EEG Based Robotic Arm

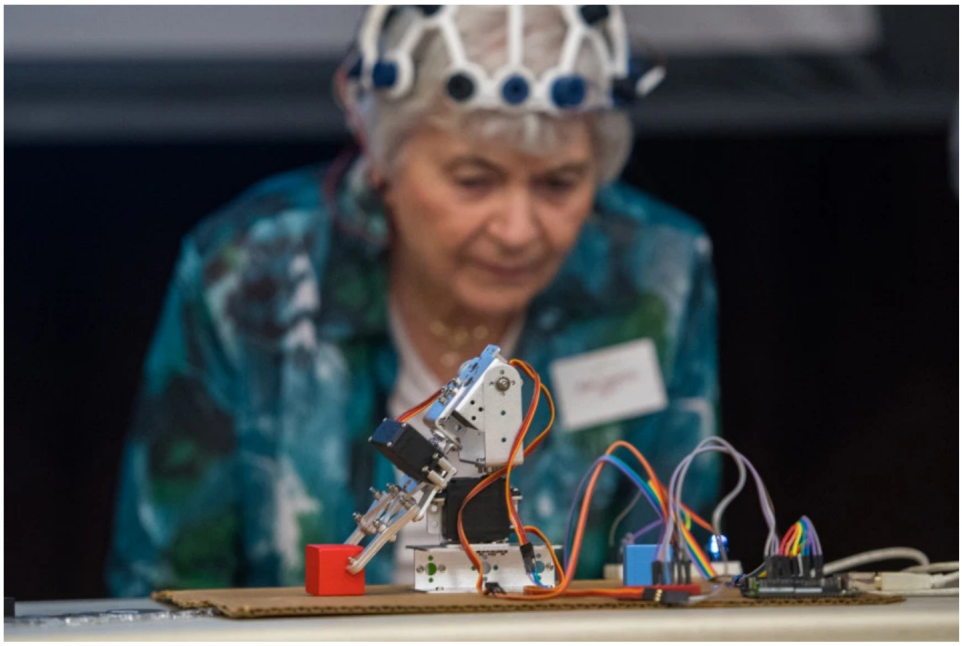
Demo Video

https://www.youtube.com/watch?v=IWUgopQdtI8

See below photos and comments from PALS from prototype trial sessions of the *Facial Expression and Head Movement based Communication Device* as part of a sponsored project.

NEWS > LOCAL NEWS

Seniors get sneak peek at the technology that could one day make daily life easier



Jean Hedrick, right, of the Morningside of Fullerton retirement community uses a Brain Computer Interface controlled robotic arm to lift blocks during a presentation of Assistive Devices made by Cal State Fullerton engineering students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. Hedrick was able to direct the arm by focusing on one of three LED lights for specific motions. (Photo by Josh Barber, Contributing Photographer)

By GREG MELLEN | Orange County Register
PUBLISHED: April 16, 2018 at 1:55 p.m. | UPDATED: April 18, 2018 at 12:52 a.m.

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."

1 of 8

Heme Murthy, left, an engineering student at Cal State Fullerton smiles as Jean Hedrick, right, of the Morningside of Fullerton retirement community uses a Brain Computer Interface controlled robotic arm to lift blocks during a presentation of Assistive Devices made by the Fullerton students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. Hedrick was able to direct the arm by focusing on one of three LED lights for specific motions. (Photo by Josh Barber, Contributing Photographer)

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Heme Murthy, left, an engineering student at Cal State Fullerton fits Jean Hedrick, right, of the Morningside of Fullerton retirement community with the head set for a Brain Computer Interface controlled robotic arm during a presentation of Assistive Devices made by the Fullerton students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. (Photo by Josh Barber, Contributing Photographer)

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Professor Kiran George of Cal State Fullerton talks about the work he and his students have been doing to develop affordable assistive technology to a crowd of residents at the Morningside of Fullerton retirement community on Thursday, April 12, 2018 in Fullerton, Calif. (Photo by Josh Barber, Contributing Photographer)

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.

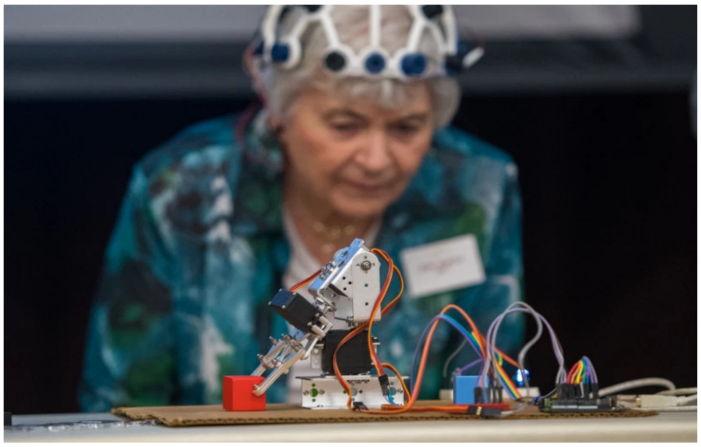
Somewhat like self-driving cars, the chair can operate in small spaces where GPS and wifi may not be available.

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.”



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Jean Hedrick, right, of the Morningside of Fullerton retirement community uses a Brain Computer Interface controlled robotic arm to lift blocks during a presentation of Assistive Devices made by Cal State Fullerton engineering students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. Hedrick was able to direct the arm by focusing on one of three LED lights for specific motions. (Photo by Josh Barber, Contributing Photographer)

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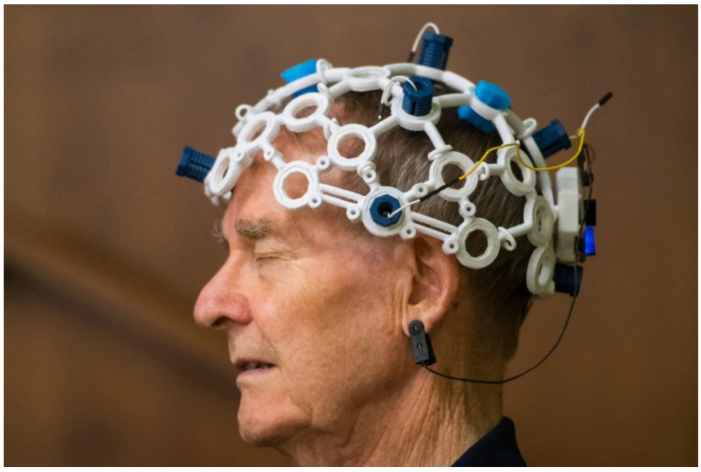
Rosemary Buden of the Morningside of Fullerton retirement community, left, works with Samuel Sisson, an engineering student at Cal State Fullerton, to demonstrate a Face-Name Recognition memory aid that Sisson and others have been working on during a presentation of Assistive Devices made by the Fullerton students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. The program was able to recognize Buden after taking just one picture of her. (Photo by Josh Barber, Contributing Photographer)



6 of 8

Hans Hennecke of the Morningside of Fullerton retirement community focuses while using a Brain Computer Interface headset to turn on and off a smart household light bulb using only his brain during a demonstration that was part of a presentation of Assistive Devices made by Cal State Fullerton engineering students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. Hennecke would focus on a noise and the device would use a home automation device, an Amazon Alexa speaker, to turn on and off the light bulb. (Photo by Josh Barber, Contributing Photographer)

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Morningside of Fullerton retirement community residents watch a self driving wheel chair 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)

8 of 8

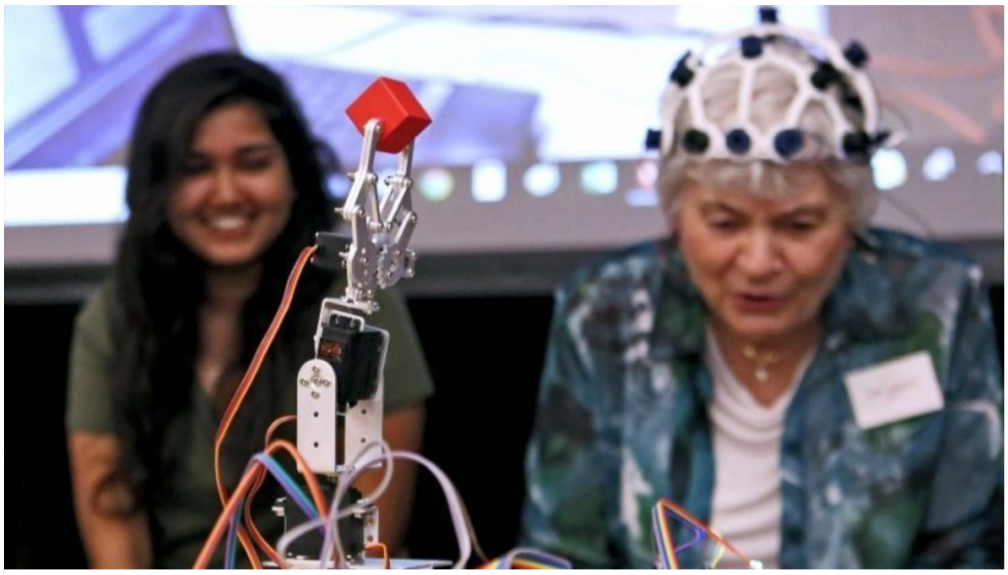
Barbara Vigano, right, of the Morningside of Fullerton retirement community applauds the group of Cal State Fullerton engineering students who worked to develop a self driving wheelchair, from left, Harkishan Grewal, Ved Contractor, and Neha Jay after a presentation of Assistive Devices made by the Fullerton engineering students at Morningside on Thursday, April 12, 2018 in Fullerton, Calif. (Photo by Josh Barber, Contributing Photographer)

https://www.ocregister.com/2018/04/16/seniors-get-sneak-peak-at-the-technology-that-could-one-day-make-daily-life-easier/

LA Times

NEWS

Tech aimed at seniors expands possibilities for an aging population



By concentrating on a set of LED lights, Jean Hedrick, right, makes a robotic arm pick up a block from a table during the Brain Computer Interface Controlled Robotic Arm demonstration by Cal State Fullerton School of Engineering students at Morningside of Fullerton on April 12. (Raul Roa / Staff Photographer)

By JESSICA PERALTA APRIL 26, 2018 | 4 PM

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.

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. (Raul Roa / Staff Photographer)

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.

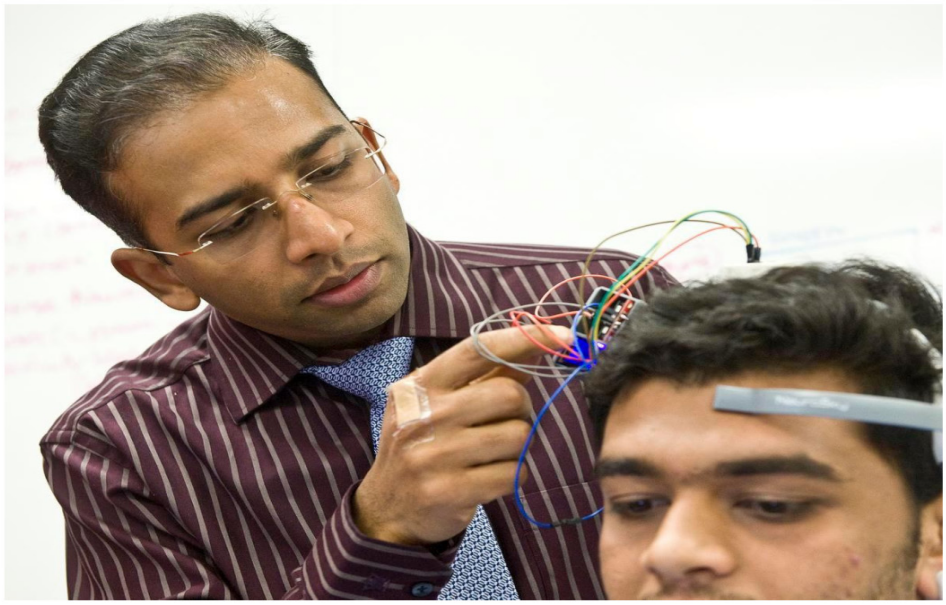
“Fortunately, staying in their own home is becoming more viable for seniors as a result of smart technology devices and monitoring apps that offer independence through connectivity.”

Jessica Peralta is a contributor to Times Community News.

https://www.latimes.com/socal/daily-pilot/news/tn-wknd-et-csuf-technology-20180426-story.html

THE ORANGE COUNTY REGISTER

CSUF developing biomedical device program



Kiran George, professor of computer engineering, is helping to develop the program.

By ORANGE COUNTY REGISTER
August 23, 2016 at 6:20 p.m.

Cal State Fullerton's College of Engineering and Computer Science is developing an undergraduate biomedical device engineering option.

The program will be an extension of the bachelor's degree offered in engineering.

"Orange County to San Diego is considered the hub of the biomedical industry and because of it, there is a huge demand in biomedical engineering," said Sang June Oh, who is directing the new program.

The U.S. Bureau of Labor Statistics reports biomedical and medical device engineers will see a faster-than-average 23 percent increase in jobs from 2014-2024.

In California, the biomedical field employed more than 270,000 people in 2013, according to a 2015 California biomedical industry report from California Healthcare Institute.

The CSUF biomedical device engineering program will add a "new flavor" to the engineering bachelor's degree, said Oh, who serves as interim associate dean of the College of Engineering and Computer Science.

It will intertwine the fields of engineering and biology, but primarily target engineering concepts.

"What we want to do is distinguish ourselves; we are very engineering-centric," Oh said. "Traditional biomedical engineering is a hybrid between engineering and biology. We want to focus more on the device aspect."

The program will cater toward engineering students interested in developing and manufacturing biomedical devices like a robotic arm or a walker that could assist people in walking, he said.

"Biomedical device engineering deals with microscopic and macroscopic issues," Oh said. "We are dealing with more of the macroscopic devices."

As part of their capstone senior design projects, biomedical device engineering students will be required to design, build and test functioning biomedical devices.

A $300,000 grant awarded to CSUF from the W.M. Keck Foundation has facilitated the development of the program. The Los Angeles-based philanthropic organization offers grants to institutions and programs with a focus on science, medical and engineering research.

The grant will allow the college to purchase appropriate lab equipment, hire faculty who specialize in the subject and develop new courses.

Assisting Oh in developing the new option is professor of electrical and computer engineering and former dean of the college Raman Unnikrishnan, as well as professor of computer engineering Kiran George.

The program has been a long time coming.

"Our previous dean, this is something he had been thinking about," Oh said. "He was envisioning this for a few years and then we saw the opportunity to create an option."

Students and faculty from the college have been positive and welcoming of the new program, he said.

"Many students in mechanical engineering want to deal with the biomechanic aspects of engineering," Oh said. "Electrical engineering students want to deal with bioelectric devices like MRI devices."

He expects the option to be popular among engineering students.

"We are trying to make all this very interdisciplinary," he said.

Three upper-division courses will be created for the program, which is expected to debut in fall 2017.

While a number of institutions in the region offer biomedical engineering programs, offering a biomedical device engineering-specific program at the undergraduate level is a rarity, Oh said.

"I am happy that we will be able to provide a training site to meet the demands of the future biomedical device engineers from our campus," he said.

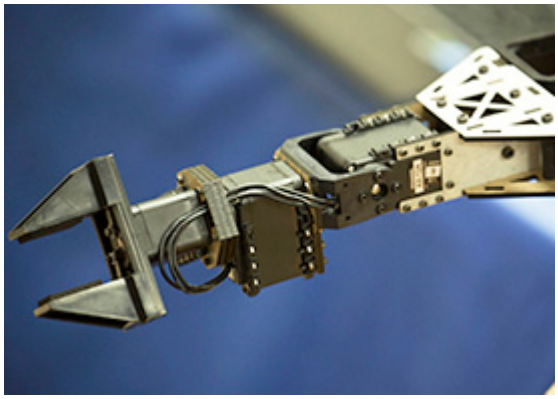
Contact the writer: amarcos@scng.com

https://www.ocregister.com/2016/08/23/csuf-developing-biomedical-device-program/

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.

http://news.fullerton.edu/publications/titan-report/Titan-Report-November-2014.pdf

CALIFORNIA STATE UNIVERSITY
FULLERTON

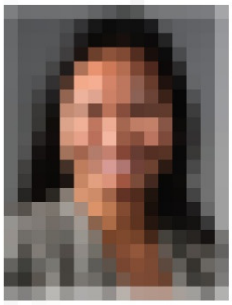
TITAN Report

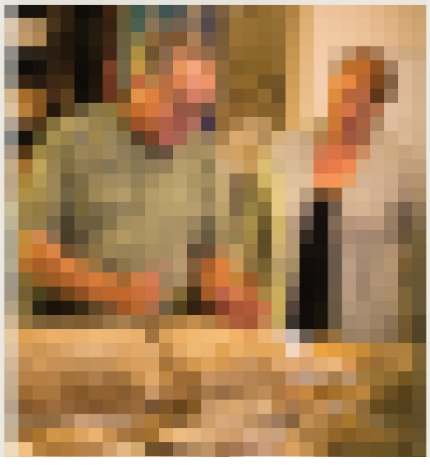
NOVEMBER 2014 / news.fullerton.edu

Robotic Arm Research Presented at Conference

To share their research to improve the quality of life for patients with Lou Gehrig's disease, Cal State Fullerton's Kiran George, assistant professor of computer engineering, and his students presented their brain-computer interface controlled robotic arm at the IEEE (Institute of Electrical and Electronics Engineers) 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.



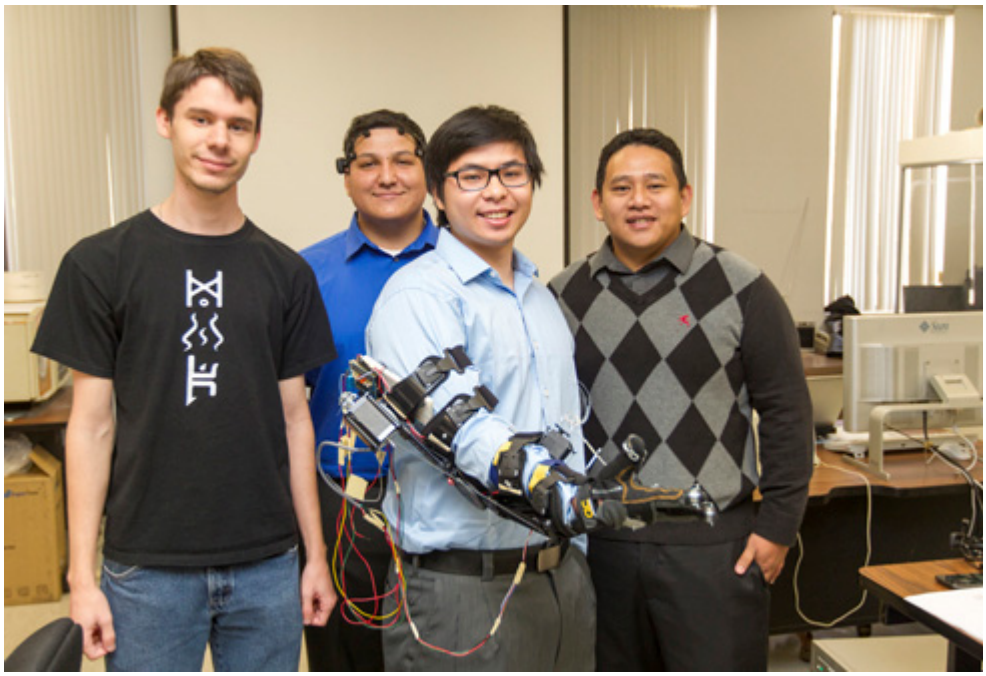


http://news.fullerton.edu/publications/titan-report/Titan-Report-November-2014.pdf

NEWS, STUDENT ENTREPRENEURS

ROBOTIC ARM COULD GIVE A HELPING HAND TO ALS SUFFERERS

APRIL 22, 2014 S.KHAN

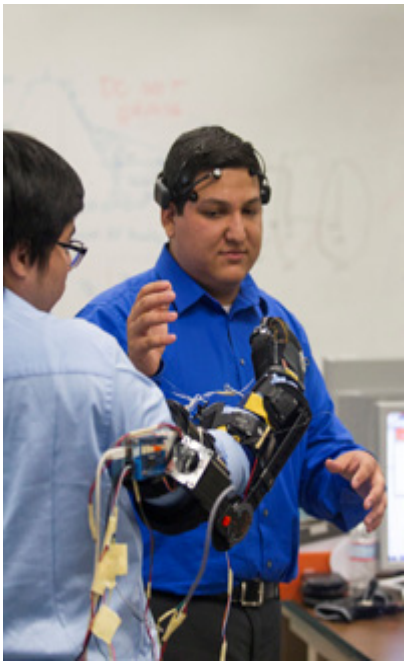


While it conjures up images of human cyborgs from science fiction movies, a robotic arm designed by California State University – Fullerton engineering students could have very real uses. With further development, the exo-skeletal device could give hope for sufferers of Amyotrophic Lateral Sclerosis (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.

DAILY TITAN
THE STUDENT VOICE OF CAL STATE FULLERTON

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.

https://dailytitan.com/lifestyle/students-continue-work-on-prototype-robotic-arm/article_39513ce0-be10-5d5d-b525-8caab01cede3.html

DAILY TITAN
THE STUDENT VOICE OF CAL STATE FULLERTON

Computer science majors build robotic arm after months of planning

BY
CYNTHIA WASHICKO
– POSTED ON MARCH 5, 2014**POSTED IN:** FEATURES, MULTIMEDIA, SLIDESHOWS, TOP STORIES

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.

http://www.dailytitan.com/2014/03/computer-science-majors-build-robotic-arm-after-months-of-planning/

LIFE

Mind games

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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 $(STEM)^2$ 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.”

https://www.ocregister.com/2014/01/03/mind-games/