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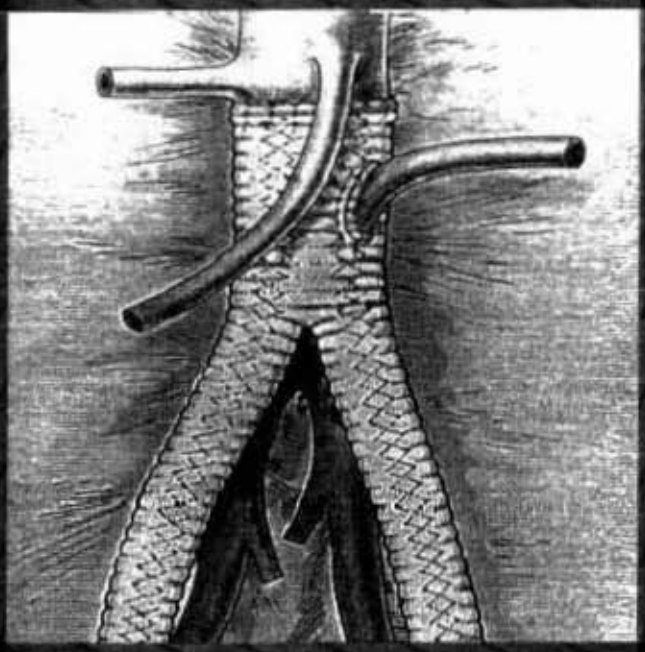

Medical and healthcare textiles

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INTEGRATION AND EMBEDDING OF VITAL SIGNS SENSORS AND OTHER DEVICES INTO TEXTILES

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ABSTRACT

The development of ubiquitous vital sign monitoring has become a very up-to-date research theme for many academics and industrial companies in the last years. With new materials and integration techniques, it is possible to implement vital sign monitoring in an economic manner, directly into textile products. This unobtrusive presence of sensors is especially important for the monitoring of children or elderly people. This paper focuses on two aspects of sensor integration: Integration of off-the-shelf electronic components, and the use of the textile material itself as sensor, or in general as an electrically active element presenting some exploratory work in the integration of electronic devices into textiles. The main objective was to reproduce and improve on previous work presented by other authors, and foster possibilities of developing garments for vital sign monitoring with immediate industrial and economic feasibility. The use of standard production techniques to produce textile-based sensors, easily integrated into garments and with mass-market potential, is one of the important motivations for this work.

INTRODUCTION

Regarding the integration of electronics into textiles, it is possible to consider various levels of integration. In a first level, commercially available electronic components are integrated into garments using special design elements fitted to the textile product exclusively to allow the introduction of the external component(s). In the next level, the textile material itself is used as an electrically active component. Its function is provided by the properties of the base material, by structural properties or by introducing electrically active textile elements by embroidery. A further step would be to implement electronic circuits within the fibres themselves, but at the time being technology is still far from providing tools to achieve this intent.

The growing availability of flexible and miniaturised sensors and electronic components has made the first level of integration quite straightforward. Regarding the embedding of the sensors into the textiles, more advanced techniques are required. A first step is to implement the sensors using textile materials based on conducting yarns or yarns with sensing properties (piezoelectric, optical fibres). Still, all the signal treatment has to be done outside the textile, by means of a dedicated electronic device.

The authors of this paper have conducted some exploratory experiments with several techniques intending to achieve measurement of heart beat and respiratory rate, using both inexpensive off-the shelf sensors and piezoelectric polymer sheets, as well as fabrics knitted with conducting yarns, acting as sensors. A review of the state-of-the-art, an overview of general principles and the results obtained in the experiments will be