Department of Biomedical Engineering

Research Student Seminar

(Supervised by Prof. Xinge YU)

Date: 22th January 2024 (Monday)
Time: 9:00 - 9:20 PM; 9:20 - 9:40 PM
Zoom link: https://cityu.zoom.us/j/94331369743
Meeting ID: 943 3136 9743

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Part I: Intelligent Soft Sweat Sensors for the Simultaneous Healthcare Monitoring and Safety Warning

Abstract

Intelligent monitoring human physiological information in real time raises the demand for skin-integrated electronics, as which is a flexible format and can be mounted onto the curved human skin for noninvasive healthcare monitoring. The biofluid such as sweat from skin contains abundant biomarkers reflecting body health conditions. Here, a skin-integrated sweat monitor with six biosensors embedded for the detection of NH_4^+, Na^+, glucose, pH, skin impedance, and surface temperature is described, which could decode the information in the fresh sweat generated during exercising. Furthermore, the system also includes an innovative safety warning mechanism, which is based on a miniaturized actuator to provide mechanical stimuli, and coupled with six changeable colors light emitting diodes corresponding to the six biosensors for providing simultaneous safety alarming to users. The self-developed microfluidics system with a hydrophilic surface allows to enhance the sweat collection rate. Meanwhile, microfluidic filters can reduce the interruption of skin debris during biosignal monitoring. These state-of-art biosensors can real-time monitor health related signals with excellent linearity and specificity. The skin-integrated sweat monitor system exhibits a great potential in human healthcare monitoring and medical treatment.

Part II: A wearable system for continuous blood pressure monitoring

Abstract

Blood pressure (BP) serves as a critical indicator for cardiovascular diseases, which is the leading cause of death worldwide. However, existing wearable devices for noninvasive BP monitoring suffer from either bulky signal processing instruments (Bio-impedance based and Ultrasound based devices), or poor interfacial instability (photoplethysmography based and pressure sensor-based devices), significantly compromising their wearability and stability. To address these issues, we have developed a comprehensive solution consisting of materials, devices, mechanical designs, data processing methods, and integration strategies for a thin, soft, and miniaturized system known as TSMS (Fig. 1)1. In particular, we introduce a novel interface adapter designed to significantly improve the compliance and stability between the user's skin and the TSMS. This adapter incorporates a micro-airbag, a pressure regulation one-way valve, and a micro-pump, working in synergy to provide sufficient pressure support to the sensing module, thereby enhancing the sensing stability and robustness of TSMS for continuous pulse wave measurement. Moreover, the TSMS incorporates a wireless transmission scheme and sampling strategy, enabling real-time wireless transmission of measured pulse waveforms and local pulse wave velocity (PWV) to an advanced data model, where continuous BP wave is estimated and presented in a mobile GUI. By incorporating local PWV into the data model, the accuracy of BP estimation is significantly improved, thereby making TSMS a promising solution for 24-hour ambulatory monitoring of blood pressure.

Biography

Xingcan HUANG is now pursuing a Ph.D. degree under supervision by Prof. Xinge YU in the Department of Biomedical Engineering, City University of Hong Kong. His research interests mainly focus on flexible, skin integrated electronics, flexible biosensors and their applications on healthcare monitoring.

Jian LI is now pursuing a Ph.D. degree in Prof. Xinge YU's group with the Department of Biomedical Engineering, City University of Hong Kong. His research interests mainly focus on flexible, skin integrated electronics for healthcare monitoring and biomedical imaging.

All are welcome!