December 12, 2013 | By Paul K. Mueller

By Enlisting 1,000 'Citizen-Sensors,' Research Team Hopes to Improve World Health


Researchers are going to deploy sensing devices in the field connected to mobile apps that allow them to track the health of individuals and the environment.

Enterprising researchers and students at the University of California, San Diego are looking for funding to complete a "citizen-sensor" project that, they hope, will revolutionize global health and environmental monitoring – especially in remote and undeveloped areas of the planet.

They also hope to attract the faith and funding of people around the world through the open, global crowd-funding resource Indiegogo, the first partnership between UC San Diego and a funding platform.

The Indiegogo campaign, they stress, is more a call for wide-spread citizen participation in health monitoring than a simple appeal for funds.

"What if you could hold the power of modern medical equipment in the palm of your hand?" they ask. The device the students call "a cool gizmo" can also monitor your environment's health by sampling the air, soil, and water for pollutants, then analyze and report the findings.
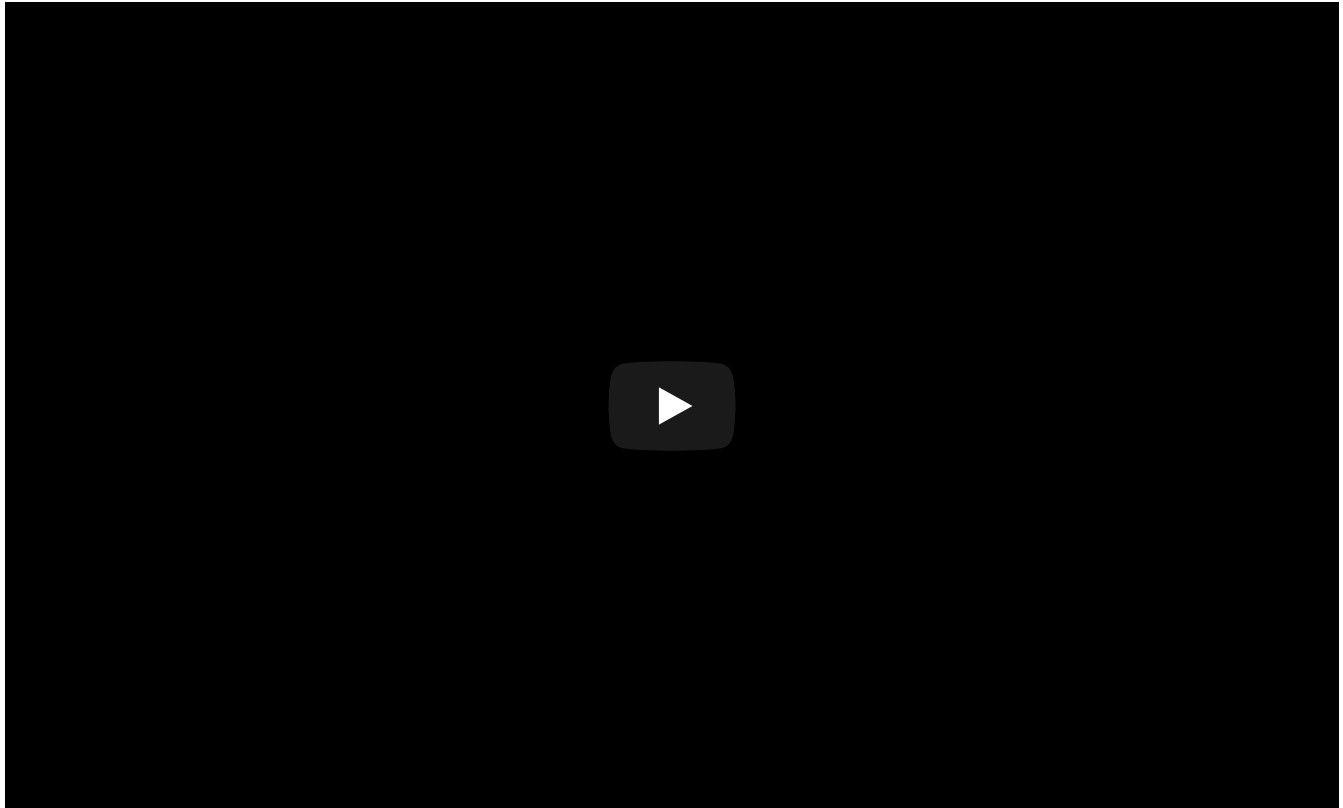

For non-Star Trek fans, the gizmo is much like the "tricorder" of the popular sci-fi series—a nifty hand-held device used for scanning, analyzing, and recording data. Less evocatively named, but nearly as high-tech, the UC San Diego device is called the Open Health Stack.

It would beneficially alter the landscape of the medical economy, researchers say, first by changing how people sense and perceive their own health, and then by collecting enough data to enable changes to environmental practices or policies.

Making those ambitious goals a reality is the role of their Distributed Health Lab, a collaboration between UC San Diego's School of Medicine and the Qualcomm Institute, the UC San Diego division of the California Institute for Telecommunications and Information Technology (Calit2).

Drs. Albert Yu-Min Lin and Eliah Aronoff-Spencer, co-directors of the lab, and co-principal investigators for the project, say that the multidisciplinary nature of the project will be key to its success. "We have a large number of truly talented collaborators in the School of Medicine as well in the School of Engineering," says Lin. "Helping their different skills to coalesce, along with the amazing energy and imagination of our students, will be instrumental."

The researchers and students – from such diverse fields as nanoengineering, medicine, machine-learning, cryptography, crowd-sourced archaeology, citizen science, and human & computer ethnography – are building the Open Health Stack using cloud infrastructure, mobile apps, and sensors that will collect and analyze data from individuals and the environment.
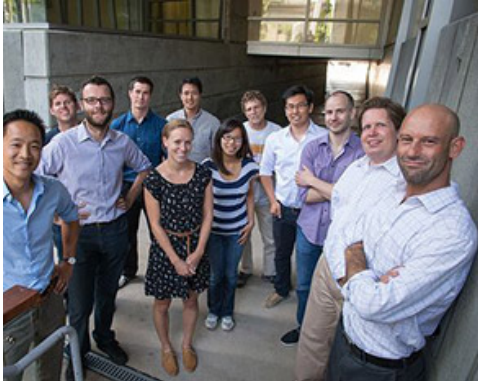
ited Health Labs team led by Qualcomm Institute
ientist Albert Yu-Min Lin (front left) and UC San Diego
ledicine professor Eliah Aronoff-Spencer (front right). The
ct is seeking $50,000 in support through the Indiegogo
ing website.

The first "layer" of the stack is SENSE, the heart of the gizmo, a health-and-environment sensor that tracks vital signs and measures, for example, heavy metals in water or cholera in streams. The pocket-size device enables users to learn more about their surroundings.

The next layer is MyOasis, a mobile app that interacts with the sensors and lets users monitor and report what the sensors discover. MyOasis visualizes data collected by SENSE, allowing users to "see" things invisible to the eye, such as heart rates.

The final layer is KEEP, a secure data-storage-and-analysis platform that detects large-scale trends, like flu outbreaks, with the help of machine-learning algorithms.

"Together," Aronoff-Spencer says, "they provide an end-to-end solution for collecting and analyzing data at the individual, community, and global levels."

With this technology, the team hopes citizen-sensors around the world will form a global network, the OASIS program, sensing and reporting information vital to their regions and their lives.

"We are exploring new ways in which the actions of individuals contribute to a 'living body' of shared, actionable knowledge," says Lin. "Our goal is to get the devices into the hands of everybody who wants them, because turning to the crowd may be the best way to sense what's actually happening on the ground."

The UC San Diego team aims to raise $50,000 through Indiegogo to advance development of their device, SENSE, and to manufacture enough of the devices for distribution to the initial validation sites.

The campaign aims to reach a target goal of 1,000 active citizen-sensors by mid-2015, and they have turned to Indiegogo to start enlisting the crowd. If they reach their monetary goals, the team says they think they'll be able to achieve a cost-per-device of under $50, a critical threshold. Details about the OASIS program, the crowd-funding process and the vendor are available here.

The Open Health Stack might also, they hope, win the $10-million Qualcomm Tricorder XPRIZE, a global competition to stimulate innovation and integration of precision diagnostic technologies, making valid health monitoring available directly to "health consumers" in their homes.

Once the easy-to-use technology is manufactured, the UC San Diego team will deploy the devices in Mongolia, Mozambique, and Haiti, the inaugural research sites.

Mongolia, they explain, is home to the last horse-based nomadic culture in the world, where almost half of the population lives a traditional nomadic lifestyle. Precious-metal mining operations, however, threaten this way of life, as toxic heavy metals and mining wastes make their ways into rivers and ground-water systems.

Similarly, Mozambique and Haiti are emerging nations with large burdens of infectious diseases which can be better controlled with increased monitoring.

The prototype design of SENSE has two parts. The smalle... samples temperature, heart-rate, and other vital signs. Th... piece can test water for heavy metals like arsenic and ur... eventually bacteria and viruses.

UC San Diego researchers will distribute the rugged, inexpensive, easy-to-operate sensors among affected Mongolians, as well as to health workers in Mozambique and Haiti, to enable them to monitor their health and their environment, and to create "maps" of that blended data to study the sensor's validity and reliability.

The students and their faculty mentors are enthusiastic not only about the scientific and technical aspects of the project, but also about the humanitarian and ecological benefits.

"We are unified in our goal," they say, "to produce an affordable, transformative, and open product to improve health care around the world."

UC San Diego's Studio Ten 300 offers radio and television connections for media interviews with our faculty, which can be coordinated via studio@ucsd.edu. To connect with a UC San Diego faculty expert on relevant issues and trending news stories, visit https://ucsdnews.ucsd.edu/media-resources/faculty-experts.