Towards an information ecosystem for animal disease surveillance using voice services

Aditi Sharma Grover[1], Gerhard van Huyssteen[2], Karen Calteaux[1],
[1]CSIR Meraka Institute, P.O. Box 395, Pretoria, 0001, SOUTH AFRICA
[2]Centre for Text Technology, North-West University, Potchefstroom, 2520, SOUTH AFRICA
Email: asharma1@csir.co.za, gerhard.vanhuyssteen@nwu.ac.za, kcalteaux@csir.co.za

ABSTRACT
In this paper we introduce a solution for disease surveillance and monitoring in the primary animal health care (PAHC) domain that uses inbound voice-based services and voice- and text-based outbound services for connecting rural veterinarians and livestock owners with a PAHC service provider. We describe our findings from the ongoing pilots, where we found that it is crucial to close the loop between data collection and information dissemination.

Categories and Subject Descriptors
H.5.2 User Interfaces: Voice I/O User Interfaces.

General Terms
Design, Human Factors, Languages.

Keywords
Voice user interface, agriculture, speech interface, developing world.

1. INTRODUCTION
Voice-based services for development have seen significant interest from the ICTD research community with several applications being developed [1, 2, 3]. Voice-based services leverage on the high levels of mobile phone penetration, low requirements for literacy, and overcome language and distance barriers in obtaining information and services. In this paper we introduce a solution that connects role players in the PAHC domain through multiple inbound voice-based services, as well as outbound voice- and text-based services (SMS, email) for information dissemination.

2. THE NEED & CONTEXT
Our work is partnered with a local PAHC and training services provider (Afrivet) whose focus is on servicing rural areas in South Africa. Afrivet works with various role players such as state veterinarians (vets), rural private vets (as opposed to urban vets who work with domesticated animals), livestock farmers, community animal health workers, etc.

It is estimated by Afrivet that a loss of approximately R3 billion (~$375 million USD) occurred in 2010/11 as a result of animal diseases. Prevention depends on accurate and timely information on disease identification reaching the various role players especially the rural veterinarians. The need for information is two-way: 1) disease surveillance data is required for early detection of diseases to prevent loss of livestock; and 2) information on disease outbreaks, notifications for new products and training need to be disseminated. We limit our initial work to private rural vets and dip tank attendants (DTAs).

ACM Dev'13, January 11-12 2013, Bangalore, India.

Communication amongst the private rural vets (highly literate users), and with Afrivet for issues such as disease outbreaks typically occurs through phone calls, with occasional emails. Currently Afrivet uses a paper-based disease reporting system where vets report on a monthly basis on diseases they have encountered in the field. Afrivet finds that only 15-20% of the vets submit these reports; administrative burden being identified as the primary cause for the low response rate. Though this provides some information on disease identification, it does not provide an early warning system for flagging disease outbreaks.

DTAs are communal livestock owners (semi-literate users), selected by the community as the caretakers of the different local dip tanks where animals are taken for regular dipping sessions and general check-ups/vaccinations. Afrivet works on a regular basis with some DTAs in a few communities, where monthly meetings are held to gather information on dip tank operations (products required, problems encountered, diseases observed, etc.).

3. System Overview
Our solution is an information ecosystem, using a combination of inbound voice-based telephone services and voice and text-based outbound services to provide a holistic solution for Afrivet to communicate with the various role-players in the PAHC domain. We believe that this solution could also be adapted easily for other similar organizations in similar domains. Figure 1 (next page) provides an overview of the Afrivet system architecture.

The first phase of development involved creating two voice-based services: 1) the V-Plan Vet Line for rural vets; and 2) the Dip Tank Line for DTAs. The V-Plan Vet Line allows vets to call in and, through voice-based form-filling, report on disease incidences encountered in field. It is essential that interaction is purely speech-based, as vets require a hands-free solution for calling the service whilst driving (right after a client callout). The second inbound service is the Dip Tank Tine in isiZulu (the predominant local language in our pilot area), which allows DTAs to report on dipping activity and problems at their dip tanks (product used, product required, diseases observed, etc).

On the back-end we currently use a human-in-the-loop approach, where transcribers extract data from the incoming calls through a customized web transcription interface. The transcribed information is channeled to a report management web interface, where Afrivet monitors the incoming disease reports. Registration of users and user management is managed internally through the web interface. The incoming calls and transcribed data are channeled to multiple databases that link to the appropriate 'dashboards' which Afrivet and transcribers access via the web.

The outbound service allows Afrivet to schedule various types of customized outgoing messages, e.g. call reminders, manager and transcriber notifications for new calls, outbreak warnings,

health tips, and newsletters, sent out based on user communication preferences gathered at registration. The goal is to afford Afrivet a one-stop place from where the information that is being received from different users can be disseminated to the multiple PAHC role-players. In the design we focus on capabilities to customize (e.g. send via SMS only to cattle owners), localize (disease outbreaks info sent only to affected provinces), and pre-schedule (set-up reminders, seasonal tips beforehand) such messages.

4. INITIAL FIELD TRIALS

The V-Plan Vet Line was initially concept tested with 3-5 vets through the Wizard-of-Oz technique, followed by an in-field user study with 14 vets for a period of 10 days, with qualitative telephonic interviews to gather feedback. As a small experiment we also created 2 versions of the system where at the end of an audio recording, the system either moves on by 'pressing the hash key' (coached in the first two prompts only) or through silence detection. For the latter, we found that some users forgot to press hash in the prompts when they were not explicitly told to so (third prompt onwards), and said the system was taking too long to move on (it would move on after a 'no-key press' timeout). For the silence detection version as well, vets wanted a shorter silence detection threshold, stressing the need for rapid reporting.

The Dip Tank Line was introduced to 21 DTAs in a focus group, with follow-up individual interviews with 8 DTAs. The first version of the line was more DTMF-based with some natural speech input for leaving messages. DTAs felt that they liked the speech input better (reasons cited were that it was easier, and also allowed them to leave more info). Overall DTAs interacted well with the system and were keen to use the line because it would be free for them to leave messages for Afrivet (a call-back mechanism) and also because it was provided in their language. We revised the line to allow more of the questions to be answered via speech input and used DTMF minimally where required, e.g. call branching. We also provided more examples in the prompts for the first 5 calls per user, to acquaint them with the line.

5. CONCLUSION

Overall we found that the vets were able to easily use the system, and said it would especially be useful if the system could replace the paper-based reporting, and also include livestock owners (their clients) in the reporting. We found it noteworthy that for DTAs the primary incentive was the service being free, saving on their airtime that they would have to use to communicate with Afrivet; this was a non-issue for vets.

A common theme across the vets and DTAs was the question regarding where the information would go and how they could benefit from the data being gathered. We realized it is crucial to close the feedback loop from data collection to information dissemination from early on in the project. Most importantly, there needs to be a 'value-add' to the incoming data before its channeled back to the user, i.e. to link different incoming data streams and provide interpreted, aggregated, and localized information back to users in the PAHC space, to create a information ecosystem, e.g. info from vets reaching the other vets, as well as DTAs, farmer, etc.

Revised versions of both lines have been launched during September and October 2012. Future efforts include the development of additional services, as well as finding ways to maintain a sustainable model.

6. ACKNOWLEDGMENTS

Our gratitude to Afrivet for contributing to the design, development, and implementation of this project. This project was made possible through financial support of the Department of Arts and Culture of the South African government.

7. REFERENCES

[1] Patel, N., Chittamuru, D., Jain, A., Dave, P. and Parikh, T.P. 2010. Avaaj Otalo – A Field Study of an Interactive Voice Forum for Small Farmers in Rural India. In *Proc. CHI 2010*, 733-742.

[2] Sharma Grover, A., Calteaux, K., Barnard, E., and van Huyssteen G.B. 2012. A voice service for user feedback on school meals. In Proc. of *DEV 2012*.

[3] Sherwani, J., Palijo, S., Mirza, S., Ahmed, T., Ali, N. and Rosenfeld, R. 2009. Speech vs. Touch-tone: Telephony interfaces for information access by low-literate users. In *Proc. IEEE Int. Conf. on ICTD 2009*, 447-457.

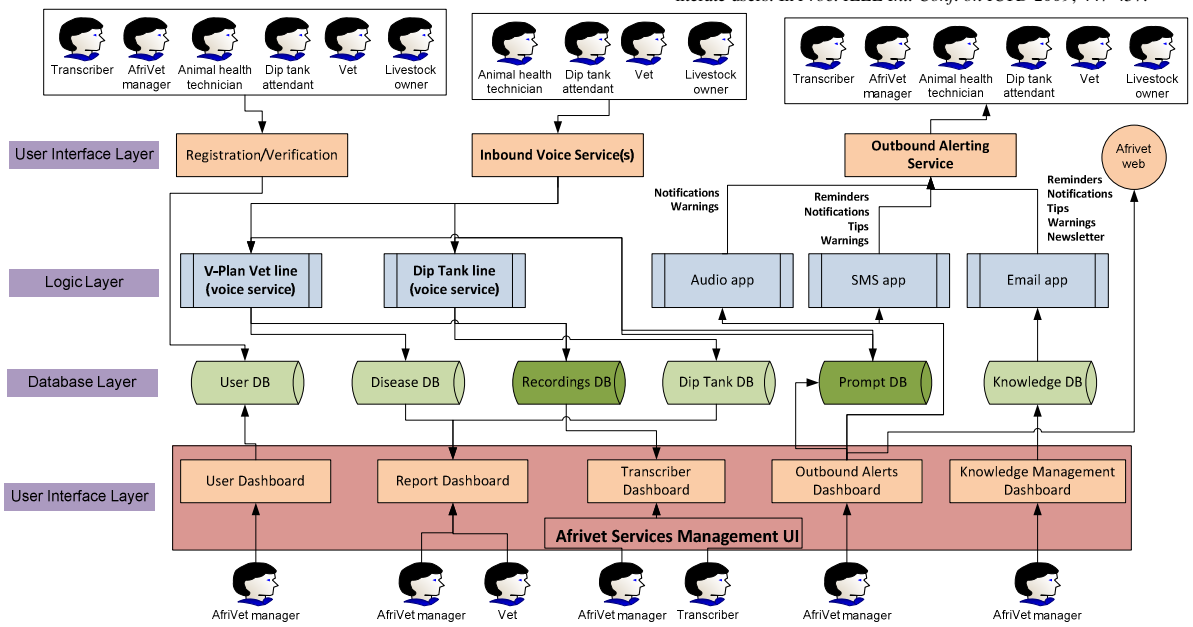

Figure 1. Afrivet system architecture