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Challenges and Opportunities in Making Digital Devices in India: Supporting the Children with Visual Impairment



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ABSTRACT

In today's world, digital devices occupy a significant part of each individual's daily activities. Digital devices are also helpful for every child with and without disabilities in their day-to-day life. As various digital devices that support normal children in their learning, different digital devices for children with visual impairments also assist them in learning. They help to enhance their knowledge, skills and attitude. Apart from the support to children with visual impairments to manage their life, digital devices assist them in reading, writing and doing arithmetic. Apart from Braille, so many devices help them use in daily activities. They help children with visual impairment increase their access to the general curriculum and improve their academic performance. Many children with disabilities depend on these devices to empower themselves and be productive in their societal lives. This advancement in technology has improved the design of such digital devices and has increased the accessibility of children with disability. But there are many challenges in accessing these devices in India due to technical and organizational barriers. These barriers hinder the effective design and accessibility of digital devices. This paper explores the challenges in producing digital devices in India for children with visual impairment and opportunities to find novel solutions. Applying the technical development, the companies should walk across the boundaries and explore new ideas to design apt and more appropriate digital products that can be accessible to children with visual impairment and make their lives productive.

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1.0 INTRODUCTION

In the age of social media, digital accessibility is essential for creating a truly inclusive world for everyone. It means equal access to online education, healthcare, employment and e-commerce for people with and without disabilities. Digital accessibility is at the centre of gaining access to the different technology products, either hardware or software. It provides equal access to a wide range of users using digital products, irrespective of their abilities and disabilities. It also helps abolish the barriers to accessing websites, mobile apps and other digital tools and technologies. It allows persons with disabilities to participate in educational, economic and political events and make them beneficial.

1.1 Digital Accessibility in India

The concept of producing digital products, like blogs & webpages, smartphone applications, and other internet resources, available to everyone is referred to as digital accessibility. Community development for people with disabilities was an important goal for India when it signed the “United Nations Convention on the Rights of Persons with Disabilities (UNCRPD)” in 2007. Since then, the government has made the internet more accessible to everyone. Access to electronic and other forms of information and communication technology should be made more accessible. The government has adopted a National Policy on Universal Electronic Accessibility to accomplish this goal ([Kulkarni, 2018](#)).

As defined by the “Ministry of Social Justice and Empowerment's Department for Empowerment of Persons with Disabilities, the ‘Accessible Indian Campaign’ aims to make Indian infrastructure, public transit, and official documents and websites more easily accessible to people with disabilities ([Accessible Indian Campaign, 2015](#))”. Despite this campaign's efforts, research on digital technology shows that India is behind other nations in adopting regulations for people with disabilities in the digital era ([The Centre for Internet & Society, 2011](#)).

1.2 Digital Accessibility and Visual Impairment

Children who suffer from total loss of sight or presence reduction can generally be visually impaired. This type of impairment consists of totally blind students and children with a vision that is insufficient to read print and should be educated in braille ([Kiarie, 2004](#)). Visual impairment is caused by genetic or environmental factors, accidents or eye injury, cataracts, glaucoma, malnutrition and vitamin A deficiency. Some people are visually impaired by birth, and some may have lost their vision due to accidents, illnesses, or diseases. Vision impairment can also be occurred due to the intake of drugs in the early month of pregnancy. As a result of limited access to health care, the majority (90 per cent) of people with vision impairments reside in developing countries ([Naipal and Rampersad, 2018](#)).

Children with visual impairment identify objects or surroundings by touching, hearing and sense of smell. They used to read by braille system, which helps people with visual impairment read and write. They use various devices for learning, such as talking calculators, talking computers, braille keyboards and screen readers. They face more challenges due to the lack of technological devices, negative attitudes, lack of writing and reading materials, lack of special needs, support services, etc. They are also unable to access the digital information present on the websites.

Digital devices help people with physical and cognitive impairments access information efficiently. They have become one of the crucial needs and support for individuals with disabilities to

perform their daily activities independently. These electronic equipment are used to receive, store, send and process digital data. They help abled and challenged individuals to equip their lifestyle productively. The children can also enhance their learning and pursue their higher studies and therefore live with dignity in society with the support of these devices.

Many sophisticated digital devices are made accessible for children visually challenged abroad, and in India, it is not extended. There is an excellent barrier to accessing these devices for children with exceptionalities due to their low affordability since they are primarily designed and marketed by foreign companies. In India, the people's ability to purchase a device or hire a product for accessing digital information is more petite. Moreover, we rely on foreign companies for many sophisticated digital devices rather than making one in our own country.

Initially, the devices developed by western countries were used by needy people in India. Now engineering college students and IIT students have started designing cheaper and customised products according to the local needs of these people. The scenario is changing at a small pace, but we have to travel a long way. The rate of making low cost-effective digital devices is low, and there is also no organised market for selling the designed products. As there is no proper marketing channel, the cost of the digital devices is higher, which people with visual impairment cannot afford.

2.0 EXISTING DIGITAL DEVICES – A GLANCE

Some digital devices help the people visually impaired to live independently. They are:

2.1 Tellmate

Tellmate is a complete set of spectacles that may be used to analyse pictures for those who have vision impairments. It uses hearing aids to turn the visuals into sound and whisper it into the ear.

2.2 FJ Typer

It's a computer programme designed to assist kids with low vision to improve their eyesight. The letters F and J of the Braille alphabet are now included on all modern keypads. Visually impaired children may use these two keys as a beginning point. The programme provides an audio prompt for every correct keystroke and informs the user what letter to enter the following time.

2.3 Smart Canes

The smart cane enables visually challenged persons to identify obstacles above the knee from three metres. Radars employ ultrasonic technology to detect nearby objects and hazards. This technology also allows it to identify items above the height of the knee, something a standard cane cannot.



2.4 BrailleMe

It is a tablet for the visually blind that costs ₹20,000, which is one-tenth the price of its worldwide competitors. It is a gadget that serves as both a reader and a keyboard. An external USB drive will allow this Braille device to access files. This may be connected to a smartphone, tablet, or computer over Bluetooth.



2.5 IrisVision

This device comprises electronic glasses with a smartphone mounted VR headset, which captures the images and offers a high magnification of up to 14x.



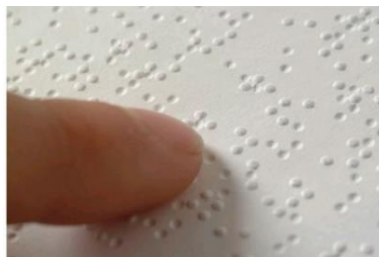
2.6 Ring to Read any Text

Most of them used their fingers to drag while reading the letters. The ring to read any text helps people with visual impairment to read the letters and make the letters sound. This ring is connected to the computer to read the text, and it can also be developed into a mobile phone.



2.7 Touch Screens to Create Figures

The gadget is the kind of tablet that uses a ferrofluid liquid metal beneath which a matrix of electromagnets is inserted and then covered with a fluid surface to give it its flexibility (Barbuzano, 2021). The magnet may generate different forms of patterns, points, and complicated shapes.



2.8 3D Printing of Children's Books

With 3D printers, this gadget seeks to transform a children's book into a tactile experience for the user. Children with visual impairments begin formal schooling at the age of six, but 3D printing technology enables parents to introduce their children to reading earlier, allowing them to have a hands-on introduction to the world.



2.9 Smart Glasses

The smart glass for children with blindness helps them move in an unknown environment. These glasses are attached to the cameras and software to find nearby materials.



2.10 App Store

Blindness is a challenging barrier to using smartphones. There are many apps installed to provide an easier life. Some of the apps are given below:

- **KNFB Reader:** A picture or printed text app to read aloud. It helps to read the different documents, guide through voice commands, and photograph the document.
- **Tap Tap See:** It is also an app for identifying objects. A picture is enough to describe the photographed object.
- **Coin Identifiers:** This App helps to identify the banknotes. This helps to determine how much money is in the pocket, and it helps to check and give the correct amount to others.



2.11 Glasses for Remote Visual Assistance

Aira Horizon smart glasses are live streaming footage and can give audio instructions for the visually challenged.



2.12 Intelligent Camera App

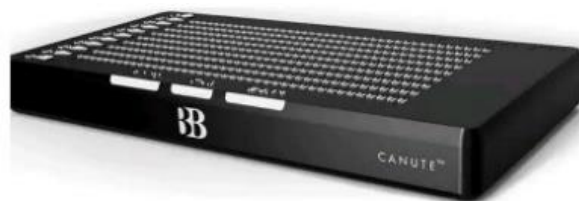
Technology giant Microsoft created an AI programme to assist individuals with impaired vision in recognising banknotes, people's faces, and document details.



2.13 E-Reader

The British company Bristol Braille has launched an e-reader for blind individuals to improve their reading experience. A multi-line braille reader known as Canute 360 displays nine lines of text

at a time (equivalent to about one-third page of standard print) and was developed by Canute Inc. in the United Kingdom ([Bhattacharjee, 2019](#)).



3.0 WHICH LIMITS THE MAKING OF DIGITAL DEVICES?

Four pillars of the “Make in India” project have been highlighted as promoting entrepreneurial development in India, not only in manufacturing but also in other industries. A new method, new infrastructure, new sectors, and a new attitude are the four pillars of the transformation. It is a tremendous challenge for stakeholders and entrepreneurs to design a digital product since they must overcome many barriers before making it.

3.1 Limitations in Technology

Technology itself is a barrier to manufacturing devices in India. Because technology can't cover accessibility solutions for different disabilities ([Lazar et al., 2015](#)), using a single technology in making a digital device is not enough to be successful. Diverse technologies must work together when creating a product for the visually impaired. The knowledge about the maximum efficiency of the device with which it works is acquired after in-depth research in cross-cutting edge technologies. The rapid change in technology makes a product outdated very quickly. Within a short period, the current device should be incorporated with new features, which else will be a failure. High tech infrastructure and the massive cost of machines also hinder the devices' production. This eventually makes fixing the cost of the device costly, and people with visual impairment with limited financial resources could not afford it.

3.2 Limitations in Organisational Sector

There is a lack of exchanging ideas and sharing experiences and good practices among the organisations which prepare devices, especially for people with visual impairment. There is a gap in linking national and regional digital initiatives and strategies in making the devices to support the disabled community. Moreover, connecting the federal authorities, the private sector, experts, educationists and training providers and society in a crew to discuss the needs of the people with visually impaired is a very hectic task in a country like India. Though the government frames guidelines and regulations, the organization may not understand them and stick to its own, complicating the manufacturing process. Also, the organisations struggle to follow the guidelines recommended by several boards to fulfil the criteria, and the making of devices thus gets intricate. The goals of the government and the organization may be the same and cheerful, but it leads to the inappropriate making of devices. Furthermore, the stakeholders are diverse and could not work together to make the digital devices for people visually impaired as a united force. The unawareness of the stakeholders about the characteristics of people visually impaired, their functional limitations, their demands and accommodations, and their poor attitude towards people visually impaired pose challenges in designing the devices effectively.

3.3 Limitations in Market Access

The lack of knowledge of the product's existence among end-users and influencers is a significant obstacle to its adoption. The disconnection between the innovation centre or manufacturing places and end-user is a substantial barrier to accessing the products. The manufacturers lack to create awareness about the products and their availability and do not highlight the product's features, which is a significant drawback in marketing. They should promote the accessibility of the manufactured device online or offline by meeting the practitioners, therapists and caretakers and discussing the advantages of the device. One of the biggest obstacles is that the technology and its benefits are not well-known to visually impaired persons due to a competitive marketplace. Only low-cost items are eligible for funding and free distribution, not high-tech ones. Comprehensive cooperation between start-ups and other community gatekeepers is required for scaling up and broader market penetration of digital gadgets that serve individuals with disabilities (BIRAC, 2021). The perception that inclusive technologies offer only low profit has given a narrow market and has also diminished the efforts of genuine organisations in creation (Goggin & Newell, 2007). Making technological products is complicated by dichotomies like profit vs human rights, inclusion vs exclusion, and profitability vs accessibility (Stienstra *et al.*, 2007).

4.0 OPENINGS FOR MAKING DIGITAL DEVICES IN INDIA

According to BIRAC (2021), so many ventures give hope to raising the start-ups with enough investment in India and marketing the digital devices made in India. A few are listed below:

4.1 Collaborating with NGOs

To have sustainable business start-ups, collaboration with non-government organisations and government funding bodies is essential. The NGOs and start-ups' cooperation illuminate many people's lives with visual impairments. The NGOs can obtain upgraded products through the start-ups, and in turn, the start-ups have a platform to market their products.

4.2 Promoting Philanthropy

Investing investment goals with life values promotes the digital accessibility of digital devices for people visually challenged in India. In the long run, rehabilitation may prove to be a wise investment since it helps create human capital, transforming resource burners into resource earners. Investors have the potential to make a significant difference in the overall prognosis for people with disabilities. They can invest their money and time in the social welfare of people with visual impairment.

4.3 Replicating Successful Business Models

Successful businesses with business models that fulfil the users' needs at a competitive price and a sustainable cost can be replicated. Adopting western business models or policies by tailoring them according to the local needs of the individuals with visually challenged in India may help to access and afford digital devices easily.

5.0 EDUCATIONAL IMPLICATIONS

The rate of producing digital devices for people with visual impairment can be increased by creating awareness about the people. In addition to their technical skills, the technical experts should

be able to define the people with visual impairment, how they are categorised, their functional strengths and weakness, and knowledge about the support services they need to live their lives. The manufacturers should be motivated to include inclusion as core criteria and follow ethical standards in making and marketing their products. A strong network with NGOs, well-trained medical experts and paramedical workers in all rehabilitation areas should be established. There should be a better understanding of the statistics of people with visual impairment and prevalence rates in India to prevent the wastage of money and time. The need gaps can be assessed to determine the impact of the products through research.

6.0 CONCLUSION

The availability of digital devices for people visually challenged in India is meagre. The start-ups can collaborate with therapy clinics, hospitals, intervention centres, special schools, health departments, and unique education practitioners to make quality, low-cost devices. They can approach government sectors working with visually challenged trusts, public healthcare centres and hospitals for tie-ups. The making of digital devices for people with visually impaired is at the nascent stage, and there are great expectations to create innovative products that could be affordable for all. During the past several years, funding from the government has grown for start-up businesses that serve persons with disabilities. The erroneous perception that making for the disabled is the government's job or the responsibility of non-profit organisations should be wiped away from the minds of our people. Thousands of students in engineering and technology fields are developing digital devices as their projects for supporting people with visual impairment. By creating an extraordinary contribution not only to the livelihoods of persons with vision problems but also to the livelihoods of all people, these young people's energy may be transformed into innovators, creators, designers, and entrepreneurs.

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