Web Georeferenced Video Player with Super-Resolution Screenshot Feature

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Abstract. In order to play georeferenced videos, The Oceanic Platform of the Canary Islands (PLOCAN) is currently using a desktop-based software. In this paper, a port to a web-based video player is reviewed. In addition to its main advantages, new features are also discussed, such as the download of super-resolved frames.

Keywords: georeference, web, video, player, html5, python, django, super resolution.

1 Introduction

A georeferenced video is a sequence of frames in which there is some spatial information associated to the temporal information (Figure 1). In this way, a video can be referenced both by time or location, using the common player controls or a map with a track of the video movement.

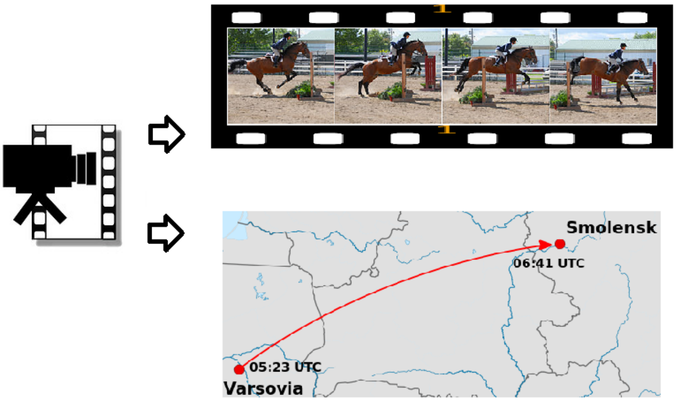

Fig. 1. Graphical description of a georeferenced video

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This technique has been increasingly used for both research and industrial purposes [1], mainly to enhance user experience and to improve search engines [2] by not only running temporal queries but also spatial ones. Indeed, recent investigations claim that search results are much more accurate when searching by location [3].

At the Oceanic Platform of the Canary Islands (PLOCAN), georeferenced videos are very common, as this organization has a collection exclusively dedicated to the deep sea research.

2 Initial Baseline

In order to play these videos, PLOCAN nowadays uses a software called 'XeoTV', owned by the Galician-based company Centro de Investigaciones Submarinas, SL (CIS). This software works consistently, but it has two remarkable drawbacks:

1. It only works on computers running Microsoft Windows.
2. It requires the user to have the requested video present in the local system before using it.

The latter is especially problematic, as videos might consist on several gigabytes. Thus, getting videos downloaded becomes an uncomfortable and non-immediate task.

3 Web Video Player

A web video player able to handle this type of video files would solve both of the previously stated problems on the current version.

One of its main advantages is that a web video player is potentially able to work on any device with access to the Internet and a web browser. Therefore, it would not only be limited to computers running Microsoft Windows, but those running alternative operating systems could use it.

But one of the key points of the web video player is that, when using streaming techniques, video does not have to be fully downloaded to start watching it. Furthermore, with a proper configuration, it could also allow the user to download and watch only the desired parts. This would save a lot of resources on the user side.

4 Super-Resolved Screenshot Feature

Taking advantage of latest researches made by the Institute on Applied Microelectronics on Super-Resolution techniques [4], it is possible to offer the users an option to download a specific frame to a super-resolved image file. This work has made this computational task fast enough to embed it into a website without a massive wait on the user side.

Whenever the user asks for the super-resolution of a certain frame, the website will query the server for it. Afterwards, the server will download the required frames from the original video to finally run a C script which will generate the resulting super-resolved frames.

In addition, the script is also available in a so-called *test mode*. When running this mode, the script will shorten the original frame to restore its previous size with its super-resolution technique. This is particularly useful because it is able to smoothen present interlacement in the image.

5 The Solution

5.1 Features

The solution will be a web application which will enable users to play the georeferenced videos while they are able to track the movement on an adjacent map. Furthermore, the users will be able to navigate through the video not only temporally by clicking on the timeline (as it usually is) but also spatially (i.e. by clicking on a map point within a video transect[1]).

An interesting technique, often referred as *pseudostreaming* in the literature, will be used. With pseudostreaming, the user will be able to seek for a specific point of the video even when it has not been downloaded yet. Most of the video websites use this technique to achieve the functionality.

5.2 Design

For the design, simplicity has been the followed path. Focusing on the current version of XeoTV which the PLOCAN users are using, the web application will have a similar design while cleaning most of its interface, which should result in a much smoother and nice user experience (Figure 2).

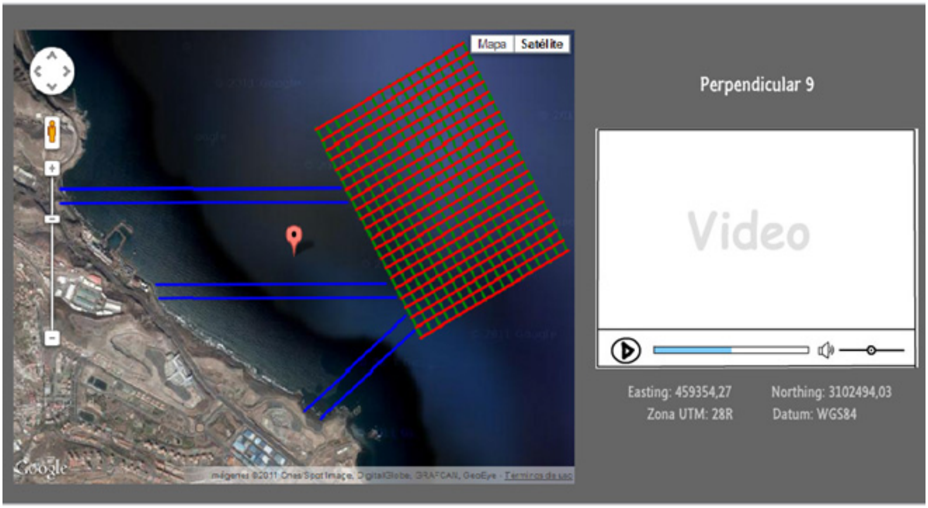

Fig. 2. Mock-up of the graphical user interface

[1] A transect is the path a specific video has gone through. In the application, it will be displayed on the map as a line.

Both the map and the video player will be the core of the web application, and as such, it is important that they are easily watched as soon as the page loads.

5.3 Implementation

The web application will have two important and separate parts, the front-end (what the user can see and play with) and the back-end (what the user cannot see and it is commonly handled by the remote server).

Back-end

The back-end will be implemented with a Python's MVC[2] framework called Django. This framework dramatically decreases the development time thanks to the amount of shortcuts it offers to the developer. Together, the chosen database engine has been *MySQL* due to its popularity and fit to the application requirements.

This configuration will be hosted on an Amazon Elastic Compute Cloud (often referred as Amazon EC2), which offers a simple and extensible server configuration, and makes it very easy to change whatever is needed in order to scale up or down the computational resources of the web server.

For the video streaming, a CDN[3] solution will be used, as it is the fastest and simplest way to make videos work with the *pseudostreaming* technique and, at the same time, it serves the videos from different servers across the world, decreasing the latency times.

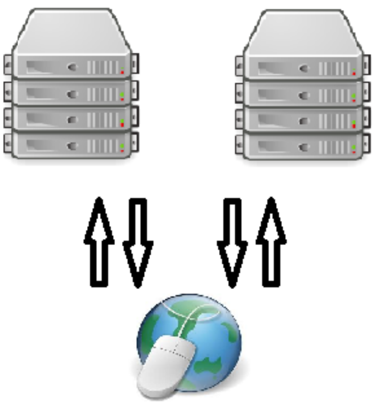

Fig. 3. Diagram with the interaction among the user and the servers

[2] MVC are the initials of *Model-View-Controller*, a software architecture pattern very common on website development which separates the logic into three different layers, so the code is modular and easier to maintain.

[3] Content Delivery Network (CDN) is a distributed system of servers which serve content to end-users with high availability and performance.

Front-end

The web application has a lot of functionality inside the front-end. The user is able to interact with the application and it is not requiring the remote server for most of the tasks. In this way, a heavy use of Javascript is going to be required, and it is going to focus on two main points:

Map

In order to work with a map, a higher-level framework called *OpenLayers* has been chosen. This decision allows the software design to be fully abstracted from vendor-specifics. In this way, even though we are planning to use Google Maps as our data source, the code is flexible enough to be simply adapted to other sources.

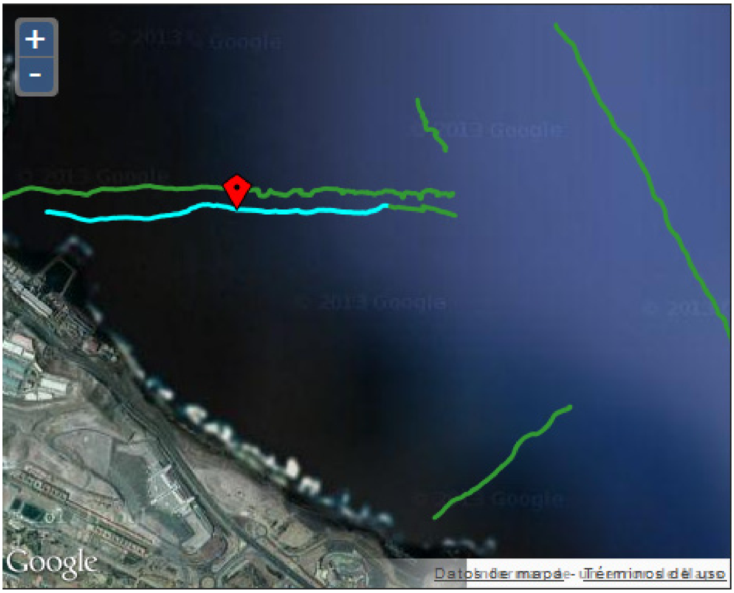

Fig. 4. Graphical user interface of OpenLayers

Video player

For the video player, two possibilities have been studied: a flash-powered video player or an HTML5 one. Our choice has been the HTML5 version of Flowplayer, mainly due to:

- Smoother user experience.
- Less computational resources.
- Native frame-by-frame seeking.
- More friendly with not-so-popular computer setups [5].

6 Future Work

The application has a clear core on its functionality with its map and video player features. However, it is easily extensible with new features thanks to the MVC pattern of its software architecture design. Currently, there are important ideas of new features that could offer an important increase on the functionality. These ideas range from a note system where users could write some interesting notes at specific points, to a multi-user system where every user could have its own map with its own videos.

7 Conclusions

It has been shown how a web video player could substitute the actual 'XeoTV' software which PLOCAN is using in order to play their georeferenced videos. In addition, this migration would solve important problems such as the use in different computer setups or the need of the video files in the local storage. At the same time, it aims to add new features such as the super-resolution of the frames asked for the application user.

Furthermore, given its web nature, new versions of the application would be getting to the user immediately. In this way, end users would always be taking full advantage of latest work, which is especially interesting for the future work stated at section 6.

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