

Instrument Corner

Smartphone apps for visually impaired persons

ABSTRACT

As ophthalmologists, we often come across visually impaired persons (VIPs) whose poor vision we cannot improve. They would benefit with low-vision aids (LVA), but most are reluctant to use them. The visually impaired find it difficult to use advanced technology, as it is often not designed with them in mind. When the world switched from phones with keyboards to full-screen touchscreens, VIPs found it difficult without the tactile feedback of physical keyboard buttons. However, in recent years, there have been numerous innovative apps to assist people with low vision, to not only navigate their smartphone but also their environment and daily life. Programmers have made the use of the high-resolution cameras, gyroscope sensor, vibration feedback, and audio feedback to convert smartphones into LVA, often for free and with no additional hardware. The authors review some of the smartphone apps available for those with low vision. These apps can bring a certain level of independence and self-confidence in these people who are otherwise often dependent on others.

Keywords: Android, blind, iPhone, low-vision aids, smartphone apps, visually impaired

INTRODUCTION

Technology is rapidly advancing, and visually impaired people would find it difficult to use complex technology. There are software available for a visually impaired person (VIP) to navigate the computers such as Jobs Access With Speech-paid software^[1] and Nonvisual Desktop Access-free software.^[2]

Visually impaired are often reluctant to start using low-vision aids (LVA) not only due to affordability and accessibility but also other factors such as social stigma and denial.^[3] However, a smartphone is often available to them, and the ability to use a smartphone can empower the visually impaired. Several smartphone apps are available to help visually impaired and blind people with activities of daily life. These free apps can work well on older smartphones also and thus remove the cost and availability barrier for smartphone-based LVA. The authors hope that visually impaired people become aware of and get training on using these easily accessible LVA already in their pockets.

Most of these apps do not require any extra hardware and many are free. There are apps designed to read out loud from the smartphone menus, voice control, read out books, and

even read out text from photographs clicked by the phone. Some apps can identify colors, objects, and money. There are apps which can be used as LVA such as magnifiers. Some innovative apps use virtual reality and augmented reality headsets to enhance the remaining vision of glaucoma and macular degeneration. There were a few multipurpose apps that did several of these functions.

Types of apps

- Smartphone accessibility
- Voice control
- Tools
- Smartphone games for the blind
- Camera-based identifiers and readers
- Navigation and maps

JOHN DAVIS AKKARA^{1,2}, ANJU KURIAKOSE³


¹Department of Glaucoma, Westend Eye Hospital, Cochin,

²Department of Ophthalmology, Little Flower Hospital and

Research Centre, Angamaly, ³Department of Ophthalmology,

Jubilee Mission Medical College, Thrissur, Kerala, India

Address for correspondence: Dr. John Davis Akkara, Department of Glaucoma, Westend Eye Hospital, Kacheripady, Cochin - 682 018, Kerala, India.
E-mail: johndavisakkara@gmail.com

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- Magnifiers and LVA
- eBook readers
- India-specific apps
- Innovative apps
- Tutorials.

Smartphone accessibility

Accessibility software is the enhancement of the operating system with high-contrast text and audio feedback and is often available in the smartphone settings without any additional app installation.

- Android accessibility suite^[4] – Menus, Select to Speak, screen reader, and Bluetooth keyboard [Figure 1]
- Blind accessibility keyboard^[5] – high contrast and voice feedback keyboard [Figure 2]
- Blind launcher^[6] – launcher menu with high contrast, voice feedback, and shortcuts

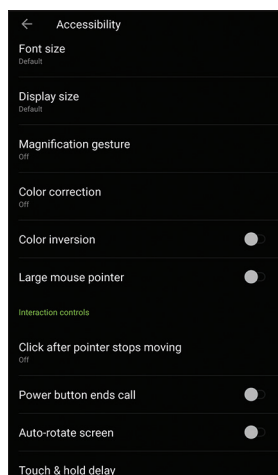


Figure 1: Accessibility options to improve the text visibility available in all Android smartphones (Image courtesy: Android accessibility suite)



Figure 3: Talking calculator app with high contrast and voice on button presses (Image courtesy: Talking Calculator)

- Google BrailleBack^[7] – connects Bluetooth Braille Keyboard
- RAY Vision^[8] – redesigned touch navigation.

Voice control

- Voice access^[9] – controls smartphone using voice commands
- Google assistant^[10] – Google's voice assistant
- Siri^[11] – Apple's voice assistant
- Cortana^[12] – Microsoft's voice assistant.

Tools

- Talking calculators^[13] – Calculators with voice control that speak out the answers [Figure 3]
- Sero (iBlink Radio)^[14] – radio app targeted at low vision
- Big Digital Clock^[15] – high contrast and large clock [Figure 4]
- Speechnotes^[16] – Voice recognition notepad [Figure 5]
- Speaking Alarm Clock^[17] – speaking alarms, stopwatch, and reminders

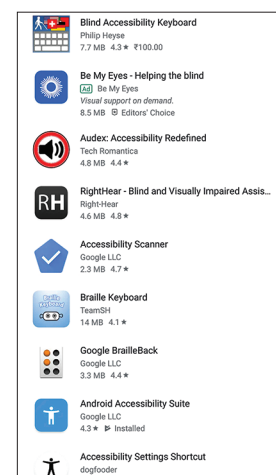


Figure 2: Third-party accessibility keyboards available in Play Store including Braille keyboards (Image courtesy: Google Play Store)

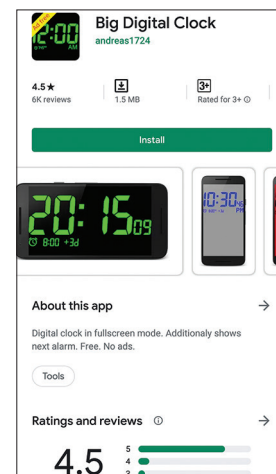


Figure 4: High-contrast, large font digital clock with alarms (Image courtesy: Big Digital Clock)

- Low vision^[18] – High-contrast clock, calculator, contacts, and camera.

Smartphone games for blind

- Blind mini games^[19] – 8 games: directions, runner, memory, hearing test, animals, numbers, tones, and fast numbers [Figure 6]
- Blind cricket^[20] – high-contrast cricket game based on sounds designed for visually impaired
- Audio Game Hub^[21] – archery, slot machine, level 3, and Super Simon
- Blind-Droid Minesweeper^[22] – Minesweeper with special mode for low vision
- ChessBack^[23] – Chess designed for low vision and blind players.

Camera-based identifiers and readers

- Cash Reader: Bill identifier^[24] – Currency identifier for several international currencies. Works offline after a particular currency database are downloaded [Figure 7]

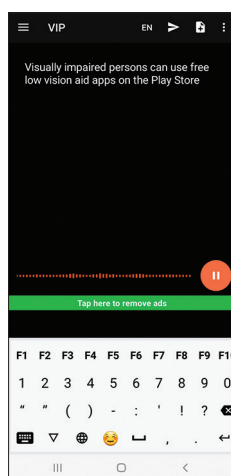


Figure 5: Voice dictation in real time (Image courtesy: Speechnotes)

- Speak!^[25] – Text reader and translator from photographs
- Envision AI^[26] – Photo describer, text, and handwriting reader
- Color grab^[27] – Identifies colors from camera view and photographs
- TapTapSee^[28] – Photo identifier
- Supersense^[29] – Use camera to look around and find a particular object you are searching for. Does not need Internet connection to work
- Labeler sound tags^[30] – Tag things with custom QR codes and use smartphone to identify them later
- Microsoft Seeing AI^[31] – Identification of people, faces, emotions, objects, and text from camera (iPhone only) [Figure 8]
- WeVoice^[32] – Object identifier and text reader from camera photographs.

Navigation and maps

- FAR Vision^[33] – navigation and restaurant menus
- RightHear^[34] – location and nearby places and navigation
- Lazarillo GPS^[35] – navigation GPS for the blind



Figure 6: Several small games to be played using sounds (Image courtesy: Blind Mini Games)

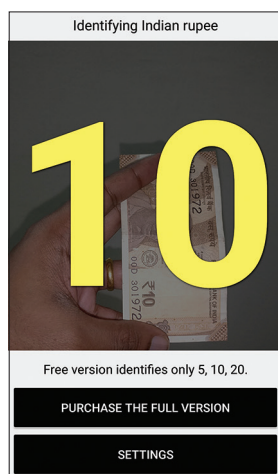


Figure 7: App that can recognize several international currencies (Image courtesy: Cash reader: Bill identifier)

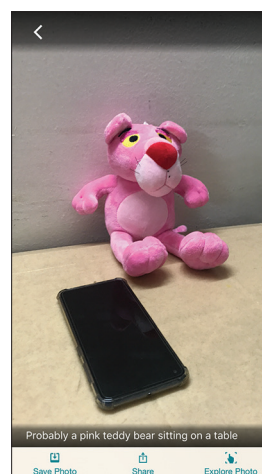


Figure 8: Microsoft Seeing AI app recognizing a scene from a real-time photograph using artificial intelligence (Image courtesy: Microsoft Seeing AI)

- Eye-D Pro^[36] – navigation, read text, and identify objects (free version has restricted features since October 2019) [Figure 9]
- GetThere GPS^[37] – voice navigation and location alarm
- Nearby Explorer Online^[38] – free outdoor and indoor navigation based on OpenStreetMaps and Google Places.

Magnifiers and low-vision aids

- My reading eyes free^[39] – camera magnifier with negative image option
- weZoom^[40] – camera magnifier with contrast, color filter modes, and LVA [Figure 10].

Book readers

- Dolphin EasyReader^[41] – book reader for dyslexia, low vision, and blind
- Voice dream reader^[42] – High-contrast, adjustable font size, OpenDyslexia font, and voice reader

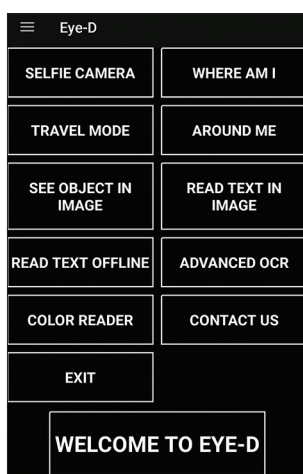


Figure 9: Eye-D App which has options to detect objects, text, and color (Image courtesy: Eye-D Pro)

- Audible^[43] – Audiobooks read by human voices
- Free audiobooks^[44] – Free audiobooks read by human voices from LibriVox-free library project.

India-specific apps

- Roshni- Currency Recognizer^[45] – Indian currency identifier [Figure 11]
- DIGNIFY^[46] – Hindi and English text reader from camera (Aravind Eye Hospital).

Most innovative

- Samsung Good Vibes^[47] – Two-way communication app for the deaf-blind. Converts text or voice into vibrations and vibrations into text or voice [Figure 12]
- Be My Eyes^[48] – crowd-sourced photo identification from sighted volunteers [Figure 13]



Figure 10: Using the smartphone as an electronic low-vision aid to read fine text on medication bottle or book. There are options to change zoom, color, brightness, and contrast.(Image courtesy: weZoom)



Figure 11: Indian-made free currency recognizer app for Indian rupee (Image courtesy: Roshni Currency Recognizer)

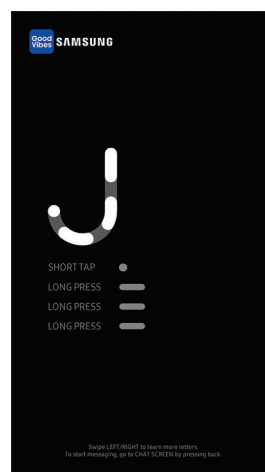


Figure 12: Samsung's innovative app that helps the deaf-blind send and receive smartphone messages using vibrations and taps (Image courtesy: Samsung Good Vibes)

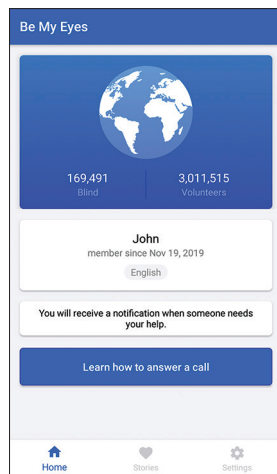


Figure 13: Crowd-sourced helping of visually impaired persons by being available for real-time visual help (Image courtesy: Be My Eyes)



Figure 14: Innovative app using synesthesia to convert live camera images into soundscapes to help the blind “see” (Image courtesy: The vOICe)

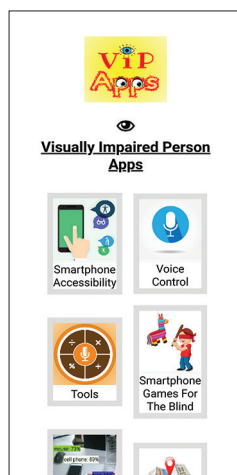


Figure 15: Guide for apps available for visually impaired persons (Image courtesy: VIP apps)

- LVFree Vision Enhancer^[49] – Free app from the University of Michigan that uses virtual reality headset as a LVA by adjusting magnification, brightness, and contrast
- IrisVision^[50] – Commercially available smartphone in virtual reality headset with camera open for advanced

macular degeneration, retinitis pigmentosa, and glaucoma patients

- The vOICe^[51] – App converts live video into soundscape which can be “seen” by a blind person through synesthesia [Figure 14].

Tutorial

- Braillic: Braille tutor^[52] – Braille tutorial
- VIP: VIP apps^[53] – Guide to these low-vision apps [Figure 15].

CONCLUSION

Smartphones have changed our lives in many ways. They are now an essential part of our daily life. Low-cost smartphones are accessible and affordable to most patients. Visually impaired can easily use free and low-cost apps to enhance their technology experience. Powerful apps can run on most modern smartphones. Indian versions of apps with support for Indian languages and Indian currencies are available. A training of the VIP is required to start using the apps.

As ophthalmologists, we come across several patients whose vision we cannot improve due to diseases beyond our control. We should be able to advise patients regarding low-cost LVA such as these apps in addition to traditional options. Ophthalmologists should be aware of these apps and low-vision clinics should have this information available. Perhaps, a tech-savvy, visually challenged person can be tasked with teaching the usage of apps to patients. In today’s world, it is almost an essential part of our daily life to be able to operate these technologies.

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Conflicts of interest

There are no conflicts of interest.

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