

Adam Jackson
Advisor: Erick Maxwell
Bowling Form Facilitator

Wearable Technology Integrated in Clothing (“Smart Textiles”)

Introduction

Sensors, batteries, and transmitting technology is improving at a rapid pace allowing for these components to be easily imbedded into clothing and fabrics. Wearable technology has become widely used on daily basis as fashion and convenience accessories like smart watches or as health monitoring devices like the Fitbit. The ability of the sensors to be embedded in the fabric itself with minimal effect on the feel has allowed for the creating of so-called “smart textiles” which are capable of receiving and transmitting data without interfering with the range of motion or comfort of the user.

Commercial Applications of Smart Textiles

The field of smart textiles is in its infancy compared to that of wearable technology as a whole. The sensor and transmitter technology is just very recently becoming compact enough to seamlessly integrate this technology into fabric. Because of this, the available technology is both expensive and unrefined.

An example of this is the Sensing Tex Smart Mat. According to its white paper the mat is still in version 1.0 and judging by the pictures provided and the specifications of the mat, there is still a substantial amount of improvement to be done on this product. This mat requires a separate box that you feed the sensors into in order to interface with a computer or another data analysis device [1]. This device is relatively simple and doesn’t have many different components which would cause the price to spike. However, because this area of research is so new the development kit for the smart mat costs \$670 [2].

The technology is headed in a direction of standalone devices. These new technologies will have a multitude of applications in the fields of education and healthcare [3]. The next generation of smart textiles will be a simple fabric object like a shirt or a floor mat which will gather data and wirelessly transmit the collected data to the desired device. Hexoskin is such a device. It was used by researchers in Nevada to collect physiological data in a hiking setting and track the biometrics of various hikers without any sort of invasive monitoring [4].

Technology behind Smart Textiles

Smart textiles are made by simply embedding various sensors between sheets of fabric. Which kind of sensor is embedded depends on what metric is desired to be measured. The typical sensor is a basic variable resistor which changes its resistance based on what it's measuring. An example of this is the resistive temperature detector. This resistor is sensitive to the temperature surrounding it, and when it changes temperature the resistance changes [5]. This resistance is interpreted by a microcontroller and the data pushed to the recording or display platform of choice via Bluetooth.

There are a few basic measures of performance for these devices. The key things you are looking for are: an accurate measurement of the desired metric, quick data transfer time, and a reliable and sufficiently long battery life [6]. If it satisfies all of these requirements it will be a strong wearable piece of technology.

Implementation of Smart Textiles

When building a smart textile there are a few things to consider. First, you must consider the range of the sensors used. There is a good chance that the workable range of the sensors will be quite large compared to the typical flocculation of the data requiring a sensor amplifier to be constructed to read usable data off of the sensors. The binding of the sensors to the fabrics that they are housed in requires the sensors to not interfere with the measurements taken. There is also the need for a strong data analytics to be taken from the sensor data which will require a GUI of some sort to be created to receive and process the data.

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