Room for Empowerment

Digital Skilling for Children with Disabilities

Project Whitepaper

Manohar Swaminathan

Microsoft Research India

Contents

Chapter 1

Goals and Methods

In India, like in most emerging economies, children with disabilities are usually at a double disadvantage: the one due to their disability and the second, usually due to the accompanying economic disadvantage of their parents. It has been well established that many disabilities in India are preventable with early detection and intervention (like blindness and deafness) and others mitigated due to early detection and intervention (like autism spectrum disorders and learning disabilities). In the modern scenario, the best path for enabling these children to progress in life is to empower them with digital skills as early as possible. This is also in line with Microsoft's mission to empower everyone in the planet to achieve more with technology.

Our research at MSR over the past two years has been to create technology solutions to empower people with vision impairments to benefit from mainstream technologies like programming environments and gaming. We have had extensive interactions and collaborations with NGOs working with people with vision impairments. We have also worked with gaze tracking technologies to enhance digital skills of children with SSMI. We have recently started collaboration with domain experts in autism to address many challenges faced by children with autism. Based on our research and collaborations so far we have identified digital skilling of children with disabilities as a long term research agenda.

1.1 People

MSR India is uniquely positioned to undertake such a major challenge since there are many researchers with expertise and research interests in a broad range of inter-disciplinary areas that are essential.

A brief note on each of the researchers is given below:

Manohar Swaminathan: Lead researcher for this project has extensive experience in computer graphics, visualization, virtual and augmented realities, use

of these technologies for people with disabilites, handheld and mobile computing platforms, human computer interactions and technologies for emerging markets.

Joyojeet Pal: The co-lead researcher has considerable experience working with assistive technologies, critical evaluation of their use, the perspective of such technologies from the end user's point of view and in particular the use of such technologies for emerging markets.

Chirnajeeb Bhattacharya: Visiting Researcher at MSRI, professor Indian Institute of Science. Expertise in many areas of ML and deep learning with interests in applying these to working with Autism spectrum disorder.

Akshay Nambi: Post-doctoral researcher, expertise in IoT, robust sensing, ML for video understanding, applications in Accessibility.

Monojit Choudhary: Researcher with expertise in natural language processing, speech technologies for low resource languages, empathy in conversations around mental health.

Gopal Srinivasan and Suresh Parthasarathy; Senior research software development engineers, with expertise in programming environment for the blind, and intersts in technologies for accessibility

Vidhya Y: A research fellow with a mAsters in Digital Soceity from III-T Bangalore and co-founder of Vision Empower Trust. Research focus is computational thinking for blind children

Shubi Agarwal: Intern, Final year master's student at National Institute of Design, Bangalore

Gesu India: Intern, BTech IIT Patna, research intern, computational thinking for blind children

Srujana Kamath; MSc Digital Societies, final year student at IIIT-Banaglore, undertsaning social media use by blind individuals

1.2 Goal

Our research and development goal is to create technologies, tools, and processes for Digital skilling of children with disabilities at scale in India. We elaborate on what we mean by each of the aspects mentioned in the above statement. Children with disabilities:

We expand on each of the key phrases in the above goal

Digital Skilling: We narrow down this catch-all phrase to the following four aspects:

- Proficient use of technology tools like smartphones, tablets, PCs and game consoles

- Proficient use of Applications on these tools, including the ability to find and use new applications that become available

- Proficient use of social media

- Computational thinking with a path towards digital career opportunities (data science, developers, etc.)

Children: As a general rule we intend to target children at as early an age as practical for each kind of impairment since it has been well established that humans learn at an immense rate when they are as young as a few weeks. Loss of some senses may deprive children of such learning and hence early detection and intervention is key to long term empowerment.

Disabilities: We include all manner of disabilities that hold back children from reaching their full potential. We include all disabilities listed and covered under the revised persons with disabilities act of India. (link)

1.3 Ludic Design for Accessibility

Our Research Approach: Our research is based on the premise that play and playfulness are central to what makes us human, and that by separating playfulness and exploration from the design experience, we fail the intended end users of our products. Given the separation of a large number of marginalized identities, particularly individuals with disabilities, from the design process, we propose that a rethinking of the design of the design of accessible technologies is needed. We propose that the design of new technologies for people with disabilities should neither be driven incrementally simply by the incorporation of accessibility features into mainstream technology, nor through a function-driven approach that ignores the experience of technology use. We propose that ludic thinking can serve to more broadly understand the role of play across various learning experiences of people with disabilities, which can in turn be useful in approaching the design process. Thus we call our research approach as Ludic design for accessibility.

The focus areas for the first 3 years will be on children with the following disabilities: vision impairment, speech and sensory motor impairments and autism spectrum disorder. We need to work in parallel with more than one disability. The traditional approach for assistive technologies is for a group to focus on one

disability and specialize in that rea. We believe that an inclusive design approach that looks at multiple disabilities has many advantages: (We do not mean working with children who have more than one disability, but work with groups of children each with a specific disability)

1. The traditional approach of working in silos prevents cross feritiliztion of ideas. Conversely, because of working with diverse disabilities one is able to create solutions that otherwise would not have been thought off. For example, our work on gaze controlled interfaces for children with SSMI while we were also working with gaming for the vision impaired led us to ask the question: can we use gaze controlled interfaces for the blind, which led us to a very novel solution.

2. An inclusive design approach leads to expanding the continuum of solutions for users other than the original target audience in unexpected ways.

You can also use paragraph titles which look like this.

Chapter 2

Room For Empowerment

The Room for Empowerment will be a physical space that gives real shape to the research ideas. The room will see a constant influx of children with diverse disabilities, their parents or teachers or facilitators along with educators, domain specialists, researchers, and technologist who seek to understand and design solutions in an interactive, iterative and participatory approach to design.

The physical space located at MSR India will be the archetype for similar Rooms that will be created elsewhere. The Room at MSRI will be the test bed for various solutions to be defined, developed and validated and then spread around the country and beyond.

The Space : The physical space itself will be warm and friendly to children of all ages and with all disabilities. Hence, simplicity of design and content will be the key. Technology is a key component of the Room but will not be the overwhelming part of the physical space. Like all sophisticated technology, it will blend with the background. The only visible piece of technology will be very high resolution large TV on one wall. There will be a high quality system that can envelope the room with audio. The rest of the space will have diffuse and subdued lighting with reconfigurable seating arrangement, ranging from everyone lolling on bean bags on the floor to a set of people around a table to a few individual retractable desktop workstations with adjustable seating. The room will be wheelchair friendly.

Use of the space : A few example scenarios are outlined below:

- Games for the blind to encourage numeracy: A group of blind children sitting in a circle and engaging in counting games. Standing up to clap their hands in time for drum beats played on the music system through an app.

- The room can be reconfigured to accommodate a group of children around a table working with a computational thinking toolkit like the Torino along

with a couple of facilitators.

- Alternately, several autistic children could be individually engaged in playing Minecraft on desktops facing the walls with facilitators moving around to help the ones who need help.

- A focus group with blind teachers to understand their current challenges in teaching STEM and how technology can help them, with everyone seated conference meeting room style around a table.

- A child with ASD plays in front of a large screen using a Wii controller and Wii pad to combine visual stimuli and muscular activation.

Replication and Scaling   Solutions developed, lessons learned and processes developed in the Room for Empowerment will then be replicated in mini-Rooms of Empowerment set up in centers around the country that are specializing in a specific set of disabilities. For instance, gaze tracking solutions for digital skilling developed at the Room will then be replicated and installed at schools for children with SSMI along with assistance to transfer and operationalize the know-how. Games for therapy of children with autism may be in a mini-Room set up at St. John's Hope Center or at the ASHA school 3

Chapter 3

Partners

To achieve the goal of digital skilling in the Room for Empowerment calls for a multidisciplinary approach requiring expertise in diverse areas of computer science and the social sciences. Reflecting the same need, the diversity of partners that we engage with is critical for the long term success of this effort. Further, given the shortage of resources that affect most organizations in India that work with the disabled community, pooling of resources as well as best practices is a pragmatic approach. Hence we will work with a small number of partners who bring in a range of expertise and strengths.

We list the set of partners with whom we are already engaged with along with a brief note on the resources and expertise they bring to this project.

3.1 Indian Institute of Science

We work with faculty at IISc who have interests in assistive technology research. The IISc is the top research institution in the country and along with the top notch faculty, attracts very good research students who will be our collaborators in many aspects of this work. At this time we are working with Prof. Pradipta Biswas, of the Center for Product Engineering and manufacturing on gaze controlled interfaces for children with SSMI. This research is currently being funded by MSRI under a research MOU with IISc.

Prof. Chrianjib Bhattcharyya, of the department of computer science and automation, is currently a Visiting Researcher at MSRI. He is pursuing a broader research agenda that includes application of machine learning technologies for early detection of autism as well as interventions for children with ASD as well as learning disabilities. We will explore ludic design aspects of this work along with engaging the partners (St. John's and ASHA, see below) to work with the children on digital skilling in the Room of Empowerment.

3.2 International institute of information technology, Bangalore

IIIT-Bangalore has a very unique program called M.Sc. (Digital Society). This program

> prepares students who have an astute understanding of the digital ecosystem. In the Information Age, digital technologies have opened up immense possibilities for economic and social change that is inclusive and sustainable. Designing and deploying digital technologies, analyzing human-computer interaction or big data entail not just technological expertise but also a nuanced understanding of the social, cultural, and economic aspects of the digital society.

3.3 Vision Empower Trust

Vidhya is currently a Research Fellow at MSR India and her research will focus on computational thinking for blind children.

> Vision Empower (www.visionempowertrust.org) is a not-for-profit trust incubated at IIIT Bangalore with a vision to empower visually impaired children through inclusive education. The motivation for this initiative came from Vidhya Y, a gold medalist in Masters in Digital Society programme at IIITB, who has been visually impaired since birth. Overcoming her immense challenges, she excelled in academics with her grit and determination. She was the first blind student to take a Computer Science major in undergraduate studies in her university. It is her dream that no visually impaired child should be denied the opportunity to study Science and Mathematics, if they wish to. The VE team has launched several projects to provide accessible solutions for education of the visually impaired. Through these solutions, VE will make STEM education accessible to school-going children with visual impairment, at par with that of their sighted peers.

3.4 NIIT Foundation

NIIT Foundation (NF) is a not-for-profit education society set up by the promoters of NIIT in 2004.

> NIIT Foundation has a mandate to reach the unreached, uncared and unattended to ensure inclusive development in India. To shape the mandate, NIIT Foundation has begun a number of programs that would

positively impact the underserved of the country through various educational interventions. The intent of NF is to better understand the education and employability issues at the grassroots level and build sustainable training intervention models.

NIIT Foundation will partner with us to take our technology and solutions for digital skilling to identified NGOs working in these areas in the National Capital region. MSRI is currently sharing our work on gaze controlled technologies for SSMI children to start pilot studies in the NCR region.

3.5   St John's Medical College and Hospital Unit of Hope

Our collaborator in this project is Dr. Ashok M.V.

Dr. Ashok MV is a core member of the Unit of Hope for the last decade. Dr. Ashok also doubles up as the Assistant Co-ordinator of the Unit of Hope team. The services provided are detailed assessments and treatments for children and parents of children with multiple disabilities. Along with all the above mentioned activities that are available for all children registered in the Unit of Hope, the following are the unique services provided in this Unit:

All children and parents from the Unit of Hope are counseled regularly to ensure compliance with the medical treatment of the child. Parents are specifically evaluated and treated for their own psychological issues that are common when dealing with a child with a chronic illness. Siblings and other stakeholders are met with regularly to make help available to them. Children are monitored for their development regularly – both clinically and with assessment tools – and plans made accordingly. This includes the Neonatal Follow-Up Clinic. Detailed reports are given that are shared with Pediatricians, Orthopedicians, Speech therapists, Occupational therapists and other teachers who are involved in the child's care. As many children seen in the Unit of Hope have co- morbid emotional and behavior problems, these are evaluated – again clinically and with assessment tools – and treated so that the child's functioning is improved. Liaison with the school and centers as well as special schools is offered for all children who are on follow up with the Child Mental Health Team.

3.6   Academy for serious handicaps and autism(ASHA)

ASHA is a school for children with autism spectrum disorder and has teachers who have considerable expertise working with such children. ASHA will be our

partner for domain expertise.

> Established in 1995, Academy for Severe Handicaps and Autism pro-
> vides education along with a comprehensive set of therapies to indi-
> viduals with autism spectrum disorders. In over two decades, ASHA
> has evolved and developed capabilities and expertise to address the
> different needs of over 500 individuals and their families.

3.7   Enable India

Enable India is an NGO working with persons with a range of disabilities primarily
to make them employable in the mainstream. Enable India has been granted Spe-
cial Consultative Status by the United Nations Department of Economic and Social
Affairs (UN DESA) which qualifies Enable India to represent the Disability sector
in the United Nations General Assembly, United Nations Human Rights Council
and other subsidiary bodies of the United Nations. Nationally, Enable India is on
the board of SCPwD (Skills Council for Persons with Disability) which is an Na-
tional Skills Development Corporation (NSDC) initiative that offers Persons with
Disabilities meaningful, industry relevant, skill based training. At the state level,
Enable India is the implementation agency for the Placement Cell of Karnataka. in
addition to direct linkages with persons with disabiliteis and their challenges for
employability, partnering with Enable India will enable our research outcomes to
be taken at scale across India.

Chapter 4

Funding

Microsoft Research India is funding the establishment of the Room for Empowerment at MSR premises in Bangalore. It also funds all the MSRI personnel listed above for their time in the project. Funding from Microsoft CELA and Microsoft Philanthropies will be sought by partner organizations with specific proposals that are built around the broad goals outlined in this document.