Thermoacoustic Biometric Authentication with 3D Map of Blood Vessels

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Technology description

We propose to extract the features of the 3D map of the blood vessels for authentication purposes. We envision complete IC integration of this solution for final implementation in a portable hand-held device with low-cost and power.

Engineers in Prof. Amin Arbabian’ s laboratory have designed a customized imaging system as a stepping stone to a highly secure, compact, low-cost biometric authentication device that uses thermoacoustic imaging to generate a 3D map of blood vessels for personal identification. Traditional biometric methods, such as finger print or iris analysis, are limited due to bulky, expensive hardware or the risk of forgery. To overcome these issues, the inventors used continuous wave excitation to combine the contrast of microwave imaging with the high resolution of ultrasound detection and created a thermoacoustic imaging system. With complete IC integration, this system could be implemented into a portable, hand-held device with no expensive optical components. The device could then be used to generate a 3D map of blood vessels in a finger, hand or arm. This map would be unique to each person, would provide more information than 2D vein analysis, and would be extremely difficult to forge. This technology could be used for identification and security, with end-user applications such as authenticating financial transactions or controlling access to electronic devices and buildings.

Related TechnologyThis technology builds upon Stanford Docket S14-053 (“Coherent frequency-domain thermos-acoustic imaging for medical and security applications”).

Stage of ResearchThe inventors have demonstrated proof-of-concept with thermoacoustic imaging of microcapillaries using continuous wave excitation.

Prof. Amin Arbabian and Miaad Alirote give an overview of the technology.

Additional Information

https://arbabianlab.stanford.edu/

Application area

Biometric identification and security- thermoacoustic imaging for highly secure authentication with end-user applications such as:
authenticating financial transactions including purchases or wire transfers controlling access for phones, cars, laptops, ATMs, building entry, etc.

Advantages

Highly secure:
Traditional biometric methods, such as finger print or iris analysis, are limited due to bulky, expensive hardware or the risk of forgery. The thermoacoustic approach is extremely difficult to forge because blood vessels are inside the body. thermoacoustic imaging has the potential to achieve penetration depth more than 5 cm (unlike photoacoustic imaging which is only suitable for superficial application) 3D map is unique to each person (even twins have different maps of blood vessels) and can be applied to image blood vessels with resolution down to sub millimeter and micrometer range higher information content and more accurate than current 2D vein analysis designed to operate even when surface of skin is perturbed or vessel map is rotated
Compact and low-cost design:
reduces device size and power requirement by employing continuous wave approach for thermoacoustics implemented with silicon/ultrasound using no expensive optical components

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