

## Summer REU Program

ARTSI's Summer REU (Research Experience for Undergraduates) program is open to ARTSI students who are US citizens or permanent residents, and who will not yet have completed their undergraduate degree at the time they begin their summer internship. There are many research opportunities to choose from. Below you will find descriptions of the positions open in 2012. A list of past years' REU students and their labs can be found [here](#). **How Does It Work?**

Students spend 8-10 weeks during the summer in the lab of a mentor chosen from the list below. You'll work out the exact start date and duration of the internship, and your housing arrangements, with your mentor. If you want to work with a mentor who's not on the list, contact Dave Touretzky to discuss your situation.

The pay is \$7,000, minus whatever taxes the host university deducts. \$500 of your pay will come as a travel advance to help meet the cost of traveling to the school where you'll be working. [Application Instructions](#) (click here) The early application deadline is March 1, 2012. No further applications will be accepted after March 31, 2012. Participating Labs for 2012  
**Monica Anderson's Lab at the University of Alabama** At Monica's Distributed Autonomous Systems Lab you will work on teams of sensor-enabled mobile robots that communicate to efficiently monitor or search a region of interest. Whether operating in indoor or outdoor areas, these mobile platforms can continuously redeploy their wireless network based on static environmental features and dynamic local events, providing better coverage and resource utilization for surveillance and search tasks. The focus of the 2011 cohort will be algorithms that coordinate surveillance between stationary cameras, ground, and air vehicles. The lab uses Player/Stage and Webots for simulation and K-team Koalas and iRobot Creates for experimental validation.

Of particular interest is the problem of combining multiple image and other sensor streams to improve position estimates in situations where GPS signals are unavailable. The lab uses K-team Koalas and iRobot Creates.

### Rachael Brady's Lab at Duke University

Rachael Brady runs the Duke immersive Virtual Environment (DiVE) at Duke University and is responsible for installations on the Library Tiled Media Wall. REU students who join Brady's lab will work on user interface and interaction problems.

Some example technologies include using the Xbox Kinect or web cameras to do human gesture recognition and translating those motions into events that can be used to control display applications such as a gigapixel image viewer, data visualization software, or art installations. The goal is to create large-scale displays which respond to multiple people interacting with the display simultaneously. Students will have the opportunity to design and implement their own interactive experience.

### Howie Choset's Lab at Carnegie Mellon University

Howie's lab develops modular snake robots. Snake robots can use their many internal degrees of freedom to thread through tightly packed volumes accessing locations that people and machinery otherwise cannot use.

Moreover, these highly articulated devices can coordinate their internal degrees of freedom to perform a variety of locomotion capabilities that go beyond the capabilities of conventional wheeled and the recently developed legged robots. The true power of these devices is that they are versatile, achieving behaviors not limited to crawling, climbing, and swimming.

We are looking for motivated individuals to program and build these robots. An ideal candidate should be a self-starter and be willing to work in a team. We will also do many field experiments.

**Ayanna Howard's Lab at Georgia Tech** Students working in Ayanna's HumAnS lab will investigate strategies enabling natural interaction between humans and assistive robots. The goal is to design, build, and test interfaces that enable humans to naturally interact with robots (whether physical or virtual) in performing activities of daily living. Combining emerging technologies in bio-sensors, vision/perception, gesture recognition, and haptics can lead to the development of systems that can enable seamless integration of the user and the robot. The goal is to replace traditional interfaces (e.g. joystick controllers and keyboards) with devices that allow natural communication between humans and machines. You will help Ayanna investigate approaches for enabling this interaction, with a focus on technologies for children and individuals with disabilities.  
**Chad Jenkins' Lab at Brown University** Chad is developing an online robotic gaming project called "R-Play" (Kostandov et al., 2007). R-Play provides an "XboxLIVE"-style environment for playing and developing physically embodied games with robotic agents, such as the Smurvs. The aims of R-Play center around breaking down the "personal robotics" barriers between society and robots through the following three core properties: fun to play, persistently executing (24/7/365), and transparent with respect to its internal workings. In Chad's lab you will work on addressing this core problem: How will typical users of technology program their robots? If learning from demonstration addresses this problem, robot games can provide a familiar medium

for humans to train robots. Charlie Kemp's Lab at Georgia Tech

Charlie Kemp's Healthcare Robotics Lab focuses on hands-on research with autonomous mobile manipulators -- intelligent mobile robots that physically interact with people and the environment. The lab's research is motivated by the potential for these robots to improve the quality and efficiency of healthcare. HRL's research has enabled robots with a variety of user interfaces to perform assistive manipulation tasks such as retrieving objects, delivering objects, opening doors, turning on lights, and cleaning a person's skin. The lab also works closely with potential end-users, including people with disabilities, nurses, and older adults. HRL is multidisciplinary, so ARTSI students will have the opportunity to be mentored by Robotics PhD students with backgrounds in computer science, biomedical engineering, and mechanical engineering. ARTSI students will gain experience programming robots using Ubuntu, Python and ROS. Interested ARTSI students can learn more about the lab from its website (<http://healthcare-robotics.com>) and its open source code on ros.org (<http://www.ros.org/wiki/gt-ros-pkg>).

Sara Kiesler's Lab at Carnegie Mellon The People and Robots Lab at Carnegie Mellon is headed by Sara Kiesler, a behavioral scientist, and Jodi Forlizzi, a design researcher. They are working with Paul E. Rybski, from the Robotics Institute, on research into human-robot interaction for personal service robots. In 2008 they built a robot, called Snackbot, that supports interdisciplinary research into robust autonomous delivery operations in office environments. Robotics research that will be facilitated by the Snackbot includes multi-sensor fusion algorithms for detecting and identifying people, objects, and locations, reasoning about dynamic tasks and environments, and communicating with people through verbal and non-verbal mechanisms. Snackbot will also support research in the fields of design and Human-Computer Interaction (HCI) on size, sound, motion, and form for effective human-robot communication. Finally, research on behavioral science will be enabled on such topics as personalization and people's relationships with interactive objects, and research on snack services drawn from behavioral economics. ARTSI students Jessica Jones and Alvin Barton helped design the robot during the summer of 2008. Students working in the People and Robots lab this summer will participate in the project by helping to improve and evaluate the Snackbot robot. There are lots of interesting research problems to tackle such as how to detect what people are taking from the tray, appropriate robot dialogue and sounds, how to monitor the robot's progress remotely, how to collect and analyze log data collected from the sensors, and how the robot can customize or personalize its services. James McLurkin's Lab at Rice University

The main research goal of James McLurkin's Multi-Robot Systems Lab at Rice University is to develop distributed algorithms for multi-robot systems. The group focuses on research using large numbers of robots, from a few dozen to almost 100. Currently, there are three projects in James' lab: building a multi-robot manipulator, designing a system of low-cost robots for a classroom gaming curriculum, and developing configuration control algorithms based on distributed computational geometry. Students joining James' lab can expect to work with other undergraduates and graduate students on one of these projects.

Illah Nourbakhsh's Lab at Carnegie Mellon The CREATE (Community Robotics, Education and Technology Empowerment) lab is developing arts-based toolkits designed to engage K-12 students and community members in robotics. These toolkits build upon existing work by Illah and Carl DiSalvo that strives to broaden the common understanding of what robots are and how they might function in our everyday lives.

Using these toolkits middle-school students can explore and employ a variety of basic environmental sensors to monitor pollution levels and create interactive artifacts, such as the robot flower, which expresses and responds to these conditions. A central tenet of the outreach effort and of the toolkits is to apply robotics in the context of student and community members' existing issues and interests, such as "telepresence". The Center's Qwekbot+ kit robot has a wireless interface that provides for remote operation from any web browser right out of the box, allowing users to experiment with telepresence experiences.

This summer the CREATE lab at Carnegie Mellon University and the Public Design Workshop from Georgia Tech will be working together in Pittsburgh to present a unique forum for community-centered robotics. The CREATE lab will be hosting Robot 250, a series of city-wide public programs featuring robots made by children and adults. The focus of Robot 250 is the creative application of robotics to personal and community expression and activism. The Robot 250 summer program includes numerous museum exhibits, educational workshops and public art installations and performances.

This is a unique opportunity for students interested in the application of robotics to societal improvement and community engagement. We are interested in students from all backgrounds, including engineering and computer science, and also students from the social sciences and arts who are interested in robotics and society. REU students will have the opportunity to engage in field research, documentation and event support activities throughout the summer. If interested, please contact Dr. Illah Nourbakhsh or Dr. Carl DiSalvo. Edwin Olson's Lab at the University of Michigan

The APRIL lab at the University of Michigan (<http://april.eecs.umich.edu>) researches autonomous robotics, with emphasis on perception, mapping, planning, learning, and multi-robot/human coordination. We recently won the international MAGIC 2010 robotics competition with our fleet of 14 robots, which cooperatively explored and mapped an urban environment, recognizing and cataloging the position of people and interesting objects. This summer, we'll be working on new methods for detecting and recognizing objects (including the use of the X-BOX Kinect sensor), as well as working on a smaller robotics platform.

Like our previous ARTSI students, this year's cohort will work along side our lab's undergraduate and graduate students. Students are organized into teams with other students whose skills complement their own. We're particularly interested in students with hands-on experience with robots, CAD, and/or Java. Those with inclinations towards mathematics (linear algebra, statistics) will find their skills put to good use!

C.J. Taylor's Lab at the University of Pennsylvania

Dr. Taylor is part of the GRASP Laboratory at the University of Pennsylvania a research group that focuses on problems in robotics, perception and related fields. One of the projects that we are interested in tackling this summer involves coordinating one or more iRobot Create's using information from a set of embedded smart camera systems. The idea is to create a system that could be used to automatically localize both the cameras and the robots to a common frame of reference. This project will build on past work that used optical signaling techniques to localize a set of smart camera modules.

Other current projects in the laboratory include investigations into telepresence technologies for robot control, multi robot mapping and visualization of fused range and image data sets. REU students would be working in a large, dynamic research laboratory setting with other graduate and undergraduate students.

Dave Touretzky's Lab at Carnegie Mellon

Working in Dave's lab you will contribute to the development of the Tekkotsu robot programming framework, or help create new educational robots that use Tekkotsu. Tekkotsu is free, open source software written in C++, with GUI tools written in Java.

Potential projects include writing cool demos for the Calliope robot (see [Chiara-Robot.org/Calliope](http://Chiara-Robot.org/Calliope)), helping to refine the design of the Calliope's arm and gripper, or extending Tekkotsu's repertoire of software primitives, particularly the Pilot (responsible for navigation), the Grasper (responsible for manipulation), and the GUI tools.

The Quality of Life Technology (QoLT) Center at the University of Pittsburgh & Carnegie Mellon The Quality of Life Technology Engineering Research Center's (QoLT ERC) vision is to transform lives of people with reduced functional capabilities due to aging or disability through intelligent devices and systems. The QoLT ERC is a unique partnership between Carnegie Mellon University (CMU) and the University of Pittsburgh, integrating CMU's strength in the design, implementation, and technology transfer of intelligent systems, and Pitt's strength in rehabilitation, health sciences and aging research. The primary objectives of the QoLT REU program are to excite undergraduate students about technology and engineering, engage them in cross-disciplinary research in QoLT to gain understanding of how to relate human functions (physiological, physical, social, and cognitive) to the design of intelligent devices and systems that aid and interact with people, expand their knowledge of emerging technologies in QoLT, and prepare them for graduate studies or professional careers in QoLT. More information about the center is available at [QoLT.org](http://QoLT.org), and information about their summer REU program is here. The QoLT REU program application is here. Contact information and FAQ can be found here, if you have any questions before applying. The application deadline is February 15, 2012. The two universities also have a joint NSF IGERT graduate training program in Assistive Technologies, headed by Rory Cooper (Pitt) and Chris Atkeson (CMU), which is seeking students from underrepresented groups. Our partnership with QoLT will provide you access to a large pool of potential mentors in Pittsburgh, and potentially, a route to graduate training in health-related robotics. In addition, QoLT partners with the Florida-Georgia LSAMP, another ARTSI Alliance Partner through which we hope to recruit additional HBCU students and faculty to Alliance activities and eventually Alliance membership.