Low Cost Wearable Sensors Strain Sensors for illness identification via Gait, Posture and muscle usage

Primary contact

Josie Hughes, jaeh2@cam.ac.uk. Department of Engineering, University of Cambridge

Team

Josie Hughes, jaeh2@cam.ac.uk. Member of the Bio-Inspired Robotics Lab in the Department of Engineering with funding from the Sensor CDT. With an undergraduate degree from CUED in Instrumentation and Sensing, I now focus on developing soft sensing for robotic manipulation, and this opportunity would allow the development of soft sensing for wearable applications.

Summary

This project develops low-cost wearable smart adhesive sensors using soft sensors which allow detection of gait, joint position or act as smart bandages. This will help with the potential identification of illness and also all the damage or impact/sports to help reduce the impact and also working to prevent future deterioration or injuries going forwards. In addition to developing the sensors, work will also look at identifying applications and testing the sensors.

Proposal

Biological System

It is possible to identify many medical conditions ranging from muscle or bone conditions or Alzheimers from change in muscular usage of gait patterns. Developing a soft, low cost adhesive sensors which can be worn on the skin obtaining strain data and patterns of behaviour to be identified such that changes be identified. This is of key use to medical practioners by identifying what long term patterns can be investigated. Additionally, such a wearable sensor is of key use to sports analysis, allowing potential improvements to be identified.

Design Goals & Plans

Although soft sensors have been developed, there has been little focus on developing an open source, low cost 'smart bandage' which is a self-adhesive patch which can be worn on the body and allows strain to be identified which in turn enables patterns to be identified enabling the changes to be identified. The key design goals include:

- Develop soft sensors (already started) and characterise and produce instructions for development and creation of the sensor. (1 month)
- Development of soft bandage system – integrated small electronics into the soft sensing material and package in an adhesive bandage system develop this in to a wireless wearable sensor communication system communicating with a base station via BLE (1 month)
- Develop electronics to interface and perform signal conditioning on the sensor response

sensor response

- Test the system on a number of users in different body locations to identify muscle, gait and pose estimations can be determined and levels of reliability and reproducibility (1 month)

- Obtain sensor data and correlate to the ground truth to allow the long term patterns to be identified using learning and pattern recognition methods. (1 month)

Proposed Outcomes

- Develop low cost waterproof soft strain wearable sensor which allows strain data to be obtained with the production method fully described and published.

- Obtain data from the sensors to allow identification of patterns to be identified

- Propose cases in which the soft wearable sensors can be use to identify medical conditions, backed up with data.

Component and Budget Estimation

Component	Source	Approximate Cost
Silicone – to develop the sensor and to allow the moulding of the sensor	DAP Silicones	£100
3D Printing for the moulds for the sensor moulds	-	£100
Wireless BLE modules to produce the smart sensors	RS Electronics	£200
PCB development (CUED)	CUED Electronics Development	£200
Sensing material compoents (graphite powder, carbon fibre)	RS Electronics	£100
Electronic Prototyping Parts	RS Electronics	£100