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Wearable Gadgets in Healthcare Management: A Systematic Review

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ABSTRACT

With the technology improvements globally, there are vast improvements in the healthcare systems though. The present review article discusses about the role of wearable gadgets, the characteristics, functions, types etc. Also, a brief note literature on the wearable gadgets is also listed and different types of application were also discussed. This review gives information on the wearable gadgets and how this has an impact on the healthcare management instead of going and getting tested in the diagnostic centre daily which eats the time of us in this busy life-style.

Keywords: Healthcare management; Wearable gadgets; Life-style; Diagnostic tests; Technology

INTRODUCTION

Since the civilization journey, the technology has started developing gradually. Technological innovations by the researchers, manufacturers, practitioners and customers are capturing increased attention of wearable gadgets or wearable technology which is also known as wearables. These sensing, information giving and communicating technologies fall under the category of electronic devices that presents the information to users by tracking a user's lifestyle behaviours in order to provide tools for better health management [1]. These are driving the transformation of health care delivery towards a new path of connected health care. Generally, these devices should be in contact directly or loosely attached to a person i.e., one form of wearables can be operated individually which functions like a connector for device and gives information like a wrist worn fitness tracker., other form of wearables capture the specific actions and execute measuring like heart rate monitor worn around chest. Though these are been existing since decades, it has become lately popular and fashionable as well. This generation has begun with smartphones, which is now a pervasive technology [2]. Wearables are generally tagged with the concept of internet, which transform future health care system. These are promoting the health management by allowing a consumer to self-care by tracking.

Generally, wearables can be worn through several ways and forms wrist watches, wrist bands, rings, eye glasses, clothes, badges, jewellery, and even shoes etc [3]. Though these devices are ease to use, still the companies, institutions are working to design these devices to provide more comfort, reliable etc. To understand more about these wearables, the awareness is required in order to differentiate these from other technological devices and thereby its distinctive characteristics are to be examined [4, 5]. The main characteristic of wearables is, these are partially or totally hand-free, as they enable the people to access the data while performing their daily routine. According to the literature, the following are the characteristics that wearables should have [6-8].

Characteristics of Wearable Technologies

- The characteristics of wearable technologies must be;
- Convey information in effective manner
- Comfortable
- Hand-free functioning
- Multi-functional
- Portable
- Reliable
- Stable
- Socially accepted
- Useful

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Functions of Wearable Technologies

The main functions of the wearable technologies are;

- Communication
- Data management
- Energy management
- Interface
- Integrated circuits

Communication, It is the transfer of the data through radio frequencies, wireless systems like Bluetooth technology etc.

Data management, is the process of storing the data.

Energy management, is the most crucial function to run the wearables with the help of batteries/charging etc.

Interface, is a helpline to for transferring the data between the user and device.

Integrated circuits, help in receiving signals from the sensors with processing units and wireless nodes on printed circuits of the device and provide the data.

Therefore, these are the five main functions of the wearable technologies.

The advances in wearable technologies and user acceptance of available wearables pave the pathway towards seamless physiological monitoring. These devices are designed and are used for different purposes. These are designed and are in use based on the usage and requirement. The device's characteristics, features vary with the use and design for using. These are grouped, based on the usage, characteristics, features etc. From the literature, it revealed that there are types of wearable technologies. There will be numerous benefits and applications of wearable technologies in the future. The usage would be categorized based on the area of utilization (**Figure 1**).

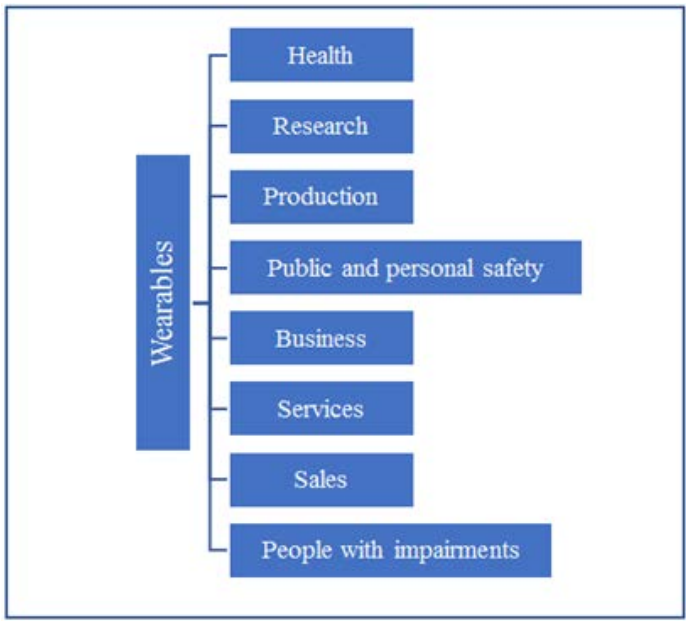

Figure 1: The applications of wearable technologies based on area of utilization

Challenges for Wearables

Before using these wearables, we have some assumptions on it, particularly on the way it works, its accuracy, reproducibility and efficiency in monitoring and ease of maintenance etc. These include, the concern related to lack of contextual as well as quality of information, battery life, privacy and security, proprietary algorithms and variables for annotating data streams. Maximum systems are developed for fitness market rather than older adults and rehabilitation. These wearables challenges in finding out its efficiency by extending its concern on validation, standardization and interoperability.

Power consumption, is one of the biggest challenges because, with no power, the wearable cannot work. Energy harvesting or scavenging has been taken as an approach to enhance useful feature of wearable sensor and are not outweighed by battery cost, size and weight. Measurement and Validation are the critical parameters to obtain accurate data from the wearables. This part is still under study, being developing a common language for measurement and evaluation of devices in order to define, the device's performance, safety and durability. Ethical and Privacy issues, plays the crucial part while using because these devices are exploiting the data from sensors such as accelerometers, gyroscopes and pedometers, breath sensing, heart-rate monitors and calorie trackers for potential as well as commercial use, which raises a doubt that the how extent the data ownership and ethical aspects of data from sensors is used for interpretation and how extent the data is kept safe and how much data has been leaked other than health record like name, age, other personal information [9]

Management is the crucial thing in any device, in case of wearables, storing the data which may be saved in cloud-based server must be accessed. If large volume content is there, it may take long hours, sometimes even days if not housed locally. Interpretation is the major part as the stored data must showcase exactly with precision. In case of the individuals who use additional apps for recording exercises, some apps may not match the locations and gives difficulty to determine. Some cause confusion like whether the individual is inactive or not wearing device. Personalized models are the Human centred design, is an area where designing and developing persuasive, seamless technologies that engage the users and provide positive behaviour on a daily basis is challenging. For example, in case of Parkinson's disease patients, the wearable technology can be helpful in monitoring fall detection, prediction in home sitting, vibration feedback etc., to assist the aspects for better understanding of intention and implement for better computational framework. Collocated interactions are the technologies that are focussed for providing more experience such as in gaming platforms etc., (**Figure 2**).

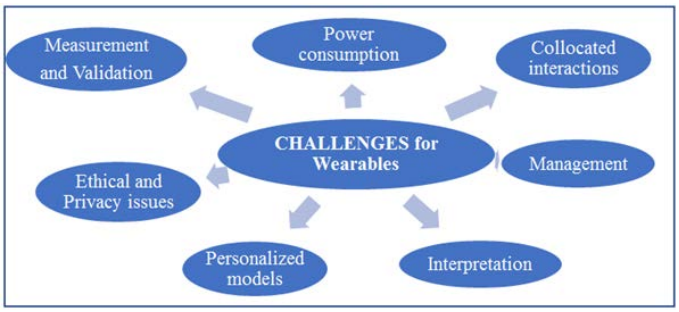

Figure 2: Challenges for Wearables

Types of Wearable Technologies

1. Wearable health technologies
2. Wearable consumer electronics
3. Wearable textile technologies

Wearable health technologies: These are the health-based

wearables, mostly carried out in health-care sector and moreover these wearables are used about for the health applications. Till date, the studies are going on to implement the design and develop wearable systems for monitoring patient's health related issues, gathering real-world information. Thus, doctors can easily monitor the heart-rate, blood-pressure, fever and other indicators which work independently while patients perform their daily routine activities. These health-related wearables can be used for diagnosing and treating several diseases. Literature states that, it can be used for e-health, m-health, tele-health, tele-healthcare, tele-medicine, tele-care and additionally in preventing chronic conditions like diabetes, in clinical management of neurodegenerative conditions such as Parkinson's disease and by responding to emergency situations like seizures in patients with epilepsy etc. Some vital application of these wearables is, using this technology while undergoing cardiac monitoring when a patient is cardiac arrested, cardiovascular diseases, rehabilitation, analysing during stroke etc.

Wearable consumer electronics: These wearables are the electronics that are intended to use every day that provide communication, entertainment and office productivity. Most of the consumer wearables are Smart phones, TV, cameras, music players, camcorders etc. Generally, these are worn to record and capture daily activities. Today, we are seeing the companies like Apple, Google, Microsoft, Nike, Samsung etc making more investments on wearables. In this class, there are different types of wearables like wrist watches, wrist bands, headbands, rings etc, the most popular and promising products are smart glasses and watches. Examples for electronic wearables are; Google's glass is one of the wearables, which is like a conventional glass, composed of the computerized central processing unit, integrated display screen, camera, microphone, bone conduction transducer and wireless connectivity. As of now, Apple's, Samsung's, Xiaomi's watches, counts the steps while walking and additionally the heart pace whereas Samsung's Galaxy Gear 2, enables the user to read and send texts, calls, and send instant notifications, monitor heart rate, exercises etc.

Wearable textile technologies: The concept of using the wearables has been recently adopted in textile industries. These help to enable the wearable electro textiles for sensing the body functions, monitoring and communicating facilities, date transfer, control of environment and other applications. These are bringing the changes in textile industries by providing the unusual characteristics in nano-coatings and nano-fibres. The most significant application of wearables in this field is clothes, where colour changes on demand of the wearer. For example, Philips company made a dress named "Bubelle" which changes its colour based on the wearer's emotions to attain popularity and social acceptance of these textile wearables (**Figure 3**).

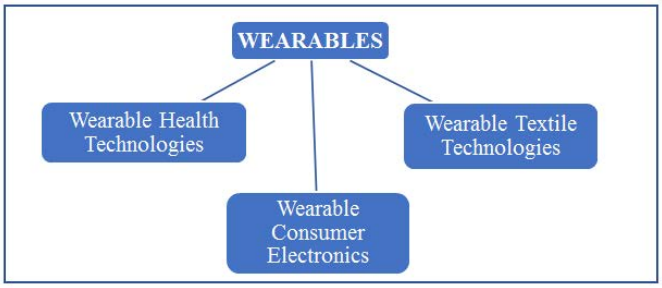

Figure 3: Types of wearables

List of Few Wearable Technologies since Decades

The following are the list of the wearable technologies that are been there since decades (**Table 1**).

Table 1: List of Few Wearable Technologies since Decades

Year	Invention	Description
1268	Eyeglasses	Roger Bacon has made first the lenses for optical purpose. On the other-hand in China and Europe reading glasses were already used.
1665	Augmented senses	Robert Hooke has inserted artificial organs to the natural which improve our other senses of hearing, smelling, tasting, and touching."
1762	Pocket watch	John Harrison has invented first practical marine chronometer to determine longitude at the time of travel through ship
1907	First wrist watch	Alberto Santos-Dumont, who was working as pilot has given idea to famous jeweler Louis Cartier to create a time piece so that he can keep his hands free for piloting.
1960	Head mounted stereophonic television display	Heiling has presented the idea of virtual reality simulator with handle bars, binocular display, vibrating seats, stereophonic speakers, cold air blower, and a device close to the nose that gives us effects of virtual reality
1977	Wearable camera	C.C. Collins of the Smith-Kettlewell Institute of Visual Sciences developed a five pound wearable with a head-mounted camera which was used by the blind persons.
1994	Wrist computer with half QWERTY keyboard	Edgar Matias and Mike Ruicci of the University of Toronto, has demonstrated this "wrist computer" which gives an alternative approach to the emerging HUD + chord keyboard wearable. The system was built from a modified HP 95LX palmtop computer and a Half-QWERTY one-handed keyboard. With the keyboard and display modules strapped to the operator's forearms, text could be entered by bringing the wrists together and typing.
2005	Fossil Wrist PDA	Wrist PDA which was running on palm OS was available in the market
2010	Sony Smart Watch	Sony has launched Android compatible wrist watch
2013	iWatch	Apple has launched iWatch – which is wearable computer can be wear on wrist and can work as full flagged mobile phone

Applications of Wearable Technologies

Wearable computers can be used in many applications in which they can be worn through user's skin, hands, voice, eyes, arms as well as motion or attention are actively engaged as the physical environment. Various application areas are as follows:

- Augmented Reality
- Behavioral Modeling
- Health Care Monitoring Systems
- Service Management
- Smart phones
- Electronic Textiles
- Music Player through Eyeglasses
- Fashion Designing
- Military Services

Limitations or Drawbacks of Wearables

Limitations of the wearables are like mishandling, discomfort, expensive and also insecurity (**Figure 4**).

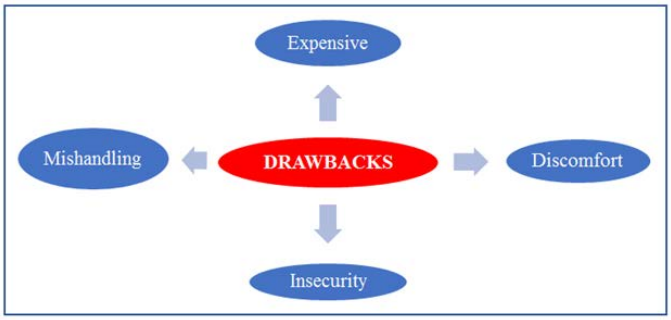

Figure 4: Drawbacks of wearable technologies

Current Developments in Wearable Technologies

In the current trend, the techniques and applications of wearables are focussing on rehabilitation. Under rehabilitation, virtual reality (VR) systems, functional electrical simulation (FES) and activity trackers are the wearable technologies being applied. These facilitate the rehabilitation through exercise programs and develop for specific health applications such as patients with neurological conditions, musculoskeletal conditions, pulmonary-impairment or with pain. Most systems are used for monitoring and providing rapid user feedback on posture and extremity movements but not designed for continuous usage. If and so these are intended for use by internet services, it widens the range of applications [10].

Future with Wearable Technologies

The electronic companies are now focussing on the wearable technologies, while few are launching the initial versions of the wearable products. This is becoming an early adaptable stage for public and commercial use. In future, the powerful and commonly held wearable product is Smart glass. As discussed above, the smart glass is like a conventional glass but it has the computerized central processing unit, integrated display screen, camera, microphone, bone conduction transducer and wireless connectivity. The price of it is too high right now but, the price falls once these glasses reach maturity stage and social acceptance of this device will accelerate.

CONCLUSION

For spreading the wearables, understanding the end-use must go hand in hand with technology development. Many challenges fall behind using wearables in routine as well as long term use which are being addressed in clinical studies like power consumption, durability, usability, comfort etc. Therefore, the advances in technology which is being focussed on wearables have a wide range of rehabilitation applications. The main objective of this review is to give brief points on how wearable technologies will become a milestone for the people using as well as the companies manufacturing. In simple words, the future will be easier, safer, healthier also quicker by using these wearable technologies.

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CONFLICT OF INTEREST

The author has nothing to disclose and also state no conflict of interest in the submission of this manuscript.

REFERENCES

1. Binkley P F (2003) Predicting the potential of wearable technology. IEEE Eng in Medicine and Biology Magazine. 2(6):23-27.
2. Jaydip Sen (2012) Ubiquitous Computing: Applications, Challenges and Future Trends. International Journal of Engineering Research and Applications. 3(4): 610-616.
3. Haghi, M, Thurow K, Stoll R (2017) Wearable devices in medical internet of things: scientific research and commercially available devices. Healthc Inform Res. 23: 4–15.
4. Chen KH, Chen PC, Liu KC (2015) Wearable sensor-based rehabilitation exercise assessment for knee osteoarthritis. Sensors. 15: 4193–4211.
5. Hartmann H, Trew T and Bosch J (2011) The changing industry structure of software development for consumer electronics and its consequences for software architectures, J sys and softw. 85(11): 178-192.
6. Liana DD, Raguse B, Gooding JJ, Chow E (2012) Recent advances in paper-based sensors. Sensors (Basel). 12(9):11505-11526.
7. Kim D, Shin G, Kang YJ, Kim W, Ha JS (2013) Fabrication of a stretchable solid-state micro-supercapacitor array. ACS Nano. 7(9):7975-7982.
8. Yonezawa Y, Miyamoto Y, Maki H, Ogawa H, Ninomiya I, et al. (2005) A new intelligent bed care system for hospital and home patients. Biomed Instrum Technol. 39(4):313-319.
9. Chai Z, Zhang N, Sun P, Huang Y, Zhao C, Fan HJ, et al. (2019) Tailorable and wearable textile devices for solar energy harvesting and simultaneous storage. ACS Nano. 10(10):9201-9207.
10. Mohammed EA, Far BH, Naugler C (2014) Applications of the MapReduce programming framework to clinical big data analysis: current landscape and future trends. BioData Min. 7:22