A Web-based Time Machine with Augmented Reality

Mikael Holmgren
Department of Computer Science, Electrical and Space Engineering
Luleå University of Technology
Skellefteå, Sweden
Email: mikael.holmgren@ltu.se

Dan Johansson
Department of Computer Science, Electrical and Space Engineering
Luleå University of Technology
Skellefteå, Sweden
Email: dan.johansson@ltu.se

Karl Andersson
Department of Computer Science, Electrical and Space Engineering
Luleå University of Technology
Skellefteå, Sweden
Email: karl.andersson@ltu.se

***Abstract*—In this demo paper we present "The Time Machine", a web-based app prototype, running in a web browser. The prototype uses the WebRTC API getUserMedia to gain access to the device camera. With access to the device camera, it is possible to implement an augmented reality view where the user can point the device at a location and access multimedia information of the past, the present, and even the future. The purpose of this paper is to stretch the mindset on what the web browser in a mobile device can be used for.**

I. Introduction

It is becoming clear that the preferred way of delivering contents and services to a mobile audience is based on pure web technology such as HTML5, CSS3 and Javascript [15][14]. With the ever increasing support in modern web browsers, it is getting easier to access features of the device that used to be accessible only for native apps. As such, web browsers are merging into platforms where it is possible to build services that are independent of operating system. When utilizing the web browser as a platform for your service, you easily get access to the increasing amount of services made available via programmable APIs on Internet. Examples of such APIs are weather data [1] and map data [2].

WebRTC [3] is a technology that has reached web browsers in mobile devices. It consists of three APIs: getUserMedia, RTCPeerConnection and RTCDataChannel. The standard is maintained by IETF [4] and W3C [13] and is still regarded as a working draft, but all three APIs are supported by both Mozilla Firefox and Chrome on Android. Support for WebRTC on iOS is limited to Ericsson's app Bowser, which only can be considered as experimental [5].

Our implementation focuses on using the getUserMedia API. The getUserMedia API can be used for gaining access to camera, microphone or getting access to view the whole user desktop. To maintain the integrity of the user, scripts cannot use getUserMedia without first being granted privileges by the user. Our implementation will only be using the camera of the device. It is important to note that when granting access to the camera, the user also grants access to the possibility that the stream from the camera is transmitted via the internet to another peer via the RTCPeerConnection.

II. The Time Machine

We have designed a service intended to be executed in a web browser on an Android-based mobile device. We call the service The Time Machine since we have been using it to display historical (and forward-looking) information, but the content could easily be replaced and/or supplemented with information from other areas, e.g. information about public art or places particularly good for skateboarders. It could also be used for more commercial purposes, where the user gets information about opening hours and receives owners from the stores that the user is interesting in. The graphical design and structure of The Time Machine is inspired by a previous proposal [6], published in the cross-media interaction design area. Even though both Chrome and Firefox support all functionality used by The Time Machine, it is best experienced using Firefox. The application consists of three different views:

In the Augmented reality view, the user sees a visual stream from the camera. The user can point the device at a building or a place and if the underlying database contains information about this place, it will display a symbol on which the user can tap in order to get historical information.

The Map view displays a map where the user easily gets an overview of which locations that hold historical data. Figure 2 shows a screenshot of what the map view looks like. It is possible to tap on the icons in order to view information about locations.

The Item view displays information about a chosen location. It contains a slide show where the user can view historical images of the location. The user can also read about the location from a slide down menu. Right side of figure 1 shows an example of what it may look like when pointing the device at a building. When tapping on the symbol in the middle, the user will see an image of what this place used to look like.

A. System description

Each view is embedded in an HTML element which can be hidden and shown when the user navigates between them. This approach reduces the use of network resources since it does not need to reload a whole page when stepping between views. Another benefit of this approach, compared

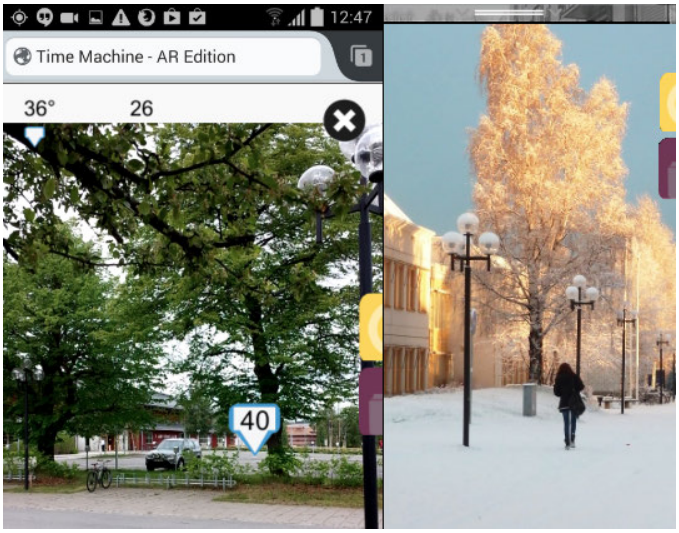

Fig. 1. Left: Augmented reality view. Right: Item view, showing the same place during winter.

to loading the page when stepping between the views, is that the user does not have to grant privileges of using the camera each time entering the augmented reality view.

1) Augmented reality view: This view is enabled with the getUserMedia API [7] to access the device camera and stream information from camera into an HTML5 <video> tag. The HTML5 canvas is used to display information such as symbols on the view. The HTML5 functionality DeviceOrientation-Event [12] is utilized to know in what direction the user is pointing the device.

2) Map view: The map is always focused on the location of the user. The Leaflet.js [8] library is utilized to display the map and all information in it.

3) Item view: To make it possible to slide between images, the slide show makes use of the jQuery Mobile API [9]. The text about a location slides down the top of the view. Since images typically have a relatively large size, all images are not downloaded at the moment the application is started. Instead, all information in this view is downloaded once the user enters the view.

4) Back end: The back end of The Time Machine consists of PHP [11] scripts that access a MySQL database [10]. The database contains all information about the locations and paths to the images that are connected to a location. Our implementation currently consists of 34 locations.

III. Future Work

As the augmented reality view is made quite generic and configurable, it would be possible to use this library in other web applications where similar functionality is desired. All functionality in the initial design proposal [6] have not yet been implemented. Examples of such functionality are social media, photographer information, and paths based on interests and filters.

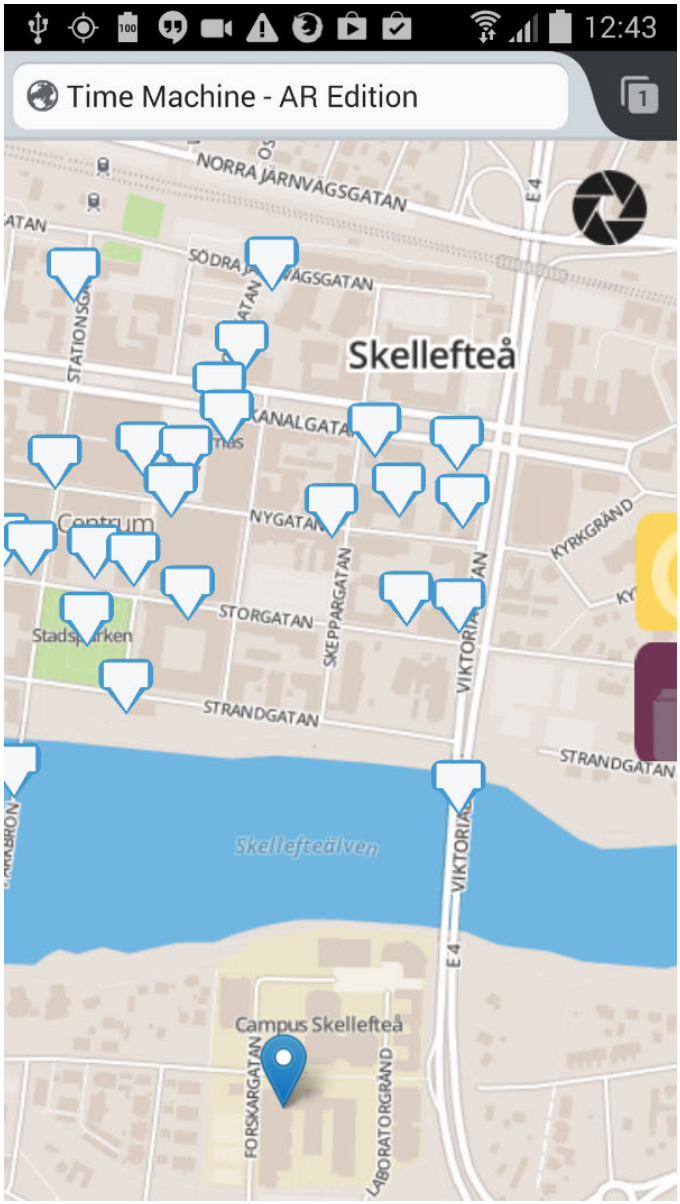

Fig. 2. Map view

IV. Conclusion

The main purpose of this article was to stretch the mindset on what web browsers in a mobile devices can be used for. One should note that some of the used technologies are only on a draft level and there are some differences between the two web browsers currently supporting the technologies used by The Time Machine. At this moment, the application works better in Mozilla Firefox due to two things: first, the coordinates given from the DeviceOrientationEvent does not work the same way in Chrome and Firefox. One would have to make special code for each browser in order to make it work satisfactory. Second, the camera stream from Firefox currently fits the screen in a better way so that the video stream fills the whole screen. This could be achieved on Chrome also but not without some

browser specific code. It is our belief that these differences will disappear as the technique and standards become more mature. Despite the problem that early adopters may find some difficulties, we believe that the web browser is turning more into a platform on which to build applications than just a tool for reading web pages.

The augmented reality works as a complement to the more traditional map view and may in some cases simplify finding the object the user is interested in. This is because it removes the required mapping between the map in the device and the real surroundings.

Our concluding and summarizing observations are that services enhanced with features like augmented reality, once reserved for native applications, can now be adapted for and and implemented through new web technology.

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