Smart Bracelets for Remote Monitoring of Wearers' Physical and Affective State

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Abstract — **Smart bracelets able to interpret the wearer's emotional state and communicate it to a remote decision-support facility will have broad applications in healthcare, elder care, the military, and other fields. While there are existing commercial embedded devices, such as the Apple Watch, that have health-monitoring sensors, such devices cannot sufficiently support a real-time health-monitoring system with battery-efficient remote data delivery. Ongoing R&D is developing solutions capable of monitoring multiple psycho-physiological signals. Possible hardware configurations include wrist-worn devices and sensors across an augmented reality headset (e.g., HoloLens 2). The device should carry an array of sensors of psycho-physiological signals, including a galvanic skin response sensor, motion sensor, skin temperature sensor, and a heart rate sensor. Output from these sensors can be intelligently fused to monitor the affective state and to determine specific trigger events for the wearer. To enable real-time remote monitoring applications, the device needs to be low-power to allow persistent monitoring while prolonging usage before recharging. For many applications, specialized sensor arrays are required, e.g. a galvanic skin response sensor. An application-flexible device would allow adding/removing sensors and would provide a choice of communication modules (e.g., Bluetooth 5.0 low-energy vs ZigBee). Appropriate configurations of the device would support applications in military health monitoring, drug-addiction mitigation, autistic trigger monitoring, and augmented reality exploration. A configuration example is: motion sensors (3-axis accelerometers, gyroscopes, and magnetometers to track steps, falls, and energy usage), a heart-rate sensor (e.g., an optical-based heart rate sensor with a single monitoring zone using the process of photoplethysmography (PPS)), at least a Bluetooth 5.0 (but a different communication device may be needed depending on the use case), and flash memory to temporarily store data when the device is not remotely communicating. The wearables field has greatly advanced in the quality of sensors; the fusion of multi-sensor data is the current frontier.**

About the Speaker

Naphtali Rishe *is a Professor of Computer Science and the inaugural Outstanding University Professor at Florida International University in Miami. Rishe is the Director of National Science Foundation's Industry-University Cooperative Research Center for Advanced Knowledge Enablement, a consortium of FIU, Florida Atlantic University, and University of Greenwich (UK). Rishe has been awarded $55 million in grants. Rishe has published 6 books, 440 papers, and has been awarded 21 U.S. patents. Rishe's geographic data management system, TerraFly, has been featured in FOX TV News, New York Times, USA Today, NPR, Science and Nature journals and in the National Science Foundation's annual report to Congress. More about Dr. Rishe at http://cake.fiu.edu/Rishe/.*

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