Technical Assistance Guide on Wearable Technology for People with Disabilities

A Corporate Partner Benefit of the
National Business & Disability Council (NBDC)
at The Viscardi Center

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National Business & Disability Council
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Transforming the lives of people with disabilities

National Business & Disability Council (NBDC) at The Viscardi Center:
# Wearable Technology for People with Disabilities

The National Business & Disability Council (NBDC) at The Viscardi Center is pleased to share with its Corporate Partners the following technical assistance guide, **Wearable Technology for People with Disabilities**. The technical assistance guide provides useful information about wearable technology, and its potential impact on the lives of people with disabilities. Wearable technology is not a new idea; for example, people have been wearing hearing aids for decades. Technological advancement in the use of sensors, cameras and algorithms are facilitating more capable and useful wearables in all aspects of everyday life, including the workplace. Among the latest inventions are glasses that can identify objects and describe them out loud, as well as clothing that translates spatial data into vibrations.

It is estimated that the wearable technology market will increase from $20 billion in 2015 to almost $70 billion in 2025.[1] The United States is leading the way, too, on patent applications for wearable technology.[2]

Wearable technology market segmentation[3]

- Smart clothing & smart sports glasses

- Activity monitors

- Sleep sensors

- Smart watches

- Augmented reality headsets

- Smart glasses

- Continuous Glucose Monitor

- Drug delivery

- Monitors

- Hand worn terminals
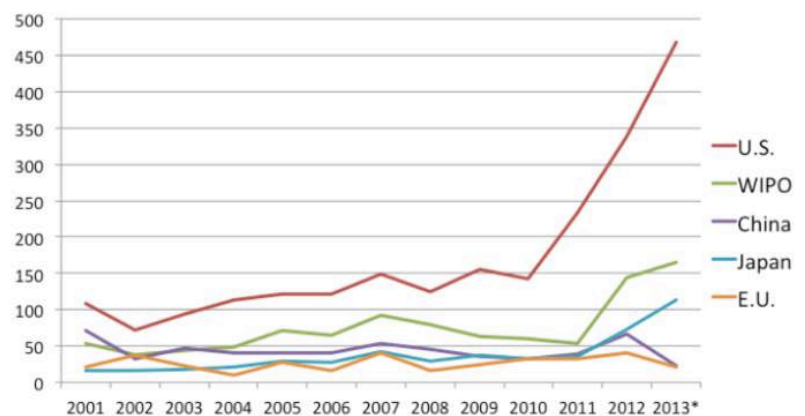
Wearable tech filing trends, courtesy of Innography

The technical assistance guide provides relevant facts and materials pertaining to wearable technology. It also provides useful industry analysis, resources and tools.

Disclaimer...

The technical assistance guide is not intended to provide legal advice to NBDC corporate partners, but rather to share relevant information, resources and tools. The content herein does not serve as an endorsement of any commercial product or service, but rather an outlet to share information and opinions about accessible information and communication technologies.

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[1] Peter Harrop, et al., IDTechEx, "Wearable Technology 2015-2025: Technologies, Markets, Forecasts." February 2015; available from http://www.idtechex.com/research/reports/wearable-technology-2015-2025-technologies-markets-forecasts-000427.asp
[2] Rich Steeves, IC Inside Counsel, "6 cutting-edge IP trends to look for in 2015: Wearable technology, 3D printing and other new technologies could create headaches in the months to come," November 18, 2014; available from http://www.insidecounsel.com/2014/11/18/6-cutting-edge-ip-trends-to-look-for-in-2015
[3] Transparency Market Research, "Wearable Technology Market - Global Scenario, Trends, Industry Analysis, Size, Share And Forecast 2012 - 2018," January 1, 2014; available from http://www.transparencymarketresearch.com/wearable-technology.html

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What is Wearable Technology?

Background & History

Wearable technology encompasses innovations such as wearable computers or devices; augmented reality (AR); and virtual reality (VR). The existing wearable technology market is dominated by a small number of devices, such as smart glasses, watches and fitness bands – many interact with smartphones and tablets via apps to track users' sleep, health, and movement.

Deloitte describes the sector as a 'mass niche' that will generate about $3 billion this year alone.[4] As technology continues to develop, wearable, in-planted and portable computer systems are becoming more adaptable to meeting the specific needs of individuals. In the area of human-computer interface, applications include devices for user input, output, context awareness, and computer interfaces that allow individuals with disabilities to interact with their environment.[5]

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[4] The Brave New World of Wearable Technology: What Implications for IP? (accessed January 5, 2016); available from
http://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2014/wipo_pub_121_2014_03.pdf
[5] A Synergistic Co-operative Framework of Health Diagnostic Systems for People with Disabilities and the Elderly: A Case Study (accessed January 5, 2016); available from http://www.wseas.us/e-library/conferences/2008/crete/Computers/114-computers.pdf

Wearable technology first made a big splash in the health and fitness world. Many people use them to do things such as track steps-per-day or log miles jogged, or measure heart rate. Today's wearable technology takes it a lot further, encompassing a litany of daily life activities. For example, some devices not only track physical activity, but it also automatically tracks sleep patterns, food intake and calories consumed. In fact, some say that wearable technology will revolutionize healthcare by assisting doctors in the operating room and providing real time access to electronic health records. By 2018, it's estimated that 130 million wearable devices will be shipped to consumers.[6]

Use of Wearable Technology for People with Disabilities
Wearable technology allows people with disabilities to perform functions that were nearly impossible a few years ago. For example, hearing aids can now be adjusted using an iPhone app or watch allowing those with hearing disabilities to communicate easily, regardless of their current environment. Wearable technology has the potential to minimize the effects of disability by substituting for loss of function. Individuals with memory loss can be given daily reminders by accessing memory cueing apps via their smart device. In addition, wearable technology is often transferable to the aging population. For example, a GPS-enabled device that helps someone with a visual impairment navigate the streets, could also help adult children keep track of their parents with dementia. Hands-free wearables are also important to users who want efficient access to information, as well as the ability to access it independently.[7]

Available Wearable Technology for People with Disabilities

It's impossible to ignore the growing wearable technology market. Its influence is sweeping, catching the eyes of everyone from fashion designers to healthcare professionals. Wearable technology has so much potential to enrich the lives of people with disabilities, not only giving them more independence, but also giving them a voice. Devices that allow individuals to perform everyday tasks-like the ability to share social media or create videos using voice-activated controls-is changing the way individuals with disabilities access and engage in society. Individuals with a variety of disabilities use wearable technologies such as Google Glass, OrCam, EM Sense Technology and Robotics. Right now, many technologists believe that wearable technologies will offer people with disabilities the best opportunity to engage in their communities.[8]

Physical Disabilities and the use of Google Glass
People with physical disabilities often use wearable technology to assist with completing tasks of daily living, as well as increase their overall level of independence. For many individuals with limited arm and hand use, wearable technology such as Google Glass provides options for individuals to record videos, store recipe information, send emails and browse the web. The device has a built-in camera that can be controlled with a tilt or nod of the head. Google Glass is a headset, or optical head-mounted display, that is worn like a pair of eyeglasses. It can give people with physical disabilities new ways of expressing themselves as well as the ability to access to social media sites using voice-activated commands.[9] Google Glass has proven itself to be one of the most useful forms of wearable technology for people with physical disabilities.

[6] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0
[7] Wearable Tech for People With Disabilities (accessed January 5, 2016); available from http://health.usnews.com/health-news/health-wellness/articles/2014/11/20/wearable-tech-for-people-with-disabilities
[8] Wearable Tech For People With Disabilities: How A Tech Specialist Is Modifying Google Glass To Be More Accessible (accessed January 5, 2016); available from http://www.idigitaltimes.com/wearable-tech-people-disabilities-how-tech-specialist-modifying-google-glass-be-more-accessible
[9] Google Glass Offers Disabled People Access to a Bigger World (accessed January 19, 2016); available from http://www.usnews.com/news/stem-solutions/articles/2014/06/10/google-glass-offers-disabled-people-access-to-a-bigger-world

Ongoing product development and research demonstrates that it allows individuals with physical disabilities to do the following:

- Communicate using built-in voice controls, eye display and audio output to express themselves. Vibrations could be used to communicate emotions or gestures.[10]
- Built-in voice controls and access points means that individuals with limited use of their limbs can effectively use the device.[11]

For people with physical disabilities, technologists are continuing to make adjustments to Google Glass to improve its functionality and use such as experimenting with switch access, which replaces the need to use a computer keyboard or mouse.[12]

Google Glass for Individuals who have difficulty hearing and are Deaf
For individuals with difficulty hearing, Google Glass can assist with communication by providing captioning and voice recognition capabilities that enables the user to see and receive information in real time. However, the feedback received by students at Gallaudet University indicates that Google Glass is not Deaf-friendly. The reasons for this are:

- For those who use sign language as their primary mode of communication, Google Glass does not have the capability to provide face-to-face communication.[13]
- The outward-facing camera in Google Glass will, at best, look at sign language from behind making it difficult for the user to see.[14]

Though this may take some time to develop as a possible solution, technology developers need to figure out a way for deaf signers to communicate with both hands as well as find ways to allow for face-to-face communication.[15] Gesture recognition capabilities are constantly being explored and it is believed that this may allow individuals who are deaf and use sign language to communicate to effectively use Google Glass. In addition, for those who need captioning capabilities, such as remote captioning, audio quality has proven to operate poorly and can affect the Real-Time Captioner's ability to transcribe information accurately.[16]

[10] Wearable Technology Like Google Glass Can Drastically Improve The Lives Of People With Disabilities, Here's Why (accessed January 5, 2016); available from http://blog.themobilityresource.com/blog/post/wearable-technology-and-how-it-affects-people-with-disabilities
[11] Wearable Technology Like Google Glass Can Drastically Improve The Lives Of People With Disabilities, Here's Why (accessed January 5, 2016); available from http://blog.themobilityresource.com/blog/post/wearable-technology-and-how-it-affects-people-with-disabilities
[12] Wearable Tech For People With Disabilities: How A Tech Specialist Is Modifying Google Glass To Be More Accessible (accessed January 5, 2016); available from http://www.idigitaltimes.com/wearable-tech-people-disabilities-how-tech-specialist-modifying-google-glass-be-more-accessible
[13] Google Glass, Wearable Technology, and Accessibility (accessed January 5, 2016); available from http://drumbeatconsulting.com/blog/2013/03/18/google-glass-wearable-technology-and-accessibility/
[14] Google Glass, Wearable Technology, and Accessibility (accessed January 5, 2016); available from http://drumbeatconsulting.com/blog/2013/03/18/google-glass-wearable-technology-and-accessibility/
[15] Google Glass, Wearable Technology, and Accessibility (accessed January 5, 2016); available from http://drumbeatconsulting.com/blog/2013/03/18/google-glass-wearable-technology-and-accessibility/
[16] William Mager: Could Google Glass be the Deaf community's 'disruptive innovation'? (accessed January 19, 2016); available from http://limpingchicken.com/2013/05/07/william-mager-could-google-glass-be-the-deaf-communitys-disruptive-innovation/

Visual and Cognitive Disabilities: Electromagnetic Sense (EM) Sense Wearable Technology
Electromagnetic (EM) Sense, or EM Sense, is a wearable technology being developed in the near future that can be worn on the wrist or, integrated into smartwatches. It works by emitting small amounts of electromagnetic noise during operation. When a user makes physical contact with such an object, the EM signal propagates through the user, using conductivity of the human body. By modifying a small, low-cost, software-defined radio, it can detect and classify these signals in real-time, enabling robust on-touch object detection.[17]

The technology will have the ability to help both people with visual and cognitive disabilities identify objects, as well as provide relevant information about the product and how it operates. It will be able to identify objects such as kitchen appliances and items used for activities of daily living, such as a toothbrush. This product will predict an individual's daily routines and activities. People with cognitive disabilities using this wearable technology, will effectively be given reminders on how to use certain products. It will also help both individuals who are blind and those with cognitive disabilities more effectively manage their time and allow them to complete certain tasks independently. For people with vision and cognitive difficulties, EM Sense technology has the potential to augment important aspects of an individual's daily routine allowing them to have less difficulty completing tasks.[18]

OrCam and its use for People with Vision Related Disabilities
A device called the OrCam helps people with visual impairments by reading text aloud to them. First, users attach the OrCam's tiny "smart camera" and earpiece to their eyeglass frames. When users want to read something, such as a newspaper article or a product label, they point their finger at the item. The OrCam then "speaks" to them via the earpiece, which uses bone conduction to carry sound through the bones of the skull to the inner ear.

OrCam can help individuals with tasks such as reading and even crossing the street by simply pointing the device at a traffic light and waiting for the system to announce "green light." In a supermarket, users can pick up a product and the device will tell them what it is, even reading off the ingredients. The OrCam recognizes words, remembers faces, locations, landmarks, describes shapes, and other features that are read back to the user.[19]

To further pinpoint the success of OrCam and similar devices, an online survey of participants with vision disabilities concluded that participants with visual impairments responded positively to two eyes-free wearable device scenarios: a wristband or ring and a glasses-based device. Discussions on projected use of these devices suggest that small, easily accessible, and discreet wearable input could positively impact the ability of people with visual impairments to access information on the go and to participate in certain social interactions.[20]

[17] EM-Sense: Touch Recognition of Uninstrumented, Electrical and Electromechanical Objects (accessed January 19, 2016); available from http://chrisharrison.net/projects/emsense/emsense.pdf

[18] Armed with electromagnetic sensors, Disney's new wearable can tell what you're touching? (accessed January 5, 2016); available from http://www.digitaltrends.com/cool-tech/em-sense-smart-watch-wearable-customizes-experience-identifies-objects/

[19] OrCam's 'vision' system for visually impaired paves the way for new wearables (accessed January 19, 2016); available from http://www.zdnet.com/article/orcams-vision-system-for-visually-impaired-paves-the-way-for-new-wearables/; Wearable Tech is Changing the Lives of People With Disabilities (accessed January 5, 2016); available from http://www.verizonwireless.com/news/article/2015/03/wearable-tech-is-changing-the-lives-of-people-with-disabilities.html

[20] Current and Future Mobile and Wearable Device Use by People With Visual Impairments (accessed January 5, 2016); available from http://terpconnect.umd.edu/~leahkf/pubs/CHI2014_ye_Wristband.pdf

Use of Wearable Technology for Individuals with Autism
A facial affect analyzer may be a useful tool for individuals with Autism, since these individuals often have difficulty recognizing and understanding facial expressions. Researchers propose the use of an "Emotional Hearing Aid," which is a wearable device receiving input from a digital camera and uses the input file to interpret the mental and emotional state of an individual and communicate this information to the user.[21]

The Emotional Hearing Aid may be helpful to individuals, specifically children with other developmental disabilities. Research indicates that in order to identify a particular facial expression, individuals rely on the spatial configuration of the major features of the face, that is - the eyes, nose, and mouth. Research also demonstrates that individuals with Autism present a different pattern of face scanning, which some researchers identify as underlying face affect recognition deficit. Therefore, sensing devices, such as an "emotional Hearing Aid" and similar wearables may be useful as both diagnostic and feedback methods for understanding how individuals with autism interpret information.[22]

Wearable technology for children, particularly those with Autism is now giving parents the ability to not only monitor their kids' location by GPS, but also their heart rate and temperature. Many disability advocates and organizations are beginning to take stock regarding the implications for this new technology. SAFE Family Wearables, a technology company based in California has designed what is known as PAXIE bands, which are designed and assembled in the U.S. The bands are water-resistant and include a 3G cellular chip offering true GPS functionality rather than radio frequency, which requires the searcher to be within a short range to monitor. The device allows parents to set a radius from a certain location, making sure they'll be notified if a child leaves that zone, whether a house, school, park or event. The bands sell for approximately $175. Technologists are hoping to add waterproof capabilities and a full lifestyle portal that would offer interactivity with other Internet devices people with disabilities, including seniors may have in their homes.[23]

Wearable Technology and Healthcare for People with Disabilities

Application of Wearable Technology in Healthcare
Healthcare in the 21st Century is changing rapidly along with technology. Technology has been applied to the field of rehabilitation and healthcare for many years. However, wearable technology has created advancements leading to improving quality of life for all individuals especially, those with disabilities. Microelectromechanical Systems (MEMS) technology has enabled the development of miniaturized inertial sensors that have been used in motor activity and other health status monitoring systems similar to an electrocardiogram (EKG), which measures electrical activity of the heart.[24]

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[21] Assistive Technology and Affective Mediation (accessed January 5, 2016); available from http://www.humantechnology.jyu.fi/articles/volume2/2006/garay-cearreta-lopez-fajardo.pdf
[22] Assistive Technology and Affective Mediation (accessed January 5, 2016); available from http://www.humantechnology.jyu.fi/articles/volume2/2006/garay-cearreta-lopez-fajardo.pdf
[23] Wearable devices that let parents monitor their kids (accessed January 5, 2016); available from http://www.cbsnews.com/news/parents-get-new-data-from-kids-wearable-devices/
[24] A review of wearable sensors and systems with application in rehabilitation (accessed January 5, 2016); available from http://jneuroengrehab.biomedcentral.com/articles/10.1186/1743-0003-9-21

Many healthcare facilities use similar applications known as "wearable units" to monitor and measure respiration and blood flow. These units consist of electrodes woven into fabric that an individual can wear. This type of wearable technology has significant implications for people with disabilities, including individuals diagnosed with cardiac or vestibular (balance) difficulties, as it's been used to monitor and measure certain muscle groups during active movement. The monitoring applications used on these wearable devices, gathers information using sensor networks that can be transmitted to a remote site such as a hospital server for clinical analysis. Clinicians are using wearables to monitor vital signs and prevent falls by detecting changes in physiological measures which includes heartrate, blood oxygen saturation and muscle activity.[25]

Wearable Robotics and its use for People with Physical Disabilities
ReWalk, a wearable exoskeleton, is a wearable device approved by the U.S. Food & Drug Administration (FDA) that provides powered hip and knee motion to enable people with Spinal Cord Injury (SCI) to stand upright and walk. It uses a backpack battery, is controlled by a simple wrist-mounted remote, which detects and enhances the user's movements. ReWalk provides user-initiated mobility through the integration of a wearable brace support, a computer-based control system and motion sensors. The system allows independent, controlled walking while mimicking the natural gait patterns of the legs, similar to that of an able-bodied person.[26]

In addition to the ability to stand and walk independently, clinical studies of the ReWalk Rehabilitation system show significant health benefits to the user, on both a physiological and psychological level. Study data of the ReWalk system indicates potential improvements in cardiovascular health, loss of fat tissue, building of lean muscle mass, and improved bowel function. Feedback from ReWalk users supports these potential benefits and others, such as better pain management, fewer medications, and potentially reduced hospitalizations.[27]

Wearable Technology and Employment

Bring Your Own Device (BYOD) Initiative
Companies that implement a "Bring Your Own Device" BYOD initiative are likely to experience a significant shift in thinking as they navigate privacy and security issues regarding protecting information in the workplace. According to Information Week's 2013 State of Mobile Security report, a survey of 424 technology professionals, found that 68% of those polled said their mobility policy allows employees to use personal mobile phones for work, with 20% saying they are developing such a policy.[28] The aforementioned corporate policy should include stringent rules as to when and how employees can use wearable technology in and out of the workplace. Several companies have started to implement their own BYOD initiatives including, Forbes®. A BYOD initiative allows companies to increase their productivity as a result of employees having access to tools that enable them to be more efficient. This is especially true for employees with disabilities. It also allows employees with disabilities to have better control of their accommodation needs, since they ultimately are using a device that is personalized for their needs.[29]

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[25]A review of wearable sensors and systems with application in rehabilitation (accessed January 5, 2016); available from http://jneuroengrehab.biomedcentral.com/articles/10.1186/1743-0003-9-21

[26] ReWalk Motorized Device Helps People with Disabilities to Walk (accessed January 5, 2016); available from http://www.disabled-world.com/assistivedevices/mobility/rewalk.php

[27] ReWalk Motorized Device Helps People with Disabilities to Walk (accessed January 5, 2016); available from http://www.disabled-world.com/assistivedevices/mobility/rewalk.php

[28] 5 Key Advantages to Adopting BYOD in the Workplace (accessed January 5, 2016); available from http://yfsmagazine.com/2013/10/02/5-key-advantages-to-adopting-byod-in-the-workplace/

[29] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

Corporate Wearable Implementation Policy
There are several considerations for a company to keep in mind when implementing policies regarding the use of wearables in the workplace:

- Prepare for an increase in data flow by making sure your networks are able to handle capacity and security issues.[30]
- Create policies around usage for wearable technologies by outlining the parameters for bringing wearables into the workplace and connecting to the network.[31]
- Establish oversight and data management that infiltrates the existing network allowing for increased capacity of wearable technology in the workplace.[32]
- Review security measures periodically as it will impact the company's information technology (IT) network and require creating a secure access system to avoid cyber threats.[33]

It is extremely important to work with Human Resources (HR) personnel on implementing policies regarding wearable technology use in the workplace. This will ensure that the guidelines are clear and concise, as well as address the needs of employees with disabilities regarding the use of wearable technology. Creating transparency and encouraging open communication with HR personnel, and other departments within the company, will allow security and access issues to be resolved quickly and efficiently.[34]

Advantages and Cost/Benefit of Adopting a BYOD Initiative in the Workplace
There are several advantages to adopting a BYOD initiative in the workplace:

- It allows a company to lower its IT costs as a result of putting information in the Cloud and not needing a fixed, physical IT infrastructure or networking.[35]
- It allows employees with smart devices to carryout business tasks wherever, and at whatever time, without the need to go into a particular site to access systems on a set schedule.[36]
- It improves productivity and staff engagement by allowing multiple people to use one communication platform at any time.[37]
- It can attract and retain the best talent including individuals with disabilities by allowing them to respond and keep track of work tasks more efficiently.[38]
- Some companies may be able to obtain stipends to purchase company-owned mobile/ wearable devices for their employees. This may allow individuals with disabilities who are unable to access the technology on their own, to benefit from using it as well as complete work tasks more efficiently.[39]

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[30] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

[31] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

[32] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

[33] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

[34] Wearable Technology Part 1 (accessed January 5, 2016); available from http://info.4imprint.com/wp-content/uploads/1P-13-0714-Wearable-Technology-Part-1-Blue-Paper2.pdf?586da0

[35] 5 Key Advantages to Adopting BYOD in the Workplace (accessed January 5, 2016); available from http://yfsmagazine.com/2013/10/02/5-key-advantages-to-adopting-byod-in-the-workplace/

[36] 5 Key Advantages to Adopting BYOD in the Workplace (accessed January 5, 2016); available from http://yfsmagazine.com/2013/10/02/5-key-advantages-to-adopting-byod-in-the-workplace/

[37] 5 Key Advantages to Adopting BYOD in the Workplace (accessed January 5, 2016); available from http://yfsmagazine.com/2013/10/02/5-key-advantages-to-adopting-byod-in-the-workplace/

[38] 5 Key Advantages to Adopting BYOD in the Workplace (accessed January 5, 2016); available from http://yfsmagazine.com/2013/10/02/5-key-advantages-to-adopting-byod-in-the-workplace/

Clearly, wearables have many positive implications for both employers and employees. Many companies are now analyzing how wearables could help employees maintain good health on and off the job. While some people with disabilities may already use wearable technology for these purposes, research demonstrates that people without disabilities who use using wearables can benefit just as much.[40]

Wearable Technology and Transportation

What is iBeacon Technology?
iBeacon was developed by Apple and uses Bluetooth low energy proximity sensing to transmit a universally unique identifier picked up by a compatible app or operating system. The technology enables smartphones, tablets and other devices to perform actions when in close proximity to an iBeacon. The identifier, and several bytes sent with it, can be used to determine the device's physical location, track customers, or trigger a location-based action on the device such as a check-in on social media or a push notification. One application is distributing messages at a specific point of interest, for example a store, a bus stop, a room or specific location for a piece of furniture. The other application that serves as an indoor positioning system, helps smartphones determine their approximate location or context for the user.

With the help of an iBeacon, for example, a smartphone's software can approximately find its relative location to an iBeacon in a store. iBeacon technology can help individuals who are blind or visually-impaired locate items and provide directional navigation.[41]

Application of iBeacon Technology for Air Travelers with Disabilities
San Francisco Airport personnel are in the process of using iBeacon technology to see how well it allows travelers with vision related disabilities to navigate one of its newest terminals. San Francisco is one of a few airports testing the use of this technology on air travelers with vision related disabilities. The beacons are being installed throughout the terminal. Each beacon will connect to a smartphone app to pop up with information when a user gets within range. For travelers with visual disabilities, the system uses Apple's voiceover technology to read out points of interest as they come on screen.[42] The iBeacon technology may assist travelers with vision disabilities with identifying certain areas within the terminal, as well as getting through security by alerting them to present their boarding passes as they approach the area. While use of iBeacon technology is still in its early stages, many retail stores and entertainment venues are beginning to analyze its implications on customers – including services they provide for individuals who are blind.[43]

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[39] 10 considerations for BYOD cost/benefit analysis (accessed January 5, 2016); available from http://www.techrepublic.com/blog/10-things/10-considerations-for-byod-cost-benefit-analysis/
[40] Wearable Technology: Rewards and Risks (accessed January 25, 2016); available from http://www.jdsupra.com/legalnews/wearable-technology-rewards-and-risks-45963/
[41] iBeacon: Wikipedia, the free encyclopedia (accessed January 5, 2016); available from https://en.wikipedia.org/wiki/Smartphone
[42] San Francisco Airport testing beacon system for blind travelers (accessed January 5, 2016); available from http://www.theverge.com/2014/7/31/5956265/san-francisco-airport-testing-beacon-system-for-blind-travelers
[43] San Francisco Airport testing beacon system for blind travelers (accessed January 5, 2016); available from http://www.theverge.com/2014/7/31/5956265/san-francisco-airport-testing-beacon-system-for-blind-travelers

Scenarios for Dealing with Wearable Technology

Scenario

A woman diagnosed with Stargardt disease, a genetic condition that causes macular degeneration, when she was 11, developed a blind spot in the center of her field of vision and is legally blind.

Solution

She was able to use the eSight device which is equipped with a video camera that sits over the bridge of the wearer's nose. The images captured from the camera are enhanced and projected onto high definition screens in front of the eyes. Using the eSight device, the user was able to see her baby for the first time. The device works primarily for individuals with some peripheral vision. While the device won't help people who have no vision, it can be customized to suit a variety of eye impairments. The user in this case, see's better in lower lighting and therefore adjusts the device on higher contrasts with "white on black." The device also allows the user to adjust brightness and shadow preferences.

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Scenario

A 26-year-old with quadriplegia is a law student at Columbia University. She was paralyzed from the chest down in a car accident. Prior to her accident, she used her smartphone to access maps to get around, take photos and share them with friends, and Googled tidbits of information for all kinds of situations and conversations.

Solution

Google Glass gives all that back to her. She now uses her iPad and iPhone with voice control software and with Siri, and she loves the ability to search with her voice and using Google Glass to search for things and see's the results in front of her right eye. Once she gets through law school, the technology will assist in her career as an attorney.

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44 CNBC News: Kathy Beitz, legally blind mom, sees new baby with special eyewear (accessed February 17, 2016); available from
http://www.cbc.ca/news/canada/kitchener-waterloo/kathy-beitz-legally-blind-mom-sees-new-baby-with-special-eyewear-1.2926876
45 Paralysis VS. Employment: The Technology That's Winning Jobs (accessed February 18, 2016); available from
http://www.amsvans.com/blog/paralysis-vs-employment-the-technology-thats-winning-jobs/

Future of Wearable Technology for People with Disabilities

Hand-Held Wearables in the Home
A new wearable technology developed at the University of Washington called, MagnifiSense can detect what devices and vehicles the user interacts with throughout the day. The technology can ultimately track the individual's carbon footprint, enable smart home applications or even assist individuals with disabilities by allowing them to monitor their daily activities. The sensor worn on the wrist uses unique electromagnetic radiation signatures generated by electrical components or motors in those devices to pinpoint when its wearer flicks a light switch or, turns on a stove.[46] This wearable technology can track user interactions with various items including, microwaves, blenders, remote controls, electric toothbrushes, laptops, light dimmers, and even cars and buses. From a rehab perspective, this technology can monitor how well individuals with disabilities perform Activities of Daily Living (ADL) such as cooking or grooming. It could also potentially detect when a stove has been left on for a long period of time and help alert someone of the danger. While this wearable technology is still in the testing phase, it holds a lot of promise for those with cognitive and physical disabilities because it potentially allows them to independently work on improving functional skills. The hope with wearable technologies such as these is that, with time and research, they will not only improve the lives of people with disabilities but also allow them to regain loss function.[47]

Information and Resources on Wearable Technology

- Wearable Technologies: What Employers Need to Know
  http://www.personneltoday.com/hr/wearable-technology-what-employers-need-to-know/
- Employer's Guide to Wearable Technologies
  http://blog.ironwoodins.com/wellness/employers-guide-to-wearable-technology
- AbilityNet: Helpful resources on wearable technologies and digital accessibility
  https://www.abilitynet.org.uk/tags/wearable-technology
- Top Wearable Technology Chart for 2016
  http://www.consumertop.com/best-wearable-tech-guide/
- ConnectAbility: Provides resources and information on leveraging mobile and wireless technologies to improve the lives of people living with disabilities
  https://connectability.devpost.com/

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[46] New wearable technology can sense appliance use, help track carbon footprint (accessed January 5, 2016); available from
http://phys.org/news/2015-09-wearable-technology-appliance-track-carbon.html
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http://phys.org/news/2015-09-wearable-technology-appliance-track-carbon.html