

Contactless vital sign monitoring

Daniel Schmiech, M.Sc.⁽¹⁾, Andreas R. Diewald ⁽¹⁾

⁽¹⁾Laboratory of applied radar technology and optical systems (LaROS)
Faculty of Engineering and Technology, Trier University of Applied Sciences,
D-54208 Trier, Germany

E-Mail: D.Schmiech@etech.hochschule-trier.de

Web: www.hochschule-trier.de/go/laros

Abstract – The most important signs of a living body that demonstrate the status of its life-sustaining functions are referred as vital signs [1]. The respiratory rate and the heart rate (two of the five primary signs) are currently measured by attaching small electrodes on the patients' skin, cable-connected to a monitoring system (e.g. ECG). This method is not always suitable, as there are several problems like skin injuries, high stress level and random loosening of the sensor, occurring because of the needed contact between the probe and the subjects' skin.

With the concept presented here a radar based system can be used to measure these two vital signs without the need of a contact between patient and sensor. The system will consist of a self-developed RF sensor, the baseband electronics with integrated digital signal processing and a visual display. One of the most challenging issues in contactless vital sign monitoring is random body movement (rbm) [2]. Operating at 24 GHz a frequency-modulated continuous-wave (FM-CW) radar with a bandwidth of 250 MHz will be used to minimize the upcoming error resulting of rbm. Other challenges base on the effect that respiration itself is a multitarget movement of the torso. Hence the signal processing algorithm will be multitarget-capable and sensitive to small movements to extract the heart rate. To reach the needed accuracy for vital sign monitoring, a model based filter will be used. In consequence of the advantages using a radar based contactless method, the system should be able to monitor patients in various situations, e.g. recumbent, seated or upright standing. Additionally, it is intended to observe more than one patient simultaneously. Therefore, the sensor is filtering and tracking different targets. The concept itself will firstly be used in an infant incubator, to minimize the stress-level and the risks of skin injuries, especially to the premature babies.

References

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