

## Project factsheet information

<b>Project title</b>	Bidirectional Access Promotion Society - Bapsi
<b>Grant recipient</b>	Bidirectional Access Promotion Society B-69, Second Floor, Lajpat Nagar-I, New Delhi-110024, India 011-29817007, 09873199898 <a href="http://bapsi.org">http://bapsi.org</a>
<b>Dates covered by this report</b>	01 – 05 – 2014 / 30 – 04 – 2015
<b>Report submission date</b>	14 – 05 – 2015
<b>Country where project was implemented</b>	India
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<b>Partner organizations</b>	Helen Keller Institute for the Deaf and Deaf-blind (HKI) Homi Bhabha Centre for Science Education (HBCSE)
<b>Total budget approved</b>	AUD 27,000
<b>Project summary</b>	<p>Bapsi, as part of its mandate to develop technology for persons with multiple disabilities, came up with a USD 50 communicator for the deaf-blind, a significant improvement over the previous technology costing around USD 2500. The new communicator used Morse code via vibration, whereas the earlier solution used Braille. This project sought to familiarize the deaf-blind and their caregivers with the new technology, to provide training in its use, to better understand the needs of the deaf-blind, to develop and test appropriate software for them, and to encourage other relevant organizations to pay attention to this neglected area.</p> <p>Since our communicator only worked for the deaf-blind who could already read and write, a tiny minority, we decided to develop two apps for the pre-literate, a slate and a game. For a trainer who is deaf, does not speak and has low vision, we developed a series of 3 apps of increasing complexity, based on the feedback provided.</p> <p>We trained students in app development, and helped two to take up a project related to the deaf-blind. We were able to make presentations at major international fora in attempting to steer future technology development towards the use of haptics.</p>

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## Project Summary

**Tips:** It is recommended to **complete this section once you have finalized the text of the report**. It will be easier to go back through to build the summary based on the highlights of the report the project team just put together.

The Project Summary can be up to **one page long**.

It should include a brief justification; an outline of the project objectives to be achieved; the project real timeline and the main activities conducted.

The abstract of the project written when ISIF Asia initially approved the project and the objectives listed in the Grants Agreement signed by APNIC and your organization should be useful inputs when preparing this section of the report.

Electronic communications has not yet reached significant pockets of humanity. Without the ability to communicate easily over distance, they have not been able to organize and demand their rights, and obtain suitable education and health services. One such neglected community is the deaf-blind, of which there are an estimated half million in India alone.

Bapsi, as part of its mandate to develop technology for persons with multiple disabilities, came up with a USD 50 communicator for the deaf-blind. It used free Bapsi apps running on an Android phone with a Blackberry-style keyboard. This was a significant improvement over the technology used by the deaf-blind in richer countries, typically an iPhone with a Braille display, costing around USD 2500. The Bapsi communicator used Morse code via vibration, whereas the earlier solution used Braille. To use it, the deaf-blind and their trainers would need to learn Morse code, a novelty for them.

This project sought to familiarize the deaf-blind and their caregivers with the new technology, to provide training in its use, to better understand the needs of the deaf-blind, to develop and test appropriate software for them, and to encourage other relevant organizations to pay attention to this neglected area. In this, we worked closely with the Helen Keller Institute for the Deaf and Deaf-blind (HKI)<sup>1</sup>, and the Homi Bhabha Centre for Science Education (HBCSE)<sup>2</sup>, both in Mumbai.

Since our communicator only worked for the deaf-blind who could already read and write, a tiny minority, we decided to develop two haptic apps for the pre-literate, a slate and a game. For a trainer who is deaf, does not speak and has low vision, we developed a series of 3 apps of increasing complexity, based on his feedback. To test the apps, we had to first explain them to the caregivers. They then tried to identify a deaf-blind person for whom the app was suited, and try to explain it to him or her. Despite the limited time the caregivers could make available for this, we were able to receive sufficient feedback to make improvements in the apps.

We trained students in app development, and helped two to take up a project related to the deaf-blind. There was considerable interest in our use of Massachusetts Institute of Technology (MIT) App Inventor<sup>3</sup>, a free facility that makes app development for Android phones significantly easier than with Java.

The deaf-blind and their caregivers are world leaders in the use of the sense of touch for communicating information, which is of great interest in the emerging fields of haptics and wearable computers. We were able to make presentations at major international fora including a global Bell Labs<sup>4</sup> videoconference, and at the (Google Accessibility Summit)<sup>5</sup>, attempting to steer future technology development towards the use of haptics.

<sup>1</sup> HKI <http://www.helenkellerinstitutefordeafanddeafblind.org>

<sup>2</sup> HBCSE <http://www.hbcse.tifr.res.in>

<sup>3</sup> MIT app inventor <http://appinventor.mit.edu>

<sup>4</sup> Bell Labs <https://www.bell-labs.com>

<sup>5</sup> Google Accessibility Summit Presentation <http://www.bapsi.org/Google-Presentation>

We have also an offer from HKI of every kind of support, including office space, except money, for our ongoing efforts in this area. HBCSE will continue to offer expertise, and encourage students to undertake projects to develop technology for the deaf-blind.

## Background and Justification

**Tips:** The reader should be reminded of the **context** your organization is working, and where the project has been developed in.

This section provides a window to **understand the challenges** faced by the community you are working with.

Include a detailed description about the situation **before the project start**, describing any relevant aspects that make the project relevant in such a particular scenario.

The reader should be provided with a clear description about the problem(s) to be addressed through this project and the motivation from your organization and team members to get involved and offer a solution.

The deaf-blind are a unique, heterogeneous group of individuals whose disability is greater than the sum of the individuals' disabilities of deafness or blindness. In India, services for persons with multiple disabilities, such as the deaf-blind, are almost negligible. As an indication of the degree of neglect, we do not even have an accurate count of deaf-blind population in India. The Census of India<sup>5</sup> does not count them, and the National Sample Survey Organisation (NSSO) 1992<sup>6</sup> has no category for them. Sense International<sup>7</sup> estimates that there are more than 500,000 such people in India, however this is an extrapolation of a survey of households in the United Kingdom. Via the Right to Information (RTI)<sup>8</sup>, we have been able to establish that not a single deaf-blind student is in the Delhi school system.

Existing means of electronic communication for the deaf-blind are very expensive, with a tag price of over USD 2500. Having identified a way to bring this number down to about USD 50, this project seeks to popularize this solution among the deaf-blind, and to learn about other problems of the deaf-blind where information technology might help.

## Project objectives

**Tips:** Please include here the **original objectives** as listed on the Grant Agreement.

If any objectives were modified, added or removed during the reported period this should be explained/justified.

The original objectives of the project were:

1. To demonstrate this solution to at least 20 organizations who are working for persons with severe disabilities.
2. To identify, train and give suitable smart-phones to 4 persons who are deaf-blind.
3. To improve our software based on their feedback, and to write new apps that offer access to email, Twitter and Wikipedia.
4. To raise awareness among the caregiver community and government about the possibilities of new technologies of relevance to the deaf-blind.
5. To keep costs as low as possible, so that the technology and support can continue to be made available free of cost.

As we started to gain some appreciation of the complexity of the situation of the deaf-blind, we needed to amend the objectives. Apps designed for literate persons were only going to be of limited utility as in India hardly any

<sup>5</sup> Census of India [http://censusindia.gov.in/Census\\_And\\_You/disabled\\_population.aspx](http://censusindia.gov.in/Census_And_You/disabled_population.aspx)

<sup>6</sup> NSSO 1992 [http://mospi.nic.in/sarvekshana\\_publication\\_main.htm](http://mospi.nic.in/sarvekshana_publication_main.htm)

<sup>7</sup> Sense International <http://www.senseintindia.org>

<sup>8</sup> RTI <http://righttoinformation.gov.in>

deaf-blind person attains literacy. We were able to identify only two organizations in the country that did any kind of serious work with the deaf-blind, one of which showed no interest in working with us. Rather than merely demonstrating our solution to a large number of organizations, we decided to focus on the one willing and established organization which is highly competent in all matters relating to the deaf-blind, namely, Helen Keller Institute for the Blind and Deaf-Blind, where we could also provide inputs to the training of trainers, and gain some depth in understanding the problems of the deaf-blind before writing appropriate apps.

## Users and uses

**Tips:** Discuss with your project team who would be the future users and how they would use the findings throughout the project lifecycle. The uses identified should relate to the theory of change that you have discussed with your project team. The discussion about theory of change, users and uses, will be a very important input to your communication strategy: depending on who the user is and of what use will be the findings, a communication strategy can be developed. For example, if the users of the findings are policy makers and the use is to influence a change in the regulatory framework, which communication approach will work the best?

**Who will be the user of these findings?**

**What are the more relevant things the project team wants to learn about or evaluate through the lifecycle of this project?**

### Theory of change

1. Having won over two deaf-blind users to our software and approach, we expect that person-to-person communication will convince other deaf-blind users to approach us for support.
2. By working with and training trainers in deaf-blind communication using the apps we developed, this technology will, over time, become part of the curriculum of trainers and the mainstream of the deaf-blind community.
3. Since we have also gained some experience with the issues of deaf-blind communication, beyond literacy, we now have the kernel of a suite of apps that engage the attention, focus and involvement of deaf-blind users, including a drawing tool (slate) and a game.
4. By bringing in a variety to stakeholders including caregivers, software developers and educators into the process for app development and testing, we hope that finding technical solutions to the problems of the deaf-blind becomes an important part of their focus.
5. The project also lends itself to being supported by corporates as a part of their Corporate Social Responsibility, thereby helping the project remain sustainable over the long term.

The primary users of the apps being developed under this project are the deaf-blind, who will use technology to be able to communicate independently. In addition their caregivers and teachers are crucial users as well. A special problem in working with the deaf-blind was that we had no means of direct communication with them, and were dependent on their caregivers for sign language interpretation. We needed to work with the caregivers before we could even bring our software to the attention of the deaf-blind.

Students who write free software as part of their projects are important users of this information. Once they appreciate the importance of addressing the problems of the deaf-blind, we are assured of ongoing improvements in the technology. In this regard, students were addressed and trained at Indian Institute of Technology (IIT) Delhi, and at HBCSE, and the Tata Institute of Fundamental Research (TIFR) in Trombay. Student interns at HBCSE are currently developing and testing apps for the deaf-blind. This involvement of students makes it possible to achieve significant results while keeping the costs low. Besides, it exposes the students to the needs of a potential user group that is often under the radar, although the socially useful impact may be considerable. This awareness may get some of them interested enough to continue to contribute to this

field, off and on, through their professional lives, and in turn to inspire others to further research and development.

Our research has been of considerable interest to those engaged in research and development in telecommunications technology and smart phones. We were invited to address Bell Labs internationally, via video conference, and the Google Accessibility Summit in Mountain View, California. We were also able to present our work at the Asia Pacific Regional Internet Governance Forum (APrIGF)<sup>9</sup> meeting in New Delhi in 2014, and feed into some deliberations at the International Telecommunications Union (ITU)<sup>10</sup>. Workshop ICT Apps for Persons with Disabilities on Wednesday 15 May 2013, at the WSIS (World Summit on the Information Society) Forum 2013 in Geneva, Prof Arun Mehta, President, BAPSI, Bidirectional Society, India, presented “Access for those who call between the cracks”. Arun Mehta made a presentation, “those who fall between the cracks” to Focus Group on Audio-visual Media Accessibility of the ITU, Geneva, on 21 January 2013. As governments become aware of their obligations to deliver services to the deaf-blind population, they will also find this research useful in arriving at cost-effective solutions.

The ability of the deaf-blind to communicate using only the sense of touch is very important in the emerging field of haptics. As technologists find ways to open up this very important sense to electronic communication, our research will help them to look closer at achievements of the deaf-blind and their caregivers in this field, and to build on it. This is of direct consequence in the emerging area of wearable computing, where input and output of data, must have as little involvement of the senses needed for physical mobility and communication -- seeing and hearing -- as possible. At present, the gamut of technology demonstrators is characteristically intrusive and socially controversial.

## Indicators

**Tips:** Indicators help to measure project’s progress. Indicators help the objectives that were set by the project team to be affordable, tangible, and measurable. They help to verify the success and rewrite the course in case we are not achieving it. An indicator could be quantitative (percentage, amount) or qualitative (perception, opinion). The ISIF Asia secretariat suggests the SMART approach to indicators:

- S** Specific
- M** Measurable
- A** Achievable (acceptable, applicable, appropriate, attainable or agreed upon)
- R** Relevant (reliable, realistic)
- T** Time-bound

Baseline	Indicators	Progress	Assessment	Course of action
<ul style="list-style-type: none"> <li>The data available is very poor and mostly anecdotal. It would not be far-fetched to assume that hardly any of the estimated 500,000 deaf-blind can read or write, or use communication devices.</li> </ul>	<ul style="list-style-type: none"> <li>Number of organizations to be contacted and worked with</li> <li>Number of apps developed for the deaf-blind</li> <li>Actual use by the deaf-blind</li> <li>Information dissemination among the caregiver population</li> <li>Information dissemination through online fora</li> </ul>	<ul style="list-style-type: none"> <li>6 apps developed</li> <li>Actual users (deaf-blind people who tested the apps) of apps: 2.</li> <li>2 Workshops held for five trainers (Morse)</li> <li>Students assignments 1 assignment to 2 students</li> <li>Online Info dissemination through Bapsi website, Google+, Facebook.</li> </ul>	<ul style="list-style-type: none"> <li>There are not many organizations in India that work with the DB. Of the two committed to working with the DB, one did not express much interest as they want to continue to work with Braille.</li> <li>The <b>number and variety</b> of our apps <b>exceeded</b> expectations; although we did not develop exactly the apps we set out to, influence by input from target audience.</li> <li>We realized that learning the Morse code is like learning a new language, which would take the DB a long time to learn.</li> <li>We also realized that as the use of Morse Code needs a basic level of literacy, but the entire DB persons who are literate are a very miniscule.</li> <li>We did not find sufficient enthusiasm from the trainers for us to undertake as much <b>Morse code training</b> as planned. The process is extraordinarily difficult, as we first have to convince the trainers.</li> </ul>	<ul style="list-style-type: none"> <li>Based on their interest and enthusiasm, we decided to work intensively with HKI. Instead of the several workshops we had planned to organize all over the country, we organized several workshops in Mumbai where HKI is located. We also appointed a coordinator for the project in the city.</li> <li>We decided to work with persons of law vision deafness instead of the totally DB. We found one such person for whom we developed special apps to meet his specific needs. Later one more user was identified.</li> <li>We were also able to identify some trainers who were interested in learning about and using the apps with their students.</li> </ul>

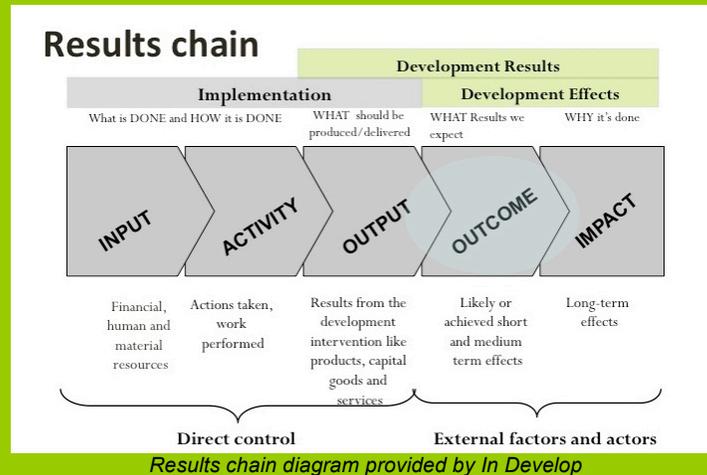
<sup>9</sup> APrIGF <http://2014.rigf.asia>

<sup>10</sup> ITU <http://www.itu.int/en/ITU-T/accessibility/dcad/Pages/201310-workshop-bapsi.aspx>  
<http://www.itu.int/en/ITU-T/accessibility/dcad/Pages/MEHTArun.aspx>  
[http://www.itu.int/wsis/implementation/2013/forum/inc/doc/agenda/WF13\\_ProgrammeBrochure.pdf](http://www.itu.int/wsis/implementation/2013/forum/inc/doc/agenda/WF13_ProgrammeBrochure.pdf)  
<https://docs.google.com/a/bapsi.org/viewer?a=v&pid=sites&srcid=YmFwc2kub3JnfGhvbWVwYWdlfGd4OjEwNDgzMm1MTAwMzU2NTU>

## Project implementation: understanding the chain that leads to results

**Tips:** This is the most important section of the report. Here, the reader will **understand the processes and operational issues** of your project and how they contribute to the achievement of the objectives and the theory of change behind the project implementation.

Is possible that the project team’s understanding of the development problems to be addressed with this project will have evolved or **changed** from those described when the project was originally submitted and approved. If that is the case, please share what motivated the change and what course of action has the project team identified.



### Narrative - project implementation

Our partners in this project are the Helen Keller Institute for the Deaf and Deaf-Blind (HKI) and the Homi Bhaba Centre for Science Education, (HBCSE), both located in Mumbai. HKI provides specialized care and training to around 100 children with varying degrees of impairment of both senses, making it possible for us to work with deaf-blind users, which has been instrumental in our learning how to address extremely difficult problems.

HBCSE is a high-level research organization focused on the evolution of science education, is already working on disabilities, and expressed interest in being involved. HBCSE is an apex science institution, providing the national educational system (and the field of pedagogy) with constant research and feedback. It hosts doctoral research students and also offers undergraduates an opportunity to work on advanced projects, as part of their degree requirements from their home universities. For HBCSE, the project team provided research-based insights into the nature and scope of communication, encompassing multiple languages and media forms. The project team also provided the opportunity for the Institute’s students, both direct students and interns from other engineering and science institutions, to undertake developmental research in communication and learning. HBCSE’s involvement is valuable, as it will provide continuity to the project, as it becomes part of their ongoing work in the field in the coming years.

At HKI, the project team was given access to the caregiving environment, and an exposure to the current spectrum of techniques employed to open and expand life-enhancing capabilities, including conceptual understanding of societal paradigms. The project team interacted with the trainer/caregiver community to attempt to create an interest in learning an existing haptic-friendly ‘script’, the established binary-based Morse Code (for which a system of training exists worldwide). We took the assistance of experienced trainers to help us interact directly with potential end-users, in order to conceptualize approaches around which apps could be built in order to address specific situations reported by users, and to help introduce apps in progress to end-users for in-development testing, for feedback and directions on improvement.

At the HBCSE, the project team worked with such student interns, under the guidance of HBCSE, encouraging them to learn how to identify gaps in communication that may be possible to address with technology, and help them build these solutions around smartphones.

For the deaf and deaf-blind, an important consideration for communication is the language, which one is used, since each language takes time and special trainers to learn. Sign language, which in practice has many flavors around the world, and is difficult to standardize owing to cultural considerations, is more practical to convey if a single language base is used, and most often in India it is English. The people around, however, speak local languages, so communication is hampered further.

The availability of Indian-language speech to text, in particular, is poor but getting better.

Getting started with this project was a major challenge, as we needed a clearance from the government to be able to accept foreign funding for it, which was very slow in coming. Dealing with the government has taught us that we need to improve our processes to work with government systems.

We had proposed that we would work with the deaf-blind. But we realized that that is a very wide category, and we needed to focus on specific groups within this category. Our earlier apps, relying on Morse code, only made sense for those completely deaf, completely blind, and literate. In India, however, there are very few in this category. We decided to pay closer attention to two other categories: 1) preliterate children, and 2) older people who are literate.

For an app to be tested, first the caregiver had to be taught the app, and convinced that it was interesting. Then, the caregiver would need to identify a deaf-blind person who might benefit from it, and take the time to teach it to the potential beneficiary. All this takes a lot of time, on top of their busy academic calendar. For some apps, such as the slate Narangi<sup>10</sup> and the picture communicator ShowItem<sup>11</sup>, we were unsuccessful in thus even bringing our app to the attention of a deaf-blind person. This will require persistence.

The training of trainers would allow our technology to reach the deaf-blind in significant numbers on an ongoing basis. However, we did not find sufficient motivation among very busy trainers to take on the additional load of learning Morse code, without any direct benefit to them. We will attempt to bring Morse code into their curriculum, and will also train any deaf-blind person who expresses interest in learning Morse code. We appreciate that it takes time, effort and demonstrated results to be able to advocate an important curriculum revision.

A careful choice of software and hardware platforms, App Inventor on Android phones, made it possible to undertake app development based on the feedback from the deaf-blind and their trainers, in time to also be able to test them out, within the short time frame available to us in this project. This is a huge advantage for dealing with different sets of people (users, trainers) who are already loaded with very difficult tasks. However, App Inventor does have serious limitations, and, as a very new platform, is still encountering teething troubles. We found it suitable for prototype development, and encourage students to use Android Studio to design production versions that run reliably on diverse mobile platforms. Using both development platforms has a significant theoretical advantage, in that features that are doable in App Inventor can be rapidly prototyped and demonstrated to the potential user, and the feedback used to make a more refined app in Android Studio.

However, the practical limitations of i) relatively short student internship periods (six months) and ii) small team size, means that while we can flexibly manage the multiple levels of interaction at which development must be supported, we do not have an assured team dedicated to any one app that can see it through from concept to completion. This can add to the overall time needed to bring any particular application to production level quality.

<sup>10</sup> Narangi app [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.narangi2&hl=en](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.narangi2&hl=en)

<sup>11</sup> ShowItem app [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.showitem](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.showitem)

2014/05	2014/06	2014/07	2014/08	2014/09	2014/10	2014/11	2014/12	2015/01	2015/02	2015/03	2015/04	
<b>Conferences/Workshops</b>												
	Project Launch Workshop, Mumbai	-Towards an Accessible Internet for people with disabilities. Asia Pacific Regional Internet Governance Forum (APRIGF), Indonesia -Dr. Arun Mehta, President, presented "Access for those with multiple disabilities: the case of the deaf-blind". -Workshop in Mumbai					Workshop in Mumbai			Workshop in Mumbai		
		Bell Labs, 360 Degrees lecture series, global videoconference. Arun Mehta was invited to speak on his work with multiple disabilities.	UNESCO /OKC provided us a stall at the National Conference and Exhibition on 'ICTs for Persons with Disabilities: Taking Stock and Identifying Opportunities' New Delhi						Arun Mehta addressed the Google Accessibility Summit, panel on "Design Challenges for Persons with Multiple Disabilities" Mountain View, California, USA			
<b>Videos (published on YouTube)</b>												
	TellMyPhone on YouTube		-ShowItem on YouTube -dbtype on YouTube		-Narangi2, on YouTube -ddebug, on YouTube			ddebug v2 on YouTube				
		Narangi on YouTube						Akhtar on YouTube				
<b>App Development (published on Google Play)</b>												
		Narangi				Narangi2		ddebug v2				
	TellMyPhone		ShowItem							Akhtar		

Input	Project activities	Outputs	Outcomes	Timeline	Status	Assessment
App writing skills, documentation skills, electronic hardware for these activities and for those at HKI, support from ISIF, HKI and HBCSE.	1.Apps developed 2.Videos produced and disseminated 3.Conferences and workshops attended and held, training sessions	A suite of Android smartphone apps has been created, working together with users, caregivers, pedagogists, and student trainees, in order to ensure the development experience was targeted and involved the widest possible engagement.  A series of videos have been produced and disseminated, covering app installation and usage  The concepts underlying this innovative approach to access technology design and development have been discussed at important international conferences on disabilities. We have also attended and held workshops on the development and dissemination of AAC technologies	The community has now an application to communicate directly with anyone (PocketSMS for those completely DB, Akhtar for those with low vision), no matter whether trained or even exposed to tools like sign language or Morse. However, its wider impact will be limited, for persons with seriously impaired vision and hearing, until Morse training is introduced as a key learning for a deaf-blind person.  The possibility of mobile games directly suited for the deaf and deaf-blind provides a novel play environment, commonly available to the person's peers, has been demonstrated as a proof of concept, and may lead to improved accessibility for such persons to the gaming environment in general.  The vibration-enhanced drawing tool opens new vistas for creative expression. A Morse-including input/output accessibility system is under development by student interns. This may create a lasting impact upon the student community, if successful	See above.	1. Akhtar: Completed. 2. Narangi.(2 versions) Completed. 3. dbBug and dbtype	The project team evaluated the applications produced against the original design/plans and, at this stage, further design improvements are possible if the apps are optimized on a more robust development platform identified.

## Project outputs, communication and dissemination activities

**Tips:** Take into account that the reader of your report has not been involved in project implementation, so readers do not have any further knowledge besides the information you are providing here.

This section of the report will allow you document the communication and dissemination efforts that the project team has conducted, which might be part of a specific communication strategy design as part of the project, or in place for the organization as a whole. When possible, please provide information about strategies in place and the rationale behind them.

Lessons can be learned from many aspects of project implementation, covering a wide variety of aspects such as technical, social, cultural and economical. Taking the rationale behind the project and its objectives can serve as a framework to draw your conclusions. Lessons can be identified by project partners, beneficiaries and general staff from the organization. A project diary and other activity records can serve as a tool to reflect during

project team meetings and immediately after project activities are conducted.

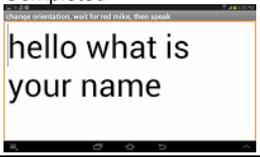
**Outputs are immediate, visible, concrete developmental change that is the tangible consequence of project activities, under direct control of the project team.**

Example of possible outputs to report are:

- New products and Services (software, online platforms, applications);
- Information sharing and dissemination (publications, conferences, multimedia, social media);
- Knowledge creation (new knowledge embodied in forms other than publications or reports, such as new technologies, new methodologies, new curricula, new policies);
- Training (short-term training, internships or fellowships, training seminars and workshops) and
- Research Capacity (research skills; research management capacity and capacity to link research to utilization of research results).



All the apps described here, have been developed and used. Each of these apps also has an associated video which shows how the app can be/has been used. The videos as well as the apps can be downloaded, **VIBRATIONS series of mobile apps** (in English)<sup>12</sup>. Dissemination of apps and videos was done using online mechanisms (Bapsi website, Google + and FaceBook) as well as through presentations made at conferences and exhibitions. The video elaborates our plans to enable the deaf-blind to receive and produce information to communicate using a smartphone. The project proposes to use vibrations to read text to make wikipedia readable, explore the benefit of speech-to-text to listen to others and text-to-speech facility to type in text and make it possible to post tweets.

Project outputs	Status	Assessment	Dissemination efforts
<p><b>TellMyPhone</b> - English and Hindi speech recognition for the deaf with low vision<sup>13</sup>: A free app for the deaf with low vision. It recognizes speech in Hindi/English and displays it in large roman text.</p>	<p>Completed</p> 	<p>The apps have been developed on a RAD, App Inventor that is itself under development, but provides an invaluable advantage of quick user feedback during prototyping. It demonstrates the success of the development approach, enabling practical development without imposing upon the users the burden of long project times with unclear outcomes, sometimes failures, and no further improvement or involvement at the end of the project. The number of views and downloads listed in the dissemination efforts column of this table to reflect the interest in the apps and perhaps their usefulness.</p>	<p>100-500 downloads</p> <p>Video about the app (215 views)<sup>14</sup></p>
<p><b>Narangi (Narangi2)</b> - A Slate for deaf-blind Children<sup>15</sup>: Tap the screen to switch between draw and sense modes. To draw, switch to draw mode, signalled by a long vibration. Now drag your finger across the screen. The drawing is black on orange. The device vibrates while you draw, with a slight change when you cross an existing line. To sense what you have drawn, tap the screen to switch to sense mode. You feel a short vibration. Now simply move your finger on the screen. The device vibrates when there is black color below your finger. To clear the screen, rotate your phone from portrait to landscape or vice versa.</p> <p>Narangi in Hindi means "orange" which is the color of the background on which you draw. Na rangi, on the other hand, means "without color". Since this is a monochrome drawing app, that seemed like an appropriate name.</p> <p>This app has been designed with the help of friends from the Homi Bhabha Center for Science Education, Mumbai. It does not collect any data from the user.</p>	<p>Completed</p> 	<p>100-500 downloads</p> <p>Video about v1 (275 views)<sup>16</sup></p> <p>Video about v2 (63 views)<sup>17</sup></p>	

<sup>12</sup> Videos and applications for download <http://www.bapsi.org/vibrations-series-of-products-for-deafblind>

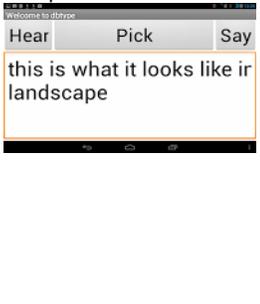
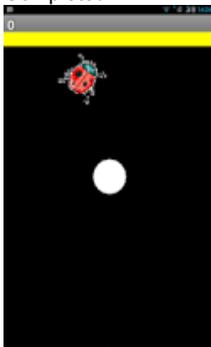
<sup>13</sup> TellMyPhone [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.TellMyPhone](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.TellMyPhone)

<sup>14</sup> Video about TellMyPhone app [https://www.youtube.com/watch?v=BnM\\_VF16rSo](https://www.youtube.com/watch?v=BnM_VF16rSo)

<sup>15</sup> Narangi application [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.narangi2&hl=en](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.narangi2&hl=en)

<sup>16</sup> Narangi v1 video <https://www.youtube.com/watch?v=TndRXvW-gxU>

<sup>17</sup> Narangi v2 video <https://www.youtube.com/watch?v=8dxibgcX5qw>

Project outputs	Status	Assessment	Dissemination efforts
<p><b>Showitem</b> - Picture Based Communication for the Non-Verbal<sup>18</sup>: Simple database functionality: associates short alphanumeric codes for pictures to call them up quickly. Press Select to find a picture in your gallery, type in a code in the text box, press Save. A list of all tags to pictures is available by pressing Pick. x deletes a single item in the database, Clear empties the database.</p>	<p>Completed</p> 	<p>As above.</p>	<p>10-50 downloads Video about the app and how to use it (53 views)<sup>19</sup></p>
<p><b>Dbtype</b> – Communication for the Deaf Mute with Low Vision<sup>20</sup>: This app allows communication to a person who cannot hear nor speak, and also has low vision. A text box using large font sizes allows communication through typing. The 'Hear' button activates speech to text, displaying the result in the text box, while the 'Say' button converts the text in the box to speech and plays it through the speakers of the device. The 'Pick' button lets you pick from pre-stored sentences. To edit these, type only the word "settings" (without parenthesis) in the text box. This opens another screen where you can edit a list of sentences, and also change the font size. When you press Save, you are brought back to the main screen.</p>	<p>Completed</p> 		<p>100-500 downloads Video about the app and how to use it (229 views)<sup>21</sup></p>
<p><b>Dbbug</b> – A game accessible for deaf-blind players<sup>22</sup>: This game can be played by a deaf-blind person. Keep the screen horizontal, and play the game by tilting it. On the screen are a bug and a ball. The ball rolls in the direction you tilt the phone. When it touches the bug, it produces a long vibration, and the bug flies to a new spot on the screen. Your score on the title bar is incremented by 1. When the ball moves towards the bug, the phone vibrates. The faster it approaches the bug, the longer the vibration pulse.</p>	<p>Completed</p> 		<p>10-50 downloads v2 video about the app and how to use it (24 views)<sup>23</sup>. V1 video about the app and how to use it (74 views)<sup>24</sup>.</p>

<sup>18</sup> ShowItem application [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.showitem](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.showitem)

<sup>19</sup> Showitem video <https://www.youtube.com/watch?v=1yJl90Pr-7I>

<sup>20</sup> Dbtype application - [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.dbtype](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.dbtype)

<sup>21</sup> Dbtype video <https://www.youtube.com/watch?v=4DyfxVWA2E>

<sup>22</sup> Dbtype - [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.dbbug](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.dbbug)

<sup>23</sup> Dbbug v2 video <https://www.youtube.com/watch?v=4bRxPvTbiAc>

<sup>24</sup> Dbbug v1 video <https://www.youtube.com/watch?v=maSmwo6aOrE>

Project outputs	Status	Assessment	Dissemination efforts
<p><b>Akhtar</b> - A feature-rich communication app for the deaf with low vision<sup>25</sup>. Akhtar is the first deaf-mute person with low vision we worked with, in developing software that allows him to communicate without human assistance. A menu offers text to speech, including frequently used sentences, the ability to load and delete files, to share text for purposes of email, chat, etc., to split text so that selected paragraphs can be pasted where desired. People who have difficulty with the cursor should find this a useful app</p>	<p>Completed</p> 	<p>As above.</p>	<p>1-5 downloads Video about the app and how it works (7 views)<sup>26</sup> Akhtar, An illustration of Bapsi's individual approach to developing technology for severely disabled persons (20 views)<sup>27</sup></p>
<p>Presentations at 7 international events:</p> <ul style="list-style-type: none"> <li>Arun Mehta was invited to speak at the Google Accessibility Summit on the panel relating to "Design Challenges for Persons with Multiple Disabilities" at Mountain View, California, USA on 10th February 2015.</li> <li>Arun Mehta was invited to speak via international video conference to Bell Labs around the world, as part of their 360 Degree lecture series on July 15, 2014, on his work with multiple disabilities.</li> <li>Arun Mehta made a presentation at a session on Computing for the Differently Abled at the Fifth International Free Software Conference in Kerala</li> <li>Bapsi organized a panel at Eighth annual meeting of the Internet Governance Forum on the 25th of October 2013 in Bali, Indonesia, which focuses on DCAD/BAPSI Workshop "Accessible Inclusion For All Abilities and All Ages, Access for Persons who fall between the cracks"</li> <li>Panelist on the Future of Accessibility at Google Global Summit on Accessibility and Usability at Google headquarters in Mountain View, California, United States, on September 17-18, 2013.</li> <li>Workshop ICT Apps for Persons with Disabilities on Wednesday 15 May 2013, at the WSIS (World Summit on the Information Society) FORUM 2013 in Geneva, Prof Arun Mehta, President, BAPSI, Bidirectional Society, India, presented "Access for those who fall between the cracks".</li> <li>Arun Mehta made a presentation, "those who fall between the cracks" to the Focus Group on Audiovisual Media Accessibility of the ITU, Geneva, on 21 January 2013.</li> </ul>	<p>Completed</p>	<p>Because the problems of the deaf-blind are far removed from the experience of most people, we expect very little to come out of these presentations. There is the chance that someone listening might come forward to supports us.</p>	<p>Google presentation<sup>28</sup> Bell Labs presentation<sup>29</sup></p>
<p>5 local events:</p> <ul style="list-style-type: none"> <li>National Conference and Exhibition on 'ICTs for Persons with Disabilities: Taking Stock and Identifying Opportunities'. 13 June 2014, Awareness workshop at HKI</li> <li>14 June 2014, Awareness workshop at HBCSE</li> <li>8 - 9 August 2014, Two morse code workshops</li> <li>15 October 2014, Workshop for students at IIT Delhi on how to write apps for Android smart phones using MIT App Inventor</li> <li>29-30 April 2015, Student interaction at HBCSE</li> <li>Paper by Dr. Arun Mheta: "Haptics and the Deaf-Blind" in the publication Promise for ALL:Wearables, 3DPricing, and Robotic<sup>30</sup> (Guest Editor: Debra Ruh), April 2015.</li> </ul>	<p>Completed</p>		

<sup>25</sup> Akhtar - [https://play.google.com/store/apps/details?id=appinventor.ai\\_arun\\_mehta.akhtar](https://play.google.com/store/apps/details?id=appinventor.ai_arun_mehta.akhtar)

<sup>26</sup> Akhtar video [https://www.youtube.com/watch?v=jjv\\_Dr6-MDU](https://www.youtube.com/watch?v=jjv_Dr6-MDU)

<sup>27</sup> Bapsi approach to tech for the disabled <https://www.youtube.com/watch?v=BJFUotMSAMk>

<sup>28</sup> Google presentation <http://www.bapsi.org/Google-Presentation>

<sup>29</sup> Bell Labs presentation [https://docs.google.com/presentation/d/1gIGUfBrW287BSYk\\_4JNxnjz9\\_wlzczybTZMSIK6C-og/edit](https://docs.google.com/presentation/d/1gIGUfBrW287BSYk_4JNxnjz9_wlzczybTZMSIK6C-og/edit)

<sup>30</sup> Promise for ALL:Wearables, 3DPricing, and Robotic <http://www.designforall.in/newsletterapr2015.pdf>

## Project outcomes

**Tips:** This section should be completed **ONLY** for the final report.

ISIF Asia expects you to report about the **outcomes** of the project as defined in the table below, based on the project implementation section of this report. Project team is encouraged to discuss the questions provided below to guide the reflection:

Can you identify and describe the relationships between the activities implemented and the social, economical, cultural and/or political benefits of your project implementation?

**Outcomes can be defined as:**

- *Medium-term effects*
- *Effect of a series of achieved outputs*
- *Should capture the changes for the beneficiaries*
- *Take place during the life of project/strategy*
- *Influence but not direct control*

A suite of apps for the deaf-blind has been designed and made available for free download from the Google Play store. These apps address specific categories of the deaf-blind as detailed above. In the process, we have gained some appreciation of what works and what doesn't, in relation to the smartphone and the deaf-blind, which will inform future development.

- We succeeded in establishing direct, unmediated communication with deaf-blind persons using our apps. This has given them an appreciation for what new technologies, such as speech to text and smartphones, can do for them. The needs of one deaf person with low-vision were addressed by three apps specifically developed for him. We are attempting to get Morse code, which we see as an important means of communication for the deaf-blind, incorporated into the curriculum for the trainers, and to offer training in Morse code to a deaf-blind man who wishes to learn it.

Three apps that we developed as part of the project but were not able to use during the course of the project, will be used by the Helen Keller Institute for the Deaf and Deaf-Blind (HKI) in the coming months, as and when a suitable person found whose needs can be addressed b those apps.

The sophistication of the deaf-blind and their caregivers in haptics has been brought home to IT companies and academics. This will hopefully lead to long-term partnerships in the area, helping to mainstream the deaf-blind.

- Projects related to the deaf-blind have become part of the activities at the Homi Bhabha Center for Science Education (HBCSE), which will magnify the effect of our work. We will attempt to get students to make production versions, incorporating feedback from deaf-blind users. We will also work with HBCSE to develop courseware for Morse code.

We have agreed with the HBCSE to look for funding to set up a permanent center at the HKI, which will provide custom solutions to disabled persons with technology problems, support the IT training of caregivers and their trainers, and facilitate student projects.

Substantial awareness has been generated among a variety of groups such as students, caregivers, software developers, academia, IT companies through talks at different fora as detailed in the section above on Dissemination.

There were some unexpected outcomes of the project as well. Although the assessment of apps is difficult, because we get no feedback; the distribution method allows feedback but does not mandate i. tAs downloads happen all over the world, we don't know how many might have used an app. It was only when a Frenchman wrote to us about a bug he had caught in one of our apps, that we learnt that he was using it.

## Project management and sustainability

**Tips:** Please comment on the general project **administration, staffing, procurement, etc.** specially those aspects contributing to the fulfilment of the project objectives as well as those that have delay project implementation. Indicate **how the project team has strengthened its capacity** and work towards sustainability with the support provided by ISIF Asia? (new equipment, training, improved administrative skills, lessons learned from the project). Has the organization increased its research or administrative skills of the team involved? Has the project allowed for a particular contribution to capacity building of women or marginalized social groups? Special attention should be paid to the expected or unexpected impact on marginalized social groups.

Have you done **anything different** to provide administrative support for this project **besides your “business as usual”** processes and procedures? Has the project inspired change inside your organization?

**Sustainability is to be examined not only in terms of staff retention and financial stability of the organization supporting the project but about the communities’ appropriation of benefits perceived from project implementation.**

The ISIF Asia Secretariat is very interest to learn if this project has generated opportunities for future development (new funding from partnerships, sponsorships, investment or other funding mechanisms), please provide details. Please explain if the ISIF Asia grant has helped to consolidate your organization and how. If any of the project activities will continue after the end of the ISIF Asia grant, please describe how your organization is planning to support future developments.

This project has raised significantly the international perception of Bapsi as an organization that can actually deliver on its promise of free technology for those with multiple disabilities. We have become proficient in app development, which is highly valued. As smartphones become cheaper, their ability, and ours, to make a significant difference in the lives of extremely marginalized people is increasing rapidly.

Our partnership with HBCSE has helped us magnify the effect of our work, and will continue to do so, because this organization has incomparably greater resources and reach than we do. We have also forged relations with the HKI, the oldest and leading institution in India in caring for the deaf-blind and training their trainers.

We have gained confidence in dealing with extremely difficult problems relating to those with multiple disabilities, which will help us reach out to other marginalized groups as well. We hope that our track record in this field, significantly bolstered by this project, will make it easier for us to approach corporates for support under their corporate social responsibility obligations.

Our audio and video recording and editing ability has also improved during this project, which will positively impact the videos we make in the future.

## Impact

**Tips:** This section of the report does not refer to the project activities, but about the **“bigger picture”**. It will be desirable if the project team can reflect on the **impact that the project has contributed to as part of other actions implemented by your organization and/or your partners.**

**Impact refers to the influence the project may had on the way people does things through the use or adoption of the project outputs; changes in the context the project was implemented; changes in the community the project has been working with; and/or changes inside the organizations that have participated in the implementation or the relationships established through the project’s implementation.**

Impact is often impossible to measure in the short term and is rarely attributable to a single activity. Impact can be linked to a vision or long-term development goal that your organization might be working towards. It can be identified as a logical consequence of achieving a combination of outputs and outcomes. Impact is usually measurable after the project life and is outside the direct control of the project team and the organization.

We expect impact of our work primarily on the deaf-blind themselves. Once they learn to communicate without the necessity of rare and expensive sign-language interpreter resources, which are comfortable communicating through touch, they will find it easier to get an education, to organize, and demand their rights. This will have major impact on governments, which have been neglecting their obligations to the severely disabled.

We have made a strong case to Google and Bell Labs, two major telecom players, about how making the phone more accessible to people who can only receive information through touch, would make the smartphone a far more versatile and powerful device.

By making work with the deaf-blind a part of the project work of students that come to HBCSE, we expect more technology to be developed that targets the deaf-blind, as well as courseware for their education. Since HBCSE is highly influential in the field of education, other organizations are likely to follow.

This project has brought us closer to our long-term goal of setting up a permanent facility that disabled persons can approach for technology problems, the way they can approach a hospital for medical issues.

## Overall Assessment

**Tips: This section of the report is extremely valuable for the ISIF Asia secretariat as it provides evidence about the role and relevance of ISIF Asia contributions in the Asia Pacific region.**

**Tips: Briefly provide your own views on the value and importance of the project relative to the proposed innovation, investment of time, effort and funding involved. Include the strengths and weaknesses of the project and the steps taken to strengthen the credibility and reliability.**

**This is your opportunity to conduct a team reflection about the value of the project for the organization. The following questions might help you to prepare a substantive overall assessment.**

- To what extent the project meet its objectives?
- What were the most important findings and outputs of the project? What will be done with them?
- What contribution to development did the project make?
- Were certain aspects of project design, management and implementation particularly important to the degree of success of the project?
- To what extent the project help build up the research capacity of your institution or of the individuals involved?
- What lessons can be derived that would be useful in improving future performance?

Very little work has so far been done to make electronic communications affordable for the deaf-blind. This project has significantly changed that.

The caregiver community of the deaf-blind works with two means of communication, Braille and sign language. Its resistance to learning a third, Morse code, is high. We think we have been able to put through the importance of introducing Morse code into the curriculum for trainers.

We have forged important partnerships with HBCSE and HKI, which will be of great help in future work.

We have also built up sufficient track record in working with the deaf-blind and other persons with multiple disabilities, to approach corporate entities in India and abroad for support to help sustain this work.

## Recommendations

**Tips: Include any recommendations in this section that you and your project team, the organizations supporting the project and the community you worked with, would like to make to other practitioners or researchers on the field facing similar problems or implementing similar solutions.**

**Please take a minute to share recommendations with the ISIF Asia secretariat that might help to improve the**

### support provided.

The project team recommends:

- Increase sensitization of engineering students to the problems of persons with disability, and the role of access technology.
- Promote platforms that ease the development of software, such as MIT App Inventor.
- Support the training of the disabled and their caregivers in technology development.
- Strengthen the technology component in the curriculum of trainers of the disabled
- Improve haptic support in smart phones.
- Set up a facility where the disabled can go with technology needs, the way they can go to a hospital for medical needs.

## Bibliography

**Tips:** Include complete bibliographic references to all sources (printed, on-line, quotes, etc) used to prepare the different sections of this report. The APA style guide offers examples about how to reference a variety of sources. <http://www.apastyle.org/learn/quick-guide-on-references.aspx>(as accessed on 3/7/2013).

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