EMERALD – the hidden gem of technology and medicine to advance health care procedures

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“HELP! I’ve fallen and I can’t get up!” But wait – you forgot to put on your Life Alert® today! What do you do now? Wait on the ground until someone finds you? Crawl to the nearest telephone? With Dr. Dina Katabi’s invention, there’s no longer a need for wearable emergency devices within your home.

When I asked Dr. Dina Katabi what her inspiration was for designing an in-home continuous patient monitoring system, she thought for a second, smiled, and then told me about her childhood. Being from a family of doctors, Dr. Katabi was primed at a young age to become a doctor of medicine, but she knew that was not where her heart lies. Nevertheless, she persisted and went to medical school for a year only to confirm that being a medical doctor was not her true passion. Dr. Katabi went to Damascus University in Syria where she began to study computer science. While there, Dr. Katabi decided that she wanted to create something that would combine medicinal practices and computer science to have a piece of home and a piece of herself in her work.

Dr. Katabi successfully obtained her Bachelor’s degree from Damascus University in 1995 as well as her Master’s degree (1999) and Ph.D. (2003) from Massachusetts Institute of Technology (MIT) in computer science. Dr. Katabi’s background in computer science helps to drive her passion for innovation of the health field through the assimilation of mobile and wireless technology to develop a better future in health care practices. Katabi currently works as a Professor of Electrical Engineering and Computer Science at MIT where her lab has established the detection of motion through solid objects using Wi-Fi frequency radio waves. Katabi’s lab has also instituted the use of ultralow-power radio signals to measure respiration and heart rate from a distance in humans – even through walls!

At Pitt Science 2019, Dr. Katabi titled her presentation, “From Wearables to Invisibles,” which caught me off guard. Wearables? My first thought was, “ok, she’s going to compare her invention to Fitbit and Garmin watches.” I soon learned how wrong I was when she started discussing the equipment used today during sleep studies. With so many wires attached, Katabi emphasized that there is no way that these people can sleep “normally.” Is there a way to measure sleep apnea without the use of a nasal probe, chest band, or lying on a specific mattress? Dr. Katabi invented a device, EMERALD, which she nicknames “invisibles.”
Dr. Katabi was originally working on making more comfortable equipment for sleep studies, but her product, EMERALD, turned out to be useful for monitoring sleep, breathing, and heart rate in elderly patients. Much like a Wi-Fi box, this sits in the background of a person’s home to monitor sleep, breathing, heart rate, and any interactions with caregivers without any sensors on the body. This is done through a low-power wireless radio signal that detects the ever-changing electromagnetic waves around us within a range of 1,200 square feet (1). As an individual moves around their house, the radio waves surrounding them change, enabling the device to detect frequency changes to track the exact position of the individual. Based on the home layout, EMERALD can detect activity in the home whether it is time spent in the bathroom, bedroom, kitchen, etc. (2). EMERALD takes note of these changes and stores the information to detect the onset of diseases and to understand behavioral patterns.

Dr. Dina Katabi continued to discuss how EMERALD can detect chronic diseases, understand behavioral patterns, and health concerns by measuring gait speed – a person’s habitual walking speed (2). For example, if a person has difficulty walking, they may have an onset of pulmonary or heart problems per Dr. Katabi. EMERALD also works as a predictor to detect depression and Alzheimer’s disease based on sleeping patterns and which rooms individuals frequent. Depression can be indicated by a lack of movement, whereas an excess of movement may be suggestive of Alzheimer’s disease.

Moreover, EMERALD device has been found to help in domestic abuse, caregiver-patient interactions and falls among elderly individuals (3). EMERALD can detect outside individuals within the house where it can monitor that person’s gait speed and interactions as well. Today, accounts on abuse are normally based off questionnaires and diaries; however, the ability to be monitored 24-7 allows behavior-related data to be collected without the use of writing.

Dr. Katabi has designed EMERALD to allow elderly individuals to no longer wear “Life Alert®” monitors in case of a fall within their home. Instead, EMERALD measures the normal elevation of a person where, in the instance of a fall, a disrupted elevation triggers an alert to a loved one through a text message. Once again, without the need of “wearables,” individuals can continue to live to their lives normally without the annoyance and inconvenience of wires and monitors attached to themselves thanks to EMERALD.

Finally, at the end of her talk, Dr. Katabi made sure to mention the importance of privacy and security that EMERALD allows. EMERALD ensures that all data that is being collected is owned only by the patient. It is
the patient’s choice to decide whom they want to share such information. EMERALD has a security protocol in place to make sure that it cannot be used to spy on people in other households.

All who attended could see the passion in Dr. Dina Katabi’s eyes when discussing her work. Dr. Katabi enthusiastically told me that to pursue anything in life, a person must have a deep interest and curiosity in the work they are doing. Her love of science and helping others continues to improve the way in which we go about normal health care procedures. Dr. Katabi – thank you for attending Pitt Science 2019 and encouraging me to keep an open mind and to never lose my sense of curiosity.

For more information on EMERALD, visit https://www.emeraldinno.com/

For more information on Dr. Dina Katabi and her research, visit http://people.csail.mit.edu/dina/

References:

