High-tech aids for the blind and visually impaired

Quest explores some advances in assistive technology

Worldwide, more than 36 million people are blind and at least 220 million have moderate to severe vision impairment. There are a variety of aids to assist people with this kind of disability in their daily lives, from talking watches and Braille tape measures to coin selectors and special telephones. In the last few years, however, technological advances have made a huge difference in easing the challenges faced by the blind and visually impaired.

For learners and students, **Braille notetakers** are especially useful as they allow notes to be recorded during class or assignments to be typed and submitted. The different models come with either a standard QWERTY keyboard, a Perkins-style Braille keyboard or a touchscreen. They can be connected via USB, Bluetooth, Wi-Fi or serial port to the internet, as well as to normal printers and monitors, so that assignments can be emailed, printed or displayed for a sighted teacher to mark. Most advanced notetakers include both Braille and speech output, allowing the learner to check whatever has been typed and review it for studying purposes via either a refreshable Braille display or the built-in speakers. The devices can also be used to read or listen to books, play music or podcasts, record voice notes or lectures, do calculations and send instant messages. When connected to a computer with installed screen-reading software, such as JAWS (Job Access With Speech) or NVDA (NonVisual Desktop Access), they allow the user to read or listen to text on the computer screen.

Printed text can be read using a stand-alone reading machine such as the Eye-Pal Solo, which resembles an overhead projector. It scans the page of printed material and reads it aloud, and the text can be saved electronically on a USB flash drive.

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A considerably more versatile and mobile option is the **OrCam MyEye** – a tiny camera that can be attached to any pair of eyeglasses. Billed as 'the world's most advanced wearable assistive device', it uses artificial intelligence and machine learning to read printed and digital text aloud, and can also recognise faces, currency and even details about products, using barcodes to identify the brand and other details, if available. It's operated by pressing a button on the device or via gesture control, by simply pointing a finger at the object being viewed. Two other gesture controls can be used to stop reading and to tell the time. The latter involves looking at the back of the wrist with the first closed; the user will hear the time, even if not wearing a watch.

However, there are also smartphone apps that do much the same thing, using the phone's camera and touchscreen screen-readers such as Apple's VoiceOver (iOS) and Android's TalkBack (now part of the Android Accessibility Suite).

For example, Seeing AI – launched by Microsoft in July 2017 – is a free app that 'narrates the world around you'. It allows the blind and visually impaired to read or identify short text, documents, products, currency and colours. As for OrCam, photographing people and adding them to the app's database will enable the user to recognise them through facial recognition technology, and get an estimate of their age, gender and emotions. The app can even read handwriting, describe photos, generate an audible tone corresponding to the brightness of the user's surroundings, and attempt to describe the scene, recognising obvious features like trees, houses, pets and furniture.

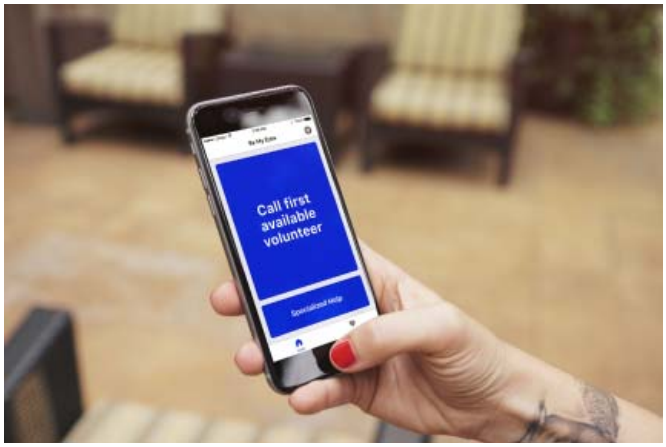
Currently, Seeing AI is only available for iPhones, and English is the only language supported. However, **Envision AI** is available on both iOS and Android, and

Envision

it can read text in over 60 languages. Developed by a start-up called Envision Technologies in the Netherlands, it won the Best Accessibility Experience prize at the 2019 Google Play Awards, considered the 'Oscars' for app developers. It can do most of the same functions as Seeing AI – and better in some cases – but it is not free, as there is a subscription fee following a month-long trial period. Likewise, Eye-D from India-based GingerMind Technologies has a free version with limited functionality, and a Pro version with a small fee of R125 and various in-app purchases, although reviews are mixed.

Google released its own version, called Lookout, on its Pixel 3 smartphone in October 2018, and it is now available on some LG and Samsung phones too, but the app can still only be downloaded by those with a USA-based account. It works slightly differently as the idea is to have the phone in a shirt pocket or hanging round the neck on a lanyard with the camera facing out, and auditory cues will be given as the person encounters things around them. The 'Home' mode, for example, will give a notification saying "couch three o' clock" if there is a couch on the person's right, while the 'Work & Play' mode looks out for things like elevators, computers and wastepaper bins. Apart from this Explore setting, there are 'Shopping' and 'Quickread' settings that scan barcodes, identify products and read text, like the other smartphone apps mentioned above.

BeMyEyes, developed in Denmark, is a free iOS and Android app that takes a different approach. Instead of using artificial intelligence, it connects blind and low-vision people with sighted volunteers for visual assistance through a live video call. A volunteer might help a blind person, for example, to choose the best tie to go with a shirt, or identify the correct platform at the train station, or read a handwritten note. To date almost three million volunteers from over 150 countries have signed up, offering to assist in more than 180 languages. Since just over 150 000 blind and low-vision people are using the app, it can take more than a year before a volunteer is called for the first time, but it is heart-warming that there are so many people willing to help.



BeMyEyes

Another interesting offering is **WeWALK**. It is available on both Google Play and the iOS app store, but it is actually a device that can be fitted as a handle to the top of any white cane, turning it into a 'smart cane'. The main function is to warn the user of obstacles up to 160 cm away, from chest height and above, using an ultrasound sensor. The user is alerted by vibrations in the handle if, for example, there is an overhanging branch up ahead. The device can be controlled via either a touchpad or voice activation, with English and Turkish currently the only languages supported (WeWALK was designed by Kürşat Ceylan, a blind social entrepreneur from Turkey). By pairing the device with a smartphone, using Bluetooth and the WeWALK app, it can be integrated with Google Maps and Voice Assistant to get audible walking directions through the phone's speakers.


WeWALK

Google Maps itself recently became more useful to the blind and visually impaired, when a new feature began rolling out on 10 October 2019, which was World Sight Day. Users will now have the option of receiving more detailed voice guidance and new types of verbal announcements for walking trips. The app will let users know that they are on the correct route, the distance until their next turn and the direction they are walking in. Upon approaching large intersections, they will get a warning to cross with added caution. And if they accidentally leave their intended route, they'll get a spoken notification that they are being re-routed. Initially the feature was only available in English in the United States and Japanese in Japan, but support for additional languages and countries will be added soon.

Google Maps

A PhD student at Stellenbosch University is making his own contribution to assistive technology for the blind, hoping to make life easier for students who come behind him, as well as academics and professionals who need to interpret technical diagrams. Rynhardt Kruger is blind himself, having been born with a retinal degenerative disease, but he is also a computer boff, who decided he wanted to be a programmer when in Grade 10. He started his BSc at Stellenbosch University in 2009 and went straight on to Honours and Master's, becoming the first blind 'Matie' to obtain postgraduate degrees in computer science.

Until Rynhardt discovered his love of computers, he wanted a career in music, as he played both the piano and violin. So it's perhaps not surprising that he blended his gifts for his Honours project, when he developed a computer-based reading system for musical scores. This was a cross-platform solution allowing blind musicians to access music downloaded from the internet using all major operating systems.

For his Master's project, Rynhardt developed software to navigate Second Life, an online virtual world. Second Life users create avatars for themselves, and interact with places, objects and other avatars. "Second Life is a virtual space for whatever you do in real life, and the technology is also used a lot in academia, for conferences," explains Rynhardt. "So I wrote a program that can be used by blind people to access Second Life, because it mostly relies on visual information – things that you can see on a screen, such as a forest clearing, or a gathering of people. I basically translated all those things into sound, through audible descriptions. My program worked well enough that I could use it to attend a virtual conference in a virtual world."

His PhD focuses on addressing a problem he encountered during his undergraduate degree. He explains that the only way for blind people to access flow diagrams, graphs and charts is to print them out on a tactile printer, and these machines are extremely expensive, so he had to make do with somebody describing diagrams to him. "But of course, if you think about the reason why people use diagrams, it's because a description isn't adequate – otherwise people would just have written descriptions in their papers! Sometimes it's necessary to know the relationships between elements in a diagram, or scale and so forth."

"So what I'm attempting to do is to use sound and a touchscreen to convey a shape of a technical diagram for blind people," he says. "Certain sounds would denote elements of the diagram, so they will be able to explore the diagram on the touchscreen, and get an idea of what it looks like by listening to the sounds."

He hopes to complete his PhD in 2020, and then continue working in the field of assistive technology.

"It's quite a passion for me," he says "Since I'm in computer science and I'm blind myself, I feel I have a deeper understanding of how assistive technologies could potentially work."

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