

A Hybrid Multi-Modal System for Conducting Virtual Workshops Using Interactive Voice Response and the WhatsApp Business API

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Abstract: Interactive voice response (IVR) forums such as CGNet Swara and Avaaj Otalo have played a pivotal role in empowering marginalised communities by providing an avenue to make their voice heard through simple phone calls. At the same time, growing internet penetration and affordable data plans are altering the ways in which rural Indian communities access and consume information. Within the context of a shift from voice to richer content environments, we present the design of a multi-modal awareness generation and data collection platform built around IVR and the WhatsApp Business API. This model was deployed for delivering virtual training modules to cotton farmers in rural Maharashtra. During the 27 day deployment, 176 people participated in the intervention, out of which 122 and 54 completed the modules on IVR and WhatsApp, respectively. In this paper, we highlight some of the interesting findings and lessons learnt during the intervention.

CCS Concepts: • **Human-centered computing** → **HCI design and evaluation methods; Empirical studies in HCI; • Social and professional topics** → *Cultural characteristics*.

Additional Key Words and Phrases: HCI4D, ICT4D, WhatsApp Business API, Interactive Voice Response, digital innovation

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1 INTRODUCTION

Interactive voice response (IVR) forums have played a huge role in empowering marginalized communities from low resource regions in accessing information, expressing opinions and improving governance [2, 21, 25]. For instance, the Chief Minister's helpline number offered by the central Indian state of Madhya Pradesh to address governance issues has collected over 10 million complaints since its inception in 2014 [3, 11]. Similarly, Avaaj Otalo (a discussion forum for farmers), Gram Vaani and CGNet Swara (citizen journalism initiatives) have showcased the ability of IVR forums to provide a platform for the voices of communities traditionally considered to be at the bottom of the pyramid [10, 14, 15].

In the decade since IVR based platforms gained popularity in ICTD interventions, the consumption preferences of rural India have evolved. Some of the major reasons revolve around growing internet penetration and amongst the most affordable data plans in the world (USD 0.21 per GB) [5]. Tik Tok, the video-driven social networking service, was gaining widespread popularity in rural India prior to its ban on national security grounds. India was its biggest overseas market with 200 million users, while WhatsApp, the instant messaging application, has 400 million users in India, the highest number globally [16, 20]. According to Research by the Internet and Mobile Association of India (IAMAI), as of November 2019, there were 277 million active internet users in rural India compared to that of 205 million from cities,

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with a growth rate of 18 per cent over the course of 2019 [28]. These changes indicate a rapid transition from voice based services to platforms capable of video sharing that offer richer content environments.

In this paper, we present the design and deployment of a multi-modal farmer training platform powered by IVR and WhatsApp. This platform was designed for awareness generation and data collection around best practices for cotton farmers in rural Indian contexts. The model uses IVR to reach users without internet connectivity or possessing basic feature phones, while allowing internet users accustomed to more interactive media environments to access the training modules through WhatsApp. The intervention was carried out in rural Maharashtra, India among cotton farmers during a 29-day period from September 5th to October 3rd, 2020. Customized lessons on soil management, pest control, fertilizers and pesticides were carried out in subsequent intervals. In presenting this multi-modal platform, we make three specific contributions: Firstly, we present the design of a hybrid model that caters to varying levels of information access and multimedia preferences among the target community. Secondly, we put forth a delayed personalised incentive scheme where users are awarded an insurance package at the end of the intervention period. This approach differs from traditional deployments where instant incentives are offered upon successful completion of tasks [12, 23], thus offering insights to researchers involved in incentive-based behavior change. Thirdly, we highlight design principles based on our experience of working with the WhatsApp Business API to create an integrated system that allowed users to send photos and videos, presenting a stark contrast to IVR forums where the type of information that can come from users is limited to voice recordings and DTMF inputs (keypad presses). This provides ICTD practitioners insights into developing hybrid technology platforms that can acquire far richer data than a IVR-only approach can offer.

Out of the 401 seed group, 122 attempted the quiz on IVR and 54 tried out it through Whatsapp. A total of 67 users completed at least one module qualifying for the incentives offered and 14 submitted at least one assignment.

2 RELATED WORK

Voice forums have played a vital role in empowering marginalized communities who are too poor to afford internet-enabled devices, too remote to access the internet, or too low-literate to navigate the mostly text-driven Internet [26]. A well-known voice-enabled initiatives within ICTD is CGNet Swara, a citizen journalism initiative that enables users to record basic governance failures and document cultural artifacts like songs by simply calling a phone number [10]. Other IVR based initiatives like Sangeet Swara, Polly, Baang, Learn2Earn and Sawaal have shown the ability to spread information to a large number of users in a relatively short amount of time, thus proving their efficacy for information-based interventions among marginalized communities in low-resource regions [17, 18, 23, 27]. However, these platforms sometimes face problems in content moderation and are often not financially sustainable. This leads to difficulties in replicating and scaling these innovations [26].

Our research builds on some of these prior interventions. For example, Learn2Earn incentivized users with prepaid mobile credits to learn about rural property rights, while we provided insurance coverage to farmers that completed all the training modules. Avaaj Otalo started as a IVR platform providing training modules to farmers, before morphing into a social space where farmers exchanged ideas with each other [15]. We built on their initial idea by adding the option of completing training modules on WhatsApp, which we think is particularly significant in light of its growth to 2 billion users globally and presence of 400 million users in India alone. Farm chat, an Android application deployed among potato farmers in rural India, presents acceptance of speech as input and responses by speech via a chat interface, influencing our design to have the training modules over WhatsApp appear not just in a text form, but also via audio recordings [6].

While these studies show the need for agricultural information and the acceptance of ICTs as credible information source by farming communities, several researchers have found that offering such services through dedicated digital environments such as mobile phone applications can adversely affect adoption rate [19]. Instead, integrating with existing platforms already being used by the target community can prove to be a more effective approach [9]. In their seminal paper on platform *infrastructuralization*, Star and Ruhleder argue that a technology becomes an infrastructure in relation to how we use it [22]. The implication they draw is that the right question to ask for the field of information studies is "when - not what - is an infrastructure," in light of the fact that a technology infrastructure "occurs" when it becomes embedded in local practices of a community. With its widespread use across geographical domains and a simple interface routinized into the daily life of billions across the globe, WhatsApp is fast becoming an infrastructure, especially for new users of the internet. It has exhibited the potential to meet various needs across the globe - for example, the BBC used WhatsApp during the Ebola pandemic to tackle fake news surrounding the disease, while several other media organizations have explored WhatsApp for better engagements with their readers ([1, 24]). WhatFutures, a future forecasting project spanning 5 countries and 487 participants, was conducted entirely over WhatsApp and demonstrated the ability of the platform to crowd source opinions from diverse geographical regions [8]. A study run by the MIT governance lab on distance learning through WhatsApp showed promising results, with participants receiving mobile phone data for sustained participation. Over the course of five cohorts, 44 participants received completion certificates out of the total 61 attended [7]. Similarly the WhatsApp Business API has been used for conducting automated surveys among Venezuelan refugees in Columbia and resettled refugees in the United States of America. Of the 3237 refugees in Colombia that gave permission to be contacted via WhatsApp for survey, 1651 started the survey and 1625 completed the follow up survey and received USD 1.43 as phone credit [4]. One of the most widespread applications of the WhatsApp Business API was during the COVID-19 epidemic, where the World Health Organization (WHO) COVID-19 WhatsApp bot was offered in 6 languages and reached over 2 billion people worldwide [29].

These real-world applications of WhatsApp point to its potential to be a tool for social good, given its familiar interface and widespread availability on people's phones. Our research is novel in that it presents a synthesized model that brings together the focus of ICTD practitioners on bottom of the pyramid populations with HCI researchers interested in the growing trend of unplatforming or appropriating existing social media platforms to design interventions [9].

3 DESIGN AND DEPLOYMENT

With the advent of the COVID-19 epidemic, organizations around the world became fixated on how their work could be done virtually. In this context, our team was approached with the challenge of delivering virtual training to cotton farmers in Gangapur block, Aurangabad (Maharashtra). Our field partner provided a list of 401 pre-selected users that needed to complete the training modules, a majority of whom had WhatsApp and used the internet. In order to create an inclusive media-rich environment while ensuring that no one was left behind, we employed both Interactive Voice Recording (IVR) and the WhatsApp Business API to deliver training to these farmers.

During its 29 day deployment, a total of 4 team members were involved in the seeding effort and outreach to the users. In order to generate traction among the community, some of the community leaders were chosen as influencers and were paid to generate awareness about the initiative. A total of four modules were played over IVR and two through WhatsApp during the course of deployment. All the content was designed and recorded in Marathi (the local language) with a conversational overtone that simulated a dialogue occurring between 2 farmers.

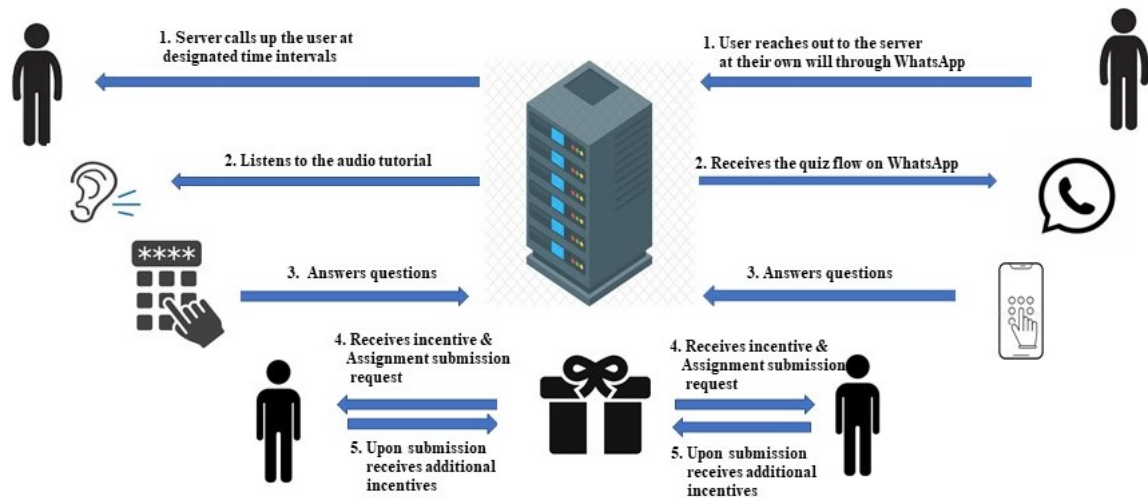


Fig. 1. Caption

3.1 Interactive Voice Response

Outbound calls were placed to all 401 pre-selected users with training modules containing a dialogue between two farmers. The narrator would periodically interrupt the dialogue and address the users with questions they could answer by pressing 1 or 2 on their phone. We felt this format was worth exploring as earlier IVR based deployments have taken the form of either a tutorial followed by questions or directly asking questions with relevant parts of the tutorial being played to those that answered incorrectly.

Incorrect answers would result in the call getting disconnected, with a message to try again during the next randomly initiated call. At the end of the interaction, permission was asked to reach out to the user via WhatsApp. If permission was granted, a message would be sent via WhatsApp informing them of the insurance coverage they had earned, along with the option of earning additional coverage for submitting assignments such as a photo of their field or the fertilizer they use. USD 133 in accidental insurance coverage was provided for completing the training module, with an equivalent amount for submitting their assignment. Those users without smartphones or internet that completed the training module on IVR could submit their assignments via a friend's phone by entering their phone number along with the assignment. Thus, WhatsApp remained an integral part of the entire design as we made the assumption that even those without personal access to WhatsApp had a friend or family member that made use of WhatsApp. We made use of the IMI Connect platform to ensure that the same phone number used by our WhatsApp bot was also placing the outbound call, thus allowing us to tell users to WhatsApp their assignment on the same number that was calling them [13].

321 of the pre-selected users were not on the Do Not Disturb registry, allowing us to place outbound calls to their number. We had to get special permission to call those on the registry, which was obtained by having them give a missed call to our number. Earlier designs employed an inbound mechanism where the outbound call is triggered by a missed call, thus allowing users to complete the training module anytime they wished. We took a conscious decision to only have outbound calls, with a view towards minimizing the breach of social distancing norms as earlier designs with in-bound mechanisms found cases where users had taken the training module on behalf of other people. We made an

exception to this rule for staff members at our partner organization, who were given a URL where they could trigger an outbound call by simply entering the users' phone number.

3.2 WhatsApp Business API

Integrating the WhatsApp element into the intervention was inspired by our needs assessment survey that saw a majority of pre-selected users actively using the app. According to the rules of the WhatsApp Business API, any reply to a user is free for 24 hours from the last message they sent to our bot. Initiating a message to a user outside the 24 hour window costs USD 0.005 per message and also requires that the message be pre-approved by Facebook. We thus designed our intervention such that any message sent to our bot from pre-selected users would trigger the same training module that was given over IVR. In case the user had already completed the module, they were informed of the amount they had earned and any pending assignments they needed to submit. To bypass literacy barriers, the module was delivered both as an audio recording and in the text of the local language spoken in the region. A 24-hour cooldown period applied to users that incorrectly answered a question during the training module.

4 RESULTS

4.0.1 Usage. 401 users were reached out to during the needs assessment survey, out of which 286 had smartphones and 111 had feature phones. These findings led us to design a multi-modal approach with WhatsApp and IVR. During the 29 days of deployment, a total of 122 and 54 unique numbers attempted the modules over IVR and WhatsApp, respectively. Completion rates were a little less than half, with 60 passing at least one module on IVR and 19 on WhatsApp. A total of 19 people submitted assignments, out of which 13 and 6 had taken the module over IVR and WhatsApp. Of those attempting the module over IVR, 27 had feature phones, none of whom managed to submit their assignment through a phone that did have WhatsApp.

During the course of deployment over IVR, 4 modules were presented to the users. All four modules were only competed by a single user, 13 users completed 3 modules while 35 users completed 2 modules. On WhatsApp only two modules were accessible, and only one user completed both of them.

4.0.2 Experience and Impact. In order to assess the experience and impact on the users, we conducted semi-structured interviews with 11 out of the 20 users we planned to interview. All participants were male and above 30 years, with the exception of one user who was 16 years old. The majority of those interviewed had completed 10th grade, while 3 had undergraduate degrees. All of the users interviewed had an Above Poverty Line Card, which determines subsidies government offers to each families. On average, users reported spending above USD 1.5 every month on recharging their phone with credits.

A majority of the users found the content delivered to be useful in their farming practice. One participant gave his motivation behind participating as follows

"I took the quiz to learn more on agricultural practices, I find knowledge to be powerful than money. The training sessions of farming and soil testing was particularly useful"

However, not all were happy with the initiative. One of the users felt our approach bordered on exploitative, perhaps explaining the low completion rates.

"I find this to be such a waste of time, how do you guys sitting in offices know about what's going on the ground, while we toil around this is a way for you guys to earn money just using our name"

One of the reasons for the low number of assignments submitted could be that the process was not clearly communicated.

"No one told me to send the assignments, that's the reason i didn't do it"

However, all of the submitted assignment complied to the instructions and qualified for the incentives. While some users preferred to have money credited to their account, most had positive feedback regarding the incentive of an insurance package. We also found some users who completed the module with their family members, indicating that its actual spread to people could be more than simply the unique phone numbers completing the module.

5 DISCUSSIONS

Over the course of 29 days, we deployed a multi-modal farmer training platform among a pre-selected group of 401 users in rural Maharashtra, 111 of whom had feature phones. To ensure that no one was excluded from the platform, outbound calls were placed to all users with the training modules, completion of which rewarded them with insurance coverage. We also delivered these training modules using the WhatsApp Business API, which reduces the cost of content delivery and offers a more content rich environment. In this section, we highlight some key learnings that might be of use to other researchers interested in designing interventions using IVR or the WhatsApp Business API.

5.0.1 Lessons in designing interface. 122 users attempted the module over IVR, compared to only 54 on WhatsApp. In retrospect, we made a mistake in ignoring the peculiarities of each platform and simply reusing the content designed for IVR and delivering it via WhatsApp, without leveraging the approachable chat interface and rich content environment it offers. The audio used in WhatsApp was an edited out version of the call flow from IVR and the text was a transcript of this audio without any conversational overtone to it.

Another reason for the difference in usage numbers between both platforms could be the manner in which each platform engaged its users. The IVR platform was setup as an outbound system, with daily calls going to pre-selected users containing the training modules. WhatsApp, on the other hand, had an inbound system that depended on the user sending a message before they were given the training module, due to the rules of the API stipulating that it is free to reply to users within 24 hours of their sending a message. We believe that practitioners must carefully consider whether to design an inbound or an outbound system, as it will impact usage on the ground.

The rules of the WhatsApp Business API allow our bot to initiate conversations with users, provided we have their consent and the message is pre-approved by Facebook. We received consent of the users via the IVR outbound call, following which a WhatsApp message was sent informing users of the insurance they had earned and the assignments they could submit to earn additional coverage. Having a message pre-approved is important to start a conversation thread with users on WhatsApp, although Facebook only approves those messages that are dynamic and personalized for each user (such as telling them the amount of coverage earned). To avoid any confusion among users, we ensured the same phone number that placed the outbound call was also our WhatsApp bots' number. We made an assumption that even those without smartphones would have access to people whose smartphones they could use. We thus built a system for people to submit assignments through any smartphone they have access to, but this was not availed of by even one of the 27 feature phone users that completed the first training module, indicating that any design having an internet dependent component can become exclusionary. At the same time, out of 111 feature phone users identified in the pre-selected group of users, 27 completed at least one module, which in the absense of IVR would have missed out on the opportunity to participate altogether.

5.0.2 Future Trajectory. While some IVR based deployments for disseminating awareness showed viral spread, we controlled for the number of users by pre-selecting 401 farmers. In future deployments, we would be keen to test referral mechanisms over WhatsApp, where referrals can be easily made by sharing contact cards. We also wonder whether the relatively low completion rate of the training modules would have been higher with incentives providing instant gratification, like mobile credits or cash transfers.

The unprecedented restrictions put in place to stem COVID-19 forced us to innovate new methods of delivering and collecting information from communities. Field teams were in no position to organize training sessions for community leaders or to conduct in person interaction. This paper provides a look at a design that tries to overcome these restrictions and deliver training to farmers via a virtual format.

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