How Should Users Convey Their Location to an Interactive Voice Response System?

Aditya Vashistha
University of Washington
adityav@cs.washington.edu

William Thies
Microsoft Research India
thies@microsoft.com

ABSTRACT

In this paper, we evaluate various ways in which users can indicate their location while using an Interactive Voice Response (IVR) service. Using an IVR survey, 71 low-income users of a live IVR service in India conveyed their location in three different ways: a postal code, a fixed line area code, and a free response. In each configuration, users spoke their location and a human transcribed the result, thereby eliminating any dependence on DTMF input proficiency or speech recognition accuracy. The analysis of survey responses suggests that people are aware and capable of representing their location with a postal code and fixed line area code. However, using the free response data as ground truth, there was higher accuracy using fixed-line area codes (72% answered correctly) versus postal codes (55% answered correctly). Since area codes are more coarse grained than postal codes in India, this result implies a tradeoff between granularity and success rate in collecting location data over IVR.

Categories and Subject Descriptors

H.5.0 [**Information Interfaces and Presentation**]: General

Keywords

ICT4D, HCI, interactive voice response, location, India

1. INTRODUCTION

In recent years, Interactive Voice Response (IVR) systems have been used as the backbone for a large number of social and economic development projects [1,2]. IVR is attractive because it caters to low-literate, oral populations and does not require smart phones, which remain rare in many areas of the world.

The availability of location data has the potential to transform the way information is created and accessed using IVR systems. For example, knowledge about callers' locations can be used for community moderation of local content, to playback location-specific content, to provide locally relevant advertisements, and to visualize data collected using IVR systems on mapping platforms such as Ushahidi, Google Maps or Bing Maps. The absence of location data on IVR systems inhibits the quality of information delivery and data collection.

In the past, researchers have stated that many people in a developing country like India have knowledge of their postal code and fixed line area code. It has been suggested to use postal code or fixed line area code to manually input location data while using an IVR system [3]. However, researchers and practitioners have not yet explored collecting location data using postal code and area code. This is because there are various unanswered concerns regarding the accuracy, robustness, usability and granularity of location data as represented by users' entry of postal code and fixed line area code. In this paper, we present the outcomes of a study we conducted to access the feasibility of using postal code and fixed line area code to input location data on an IVR system.

2. METHODOLOGY

We launched a toll free entertainment IVR service, Talent Hunt, from May to June 2013 [4]. By the end of the experimental trial, more than 1,300 callers called 20,000 times and spent 1,700 hours recording and voting for songs, jokes and poems. In order to collect information about users' demography and motivation, we asked users to answer some questions via an IVR survey. We requested users to record responses for multiple questions such as age, education, income, presence on social media, email accounts, familiarity with SMS, feedback on the original entertainment service etc. In addition, we also asked users to input their location data in multiple different ways. We requested users to speak the name of the location from where they are calling, as well as the postal code and fixed line area code of that location. The prompts of the IVR service, the survey questions and their responses were in Hindi. The first author translated and transcribed the responses to all survey questions into English.

3. RESULTS

We presented the survey to 189 regular users who called our IVR service more than 10 times. All 189 users were asked to speak the name of their location, of which 150 users responded. 82 of these 150 users reached the question where they were asked to speak their postal code. 79 of these 82 users reached the question where they were asked to speak their fixed line area code.

Other parts of our survey collected demographic information on the respondents. Of the 79 users, 77 were male and 2 were female. The average age of the users was 25 years (max = 50 years, min = 13 years). The users spanned 11 states of India, and 48% were from Madhya Pradesh and Rajasthan. The most common levels of education were High School (N=18), Bachelor's degree (N=17), and Middle School (N=12). 24 users reported earning a monthly salary (max = Rs. 35,000; average = Rs. 11,000; min = Rs. 300), 31 users reported being unemployed and 24 users did not respond when asked about their monthly salary. 16 users had either a Facebook account or an email account. Only 5 users had both Facebook and email account.

Table 1: Comparison of location input modes

	Postal Code	Fixed Line Area Code
Total sample	71	71
Correct response	39	51
Said "I don't know"	16	9
Spoke area code in place of postal code (or vice versa)	7	2
Other incorrect response	7	7
Did not answer	2	2

For our analysis, we restrict our attention to 71 users whose audio recordings were intelligible (so as to allow for reliable coding of data). We use the free response question as the ground truth location. We converted postal codes and fixed line area codes to locations using online databases and services [5,6]. These codes can also be converted to a latitude and longitude pair so as to display the associated data on a mapping platform [7].

The results of our analysis appear in Table 1. Of the 71 users, 39 (or 55%) conveyed a correct postal code, while 51 (or 72%) conveyed a correct fixed line area code. Of responses that were incorrect, the most common was users who said they didn't know the answer (16 in the case of postal codes, and 9 in the case of fixed line area codes). Seven users offered the correct area code when asked for the postal code, while 2 users provided the correct postal code when asked for the area code. For each of the codes, seven users offered a different incorrect response, most commonly a valid code for a different part of the country. Two users in each case did not provide any answer at all.

We also analyzed the overlap of users' knowledge about postal codes and fixed line area codes. 33 users inputted both a correct postal code and a correct fixed line area code. 6 users were correct only in the postal code, while 18 users were correct only in the area code. 14 users did not enter a correct postal code or a correct fixed line area code. A McNemar test shows that users were significantly more likely to enter a correct fixed line area code than a correct postal code (p=0.02).

In order to visualize the difference in the granularity of the postal code and area code, we also plotted the location of two different postal codes of the city of Bhopal which were recorded by two users. Both the users specified the same fixed line code for their location but different postal code. When plotted on Bing maps, the distance between the location corresponding to postal code 462016 (R S Nagar S.O area in Bhopal; point A in Figure 1) and postal code 462010 (Balampur B.O area in Bhopal, point B in Figure 1) is around 34 KM, though they share the same area code.

4. DISCUSSION

Though it is easiest for users to speak the name of a location, until there is accurate speech recognition on local languages, it requires significant manual efforts to translate and transcribe the responses. Moreover, users described their location with differing granularities. Thus, we recommend giving clear instructions (e.g., please record your block name followed by city name) to users
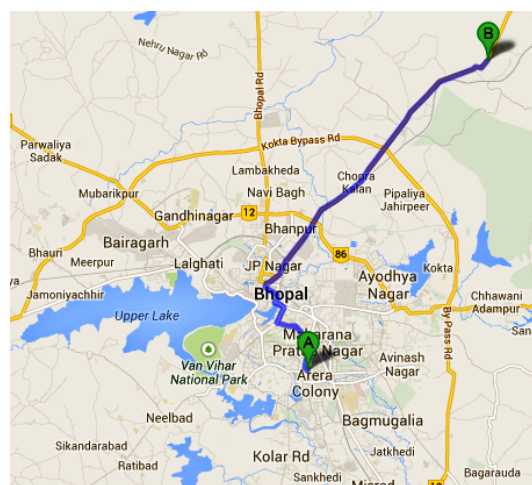
Figure 1: Two different postal codes in the same area code

when asking them to record the name of their location on an IVR service.

The analysis suggests that though postal codes and fixed line area codes can be used to input location data on IVR systems, low accuracy prohibits their use in critical scenarios where location must be captured accurately. The results also show that users were more accurate and responsive in recording fixed line area codes than postal codes. However, as seen in Figure 1, area codes have coarse granularity in comparison to postal codes. We also observed that in some cases the granularity of the postal code was coarser than the spoken location and vice versa.

We recommend using postal code and area code only in those application scenarios where it is not necessary to robustly and accurately capture location data. We recommend using area codes in scenarios where coarse granularity is acceptable. For example, an IVR service where users have to enter location data to get city level news and information will be well served by inputting area code as location data. We recommend using postal codes in scenarios where more accurate location information is required. For example, an IVR service for grievance redressal will be well-served by inputting postal codes as location data.

5. REFERENCES

1. Mudliar, P., Donner, J., and Thies, W. Emergent Practices Around CGNet Swara, A Voice Forum for Citizen Journalism in Rural India. *ICTD*, (2012).
2. Patel, N., Chittamuru, D., Jain, A., and Dave, P. Avaaj Otalo: a field study of an interactive voice forum for small farmers in rural India. *CHI*, (2010), 733–742.
3. Vashistha, A., Cutrell, E., and Thies, W. Mapping Interactive Voice Response Call Data in Developing Regions. *Workshop on Geographic Human Computer Interaction, CHI*, (2013).
4. Talent Hunt Voice Forum. http://research.microsoft.com/talenthunt/.
5. India Post PIN Code Search. http://www.indiapost.gov.in/pin/.
6. STD Codes in India. http://www.stdcodes.in/.
7. GeoPostCodes. http://www.geopostcodes.com/.