Conductive Stretchable Fabric-Based Body Motion Sensing and Feedback

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Purpose of the project

This project aims to develop a **wearable** platform that enables the generation of a three dimensional **model** of the human skeleton and tracking its **motion**.

**Conductive stretchable fabric (CSF)**
- Made from nylon/spandex
- Comfortable for long-term wear
- The fabric is coated with a conductive polymer
- When it is stretched, its resistance changes
Findings

CSF based joint angle detection (Take elbow joint as an example)

Angle definition on elbow joint

- The mapping from resistance measurement to stretch distance is nonlinear
- The mapping from stretch distance to joint bend angle is nonlinear
Smart and Connected Future

Resistance change measurement

Resistance change measurement

... Resistance change measurement

Elbow joint angle

Shoulder joint angle

Knee joint angle

CSF based portable body motion sensing
A Platform for Cyber Physical Systems

- Fall detection
- Hand & finger gesture recognition
- Robot control
- Remote control

Activity Recognition
Gait monitoring

Healthcare

Robot control

HCI & control

Golfing
Playing volleyball

Sports analysis

Running
Swimming

Wii based game

Game & VR/AR

VR/AR

Kinect based game
Open Research Questions

• How to seamlessly integrate feedback device (e.g. vibrotactile feedback, voice, emotion, etc.) with CSF-based motion sensing system?
• How to automatically adapt the joint angle sensors to dynamic deployment contexts (location deviation, different tightness, etc.)?
• How to adapt the mapping models to the aging of CSF?
• What is the impact of climate factors (temperature, humidity, etc.) on the joint angle sensors?
• How to sense bend angles of multiple degree-of-freedom only using one conductive stretchable fabric?
• How to embed tens of connection wires into one fabric suit without mutual interference?
Happy Birthday, Jack!