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Mini Review

Advanced Wearable Devices in Healthcare

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Abstract

Wearable devices are very important in health care applications for better and effective use, to be utilized at faster speed. With the development of science, newer and newer designs of wearable devices are being evolved, for advanced applications. Different types of new wearable devices are described here for health care applications, with future impacts.

Keywords: *Device; Wearable Device; Skin-Based System; Smart Systems; Nano-Designs*

Introduction

These days, electronic devices and systems are designed, to enable them to be worn on the human body or on any part of the physiological system [1-10]. Generally, wearable devices are planned to be kept in touch with the skin or by wearing them by stucking in clothing like a shirt or a pant etc., in different forms, for medical or other applications [11-39].

In some cases, smart material, conductive paste, strips, wires, springs, coils or bio-logical leaves, wire gauge, etc. are useful for use in electronic systems [40-48].

Developments and applications

Advances in healthcare wearable devices are in many applications. Sensors, transducers, electronic systems and miniature devices, mni/nano-systems, smart gadgets, smart chemicals/paints, bio-fluids, textile-based clothings are some of the acceptable wearable devices/or systems for healthcare applications [1-40].

Some of the recent biomedical or health care problems are in applications of Parkinson's disease [27,28], Alzheimer' disease, physiological, psychological, drug delivery, neurological disorders, muscle disorders, hypertension, etc.

Other possible future applications are; smart wearable ECG machines, blood pressure monitors, wearable fitness trackers, smart health watches, biosensors and devices, future medical devices, smart oximeters, etc. [42-47].

Healthcare wearable devices: Future technologies are given in figure 1 [5-48]:

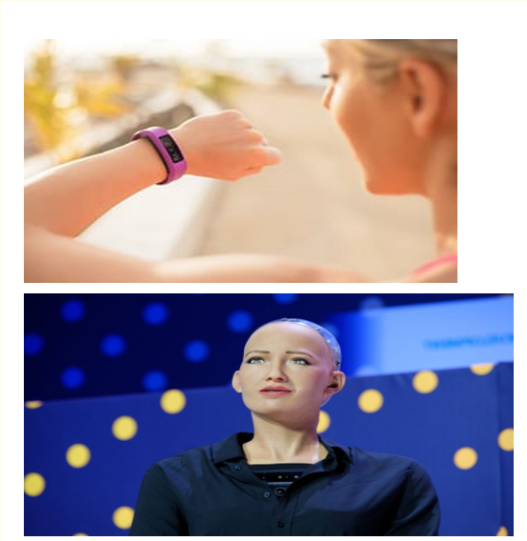

Figure 1: *Wearable technology in healthcare (Examples of AI by Apple).*

a) Biofluid-based healthcare wearable devices [29-36]:
   i. Sweat-based healthcare wearable devices.
   ii. Tear-based healthcare wearable devices.
b) Skin-based healthcare wearable devices [33-36]:
   i. Textile based wearable devices.
   ii. Tatto-based wearable devices.
c) Wearable drug delivery systems [38-46]:
   i. Smart bandages.
   ii. Touch actuated transdermal delivery systems.
   iii. Smart lens, smart rings, self heatable gums.
d) Wearable electronic devices and wearable electronics systems [35-42]:
   I. These are constantly worn as clothing to provide intelligent assistance.
   II. Memory is controlled.
   III. Control of intellect, communication and physical senses.
e) IOT (Internet-of-things) based healthcare wearable devices [37-48].
f) AI (Artificial intelligence) based healthcare wearable devices [41-44].

g) Use of machine learning healthcare wearable devices [41-44].

h) Cloud-based healthcare wearable devices [41-44].

Conclusion

Advances in healthcare devices are discussed. Future technologies of healthcare wearable devices, mainly, IOT, AI, Cloud-based and with Machine learning are presented.

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