Look mom, no wires: The hands-off and wire-free future of patient health monitoring in both the medical and home setting.

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Pitt Science is an annual conference held at the University of Pittsburgh where curious minds come to talk science. One of the keynote speakers this year was Dina Katabi, PhD who is the MIT wireless center director. Her and her team are developing Emerald, a wireless health monitoring device.

As first time Pittsburgh public transport riders, a fellow first year PhD student and I, were nervous about hopping a bus from Duquesne University to the University of Pittsburgh. We even scheduled extra time in our day to arrive early to the conference, just in case we got lost and to nab good seats in the lecture hall. Being early birds also paid off since we had time to converse with Dr. Katabi before her talk. As two eager first year PhD students, the idea of approaching a renowned scientist to engage in small talk was overwhelming. However, this is a decision I’m thankful we made, since Dr. Katabi pleasantly greeted us with a smile.

When asked what motivates her, Dr. Katabi stated it’s about remaining curious. As a scientist, Dr. Katabi believes in trying to solve problems and answer questions. She then went on to mention her roots in Syria. She came from a family of medical doctors who had hoped after her studies at Damascus University in Syria she would follow in her family’s footsteps (1). However, Dr. Katabi found a passion for helping others in a different flavor. She had a love for computer science and healthcare, and was able to create a marriage between two seemingly exclusive fields. She views technology as a “tool” so that as the world becomes more integrated with complex technology our lives should become easier. Emerald is one of these tools Dr. Katabi is envisioning for the future, and has already attracted attention, even from former President Obama who took it for a spin around the White House (1).

Many people today use wired or wearable health monitoring devices, such as those found at the hospital, sleep lab, or even the kind you may be wearing right now such as a smart-watch. Dr. Katabi is looking beyond skin-contact devices into a wireless health monitoring device no more invasive than a WiFi box found in a home. This technology they coined Emerald, utilizes electromagnetic waves altered by the body to monitor an individual's health status. Meaning no physical contact such as wires, on-person devices, nor special clothing is required. Emerald is capable of monitoring through walls between rooms and can perform motion tracking to measure gait speed, activity, sleep, toileting, eating, and caregiver interactions. The device can also be a predictor of cognitive impairment based on physiological
changes detected. Additionally, Emerald can alert a caregiver by text, phone, or email of a potential problem with the patient.

This technology offers the option of in-home continuous patient monitoring. With six out of ten adults in the United States suffering from a chronic disease this technology could change the way these individuals receive medical care (2). Emerald is 97% accurate in measuring breathing rate and is also able to monitor walking patterns of patients with mobility impairment diseases such as Parkinson’s disease, Huntington’s disease, ataxia, and multiple sclerosis. The device is, additionally, able to monitor congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) patients who are at an increased risk of exacerbation which could lead to hospitalization. The degree of anxiety felt by those suffering from Alzheimer's disease can surface as repetitive behavior, another aspect Emerald’s motion tracking software can monitor.

Additionally, here in the United States, sleep is a problem for one out of every three people experiences sleep difficulties. With the added convenience of sleeping in the home and without wearing uncomfortable wires, Emerald is accurate about 80% of the time in monitoring a patient's sleep pattern. This is comparable to sleep lab data that is prone to subjective bias due to different sleep technicians’ patient data interpretation.

Dr. Katabi and her team have worked with medical doctors to start the early stages of testing. Emerald has been tested in nursing homes and has been deployed in over 250 homes. These devices have been launched in homes of individuals suffering from Parkinson’s disease, pulmonary disease, depression, and Alzheimer’s disease. Emerald was able to give insight to the living patterns of patients with never having to deeply question the person, have them keep detailed logs, or wear any kind of medical device.

With such powerful in-home technology, a line from Spiderman comes to mind: “with great power, comes great responsibility.” In the modern age of technology, privacy has become a major concern, a point not unnoticed by Dr. Katabi and her team. The Emerald devices are currently used only in accordance with medical protocols, and not sold to the public. Once the device is made available to the public, additional security mechanisms will be deployed based on the concept of challenge response. Specifically, anyone trying to access the data must follow a simple set of physical commands prompted by Emerald, i.e. take two steps to the left, walk the border of the room, etc. If, the individual trying to access Emerald is not able to complete these tasks they will be locked out of the system, thereby preventing, say your neighbor from accessing your private personal information.

The ability to create a device, with such a variety of capabilities, has the potential to revolutionize healthcare both in the medical setting and home setting. I look forward to seeing the progress that comes out of Dr. Katabi’s lab going forward, as after meeting her and listening to her speak I will
definitely be keeping an eye on her work. Maybe someday I will even have her technology within my own home.

References


