

Wireless Sensor Startup Wins UC San Diego \$80K Entrepreneur Challenge

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Wireless sensors that monitor your heart even though they do not actually touch your skin are at the center of UC San Diego electrical engineering PhD student Yu Mike Chi's dissertation. This technology - and the plan for commercializing it - earned Chi and his Cognionics team the top spot in the UC San Diego Entrepreneur Challenge. The prize includes \$25K in cash for the startup and \$15K in legal services.

Engineers and physicians are increasingly looking to wireless technologies and innovative circuit designs to develop sensors that cut health care costs through better preventative care and shorter hospital stays. Wireless sensors also offer patients more freedom than wired sensors hooked to machines. The UC San Diego wireless sensor project could lead to unobtrusive heart sensors for long term cardiac health monitoring that do not touch the skin and do not tether patients to machines.

The sensors record "biopotentials" - tiny voltage signals that appear on the skin surface. Biopotentials emanate from electrically active cells, such as neurons and cardiac cells, and propagate through the conductive media of the human body.

At the final phase of the 2009-2010 UC San Diego Entrepreneur Challenge, on June 2, Chi gave a 12 minute presentation of the Cognionics business plan to the panel of judges, followed by an 8 minute question-answer period. When the Q&A finished with a few minutes to spare, Chi quickly set up a live demo. Pressing the sensor into his chest, over his clothes, the electrical activity of his heart appeared on the giant presentation screen.

Chi is also working on wireless sensors that record brain activity, though these sensors are not part of the winning business plan.

Chi is developing these technologies under the guidance of professor Gert Cauwenberghs from the Department of Bioengineering at the UC San Diego Jacobs School of Engineering. Cauwenberghs is also Co-Director of the UCSD Institute for Neural Computation.

The new sensors that Cognionics is developing are "wireless" in two different respects. First, the sensors record biopotential through clothing fabrics, and therefore do not touch the skin directly. "Today you have to put sticky patches on your chest to record this information. It's uncomfortable and messy," said Chi.

Second, the information the sensors collect is sent to computers over wireless channels, rather than over wires.

"One of the goals of this wireless sensor project is to take the sensing technology out of the typical hospital setting and into the home environment, without constraining the mobility of the patient," said Cauwenberghs. "Also, our approach could allow you to monitor cardiac or brain activity during exercise, or to monitor the health of soldiers in the battlefield, so it can be transformative in that sense."

Various wireless sensor prototypes for recording biopotential have been around since at least the 1960s, but according to Chi, "no one has gotten it past a lab prototype...you don't see them out in the marketplace." Chi cited problems with cost, reliability, and difficulty recording clinically relevant electrical signals as causes of the roadblocks, particularly because wireless sensors are more complex than the wired versions.

"We managed to reduce the circuitry for the sensor into a single integrated circuit that makes it more reliable and cheaper than other methods. We have two lab prototypes that are working," said Chi.

"There are other companies that are doing wireless sensors, but Mike's solution offers one that eliminates not only the wires for transmitting the data, but also the wires between electrodes that are conventionally needed to establish a voltage signal with a reference and ground," explained Cauwenberghs. Chi says he is dedicated to launching this company in San Diego after he finishes his PhD.

"I want to stay in San Diego. Wireless health is starting to become a big thing in San Diego," said Chi.

The Cognionics Team: Young Minds from "the Mesa" Cognionics is an early stage startup project, whose members include:

Yu Mike Chi: PhD student, Electrical and Computer Engineering Dept, UCSD Jacobs School of Engineering
Yuchen Cao: PhD student, Dept. of Chemistry, UC San Diego
Mehmet Parlak: PhD student, Electrical and Computer Engineering Dept, UCSD Jacobs School of Engineering
Ping Wang: PhD student, Salk Institute
Stephen Chen: PhD Student, The Scripps Research Institute
"Von Liebig has been a great help," said Chi, who took the entrepreneurship for engineers course sequence as a graduate student from the William J. von Liebig Center for Entrepreneurism and Technology Advancement at UC San Diego. "We received a lot of great advice from our von Liebig advisor, Mike Elconin." Cognionics is working with the UCSD technology transfer office on the intellectual property process.

A Lab to Market team from the UC San Diego Rady School of Management also provided crucial support. The Rady School team, all graduating MBAs, included Silvia Mah, Lydia Grypma and Kabir Gambhir, Neal Chen and Ali Esteghlalian. Cognionics already won the elevator pitch competition and made it to the finals in the executive summary competition, both part of the 2009-2010 UC San Diego Entrepreneurship Competition.

Chi also acknowledged advisory assistance from Qualcomm, Connect and Oregon State University.

While describing how the current technology was developed, Chi said, "We took a look at what was out there, how people were building sensors today, and we realized people were using clunky hacks, and we saw it would be simpler if it were on a single circuit...it's about customization."

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