User feedback on usefulness and accessibility features of mobile applications by people with visual impairment

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Purpose: This study aimed at compiling a catalog of mobile applications with accessibility features. The results are expected to provide useful insight into its usage in daily life. Methods: This study was conducted at the Institute for Vision Rehabilitation, Hyderabad in two steps. In step one, 57 potential mobile applications that were useful for persons with visual impairment were identified. In step two, these were explored by 15 participants and their feedback was analyzed through SPSS statistical package. Results: Fifteen mobile users who are visually impaired took part in the study whose mean age was 22 years. A total of 57 mobile applications were explored and rated as per the user’s feedback on its usage and accessibility features. Overall rating of general applications ranged from 2.3 to 4.55 and the rating of exclusive applications designed for visually impaired ranged from 2.8 to 4.8. Compilation of catalog of mobile assistive software and its usage through the data generated from this study provides important information to the PVI. Mobile users with visual impairments, the built-in accessibility features of the apps that were originally developed for the general population is the constructive move by the app developers towards inclusion. The same should be reinforced that henceforth all new applications to be accessible for people with disabilities to the standards prescribed by the Web Content Accessibility Guidelines. Conclusion: Mobile technology is a real boon to persons with visual impairment in enhancing their independence. The catalog on accessible mobile applications developed through this study is a valuable tool in providing information on a wider collection of apps to new mobile users.

Key words: Accessibility guidelines, assistive software, mobile technology, visual impairment

Technology enables acquisition of information and knowledge required for education, employment, and building social networks. In today’s world, assistive technology (AT) has enabled people with visual impairment (PVI) to access the same level of information and knowledge in areas such as employment, education, communication, independent living, and leisure thus enabling their overall functional independence and social participation.[1-4]

Among the communication technology, smartphones have been gaining increased attention than desktops, laptops, tablets, television, etc., because of its convenience in usage for multiple purposes.[5] The influence of smartphones is likely to continue in the years to come, as this cutting edge technology becomes more and more ubiquitous all around the world. Smartphones are not exempted for PVI as with AT they can have the freedom to access the same level of information like any other sighted users.[6] They become the game changers as they grant the same access to the digital world to users with visual impairment as everyone else. Most mobile operating systems (Android, Windows, and iOS) offer inbuilt accessibility features such as screen readers, screen magnifiers, speech to text features, etc., which allow people with impairments to access information that would otherwise be inaccessible or require manual assistance can now be automatically transformed into formats better suited for them.

There are several generic apps in usage that enable one to browse information, check emails, send text messages, shop online, book tickets, etc. However, its usage becomes difficult by PVI as a large majority of these apps have been originally designed for people with normal sight with little accessibility features added at later point posing difficulties in free usage. On the other hand, there are several apps claimed to be developed exclusively for PVI,[7-16] which users are restricted or may not be the choice of an app by PVI as most often the developers developed such apps were developed without consultation the opinions of end users on their priority and convenience.

This study aimed at compiling a catalog of mobile applications with accessibility features, which can be used as a referral guide for persons with visual impairment and practitioners. The analysis of user’s feedback on these applications is expected to provide useful insight into the practical usage of these applications in a real-life situation. The feedback on critical accessibility features is also expected to be useful for the developers in designing future products.

Methods

This study was conducted at the Institute for Vision Rehabilitation, LV Prasad Eye Institute, Hyderabad in 6-months.

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## Table 1: Description and users' feedback on mobile apps that are exclusively designed for the people with visual impairment (n=45)

| Application                  | Platform               | User Rating | Rating - Category |
|------------------------------|------------------------|-------------|-------------------|
| Voice over                   |                        |             |                   |
| TalkBack                     | Android                | 4.2         | 1.2-4.8           | 3.5 |
| Narrator                     | Windows                | 3.8         |                   |     |
| KNFB reader                  | iOS & Android          | 4.1         |                   |     |
| Text Detective               | iOS & Android          | 1.8         |                   |     |
| Simply Reading               | Android                | 4.0         |                   |     |
| Smart Lens                   | iOS and Android        | 4.8         |                   |     |
| Office Lens                  | iOS                    | 4.1         |                   |     |
| Talking Typer                | Android                | 1.2         |                   |     |
| Daily Activities             |                        |             |                   |     |
| Color Identifier             | iOS & Android          | 2.8         | 1.8-3.5           | 3.5 |
| Looktell money reader        | iOS                    | 3.5         |                   |     |
| Blip Blip Hourly chime       | Android                | 4.0         |                   |     |
| MessagEse keyboard           | iOS & Android          | 3.2         |                   |     |
| ScanLife Barcode & QR        | iOS & Android          | 1.8         |                   |     |
| AutoRingtone Pro             | iOS & Android          | 3.0         |                   |     |
| Food app                     |                        |             |                   |     |
| Good Food Talks              | Android                | 2.3         | 2.3               | 2.3 |
| Human assistance             |                        |             |                   |     |
| Be my eyes                   | iOS & Android          | 4.8         | 4.3-4.8           | 4.55|
| Helping Hands                | iOS and Android        | 4.3         |                   |     |
| Multipurpose                 |                        |             |                   |     |
| Eye-D                        | Android                | 4.2         | 2.4-4.9           | 3.8 |
| Aipoly                       | iOS & Android          | 2.4         |                   |     |
| Seeing AI                    | iOS                    | 4.9         |                   |     |
| Seeing Assistant light       | iOS & Android          | 3.7         |                   |     |
| Magnifiers                   |                        |             |                   |     |
| Zoom                         | iOS                    | 4.1         | 3.8-4.1           | 3.9 |
| Magnification gestures       | Android                | 3.9         |                   |     |
| Visor Magnifier              | iOS & Android          | 3.8         |                   |     |
| Navigation                   |                        |             |                   |     |
| ViaOpta Nav                  | iOS & Android          | 3.1         | 3.1-4.1           | 4.6 |
| Seeing Assistant Move        | iOS & Android          | 4.1         |                   |     |
| Leisure & Social             |                        |             |                   |     |
| Vorail                       | iOS & Android          | 3.7         | 3.75-5            | 4.3 |
| Newshook                     | iOS & Android          | 4.3         |                   |     |
| A blind legend               | iOS & Android          | 5.0         |                   |     |
| LibriVox                     | iOS & Android          | 4.1         |                   |     |
| NFB- connect                 | iOS & Android          | 3.7         |                   |     |
| Greta                        | iOS & Android          | 4.0         |                   |     |
| Braille apps                 |                        |             |                   |     |
| Brailliac-Braille Tutor      | Android                | 1.8         | 1.2-4.1           | 2.49|
| Google Brailleback           | Android                | 4.1         |                   |     |
| Braille Buddy                | Android                | 2.4         |                   |     |
| Braille                      | Android                | 2.3         |                   |     |
| BrailleOne                   | Android                | 2.7         |                   |     |
| Smart Braille                | Android                | 2.1         |                   |     |
| Braille contraction          | Android                | 2.2         |                   |     |

Contd...
period (July–December 2018) in two steps. In step 1, internet search was done to find information on mobile apps that were exclusively developed for blind and low-vision users as well as all other apps developed for general use but have the accessibility features for use by blind and low vision. The search resulted in finding a total of 57 potential apps. These apps were classified into subgroups based on its functionality such as Braille apps, text readers, image readers, GPS navigation apps, screen readers, screen magnifiers, barcode identifiers, color identifiers, leisure apps, volunteer assistance apps, shopping apps, transport apps, etc. Key information’s of these apps such as developer’s information, description of function of the app, compatible platform, paid or open-source, and link to explore more information on the app.

In step 2, an open invitation was sent to 25 mobile users who were the previous beneficiaries of the rehabilitation services (April–June 2018) to participate a workshop organized at the center to explore and share their feedback and comments on the 57 apps that were identified previously, in which a total of 15 beneficiaries participated. The mean age of the participants was 28 years. Participants were asked to explore each app and rate their comments based on their satisfaction on a scale of 5, (1 – least and 5 – very high). Participants were asked to do the rating of the apps based on the parameters such as the usefulness of the app relating to their daily function, accessibility features of the app to use them easily, and their comments on pricing if it was a paid app. Descriptive analysis was performed on the cumulative data retrieved from the participants using the Statistical Package for Social Sciences (SPSS) 16.0 (SPSS Inc., Chicago, IL). The study protocol was approved by the Institutional Review Board of LVPEI, and the research adhered to the Tenets of the Declaration of Helsinki.

**Results**

A total of 15 participants took part in the study whose mean age was 22 years. The educational qualification of the participants was graduate and above, all of them were all also employed (n = 15). The years of experience in smartphone use is a minimum of 7 years, except for 1 participant. Two-thirds of the participants were familiar in using the assistive gestures from both iOS and Android.

A total of 57 apps were found to be useful for persons with blind and visually impaired from the internet search, which were broadly fit under 12 categories [Fig. 1] such as voiceover, daily activities, food apps, human assistance, multipurpose, magnification, navigations, leisure & social, braille, online library, transport, and online shopping.

Within categories, the highest number of apps developed for voiceover (n = 8), Braille (n = 9), leisure & social (n = 6), and daily activities (n = 6). The overall rating for applications among all categories ranged from 2.3 to 4.55. Voiceover (n = 8) and Braille (n = 10) related had highest applications within the category and food-related category had the least application (n = 1). Excluding food-related and Braille-related category, the remaining applications had scored an average of 3.5 ratings. Google Braille (4.1) and Pocket Braille (4.3); the remaining Braille-related apps were very poorly rated [Table 1].

The overall rating for all 12 generic applications was ranging from 2.8 to 4.8. From the list of applications, nine were designed to be functional both in Android and iOS platforms [Table 2].

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**Table 1: Contd...**

| Application                  | Platform        | User Rating | Rating - Category |
|-----------------------------|-----------------|-------------|-------------------|
| The Android Braille slate   | Android         | 1.8         | 3.6               |
| Arabic Braille              | Android         | 1.2         | 3.6-4.3           |
| Pocket Braille Library      | iOS & Android   | 4.3         | 3.9               |
| Bard Mobile                 | iOS & Android   | 3.6         |                   |
| Go Read                     | Android         | 4.3         |                   |
| Learning Ally Link          | iOS & Android   | 3.8         |                   |

**Table 2: Description and users feedback of third-party mobile apps that have assistive gestures for use by people with visual impairment (n=12)**

| Name           | Platform       | Key function          | Rating |
|----------------|----------------|-----------------------|--------|
| Uber           | iOS and Android| Cab services          | 4.5    |
| Ola            | iOS and Android| Cab services          | 2.8    |
| Uber Eats      | iOS and Android| Food delivery services| 4.2    |
| Swiggy         | iOS and Android| Food delivery services| 3.7    |
| Amazon         | iOS and Android| Online shopping app   | 3.3    |
| Big Basket     | iOS and Android| Online shopping app   | 3.1    |
| XL cinema      | iOS and Android| Audio description     | 4.2    |
| Google Maps    | iOS and Android| GPS navigation        | 4.0    |
| Tapzo          | iOS and Android| Multipurpose          | 4.0    |
| Siri           | iOS            | Voice assistant       | 4.8    |
| Google assistant| Android       | Voice assistant       | 4.6    |
| Cortana        | Windows        | Voice assistant       | 4.2    |

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**Figure 1: Categories of mobile apps with accessibility features**
Discussion
This study enabled in creating a roadmap for the PVI; blind and low vision on various assistive mobile technologies that are available for use by them. Through the user group, this study explored the functionality of an overall 57 mobile applications that have accessibility features of which 12 applications were exclusively designed for the blind and low vision and the remaining were generic users including the visually impaired. The feedback of the users ranged from 1.2 (the least score) to 5 (the highest score) indicates in a sense the accessibility features for the VI users. Among these apps that were related to Braille were rated the least (Range 1.2–2.7) and apps related to reading were rated high (Range 4–5). This feedback is an important indicator for the researchers and educators in the further development of their apps for PVI. It’s really important to include the PVI in the design of the app right from the stage of “concept perception” for their feedback on the usefulness of the app and expected features of the app by them. Among the third-party apps, all 12 were rated good (Range 2.8–4.8 with a median of 3.95), which is a positive indicator that PVI could access even the general apps at ease through screen readers, which they can enjoy the benefits of such apps.

There has been increasing awareness among the software developers, in developing an inclusive platform for the PVI to access information and knowledge. Hence, there have been efforts to develop all-new or redesign web applications accessible to people with disabilities to the standard prescribed by the Web Content Accessibility Guidelines 2.0. Touch displays in mobile devices are more and more present in everyday life. Hence, built-in accessibility should be made mandatory from the beginning of developing the applications so as the PVI enjoys every single app at the same phase that is in existence like sighted rather waiting for the accessibility features to be redesigned.

Conclusion
The findings of this study indicate that mobile technology is a real boon to the PVI in enhancing their independence. This study enabled in developing a portal on accessible mobile apps for the PVI, which can assist them to gain first-hand information and knowledge to a wide collection of apps available for them. The user feedback and rating from this study will be of use to the developers to consider certain factors in their design centered on PVI. This study recommends future work on understanding the challenges and barriers in mobile phone usage among nonmobile users with vision loss.

Implications for practitioners: developers of apps for individuals with visual impairments need to refine and test the existing apps. Practitioners need to be knowledgeable about app usage so they can provide effective instruction to their students or clients. This study provides preliminary information regarding app usage among persons with visual impairments.

This study acknowledges the limitation of a smaller sample size from the participant of a workshop; hence, the results cannot be considered as the generalized opinion of all PVI. Based on this information, further studies in this direction with larger sample size are recommended.

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Conflicts of interest
There are no conflicts of interest.

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