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Wearable Computing

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Abstract: ***Wearable computers are computer devices or systems integrated into the clothing or attached to the body of a person. The evolution of wearable computing devices, driven by the confluence of information and communication technology, has changed the way people use online services by keeping them always connected. This paper provides a brief introduction to wearable computing with its technical issues and challenges that must be addressed to reap the huge benefits.***

Keywords: wearable computing, wearables, wearable technology, body-borne computing**.**

I. INTRODUCTION

Wearable computing devices are miniature electronic or digital devices that are worn by a user, including clothing, watches, glasses, shoes, and similar items. A wearable computer is a never-sleeping ever-present network-connected electronic system that can be used at anytime and anywhere and does not in any way disturb the user's interaction with the real world. It should be worn, much as eyeglasses or clothing are worn, and interact with the user. The key properties required to achieve the above are [1]: (1) non- disruptive user interfaces, (2) handsfree operation, (3) an unobtrusive form factor, (4) the ability to recognize and act on events in the environment, and (5) seamless, ubiquitous connectivity. Users no longer need to remove a phone from a pocket to retrieve information because wearable computing devices would change the fundamentals of human machine interaction. Wearable computers will let you be online anywhere you go. Potential implications of introducing wearable computers are collaboration, information overload, situation awareness, and social relationships.

A common feature of wearable computers is that there is constant interaction between the wearable and user and there is no need to turn the device on or off. Wearable devices provide various information, such as data about the wearer, a vicinity map, a flashlight, a communicator, a poison detector or an enemy-tracking device. They are for everyone. They are already a part of many people's lives, in the form of a smartphone or smartwatch that helps them find their way if they get lost, or helps protect them. A primitive version of wearable computers is the cell or mobile phone. Modern wearable devices include micro-chips, smart tattoos, smart wigs, Apple Watch, Google Glass, and the Samsung Galaxy Smartwatch.

The modern wearable computer was invented by Steve Mann, in the late 1970s. He was a professor at the University of Toronto, Canada and was hailed as the father of the wearable computer. Mann describes computer wearables as constant and always ready, unrestrictive, not monopolizing of user attention, observable and controllable by the user, attentive to the environment, useful as a communication tool, and personal devices [2].

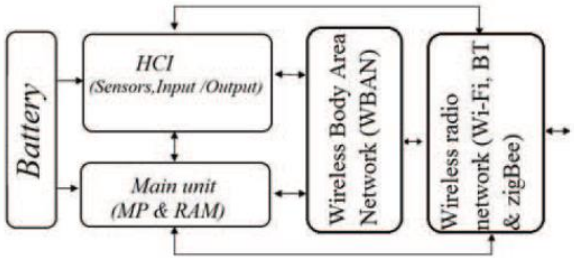

Figure 1. The block diagram of a typical wearable computing system [3].

Figure 2. A typical example of a wearable computing device [4].

The wearable computing has evolved around three major factors: minimization of computer size increased mobility of people, and increasing personalization of devices. The field of wearable computing is an intersection of computer science, microelectronics, and wireless communication (such as Bluetooth, 3G LTE, Wi-Fi, ZigBee and WiMAX). The block diagram of a typical wearable computing system is shown in Figure 1. It consists of a battery, a human computer interface(HCI), and a wireless body area network WBAN) [3]. A typical wearable computing device is shown in Figure 2 [4].

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II. APPLICATIONS

Wearable computing devices have been developed and applied in several areas including user interface design, augmented reality, pattern recognition, compensating disabilities, supporting elderly people, fashion design, behavioral modeling, health care monitoring systems, service management, mobile phones, smart phones, military domain, industrial settings, aircraft maintenance, space operations, and electronic textiles (or smart fabrics). In many of these applications, the user's body is often engaged as the wearable device's interface. This usually includes: the skin, hands, voice, eyes, and arms [5]. For example, a wearable device can be used to monitor the temperature and pulse rate of the person on a regular basis outside the clinical settings. Wearable real-time computing technologies can help people with social disabilities to communicate and interact socially. The potential for wearable computing technology is immense in both the military domain and in the commercial sector.

III. CHALLENGES

Designing high quality wearable computing devices is not an easy task and its implementation has faced many issues, both technically and ergonomically. As the adoption of wearable devices increases, there are cultural and social impacts that represent both barriers and opportunities. These issues must be resolved before we can effectively use the wearables everywhere.

A wearable computer should be relevant, concise, modular, and easy to wear. A striking challenge in designing wearable computers is creating appropriate interfaces. The term "interface" is used as a generalization to refer to the fields that address human and computer interaction [6]. The interface between the human operator and the computer system has lagged behind the incredible development in hardware and software technologies.

Security and privacy are always crucial to all personal information systems. With the emerging success of wearbale devices, the risk of threat is also increasing rapidly. Patients fear the leakage of their medical histories over wireless channels. Security techniques such as encryption and biometric sensor can help in secure the patients' information and ensure their privacy [7]. The fact that sensitive information is being freely shared and captured clearly raises concerns about privacy and social tensions arising from the use of wearable technologies. To gain the trust of users, we must ensure data privacy and data security. Legislation can provide another privacy threat to employees. It has been reported that wearable computing causes people to behave in a prosocial manner. If this is the case, the public's fear that people with wearable computing will invade their privacy is unfounded [8].

A challenge relates to the use of activity-recognition systems. Activity recognition is a key principle underlying wearable computing. Activity recognition in wearable computing is challenging because of a high variability along multiple dimensions [4]. Another serious issue is open standards to enable interoperability between different services.

In creating wearable systems, many trade-offs occur with respect to the challenges discussed here. Researchers are searching for solutions for the challenges facing wearable computing.

IV. CONCLUSION

Wearable computing technology has caught up in performance, functionality, and scalability. However, despite its rising popularity, the field of wearable computing is still in its infancy and it seems that it will become even more important in the near future. Wearables will be central to business, healthcare, and personal systems. Without doubt, health and fitness wearables will continue to reign in popularity.

Wearable devices are creeping ever closer to us and many engineers predict the trend will continue. Computers will be seamlessly woven into our clothing, fashioned into our jewelry, and painted on our skin. In the coming era of wearable computing, we will be able to manipulate digital bits with our hands. The development of wearable computers has shown a trend towards mobility and portability. It is hoped that someday, we will become accustomed to clothing-based computing [9].

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