ACQR: Acoustic Quick Response Codes for Content Sharing on Low End Phones with No Internet Connectivity

Jennifer Pearson, Simon Robinson, Matt Jones, Amit Nanavati, Nitendra Rajput
Spoken Web

- IVR telephone system
- Dial-up voice sites
- Interactive
- Interconnected
Sharing

• Sharing locations on the internet = easy
• Usually: send a link
Sharing

• Sharing locations on the Spoken Web = difficult
• No way to share a specific location
• Spoken Web is:
  • a complex hierarchy
  • not easily searchable
Study: existing sharing

• Eight current users interviewed

• Shared via:
  • Memorisation
  • Playback
  • Phone number
  • Navigation instructions

• A demonstrated need for a better solution
Related work

Sharing during calls [7]

Audio-based sharing [34]

High-end inputs; low-end devices [29]
Our approach

- **ACoustic Quick Response codes**: ACQR
- Synchronise via DTMF tones
- Completely service-side
- Usable on any phone
Welcome to the "voice of experienced farmers" system
User Interaction

- Audio codes for sharing: ACQR
User Interaction

- Audio codes for sharing: ACQR
User Interaction

• Audio codes for sharing: ACQR
User Interaction

- Audio codes for sharing: ACQR
Scenarios

- Use of audio supports multiple sharing relationships

One-to-One

One-to-Several

One-to-Many
Robustness Evaluation

- Recognition testing
- Various environments with differing ambient noise.
- 200 sharing tasks in each environment
## Robustness Evaluation

<table>
<thead>
<tr>
<th>Environment</th>
<th>Ambient noise (dB)</th>
<th>Recognition rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside, quiet room</td>
<td>26</td>
<td>99.5</td>
</tr>
<tr>
<td>Outside, quiet park</td>
<td>46</td>
<td>99.5</td>
</tr>
<tr>
<td>Inside, information radio show</td>
<td>62</td>
<td>98.5</td>
</tr>
<tr>
<td>Inside, busy marketplace</td>
<td>69</td>
<td>98.0</td>
</tr>
<tr>
<td>In car while driving (50mph)</td>
<td>77</td>
<td>98.0</td>
</tr>
<tr>
<td>Outside, alongside busy highway</td>
<td>79</td>
<td>97.0</td>
</tr>
<tr>
<td>Inside, loud music</td>
<td>82</td>
<td>98.0</td>
</tr>
<tr>
<td>Inside, very loud music</td>
<td>101</td>
<td>84.5</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td><strong>96.6</strong></td>
</tr>
</tbody>
</table>
Focus groups, Rural India
Findings

- “very helpful. 100% useful”
- “[the ACQR service] saves a lot of time, it is efficient and good for sharing between farmers”
- “this is [an] extremely useful medium where we can share with each other very fast”
Long-term Field Deployment

- Continuously available to Spoken Web users for 8 months (at time of writing)
- Main users: Gujarati speaking farmers, mixed literacy, from rural Gujarat, India
Findings

• Used by 358 individuals (35% of the 1033 unique callers over the period)

• 246 tried sharing; 267 tried receiving; many tried both:
  • Send actions: 1202
  • Receive actions: 1004
Usage

- To date: 294 successful sharing actions
Conclusions

- New ways of interacting with audio-only services
- Re-seeing existing infrastructure