SYSTEMATIC REVIEW ON WEARABLE GADGETS IN HEALTHCARE MANAGEMENT

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Introduction

Since the start of the civilization, technology has gradually developed. Technological innovations by researchers, manufacturers, practitioners have been capturing... Cancel that line. There has been increased attention on wearable gadgets or wearable technologies by researchers, manufacturers, physicians, and patients. These technologies, which sense, give the information and communication, fall under the category of electronic gadgets... ...that present the information to users by tracking a user's behavioral patterns in order to provide better tools for health management. These are driving transformation of healthcare towards a new and better path of connected health. Generally, these devices should be in contact directly or loosely attached to a person. A wrist-worn fitness tracker for example. Other form of wearables captures specific actions and execute measuring like heart rate monitor worn around the chest. Though these are being used since many years, it's use has become lately widespread. This generation has begun with smartphones, which is now a pervasive technology. [2] Wearables are 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 eye glasses, clothes, wrist watches, wrist bands, rings, badges, jewellery, 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.

CHARACTERISTICS OF WEARABLE TECHNOLOGIES [6, 7]

The characteristics of wearable technologies must be;

- ✓ Convey information in effective manner
- ✓ Comfortable
- ✓ Hand-free functioning

- ✓ Multi-functional
- ✓ Portable
- ✓ Reliable
- ✓ Stable
- ✓ Socially accepted
- ✓ Useful

FUNCTIONS OF WEARABLE TECHNOLOGIES [8, 9]

The main functions of the wearable technologies are;

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

Communication, 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 critical function for wearables to function with the help of batteries/charging etc.

Interface, is a helpline for transfer of data data the user and wearable.

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.

The advances in wearable technologies and user acceptance and widespread availability of wearables lead the way towards seamless physiological monitoring. These devices are designed and are used for various 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 a review of the literature, it revealed that there are various 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.

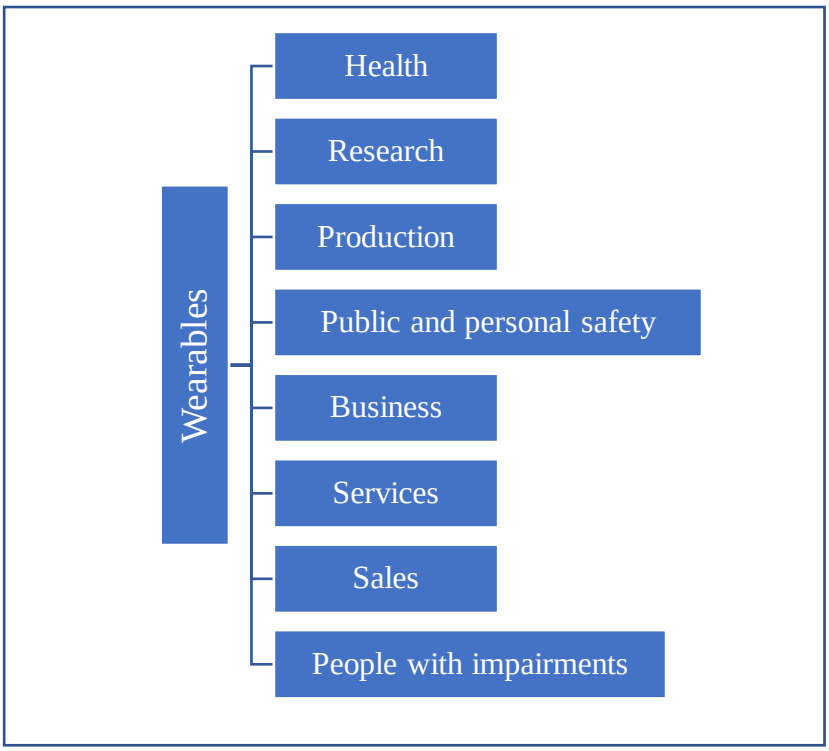


Fig no.01: The applications of wearable technologies based on area of utilization

CHALLENGES FOR WEARABLES [10-13]

Before using these wearable devices, we have some assumptions, specifically about how they work, their accuracy, reproducibility, and efficiency in monitoring and maintainability, etc. These include concerns related to poor quality and contextual information, battery life, privacy and security, proprietary algorithms, and Variables for annotating data streams. Most of the systems are designed for the fitness market rather than the senior and rehab markets. These wearable devices challenge to discover their efficiencies by increasing their interest in validation, standardization, and interoperability.

Power consumption is one of the biggest challenges, because without power, the portable device cannot function. Energy harvesting or sweeping was chosen as an approach to improve the wearable sensor's useful function and is not offset by the cost, size and weight of the battery.

Measurement and validation are the crucial parameters to get accurate data from wearables. This part is still under investigation and a common language for device measurement and evaluation is being developed to define device performance, safety and durability.

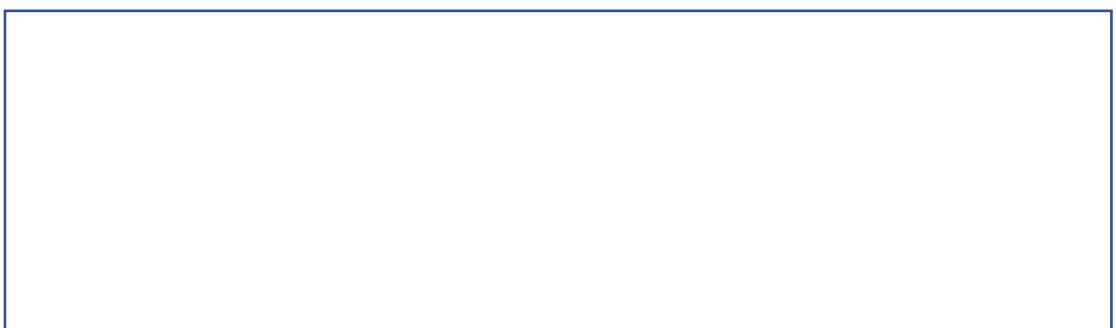
Privacy and ethics

These issues play a crucial role in usage as these devices use data from sensors such as accelerometers, gyroscopes and pedometers, respiration sensors, heart rate monitors and calorie trackers for potential and commercial purposes, which poses a problem. There are potential concerns about the extent to which data ownership and ethical aspects of sensor data are used for interpretation and the extent to which data is kept secure and how much data other than health data such as name , age and other personal information has been breached.

Management is the essence of any device. In the case of portable devices, you need to access the storage of the data, which can be stored on a cloud-based server. Large content can take many hours, sometimes even days if not hosted locally.

Interpretation is the main part as the stored data must be presented accurately and precisely. For people using additional apps to log exercise, some apps may not match locations and may be difficult to pinpoint. Some create confusion, such as when the person is inactive or not using the device.

Personalized models and human-centric design is an area where designing and developing seamless, compelling technologies that engage users and deliver positive behaviours daily is challenging. For example, wearable technology can be useful in patients with Parkinson's disease to monitor fall detection, home prediction, haptic feedback, etc., helping to better understand intent and implement a better computational framework. Placed Interactions are technologies that aim to provide more experience, such as on gaming platforms.



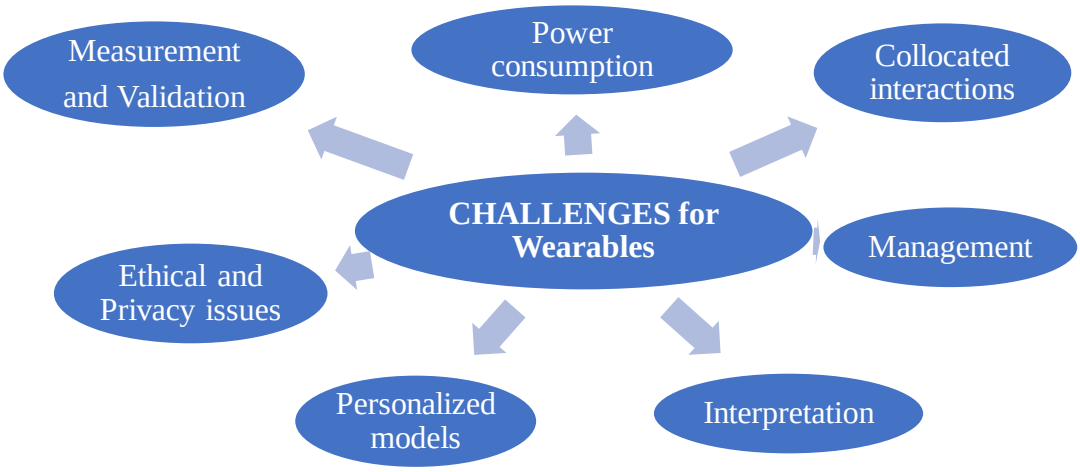


Fig no. 02: Challenges for Wearables

TYPES OF WEARABLE TECHNOLOGIES [14]

1. Wearable health technologies
2. Wearable consumer electronics
3. Wearable textile technologies
4.

Wearable health technologies:

These are health-related wearables that are manufactured in the healthcare sector and are also used for healthcare applications. To date, work continues regarding the implementation of the design and development of wearable systems to monitor patients' health-related problems, collect real-world information, monitor heart rate, blood pressure, fever and other indicators that work reliably and independently while patients do their everyday routine activities.

These health-related wearable devices can be used to diagnose and treat various diseases. The literature shows that it can be used for e-health, m-health, tele-healthcare and beyond in the prevention of chronic diseases such as diabetes and in the clinical treatment of neurodegenerative diseases like Parkinson's. Sickness and response to emergency situations such as seizures in patients with epilepsy, etc. An important application of these wearable devices is the use of this technology in cardiac monitoring in cardiac arrest, cardiovascular diseases, rehabilitation, analysis during stroke, etc.

Portable Consumer Electronic Devices -

These portable devices are electronic devices for everyday use that provide communication, entertainment,and productivity in the office. Most portable consumer devices are smartphones, televisions, cameras, music players, camcorders, etc. In general, these are used to record and record daily activities. Nowadays we see companies like Apple, Google, Microsoft, Nike, Samsung etc. invest more in wearable devices. In this class, there are several types of wearable devices such as wristwatches, bracelets, headbands, rings, etc. The most popular and promising products are glasses and smartwatches. Examples of wearable electronic devices are Google Glass is one of the wearable devices which, like traditional glass, consists of a computer-controlled central processing unit, an integrated display, a camera, a microphone, a bone conduction transducer, and wireless connectivity. From now on, Apple, Samsung and Xiaomi watches will count steps while walking and heart rate, while Samsung Galaxy Gear 2 allows the user to read and send text messages, make calls, and send instant notifications, monitor heart rate to do exercises, etc.

Wearable Textile Technologies:

The concept of wearing wearables has recently been adopted in the textile industry. These are helping to enable wearable electro-textiles for sensing body functions, facility monitoring and communication, data transmission, environmental control, and other applications. These bring about changes in the textile industry by offering unusual properties in nano coatings and nanofibers. The most important application of wearables in this area is clothing that changes color at the user's request. For example, to achieve the popularity and social acceptance of these textile accessories, the Philips company made a dress called “Bubelle,” which changes colour depending on the emotions of the wearer.

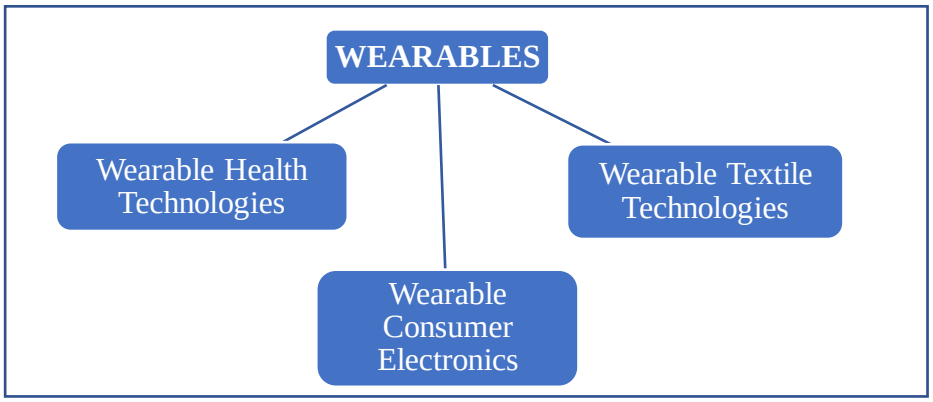


Fig no. 03: Types of wearables

LIST OF FEW WEARABLE TECHNOLOGIES SINCE DECADES [15-20]

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 [21-23]

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
- Behavioural Modelling
- Health Care Monitoring Systems
- Service Management
- Smart phones
- Electronic Textiles
- Music Player through Eyeglasses
- Fashion Designing
- Military Services

LIMITATIONS OR DRAWBACKS OF WEARABLES [24, 25]

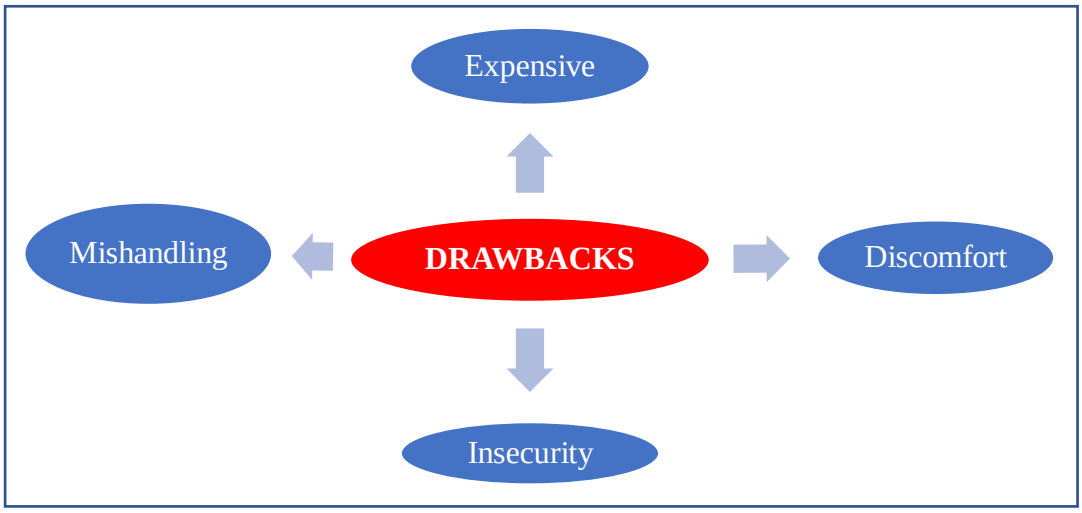


Fig.no. 04: Drawbacks of wearable technologies

CURRENT DEVELOPMENTS IN WEARABLE TECHNOLOGIES [26]

In the current trend, wearable technology and applications are focused on rehabilitation. Wearable technologies used in rehabilitation include virtual reality systems (VR), functional electrical simulations (FES) and activity trackers. These facilitate rehabilitation through training programs and have been developed for specific health applications, for example for patients with neurological and musculoskeletal diseases, pulmonary insufficiency, or pain. Most systems are used to monitor the and provide quick feedback to the user on posture and limb movements but are not designed for continuous use. If they are to be used by Internet services, the range of applications is expanded.

FUTURE WITH WEARABLE TECHNOLOGIES [27-30]

Electronic companies are now focusing on wearable technologies, while only a few are bringing initial versions of wearable products to market. This will be adaptable for public and commercial use at an early stage. The powerful and widespread wearable product of the future is smart glass. As explained above, smart glass is like traditional glass but features a computer controlled central processing unit, integrated display, camera, microphone, bone conduction transducer and wireless connectivity. The price is still too high now, but it will come down once these glasses

reach advanced stage of development, and the social acceptance of this device increases.

CONCLUSION

For wearables to spread, end-user understanding must go hand in hand with technology development. When using wearable devices in routine and long-term use, there are still many challenges that are being investigated in clinical trials, e.g., B. Power consumption, durability, ease of use, convenience, etc. Therefore, technological advances, focusing on wearable devices, have a wide range of rehabilitation opportunitie and applications. The main purpose of this review is to briefly lay out how wearable technologies will be game changers for both the people who use them and the companies that make them. In simple words, the future will be easier, safer, healthier, and faster using these wearable technologies.

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