Terahertz – based non-contact vital sign measurements

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Introduction

Vital signs are essential indicators of a person's physiological status and overall health. Regular monitoring of vital signs enables early detection of health issues, guides treatment decisions, and aids in assessing the effectiveness of interventions. Conventional methods have the disadvantage of being contact-based, which leads to low comfort when worn especially for people with sensitive skin. In recent years, terahertz technology has emerged as a promising candidate for contactless vital sign measurement. We are presenting an overview of our latest research that investigates the feasibility and accuracy of using terahertz technology for assessing vital signs without contact.

Methods

Our approach to non-contact measurement uses terahertz-based reflection measurements at 230 - 320 GHz. Terahertz reflection measurements give the possibility of evaluating accurate distances. That can be used to determine heart rate and respiration rate, as the heart beats, the blood flow induces minute movements of the body, including the chest, and the skin. These movements can be measured by the system.

Similarly, during respiration, the expansion and contraction of the chest result in movements that can be detected by the measurement system. By analyzing the resulting signals, the respiratory rate can be calculated.

Results

We successfully determined and evaluated the heart rate and respiration rate in clinical and care environment. In particular, the use of neural networks allows to detect critical conditions and changes over time.

Conclusion

Our approach highlights the potential of terahertz technology for non-invasive and contactless measurement of vital signs. The results indicate that terahertz-based-systems can measure more accurately than classical radar-systems. They can detect and monitor changes in heart rate and respiratory rate. Furthermore it gives the oppurtunity to be miniaturized in future due to the higher frequencys. By using artificial intelligence, critical conditions can be detected and changes over time can be analyzed.