

# DigiVet: a knowledge-based veterinary system for rural farmers in North-Ghana

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**Abstract.** Rural communities in Northern Ghana are facing several environmental and social/educational restrictions and limitations that prevent them from accessing information and sharing knowledge. One of the information needs that subsistence farmers living in these areas have is that they do not have access to information on animal health or to veterinarians in case one of their animals falls ill. In order to stimulate going to a veterinarian, a voice-based veterinary information service named DigiVet has been developed. This paper describes the work done in the previous two development rounds and discusses a possible extension by introducing a purely voice-based telephonic version of DigiVet.

**Keywords:** DigiVet, ICT4D, Kasadaka, North-Ghana, Rural farmers, Knowledge-based system, Voice-based information service

## 1 Introduction

Inaccessibility of knowledge influences the lack of socio-economic development in rural areas in rural areas in Ghana. Poor infrastructure and lack of education are factors that increase communication gaps between experts and rural laymen. W4RA (Web Alliance for Regreening in Africa) [7] aims to incorporate ICTs in the already existing local communicative infrastructure in order to benefit these communities in sharing knowledge and accessing information. Environmental and educational restrictions, such as poor roads and illiteracy, are some of the factors that increase the digital divide between these rural communities and citizens [3]. One of the information needs that the farmers have is on animal health.

DigiVet is a voice-based veterinary information service that aims to support subsistence farmers in making the decision whether or not they should go visit a veterinarian, while bringing them into contact with each other. This paper introduces the purely voice-based, telephonic alternative to the already existing visual variant. This version was created to increase the scope of the service.

## 2 Use-case description

The set use cases of which the one described in this paper is a part, was conducted during a field trip to the village Zanlerigu in Northern Ghana. Interviews that were held with local, subsistence farmers, formed the input for the

use cases, which could then be translated into relevant ICT services. Figuring out there information needs through conducting interviews is complex, because of the language barrier and the difficulty of the farmers in expressing the specific information gaps that prevents them from working more efficiently.

The subject of the use case described in this paper is animal health care. Some animal diseases spread within and between villages, others can only be cured with the intervention of a veterinarian. The problem that arises in these rural areas is that the expertise is often not locally available and poor infrastructures prevent information and knowledge from being accessible. Some farmers indicated that they would like to have information on animal diseases, disease patterns, diagnosis and symptoms, to enable them to take preventive action and preclude cattle loss. Gaining information from a local veterinarian could thus be relevant and useful in these cases. The idea of the elaboration of the use case is to enable veterinarians to enter the up-to-date news and knowledge regarding common diseases verbally into a voice-based system.

## **2.1 First prototypical cycle of DigiVet**

A first voice-based prototype was build in 2015 that showed a simple interface in which farmers could click through a set of symptom related questions on a touch screen connected to the Kasadaka [4]. The Kasadaka is a rapid-prototyping platform consisting of a Raspberry Pi[2] and a GSM dongle. The main idea behind the Kasadaka is that it is composed of some basic hardware and software requirements that enable the rapid development of new voice-based information services. The first prototype of DigiVet did not yet contain animal disease information that could be used in the real world.

## **2.2 Second prototypical cycle of DigiVet**

In the beginning of 2016, the second prototype of DigiVet was created. This included an improved knowledge base, based on the CommonKADS methodology [5]. In order to develop this new version, interviews were held with a Dutch as well as local, Ghanaian veterinarians. The latter was done by the W4RA group, by interviewing three veterinarians working in rural Northern Ghana. The Dutch veterinarian that we interviewed had stayed in Tamale, Ghana for a couple of months where she had worked in a veterinary clinic. Based on these interviews, the objective of the system was changed from providing a diagnosis to giving an outcome of the decision whether or not a farmer has to go see a veterinarian. This was done in order to prevent that farmers would cure the animals themselves and in order to stimulate them to more proactively visit a veterinarian.

## **3 System design**

As DigiVet aims to make veterinary information more accessible to all farmers living in remote areas, the reach of the service can be increased by creating a

telephonic accessible version of it. Therefore, a prototype is developed which elaborates on the already developed visual version of DigiVet by a second one that enables local farmers to call to the Kasadaka, and in this way accessing DigiVet.

Figure 1 shows the call-flow diagram of the system. When a farmer calls the system, it primarily welcomes the farmer and asks him/her to indicate the type of animal he wants to gain information on. The farmer can then answer all of the questions by pressing on the corresponding Dual Tone Multiple Frequency (DTMF) numbers. For example: "Press 1 if you have a dog". After the system knows what kind of animal the farmer has, a general question is asked. If a farmer answers this question with yes, more specific questions will be asked, if not, the next general questions is prompted. Subsequently, if the system has enough information, it will give the output to the farmer regarding the decision whether or not to go see a veterinarian. Finally, the decision is given and an option should be provided to contact a close by veterinarian.

## 4 Prototype description

With the use of VoiceXML files uploaded to Voxeo Evolution [1] a prototype of the call system was developed. At present, the prototype only works for cows. This means that the first selection that has to be made in order to use this service should be to press 1. The prototype contains a few questions which can be answered with yes or no, respectively by pressing 1 and 2. Please click on the Skype number [6] below to call the system:

Skype number: +990009369996161228

### 4.1 Prototype fidelity

The prototype described in the previous section merely contains a small part of the system. At this moment, the user can only select a cow, and the system contains only a few questions after which a decision is made and the user can choose whether or not to contact a veterinarian.

The reason for keeping this prototype small, is because we want to connect the system to the database that stores all the possible questions. So, the system should be able to retrieve the right question from the database based on the input of the user.

At this moment, if a farmer wants to contact a veterinarian, a telephone number is given. However, it would be nice to provide the farmer with the option to let the system call the veterinarian for the farmer.

## 5 Conclusion and Discussion

### 5.1 Future work

This chapter introduces the points of improvement that are considered future work. We also discuss some general points of improvement of DigiVet.

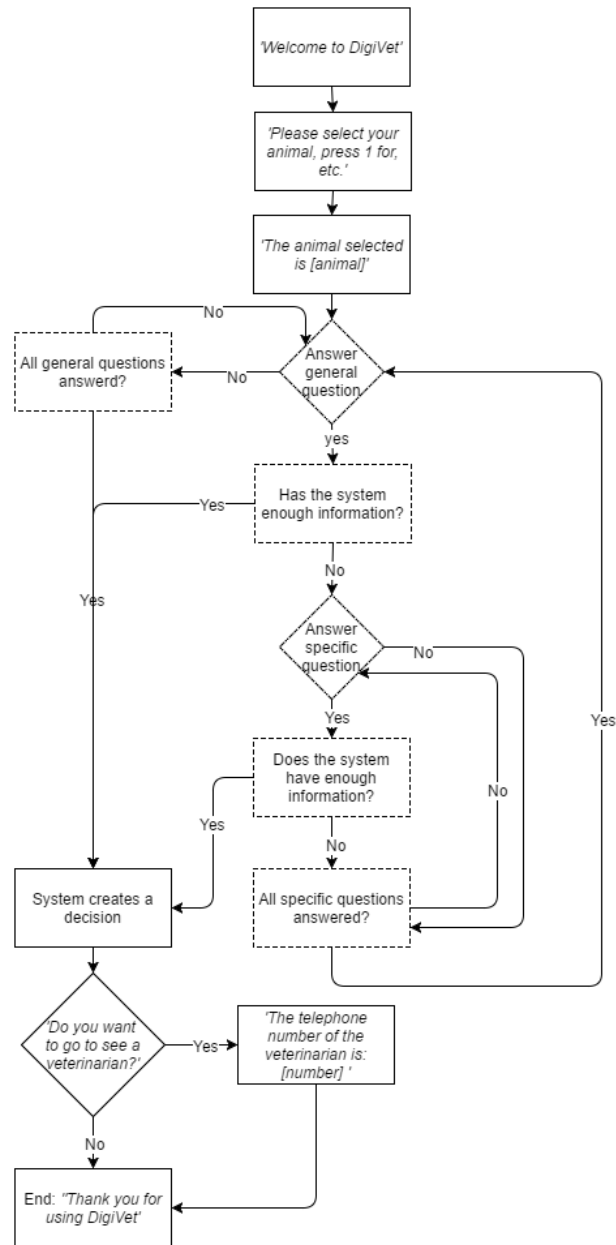


Fig. 1: Call-flow diagram

In section 4.1, some points of improvement have already been discussed. First, the system should be connected to the database which stores all the possible questions, in order for the system to select a follow-up question based on the input of the user. Second, the option to directly call a veterinarian should be included.

If the system is connected to the database, it should also be able to make a decision based on the number of questions answered with yes. This would thus be based on a scoring system.

In order to develop DigiVet into an ICT service which can be deployed in North-Ghana, several steps have to be taken. To finish the current prototype, the most important thing is that local languages should be supported. This can be done by adding sound fragments, recorded in the local language, to a database. The database used will also be converted to a triple store. Another important step is including functionalities to contact veterinarians by sending text messages or by calling them directly. Moreover, a back-end system for the veterinarians should be build to enable them to add new information into the system. Finally, the prototype should be tested in North-Ghana to receive feedback provided by the local farmers. This will clarify how they use it, but will also incorporate more local and common information on diseases and to adjust the variables of the system which take care of the decision whether or not a farmer has to go to a veterinarian.

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