Department of Mechanical and Biomedical Engineering

Seminar Series

MEMS-based Sensor Fusion for Human Motion Tracking and Recognition

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Date: 22 Dec., 2011 (Thursday)
Time: 9:00am < Tea Reception at 8:45am >
Venue: Room B6619 (SEEM & MBE Conference Room)

Abstract
Due to their small footprint, lower power consumption, and reduced system cost, MEMS-based inertial sensors are currently being explored world-wide for applications spanning many fields, including computer-human-interface, healthcare, military weapons, and position-tracking for mobile devices. However, due to the extremely small proof-mass used in MEMS sensors, they are hampered by lower responsivity and higher drift-rate, and hence have lower signal-to-noise ratio, than conventional motion sensors. This presentation will discuss the fundamental limits of MEMS sensors in measuring human motions, and will disclose the circuit architecture, signal processing algorithms, and computational methods that can be used to enhance the accuracy of human motion tracking and recognition using MEMS-based acceleration sensors. As an example, the fusion of MEMS acceleration sensor and camera data was investigated and proven to be extremely effective for tracking low-frequency human hand motions if specific Kalman filtering algorithm is used. Several advanced applications of MEMS motion sensors using specialized circuits and algorithms will also be presented: 1) Human-Robot Interactive Technology for Toys, 2) Mobile Human Air-Bag System, 3) 3D Digital Writing Instrument, 4) Home Security Motion Detection System, 4) Hand-Gesture Recognition for Interactive Input Technology, and 5) Human Gait Measurement and Recognition for Rehabilitation.
About the Speaker

Guanglie ZHANG received his B. Eng. (1997) and M. Eng. (2000) degrees in Electronic Engineering, and then his Ph. D. degree (2003) in Control Science and Engineering, all from Xi’an Jiaotong University (XJTU), China. Before graduating from XJTU, he served as the project leader (1998-2000) for the Film Series Progressive TV for Hisense, one of the earliest and largest electronics manufacture in China, and designed the DP2988H system that became a successful product. He also served as the Head of R&D Department (2000-2002) for Digital Technologies Limited (DTL) of XJTU. At DTL, he was one of the main designers of the first de-interlacing video processing ASICs (VPP860) for TV manufactures in China, and received numerous awards for his contributions to this project, including First Prize, Technical Progress Award, from Xi’an Jiaotong University, and First Prize, Science and Technology Award, from Shaanxi Province. Dr. Zhang later joined The Chinese University of Hong Kong (CUHK) as a Research Fellow (2003-2007) where he developed the world’s first reconfigurable machine for Monte Carlo simulation for derivative pricing, and also wireless MEMS motion sensing technologies for human airbags and 3D digital pen applications. Between 2007 to 2011, he served as the CTO of Virtus Asia Ltd. where he led a team to develop advanced MEMS sensor applications for the Hong Kong ASTRI, the Hong Kong Prince of Wales Hospital, the US National Institutes of Health, and the US Department of Defense. He is now serving as the Head of R&D of Bewis Sensing Technology LLC. and developing micro/nano sensing technologies targeting Chinese markets. Dr. Zhang’s current research interests are in the areas of biomedical motion assessment based on micro IMUs, human-motion recognition algorithms, and complex-sensor-network fusion algorithms.

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All are welcome!