NATIONAL ROBOTICS INITIATIVE GRANT WILL PROVIDE SURGICAL ROBOTS WITH A NEW LEVEL OF MACHINE INTELLIGENCE

The Complementary Situational Awareness (CSA) for Human Robot Partnerships is a five-year, $3.6 million project funded by the NSF in which a Vanderbilt associate professor of mechanical engineering directs a team that seeks to provide surgical robots with a new kind of machine intelligence to significantly extend their capabilities and make them much easier and more intuitive for surgeons to operate. The team plans on designing the robot to be aware of what it is touching and then use that information to assist the surgeon in carrying out surgical tasks safely. CSA may have a major impact on other areas as well and could be used by bomb squad or rescue robots.

HUMANOID ROBOT HELPS TRAIN CHILDREN WITH AUTISM

As part of the 2014 Coalition for National Science Funding exhibition, Russell the Robot was brought to Washington, D.C., to engage with members of Congress and their staff. The two-foot humanoid robot acts as the front man for Adaptive Robot-Mediated Intervention Architecture (ARIA), an elaborate system of cameras, sensors, and computers developed at Vanderbilt that helps young children diagnosed with Autism Spectrum Disorders (ASD) learn basic social skills. An NSF grant supported the development of this system and enabled the experiments that showed children with ASD paid more attention to the robot than they do to human therapists.

RECENT CAREER AWARDS AT VANDERBILT

The Faculty Early Career Development (CAREER) Program is a foundation-wide activity that offers the National Science Foundation’s most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations. Following are a few examples of research being conducted by CAREER award recipients.

- Assistant Professor of Mechanical Engineering Robert J. Webster III and Assistant Professor of Neurological Surgery Kyle Weaver are in the process of developing a new technique that will allow robots to relieve the damaging pressure caused by brain hemorrhages. The new image-guided surgical system employs steerable needles about the size of those used for biopsies to penetrate the brain with minimal damage and suction away blood clots.

- Assistant Professor of Mechanical Engineering Jason Valentine's grant will allow him to continue research that will lead to a new class of ultra-compact optical elements that can improve the performance and integration of a wide range of devices such as visible and infrared cameras and light-wave imagers, and provide an enabling technology for applications such as free-space telecommunications and optical manipulation.

- Assistant Professor of Learning Science and Science Education at Vanderbilt’s Peabody College of education and human development Pratim Sengupta is using his award to support his research on the computational reconstruction of K–12 science. He will use these funds to continue the development of a visual programming language and modeling platform designed to integrate computer programming and modeling with K–12 science classrooms. Sengupta is the first Peabody researcher to receive a CAREER award since its inception in 1995.

ELECTRIC “THINKING CAP” CONTROLS LEARNING SPEED

With the support of an NSF grant, Vanderbilt psychologists showed that it is possible to selectively manipulate our ability to learn through the application of a mild electrical current to the brain. When anodal current was applied through an elastic headband, subjects became more cautious, less error prone, and more adaptable to new or changing situations, and learned from their mistakes more quickly. The implications of the findings extend beyond the potential to improve learning. The technique may also have clinical benefits in the treatment of conditions like schizophrenia and ADHD, which are associated with performance-monitoring deficits.
TENNESSEE’S EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (EPSCoR) AWARD

In October 2010, Tennessee was one of seven states selected by NSF to receive an EPSCoR Award, totaling $20 million for five years. This is one of the largest federal science grants ever awarded to the state. The collaboration, known as Tennessee Solar Conversion and Storage Using Outreach, Research and Education (TN–SCORE), draws upon the state’s expanding energy industry and brings researchers from Tennessee universities and Oak Ridge National Laboratory together to boost energy-related research and education across the state. Vanderbilt’s Institute for Nanoscale Science and Engineering (VINSE) is playing a key role by conducting research and by training undergraduate and graduate students as well as faculty from across the state.

Using the funds from the TN-SCORE grant, a new collaboration between the service organization Vanderbilt Student Volunteers for Science (VSVS) and VINSE created VSVS Rural which provides teachers in rural communities with kits containing science lessons and the training needed to provide students with interactive and engaging science lessons. Since its establishment, the VSVS Rural program has trained 76 Middle Tennessee teachers, prepared 762 kits for middle school classrooms, and reached just over 8,000 students. The high school field trip program has had 837 students attend and has 350 high school students signed up to attend for spring 2015. As of winter 2015, the program has worked with 36 high schools from 15 Middle Tennessee counties.

PROTECTING PATIENT PRIVACY

M. Eric Johnson, dean of Vanderbilt Owen Graduate School of Management, is a principal co-investigator on a $10 million, five-year grant from the Secure and Trustworthy Cyberspace program of the NSF. The grant will support research investigating ways to protect patient confidentiality and privacy as health organizations move toward the use of electronic medical records.

EDUCATION PROGRAMS FUNDED BY THE NSF

Twenty-one Vanderbilt Graduate School students have won prestigious National Science Foundation graduate research fellowships in 2014. This year, fifteen of the new fellows are current Vanderbilt Graduate School students, and six are incoming first-year graduate students. They will bring the total number of students on campus who are actively receiving this support to 60.

The NSF-supported Fisk–Vanderbilt Masters-to-PhD Bridge Program is a collaboration that allows students to complete a master’s degree, fully funded, at Fisk and fast-tracks them into a Vanderbilt doctoral program, with full funding. Since 2004, the Fisk–Vanderbilt Masters-to-PhD Bridge Program has admitted more than sixty students. In 2013, the Bridge Program became the nation’s No. 1 producer of minority Ph.D. recipients in physics, astronomy, and materials science as the program’s inaugural class completed their doctoral degrees.

The Center for the Integration of Research, Teaching, and Learning (CIRTL), of which Vanderbilt University is a member, has received a three-year, $5 million grant from the NSF to improve the quality of STEM education. CIRTL is partnering with Vanderbilt’s Center for Teaching to offer the Blended and Online Learning Design Fellows program which is intended to promote learning in the STEM fields by implementing and advancing high-impact, evidence-based learning and teaching practices.

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