Chapter 25
Unobtrusive Wearable Technology for Health Monitoring

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ABSTRACT

There are a number of situations in the context of health and wellness where it is desirable to monitor a user for a period of time – either for short term assessment or longer term monitoring. It is further desirable, especially for long term monitoring, that the device chosen to do so has a minimal impact on the user. This form of monitoring is unobtrusive monitoring and uses wearable technology to achieve its aims. This chapter presents an overview of unobtrusive monitoring using wearable devices, discusses some common device types and the data that are available and makes some recommendations for factors to consider when choosing or designing a device for unobtrusive monitoring.

INTRODUCTION

There are a number of situations, in a healthcare context, where monitoring is desirable, either in the long term, or in the short term. These include, but are by no means limited to, management of long term conditions such as asthma, diabetes and some mental health conditions; monitoring activity and physiological parameters for general health and lifestyle; monitoring patient progress in rehabilitation programs; and monitoring for sports performance evaluation. In these situations, it is highly desirable to use a single device which is easy to use and has minimal set-up and user interaction requirements. In essence, it is important, especially for longitudinal monitoring, for the device to not be a burden to the user, and this gives rise to the idea of unobtrusive monitoring.

With the development of technology – especially the boom in wearable devices – there are a great variety of devices, both commercial and research based that offer a solution when unobtrusive monitoring is required. Devices range from single-purpose sensors, designed to monitor a specific parameter, to sensor-platforms, which offer a suite of monitoring options. In addition to the range of sensor options, there are a number of communication technologies and modalities available that support data transmission in both real-time and batch modes. These two options combine to provide a great variety of monitoring solutions.

Care must be taken however, to select the right monitor for the designated task and especially in choosing one that meets the unobtrusiveness criterion. This chapter provides an overview of wearable technology for unobtrusive monitoring and offers some suggestions for ensuring that the correct device is chosen. The remainder of the chapter is organized as follows. The background section presents an overview of unobtrusive wearables, explains why unobtrusiveness is important and the benefits it brings. The overview of wearables section outlines some common features among wearable technologies and highlights how some specific devices have been used. The data gathering and usage section describes the data that is available from wearable monitors and how it can be used. The design and usage considerations section presents some pointers on the design or selection of an appropriate device. Finally, the future research section points to the likely direction of research in this area.

BACKGROUND

This chapter is concerned with the use of unobtrusive wearable devices for monitoring health. In this section we define what is meant by an unobtrusive wearable and explain why the criterion of unobtrusiveness is important.

What Is an Unobtrusive Wearable?

A wearable device is one that is designed to be worn on the body by the user, with the implicit assumption that it can be removed easily. This is in contrast to devices that would be considered implantable, such as an intravascular glucose sensor and insulin pump proposed by Renard (2002), or otherwise attachable such as tattoo sensors, as used by Rakibet et al.(2014).

An unobtrusive wearable device is one that blends seamlessly with the user's day-to-day life and does not make its presence unduly known. This can be achieved through small size, careful design or by masquerading as an every-day object.

Unobtrusive wearable devices do not intrude upon the wearer, through either form or function. That is to say, that the device will be small enough and light enough to not be a physical burden, and attractively designed such that the user is not made socially uncomfortable wearing it. This is sometimes achieved, or enhanced, by adding a 'secondary' function to the device that the user finds desirable, a watch screen in the case of a wrist wearable for example.

The function of the device will also not intrude upon the user, with the caveat that this is not always possible to achieve depending on the exact use of the device. In general however, the device will not need the user to interact with it overly much and those interactions will be quick and easy for the user to carry out.

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