

## Cross-Platform User Interface of a Web Application in Agrarian Sector

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### Anotace

Předložený článek se zabývá procesem vytvoření optimalizovaného výstupu webové aplikace pro mobilní zařízení v podobě responsivního layoutu se zaměřením na agrární WWW portál. Velkým přínosem bylo použití a otestování technik user experience (UX) v krocích UX, výzkumu, designu a testování. Pro výzkum a otestování byly použity dvě skupiny uživatelů po pěti lidech reprezentující cílovou skupinu. Výsledný responsivní layout byl vyvinut s důrazem na ergonomické uspořádání ovládacích prvků a obsahu, konzervativní design, zabezpečení přístupnosti obsahu pro handicapované uživatele a možnost rychlé a jednoduché aktualizace. Výsledné poznatky jsou aplikovatelné na webové informační zdroje agrárního sektoru (zemědělství, potravinářství, lesnictví, vodohospodářství) a rozvoje venkova a v širším kontextu platí obecně.

### Klíčová slova

Informační zdroj, responsive layout, webová aplikace, user experience, UX, mobilní zařízení.

### Abstract

The paper treats the process of the creation of a web application optimal output for mobile devices in the form of a responsive layout with focus on the agrarian web portal. The utilization and testing of user experience (UX) techniques in four steps - UX, research, design and testing - were of great benefit. Two groups of five people representing the task group were employed for the research and testing. The resulting responsive layout was developed with the emphasis on the ergonomic layout of control elements and content, a conservative design, the securing of content accessibility for disabled users and the possibility of fast and simple updating. The resulting knowledge is applicable to web information sources in the agrarian sector (agriculture, food industry, forestry, water supply and distribution) and the development of rural areas. In wider context, this knowledge is valid in general.

### Key words

Information source, responsive layout, web application, user experience, UX, mobile devices.

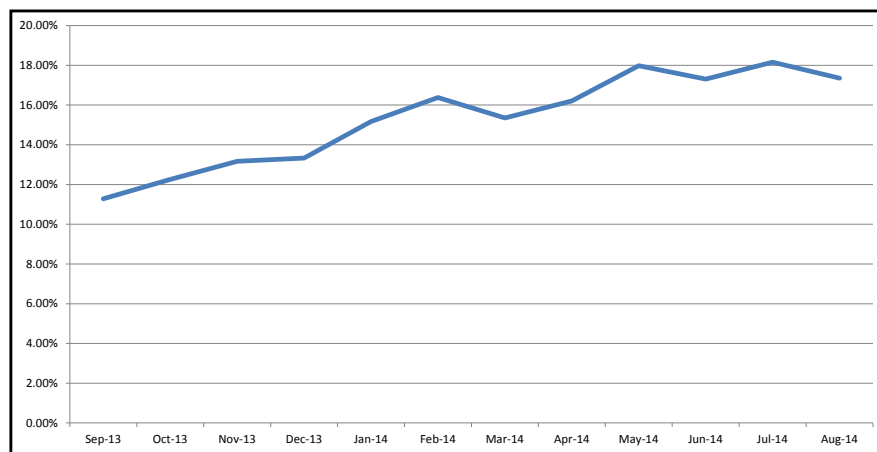
### Introduction

Currently, more and more users of web and internet information sources have been using mobile devices. According to the NetMarketShare agency people use access to web presentations and applications from mobile devices in approximately 17-18 %<sup>1</sup> of cases (NetMarketShare, 2014) and there has been a tendency of permanent growth of this percentage. The similar situation exists in the agrarian sector. The latest research data about the use of information and communication technologies by agricultural enterprises in the Czech Republic (carried out by the Department of Information Technologies, Faculty of Economics and Management, Czech

University of Life Sciences Prague) show that 43 % of respondents use smart mobile devices for various purposes. Even though only a part of these users utilize their devices for the access to WWW, statistics shows an incessant increase in this respect, too.

Users should therefore have a chance to work with web applications from their mobile devices, too. However, in a number of events the designers and administrators of such applications will not allow them to do it in sufficient comfort. In practice this leads to situations in which information is scattered on various screens which is rather annoying for the users (van der Kolik et al., 2013). Modern web applications should offer them

<sup>1</sup> August, 2014



Source: NetMarketShare

Figure 1: Browsing by mobile devices.

an ergonomic interface for mobile devices.

One option how to solve this problem is a responsive design or a responsive layout. The responsive design enables the optimal display of user interface of the application on mobile devices, reduces requirements on scrolling (Lestar et al., 2014) and thus represents a long-term solution of current demands of developers, designers and end users. (Rempel, Bridges, 2013).

In the creation of web applications' design there is a great benefit in the utilization of user experience (UX). The insight into users' preferences (platforms Android, iOS and Windows Phone or 8, at least) is crucial for both product designers (Chien et al, 2014) and the developers of web applications. There exist various techniques of UX testing method: for instance, five-second test includes the display of visual or information web design for a period of five seconds. The respondents are subsequently asked about various aspects (Doncaster, 2014). To other techniques belong: a) eye tracking which is often used in applicability tests (Olmsted-Hawala et al, 2014); b) the evaluation of users' satisfaction during their interaction with digital content (Zahidi et al, 2014); c) the research of usefulness in relation to context and experience factors (MacDonald and Atwood, 2014). In any case, the results depend on the task group of users. This fact has been established by a great many researches. Significant differences will exist, for instance, between university students and seniors (Brajnik, Giachin, 2014).

## Material and methods

The agrarian WWW portal Agris shows an increasing number of mobile devices utilization, too. This portal has become of the most frequently visited unified on-line information sources for the area of the agrarian sector (agriculture, food industry, forestry, water supply and distribution) and rural areas. Based on Google Analytics it was found out that in 2012 only 3% users accessed the portal from mobile devices but by 2014 the number has risen to 13% (10% from smart phones and 3% from tablets). Even though this is less than what has been shown by the research of agricultural enterprises' equipment with mobile devices, a rapid growth has been registered. One of the reasons of this disproportion is the nonexistence of the agrarian portal mobile version which would be optimized for different mobile devices of the most frequently utilized platforms Android and iOS with browsers Android Browser, Safari and Opera Mini.

In 2014 we moved to the task of making the content of the agrarian WWW portal Agris accessible for mobile devices. The work has been carried out in three steps:

1. the creation of a responsive design for web browsers,
2. the creation of a native application for the Android platform,
3. the creation of hybrid applications for platforms iOS, Android and Windows Phone 8 (Šimek et al., 2014).

The requirements on the creation of the resulting responsive layout were as follow:

- ergonomic layout of the responsive design control elements and content,
- a conservative design because the users of the agrarian WWW portal Agris are rather conservative,
- the possibility of a fast and simple updating,
- the securing of content accessibility for disabled users.

The whole implementation process consists of four integral steps:

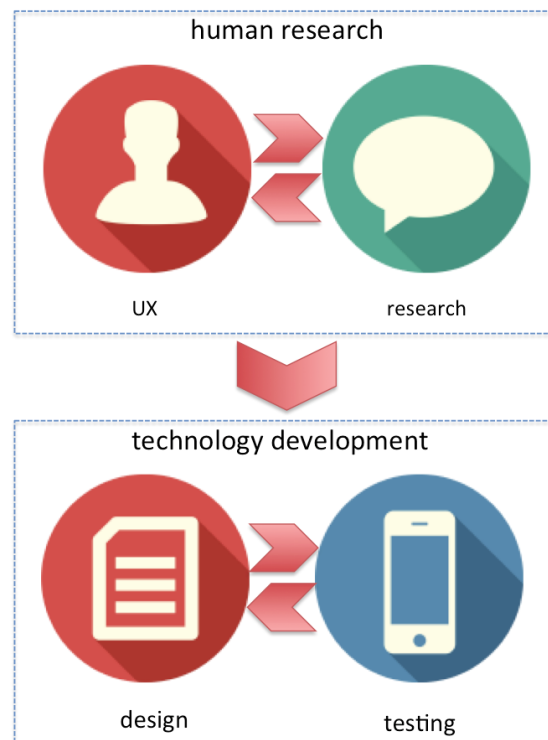
1. UX (User eXperience),
2. research,
3. design,
4. testing.

Into User Experience we include people's behaviour, their attitudes and emotions during their utilization of the agrarian WWW portal Agris in desktop versions of web browsers. It contains practical, meaningful and valuable aspects of the users' interaction with the web output of the agrarian portal.

The research part of the process comes immediately after UX and is based on the task group of users' requirements. Input data are the results from Google Analytics (users' behaviour), results from UX and from interviews with five users representing the task group of users. Users' requirements are thus sufficiently covered and at the same time an excessive redundancy of input data is prevented.

The design part of the responsive design implementation of the agrarian WWW portal consists of plans of sketches and processes, the creation of wireframes and the consequent transfer into a graphical design. During the creation of sketches and processes the maximal emphasis is placed on the effective accessibility of the agrarian portal content and functions. The graphical design is consequently transferred into the real responsive layout.

The final testing consists of two parts: a technological testing and a user testing. The technological testing is concentrated on the correct display of content and functions on a wide range of mobile devices. The user testing is concentrated on the ergonomics of applicability and a comfortable control by the users. In the event of serious errors these are described both uniquely and in detail and then returned to the design level.



Source: authors' own research

Source of icons: IconArchive.com, author: Pelfusion (pelfusion.com)

Figure 2: The responsive layout implementation process of the agrarian WWW portal Agris.

## Results and discussion

Based on knowledge about both the utilization of the agrarian WWW portal Agris by mobile devices users and the UX results, the first step of the optimization of the displayed content and available functions on the most frequently utilized mobile devices was implemented. The responsive design was developed with the help of MediaQueries technology in Cascading Style Sheets 3 (CSS3) which allows the adaptable depicting of the agrarian portal output depending on the parameters of users' end devices. Considered are the data on:

- the web browser of the mobile device,
- the size and resolution of the display,
- the layout of the mobile device (portrait, landscape).

The whole agrarian web portal is configured in order not to be considered as masked (by for instance a full-text Google browser) because that would lead to the elimination from search results.

The same content is therefore submitted to browsers of all the end devices including the robots of full-text browsers, for instance Google (Googlebot-Mobile) (Figure 3).

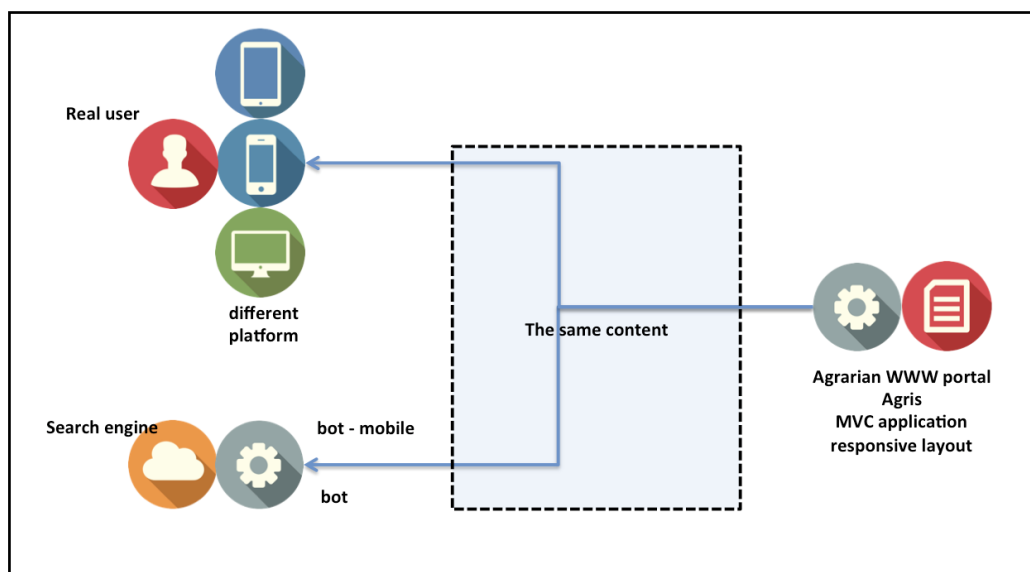
During the final implementation Bootstrap, jQuery Mobile, CSS pre-processor Sass, Kickstrap and YUI tools were used. The result is an ergonomic layout of control elements and content with the emphasis on the possibility of an easy and fast adjustments and updating, and the accessibility of the content to disabled users. Thanks to the utilized tools it is possible to implement minor improvements in the display on a chosen mobile device in a couple of minutes. The creation of an independent output for a new mobile device can take – depending on the demand factor and reusability of the code – hours or days.

The accessibility was carried out according to international methodology Web Content Accessibility Guidelines version 2.0 (WCAG 2.0) at level one A (W3C, 2008) and in accordance with intimation No 64/2008 Col. of the Czech Ministry of Interior at the level of compulsory rules. The result thus meets all four requirements:

1. Perceptibility – information and components of user interfaces are presented in order for the users to be able to perceive them.
2. Controllability – all the parts of the user interface and all navigational elements are controllable.

3. Understandability – information and the control of the user interface are understandable.
4. Robustness – the content is robust enough to be reliably interpreted by a wide range of access devices including assistive technologies.

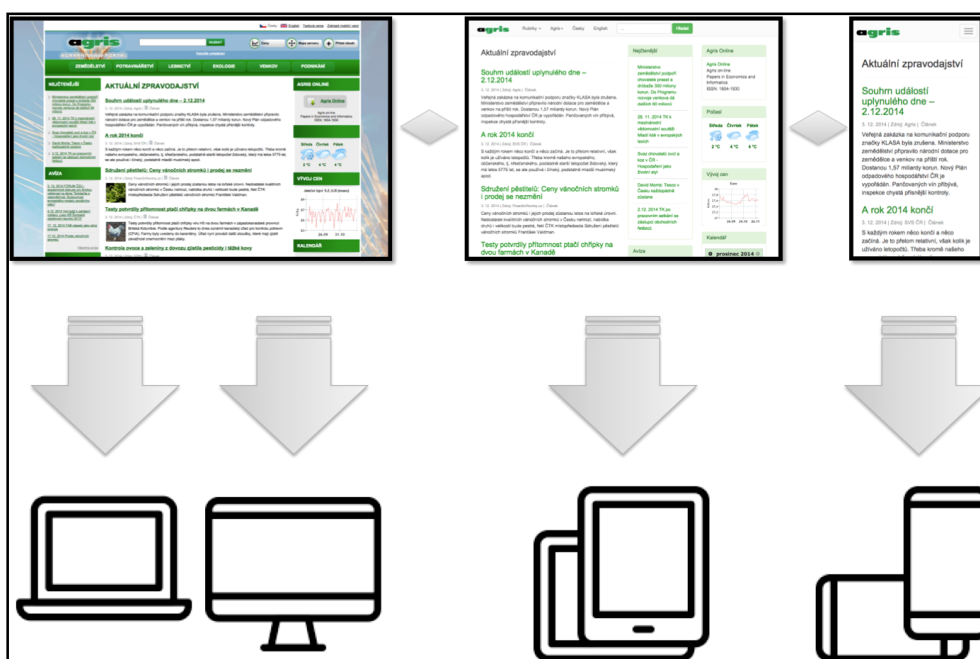
The final testing with the users was carried out in the form of manual work with the resulting responsive design on two types of equipment: Samsung Galaxy S III and Samsung Galaxy Note 10 in both horizontal and vertical layouts. It evaluated users' satisfaction during their interaction with the digital content (Zahidi et al., 2014) and did a partial research of usefulness in relation to context and experience factors (MacDonald and Atwood, 2014). Thanks to UX it was possible to design the ergonomics of control and content so successfully that five testers (who had been chosen from the task group of users) had only minor critical comments on the agrarian WWW portal Agris control on mobile devices. Their comments were incorporated into the design and tested again with a slight delay only. These users were different from those who had taken part in the research part of UX. For the screening of the appropriate display on various devices, a development tool for the simulation of mobile devices in desktop browser Google Chrome was used.



Source: authors' own research

Source of icons: IconArchive.com, author: PelFusion (pelfusion.com)

Figure 3: The distribution of the content to various http clients.



Source: authors' own research

Source of icons: IconArchive.com, author: IconsMind (iconsmind.com)

Figure 4: The distribution of the agrarian WWW portal Agris layout to end devices.

## Conclusion

By the creation of the responsive layout the first step was made for both the optimization of the content display and the improvement of the ergonomics of the agrarian WWW portal Agris control on mobile devices. The users, who access the portal by smart phones or tablets and whose number is incessantly growing, are able to utilize the full spectrum of service and information comfortably.

Another advantage is that users can switch from „mobile“ to „classic“ design. This will be appreciated by the users of 10“ tablets with high resolution (retina displays). This switch is ergonomically placed into the upper right-hand corner (next to the language and text version options) and has been in this place since the last change of the global design of the portal in 2011. The users who regularly visit the portal are already accustomed to looking for technical control elements here.

The responsive layout has one disadvantage and it

is the need of permanent connectivity and online work with the portal. A certain solution could be the utilization of Web Storage technology (W3C, 2014). However, this is not a pure responsive layout or the creation of an optimum design for the mobile devices of the current agrarian portal. This drawback will be eliminated by the creation of a native application for Android platform and hybrid applications for Android, iOS, Windows Phone and Windows 8 platforms which will be implemented during next two steps of making the agrarian WWW portal Agris available for mobile devices with a consequent comparison of efficiency.

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