Rural Communities Crowdsource Technology Development – A Namibian Expedition

Colin Stanley, Heike Winschiers-Theophilus, Michel Onwordi, Gereon K. Kapuire

Polytechnic of Namibia
School of Information Technology
Software Engineering Department
+264-61-207-2752
{cstanley; heikew; monwordi; gkapuire} @polytechnic.edu.na

ABSTRACT

In this paper, we describe our newest project endeavor in which we conceptualize crowdsourcing technology development for and with rural communities in Namibia. The project is based on design work which was carried out over a longer period of time with a single rural pilot community in Namibia and its transferability of technology and concepts into other rural communities. In an attempt to overcome expensive technology adaptations we explore the possibility of having rural communities' crowdsource their defined and specified technology needs. We describe the concept and our current implementation with a first user evaluation in two rural communities. We also discuss the next phase of the project.

Categories and Subject Descriptors

H4.m. **[Information systems applications]**: Miscellaneous, H.5.3 **[Information Interfaces and presentation (e.g.HCI)]**: Group and Organization interfaces

General Terms

Design, Experimentation, Human Factors

Keywords

Crowdsourcing, rural community, communication platform, open source development, tablet development, African, Namibian

1. INTRODUCTION

Southern African countries have recorded a rapid uptake in mobile technology usage. However while the number of users in rural communities' increases the design of tools and applications is still urban based. Thus often technology usage is not beyond ordinary functionalities. While our work with rural communities in Omaheke over the last five years has shown great potential for innovative design ideas among community members, it has often not yet materialized due to a shortage of technology developers and funding.

However, people with technical skills could be contacted by making use of the Internet and thus taking full advantage of the Internet based business communication approaches such as crowdsourcing that allow faster, cheaper and good quality product delivery to customers [1]. Crowdsourcing business approach allows a customer to place their requirement for a product with proposed price if any on a crowdsourcing website such as 99designs.com [2] and the crowd (technical people on the Internet) provides the solution, then the customer select the preferred delivered product. The crowdsourcing phenomenal is attributed by the fact that the crowd that delivers the product is composed of global people around the world with diverse expertise who work on their own freedom thereby stimulating innovation and creativity.

ICTD 2013, Dec 07–10, 2013, Cape Town, South Africa.

http://dx.doi.org/10.1145/2517899.2517930

2. PRINCIPLES OF CROWDSOURCING

Crowdsourcing is rooted in the process of asking others to help you with a problem that you cannot resolve on your own. This may be due to limited resources, skills, or time constraints. Crowdsourcing in the traditional sense has been inherently used in rural communities especially in the Herero communities. Whenever, one homestead has a major task to be done e.g. branding of cows, people from other homestead spontaneously join to help out and are usually rewarded for that. This behaviour could be induced by factors such as kinship, debt, mutual obligation, or common forms of community practice. Hence, the extension of these relations and concept into the virtual crowdsourcing context will be explored in a later phase. Crowdsourcing has gained its momentum with the use of the Internet as a platform that allows massive virtual collaboration of people with diverse culture, work ethics, and different time-zones to work together. With the use of the Internet a request for a task to be performed is circulated faster and reaches far broader audience as compared to other medium of communication. Common tasks requested on the Internet are usually for designs, funding, minor tasks, data gathering and business ideas.

It should be noted that the tasks requested to be done are not only problems to be solved they could also basically be fun competitions too. The reward for those that completed the task is not only on monetarily basis; it can even be tokens of appreciations. According to [5] appropriate inducements strategies for example whereby the delivered products are evaluated and the inducement is given to the best product' producer should be considered for crowdsourcing or virtual based organizational business structures. Traditional inducements such as bonuses and promotion used in companies are not viable for these structures. We are aware of other challenges such as crowd sustainability and social exclusion [3] within crowdsourcing platforms however these will be addressed only in the next phase of this project.

3. COMMUNITY-BASED DEVELOPMENT

3.1 Background

Over the last five years, our research group has been co-designing indigenous knowledge management prototypes in collaboration with a rural pilot community in Omaheke. The latest prototype, the HomeSteadCreator, is a 3D graphics application on an android based tablet, which was originally designed to facilitate a 3D contextualization of indigenous practices [4]. The tool consists of a selection of 3D objects representing real elements in the rural surroundings, and an empty sandy ground on which users can build up scenarios from the 3D interface objects. Upon evaluation with other rural communities in Namibia and Malaysia, besides specific feedback, the evaluators developed further usage ideas, such as visually enhanced story-telling, sustainable stock management, land planning, etc [6]. Thus besides deploying the original application to other communities we have realized that a number of adaptations should be made based on the communities requirements. However we do not have sufficient developers who could continuously adapt technologies to new requirements of individual rural communities. Rethinking design modularization we decided to explore the possibility of crowdsourcing the design of 3D objects as an alternative affordable solution to further local technology developments.

3.2 Community Crowdsourcing

A major design challenge in facilitating communication between rural community members and technical people globally is their fundamental diversity. While one group usually follows an urban lifestyle with a technical inclined perspective and corresponding skills, the others live in rural areas and engage with indigenous knowledge. To the best of our knowledge there is no platform that facilitates and synergies technical community requests to be crowdsourced. Thus we are in the process of developing a community crowdsourcing platform (CCSP). The CCSP takes into account the technical diversity of the two groups (technical and rural community) communicating. Most rural community members in Namibia are not familiar with the usage of web based applications while technically versed people use web applications on a daily basis. However our usability evaluations [6] have shown that rural community members of all ages are skilled to use tablets with minimal exploration time. Therefore, the CCSP platform should be portable to work on tablets with minimal instructions and reading as most rural community members in Namibia are semi-literate only. Furthermore as for all crowdsourcing approaches we need to identify incentives for technical people to freely deliver solutions to the rural community members.

4. CROWDSOURCING PLATFORM IMPLEMENTATION

In conjunction with the undergraduate software engineering students we have implemented a web-based crowdsourcing platform with an android back-end for the rural communities. In this section we briefly describe the overall system, the android back-end, as well as the prototype evaluation with two rural communities.

4.1 Overall project implementation

The CCSP allows a community member to upload a request of any format such as text, audio, and image. The request could be a 3D graphical design that the community member will use to engage the youth through a digital indigenous knowledge representation. The uploaded request should be published to the crowd of designers to perform the requested tasks. Once the designers are done with their proposed solution/s, they can upload it to the CCSP. Finally the community member will be able to download the preferable graphic onto their tablet. The CCSP application flow is depicted in Figure 1 below.

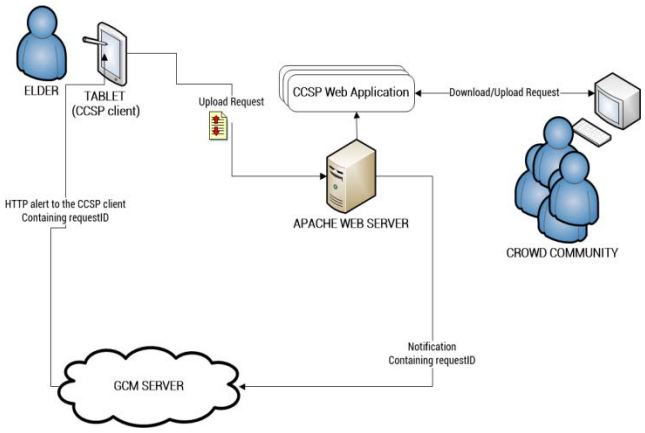

Figure 1: CCSP overview

4.2 System Implementation Details

The CCSP server and client architecture caters for a scenario where users select a photo of an item or drawing and submit it to the crowd for 3D modeling, receive an alert once the model is complete and available for download. In order to facilitate this use case the following components and architectural structure was designed.

The CCSP component was developed as a web application/web service using the PHP platform. It serves as an interface for the crowd to receive requests submitted by the rural community and to submit their completed models. These requests typically contain images and a short narrative of objects or drawing being submitted. This component also exposes a REST based web service allowing easier communication between it and the CCSP client.

The Apache Web Server acts as the host for the PHP based web application. This component was chosen due to its ease of configuration and support for PHP based web applications.

The Google Cloud Messaging (GCM) Server: In order to alert the mobile device concerning the availability of completed 3D models, this component was used. GCM is a freely available Google created solution that allows 3rd party servers to provide push notifications to android mobile applications. The ability to send push notifications is an important aspect of this architecture as it reduces the power and data consumption of the CCSP client by avoiding needless polling.

The Android Tablet running the Honeycomb version of the android operating system was chosen for this implementation. A tablet interface was chosen due to the gestural interactions it naturally supports, such interactions (swiping, pinching, etc) make the user interface more intuitive for elders within the rural community.

The CCSP Client is an android application designed to run on tablets supporting the Honeycomb version of the android operating system and upwards. Its primary functionality is to display a list of pictures taken with the device which the rural community wishes to submit to the crowd. Along with this request is usually a short narrative. Using Base64 compression all of this information is sent by the CCSP client to the CCSP web application via its REST based interface in the form of JSON

(JavaScript Object Notation). Each request has a unique identifier, once an alert is received containing this same unique identifier, the CCSP client initiates a download request to receive the completed 3D model.

4.3 Community Evaluation

To evaluate the community back-end of the platform we chose a Herero rural community in Okomakuara, Eastern Namibia, home of one of the undergraduate students (see picture 1 below). The later obtained consent from the community members and an agreeable day. Together with three of the undergraduate students we traveled to the rural community, who had never before participated in a technology evaluation exercise and did not have any knowledge about our 3D graphic application. To ensure the participants understand the context and purpose of the crowd sourcing platform we took the participants through the entire process. We first introduced the HomeSteadCreator to the group. We then explained that if anyone needs additional objects to complete a narration they could request it from the crowd out there. We asked the participants to take a picture of an object they would like to get modeled in 3D as well as to draw an object they would like to be modeled but which they cannot find around to take a picture. The elders were hesitant at first with the drawing, yet once one made the first sketch, fellow participants decided to add in and improve collectively on the drawing. Once the group was satisfied, a photo was made and a request created to be crowdsourced. To simulate the entire process we ensured the drawing would be an object which we had readily as a 3D graphic on the computer. We then showed how it would look like once they received a 3D graphic and how they would then use it in the HomeSteadCreator.

Picture 1: Okomakuara community members with facilitators

The engagement during the evaluation as well as in the discussions that followed showed the interest of all community members present. Elder women as old as in their eighties actively participated, trying out the technology as well as asking questions and making suggestions (see picture 2). The community indicated that they would like to participate in our long term study in exploring community requests being communicated to the crowd. Thus this village has been chosen as one of the pilot rural sites for our further investigations.

Picture 2 : Community women and the facilitator

A second crowdsourcing community evaluation was done in the northern side of Namibia in one of the close by villages of Opuwo. The crowdsourcing concept was once more well understood and accepted by the Himba community in Opuwo as shown in picture 3 (Himba traditional man showing which home items should be captured for crowdsourcing)

Picture 3: Himba traditional man and one of the facilitators

5. CONCLUSION AND WAY FORWARD

Facilitating the crowdsourcing of technical requests straight from rural communities is a challenging endeavor from a design and development perspective. While the general concept of crowdsourcing is well understood in the rural communities, expanding the traditional practices of crowdsourcing of daily tasks in the village to digital artifact creation and technical problems still presents an abstract challenge. The rural community members need to gain a holistic understanding of the process as well as the specifics of a request formulation. We have therefore run a comprehensive simulation based evaluation with the new community. As the concept was well received and the usability of the tablet application proved to be intuitive we shall engage this and other communities in the co-design of the next version.

Regarding the web-based crowdsourcing interface we are in the process of defining strategies that would attract and keep designers and developers interested in providing solutions for the rural communities. We will experiment with a life system, where we upload a couple of requests with our pilot communities and

study crowd responses, as well as community satisfaction. We will follow an evolutionary approach of improving the community crowdsourcing platform as we evaluate the communication.

6. ACKNOWLEDGMENTS

We would like to acknowledge our 2013 Software Engineering project students who have contributed to the implementation and evaluation of the first prototype. Furthermore we would like to thank the Okomakuara community members who have participated in the one day evaluation workshop. And last but not least we acknowledge our fellow researchers who have provided prior insights and technologies.

7. REFERENCES

[1] Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., & de Vreede, G. J. (2013, January). Conceptual Foundations of Crowdsourcing: A Review of IS Research. In 2013 46th Hawaii International Conference on System Sciences (pp. 579-588). IEEE.

[2] 99designs [On-line] Available from: http://99designs.com/ [Accessed 23rd July, 2013. WAST 10:33]

[3] Felstiner, Alek. The Weakness of Crowds. Limn, [no date]

[4] [On-line] Available from: http://limn.it/the-weakness-of-crowds/ [Accessed 2nd September, 2013. WAST 10:33]

[5] Rodil, K., Winschiers-Theophilus, H., Jensen, K., Rehm, M. (2012) Homestead Creator – a tool for indigenous designers, NordiChi 2012, Copenhagen

[6] Scekic, O., Truong, H., Dustdar, S., Incentives and rewarding in social computing Commun. ACM, Vol. 56, No. 6. (June 2013), pp. 72-82, doi:10.1145/2461256.2461275

[7] Winschiers-Theophilus, H., Winschiers-Goagoses, N., Rodil, K., Blake, E., Zaman, T., Kapuire, G., Kamukuenjandje, R., Moving away from Erindi-roukambe: Transferability of a rural community-based co-design, Proceedings of the 12th International Conference on Social Implications of Computers in Developing Countries, Montego Bay, Jamaica, May