StrapMaps: Bringing Map-based Navigation to the Straps of Bags

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Abstract

Most outdoor activities and outdoor sports do include a navigation component. For example, hiking, mountaineering, biking and climbing activities require orientation and wayfinding at certain points to certain degrees. With the rise of personal GPS devices, numerous navigation apps now exist that are tailored to the specific needs of the outdoor enthusiasts. Nevertheless, they all have the common problem, that they require the users to "store" the mobile device in their pockets and / or have the "hands free" for interaction. While wearable devices, such as smartwatches, overcome this problem, they have the disadvantages that they often offer very small screen space. In this paper we present StrapMaps, a concept to bring interactive e-Ink displays to straps of backpacks or harnesses to present map information while on-the-go in nature.

Author Keywords

wearable devices; cartography; mobile maps; strapmaps; stripemaps; hiking; climbing

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: *User Inter-faces — input devices and strategies, interaction styles*

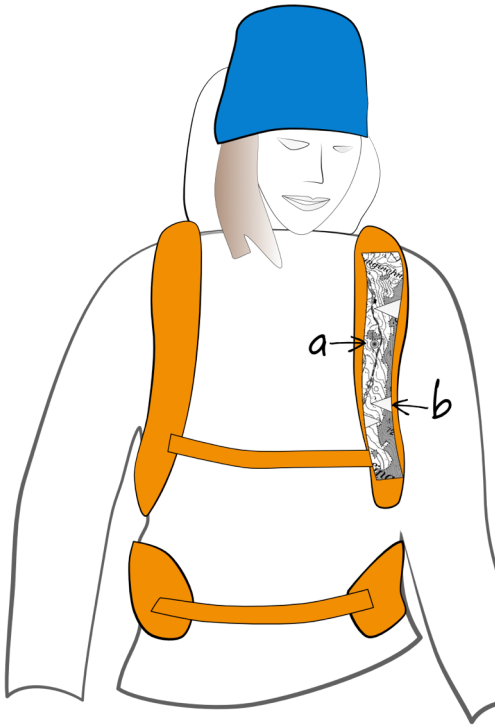

Figure 1: The StrapMaps concept; an interactive e-ink display it attached to a backpack. A location indicator a) shows the current location on the linearized map. The cuts e.g. b) along the route indicate the direction of the turn the user needs to make to navigate along the path.

Introduction & Motivation

Ubicomp technologies have great potentials to support alpine sports. In a range of activities from climbing, mountaineering or mountain biking, to hiking, navigation and orientation often is a great portion within these activities. Even though people are used to rely navigating on their mobile devices in urban environments, most outdoor enthusiasts still rely on fairly low-tech solutions in the mountains [4].

Papers maps, handheld GPS devices or fully ruggedized smartphones are used for good reasons. First, as the outdoor activities typically last for a full day, low power consumption is critical. Secondly, standard screens are hard to read in bright sunlight conditions and therefore people often get back using "low-tech solutions" (e.g., paper maps or handheld GPS devices) instead of smartphones or smartwatches. Nevertheless, also the low-tech variants have their own disadvantages. Handling those devices in nature could be cumbersome: Typically, a paper map or a handheld GPS device needs to be stored in a pocket or in a bag and, for example while climbing or mountaineering, the users not always have their hands free. In addition, the user experience of e.g. a handheld GPS device is not meeting the standards of today's mobile devices and the interaction with them is typically quite slow.

Wearable devices have the potential to overcome these problems, for example by including e-Ink displays that are better to read outdoors (e.g. the smartwatches by Pepple[1]), but again they have the main disadvantage, that they just offer a very limited screen space.

In this paper we present the concept of StrapMaps to combine the best of both worlds. StrapMaps bring maps and position information (by linking StrapMaps with a mobile device) to the straps of a backpack or climbing hardness (as can be seen in Figure 1). By linearizing the map content, StrapMaps offering a fairly large screen. Therefore they are able to provide an overview on a full route at one glance. Full route knowledge is particular important outdoors, as a decision at a waypoint may influence further decision throughout the day. Therefore, map based techniques are preferred compared to alternative approaches, such as tactile navigation techniques [6] which better address the navigation needs in urban environments.

Related Work

The StrapMaps concept is highly inspired by the StripeMaps applications presented at ACM MobileHCI 2015 [7]. StripeMaps is a novel cartographic approach for smartwatch maps targeted at pedestrian navigation. Just as web designers simplify multiple column desktop websites into a single column for easier navigation, StripeMaps transforms any two-dimensional route maps into a one-dimensional "stripe". These "stripes" can be easily browsed on a smartwatch by scrolling in only one direction as one does with a well-designed mobile website.

[1] https://www.pebble.com

Figure 2: A climbing topo displayed on a StrapMaps attached to a climbing harness (left bottom corner). Compared to figure 1 no location indicator nor cuts are shown, as no positing information is available and climbing topos are already linearized (see cutout).

Besides a large corpus of related work on improving the input and output capabilities [e.g. 3] and map-based navigation techniques in general [e.g. 5], researchers also started to explore the advantages of e-ink displays [2] for wearable device. For example, the DisplaySkin device [1] uses a flexible E-Ink display circling around the user's wrist. In contrast to related work, StrapMaps is the first approach to attach e-Ink displays to sports accessories and show linear maps at once compared to the StripeMaps approach [7].

StrapMaps

The main concept of StrapMaps is to linearizing the map content to make it fit the long, but small straps of a mountain backpack or climbing harness. Interestingly, climbing topos as shown in Figure 2 (a topo shows the approximate shape of the route, the important rock formations and details of the grade and protection of each section of the climb[2]) typically already have a linear shape and nicely fit on our StrapMaps screens.

For hiking maps, we use the StripeMaps algorithm [7] to create linear maps. Therefore, first the users select a route they would like to hike, bike or climb. The algorithm then divides the route into segments that can be displayed in a linear way as can be seen in Figure 1. The cuts along the route indicate the direction of the turn the user needs to make to navigate along the path. Wenig et al. [7] have already shown, that this simplification allows StripeMaps to outperform both traditional mobile map interfaces and turn-by-turn directions for pedestrian navigation using smartwatches.

By using e-paper technology, the StrapMaps display is both flexible and does only consume little power. This makes it suitable for long day trips or multiple day trips. Even though StrapMaps can be used without positing technology, we aim to integrate position information from mobile devices via Bluetooth LE. In this case, beside the route information, also position information be displayed, as shown in Figure 1 a).

We are currently building a first prototype of the StrapMaps and hope to present it alongside with the poster at Ubicomp 2016.

Conclusion & Future Work

In this paper we have discussed and the described the StrapMaps concept. With StrapMaps we believe to combine the best of two worlds and bring a novel and useable map based navigation technique to many outdoor enthusiasts. Even though we are at an early

[2] https://en.wikipedia.org/wiki/Topo_(climbing)

stage, we believe that the benefits of StrapMaps are manifold including the following two important points:

- First, no additional device is required. StrapMaps work as a self-contained add-on to most backpacks. Multiple maps can be stored on the strap and used when needed changed throughout the day. All route information can be inspected at any time with a simple glance at the strap of the backpack or climbing harness.

- Second, StrapMaps can be operated hands-free. This is particular important for alpine sports such as rock climbing. In addition, e.g. compared to a wearing a smartwatch while climbing, it has no safety risks.

- Third, the StrapMaps e-Ink display form factor supports the presentation of linear route visualizations, which have been proven, in practice as well as in research, to be use well-suited for pedestrian navigation.

We are currently in the development of a first prototype and plan to conduct user studies to compare the performance of StrapMaps against paper maps and GPS handheld device in outdoor environments.

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