Mercury Systems Inc.

Mercury Systems Inc. has donated a $300,000 gift to support the “Intelligent Radar System” research project, directed by Kiran George, professor of computer engineering. This project will allow the College of Engineering and Computer Science to build out capacity in artificial intelligence, including developing curriculum, advancing research and engaging students in projects. Tony Girard, Mercury’s chief technology officer, is one of the newest members of the Dean’s College Leadership Council.

Support the College of Engineering and Computer Science.

---

Cisco

Cisco — through the Silicon Valley Community Foundation — has provided a $300,000 grant to build the College of Engineering and Computer Science capacity in IoT, or internet of things, curriculum and project experiences. As industry grapples with the influences of new technologies, this grant will help better prepare students for the workforce by exposing them to leading companies in the IoT space and providing hands-on learning opportunities.

Support the College of Engineering and Computer Science.
This high-tech prototype doesn’t bark or sit on command. “SED” — Seeing Eye Dog — is a four-wheeled robot created by a team of computer engineering students. This “service robot” is built with a cane-like handle and the latest technology.

“Our project was not made to replace a guide dog, but to create a robot that helps the visually impaired and blind travel on foot from one destination to another,” says Peter Fink, who developed the project with classmates Riad Maulana Soliven and Daniel Verdugo. “An internet-based, voice-controlled app on the user’s phone can remotely control the GPS-guided robot.”

In another corner of the College of Engineering and Computer Science, computer engineering majors David Luu, Kushal Jain and Riken Parekh have designed a novel project using high-tech circuitry to harvest energy from Wi-Fi sources to power wireless electronic devices. Mobile device users could,
theoretically, charge a wireless device’s battery — a smartphone or laptop — by collecting energy from nearby Wi-Fi networks. Using antenna and circuitry attached to a battery, the students are able to “harvest” energy from Wi-Fi signals and transform it into electrical energy.

“The focus of our project is to scavenge excess energy given off by Wi-Fi routers. We’re addressing the current energy crisis from another direction,” Luu says. “While the world is more focused on new ways to produce energy, our research tackles the problem through Wi-Fi energy scavenging.”

These student research projects, under the direction of faculty adviser Kiran George, professor of computer engineering, were created through the college’s ECS Corporate Partners program, which brings students, faculty and industry together to develop new technologies and prepare students for the technical and engineering workforce. The projects were made possible through the college’s internet of things (IoT) program. One of the college’s corporate partners, Cisco Systems Inc., supports the IoT program, with funding awarded through the Silicon Valley Community Foundation, in collaboration with Cisco Corporate Social Responsibility.

Incubating Innovation
This collaborative effort with local industry began in fall 2017, with 20 student projects sponsored by 11 corporate partners. Partnerships expanded this past academic year to 36 student projects supported by 17 corporations, such as Edwards Lifesciences, Unisys, Mercury Defense Systems and Walt Disney Parks and Resorts.

The long-term vision for the program is to have every senior capstone project sponsored by industry, says Susamma “Susan” Barua, dean of the College of Engineering and Computer Science. “The Corporate Partners program provides a structured framework and allows the college to reach out to industries year-round and arrange for supported undergraduate and graduate projects, including senior capstone projects,” explains Barua. “These projects represent real-world engineering and computing problems that teams of students can solve.”

A project’s concept, scope and length are discussed to provide a unique learning opportunity for the students while addressing the company’s challenge or need. The projects typically last through the academic year, with faculty members guiding students to ensure positive outcomes and maintain strong relationships with industry, George notes.

Corporate partners support the program not only because it provides a way to give students an immersive, applied learning experience but it also establishes a recruitment pipeline of diverse and talented individuals who offer fresh perspectives to challenges facing the industry, Barua points out. Partners also mentor and share industry experience, can serve in advisory roles and benefit from increased visibility within the campus community.
“There are several advantages for students who work on these corporate-supported projects,” George says. “They appreciate the opportunity to relate the theoretical concepts they learn as part of their coursework and apply it to real-world applications.”

While collaborating on a project, students learn teamwork, problem-solving, and communication and leadership skills — attributes employers are looking for in their hires, Barua adds.

Additionally, students working on industry-sponsored projects often have opportunities to secure internships and even full-time employment at the partner corporations because of their direct contacts with the company and industry mentor.

**Skills for the Future**

Education is part of Cisco’s mission to help solve society’s toughest problems, says Tae Yoo, Cisco’s senior vice president of corporate affairs/corporate social responsibility. “As technology transforms the way we live and work, Cisco believes educational institutions and organizations focused on emerging entrepreneurs can be a powerful force for change and local economic development,” Yoo points out. “Public universities, such as Cal State Fullerton, not only have the capacity to meet industry demand for a digitally skilled workforce in Orange County, but also play a leading role in shaping entirely new ideas and industries to fuel the local economy and create jobs in the future.”

Alumnus and scientist Greg Wright, senior director of research and development at Edwards Lifesciences, also believes that students who work on industry projects are more prepared for the workforce.

“These projects teach students how to design and qualify equipment, innovate to improve manufacturing, and create drawing and design features on new machines. All of these skills could be applied to many different careers in the engineering field,” says Wright, who earned a bachelor’s degree in biological science in 2000 and a master’s degree in biology in 2008 from Cal State Fullerton.

Edwards Lifesciences, an Irvine-based medical device company with 12,000 employees worldwide, specializes in structural heart disease and critical care monitoring. It has supported more than 20 students in five projects over the last two years.

“Edwards Lifesciences gets the opportunity to assess and mentor the next generation of engineering leaders,” Wright says. “They work with our teams to develop products that help patients worldwide, as well as launch products that drive company growth.”

Some of these student projects range from developing tissue and valve testing equipment to designing next-generation tissue technologies and manufacturing equipment that could have a big impact on reducing manufacturing costs.

“Students get the chance to gain experience designing studies, working with experienced engineering leaders, innovating and getting a feel for how the medical device industry operates,” Wright adds. “This gives them the opportunity to see if this industry is the right fit for their careers.”

Luu, a junior on track to graduate in spring 2021, agrees that being engaged in an industry-supported project will give him a competitive edge in landing his first job after graduation: “This Wi-Fi project tested our ability to look outside the box to solve unforeseen issues, and the experience will help us when we finally join the workforce.”

Soliven, who worked on the service robot, adds that one of the most valuable skills he learned is how
to work in a team environment — a skill needed to be successful in his future technical career. “I’ve also learned time management, how to communicate my ideas, and find solutions to make certain components function properly,” he says.

For industry, being a corporate partner is not only about playing a leading role to shape a skilled workforce, but paving the way for students’ future careers.

“I received a great education at Cal State Fullerton and want to give back to the university. I believe giving back to the community is a big part of what defines us as leaders,” Wright says. “I also want to encourage all students to be proactive with their careers because the world and job industry is getting tougher and more competitive.”

Most people take for granted being able to take a shower without help. But for individuals with ALS (amyotrophic lateral sclerosis), a progressive neurodegenerative disease, or other immobilizing condition, bathing is not a simple task.

To make lives easier for people with disabilities, a team of Cal State Fullerton computer engineering students designed and built a voice-controlled smart shower — an internet-based prototype that allows individuals to use their voice to turn water on and off and control water temperature.
The showerhead is on a motorized track and uses voice controls by interfacing with Amazon's Alexa through the use of an Amazon Echo, explained graduating senior James Michael Perez, the project's team leader.

"Our project allows individuals with disabilities the necessary freedom of showering by themselves," Perez said. "It's practical and beneficial to anyone whose motor functions are restricted, including those with disabilities, as well as the elderly."

The inspiration for the students' senior design project came from Fullerton College film student Ryan Gomez, who has Duchenne muscular dystrophy, a genetic disease that affects mostly males. The 21-year-old was diagnosed at the age of 3, and by 13, was not able to walk. Duchenne slowly takes muscle strength away from the arms, legs, and eventually, the heart and lungs, Gomez said.

Gomez and his former caretaker approached the College of Engineering and Computer Science to help him develop a prototype. Since age 11, he's had the idea for a shower to help disabled individuals.

"I'm in a wheelchair and need to rely on a caretaker to adjust the shower for me, including the temperature and showerhead position. I thought a remote-control showerhead would help others like me to be more independent while taking a shower," Gomez said.

Kiran George, professor of computer engineering, suggested a team of students tackle the innovative idea for their senior design project. George has advised the students in developing a prototype, while Gomez has worked closely with the students on the design. The team also includes computer engineering majors Jessica Diaz, Cory Longshore and Hugo Simon, all graduating seniors. The student team will present their project at 9 a.m. Wednesday, May 15, during the 2019 Computer Engineering Program-Senior Design Presentation and Demonstration in Room 301 of the Computer Science Building. Gomez and his family will be in attendance. Other graduating seniors also will present their inventive senior projects during the 9 a.m.-noon and 1 to 4 p.m. sessions.

Perez relayed that the students have learned valuable technical and practical lessons by working on the project, including trial-and-error to find the best design to facilitate the movement of the showerhead and motor.

"We've also gained experience working with others, especially since in the workplace, communication is key," said Perez, who has accepted a tentative job offer with the U.S. Department of Defense. "Additionally, I hope to do more application-based projects for people with disabilities or limited mobility. This project taught me how to write in a technical dimension, which is an important skill as an engineer."

Gomez, who plans to transfer to a four-year university after he earns his associate's degree in 2021, is optimistic about the prototype.

"I would like to eventually see a showerhead invention become a tool for others like me who could benefit by bathing on their own with no assistance."

http://news.fullerton.edu/2019sp/smart-shower-project.aspx
Wearing what looked like a space-age bicycle helmet, Jean Hedrick leaned forward and stared intently at the light displays in front of her.

Nearby, a robotic arm spun, dropped its claw and picked up a block.

It was Hedrick manipulating the robotic arm, without touching its computer. The helmet she wore was fitted with electrodes measuring electrical impulses from her brain and sending commands to the mechanical arm.

However, no matter how hard Hedrick stared at the last light in the display, she could not get the pesky robot arm to drop the block.

Well, two out of three wasn’t too bad.
The robot is one of four devices being developed by students in Cal State Fullerton’s School of Engineering under the direction of professor Kiran George and the Bio-Electrical Signal Based Lab. Last week, residents of the Morningside of Fullerton senior community were given a preview of the cutting-edge technology.

Once perfected, the brain-, eye- and sound-controlled devices could help seniors and people with disabilities by performing regular tasks in their daily lives.

In addition to the robot arm, students, with the help of their senior volunteers, demonstrated a facial-recognition program that would allow seniors, particularly those with symptoms of Alzheimer’s and other cognitive diseases, put names to faces via a mobile phone. There was also a mind-controlled wheelchair and a device that could communicate using a computer-generated voice with home-assist devices such as the Alexa and Google Home systems to perform tasks such as turning electronics on and off.

Study and development of mind-controlled devices has been around for years and is a rapidly developing technology. However, to date, two major obstacles have slowed development for home use: training and affordability.

“There’s a long gap from here to a marketable product,” George said.

In a perfect world, George said he envisions affordable “plug and play” devices. But Hedrick’s struggles with the robot arm were indicative of the issues still to be ironed out of converting a brain-command to the machine.

“No matter how hard I looked at it,” Hedrick said of the light that would command the robot to drop the block, “I couldn’t get it to work.”
The costs of such devices are also prohibitive, George said, with estimates that only one in 10 seniors could afford many of the mind-controlled products on the market.

While the science and technology may be available to create certain devices, George said “if it’s unaffordable, it will sit in a lab.”

Regardless of the challenges, residents and students were excited by the potential. Harkishan Grewal, a masters student, demonstrated a wheelchair equipped with technology that could guide it through a mapped living area and also could detect obstacles, such as people and walls with a lidar – a sensor akin to radar, but using light rather than radio waves.

Somewhat like self-driving cars, the chair can operate in small spaces where GPS and wifi may not be available.

Grewal said he was attracted to automatic navigation and mobility after attending an ALS walk to support those who suffer from crippling amyotrophic lateral sclerosis, or Lou Gehrig’s Disease. “That drew me in,” he said. “And there’s the cool factor.”

Vinay Karigar, a masters student in computer engineering, and Marco Solis, a senior, worked on a head-worn device that sends brain commands to the computer, which converts those into verbal commands to a home assistant to turn a light on and off.

Although the device works better in the lab than it did at the demonstration, the students saw a bright future.

“The world is fast moving” Karigar said, “and everyone wants to be more independent.”
Morningside of Fullerton retirement community residents watch a self-driving wheelchair move during a presentation of Assistive Devices made by Cal State Fullerton engineering students at Morningside on Thursday April 12, 2018 in Fullerton, Calif. (Photo by Josh Barber, Contributing Photographer)

An electrode-rigged helmet on her head, 81-year-old Jean Hedrick stared intently at three LED lights as they alternated on and off.

A robotic arm slowly started to move.

The Mind-Controlled Robotic Arm is one of four prototypes a group of residents at the Morningside of Fullerton retirement community were able to learn about and test through a live demonstration on April 12 from the Cal State Fullerton Bio-Electric Signal Based Systems Laboratory.

“I thought it was exciting — just really neat,” Hedrick said. “That technology was way advanced from anything I’ve ever heard or seen.”

The program, a partnership between the retirement community and the Cal State Fullerton laboratory, was aimed at educating senior citizens about technology that could be available to them in the not-too-distant future, as well as allow laboratory students to feature their work.
Thirteen lab students, in small groups, demonstrated their respective projects to the residents. “Demos such as the one we did today helps us showcase the wonderful work our students have been doing at the university,” said Kiran George, professor and coordinator of Cal State Fullerton’s Computer Engineering Program, who oversees the laboratory. “Activities such as today’s not only provide students an opportunity to share their work, but also boosts their confidence.

“Furthermore, feedback from the audience — potential users — can provide rare insights into how their current device could be alternatively designed.”

The other three prototypes demonstrated to seniors included a self-driving wheelchair, a memory aid for those with Alzheimer’s disease and Mind-Controlled Home Automation — a home automation system used with ALS patients who can’t speak.

By concentrating on an audio frequency while wearing a 3-D printed device on his head, senior citizen Hans Hennecke was able to turn on a lightbulb during a demonstration by Cal State Fullerton engineering students at Morningside of Fullerton on April 12.

George said laboratory students work on projects that can potentially help individuals with disabilities, those with neuromuscular degenerative diseases, such as ALS and Alzheimer’s, and senior citizens. He said the main purpose underlying the projects is to develop devices that are accessible — both low-cost and easy to use.

“Some devices that you get on the market [are] so expensive,” George said.

Morningside of Fullerton Marketing Director Taylor Bentley said the residents enjoy educational lectures. The retirement community has an ongoing partnership with the college, allowing for such events.

“We have active residents eager for educational opportunities,” Bentley said. “The key for us is bringing these different generations together to help teach our seniors about what the future may hold.”

The Cal State Fullerton demonstration isn’t the only program aimed at seniors.
Cox Communications held an event at the “Cox Connected Independence” smart home in Lake Forest, which shows how internet-enabled devices give seniors the ability to live independently at home, said Ryland Madison, director of product marketing at Cox Communications.

“Nearly 90% of adults age 65-plus would prefer growing old in their current home instead of moving to an assisted living facility,” Madison said. “Given that there is smart home technology readily available on the market today, the ability to age in place is becoming a more realistic option for many aging Americans.”

Some of the technology demonstrated at the smart home included Cox Contour, which allows for voice-commanded, remote-free viewing; Anova Precision Cooker, allowing for cooking via an app; The HAPIfork, an electronic fork that monitors eating habits; Joy For All Orange Tabby Cat, a realistic model cat that purrs and responds to petting and LiveFine Automatic Pill Dispenser, in which a caregiver can load up to 28 days of medications in sealed compartments that are dispensed on a programmed schedule.

“A ‘silver tsunami’ of aging baby boomers is already having a huge impact on consumer purchasing, technology and senior housing,” Madison said. “Many seniors will be unable to afford a retirement community even if they’d like to live in one – especially given the high cost of housing in California – and aging in place is a reality for them.

“Fortunately, staying in their own home is becoming more viable for seniors as a result of smart technology devices and monitoring apps that offer independence through connectivity.”

Jessica Peralta is a contributor to Times Community News.

CSUF students develop app, hardware for mind-controlled wheelchairs

By ANGIE MARCOS / STAFF WRITER

Feb. 1, 2016

Updated 8:07 p.m.

With the aid of a smartphone application and hardware, Cal State Fullerton students have created a low-cost and easily manageable system by which an electric wheelchair can be controlled by brain waves and facial movements.
The project – Brain-Computer Interface Controlled Driving Aid for Electric Wheelchairs – is being led by graduate computer engineering student Nikhil Shinde and undergraduate computer engineering students Graciela Cortez and Rayton Espiritu.

“It is a brain-controlled wheelchair,” said Shinde, 25.

The project is Shinde’s graduate thesis project and focuses on the needs of those with ALS.

Amyotrophic Lateral Sclerosis, or ALS, is a progressive neurodegenerative disease that primarily affects nerve cells in the brain and spinal cord.

Persons with ALS – referred to as PALS – progressively lose muscle movement and control.

Through the students’ creation of the BCI Controlled Driving Aid, a mobile application that can be used on Apple and Android devices, electric wheelchairs can be controlled by thoughts and basic facial movements like raising one’s eyebrows or blinking one’s eyes.

A headset worn by the individual recognizes the user’s brain electrical activity and facial movements. It then wirelessly transmits and translates those messages into control signals by way of the smartphone application.

“An individual can operate the electrical wheelchair using the driving aid with a combination of mental thoughts and basic facial movements,” said CSUF Associate Professor of Computer Engineering Kiran George, who serves as the project’s faculty mentor.

Electrical activity from the brain is picked up by the headset and separated into different types of waves – for example alpha waves or beta waves – and sent to the application.
“If the level is above a predetermined threshold, the smartphone triggers the controller on the electric wheelchair via Bluetooth, which in turn moves the wheelchair either forward, backward, left, right, based on the state shown in the app,” George said.

Eye blinks can be used to change direction.

The goal of the project, Shinde said, is “to make (individuals with ALS) independent and to improve their quality of life.”

The application is not yet available pending further research and adjustments.

**What makes this project unique**

The students began working on the Brain-Computer Interface Controlled Driving Aid for Electric Wheelchairs project last spring and will continue to work on it throughout this semester.

While similarly programmed wheelchairs exist, what makes this project unique is the pricing. The group is working to keep the cost of the application and hardware under $150.

“One of the major goals of this project is to make this technology affordable to (anyone),” George said.

It is also the main challenge of the project, he said.

Another unique component is the system’s ability to be retrofitted to any electric wheelchair without any modifications. It also requires little training to understand.

“The system is designed in a way that it requires minimal training to operate,” George said. An individual can be trained in less than 30 minutes, he said.
The students’ project currently has four motion sensors installed that prevent the chair from colliding with structures or objects; they plan for a total of 15 safety sensors to be installed by the end of the semester.

Besides keeping the cost of the system low, the students face the challenge of making the system easily usable for a wide variety of people.

The signal strength recognized by the headset varies depending on the user. Because of this, settings initially have to be customized for each user, George said.

In the future, George would like to see the project expand.

A separate group of CSUF graduate students, also under his guidance, is working on making the electric wheelchair able to recognize verbal commands, as well as navigate using 3D mapping.

His goal is for PALS to be able to type or say the word “kitchen” and subsequently be taken to the kitchen through a 3D mapping program graduate students are working to create.

Making a difference in the lives of PALS

George partnered with the ALS Association of Orange County Chapter last year for a robotic arm project. Around the same time, he proposed the electric wheelchair project idea to the association.

The association responded by donating an electric wheelchair so the students could apply their research.
By modifying existing hardware and software, as well as creating new ones, the computer engineering students are working to make the management of the electric wheelchair as hands-free as possible.

“About 75 percent of persons with ALS experience limb onset ALS,” George said.

“PALS experience difficulty with tasks requiring manual dexterity such as buttoning a shirt, writing or turning a key in a lock,” he said. “As a result, PALS with limb onset are unable to operate an electric wheelchair and have to heavily rely on their caregiver/family member to perform even simple tasks such as moving from one room to another.”

The students’ mobile application and hardware would allow PALS to become somewhat independent, he said.

Last month, Shinde, Cortez and Espiritu presented their project and research at the 28th annual Cal State University annual Biotechnology Symposium.

In the spring, the project will be put to the test when the students bring the chair to the ALS Association of Orange County Chapter to be tested. PALS will test the device and provide feedback to the group.

“The partnership with ALS Society of Orange County Chapter provides the project team with such a unique opportunity,” George said.

For Cortez, knowing her work will be put to use in the coming months has made the project more meaningful.

“I’ve enjoyed working on something that I know will help people with disabilities,” she said. “It’s really fulfilling.”

George hopes the time spent working on the project teaches his students to effectively brainstorm solutions, research problems and implement them, as well as develop interpersonal skills.
KTLA News channel Interview - Facial Expression & Head Movement based Communication Device
LIFE

CSUF students work on a low-cost device to help people with ALS communicate online

April 21, 2015

Updated 8:11 p.m.

BY ANGIE MARCOS / STAFF WRITER

Tilt your head to the left and the cursor on your computer moves in that direction. Tilt your head to the right and the cursor immediately flashes across your screen to the right.

Raising your eyebrows enables a left click, while hard blinking your eyes enables a right click.

This is happening with a low-cost device seven Cal State Fullerton engineering students are working on. They hope it will allow those with amyotrophic lateral sclerosis, or ALS, to access the Internet and communicate with people electronically.
ALS, also referred to as Lou Gehrig’s Disease, is a progressive neurodegenerative disease that affects nerve cells in the brain and spinal cord. The disease can cause muscle weakness in hands, arms and legs and can affect speech, swallowing and breathing.

About 75 percent of people with ALS – or PALS – require some form of communication assistance.

The CSUF project, titled “Low-cost brain-computer interface based wireless electronic communication system for ALS patients,” is being led by Cal State Fullerton associate professor of computer engineering Kiran George.

George invited a select number of students from his classes to participate in the project.

The team is working to make the device as impactful, user-friendly and low-cost as possible, George said.

With the aid of the device, PALS will be able to communicate via email, text and chat messaging, social media and Skype, among an array of other options.

“Due to the aggressive and progressive nature of the disease, PALS are unable to leave the house,” George said. “Simple tasks such as Internet browsing and electronic communications via social and media outlets allow them to stay connected to friends and family, and help them interact with fellow PALS.”

**How it works**

Seven computer engineering and electrical engineering graduate and undergraduate students are working to create two types of headsets for the system.

“Dr. George offered me the opportunity to do some real life research and I jumped at it,” said Aaron Castillo, a 31-year-old graduate computer engineering student.

“We just want to improve their quality of life as much as we can,” he said.
The electronic communication device is made up of four main parts: a gyroscope, which measures orientation; a transceiver chip, which is a module that is used to communicate wirelessly; a microcontroller; and a brain-computer interface headset.

The headset has an arm that extends over the individual’s forehead. The arm recognizes the user’s facial expressions and movements when they raise their eyebrows – left click – or hard blink – right click.

The gyroscope recognizes when the individual tilts his or her head left or right, allowing the mouse cursor to mimic the movement.

If an individual’s ALS is so severe it has inhibited their ability to hold their head upright, the headset can be re-configured to recognize the head tilt as the neutral point.

The most challenging part of the project has been keeping the cost of the device reasonably low, George said.

Ideally, the group would like the system to cost less than $200; similar systems can cost thousands of dollars.

“We’re trying to find as many cheap parts as we can and stretch them to their limits,” Castillo said. “The most expensive part is the headset.”

A second project the students are working on is an extension of the electronic communication project: An “electrooculography” system for a robotic arm.

The EOG system will allow the arm to be controlled by a person’s eye movement. If the individual looks left, the arm will move left; look right and the arm follows suit.

Next on the agenda is allowing the arm to grasp objects and bring them to the individual based on eye movement and facial movement.

Students have worked on the software, manufacturing and configuring of many of the projects’ details. Other items, like the robotic arm itself, were purchased from outside vendors.
Prototypes for both projects are still under evaluation.

**A user-friendly device for individuals with ALS**

David Diaz, a 25-year-old computer engineering graduate student, is working on a virtual keyboard for the electronic communication project.

With a readily available virtual keyboard, not much clicking is needed. Instead, the individual can lead the cursor with a tilt of the head to the first few letters of a word and the software will offer word suggestions, Diaz said.

This adds to the project’s main goal of helping PALS communicate in a world that relies so heavily on technology, he said.

ALS is a variable disease, meaning it effects each person in a different way and at a different rate.

This is what has made the project most challenging for Diaz.

“I can test this as much as I want on myself, but you may have a different hard blink or eyebrow raise than me,” Diaz said.

Because of this, each headset can be customized to reflect each individual's current needs, he said.

“We want to be able to use daily technology to our advantage,” Diaz said. “Having this gives (PALS) the chance to communicate with people all over the world.”

George became interested in the electronic communications project when he was a part of a mind-controlled robotic arm project last year headed by the ALS Association's Orange County chapter. In the next couple of months, the group will test its prototypes on PALS through a partnership they have formed with the Orange County chapter.

George recently received a $100,000 grant from the Disability Communications Fund for the development of the project.
A group of students, led by a Cal State Fullerton computer engineering professor, is working to make communication easier for patients diagnosed with amyotrophic lateral sclerosis, also known as Lou Gehrig’s disease or ALS.

Kiran George, Ph.D., associate professor of computer engineering, hopes to create an affordable wireless prototype that will allow people with ALS to communicate and even use social media through thoughts and body signals, he said. The project is funded by a $100,000 grant from the Disability Communications fund based in Oakland, California.

The device George and his team are developing would cost a fraction of what current communication systems do—just $200.

The device would take steps toward limiting the cost of living with ALS, which can reach into the six figures over a lifetime.

Costs associated with ALS care have been estimated at $63,692 per year, according to a 2013 study by the Muscular Dystrophy Association.

“The overarching goal of this project is to design and pilot test a low-cost electronic communication system that would allow persons with ALS to effortlessly access the internet and engage in electronic communications,” George said in an e-mail.

Current communications systems are pricey and don’t adapt well to patients’ changing conditions, George said.
“Currently available systems, similar to the one being developed at CSUF, cost thousands of dollars,” George said.

“Moreover, these systems cannot be customized to the needs of patients as their symptoms worsen—as the disease progresses patients are unable to use the previously used input.”

The system George and his team are working on would improve on some of those deficiencies.

“The communication system I envision is a wireless headset with four to five sensors that the patients would wear to operate a laptop or tablet that will have a shelf-life of three to four years,” George said.

The system would track biosignals, including thoughts, through EEG signals and facial expressions using EMG signals. It would also track movement of the patient’s head using a gyroscope, George said.

The system will let patients control electronic devices such as laptops and tablets for communications such as email, text, chat and Skype by voluntarily manipulating these biosignals, he said.

In accepting the grant, George and his students have one year to develop the system, and will file two progress reports with the Disability Communications Fund, the first of which will be due in June.

Before then, George plans to test a prototype with patients in May.

The thought of learning valuable experience was one that 25-year-old Fullerton master’s student, David Diaz, said he couldn’t pass up.

“(George has) given us an objective toward making it easy for ALS patients to work toward having the ability and convenience to work on the computer with limited movement,” Diaz said. “He provides us adequate tools, software, equipment to help us work toward that experience.

For now, George has five CSUF students performing a variety of tasks, but that number could increase soon.

“Currently all students working on the project are students from my classes,” George said. “In summer, several students from the community colleges will also have the opportunity to be involved in the project.”

Yeu Cheng, a second-year computer engineering master’s student, contributes to the technical aspects of the project.

The experience goes beyond working with the latest tools and gives the group a chance to impact others’ lives, he said.

“We’re really working with very cutting-edge technology and it’s kind of like a field that’s still very new,” Cheng said. “You know, the emergence of robotics mixed with interfacing with the brain and all that, so it’s really exciting to work in the field and to know that what we do can potentially have a positive impact on the people with ALS.”
A group of Cal State Fullerton students and one alumnus presented their research on a mind-controlled robotic arm at the Institute of Electrical and Electronics Engineers (IEEE) conference last week in San Diego.

The students, along with Associate Professor of computer engineering Kiran George, Ph.D., developed the arm last year and began working with patients diagnosed with Amyotrophic lateral sclerosis (ALS).

More commonly known as Lou Gehrig’s disease, ALS is a neurological disorder that affects nerve cells in the brain and spinal cord. The progressive degeneration of nerves leads to paralysis and eventually death as the nerves become incapable of sending motor signals to the spine and muscles, according to the ALS Association. Approximately 5,600 people are diagnosed with ALS each year.

The group is allowing their design to be recreated to benefit those who need it.

George and his team of assistants have worked with 12 ALS patients over the past four months on a newer generation of the arm. Now in its third iteration, each version has enabled the arm to complete more and more tasks.

“The current generation of the arm allows only for simple tasks to be performed by patients, such as picking up a bottle of water and taking a sip from it,” George said. “This seemingly simple task is very significant to the patients, as it gives them independence and confidence that helps them make it through the devastating ALS disease.”

The patients testing the robotic arm were chosen based on their stages of ALS. This allowed the group to determine how the arm functions with patients at multiple stages of the disease, which is important because ALS progresses differently in each patient.
The group’s work with ALS patients allowed them to implement functions that would best address the issues faced by the patients, since there is a wide variety of patient needs for the technology.

Hayden Donze, a computer science alumnus who worked on the first two generations of the project, experienced working with two patients personally.

No case is exactly the same, Donze said. One patient Donze worked with had most of his motor skills, but the disease affected his speech, making it hard for him to communicate.

As the group continues to work with ALS patients, the arm will develop based on user needs and preferences. The ultimate goal, George said, is an affordable, functional arm that is easily usable by people with ALS.

CSUF NEWS SERVICE

Robotic Arm Research Presented at Conference

Oct. 7, 2014

Kiran George, associate professor of computer engineering, and his students are presenting their high-tech robotic arm system at the Oct. 5-8 IEEE International Conference on Systems, Man and Cybernetics.

To share their research to improve the quality of life for patients with Lou Gehrig's disease, Cal State Fullerton's Kiran George and his students are presenting their brain-computer interface controlled robotic arm at this week's IEEE 2014 International Conference on Systems, Man and Cybernetics in San Diego.

George and the students are developing a low-cost, brain-computer interface-assisted robotic system that allows such patients, with minimal effort and training, to perform simple, but significant tasks, that they would otherwise be unable to perform.

"We've been working with ALS patients to build a cost-effective system that would assist people in regaining control," said George, associate professor of computer engineering, who also is a panelist on a discussion about the state-of-the-art technology.
While it conjures up images of human cyborgs from science fiction movies, a robotic arm designed by California State University – Fullerton engineering students could have very real uses. With further development, the exo-skeletal device could give hope for sufferers of Amyotrophic Lateral Sclerosis (ALS), also known as Lou Gehrig’s disease.

Photos show black plastic bands wrapped around a student’s forearm and upper arm. A black glove covers his hand, with wires that run from his upper arm down to each of his fingers and end at small silver clamps. The device also comes with a headset that can measure brain waves, according to CSU Fullerton’s newspaper the Daily Titan.
The Brain-Computer Interface Robotic Arm for Rehabilitation project, under the direction of Kiran George, associate professor of computer engineering, is funded by the Western Digital Foundation and the National Science Foundation. The project was originally part of a $400,000 NSF CAREER award that George won in 2012.

ALS leads to degeneration and eventual death of the brain’s motor neurons as well as the spinal cord. Sufferers eventually are unable to move certain muscles, which can atrophy over time.

According to the Titan, the robotic arm moves in response to the brain waves that generate when a person looks at certain visual stimuli. A headset with 14 different sensors is able to detect special brain signals that are triggered by expressions like a wink or smile, which can be used to communicate with the arm’s computer, George said.

“(We) can use this natural phenomenon that occurs in your brain as a way to understand when you’re looking at that stimuli and we can use that to control anything,” computer science student Michael Vavro said in the Titan article. “The whole heart of it is the fact that we’re taking advantage of those phenomena to understand what’s going on in your brain and then use that to make a movement.”

The hand can grip objects, although the individual fingers don’t currently work, George said. But a fully functional hand could happen in the coming months, according to the Titan. The team also plans to use brain signals triggered by imagined movements, like imagining yourself waving your hand or pushing an object, George said.

The goal, according to CSU Fullerton news, is to create a final product that is affordable, noninvasive, and user-friendly. Mechanical arms currently available on the market can cost $10,000 to $15,000. George envisions an arm for less than $500.

Eventually, the Orange County, Calif. chapter of the national ALS Association got wind of the robotic arm through a newspaper feature, and contacted the student group to set up meetings, George said. Since then, the students are working on other ALS-related projects: like applications that could allow patients to type and use a computer with just their thoughts.

Another Daily Titan story describes the group’s recent meetings with the Orange County chapter. Some patients already see the potential. “This in a perfected form could change an ALS person’s life,” said ALS patient and association member McCurdy.
Students continue work on prototype robotic arm

BY CYNTHIA WASHICKO
POSTED ON MARCH 26, 2014 POSTED IN: FEATURES

His arms were the first to go.

That’s what Sharon McCurdy remembers of the time shortly after her husband, John McCurdy, was diagnosed with Amyotrophic Lateral Sclerosis (ALS). His hands now lie furled in his lap, resting on legs that also refuse to function.

John was diagnosed with ALS, more commonly known as Lou Gehrig’s disease, two years ago. The illness leads to the degeneration and eventual death of motor neurons in the brain and spinal cord, according to the ALS Association. The degeneration causes a progressive loss of control over voluntary movements.

Helping patients like John was the focus of a meeting on March 18 between a group of Cal State Fullerton students and the Orange County chapter of the ALS Association. The students have been working for months on a prototype for a robotic arm that could be used to aid ALS patients.

The arm and corresponding headpiece use signals from the wearer’s brain to move motors on the arm. Those motors, in turn, move the framework of the robotic limb and the wearer’s arm and hand with it.

Michael Smith, past president of IEEE Systems, Man and Cybernetics Society, worked with the students prior to the meeting to help them develop the arm to best fit the patients’ needs.

Smith said a tool like this, even in a simple form, could make a world of difference in the life of an ALS patient.

“It’s all about function,” Smith said. “What people with ALS are concerned with … is ‘What can this device do for me?’”

Smith said the goal is not a perfect tool. The goal is to allow a patient to do something they wouldn’t be able to do otherwise.

Although the device may not be perfect, it will still help many people.
Sharon McCurdy said allowing her husband to regain control over simple tasks could have a remarkable impact on both his life and hers.

“This in a perfected form could change an ALS person's life,” McCurdy said.

Kiran George, Ph.D., an associate professor of computer engineering, heads the group of students developing the arm. He said the meeting gave the students and himself insight into what an ALS patient needs.

“We learned at the meeting that the needs of the each patient (vary) based on the kind of onset and progression of ALS; in other words the arm has to be customized for each patient,” George said.

The arm will require more than a year's worth of work, at least, before it is ready for commercial production. In the interim George and his students already have plans to adjust the arm so that it best fits the needs of ALS patients. Those plans involve developing a system to go over the wearer's hand, since putting on the glove that is used now can be difficult for someone with ALS.

Hayden Donze, a senior computer science major and member of the team, said the insight gained from the patients will make the road to getting the arm commercially ready much easier.

“We still have a lot of work to do, but it's going to be easier to do it because now we have a direction to go in,” Donze said.

Following that direction will inevitably take over a year onto a project that has already spanned months, but the end result could mean someone else’s arms won’t be the first to go.
Bands of black plastic and velcro encase the student’s arm as multicolored wires swirl down to small silver clamps around his fingertips. A matching band wraps around the back of his head and extends plastic tentacles across his forehead.

The entire system was developed with a deceptively simple function in mind: to robotically move the wearer’s arm and hand.

Although this initially seems like a scene straight from a science fiction show, it is the result of months of work done by a group of students at Cal State Fullerton.

As Micheal Vavro, a junior computer science major, opens and closes his hand, he showcases the culmination of that work. Vavro said the device recognizes brain waves created when a person looks at a certain stimulus and utilizes those to move the robotic arm.

“(We) can use this natural phenomenon that occurs in your brain as a way to understand when you’re looking at that stimuli and we can use that to control anything,” Vavro said. “The whole heart of it is the fact that we’re taking advantage of those phenomena to understand what’s going on in your brain and then use that to make a movement.”
While the device seems like a well-oiled machine now, it has taken almost a year of planning and prototypes to make it complete.

The team started working on the robotic arm during the summer of 2013. The initial planning, Vavro said, had much to do with finding the right control technique.

“There are so many ways to extract a small signal, the one that you’re looking for, that needle in the haystack, from all of that hay,” Vavro said. “With several ways to do that, it’s a matter of figuring out which way you want to do it.”

As it currently functions, the system uses facial expressions from the user to function the arm, said Hayden Donze, a senior computer science major. While this system works, he said, it’s one that requires training, which makes it difficult for a new wearer to use the arm right out of the box.

Moving forward, he said the team is working to implement a system called Steady State Visually Evoked Potentials (SS VEP). This particular system requires the user to focus on a flashing light to move the arm, rather than relying on more subjective facial expressions.

“(SS VEP) doesn’t require any training; it makes the arm far more robust,” Donze said.

The change to a more universal system is not the only improvement in the works either.

Adrian Iniguez is the sole mechanical engineer on the team and is largely responsible for the physical mechanism of the system. In the coming months, Iniguez said, he hopes to fine-tune the movements in the arm to allow for movement of the individual fingers.

“It’s tough, but it’s also … good because it plays a little more to my skills, and a little more towards what I have to do in the future,” Iniguez said. “And also, because I did that, other people learned what I had to do, and I learned what other people had to do.”
The crossover of a variety of disciplines offered an opportunity to learn information that would not have been taught in his normal major course, Iniguez said. The students comprising the team have majors that range from computer science to mechanical engineering and each skill set was required to get the project to where it is now.

“(Working with a varied group has) been incredibly helpful,” Donze said. “It’s the same thing when you bring on an electrical engineer and all the other disciplines, now you have more people who can do more specific things.”

The group is headed by associate professor of computer engineering Kiran George, Ph.D. One of the aspects of this project that makes it both incredibly valuable and important, George said, is the fact that it has the potential to provide a service to a group of people who would receive tremendous benefit as a result.

“This is a real-world problem, this is not a textbook problem,” George said. “Say, for example … patients with ALS can really use the system … so this is our way to give back to the community, the society.”

George said he is wasting no time in getting his team ready to tackle those real-world issues. The team will meet with patients suffering from amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig’s disease.

ALS is a degenerative disease that affects nerves in the brain and spinal cord, eventually causing paralysis as the brain becomes incapable of sending motor signals through the spine and to the muscles, according to the ALS Association’s website.

George said working with the ALS Association is one way the group can use the project to give back and how it’s going to help people. The partnership would also provide the students with some real-world context to their work, to add to the lab work that the project demands so much of.

“My goal for them (for being involved with the association) is to get a context of what they’re doing, because otherwise it’s just a lab project,” George said. “I want it to go beyond that because only then can they (understand) why they’re doing it, how it’s going to help somebody.”

As the group starts working with patients, however, development on the project will continue. While mechanical arms currently available can range from $10,000 to $15,000, George said his ultimate goal is to have a device that is both affordable and widely accessible for patients around the world.

“What I envision is a … product, probably less than $500, that anybody could afford,” George said. “Our goal is to have the design available for use across the globe, such that the design can be printed using a 3-D printer and assembled for use immediately.”

While fully robotic suits may remain in comic books and movies, CSUF now has its own piece of working science fiction on campus.
Mind games

Jan. 3, 2014

Updated 4:09 p.m.

By SHERRI CRUZ / ORANGE COUNTY REGISTER

Jose Gutierrez, from left, Adrian Iniguez, Hayden Donze and Yeu Cheng are a team of four Cal State Fullerton students who collaborated to create a robot arm that is part of a brain-computer interface - artificial intelligence project. Using a headset, brain waves are read with software that adjusts to the user’s movements. The team demonstrated the arm to executives from Western Digital.

ANA VENEGAS, ORANGE COUNTY REGISTER

Undergraduate students Hayden Donze and Adrian Iniguez, both 23, have ambitious career plans.

Donze wants a job comparable to Peter Norvig’s. He’s director of research at Google Inc. Iniguez wants to build the spaceships that will mine natural resources on asteroids.
**Brain-Computer Interface (BCI)**

Cal State Fullerton students are developing software for brain wave-reading headsets, which allow users to control devices with their mind.

**Main projects:** Mechanical arm for rehabilitation purposes and "middleware" software that video game developers can use to make games for the BCI headset.

**Research director:** Kiran George, associate professor of computer engineering

**Student leaders:** Adrian Iniguez and Hayden Donze. Both began BCI research at Cal State Fullerton as part of (STEM)^2 Summer Research Experience program, which is designed to give community college students research experience. The program is a collaboration with Santiago Canyon College in Orange, Citrus College in Glendora and Cypress College.

**Funding:** National Science Foundation and corporate sponsors

They both plan to get doctoral degrees. For now, they lead brain-computer interface projects at Cal State Fullerton.

Donze demonstrates. He puts on a headset that allows him to play a video game on a PC without using his hands. The wireless headset doesn't "read" his mind. Rather, the 16 electrodes detect electrical signals in his brain. Software interprets his brain wave data.

If a player is bored, frustrated or agitated, the game can adapt to the player, Donze said. “It takes a lot of data processing to get there.” The software has to be trained to associate the brain wave patterns with the player's intentions.

Specifically, Donze is developing “middleware” that software companies, such as Santa Monica-based Riot Games, can use to make games for the headset. The middleware would connect the headset software to a game.

Brain-computer interface, or BCI, has been around for decades, but interest in the technology has significantly grown in recent years, Donze said. It holds the promise of eliminating input methods such as joysticks, mice, touch screens and keyboards.

The consumer BCI headsets, which can be bought online, are still in their infancy. There are two dominant companies that make BCI headsets for consumers. One is San Jose-based NeuroSky Inc. Donze uses a $300 Epoc headset made by an Australian company, Emotiv Systems.

Donze is using Emotiv's software to build his software.

“We intend to add functionality that is specific to making video games that utilize the headset,” he said. “This will give customers a solid framework from which to build their games.”

**Emulating ‘Iron Man’**

Iniguez is working on a related project – controlling a mechanical arm using a BCI headset. The mechanical arm, attached to a person’s arm, could be used by someone who has lost strength in their arm or has paralysis.
Head Games

First-place winner among 19 teams in a business-pitch competition that was part of Cal State Fullerton’s new venture creation and new venture launch classes. Students generate business ideas, test the feasibility of the idea, write a business plan and pitch it to investors. Some students go on to refine or change their business plans and perhaps even launch those businesses.

Won: $500 scholarship from NCH Tax & Wealth Advisors

Head Games team: Hayden Donze, technology, computer science major; Wilfred Batas, marketing, entrepreneurship major; Thomas Kelly, operations, entrepreneurship major; Ty Martell, finance, entrepreneurship major

Head Games judges: David McConnell, founding partner of Capital Partners Worldwide; David De Filippo, regional vice president of Union Bank; Peter Meyers, vice president of Farmers and Merchants Bank; Mike Ames, professor emeritus, Mihaylo College of Business and Economics; Matthew Gallizzi, owner at NotixTech; Freeman LaFleur, founder of Zosimus Labs; Michael Sawitz, founder and chief executive of FastStart studio; Manish Patel, chief executive of Where 2 Get It; and Wally Hicks, president of Affluent Target Market

New venture professor: John Bradley Jackson, known as Professor JJ, director of the Center for Entrepreneurship at Cal State Fullerton

Research adviser: Kiran George, associate professor of computer engineering

Head Games coach: Jack Mixner, owner of Fullerton-based Mixner Strategy

It could be an “Iron Man” kind of thing in the future, he said. You could use your brain to move it, and it could make you 10 times stronger.

The mechanical engineering major is working on a way to control the arm without training the software. For example, wearing the headset, a person could look at a blinking device on the arm to cue the arm to move.

The goal is to have a finished product that someone could use or buy, Iniguez said. “If there was something out there for $200 or $300 that I could control with my brain, I would totally go buy it. It’s like comic book stuff right there.”

Other students are working on BCI projects, such as using the headset to text. “The headset can pick up the perceived emotions,” Iniguez said. It could make text messages more personal. “Maybe you could send the data of the emotion,” he said. The applications of BCI are many.

Securing funding

Iniguez and Donze recently demonstrated the feasibility of the arm to Irvine-based Western Digital Corp., which sponsors the mechanical arm project. The maker of data storage products will help the students advance the project.

The National Science Foundation funds the BCI research at Cal State Fullerton. The students' research adviser, Kiran George, associate professor of computer engineering, secures grants and assigns BCI projects to students.

George has landed more than $1.3 million in research funding in the past three years. He recently secured $50,000 in National Science Foundation funding to help his student researchers learn how to commercialize technology.

The business model

George coordinated with John Bradley Jackson, professor and director of the Center for Entrepreneurship at Mihaylo College of Business and Economics, to have Donze and business students work together. “Traditionally, engineering and business don’t collaborate on projects,” George said.

As part of Jackson’s new venture creation class, entrepreneurship majors took on business roles and built a business plan around Donze’s software for game developers.
Donze worked with Ty Martell, who took on the finance role in the business; Wilfred Batas, marketing; and Thomas Kelly, operations. They named the business Head Games.

Donze met with the business students one hour a week, helping them understand the software. The business students worked out the details—$116,909 profit on $492,250 in revenue in the first year; return on investment for investors, 10 percent; and the company’s exit plan, which is to sell after three years.

In addition to the “software development kits” for video game developers, the Head Games team also plans to generate revenue by selling small video games for the headset on Steam, an online video game marketplace.

Sales of online games for consoles and computers are expected to be $35 billion by 2018, up from $21 billion in 2012, according to San Diego-based DFC Intelligence.

**Making the pitch**

The grand collaboration between the Center for Entrepreneurship and computer science and engineering also draws on business mentors and sponsors in Southern California, as well as the (STEM): Summer Research Experience program.

The eight-week, paid summer program puts community college students together with Cal State Fullerton faculty on research projects, under the direction of George. That is how Donze and Iniguez got started on BCI research. Donze attended Santiago Canyon College in Orange and Iniguez attended Citrus College in Glendora. The program also accepts Cypress College students.

The Head Games team recently pitched their business plan to a classroom of invited venture capitalists, bankers and other business professionals as part of a Center for Entrepreneurship Investment Panel competition. Jack Mixner, owner of a Fullerton-based strategic planning company, Mixner Strategy, coached the Head Games team.

Head Games, competing with 18 other teams, won first place and a $500 scholarship from Fullerton-based NCH Tax & Wealth Advisors.

“This is really a viable business,” said Martell, who wants to see the project through to launch. In Jackson’s new venture launch class, the students aim to refine their business plan or make changes, with the intent of launching a business.

The Head Games business concept needs more research and testing, Jackson said.

“Innovative technology is great but is only part of the recipe for a successful business,” he said. “A successful new venture needs a viable business model, which is a fancy term that describes how the firm will provide value to the customer and make money,” he said. “Head Games has great potential.”

**Ridiculously busy**

Donze and Iniguez get a stipend for research they do at Cal State Fullerton. They also have full course loads and regular jobs. “Hayden and I are ridiculously busy all the time,” Iniguez said. “I have three-ish jobs,” he said. Donze works at Unisys Corp., which has an Irvine office, and tutors at his former community college.

Iniguez will graduate in two years, and Donze graduates in the spring.
Donze taught himself how to program while he was in high school. “I got really good at teaching myself programming,” he said. He's familiar with 12 languages. He mainly uses C++, Python and Matlab.

He attended community college to catch up with math classes. He needed five but took seven. He likes math, and though programmers don't need to be mathematicians, he said it helps.

Donze pays his college tuition with grants, scholarships and money he's earned. He's applying to graduate schools, where he plans to study artificial intelligence in robotics. “Artificial intelligence becomes more interesting in robotics because you have more sources of input,” he said.

He's applied to UC Irvine, Caltech and Stanford University.

Ultimately, Donze would like to head research at a large company. “Researching for a company sounds like so much fun.”
Student Research for ALS Patients

User-Friendly Prototype Helps People Communicate Online

Aug. 25, 2015

Student Aaron Castillo tests a high-tech communication device that he and fellow classmates are developing with computer engineering faculty mentor Kiran George to help those with ALS.

Computer engineering major Krystle Ilisastigui hopes her efforts to help develop a high-tech communication device will improve the quality of life for those with amyotrophic lateral sclerosis, or ALS.

Ilisastigui and several of her classmates are developing an electronic communication system to enable ALS patients to access the Internet and communicate via email, text document, chat or Skype using thoughts, facial expressions and head movements, said Kiran George, associate professor of computer engineering.
George and his students have worked on the prototype since February — supported by a $100,000 grant from the Oakland-based Disability Communications Fund — and partnered with the ALS Association Orange County Chapter to fine-tune the technology and design. This summer, the communication device was tested with the help of patients at the chapter's Tustin office.

I have 100 percent faith in you," said Cal State Fullerton alumnus Dean Zarkos, diagnosed with ALS in 2011, as students placed a wireless headset on him.

With the device, patients like Zarkos — who uses a motorized wheelchair and is unable to move his hands, arms or legs — can communicate online with head tilts and facial expressions.

"What they are doing is phenomenal: it's cutting-edge technology. Anything that can help patients like myself is a tremendous asset for us," said Zarkos '78 (B.A. political science) of Seal Beach, who holds an MBA and law degree and owns a property management business.
"I can see it opening up the world for people like me. You can do email — communicate with anybody. These students make me proud to be a Titan."

ALS, commonly known as Lou Gehrig's disease, is a progressive neurodegenerative disease. An estimated 75 percent of ALS patients lose their ability to speak, along with use of their hands, said George. Speech problems are progressive, and most will experience a severe breakdown in their ability to communicate with others, he added.

"Patients face tremendous barriers that make electronic communication a challenge. This inability to communicate is equally frustrating and emotionally devastating," George added. "But this device will help them to engage in electronic communication and allow them to stay connected to friends and family."

What is most appealing about the technology is that the device is user-friendly, requires minimal training and is low cost, observed Jared Mullins '04 (B.A. political science), executive director of the ALS Orange County Chapter.

The wireless communication system utilizes commercially off-the-shelf components to minimize design time and cost, George explained. The goal is to keep the device's cost under $150.

While the project allows students to apply what they learn in class and put it to practical use, it also is an eye-opening experience in seeing how their work could help ALS patients regain control of simple tasks.

"It's been challenging and a great learning experience for us to work directly with the patients," said graduate student David Diaz. "It's real hands-on — something you are not going to get in the classroom."

Fellow graduate student Aaron Castillo added that one of the biggest challenges has been to personalize the device to meet patients' needs as the disease progresses.

"We're going to give this project everything we have; we just want to help," Castillo said.

George and his students also are working on other brain-controlled systems for ALS patients, in which thoughts and expressions can be used to control a robotic arm and electric wheelchair.