Portable microwave sensors for measuring vital signs

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Current medical techniques for monitoring the heart rate and other vital signs use electrodes attached to the body, which are impractical for patients who want to move around. Plasma physicist Atsushi Mase, a scientist at Kyushu University in Japan, and colleague Daisuke Nagae have developed a new technique to disconnect people from their electrodes by using microwaves.

The work, which could lead to the development of non-invasive, real-time stress sensing in a variety of environments, is described in a recent issue of the journal *Review of Scientific Instruments*, which is published by the American Institute of Physics.

The system uses very weak microwaves to irradiate -- and scatter off -- the human body. A sensitive microwave sensor monitors the reflected waves, which change in phase in response to motions of the body, including the regular displacement of the chest during breathing or, the slight movement of the chest caused by the beating heart.

"The skin surface moves slightly," Mase says, "synchronizing to respiration and heart beat."

Using signal processing algorithms and techniques to filter out the effects of random body motions, Mase and Nagae were able to detect changes in heart rate in near real-time, which allows an evaluation of autonomic nervous system activity.

"We plan to apply the system to various conditions, including for clinical use -- such as for the overnight monitoring of human vital signs -- and as a daily health monitor, including detecting signs of sleepiness in drivers and preventing stress-related illnesses," he says. In the future, the system could even be used as a security monitor to distinguish the subtle signs of stress in potential terrorists.

More information: The article, "Measurement of heart rate variability and stress evaluation by using microwave reflectometric vital signal sensing" by Daisuke Nagae and Atsushi Mase appears in the journal *Review of Scientific Instruments*. See: link.aip.org/link/rsinak/v81/i9/p094301/s1

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