



The Importance of Wearable Technology in Elderly Healthcare

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Abstract

Wearable sensors are an important part of the new telemedical concept, which aims to improve the quality and efficiency of healthcare via the use of information technology. The use of sensors in patient diagnosis, treatment, and monitoring has the potential to transform not just medical practice, but the relationship with one's body and mind, as well as patients' and health providers' roles and duties. Consequently, researchers have been interested in wearable sensors in recent years because of its potential uses in motion detection, personal and public healthcare, future entertainment, man-machine interaction, artificial intelligence, and several other disciplines. This study focuses on elderly healthcare as wearable technology plays an important role in providing healthy care for the elderly, supporting their lives and daily activities, besides assisting them in becoming self-sufficient, and most importantly the ability to monitor their health status remotely and send emergency alert signals to concerned individuals or medical institutions.

Keywords: Wearable sensors, personal health, health monitoring, wearable electronic devices, elderly care.

Introduction

Wearable technology has advanced intensely in a variety of areas such as health care, education, and social networking. Some of these innovations are rapidly becoming embedded in people's daily lives (Kim et al., 2021). As a sequence, this technology is seeking a method to implement sensors with the human body in such a way that facilitates communication between the human body and the computer components that he wears, such as clothes, shoes, accessories, and everything else that a person can wear, in order to make the user's daily life easier and add a touch of luxurious lifestyle.

Since the health sector is one of the most prominent sectors in which modern technology plays an active role, keeping up with developments in the medical technology has become an urgent necessity. Therefore, wearable sensors and electronics have drawn significant attention in the medical area, because of their ability to track human health in real time, which allows an exact diagnosis at any time and improve medical treatment, particularly for the elderly and those with persistent conditions that require constant monitoring (Gao et al., 2020).

These sensors have the potential to send a warning signal in the situation of a medical emergency to the caregivers in an effort to monitor the health of the elderly from distance. Figure (1) shows how wearable sensors are used to create a remote health monitoring system. As illustrated, body-worn wireless sensors collect health-related data, for example heart rate and respiratory rate, which is then transferred to a hospital, a doctor, or a family member via an information access, such as a

mobile phone. Afterwards, this information can be used by clinicians and caregivers to make treatments as required (Ali et al., 2019).

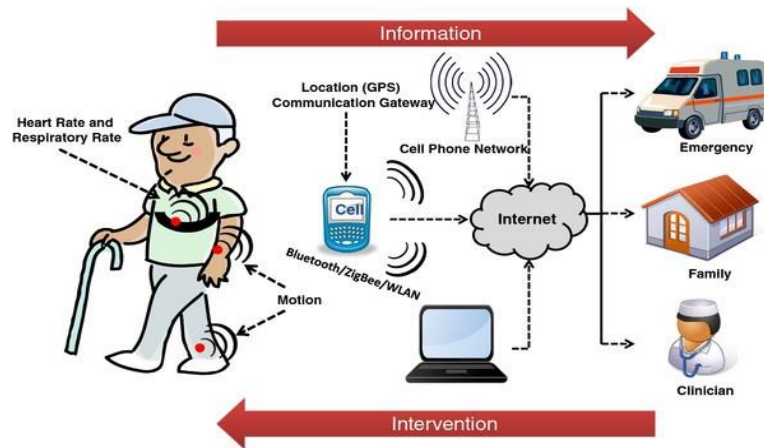


Figure (1). Wearable sensors connections (Natural Electronics, 2019).

Hence, this study concentrates on the benefits of the technological developments and wearable technology in the service of the elderly, by providing them with vital information and indicators quickly and easily, and encouraging working on the design of these devices with a visual appeal to remove discomfort from the user.

Research Problem

Success in adopting and using wearable technologies require having a solid knowledge in using them, as well as an understanding of the obstacles that may arise (Benny et al., 2016). It is worth noting that elderly face difficulties in using and interacting with advanced technology devices as they grow older and lose vital functions, as well as physical and mental ability in general. For that reason elderly require special devices and applications to support them in their routine lives and activities. Moreover, many wearable devices come in a medical automated form, which causes

embarrassment and a sense of helplessness, as a result many are unwilling to use it.

Research Questions

The following questions can be presented in response to the research problem:

- 1- What wearable devices do the elderly need to receive remotely health care and make their life easier?
- 2- Are commercially wearable devices suitable for the abilities and demands of the elderly?
- 3- Do wearable devices have an acceptable and appealing appearance in which the elderly avoid embarrassments?

Wearable Sensors

Wearable sensors have no precise definition, but it may be described as an item or accessory worn by the user that includes integrated computerized electronic technologies that record data ranging from physical activity, movement, heart rate, and UV radiation exposure, to audio and video data, which can be used later for reference and analysis (Puri, 2017).

Wearable sensors are sometimes known as detectors that may be fixed to someone's body for a short period of time. Wireless, small circuits incorporated in patches, bandages, wristbands, rings, or shirts are commonly used in creating these sensors. They can be used in conjunction with portable devices, such as a cell phone, to store and upload physiological or behavioral data. As seen in figure (2) Smart watches, rings

and headsets, and smart eyewear are examples of wearable sensors (L'Hommedieu et al., 2019).

About a decade ago, most wearable sensing devices relied on stiff electrical devices developed on semiconductor electronics platform, but lately, sensing devices that utilize flexible electronics have become the focus of attention.

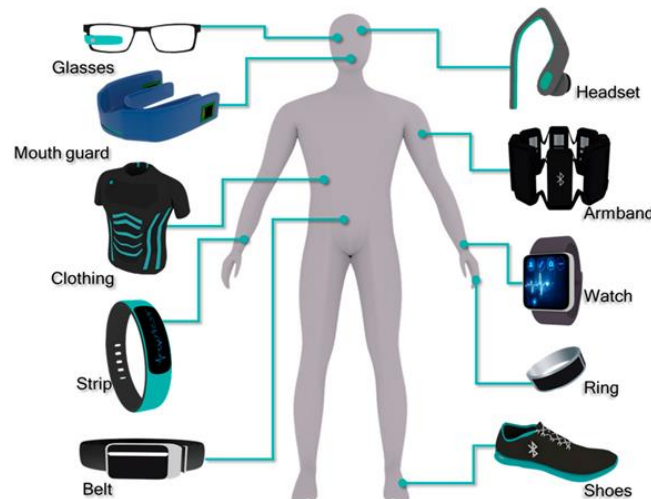


Figure (2). Wearable devices worn on body parts (Guk et al., 2019).

Unlike firm electronics, these flexible sensing devices have a wide range of mechanical properties, which makes manufacturing more complex. Up to this point, the most prevalent way for manufacturing soft sensing devices has been to merge flexible material shapes onto a stretchy base via screen printing, photolithography, micro channel molding, and lamination (Butt et al., 2022). However, there are several disadvantages to these technologies, such as high costs, multistep production procedures, limited durability, and prototyping and scaling challenges (Guk et al., 2019).

Wearable Sensors Market

The wearable technology sector is growing rapidly due to the rapid expansion in the electronic sector as well as digitalization. People's health and safety awareness has increased as a result of increased consumer electronics spending, globalization, and healthier habits, all of which are driving the growth of wearable devices. The accessibility and comfortability provided by these devices, and the growth of smartphones and connected equipment, are also driving the development of wearable devices to unexpected levels (Vesnic-Alujevic et al., 2016).

Furthermore, the number of sold wearable devices has increased substantially in recent years. Sensors are increasingly being used in these wearable devices as a result of this trend. According to Cisco Systems, the growth of connected wearable devices from 325 million in 2016 to 593 million in 2018 has a lot of promise, particularly in healthcare (Motti, 2019). Wearable devices demand is expected to grow across several industries, it's market size was valued at USD 660.89 Million in 2020 and is expected to reach USD 5,208.05 Million by 2028, as illustrated in figure (3) (Butt et al., 2022).

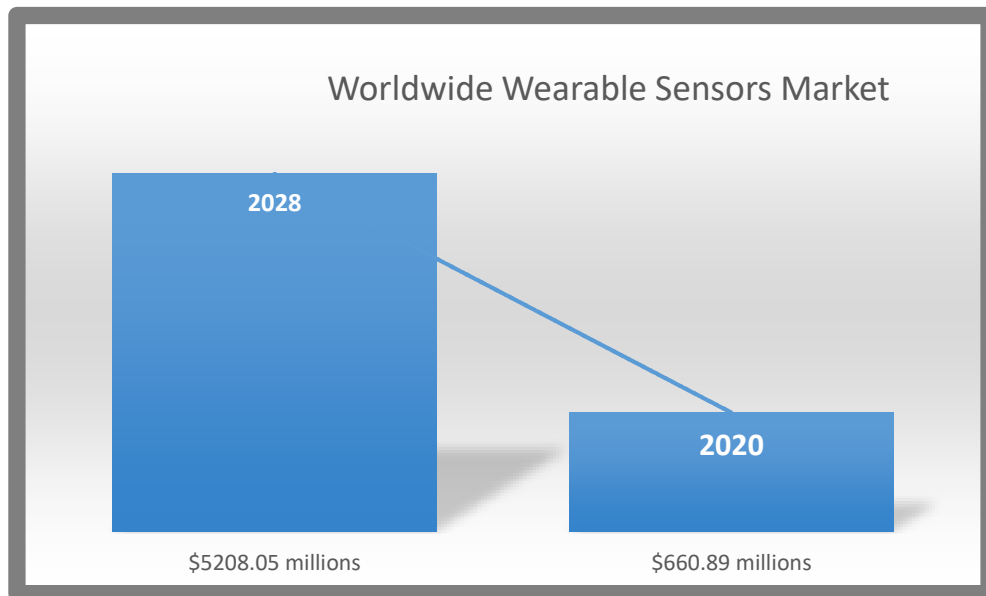


Figure (3). Worldwide Wearable Sensors Market between 2020 and 2028

The role of wearable technology in healthcare

Wearable technology sensors have a wide influence on the areas of medical care, fitness, and aging, so the fundamental purpose of wearable technology in all of these areas is to efficiently integrate them into the lives of individuals (Motti, 2019).

Currently, wearable devices in healthcare is gaining more attention, due to the developments of information technology and the growing interest in the field of health care for a variety of reasons, including the proportion of elderly and the increase of diseases linked to life habits. Vital and physiological signs are measured and collected through systems that are worn around the wrist or linked to clothes. In addition to collecting data, wearable devices can be used to obtain real-time information to achieve continuous tracking through daily life, thus enhancing healthcare and dealing with situations that does not require medical facilities.

Wearable health care devices are characterized by the integration of health and technical elements, as well as the tracking and transmission of health data to users in real time. Wearing a bracelet or necklace 24 hours a day, for example, allows users to track their health in real time, including sleep, calories burnt, heart rate, and distance traveled. By analyzing this data, users can properly manage their physical condition to improve their health level (Gao et al., 2020).

As for the elderly, wearable sensors can be very helpful in measuring blood pressure, pulse oximetry, glucose level, temperature, weight, motion, brain activity, hydration and respiration as can be seen in figure (4) (Ballaji et al., 2018).

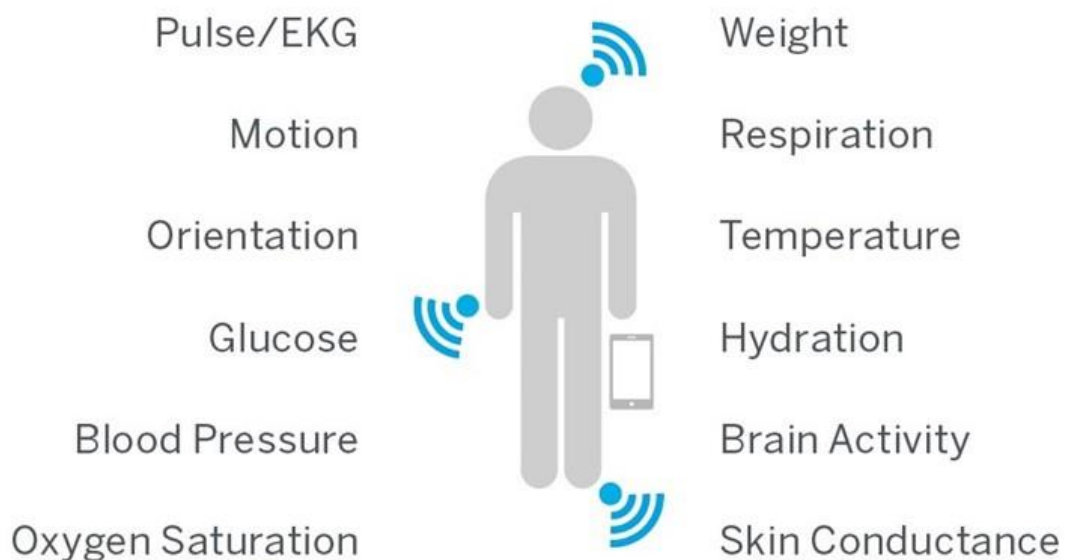


Figure (4). Health indicators measured by wearable sensors.

Problems facing elderly in wearable technology

Since the technological boom of the 21 century, the elderly have had difficulty keeping up with the latest trends, it is well known that the elderly have different difficulties interacting with or mastering current technology. Many studies on the elderly and their use of wearable devices have been conducted around the world, including South Africa, Europe, Malaysia, and North America, and by comparing these studies, it was shown that the decline in physical and mental abilities has led to the same problems for the elderly regardless of their different cultures and societies (Fletcher et al., 2010).

Some of the major barriers that elderly face when it comes to technology are:

- 1- Some elderly feel that technology is only associated with the younger generation and that they do not benefit from it (Chouvarda et al., 2019).
- 2- Most commercially modern products target the younger generation, and therefore the elderly show no interest in these products, such as smart watch products which target the younger generation by providing numerous duties that are not of interest to the elderly (Fletcher et al., 2010).
- 3- For the elderly, most digital devices are difficult to operate and use, unless they get assistance from friends and family to use these devices.
- 4- Some elderly are afraid that the wearable device might discover a major health issue.

Wearable technology requirements for the elderly

In order to provide modern technology to the elderly, we should first find the correct interaction between them and the device in use, especially that the elderly have unique requirements when using these devices compared to young people, as with each new version released the difficulty of its use is significantly greater.

The following considerations must be taken while introducing modern technology to the elderly:

- 1- Wearable devices should be both easy and simple to use because of the physiological and reasoning changes that rise with age.
- 2- In terms of size, weight, and effect on the physical movement, the wearable device should be simple to put on and take off at any time and place.
- 3- The device should function as a supplement to the daily healthy living system, with the ability to transmit assistance signals to the appropriate institutions in times of emergency.
- 4- Due to their limited ability to see clearly, the size of the button or icon on the device is important for the elderly, thus small buttons are difficult to operate with a finger.
- 5- Elderly are more conservative than the younger generation towards the issue of privacy, as elderly are less likely to share their privacy and information, especially if this information brings social harm.
- 6- Exterior appearance of wearable devices should be appealing, as elderly prefer to wear invisible sensors or alert systems which are

hidden in a watch or ring, as they do not want to be seen wearing a health monitor in public. This idea was supported by a study on the extent to which the elderly accept the use of these devices in their health care, which revealed that they are ashamed to wear them and prefer not to seem as an elderly person in need of care and assistance (Puri, 2017). Figure (5) shows examples of wearable device in a medical automated form which cases reluctance to use them by the elderly.



Figure (5). Examples of wearable devices in a medical automated form.

Conclusion

Wearable devices are becoming increasingly popular in a variety of industries including healthcare due to the growing elderly population around the world. The focus of this research was to take advantage of the remarkable technical advancements and wearable technology to serve the elderly and take care of them properly by acquiring information and critical vital indicators quickly and on a regular basis, and the findings of the research were as follows:

- 1- Availability of health technology is one of the most important determinants of health to the elderly, enabling them to stay in their homes due to the developments in wearable technology and sensors which have led to the enhancement of the service system provided to the elderly.
- 2- Wearable sensor development aims to provide continuous real-time health monitoring, resulting in rapid and exact diagnosis at any time and location. Unlike traditional wearable sensors, which are heavy, inflexible, and planar, next-generation wearable sensors has centered on developing flexible wearable systems.
- 3- The use of wearable technology in elderly care can be divided into three categories: finding their location, identifying their daily activities, and monitoring their vital signs.
- 4- Most elderly people have trouble adapting to new technologies, so their needs and requirements for wearable technology must be acknowledged and taken into account when wearable devices are designed.

- 5- When designing wearable devices for the elderly, the body factor and the aesthetic aspects must be taken into account to avoid embarrassment from the person wearing these devices.

Recommendations

- 1- Support and fund studies and research conducted in the field of wearable sensors and devices in general, especially those involving the elderly healthcare.
- 2- Designers of wearable devices must take into account age-related changes in reasoning, sensory, and manual functions for the elderly category.
- 3- It is necessary to improve the elderly's perceptions of modern technology by offering wearable devices that are simple to use and appropriate for their abilities and needs.
- 4- Creating a balance between the visual and functional aspects of the wearable devices for the elderly, and creating these devices in a way that pleases and motivates them to use it.
- 5- Pushing and encouraging industrial firms to enter the microelectronics sector, which benefits the wearable devices industry and the elderly health care in return.

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