

WEARABLE DEVICES – INCREASING INDUSTRIAL APPLICATIONS AND ADVANCES IN TECHNOLOGY

Mika Kinoshita
Manabu Nagashima
New Business & Technology Dept., Technology & Innovation Studies Div.
Mitsui & Co. Global Strategic Studies Institute

In recent years, a number of wearable devices have been developed not only for consumer use but also for industrial use. In this report, we will discuss the future outlook of wearable devices by categorizing their applications into groups, looking at the overall trends, and examining business opportunities and challenges in business applications, for which the market is expected to expand.

DEVELOPMENT OF WEARABLE DEVICES ACCELERATING

Wearable devices can be defined as computers that are not only portable but can be worn on the human body and that are equipped with sensors and wireless systems. Research and development of such devices started in the 1980s. Steve Mann, who was enrolled at MIT in the 1990s, is said to have created the world's first wearable device -- a backpack-mounted computer with a camera viewfinder attached to a helmet.

The expansion of the wearables market was first driven by the launch of activity tracking wristband Fitbit in 2009. Wearable devices have become more widely known after Apple Watch (wristwatch-type), the top selling wearable device for consumers, hit the market in 2015.

In addition to a wrist-worn type, there are various types of wearable devices, such as eye glasses (smart glasses), head-mounted displays (HMDs), clothing, shoes, and belts. Many players are working to develop new products.

A leading example of smart glasses is Google Glass. In 2012, Google started to sell the early prototype of Google Glass targeting developers of wearable devices, apps, and other content mainly in the US, which attracted public attention to wearable devices. However, the original product failed to get off the ground due to basic functionality issues, including poor battery life per charge and overheating, as well as users' unintentional invasion of privacy caused by use of the recording function. Although production ceased, Google Glass returned with a new model in 2017. The new Glass Enterprise Edition is aimed at workplace applications and sold as a package of solutions, i.e., not only devices but also systems that can be used for various applications.

The mainstay of head-mounted displays (HMDs) have been VR (virtual reality) HMDs provided by HTC (product name: VIVE) and Oculus (Rift). Through such devices, users see an entirely virtual world and become immersed in specific content, such as games and films. Meanwhile, Magic Leap, in which Google, Alibaba Group, and other companies invested a total of USD 1.9 billion, revealed its AR (augmented reality) HMD product Magic Leap One at the end of 2017. AR is a technology which overlays virtual objects on the real world environment. This technology enables workers to understand complex instructions intuitively, and makes our daily lives more convenient (e.g., AR-navigation system). As such, applications and future developments of AR HMDs warrant attention. Microsoft released its AR HMD HoloLens earlier than Magic Leap, and it is mainly for industrial applications.

FUTURE APPLICATIONS OF WEARABLE DEVICES

Wearable devices are most commonly used in the healthcare field now. Typical examples are activity tracking wristbands and smart watches, which have been used by individuals for health-management purposes. Recently, there are also an increasing number of business applications, for which companies can recover investment costs more quickly. For example, insurers provide incentives for subscribers according to their physical activities tracked with such devices, and corporate health insurance associations distribute them for employees' health management. Another example is construction companies using them for checking the health condition of workers at a construction site.

One of the latest examples of wearable devices used for healthcare purposes is rehabilitation equipment using VR technology developed by mediVR(Chart 1). Not only does this equipment improve efficiency at medical institutions, it also helps users recover motor functions while having fun with game-like exercises. Based on each patient's achievement, the next rehabilitation program will be proposed, and rehabilitation assessment can be quantified. The standardization of know-how in rehabilitation is also possible, and such know-how can be shared among medical institutions more easily. The equipment allows one physical therapist to instruct several patients at one time, and in the future, patients will be able to undergo rehabilitation programs at home, with medical professionals operating the equipment by remote control.

Chart 1: VR-Based Rehabilitation Equipment Developed by mediVR



Source: Company website

Wearable devices are categorized into some groups (Chart 2). Shipment of each group is shown in Chart 3. Other Wearables, which include wearable devices for industrial applications, have grown steadily as a result of long-term R&D efforts, and the market size is bigger than those of Fitness Wearables and Smart Watches, both of which are mainly for consumers. Meanwhile, the market size of Smart Glasses and HMD/cameras is still small, but the growth rate is the fastest among all groups. With integration of VR/AR technologies, growth in such products will likely be driven by industrial applications, which will be added to the existing market for wearable devices for enterprise use. As such, the market for wearable devices for business applications is expected to expand.

Chart 2: Categories of Wearable Devices and Their Applications

Category	Description	Products	Current Applications		
			Industry	Industry/ Individuals*	Individuals
Fitness Wearables	Smart watches for sports/outdoor use, wristbands, smart clothing, chest straps, etc.	Fitbit, Garmin®20XT, Polar M400, OMsignal OM Smart Shirt, etc. 		○	○
Smart Watches	Smart watches for daily use, such as Apple's Apple Watch Series 2, Samsung's Samsung Gear S3	Apple Watch Series 2, Samsung Gear S3, Huawei Watch, Asus ZenWatch 2, Tag Heuer Connected, etc. 		○	○
Smart Glasses and HMD/Cameras	Smart glasses (eyeglasses), head-mounted displays, etc.	Sony SmartEyeglass, Panasonic Arbitrator, Sony PlayStation VR, Facebook Oculus Rift, Samsung Gear VR, etc. 	○		△
Other Wearables	Headsets and other wearable devices for industrial/medical/military use	Plantronics Voyager Edge, Jabra Supreme UC, Brother AiRScouter, etc. 	◎		

Source: Development Bank of Japan (November 2016), "Current Status and Future Outlook of Wearables Market"; some information added by MGSSI; images of products from each company's website.
* Companies' bulk purchase for individuals' use

Chart 3: Global Shipment of Wearable Devices



Source: Compiled by MGSSI based on data from Gartner's Forecast for Wearable Devices Worldwide 2016-2018 and 2021 (August 2017).

At factories and production sites, wearable devices are used mainly for supporting workers by giving appropriate instructions for complex tasks. Recently, they are also used for training unskilled workers.

Airbus and Accenture jointly developed a state-of-the-art application using Vuzix Corporation's smart glasses for the cabin seat marking process. This technology improves accuracy of marking, reduces work time, and increases workforce productivity by 500%.

AR HMDs, including HoloLens developed by Microsoft, can reproduce 3D-images based on pictures previously taken, and help inexperienced workers to learn specific skills by overlaying work procedures onto the equipment in the physical world. Companies use this technology to promote digital transformation, and recover investment costs with profits earned from improved efficiency. Business applications like this will likely expand going forward.

Meanwhile, Japanese restaurant operators are facing a labor shortage, with more and more workplaces suffering from a shortage of mentors who can train new staff as well as time to train. In response to these issues, Panasonic developed Kronosys smart glasses for enterprise use. In addition to remote audio/visual training, the device is expected to contribute to reducing long working hours and saving manpower by linking wearable devices and kitchen equipment, and thereby achieving more efficient kitchen operations.

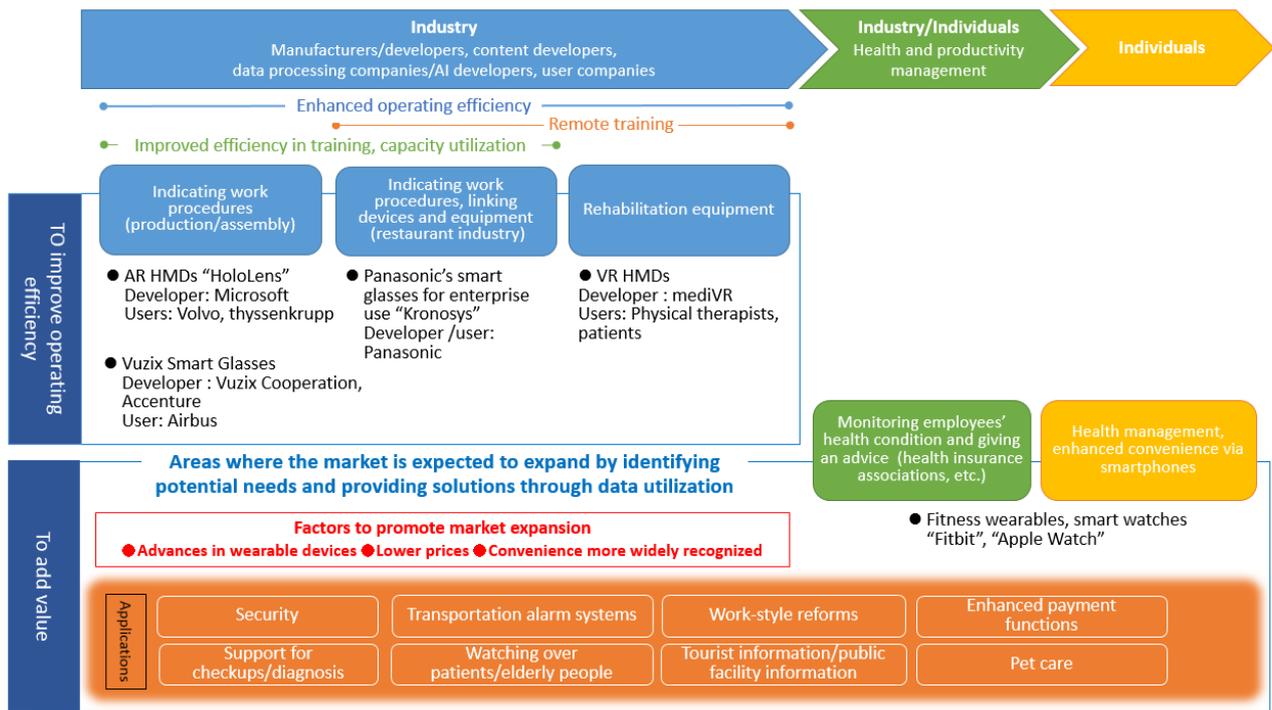
BUSINESS OPPORTUNITIES AND ISSUES RELATED TO WEARABLE DEVICES

The process by which wearable devices have become widely used is similar to those of Internet and GPS technologies, which were originally developed for military purposes. People who use wearable technology in their workplace will be more aware of its convenience. This, together with likely reduced hardware costs thanks to advances in technology, should promote the wider use of wearable devices by consumers. In the US, research on utilization of wearable devices in sports such as football and baseball is underway. For example, smart clothing is used to maximize the performance of each player and to select starting players based on predicted physical condition. In addition, an athlete's activity (running distance, coverage zone) in a game is visualized and provided to the viewer. In Japan, some professional baseball teams have started to use data obtained from wearable devices to improve each player's performance. Applications for sports is an area with growth potential, as professional athletes take the lead in using wearable devices and amateurs follow suit.

In business applications, the key for success is enhanced operating efficiency and increased profitability with value-added services, for both wearable device operators and user companies (Chart 4).

Wearable device operators here refers to developers/manufacturers of hardware, developers of applications and other content (software), as well as related platform operators, AI developers, and companies engaged in cloud-based data processing. They need to coordinate with each other and find the best way to integrate functions of wearable devices into existing systems, and propose how to use wearable devices in a way that a user company can easily imagine. To do so, it is necessary to (1) closely cooperate with a client company in conducting demonstration experiments and (2) partner with companies with specific knowledge that is useful to solve issues. Meanwhile, it is time for user companies to consider whether wearable devices can be used to enhance efficiency in operations such as marketing, development, and maintenance and to improve quality, with an eye on boosting their competitive edge.

Chart 4: Applications of Wearable Devices in Each Area and Areas with Prospects for Market Expansion



Source: Compiled by MGSSI based on information from an NRI Knowledge Insight report on the wearable devices market.

From a business perspective, regardless of being a hardware developer, content developer, etc., it is important not to seek profits from selling wearable devices themselves, but to look to services and operations using wearables. The value of wearable devices lies in providing unprecedented user experience by enhancing AI and content that can be accessed on a cloud. In addition, the variety of data that such wearable devices deal with is a key for creating new business and markets. It is also possible to accumulate a vast amount of various data, utilize it for a myriad of purposes, including safety, health management and marketing, and identify potential needs and cater to them. Depending on the ideas, new business opportunities can be created.

As described above, the adoption of wearable devices has expanded from manufacturing to service industries. If costs are reduced and functions are enhanced thanks to technological improvements in the future, wearable devices will be further used by labor intensive service operators. For example, if store personnel and travelling sales staff are equipped with wearable devices, they can sell products by checking regular customers' preferences, needs, and purchase histories in real time, leading to productivity improvement. By analyzing such references and customer behavior data, companies can also identify unmet customer needs and develop new solutions.

Google offers VR/AR game developers access to Goggle Map APIs, the function to use Google Map's data for game development. The company apparently aims to expand the market by promoting development of content for wearable devices.

SOCIAL CHANGES TO BE BROUGHT BY WEARABLE DEVICES

Smartphones have achieved mass adoption by replacing conventional feature phones and also attracting new users with user-friendly operations. Currently, about 4 billion smartphones are used as an interface worldwide. Meanwhile, the number of wearable devices in use is still about 100 million units. With business applications increasing, the convenience of wearable devices will be more widely recognized by users, including those who have not purchased smartphones. If the number of users increases significantly, wearable devices will likely replace smartphones and become an essential user interface in the digital society.

Business applications of wearable devices are expected to contribute to enhanced production efficiency and cost reductions. In addition, they will help secure production force in developed countries, where working populations are declining.

Technical challenges facing wearable devices include longer operating time, which is currently restricted by battery life and the limitations of other power sources, the balance between faster data transmission speed (for real-time operations) and lower power consumption, further downsizing, weight saving, and biocompatibility. It is also pointed out as a social problem that data obtained through wearable devices could lead to new privacy concerns (leak of personal data or other people's images).

Despite such issues, the benefits from using wearable devices, which are designed as user friendly devices that can be used by "anyone, anytime, anywhere", are large. Therefore, further developments of the technology are awaited.

Any use, reproduction, copying or redistribution of this report, in whole or in part, is prohibited without the prior consent of Mitsui & Co. Global Strategic Studies Institute (MGSSI). This report was created based on information and data obtained from sources believed to be reliable; however, MGSSI does not guarantee the accuracy, reliability, or completeness of such information or data. Opinions contained in this report represent those of the author and cannot in any way be considered as representing the unified opinion of MGSSI and the Mitsui & Co. group. MGSSI and the Mitsui & Co. group will not be liable for any damages or losses, whether direct or indirect, that may result from the use of this report. The information in this report is subject to change without prior notice.