Mobile Mapping of Dragonflies and Birds by Portable Web Apps

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Abstract

Mobile applications gain importance by the increasing number of smartphones and tablet computers in use. Web apps – in contrast to native apps – allow the development of portable solutions for different mobile operating systems. We present a mobile mapping application for capturing wildlife observations of volunteers. This web app exploits extensively current W3C and HTML5 specifications.

Keywords: mobile application, mapping, web application, HTML5, volunteered data.

1   Introduction

The knowledge about our wildlife is mainly based on regular observations. In Germany most of this fieldwork is done by volunteers [5]. For increasing the quality of their observations as well as for attracting younger people, it is important to replace traditional gears like paper maps and daybooks by IT-based tools. An obvious solution is to use common *smartphones* and *tablet computers* (like the iPad) for this task. These mobile devices allow running special applications, typically termed as *"apps"*. For mobile mapping of wildlife observations, the "ArtenFinder iPhone App" (http://www.artenfinder.rlp.de) is a typical example for such application. However, the name of the app indicates an essential drawback: Apps are strongly coupled with the underlying operating system; the development of iPhone apps, e.g., requires the use of a different programming language as well as of different APIs as Android implementations. This leads to additional efforts and increases the dependency from special manufacturers. Programmers for Windows Phone 6.5 apps are especially aware of this problem because their programs do not run under Windows Phone 7+.

Therefore, ARDINI ("**Ar**tenerfassung **di**gital in **Ni**edersachsen"; http://www.ardini.de) – a joint project of two universities, a GIS company and two environmental associations – decided to chance a new approach and to develop a *mobile web application* (*web app* shortened) for capturing and mapping field observations. Such a web app is completely programmed by using JavaScript. This web app has to fulfil several requirements: It should

- be usable on different hardware types (smartphone and tablet computer) and operating systems (iOS as well as Android),
- be highly configurable,
- take use of the GPS sensor of the devices,
- support maps of different scale and different providers,
- be useable offline, i.e. with no phone connection,
- be integrated into a workflow without media breaks,
- utilize gestures,
- provide the main characteristics of the animals including name variants, habitats, pictures, and voices, and
- avoid or detect inconsistent inputs.

ARDINI supports the mapping of dragonflies, of migratory birds and of breeding birds. These species were selected because they allow considering and implementing quite different types of fieldwork. Migratory birds are captured by single observations whereas breeding birds require a sequence of observations over several weeks. Dragonflies are counted during campaigns. Within ARDINI also a web-based GIS application was developed which allows a post-processing of observations; for details of the web-based GIS see: [1].

2   Design and Implementation Issues

Workflows for the different species were designed by analysing existing printed forms and by interviewing experts from the environmental associations. First implementations are refined stepwise by adding functionality and by incorporating the experiences from field tests with (rather inexperienced) students of Biology as well as with volunteers from the environmental associations.

Figure 2 at the end of the paper illustrates parts of the workflow by screenshots of the web app for (1) selecting species, (2) confirming the location of an observation, and (3) defining a project area.

Let us emphasize that the decision for a web app and the support of the reported requirements would not be realizable without the recent developments of HTML5 and CSS3 – these technical issues distinguish the mobile ARDINI application from similar developments.

The location of the device is determined by the W3C Geolocation API [6]. Observations are stored locally on the devices via the W3C Web SQL Database API [2], i.e. de facto via SQLite (http://www.sqlite.org/). The application is

configured by using the W3C Web Storage API [3]. Its offline capabilities are based on the W3C Offline Web Applications API [4].

The communication with the central server is performed by HTTP AJAX requests. JSON (http://json.org/) and GML are used as data exchange formats.

For implementing the graphical user interface (GUI) of a web app, the usage of a suitable framework is advisable. We decided to use the "Sencha Touch Mobile JavaScript Framework" (http://www.sencha.com/products/touch/): It supports many mobile devices, provides several complex GUI elements and is highly flexible. HTML elements are completely derived from JavaScript. User inputs are supported by proposal lists and situation-depended filtering.

Orientation in the field requires the display of the user's current location within a map. Another task for the map is the manual modification of the place of an observation, which is by default determined by using the Geolocation API. However, in some cases the real position of the animal may differ. Therefore, the Google Maps JavaScript API V3 (http://code.google.com/apis/maps/documentation/javascript/) as well as the OpenLayers API 2.11 (http://openlayers.org/) are integrated. The latter displays in addition maps from Open Street Maps (OSM, http://www.openstreetmap.org/) which in several cases contain dirt roads that are lacking in Google street maps.

Figure 1: Adding the observation of a breeding bird.

For offline use of the map, the user can specify (before fieldwork begins) an area of interest and load the corresponding OSM tiles of different levels-of-detail onto the mobile device.

Currently, the system supports 344 bird species and provides 466 voice files. In Figure 1, the location of a breeding bird has to be confirmed. In addition, 74 species of dragonflies with 189 images are provided by the ARDINI application.

3   Conclusions

First field tests using a preliminary implementation of the ARDINI web app proved its concept. High-end smartphones and tablet computers allow smooth working in the field. Also testers unfamiliar to smartphone technology before, were able to capture and map observations after a short introduction. In case of smartphones, the field tests have shown that still the operation time of standard batteries are not sufficient for a complete day of fieldwork.

The integration of further sensors (like camera and compass) is currently not possible by pure web apps. For avoiding this restriction, we started to use "PhoneGap" (http://phonegap.com/) which runs the web app as native application using an embedded web browser.

References

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Figure 2: Parts of the workflow: selecting species (1st line), confirming the location of an observation (2nd line), and defining a project area (3rd and 4th line).