

## UMass Lowell Robotics Lab

Professor Holly Yanco founded the UMass Lowell Robotics Lab in 2001. Our research focuses on human-robot interaction (HRI), including multi-touch computing, interface design, autonomy, trust, and evaluation methods.

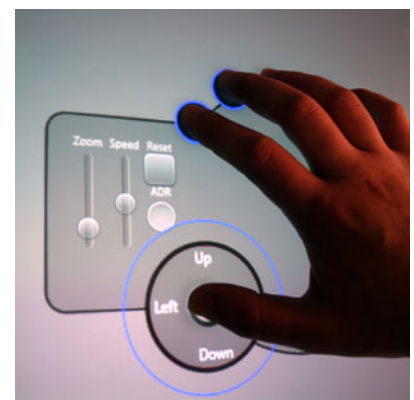
## Urban Search and Rescue

Obtaining and maintaining situation awareness (SA) is critical to the successful operation of remote robots. We have worked to develop effective HRI techniques for making human operators aware of the robot and its environment. We have used an ATRV-JR robot outfitted with laser range finders, sonars, and multiple cameras. We collaborate with first responders to validate our systems.

## Multi-touch Robot Control

As robots become more common in large teams, we need to manage their actions as individuals and groups. We have created a single-robot control unit and a multi-robot command and control interface. The system is designed with discrete modules to allow integration of a variety of data including city maps, building blueprints, and other geo-referenced data sources. Users can interact with all of the robots deployed at a disaster response by instantaneous or delayed commands of tap and drag, defined waypoints, and specified paths for the robots to follow. Users can pan and zoom on any area on the overhead view while viewing video feeds from individual robots.

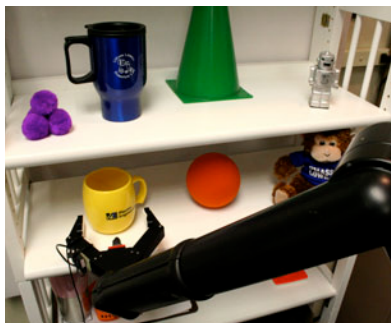
Manual robot control is achieved by using the DREAM (Dynamically Resizing Ergonomic And Multi-touch) Controller. The controller is virtually painted beneath the user's hands, changing its size and orientation according to our algorithm for fast hand detection, finger registration, and recognition of handedness.



### Assistive Technology

While assistive devices such as powered wheelchairs and robot arms improve the quality of life for some, others are unable to effectively use these technologies due to the systems' limited user interaction methods. Users may also have cognitive impairments. Unlike other robot technologies that must be operated at a distance, assistive robots work in the same space as their user. Our lab draws upon over fifteen years of assistive technology experience to develop assistive robot technologies with more user-friendly interaction methods.

The most frequent activity of daily living (ADL) is the "pick-and-place" task. We have developed a vision-based interface for a commercially available wheelchair mounted robot arm to bring objects back to the user. The interface displays the wheelchair occupant's view. The person selects the desired object in an "I want that" manner using a touch screen, joystick, or single switch. The system then autonomously retrieves the object.



### Robotic Telepresence

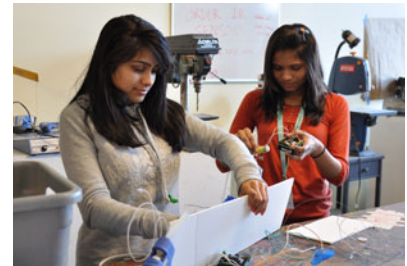


Commercial telepresence robots can be thought of as embodied video conferencing on wheels. We conducted a series of user studies of two telepresence robots in an office environment. One study focused on virtual teams in which a remote teammate used a telepresence robot to attend his/her regularly scheduled team meetings. We found that people who used to be in the same building as their teammates and then moved to a different location had the best experiences recreating this closeness with their teams using the robots.

Research is now being performed in long-term care facilities, where the robots will be used by and with people with disabilities. We hypothesize that telepresence robots can recreate the closeness of daily interactions and mitigate isolation.

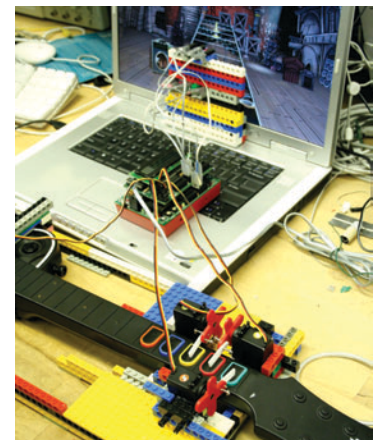
### K-12 Education

The Robotics Lab is involved with a number of programs designed to stimulate interest of science and technology in students from elementary school through college. Artbotics combines art and computer science to make kinetic sculpture. We also offer a variety of workshops for K-12 teachers.



### Robotics Minor

UMass Lowell offers a Robotics minor to prepare students for careers in the growing robotics industry. This allows for students in science and engineering majors to get the education they need to work in this exciting, ever-evolving field. For more info: <http://www.uml.edu/robotics>



### Funding and Collaborators

Research in the Robotics Lab is funded by the National Science Foundation, the National Institute of Standards and Technology, the U.S. Army Research Office, and Microsoft Research. Our collaborators include Carnegie Mellon University, the Crotched Mountain Rehabilitation Center, iRobot, Massachusetts Task Force One, the MITRE Corporation, and the University of Pennsylvania.