassis; roller bard; human interface touch-screen mounts; water-resistant enclosures for long-term outdoor operations; vibration/shock isolation mounts for sensitive electronics; and modular aluminum frames. Subsequent semesters will shift towards independent assignments in mechanical design.

**Who should apply:** Students at a minimum must have successfully completed MAE 2250 Mechanical Synthesis or an equivalent shop/design course. Other mechanical design and machining experience beyond MAE 2250 is desirable, but not strictly necessary. Student must be willing to spend time in the machine shop during the semester. *Freshmen-junior undergrads are especially encouraged to apply, as are experienced seniors planning to stay for M.Eng.*

2. **1 ECE/MAE student:** micro-controller based sensor network for outdoor Segway robots

**Description:** Student will design, program, and validate a new Arduino-based (or Netduino – based) micro-controller board for accurately synchronizing multiple sensor data streams (LIDAR, GPS, IMU, odometry) on our outdoor Segway robots (pictured above). Student will also be responsible for maintaining, de-bugging, and documenting various other electrical components for the outdoor Segways and other robots/equipment in our lab.

**Who should apply:** Students who have experience with micro-controllers and circuit design/fabrication at the level of MAE 3780 Mechatronics, ECE 3140 Embedded Systems, ECE 4760 Digital Systems Design, or equivalent courses. Other electronics and design experience beyond coursework is highly desirable, but not strictly necessary. Student must be comfortable with programming in C, C++ or C#, perform extensive hardware tests, and deliver thorough documentation. *Students interested in doing an M.Eng. project or senior project are especially encouraged to apply.*

3. **1 CS/ECE student:** simulation system for mobile robotics

**Description:** Student will design and program a system for testing robotic applications in a simulated environment. Focus will be on tying together physics simulators, such as those in ROS or Microsoft RDS, with the existing C# robotics framework used in ASL.

**Who should apply:** Students should be comfortable with programming in C# or similar/related languages (especially Java or C++) and should have successfully completed at least 1 course emphasizing programming through practical projects/labs (e.g. MAE 4180 Autonomous Mobile Robots, CS 4758 Robot Learning, CS 4760 Computer Vision, or similar MAE, CS, or ECE courses). Other programming and software development experience beyond coursework is highly desirable.

4. **1 CS/ECE student:** visual odometry for robotic navigation

**Description:** Student will design, program, and validate a visual odometry system to be used on the segway-based robots shown above. The focus of this project will be on building a robust system capable of operating in a wide variety of environments with minimal human intervention

**Who should apply:** Students should be comfortable with programming in C# or similar/related languages (especially Java or C++) and should have successfully completed at least 1 course emphasizing programming through practical projects/labs (e.g. MAE 4180 Autonomous Mobile Robots, CS 4758 Robot Learning, CS 4760 Computer Vision, or similar MAE, CS, or ECE courses). Other programming and software development experience beyond coursework is highly desirable.

5. **2 ECE/MAE students:** rotating LIDAR sensor

**Description:** Students will work in a small group to design, build, calibrate, and test a system for 3D range sensing using a rotating LIDAR sensor. This project will include both the mechanical design and assembly of the sensor and the development of a micro-controller system for control and data packaging.

**Who should apply:** Students who have experience with micro-controllers and circuit design/fabrication at the level of MAE 3780 Mechatronics, ECE 3140 Embedded Systems, ECE 4760 Digital Systems Design, or equivalent courses. Students who have successfully completed MAE 2250 Mechanical Synthesis or an equivalent shop/design course and are interested in machine design.

6. **1 CS student:** graphics system for data display

**Description:** Student will design and program a new system for rendering 2 and 3D data from robot sensors and control systems. This system will be integrated with the ASL C# robotics framework and will replace the existing OpenGL rendering library.

**Who should apply:** Students should be comfortable with programming in C# or similar/related languages (especially Java or C++) and should have successfully completed at least 1 course emphasizing programming through practical projects/labs (e.g. MAE 4180 Autonomous Mobile Robots, CS 4758 Robot Learning, CS 4760 Computer Vision, or similar MAE, CS, or ECE courses). Other programming and software development experience beyond coursework is highly desirable.