

# Social Media Platforms for Low-Income Blind People in India

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## ABSTRACT

We present the first analysis of the use and non-use of social media platforms by low-income blind users in rural and peri-urban India. Using a mixed-methods approach of semi-structured interviews and observations, we examine the benefits received by low-income blind people from Facebook, Twitter and WhatsApp and investigate constraints that impede their social media participation. We also present a detailed analysis of how low-income blind people used a voice-based social media platform deployed in India that received significant traction from low-income people in rural and peri-urban areas. In eleven-weeks of deployment, fifty-three blind participants in our sample collectively placed 4784 voice calls, contributed 1312 voice messages, cast 33,909 votes and listened to the messages 46,090 times. Using a mixed-methods analysis of call logs, qualitative interviews, and phone surveys, we evaluate the strengths and weaknesses of the platform and benefits it offered to low-income blind people.

## Keywords

Blind; Social Media; Interactive Voice Response System; ICT4D; HCI4D

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI); Miscellaneous.

## 1. INTRODUCTION

About 90% of the world's 285 million visually impaired people live in low-income settings [37]. India has the largest blind population, with more than 63 million visually impaired people [21]. The majority of visually impaired people in India have limited access to computing devices, Internet services, and digital assistive technologies like screen reader software in local languages. These barriers in accessing information severely impede their education opportunities [32], job prospects [19], social status, and potential to overcome poverty.

In the last decade, social media platforms have revolutionized the way information is reported, consumed and shared and have

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ASSETS '15, October 26-28, 2015, Lisbon, Portugal

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DOI: <http://dx.doi.org/10.1145/2700648.2809858>

deeply impacted the lives of billions of people around the world. In addition to providing entertainment, information, and abundant user-generated content, they are seen as an instrument of social change. Many people believe the social media revolution to be the biggest societal shift since the industrial revolution [27,42]. Social media platforms are also playing a pivotal role in supporting academic collaborations [11], managing crisis response [28], political campaigning [17,38], and organizing civil society movements like the Arab Spring [26,29]. Even during the devastating 2015 Nepal earthquake, the BBC used the public chat feature of Viber to share information and safety tips with affected people [43].

Several researchers have studied the use of social media platforms by people with disabilities in the developed world [4,5,7,31,39]. A few researchers have also analyzed the use and non-use of social media platforms by low-income people in the developing world, including studying the role of Facebook in providing employment opportunities to young adults living in urban slums in Nairobi [40], improving communication, technology and English language skills of young adults living in urban slums in South India [24], and empowering marginalized people living in urban slums in Brazil [16]. Wyche et al. studied Facebook use and non-use by low-income rural Kenyans and found that the constrained access of devices, Internet, and electricity impede online participation [41]. However, the use of social media platforms by blind people in the developing world has received no attention as yet.

There is a need to study the use (and non-use) of existing social media platforms by blind people in low-income settings, identify benefits received by them, understand the challenges encountered by them, and assess the need for designing a new accessible social media platform. The findings will inform the design of social media platforms for the 256 million visually impaired people who are living in low-income settings.

**As a primary contribution**, we present the **first analysis** of the use and non-use of social media platforms by low-income blind people living in rural and peri-urban India. We found that low-income blind people in India use social media platforms to expand their connections, receive instrumental benefits, uplift their social standing, and access informative and entertaining content. However, the cost of smartphones and internet access, difficulties in understanding the language of the audio output of screen reader software, inaccessible features of existing social media platforms and lack of training has resulted in many blind people either not exploring these platforms or abandoning their use. These financial constraints, socioeconomic barriers, issues with English language proficiency, and infrastructural limitations accentuate the need for designing a new social media

platform that is cognizant of the constraints of blind people living in low-income settings.

In prior work, we designed and deployed *Sangeet Swara*, a new social media voice forum in the Hindi language [33]. The platform was built using Interactive Voice Response (IVR) technology and was accessible using any phone. It enabled callers to record voice messages, listen to messages recorded by others, vote on them, and share them without needing Internet access. The platform was deployed to engage low-income people and understand whether community moderation can be used for managing content on IVR systems. The platform saw significant adoption by low-income communities, receiving over 25,000 calls and 5000 voice messages from more than 1500 people in an eleven-week deployment. The details of the system design, deployment in India, results on community moderation and engagement by low-income communities are available in [33]. However, to our surprise, *Sangeet Swara* also received broad and impassioned usage by low-income blind people in rural and peri-urban India. In fact, more than 26% users of the platform were blind.

In this paper, we re-examine the usage of *Sangeet Swara* as part of the broader landscape of social media use by blind people. As a **secondary contribution**, we present new findings about how blind people from low-income settings used *Sangeet Swara*. In particular, we present detailed analysis of the content generated by blind participants, demographics, reasons for the high adoption of the platform, strengths and weaknesses of the platform, benefits and challenges offered to blind participants, and design implications for future systems.

Our analysis revealed that blind participants deeply valued their interactions with other participants on the platform. The analysis of call logs of fifty-three blind participants revealed that although they made up just 3.5% of all users, they contributed 25% of the number of recorded voice messages, 24% of the number of playbacks, 19% of the number of calls, and 25% of the number of votes cast by users. Our qualitative interviews and phone surveys also received emphatic responses from blind participants. Finally, we found that blind participants received several instrumental benefits, shared entertaining content, and built social capital using our platform.

## 2. RELATED WORK

The use of social media platforms by people in developed countries is a well-studied phenomenon [6,11,30]. In addition, a few researchers have studied the use of social media platforms by people with visual impairment in the developed world. For example, Fuglerud et al. studied the usability and accessibility challenges faced by visually impaired Norwegian people using social media platforms [7]. Wentz and Lazar presented a usability evaluation of the Facebook desktop and mobile interfaces, finding the mobile interface to be more accessible than the desktop interface [36]. Wu and Adamic conducted a large-scale empirical study of how blind people use Facebook and found that most of the content they produce relates to vision impairment [39]. They also concluded that blind people receive more feedback on their content, though their Facebook activities are similar to that of the general population. Brady et al. have investigated how social networking platforms can be used for asking visual questions posed by blind users [4]. Though findings from these studies are immensely insightful, it is

difficult to generalize them to blind people in developing countries due to huge differences in infrastructure, economic resources, education, language, and other contextual differences.

Research on social media usage by low-income, low-literate users in developing countries has also been well studied. Prior work has demonstrated that people in low-income settings derive instrumental benefits, earn social capital, and access entertainment through social media platforms. Young adults from an urban slum in Nairobi have used Facebook to support income generation activities, search employment opportunities, and seek remittances from friends and family abroad [40]. Their counterparts in South India have used Facebook to expand their social connections, learn English language skills, and transform self-perception [24]. People from urban slums in Brazil have used Facebook to access entertainment, organize and plan protests, and communicate with friends and families [16]. Mäkinen and Kuria analyzed the role of social media platforms as an alternative medium for participatory journalism during a post-election crisis in Kenya [12]. Bosch studied the use of Facebook by South African students and lecturers for teaching and learning [3]. Bosch also explored the role of social media platforms in enabling young women in South Africa to express and experience their sexual identity [2]. Wyche et al. studied Facebook use and non-use by low-income rural Kenyans and found that limited access to computers and smartphones, expensive Internet access, and unreliable electricity impede online participation [41]. Medhi-Thies et al. deployed an audio-visual social networking smartphone application for low-literate farmers in rural India and found that farmers authored posts related to agricultural information, families, local grievances and aspirational content [14].

Several other researchers have used IVR technology to design voice forums for enabling low-income, low-literate people to record and share voice messages. Some notable examples are *Avaaj Otalo* that provides an agriculture discussion forum for farmers in India [22], *CGNet Swara* that provides a citizen journalism platform for tribal people in Central India [15], *Ila Dhageyso* that provides a civic engagement portal for tribal people in Somaliland [9], *Polly* that shares job opportunities in Pakistan [25], a content creation and dissemination portal for people in rural India [1], and others [8,10].

A few researchers in the Information and Communication Technologies and Development (ICTD) community have also conducted research on understanding the role of technology for blind people living in urban India. They provided general recommendations for low-cost assistive technology [20], explored the usage of screen reader software [13,18], and analyzed workforce participation and underemployment [19]. Pal and Lakshmanan have noted that "*access to assistive technology is beginning to create an important and vocal population of people with vision impairments who interact independently on social media*" [19]. However, the participants in their research were generally from middle or upper class urban backgrounds and not representative of blind people in rural and peri-urban India.

Research that studies the design and use of technology by low-income blind people from rural areas in developing countries is severely limited. One exception is a study that examines the challenges faced by low-income blind people in accessing educational content and their coping mechanisms [32]. The

study found that acute shortages of Braille content, high quality audio books, and inexpensive text-to-speech for local languages have motivated low-income blind people to create, consume, and curate peer-produced audio content. One of the primary reasons for the scarcity of work targeting low-income blind people are the challenges experienced by researchers in making meaningful contact with them and gaining their trust.

Although researchers have studied technology use by blind people in India, few researchers have studied their social media usage. In prior work, we presented cursory findings on social media use by low-income blind people [33]. In this study, an IVR-based social media platform, *Sangeet Swara*, was designed and deployed to investigate whether community moderation can be used for managing the content generated on IVR platforms. In addition to low-income people who used the platform, the platform also received traction from low-income blind people. However, the analyses presented in [33] focus on all users of the platform rather than specifically analyzing call logs of blind participants, content generated by them, their demographic details, and the impact of the social media platform on their lives. To the best of our knowledge, ours is the first study that provides insights on how low-income blind people use social media platforms.

### 3. SOCIAL MEDIA USE AND NON-USE

To gain access to low-income blind people from rural and peri-urban areas, we contacted a non-profit organization, *Rajasthan Netraheen Kalyan Sangh*, in Rajasthan, India that conducts free computer training for blind people. The training lasts six months and each training batch has around eight participants. During the training, students learn to use Talking Typer, screen reader software like JAWS and NVDA, Microsoft Office, the Internet, and social media platforms. Students take an external examination at the end of six months and, after passing the examination, students receive a government-issued certificate that enables them to apply for several government jobs in Rajasthan and other states.

#### 3.1 Methodology

We recruited current and past students of the training program and their social contacts in order to investigate social media use and non-use by low-income blind people. We used purposive sampling and snowball sampling to select participants who satisfied either of the following inclusion criteria:

- Must be a blind from low-income family
- Must be an instructor or facilitator of the training program

In order to understand the broad spectrum of social media use and non-use, we separated participants into four categories based on their social media use: recent adopters, disenchanted users, consistent users and non-users. Recent adopters were participants who joined a social media platform in the last six months, disenchanted users were participants who either stopped using social media platforms or used them rarely, consistent users were participants who used social media platforms at least once a week for more than six months, and non-users were those who never used a social media platform. We also interviewed instructors and facilitators of the training program for triangulation, and to understand the opportunities and challenges technology offers to blind students in the program.



**Figure 1. Blind participants using social media platforms in the computer lab.**

We focused our attention on the three most popular online social media platforms in India: Facebook, WhatsApp and Twitter.

We used a mixed-methods approach spanning several qualitative and quantitative analyses. Our primary tool of analysis was twenty-two in-depth semi-structured qualitative interviews. We conducted observations on how computers, phones, and social media platforms were used by participants. We also analyzed activities on participants' social media accounts. We interviewed eighteen social media users and non-users, two instructors and two facilitators. Each interview began with demographic questions, followed by general questions about participants' experiences with mobile phones, computers, and the Internet. We then asked several questions to understand social media practices of blind users, strengths and weaknesses of the platforms, benefits and challenges offered, and constraints that impede social media participation. The interview with facilitators and instructors focused broadly on various social, technical, societal, and economic barriers faced by low-income blind students that impede their access to social media platforms.

Out of the eighteen social media users, eight were recent adopters, two were disenchanted users, five were consistent users, and three were non-users. Twelve interviews were conducted face-to-face on the premises of the non-profit organization while ten were phone interviews. The interviews were conducted by the first author (male, 28 years) in Hindi. Each interview lasted around forty-five minutes. We digitally recorded each interview and took detailed notes on paper. We reviewed and analyzed data immediately after conducting each interview. The insights obtained from the data analysis added more questions for the next interview. We continued to recruit participants until no new observation emerged. We spent ten hours observing participants using computers and social media platforms to understand their challenges and usage patterns (see Figure 1). We also analyzed the social media accounts of five participants to understand their usage and corroborate what they reported in the interviews.

#### 3.2 Participants Demographic Information

##### 3.2.1 Social Media Users and Non-users

Out of the eighteen participants, eleven were completely blind and seven were partially sighted. Out of the seven partially sighted participants, one had 5% visibility, four had 20% visibility, and two had 40% visibility. Six participants were blind since birth while others lost vision at the average age of 9.75 years (min=2 years, max= 26 years, S.D.=7.28 years). Only one participant used a computer before losing vision. Fourteen

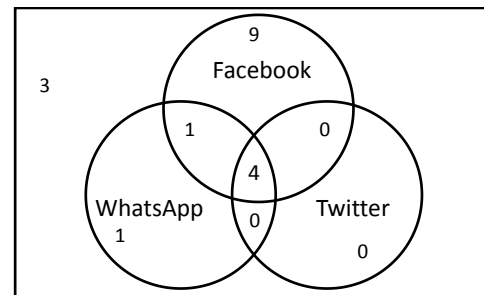
participants were skilled in reading and writing Braille content. Four participants reported themselves as slow while using Braille content: three of these were partially sighted and one was a late blind.

Our sample had sixteen male participants and two female participants. The average age of participants was 24.2 years (min=17 years, max=34 years, S.D.=4.18 years). Fourteen participants were students, three were unemployed, and one person ran a Photostat and stationery shop earning a monthly income of 200 USD<sup>1</sup>. One participant was a middle school student, two were high school students, nine were pursuing a bachelor's degree, and two were pursuing a master's degree. Two participants had finished a master's degree, and two participants stopped studying after completing high school. The participants were from five states in India. The majority of them were from villages (N=10) and small towns (N=2). Five participants were from second-tier cities and one participant was from a first-tier city. Most of the participants were from low-income households. The median monthly household income was 166 USD (min=0 USD, max=1667 USD, S.D.=473 USD). The average number of members in a household were seven (min=4, max=13). By normalizing the monthly income by family size, we found that half of the participants lived on 0.88 USD per day and two-thirds on less than 2 USD per day. The average annual income of participants was 387 USD, roughly a quarter of the per capita income of 1610 USD in India [44]. Two participants had no family income and were living on a monthly stipend of 8 USD provided by the government. The majority of the participants were from families of daily wage laborers (N=4), farmers (N=3), small shop-owners (N=2), carpenters (N=1) and household help (N=1).

All participants owned a mobile phone. 40% reported sharing their phone with family members. Nine participants used a basic phone, seven had a feature phone and two owned a smartphone. All participants used phones primarily for sending and receiving voice calls and only one participant used it for sending SMS. Five participants used screen reader software on their phone, specifically Talkback, Talks, and eSpeak. Six participants reported using the Internet on their phone for accessing social media websites (N=5), email (N=4), news (N=3), and downloading applications and songs (N=1). All but one participant reported using a computer at least once in their lifetime. However, only ten participants reported using a computer at least once in the last three months. Fourteen participants had used a computer in a shared setting while three had computers at home. All computer users used screen reader software and five participants used magnification software. Both JAWS and NVDA screen reader software were equally popular among participants. Eleven participants reported using the Internet regularly on a computer, primarily for accessing social media websites (N=8) and email (N=7), downloading books and songs (N=3), and online shopping (N=2). Three participants used the Internet rarely on a computer while four never used the Internet on a computer.

### 3.2.2 Instructors and Facilitators

Our sample had two facilitators (both male) and two instructors (one male and one female). The average age of instructors was 27.5 years whereas the average age of facilitators was 37 years.



**Figure 2. Venn diagram describing the distribution of social media users and non-users among 18 participants.**

Both the instructors were sighted whereas both the facilitators were completely blind. The average monthly income of instructors was 200 USD whereas the average monthly income of facilitators was 780 USD. All of them had at least a Bachelor's degree. Only one facilitator owned a smartphone, while the other three used a feature phone. The participants reported using the Internet on a computer (N=4) or a phone (N=2) and had an account on at least one social media platform.

## 3.3 Analysis

We translated and transcribed each interview in English. We used open coding and axial coding to analyze the data obtained from qualitative interviews and observations. Our observations and interviews with eighteen social media users and non-users formed the basis for understanding the reasons for use and non-use of social media platforms. We did not analyze the social media use of the instructors and facilitators, and used the interviews with the instructors and facilitators for triangulation. We present the results of our analysis in the following sub-sections.

### 3.3.1 Social Media Use

The distribution of participants across Facebook, Twitter, and WhatsApp is depicted in Figure 2. All but three participants had used at least one of the three social media platforms. Despite this unexpectedly high adoption, seven participants were unable to answer our question: *what are social media platforms?* Many of them had never heard the term *social media* or *social networking*. In fact, one participant explained social media as *“the organizations that perform social work.”* Participants heard about Facebook, Twitter, and WhatsApp from multiple sources: friends, the training institute, and mainstream media. Nine participants learned about the platforms from their family members and acquaintances, mostly when they overheard the name of these platforms during a group conversation. Seven participants learned about the platforms during the training, while two participants heard about them while listening to a program on television that encouraged viewers to ask questions on Twitter or Facebook. Fourteen participants had an account on Facebook, six had an account on WhatsApp and four were Twitter users. Nine participants had an account only on Facebook while the number of such users for WhatsApp was only one. One participant had an account on both WhatsApp and Facebook. Four participants had an account on all the platforms. On the basis of the numbers alone, Facebook was the most preferred platform while Twitter had the least adoption.

Two of the fourteen accounts on Facebook were locked or perceived inactive by the users either because participants forgot

<sup>1</sup> In this paper, we use an exchange rate of 1 USD = 60 INR

their password or they abandoned the use of Facebook. Sixteen users were able to describe to our satisfaction the features and usage of Facebook. Two participants had never heard of Facebook. Our sample contained a wide variety of users in terms of the time since they created a Facebook account (min=7 days, max=4 years, average=12 months). The distribution of the number of Facebook friends of participants was skewed by outliers (min=4, max=700). The median number of Facebook friends was eleven while the average was 122. We found an order of magnitude difference between the median number of Facebook friends for participants in our sample and the numbers reported for blind people in developed countries [4,39]. We observed that recent adopters had fewer friends than consistent users and disenchanted users. Wu and Adamic also reported a similar finding and concluded that the difference in network size is dependent on the length of time users have been on Facebook [39]. Many participants used Facebook to broaden their social circle. On average, 75% of participants' Facebook friends were people they knew in an offline setting while 25% of their connections were people they met only online. In addition to strengthening existing connections with the blind community, some participants used Facebook to have more interactions with sighted Facebook users. This was more evident for consistent users: 69% of their Facebook friends were sighted while this number was only 17% for recent adopters. Participants used Facebook for an average of one hour each day. Two participants reported using Facebook for more than 2.5 hours each day.

Participants reported broad usage of Facebook. They used it for widening their social circle, accessing and sharing news, songs and other informational content, sending photos, and chatting. To our surprise, five participants described Facebook as an e-commerce platform. They perceived it as a platform to contact a person who runs a business on Facebook and to market your own business. One of the participants explained his Facebook experience as follows: *"Facebook is for making friends and developing your business. If anyone like to buy something, they can buy it. When I will start a business, I will give a presentation to my friends, market it, and put advertisements on Facebook."*

Participants' Facebook experience was dominated by advertisements. Though Facebook serves advertisements to all its users, sighted users often learn to ignore these advertisements. On further investigation, we found that screen reader software divides the Facebook website into four panes. The last pane mostly consists of sponsored content. Because participants had limited experience switching between the panes using JAWS commands, these advertisements became central to their overall Facebook experience. The instructor noted that the advertisements were quite irritating to some students: *"Once the cursor moved to the last pane, many students were just lost. They got frustrated. They need much more practice to operate Facebook properly."*

The most popular feature on Facebook was chatting with friends. This was corroborated through analysis of participants' Facebook activities. Some participants considered online chatting as *"opening doors to a new world full of opportunities."* A majority of the participants (N=9) reported that their Facebook friends primarily use Facebook for chatting. The participants enjoyed interacting with both Facebook friends and Facebook strangers (Facebook users who are not their friends on Facebook). Facebook chatting also enabled them to

have an asynchronous communication similar to SMS where they could send a reply at a time of their convenience without spending any money on telephone calls or SMS.

WhatsApp was the second-most popular social media platform among the participants. Ten people explained the usage of WhatsApp to our satisfaction. Out of those ten people, six had an account on WhatsApp. The participants considered WhatsApp primarily as a social media platform for mobile phones. We found broad usage of WhatsApp including group chatting, individual chatting, and sharing songs, videos, voice-messages and even location. Three participants considered it as a platform for strengthening existing connections rather than facilitating expansion of their social network. This is because a WhatsApp user can share information only with people on the contact list of his phone. The users in our sample enthusiastically appreciated the feature of sending voice messages to other users:

*"I like sending voice messages on WhatsApp. It is simple to use. We hear the messages recorded in the voice of our friends. It is also cheaper than a phone call. Phone calls are good only for having long conversations. The only downside of voice messages is it requires a faster connection."*

P1 (Male, Bachelor's Student, 23 years, Rajasthan)

The majority of participants perceived Twitter as a social media platform to connect with celebrities and experts, and have *"intelligent conversations with friends"*. Though ten people knew the purpose of Twitter, only four people had an account. One account was locked. Even those who had an account, reported using it only for an average of five-minutes per day. Six users reported that either they do not have time to learn a new platform or they find it less engaging than Facebook and WhatsApp. This thought was echoed by the instructors: *"Only a few students used Twitter, mainly because none of their friends are active Twitter users"*. Two participants in our sample also reported using LinkedIn and Google Plus.

Out of the five participants who were both WhatsApp and Facebook users, three stated Facebook was their favored social media platform while two preferred WhatsApp. Participants preferred Facebook because it enabled them to expand their social network. WhatsApp was preferred primarily because it enabled them to exchange voice messages. WhatsApp also instilled a sense of faith in some participants: They were more convinced that they are not talking to imposters:

*"I trust people on WhatsApp more than the people on Facebook. Facebook has many people with fake profiles because it is easy to create a fake email ID and thus, a fake Facebook account. While creating a WhatsApp account, you have to use your own phone number."*

P2 (Male, Bachelor's Student, 23 years, Rajasthan)

### 3.3.2 Benefits

Participants derived significant benefits by using social media platforms. Nine participants used these platforms as an efficient instrument to increase their social circle. Eleven participants used these platforms for chatting mainly to strengthen their existing links.

All participants deeply valued their existing offline social networks of friends, colleagues, and teachers and reported receiving valuable information about scholarships, educational

material, health schemes, and employment opportunities through them. This assertion is also supported by one of the instructors who believed the network of blind students to be very cohesive: *“They know most of the blind people in the state. They will even tell you how many people in Rajasthan are blind. They rely on each other to share information.”* Fourteen participants reported that they meet their closest friends only twice in a year. Despite having access to mobile phones, they were able to interact with their friends only once or twice in a month because they could not afford voice calls<sup>2</sup>. These constraints are even more prominent when their friends are from different states as out-of-state voice calls incur higher call charges. One of the participants whose monthly family income is 23 USD expressed: *“I only call my friends when I have a question related to a career opportunity or to wish them on festivals. Everytime I call, I have to speak for 4-5 minutes and that is expensive.”* Though many of their friends still do not use these social media platforms, online chatting has empowered these users to have longer and more frequent conversations with friends who are using these platforms. Despite being separated by geographical distance, they reported feeling connected to their friends. These interactions not only supplement their need to access instrumental information, but also provide avenues for fun and entertainment:

*“Now I get in touch with my friends using Facebook chat. Some of my friends live in other states as well. Now, three of my friends are in touch with me using Facebook. We can share information on business opportunities and competitive exams with each other. We also share songs.”*

P3 (Male, Unemployed, 30 years, Rajasthan)

Six participants considered social media platforms as an avenue to get information on interesting topics and current news. Five participants used these platforms for sharing photos, videos, jokes, and even documents with others.

We also found aspirational use of social media platforms. Participants used them to attain a higher social status and get respect from sighted people. Five participants reported that often they were treated in a condescending manner by society. They believed that their friends, colleagues, and sometimes even family members had an inferior outlook towards them:

*“People think that even if we study, we will not get a job. When we go to mobile shops for recharging the Internet, they think that we are joking. They have a perception that even if I use Facebook who is going to be friends with me?”*

P4 (Male, Bachelor’s Student, 25 years, Delhi)

Despite this, participants had a strong desire to show the world that they can operate computers and are no less confident and knowledgeable than sighted users. They use social media platforms for demonstrating their use of computers and familiarity with technology:

*“When I say to people that I use a computer, then no one believes me. They think I am blind and when they cannot operate a computer properly how I will be able to. But when I send a request on Facebook, they know it is me who has sent that request. People in my locality now know that I use the computer.”*

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<sup>2</sup> The cost of voice calls in India is around 1 cent per minute.

P4 (Male, Bachelor’s Student, 25 years, Delhi)

### 3.3.3 Challenges

Participants experienced several challenges while using social media platforms. Most participants studied in a Hindi-medium school and had poor English language proficiency. Eleven participants complained about the language of audio output used in the screen reader software. They were unable to understand English words and the American accent output by the screen reader software and coped with it by reducing the playback speed. Three participants reported taking a few months to get used to the accent. The limited understanding of English also lowered the self-confidence and self-prestige of many participants. They felt disadvantaged and considered *“using the Internet a dream”* for people with limited skills in English and JAWS:

*“I have to keep the speed of the talking software very slow and this hampers my productivity. Though our intellect is comparable to sighted people, we are unable to compete with them because of the lack of English skills. I feel disadvantaged.”*

P2 (Male, Bachelor’s Student, 23 years, Rajasthan)

The instructors also considered the language of screen reader software to be one of the major limitations that impedes students’ use of social media platforms and the Internet. According to them, 90% of the students who came to the training program in the last two years were unable to write their name in English. Their training was significantly impacted because of limited English language proficiency. The instructors coped with it by translating many portions of the course content to Hindi.

Although chatting was the favorite and most frequently used feature, many participants were unable to use this feature because of screen reader difficulties in interpreting abbreviations common in texting and code-mixing (e.g., so-called “Hinglish” a mix of Hindi and English). Many people preferred WhatsApp because they could send voice messages to chat:

*“Nothing is better than sending messages in our voice. It helps in having a clear conversation. Many people use abbreviations for words. The screen reader software cannot read such content. It is very easy for a sighted user to read it, but blind people struggle a lot while chatting.”*

P1 (Male, Bachelor’s Student, 23 years, Rajasthan)

Eight participants reported that listening to messages in the voice of senders would be the best functionality Facebook could offer. One participant even reported that this feature would be like *“lighting a candle in darkness.”* Though Facebook messenger has voice chatting functionality, none of the participants knew about it. The participants referred to the voice of screen reader software as robotic and devoid of any emotions. It impacted the user experience significantly:

*“If I could hear the voice of my friend rather than JAWS reading his message, it would be so much better. JAWS is like a robot. I cannot get the feelings and emotions when JAWS read out messages sent by my friends. It diminishes the impact of chatting.”*

P5 (Male, Unemployed, 24 years, Madhya Pradesh)

Six participants complained about accessibility features and navigational challenges. In WhatsApp, when a user press the

icon for sending a voice message, the output from screen reader software overlaps with the voice message sent by participants. This diminished the user experience of two WhatsApp users in our sample. Four participants reported that the screen reader software randomly stopped working, possibly because of an unsupported font or script. Eight participants found it challenging to navigate across panes and to remember the commands of screen reader software. Many features also do not have associated commands. For example, several participants complained about the lack of commands for Facebook chatting. Rediffmail, a popular email service in India with 93 million subscribers, was also unsupported by JAWS. Three participants found it difficult to send friend requests on Facebook. Often they do not know the email address of a friend and when they search the name on Facebook, they find hundreds of profiles with the same name. Because they are unable to distinguish among profiles by looking at the profile picture, they have to go through an “arduous and irritating” process of reading profile descriptions. Three participants complained about the lack of captions on photos posted by their friends. Three other participants expressed strong sentiments for the limited adoption of audio captcha on many websites: “Can you imagine that the website of Indian Railways does not have an audio captcha? What is the point of learning a computer if I cannot even book my train tickets?”

Many of the features and terminology are not localized to geographical regions. Four participants found it difficult to learn and understand features of social media platforms. The participants found the concepts of *wall*, *tweet*, and *follow* difficult to grasp. Both participants and instructors noted the importance of training and continued usage of the platforms to overcome these semantic barriers.

### 3.3.4 Social Media Non-Use

We asked the eight recent adopters whether they would be able to use social media platforms after completion of the training. Though all of them stated that social media platforms play a pivotal role in their life and they would very much like to continue using the platform, half of them reported that they would not be able to use them at all while two of them reported that they would be able to use them only rarely. This means that 75% of the recent adopters expected to become a disenchanted user or a non-user in the near future.

The major reason for social media non-use by disenchanted users, potential abandonment by recent adopters, and the inability of non-users to explore these platforms is the same: **the cost of devices and the Internet**. This finding is also supported by prior research on the use of social media platforms by users in low-income settings [3,41]. Eleven participants attributed the cost of devices and the Internet as the primary reason for their non-use of social media platforms. Many participants were living in severe poverty and owning a smartphone or a computer was seen as a luxury rather than a necessity. Many participants reported belonging to sections of society “where no one has seen a computer or smartphone before.” All but one participant were dependent on others for supporting their expenses. Many participants asserted that the first thing they would buy after becoming independent is a computer or a smartphone for learning more information:

*“I rarely shave and get a haircut because I am unemployed. My financial situation is terrible and I have no family support. If there is no income, there*

*will be no phone, no Internet, and no Facebook. When I will have enough money, I will buy a computer and make an account on Facebook.”*

P6 (Male, Unemployed, 34 years, Rajasthan)

Some recent adopters were worried that they will forget what they have learnt by the time they buy a computer because of the lack of practice. Though some organizations distribute low-cost computers and smartphones to blind people, participants reported that it would be challenging for them to pay even for the Internet: “Paying for Internet recharge would be tough. A smartphone without the Internet is like a dumb phone.”

Participants also expressed difficulties in visiting Internet cafés for accessing social media platforms. The facilitator of the training program reported that approximately 50% of incoming students have not taken a mobility training. All participants but three reported not stepping outside their home and training institute alone. Even if they visit an Internet café, the accessibility features are often not activated on the computers:

*“Going to a café is a laborious task. The computers there do not have screen reader software. I have requested the owner to install them, but he is not interested because few blind people go to his café.”*

P7 (Female, Unemployed, 27 years, West Bengal)

Two recent adopters had a strategy to overcome this challenge. They planned to download NVDA in a portable flash drive and run the software from the drive itself. NVDA provides the ability to run it from a portable USB drive without needing administrative privileges on a computer.

### 3.3.5 Desire to Use New Media Technologies

Several participants expressed a strong desire for accessing information and entertainment using new accessible technologies designed specifically for them. The success of voice messages on WhatsApp, participants’ desire to hear messages in the voice of sender, problems with the language of screen reader software, lack of access to computing devices, and severe financial constraints prompted us to seek alternative low-cost technologies that can be appropriated for them.

In recent years, various researchers and practitioners have designed *voice forums* for enabling low-income, low-literate marginalized people in the developing world to report, access and share information [1,9,15,22]. These voice forums are built using IVR technology that enables users to record voice messages and listen to the messages recorded by others using basic voice telephony. This facilitates asynchronous communication among users which is similar to chatting. The successful deployments of voice forums in the ICTD community prompted us to investigate the adoption and usage patterns of IVR technology among participants.

All participants had used an IVR system at least once in the last three months. Nine of them used it for finding out the balance on their pre-paid phones, six of them used it for speaking to a customer service center, and the rest used it to access a conference calling system. Sixteen participants found IVR technology easy to use. Only two participants found IVR systems difficult to operate and time consuming, and believed that many blind people would not even know how to use such systems. One participant avoided using IVR technology out of the fear that “the excessive use of voice calls will damage ears because of radiation emanating from the phone.”



In a group session, we showed a demonstration of a Hindi-language based voice forum to eight participants and two instructors where they could call a number and press 1 to record a voice message and press 2 to listen to recorded messages. This voice forum can be visualized as a single voicemail system shared by all the users. Though voicemail features are very popular in North America, they are rarely used in India. We received an enthusiastic response from the participants: everyone found the voice forum easy to use. Many participants were excited about the potential of the voice forum for voice chatting. Three participants also recorded a voice message during the demo session (one of them is shown in Figure 3). Participants liked the fact that they did not have to listen to the “robotic voice of screen reader” and the messages sounded natural. Six participants believed that all of their blind friends would be able to use this system. They reported the voice forum to be much better than the IVR systems they had used for accessing customer services.

#### 4. Voice-based Social Media Platform

In our prior work, we designed, built, and deployed *Sangeet Swara*, a social media voice forum for low-income, low-literate people in India to understand whether the participants would be able to moderate the user-generated content on the voice forum without any outside support. The deployment saw significant adoption by low-income people in rural and peri-urban India. In an eleven-week deployment, we received 25,381 calls by 1521 callers, 5376 voice messages recorded by 516 people, around 200,000 playbacks of these messages, 40,590 upvotes, 99,150 downvotes and 773 share events. Though we did not promote the platform on any of the channels accessible to blind community, to our surprise, we found that *Sangeet Swara* was extremely popular among low-income blind users in India. The detailed discussion on the design of the platform, deployment, adoption by low-income users, success of community moderation in managing content on the platform and improving the quality of user-generated content, the challenges in financial sustainability is presented in our prior publication [33].

In this paper, we focus our attention specifically on the use of *Sangeet Swara* by low-income blind people in rural and peri-urban India. In particular, we empirically evaluate:

- Content produced, consumed and shared by blind participants.
- Usability experience of blind participants.
- Impact of the social media voice forum on blind participants.

In the next sub-sections, we briefly discuss the design of *Sangeet Swara* for the sake of providing a complete picture. Thereafter, we present a detailed analysis of how low-income blind people used the voice forum, what content they produced, strengths and weaknesses of the voice forum, and the benefits and challenges offered to blind participants.

##### 4.1 Design

*Sangeet Swara* enabled low-income people in rural and peri-urban India to record and listen to user-generated entertaining content like songs, jokes, poems, and anything that participants wanted to share. Similar to the *like* feature in Facebook, our system also requested callers to cast votes while listening to messages on the voice forum. Similar to the Facebook *wall*, each caller was played voice messages sequentially. The votes cast by



Figure 3. A blind participant accessing the demo of a voice forum.

callers were instrumental in deciding the quality of the messages and the order in which the messages were presented to callers. Similar to the *share* feature on Facebook, participants could also share a voice message with others. An account was automatically created the first time participants called our system. The username for each account was the phone number used for placing the voice call.

To access the system, participants placed a call on a toll-free number. Once the call was connected, participants were requested to select one of the four options by pressing the relevant key on their phone keypad:

1. **Access analytics on your messages.** Callers could press 1 to access the latest rank for each message recorded by them and the number of participants that heard them.
2. **Record a new message.** Callers could press 2 to record a new message. The callers were encouraged to introduce themselves in the beginning of the message. The maximum permissible length of messages was seventy seconds. After recording a message, the callers received an SMS containing a five digit numeric code corresponding to the message they recorded.
3. **Listen, rate and share messages.** Callers could press 3 to listen to the messages in the voice forum. Each message was played sequentially. At the end of each message, the callers were required to either give an upvote to the message by pressing 1 or downvote it by pressing 2. They could listen to the message again by pressing 3. They could share the message by pressing 4. On selecting the option to share content, we forwarded the caller an SMS containing the numeric code for the shared message. In the SMS, callers were encouraged to forward the SMS to their friends to share the numeric code for the message they wanted to share.
4. **Access a message directly.** Callers could press 4 to enter the numeric code for accessing a message directly. This feature alleviated the need to wait for a particular message to show up in the playback list.

Callers could barge in at any time for any prompt to indicate their selection. All the prompts were recorded in a slow and clear diction by a native Hindi speaker (male, 28 years). We developed the system by using IVR Junction [34] and Voxeo Prophecy [45].



## 4.2 Methodology

We used a mixed-methods approach to analyze the usage by blind participants. We conducted a structured phone survey that asked one pre-recorded question to callers every time they called the voice forum. The survey consisted of fifteen subjective questions recorded in Hindi. The questions were asked to understand the background of participants, collect demographic data, evaluate the user experience and efficacy of community moderation, and investigate the impact of the voice forum on them. The survey was completed by a total of 204 participants. Although we did not specifically ask them, while giving information on their background, 26% of the survey respondents (N=53) voluntarily identified themselves as blind [33]. **For the analyses presented in this paper, we only consider data contributed from those fifty-three respondents who voluntarily disclosed that they were blind.**

For our user analysis, we studied survey responses contributed by the fifty-three blind participants. We translated and transcribed their responses in English and analyzed them using open coding. The average length of the response was 38 words. We also studied the call logs of the fifty-three blind participants to understand usage patterns.

For content analysis, we randomly sampled a hundred messages from the voice messages recorded by blind participants and inspected them on several criteria like gender, content type, location of callers, the quality of the recording, etc.

We also conducted thirteen semi-structured qualitative interviews with blind participants to investigate the user engagement, and measure the strengths and weaknesses of *Sangeet Swara*. The interviews were conducted in Hindi by the first author. We reviewed and analyzed data immediately after conducting each interview. The insights obtained from the data analysis added more questions for the next interview. The interviews were translated and transcribed in English, and were analyzed using open coding.

## 4.3 Analyzing Call Logs of Blind Participants

On quantitatively analyzing call logs of the fifty-three blind survey respondents, we were surprised to see their disproportionate usage of the system. The fifty-three participants were only 3.5% of all participants on the platform. However, they were responsible for recording approximately 25% of all contributions. The median number of messages recorded by these blind participants was 13 (max=170 messages). Seven of them recorded more than fifty messages each. They placed 4784 voice calls (19% of total calls received), cast 7350 upvotes (18% of all upvotes) and 26,559 downvotes (27% of all downvotes), shared 57 messages (8% of all shared events) and listened to messages 46,090 times (24% of all playback events).

Forty-three participants answered all questions on the survey while ten participants answered the survey partially. Although a few blind participants did not record any voice messages, they were heavy listeners of the content contributed by others. Two such blind listeners called the voice forum 23 times and 123 times respectively. These listeners also recorded emphatic and verbose responses (with an average length of fifty-words) to the questions asked in the phone survey. The number of messages recorded by blind contributors, votes cast by them, messages listened by them, and the average length of responses given by

blind listeners in our survey is strong evidence that blind contributors and listeners valued *Sangeet Swara*.

## 4.4 User Analysis of Blind Participants

The blind participants in our sample were from thirteen states in India. Two-thirds of them were from rural regions. 93% of the respondents were male, and 7% were female. The average age of the blind participants was 24.6 years (min=15 years, max=42 years, S.D.=8.1 years). They came from a broad range of educational backgrounds: 17% held or were pursuing a Master's degree, 19% held or were pursuing a Bachelor's degree, 21% were in high school, 10% were in middle school, 2% only completed primary school, 2% were uneducated and 10% were trained in music. 19% of the participants did not share information on their educational background. 24% of the blind participants were employed and earned an average monthly income of 107 USD (min= 5 USD, max=334 USD, S.D.=110 USD). 45% of the blind participants were students, 14% were teachers, 12% were unemployed, 9% worked either as a telephone operator or a singer. We did not have employment information for 20% of the participants.

All blind participants owned a mobile phone. 26% of them reported using SMS, another 26% of them reported not using SMS, and 48% of them did not share this information. Only one blind participant had an email account and three participants had a Facebook account. Many participants had never even heard of Facebook and often responded: "*We do not have a Facebook account, but we have an account in Bank of India.*" They associated the word *account* with banking services rather than Internet services.

## 4.5 Content Generated by Blind Participants

All one hundred messages in the random sample that we analyzed were recorded by male participants. In sixty-eight messages participants reported their location, in seventy-seven messages they shared their name and in twenty-five messages they shared their phone number publicly with all participants on the voice forum. The participants were from nine states in India. All messages but one were high-quality recordings. The average length of voice messages was 47 seconds (min= 5s, max=70s, S.D.=22.2s).

Thirty-nine messages were similar to the messages that people generally share on Facebook, WhatsApp, and Twitter. This category comprised discussion on topics trending in the platform, generic informative messages, messages intended for specific people, discussion on topics of national and regional interest, messages requesting feedback from other participants, messages requesting or sharing phone number, etc. We found seven flirtatious messages where participants showered special attention and adulation to female contributors. One person also recorded a message reprimanding those who were recording flirtatious messages for women participants. We found four messages where participants spoke about visual impairment. Twenty-four messages were poems. Most of them were written to express feelings on love, separation, motherhood, visual impairment, environment, women empowerment, success, and persistence. Twenty-one messages were songs, including folk songs (n=10), Bollywood songs (n=8), and even recordings from a playback device (n=3). To our surprise, we saw nine messages where people shared general knowledge information with each other by asking questions or recording answers to the questions asked previously. One example of a question asked on the forum

is, “When is the World Environment Day celebrated?” Two messages were jokes. We also found two messages containing abusive language and one message where a participant recorded sexually explicit content. We have made available twenty-five randomly selected messages recorded by blind participants at <https://soundcloud.com/socialmediavoicforum/sets/random25>.

## 4.6 Usage by Blind Participants

### 4.6.1 Adoption

*Sangeet Swara* received a huge response from blind people (see Figure 4 for a photograph of one of our users). Although 26% of the survey respondents self-reported themselves as a blind, we believe this number is a conservative estimate of the actual percentage of blind participants who used the voice forum. The representation of blind people on our platform is significantly higher than their representation on Facebook, Twitter, WhatsApp or even among the population of India. In addition, the participants were spread out all across India. They recorded several positive sentiments about the platform and shared impactful stories on how the platform was playing an influential role in transforming their lives. For example, several participants shared that the platform connected them with blind participants in other states and far-off locations. The voice forum was the first introduction to a social media platform for 99% of participants in our sample. They valued the interactions with other blind participants and derived several benefits by using the platform:

*“Using this platform is a great experience. I listen to people from all over India, made many new friends, and heard many creative talents of other blind people. In this fast life, no one has time to listen to jokes, songs, and one-liners. Those who have time, do not have resources. Those who have resources, they do not have time. Now a days, literate, illiterate, poor, rich everyone has a mobile phone. The platform has enabled those who do not have resources to consume entertaining content anywhere, anytime, and in any quantity.”*

U1 (Male, Telephone operator, 31 years, Maharashtra)

Many participants perceived the forum to be exclusively designed for and used by low-income blind people, primarily because of the sheer number of blind users and abundance of songs, poems and discussions central to visual impairment. For example, we found three songs on the importance of Braille and a discussion on Louis Braille during the content analysis. Blind people used the platform to meet new people and earn social capital. Many participants also exchanged their phone numbers by recording a message on the platform for having longer offline conversations with other users on the platform:

*“The platform is a boon for blind people. It gives us the opportunity to show and improve our talent. Blind people who use the platform are very competitive and they continue to improve their messages. We also reach out to people in far-off towns and get to know them better. We get a lot of knowledge. I also get inspiration from listening to other blind people. Blind people who want to learn and make progress share informative messages with us.”*

U2 (Male, High school student, Uttar Pradesh)

We were curious to understand how blind participants heard about the voice forum. Eleven participants reported that they

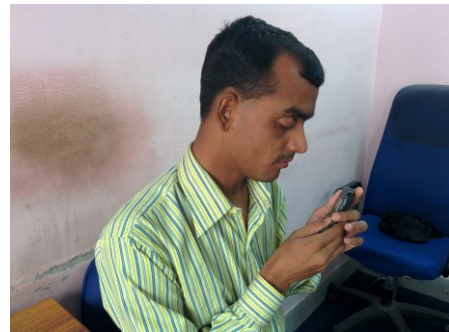


Figure 4. A blind participant accessing *Sangeet Swara*, a social media voice forum

were told about the platform either by a friend or a teacher. Five participants reported spreading information about the platform by calling their friends. During the qualitative interview, one participant reported receiving a phone call from a friend to convey the gratitude for introducing him to the platform: “*You have given me a new life. The platform is very good.*”

### 4.6.2 Benefits

The participants were excited that their messages were heard by people distributed all across India. When asked who (according to them) listened to the messages on the platform, many participants responded that “*literate, knowledgeable and inquisitive folks,*” and people of all generations listen to it: “*Mothers, sisters, kids, old, government workers, officers, students, farmers, everyone listens.*” The participants shared personal stories and accounts of life on the forum. We also found several messages where blind people recorded a song or poem sung by their children.

The participants regarded the platform as an avenue to access entertainment, share information, and learn skills. Many participants perceived it as a platform to show, judge and share feedback on musical talent. Five people believed that the platform was developed by *The National Academy of Music, Dance and Drama* and the Government of India to provide opportunities for low-income blind musicians. Several participants also learnt about and discussed current national and regional news. For example, five participants recorded performances and news on the 2013 North India floods:

*“Whatever I say about this platform will not be enough. We hear good jokes, songs, poems and even useful knowledge. We listen to the important news of India and world. We also got to know the latest situation of North India floods on the platform.”*

U3 (Male, High school student, 18 years, Gujarat)

Many participants also felt comfortable recording their career goals, aspirations and vision. They used the voice forum for motivating people to fight corruption and violence, and serve the underserved communities:

*“I want to become a good man and fight corruption in India. Some people are using violence against women, killing the innocents, depriving the poor of the dignity. When will this end? It will end when we decide to become righteous and law-abiding citizens. We are the future, we have to make our country successful.”*

U4 (Male, Student, 15 years, Jharkhand)

Many blind participants derived instrumental benefits from *Sangeet Swara*. Five participants reported learning social skills by using the platform. An eighteen-year old student from a small city in Madhya Pradesh reported that he “*learnt how to speak properly, how to behave, and how to respect others*” by observing the interactions of other participants. Three participants reported that the platform has improved presentation of their thoughts, refined their grammar and accent, and helped them learn new vocabulary. They attributed an increase in their self-confidence to platform:

*“The platform has provided me a lot of self-confidence. I can learn anything from the platform. I learn a lot from general knowledge questions asked on the platform. It is a great way to learn and understand principles of life. No matter how much I praise, it will never be enough. We get entertainment and knowledge. We also learn how to record better messages. The platform gives me a lot of pleasure and knowledge.”*

U5 (Male, High school student, Orissa)

*Sangeet Swara* provided more accessible venues for women and young girls for accessing information and entertainment. A fifteen-year old female student from a small town in Uttar Pradesh found the platform better than Facebook and Twitter. She found the content on the platform informative and suggested that the platform provided her a gateway to create new friends without the need to go to a cybercafé: “*It is a great knowledge tool. We get to know more people and more people get to know me. It is much better than Internet, Facebook and Twitter because we can use it without spending money. We can chat, listen to messages, understand them and learn from them.*”

The platform was successful because it could be accessed using any phone without the need of an Internet connection. It provided several useful features like voice chatting, voting, and content sharing. As voice is a natural and accessible medium, the forum was usable by blind people with limited technology exposure. The language of the system was in Hindi and it alleviated the challenges blind people face with the language and accent of screen reader software. Because the voice forum was a toll-free line, even the poorest of the poor could also use it. It enabled several uneducated and unemployed blind people to create their own India-wide social network: “*I come from a village where it is very difficult to get educated. I want to thank you sincerely because you enabled all blind people in India to get to know each other.*”

#### 4.6.3 Room for Improvement

Among all recorded messages, we found twenty-two messages containing abusive content. Many participants reprimanded those who recorded abusive content. Twelve blind participants complained about the abusive content during the phone survey: “*Abusive messages should not be played. It causes pain in our heart. Please note the phone number of people who record abusive content and warn those who are misusing the service. It is a true adage that one bad fish can spoil the whole pond.*” In the next iteration, we propose to include a feature to flag the messages for abusive and derogatory content.

Only a fraction of all events (*playback, vote, share, record*) were *share* events, primarily because the sharing of content required participants to read and send SMS. In our formative study, we observed that various participants either remembered the phone

numbers of their friends or wrote it on a Braille paper. In the next iteration of the social media voice forum, we propose to provide a functionality where a user enters the phone number of a friend to share the message rather than forwarding an SMS. Once a valid phone number is entered, the friend will receive a call and the voice message will be played. It is also worth exploring the use of acoustic quick response codes for sharing the call position in an IVR tree with other participants [23]. The technique uses remote generation and recognition of audio codes and requires setting-up additional servers for running it.

The participants also shared suggestions for improving the design of the platform for future deployments. Six participants requested a feature to send personal messages to other participants. Two participants also requested a discussion forum where they could record replies to the messages while listening to them. We plan to include these functionalities in the next iteration.

## 5. DISCUSSION AND CONCLUSION

In this paper, we have presented a detailed analysis of social media use and non-use by low-income blind people living in rural and peri-urban India. We have explored strengths and weaknesses of Facebook, Twitter, and WhatsApp for blind people. Though participants derive several instrumental benefits and gain social acceptance and entertainment by using these platforms, several socioeconomic barriers, limited English language proficiency and constrained access to computing devices impede the widespread adoption. We also presented the detailed analysis of how low-income blind people in India adopted a social media voice forum that was not originally designed for them. The platform spread rapidly among them without any marketing effort and enabled them to make new connections, showcase their talent and learn information.

Though we demonstrated the strong potential of the social media voice forum for low-income blind people, financial sustainability of such voice forums is still a concern. A limitation of our work is that we provided the service for free. Future work is needed to figure out how to make such systems financially sustainable. Many participants in the formative study expressed concerns over higher unemployment rate and were desperate to get a job because of severe financial constraints. Previous studies have also indicated several challenges and discriminations blind people face before and after getting employed [19]. We are presently researching the potential of using crowdsourcing on basic phones for providing additional earning opportunities to blind participants and to subsidize the cost of participation on the social media voice forum through crowd work.

We observed that a majority of the contributors were male blind participants. The user analysis also revealed that only 7% of the participants were female. The low participation from women in low-income families was not unexpected. A majority of them do not own a phone themselves and use the phone of a male family member. Moreover, social and cultural norms discourage young and married women to share their voice and interact with strangers. Some of the female participants were highly engaged with the system. One female participant, a teacher by profession, recorded fourteen songs, poems and contributed messages to several discussions. Many male blind participants offered special attention to female participants and asked for their phone numbers for having offline conversations. Though there were several discussions on the voice forum for discouraging people

to embarrass female contributors, there is a need to make both offline and online social media platforms more inclusive of low-income blind women. In the next deployment, it will be fruitful to also measure the effect of flirtatious messages, abusive messages and supporting messages targeted at female members on their participation.

One of the participants in our formative study suggested merging offline voice-based social media platform with the online social media platform like Facebook and Twitter: “*Could you design a system where we can press 1 to access Facebook, press 2 for Twitter. Can we leave a message in a voice that can be uploaded on Facebook and get translated into text?*” Though his requirements are partly supported by existing tools like IVR Junction [35], there is a need to better integrate these platforms for providing a global reach to voice forum users and facilitate seamless interactions with the global population.

One of the instructors expressed concern on the longevity of social media voice forum. He believed that such platforms will become obsolete when smartphones and Internet becomes pervasive. He argued that blind people who have access to smartphones, use the audio output of a screen reader software to check phone balance rather than using the IVR feature. However, we believe that our work has longevity. Even when people have smartphones, they will continue to use voice as a dominant communication medium. For example, voice features of smartphone applications like WhatsApp, Viber, and Skype are very popular among the present Internet population.

It is worth mentioning that many low-income blind participants either did not know about piracy or they did not care about digital rights infringement. A majority of the participants in the formative study did not know about the cost of screen reader software. For them, both NVDA and JAWS were freely accessible. Only one user bought a screen reader software for 50 USD from a non-profit organization. Many recent adopters planned to either download it or ask a copy from friends and instructors. The pervasive piracy of screen reader software in India is also reported by other researchers [13]. Even in our voice-based social media platform, we received many messages where participants recorded songs from other playback devices without caring about copyright issues.

The instructors, facilitators and many participants were enthusiastic about the promise of new media technologies in providing them information and strengthening their social connections. Many participants stated that they are living in a technological era and the road to success is difficult without learning information technology. Not everyone was excited about technology though, one participant expressed concern about the overuse of technology: “*We survive because of our other senses. We should be less dependent on technology and more on our senses.*” Participants exhorted the research community to improve existing technologies for blind people and design new media technologies that are more cognizant of their economic, social and infrastructural constraints.

## 6. ACKNOWLEDGMENTS

We are grateful to Jitendra Bhargav, Bhim Singh Thakur and staff of *Rajasthan Netraheen Kalyan Sangh* for their assistance with the study. We are thankful to Gaetano Borriello, Richard Ladner, Bill Thies and the anonymous reviewers for their helpful suggestions. This work was funded in part by the Noe Professorship at the University of Washington, USAID grant

award AID-OAA-G-14-00014, as well as the Catalyst Center for Sustainable Development at Microsoft Research India.

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