Fabric based wearable technology for stroke rehabilitation

Kai Yang[1] , Katie Meadmore[2], Ann-Marie Hughes[2], Neil Grabham[1], Matt Spraggs[1], Chris Freeman[1], Steve Beeby[1], Russel Torah[1], John Tudor[1]

1 Electronics and Computer Science, University of Southampton
2 Health Sciences, University of Southampton

Introduction

SMARTmove[1] project is funded by the Medical Research Council, which brings together a multidisciplinary team with expertise in materials, direct-write fabrication, control algorithms, electronics, sensors, user interfacing and end-user engagement. The project will deliver a wearable training system that employs functional electrical stimulation (FES) for upper limb rehabilitation following stroke.

Method

Our project uses bespoke printable pastes to print electrode arrays directly onto everyday fabrics, such as those used in clothing. The resulting garments have cutting-edge integrated wireless electronics and sensor technologies. Advanced control algorithms adjust the electrical stimulation based on the patients' automatically captured limb motion to enable them to perform precise functional movements, such as eating and drinking.

Results

The feasibility of materials and manufacturing of the electrode arrays on an everyday clothing textile has been demonstrated. The materials used have had biocompatibility confirmed using ISO standard 10993-5 cytotoxicity testing. The durability to bending and washing is to be investigated. Tests have shown that the electrode arrays can provide effective assistance during movement (e.g. hand opening, pinching, pointing, light switch activation) by using an iterative learning control system and sensor technologies. The clothing prototype and the user interface designs are informed by an end-user group consisting of stroke survivors, carers, engineers and healthcare professionals.

Discusion and conclusions

Current commercial FES devices use large electrodes that only stimulate a limited number of muscles, resulting in simple and imprecise movements. Our fabric electrode array, together with the advanced control system, can achieve precise movements allowing daily activities to be supported. The involvement of the end-user group maximises the practical impact of the system. Our MRC project translates this technology from the feasibility stage to a functional prototype able to deliver a comfortable, easy to use, accurate and cost effective solution for upper limb rehabilitation following stroke.

Your references in Arial Narrow 10pt font (please use a maximum **of three references**)

1. www.smartmove.soton.ac.uk

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