

The Virtual galleries

Introduction

My project's idea is principally to develop a *Virtual Museum* and a site from which you can access and interact with the Museum itself.

The idea started from an important historical place of the First World War, which is really difficult to climb and to visit: it's the so called 'Galleria di Castelletto', placed at the base of the Tofana 1° di Rozes and at the beginning of the 'Ferrata Lipella', starting altitude of 2105 meters and arriving altitude 2778 meters. We are talking about a system excavated in 1916 by the Italian soldiers, in a particularly important place because the



Tofane was the scenario of a series of important events of the Second World War, for example the 'Battaglia delle Tofane', which was more a resistance period than a battle.

Author : Rüdiger Kratz, St. Ingbert, https://upload.wikimedia.org/wikipedia/commons/7/7a/Tofana-Massiv_2690_a.jpg, license by https://meta.wikimedia.org/wiki/Licensing_update

Objective and Purpose

The project would be developed in order to make this historical site accessible to everyone, also to that classes of people with motor difficulties, like children or senior citizens or people with disabilities, who could not afford a similar type of physical effort.



https://it.wikipedia.org/wiki/File:Grotte_e_gallerie_militari_interno_del_castelletto_%E2%80%93_Veneto.jpg

Author: Touring Club Italiano, <http://www.touringclub.it/>, license by

https://upload.wikimedia.org/wikipedia/commons/a/ae/Grotte_e_gallerie_militari%2C_interno_del_castelletto_%E2%80%93_Veneto.jpg

The idea is to transform the site in a virtual 3D model, in which the visitors could move and interact with the help of a joystick or another type of technical tool, in order to explore the entire site, and in order to click over some relevant points that would be introduced to explain some historical dates and concept and to listen some music related to the World War Word, the so called 'Canti degli Alpini'. The visit, in this way would be more similar to a virtual game than a Museum exploration, because the high level of interaction that the visitor is able to define.

Moreover the route would start with a theme, the 'Poesia dell'Anonimo', a poem written by an anonymous soldier, find in the proximity of the gallery.

It's a beautiful poem that expresses in a great way the suffering of the soldiers during the war, not only in terms of physical and psychological privation and effort, but also because of the consequent losing of humanity perceived by the soldiers themselves forced to face the cruelty of murdering other human beings in order to survive. This poem in my dea would be a guide to the rest of the visit.

After the definition of the Virtual experience the plan is to develop a site entirely related to the 'Galleria di Castelletto' and the 'Ferrata Lipella', in which you could find:

- A map of the entire site;
- A sort of historical definition with more information about the site and the First World War;
- A presentation of the important figures who were connected to the site, a sort of portrait area;
- A series of links and explained connection to other relevant places;
- Obviously the access to the Virtual Museum.

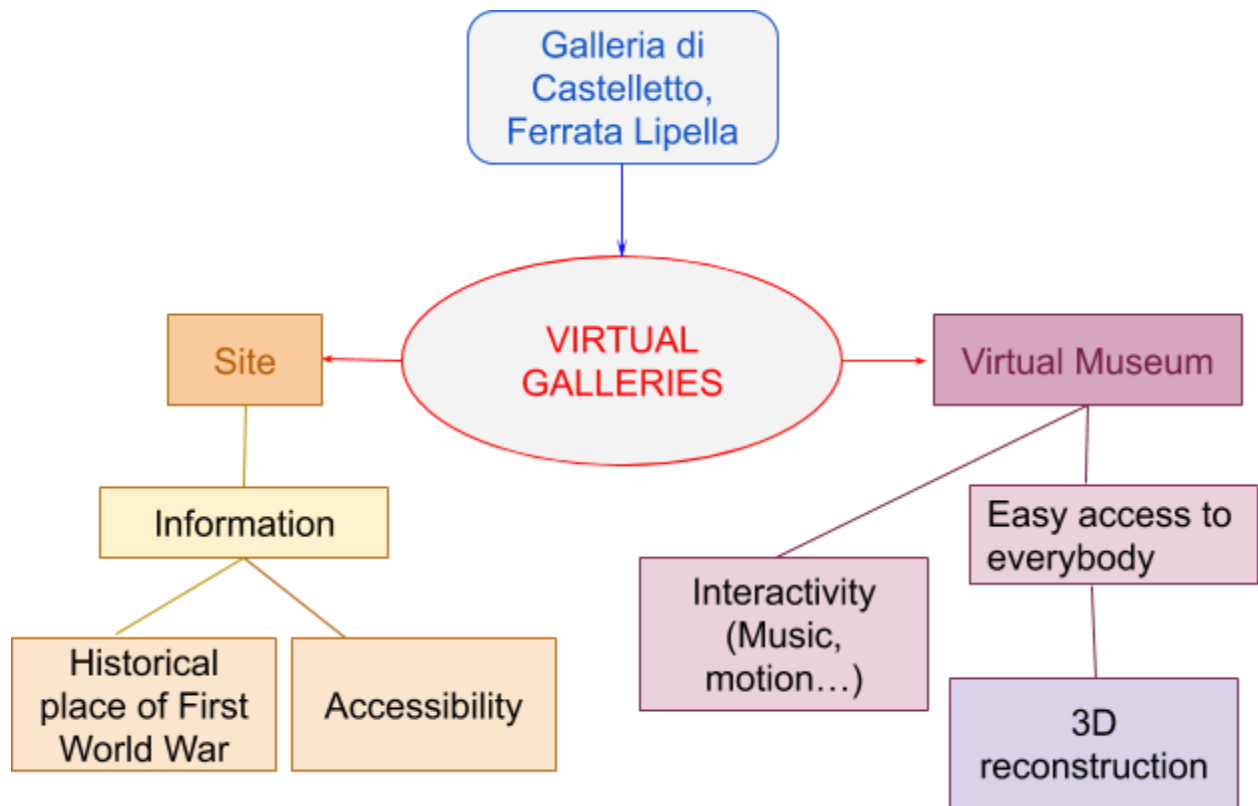
Museological Approach

Obviously from a Museological point of view we are working with **Virtual on Real**, so a reconstructed real space in 3D virtuality that could be browsed and explored as the real one .

So I think that we are developing a **Category A** Virtual Museum: A Virtual Museum enhancing Marketing (even if in this case I think that

Exploration suits better), in a CLOSED SPACE, with OPEN INTERACTION, with SELECTED OBJECTS presented as Digital, VIRTUAL ON REAL model, NOT allowing VISITORS' CONTRIBUTIONS.

Conceptual Map



Description of Workflow, Development and Technological Requirements

As we said the project is substantially divided in two parts: the virtual designing and the site.

The first step of this project is a collection of a really important set of images and photos of the 'Galleria di Castelletto' and the 'Ferrata Lipella', in order to collect a sufficient quantity of material to create the 3D Virtual Image of the entire site using the technique of panoramas and DPF's virtual reconstruction.

The collection of the images has to be *in loco*, because we need the most precise perception of the 'Galleria', with a large number of photos and with the right level of light, and the 'Galleria' is a closed place, so we could not obtain satellite images. Moreover, we also need to collect the photo of the outside landscape and of the Ferrata, but we could decide to use satellite images.

So we have to use a laser scanner or a digital camera but I think that a digital camera is the ideal solution, because it's not only easier to carry and cheaper, but it would also provide a better resolution in a space in which the appliance support is unstable because of the soil disturbance.

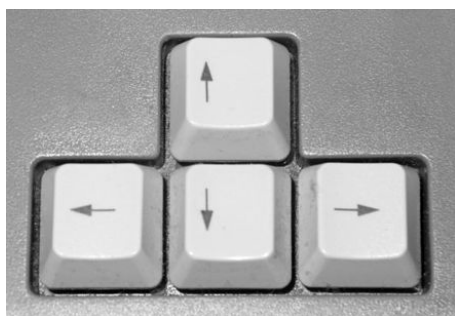
Initially I was thinking to use photogrammetry technique with the identification and collimation of bi-univocal corresponding points of photos (considering the set of photos in subsequent pairs) in order to determinate camera position and orientation and obtain the stereographic model.

I was thinking to apply the *Image Based Modelling* which is a method that takes advantage of automatic approaches and allows 3D models to be obtained from a set of photos referring to some photogrammetric solutions. This system is based on *Dense Automatic Matching*, so the same bi-univocal identification of points made in photogrammetry but in a dense-massive way, this means that the automatic identification of the corresponding points is carried out for each pixel of each image. IBM is based on non calibrated images, so all the information about

the camera as to be worked out from the photos so that the computation of camera calibration could be done automatically. Once the algorithms have identified all the corresponding point in the photo sequences, the software, based on this matching process, estimates the right camera position at the moment of shooting. Starting from the camera positions, a dense 3D object reconstruction is carried out, other words, for each pixel of the images the software computes, in addition to the RGB value, its xyz position in space. We have to consider that a 3D image is not a copy of the reality but an approximation. I was considering, in this scenario, to work with .mtl and .obj files in order to obtain the 3D image, using for example a software like PhotoScan and to make the experience more intractable to insert the possibility to move inside this 3D route, exporting our photogrammetry in *Blender*.

At last I reconsidered everything and I decided to use the [DPF](#) (Depth Panoramic Frame), that is a compact data model developed by B. Fanini and E. d'Annibale for omnidirectional image-based data

transport (panoramic images and videos) targeting VR dissemination, suitable for online and local contexts (or web-apps). It offers full sense of presence and scale within VR fruition by restoring a 3D space without transmitting original dataset (e.g.: very large point-clouds) using instead an egocentric optimized encoding. This type of system is easier to use, it has already a complete and organized *javascript* implementation with it's own library and allows me to insert the possibility to move and explore inside its implementation structure, generating a network of DPFs using XML by simply calling `myExplorer.parseXML`. This would create a passage through different DPFs in order to obtain a continuity effect clicking on a specific green sphere that gives access to another DPF. This model allows the visitor



to move inside the reconstruction with the mouse cursor or using the arrows' keys or alternatively the WASD keys.

Images from Wikimedia and pxhere (https://commons.wikimedia.org/wiki/File:Arrow_keys.jpg,
<https://pxhere.com/en/photo/908969>)



The development is quite similar to the one I was thinking previously, because it would start as well from photos to generate through IBM a 3D images, as panoramas are generated through photogrammetry's technique.

Moreover the DPF has: an easy deployment on a webpage and an easy integration with external devices, that are characteristic that I both need in the step of inserting my *Virtual Museum* on the site that I would implement.

In addition, I would be able to insert relevant points and markers defining *onHover* functions to add some semantic descriptions, then I could add selection handling `myDPF.onSelectAnnotation(id, onSelect)` to play a sound, in my case .mp3 recordings, music and historical description.

The result would be really similar to the idea expressed in [Trail me up](#).

DPF is a js library (**DPF.js**) developed on top of OGS.js library and **HTML5/WebGL** and **WebVR** technologies, it's an Open source

javascript implementation and you could see online all the API documentation, the reference paper and some examples on [GitHub](#).

As I wrote before, I would also insert something more: the possibility to click on semantic points that would give access to music and historical notes, something similar to video games' interactivity, using the function [myDPF.onSelectAnnotation\(id, onSelect\)](#).

The visitors clicking on this relevant points would be able to listen to some recordings of historical importance, or to some music of the 'Alpini', chosen appositely.

Initially I was thinking to insert two icons, designed as .jpg or .png to be connected to the semantic of the action: for example a note for the music and the Italian flag for the historical facts.

The recording would be developed as simple mp3. To produce .mp3 - .mp4 music files we simply need a recorder system (a microphone), so we don't use formats like MIDI, but we need a LAME codifier with at least 128 or more kbs.

The second part of my project involves the creation of an Open site in which the Virtual Museum experience is available, and in which you

could find the possibility to access to different areas and information: a personal area in which you could log-in and create an account; a general and historical description of the area with a series of maps and connections with other important places; another historical description of most relevant events, a portraits' area of important people that have been involved somehow with this area.

The site would be developed using HTML, CSS, JAVASCRIPT and BOOTSTRAP.

Foundable difficulties

I suppose that the most complex part of this project is the collections of the high number of photos with an important level of quality that we need: as I said, it's difficult to access the site and to find the ground stability to have photos with an easel, which is quite important in producing photos for photogrammetry, not mandatory, but absolutely useful to improve the definition and the compatibility, in terms of axis, of subsequents photo. For this reason, I think that this phase would take a lot of time, in order to have a good starting material, took with

precision and with hand-made regulation of the axis, so an approximation obviously. Also the nature of the camera is important, we need a good digital camera but we have also to consider the budget.

Further development and maintenance issues

A possible further development of this project is the adjunction of more information and parts in the site, or maybe an implementation of the site area that would be added at the 3D model.

From the point of view of the maintenance it would be just related to the development of the technologies and the updating of the libraries and eventually the data model.

Bibliography

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