Holistic Model for Designing a Climate Service Application on the KaiOS Platform

Ville Myllynpää
University of Turku
Vesilinnantie 5
20014 Turku, Finland
ville.myllynpaa@utu.fi

Julius Virtanen
University of Turku
Vesilinnantie 5
20014 Turku, Finland
julius.e.virtanen@utu.fi

Jani Haakana
University of Turku
Vesilinnantie 5
20014 Turku, Finland
jani.k.haakana@utu.fi

Erkki Sutinen
University of Turku, Windhoek campus
340 Mwandume Ndefumayo Avenue
13301 Windhoek, Namibia
erkki.sutinen@utu.fi

Abstract
Interest towards building and operating climate services is constantly growing globally, especially regarding utilization of mobile technologies in those services in the Global South, in order to reach rural farmers effectively. However, multiple issues are currently limiting the design and development of these services for reaching their full impact.

Based on a recent field study, we present the criteria for a mobile climate service app for small-scale farmers in Namibia. It will be based on the KaiOS "smart feature phone" platform, and combines holistically climate, weather and agricultural information in a form that guides the farmer through the agricultural cycle. The app is currently in its early development phase, with a set of pre-selected features being built. Further field work with the local farmers will define the final set of features and the eventual user interface (UI) design of the app.

CHI'20 Extended Abstracts, April 25–30, 2020, Honolulu, HI, USA

ACM ISBN 978-1-4503-6819-3/20/04.
https://doi.org/10.1145/3334480.3383084

Author Keywords
Climate services; mobile applications; agriculture; HCI4D; ICTD; co-design; Global South

CSS Concepts
- Graphical User Interfaces

Introduction
As climate change is increasingly affecting the life of some of the most disadvantaged people on earth, the

small-scale farmers[1] in the Global South, they crucially need information on how to adapt to the changing climate conditions, such as changes in the distribution and amount of rainfall. Climate services, defined as provision of climate information to help individuals to make climate smart decisions, are commonly proposed as a method of delivering this information in a way that is relevant and useful for the user [11].

Mobile services are being proposed as an applicable and cost-effective way to spread information to this large group of people, often based in remote rural areas. As the network infrastructure and device ownership issues have been mostly solved, the emphasis has been moving towards solving issues around the mobile services´ usability and the way how the information is presented on the phone screen, aspects which can prohibit these services for reaching their full potential as a beneficial way to provide crucial information to small-scale farmers [6,2].

Our team has been researching the design and implementation of climate services for small scale farmers in the Global South since 2010. A recent field study took place in the Morogoro region in Tanzania. We interviewed local farmers regarding their information requirements and mobile phone usage patterns [8]. We also ran a limited co-design session, where we trialed various co-design activities for weather & agricultural icon design [7]. Based on our learnings from our field studies and extensive literature and report review process, we have designed an interface mock-up and workflow for our prototype climate service application. We recently started the actual development phase, and the next field-based co-design sessions are currently scheduled for the coming June-July 2020. The main aim of our app is to provide farmers with information, action options and notifications, based on the up-to-date forecast and current research, on how to cope with these changing climate conditions.

Recently, we decided to relocate our project to Namibia, due to university level cooperation between our home university, University of Turku, Finland (UTU), and University of Namibia (UNAM). The first step of this cooperation was the opening of the "Future Tech Lab" in the UNAM main campus[2]. Therefore, our on-going development and co-design activities are going to take place in Namibia.

According to our guiding principle, we will design and build concrete, functional apps, which can be tested and demonstrated together with the local farmers. The apps will show our interpretation on how somewhat abstract climate services concepts can look like as real mobile phone applications.

Literature review

The Global Framework for Climate Services [11], which was initiated by the World Meteorological Organization (WMO), as a steering framework for developing climate services, has a guiding role for our research. We are focusing on the "user interface platform" pillar of the framework, which refers to the interaction between the service users and information providers. By following the framework, we will ensure that our findings will be appropriate and applicable in other climate service

[1] Alternatively called subsistence or communal farmers

[2] https://ftlab.utu.fi

development projects, since almost all of them follow this framework.

The overarching literature for this research covers climate services, mainly relating to the issues which limit their usability, adaptation and scalability among the small-scale farmers in the Global South [1,2,4,5,13,14]. The literature has revealed the following set of factors as key issues: the lack of understanding user requirements [1,5,13], the usability of the services and the ways information is represented [5,9,14].

As an interdisciplinary study, we integrate HCI related studies, especially those on ICT usage and adaptation in the Global South, which reveals important background on how technology is used, and which design aspects work and what don't in these settings [3,6,10,16]. Another important aspect relates to the co-design and community centric design approaches, which clarify how to conduct design research experiments in rural communities [12,15,17].

HCI is probably the most essential research context for this work, as a fundamental study of how users connect to the technology. As an indication of this, couple of essential papers, [6,10,12,15] among others, which have influenced our research, design and practical work notably have originated from this field.

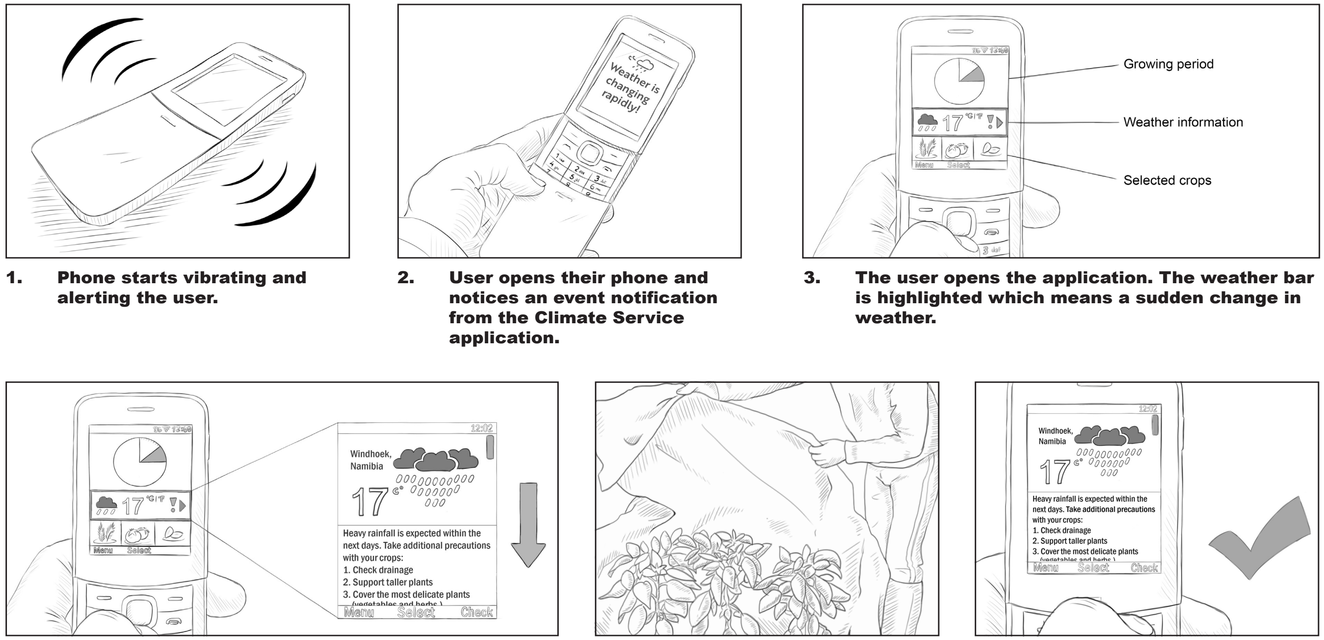
Technology overview

We decided to use a rather recent mobile phone operating system called KaiOS, which the company defines as a "smart feature phone" platform[3]. The system allows the use of HTML5 based applications in certain feature (aka bottom) phones, which are currently on market in 40+ countries, with 10+ different brands, with an estimated overall sale of over 100 million units. KaiOS allows the "best of the both worlds" type of functionality, where the users have access to smartphone applications, in a phone which has a longer battery life (up to 28 days), a better durability and a more competitive price point (around US $20) than traditional touch screen smartphones[4]. These aspects solve some of the commonly mentioned phone usability issues among rural farmers. These factors include charging (no grid connection, solar or aggregate based charging stations which are rather costly to use), durability (using phone with wet and dirty hands, exposure to dusty and moisty field conditions) and cost (users spend a considerable part of their income for buying phones, purchasing airtime and charging their phones) [8].

Unfortunately, KaiOS based phones are not currently in sale in Namibia, but they are expected to arrive there as soon as its market area is expanding in Africa. We currently see Namibia more as a technology test bed, and not necessarily the sole end market for our app at this point. During our various meetings with the locals, people were interested in KaiOS phones features and they were convinced of the feasibility of these phones in the Namibian market, some were even willing to buy it straightaway. This shows the potential of the KaiOS based phones in Namibia, once the local Mobile Network Operators take them to their selection.

[3] https://www.kaiostech.com

[4] https://www.kaiostech.com/vodacom-launches-smart-kitochi-tanzanias-first-smart-feature-phone-powered-by-kaios/



1. Phone starts vibrating and alerting the user.

2. User opens their phone and notices an event notification from the Climate Service application.

3. The user opens the application. The weather bar is highlighted which means a sudden change in weather.

4. Selecting the weather bar brings up a menu which displays notifications for upcoming weather patterns. A warning for the user is presented.

5. The user takes precautions to protect the crops. (Covering delicate plants)

6. The crops are protected against the weather. The user can continue as normal.

Figure 1: Weather event alert view

Design aspects

Our approach to climate service design and development is interdisciplinary, where we combine climate, weather and agricultural information into one single service. Our current iteration version utilizes a model where the app will show the information only when it is timely needed during a certain point of the agricultural cycle. From the technological point of view, KaiOS would also be suitable for the model where the user has access to all the information from the start, allowing them to study the information when convenient.

In our prototype system, the agricultural cycle is divided into steps and the app gives timely relevant information for each step at that moment when it is topical (see Figure 1). We time the beginning of the agriculture season for the moment when the Consensus

Outlook for the coming Rainfall Season has been prepared and published by the Southern Africa Regional Climate Outlook Forum (SARCOF), meaning around end of August[5].

Example user case is the following. The user of the app, a farmer, is in process of making the decision of what crops and which varieties to grow at the beginning of the season. The app would then propose the optimum crops and planting times based on the seasonal forecast, farm location and other factors. Another example is a situation later in the season, when some erratic weather event occurs: the app will alert the user to take required preparation actions (see Figure 1).

The app will also contain a "task to do list" type of function, where the user can see the necessary actions needed for a certain crop in its growing cycle, as well as receive notifications when an urgent activity, such as pruning or watering the crops, should be done. We are also implementing a feature which would allow farmers to contact the experts in cases when the information, which they are looking for is not available in the app or they want to clarify something. However, in all these cases, the farmer would have the final say on which actions they would eventually do, as the apps role is only to guide, not tell what to do. It is the farmer who is carrying all the risks, so they must make the final decision.

The current features of our initial prototype app were selected and tentatively designed based on the literature review and our experiences on our previous field studies. However, we will continue the design and development process, including UI design, adding and removing functions, together with the local farmers in the coming co-design sessions. In our experience, it is rather challenging to start with a blank canvas in these kinds of communities, where previous exposure to technology and its possibilities (and limitations) is generally rather low. Therefore, we chose to start with these design ideas – that, however, got inspiration and influence from our earlier field studies – and use them as a base for the actual co-design work. We are presenting those ideas here as a prequel to our next actual field research, whose findings will then be reported in the coming publications. The app´s features, as well as the information provided through it will also eventually vary between various geographical areas in Namibia, depending on the local conditions and user requirements, allowing it to be locally relevant

We see that utilizing SMS messaging in normal bottom phones is the most relevant comparison point for this app in the climate service context, as SMS based systems are currently the prevailing way of delivering this information. Therefore, when compared to using SMS messages in traditional feature phones, a KaiOS platform-based app enables a better way of presenting complex weather and agricultural information, by allowing usage of symbols, pictures, audio and even videos. KaiOS also contains text-to-speech functionality, with certain languages, allowing an easier way of sharing information to low-literate people, without using specially pre-recorded audio clips. Also, multifaceted information is more accessible to the user in terms of browsability and linking relevant topics together. Another important factor in our case is the possibility to use notification alerts. This allows alerting

[5] http://csc.sadc.int/en/news-and-events/265-climate-outlook-oct-2019-to-mar-2020

users when the app has something new, timely or otherwise relevant information to show for the user or when the user should complete a certain timely action (see Figure 1).

As of now, we are not cooperating with any National Meteorological Service nor research organization, instead we are relying on the publicly available weather and climate data in our prototype. Currently we are focusing on solving the technical aspects on how this multidisciplinary information could be presented in the app. We aim to find partners which can provide the needed weather & climate data and agricultural information or otherwise make use of the increasingly available open data. We are prepared to integrate third party APIs to our app, so we can connect to any available database, which can provide information in the appropriate form.

Conclusion

We assume that our design interpretation is at least partly solving some of the design issues raised up in the literature, as well as providing a truly multidisciplinary information for farmers and that way solving their information demands. This being one of the first research-oriented projects on the KaiOS platform, it can also open new research ideas for the HCI field in terms of utilizing the "smart feature phone" platform in other research projects and studies.

This extended abstract aims to work as a prequal for our ongoing and future research work, with a goal to present this research project to the HCI field and get their input and feedback. Our next goal is to field test and further design these application functionalities together with the local small-scale farmers in Northern Namibia during mid 2020. We expect this phase to bring interesting results, both for the future development actions of this application, as well as for HCI4D and ICTD scenes, mainly in terms of user interface design and usability.

Recently we have also included a couple of local university students into the app design and development process, in order to get the local view to the topic, as well as novel ideas for the functionalities and UI design. Another purpose is to train local talent, which would be needed in the scale-up and upkeep phases, as well as building local ownership for the end product. We are also planning a unique scale-up model, which is based on collaborating with the local developers, based in the different regions of the country, whose role would be to adapt the app in the local conditions. This is especially important in highly diverse countries, such as Namibia, where regions vary significantly in terms of agroecological, cultural and economic factors.

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