EVISUGE: Event VISUalization on Google Earth
EVISUGE: Οπτικοποίηση Γεγονότων στο Google Earth

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ΠΕΡΙΛΗΨΗ

Σε αυτό το άρθρο παρουσιάζεται το EVISUGE, ένα σύστημα που επιτρέπει την οπτικοποίηση και διαχείριση σεναρίων του πραγματικού κόσμου στο Google Earth. Ένα EVISUGE σενάριο απαρτίζεται από γεγονότα, τα οποία αναπαριστώνται σύμφωνα με το μοντέλο αναπαράστασης γεγονότων MOME (MObile Multimedia Event Capturing and Visualization) που έχουμε αναπτύξει. Τα γεγονότα των σεναρίων οπτικοποιούνται με βάση τα χωρικά και χρονικά χαρακτηριστικά τους πάνω από τους τρισδιάστατους αλληλεπιδραστικούς χάρτες του Google Earth. Οι δυνατότητες του συστήματος EVISUGE επιδεικνύονται μέσω πραγματικών σεναρίων: *(α)* Τον καθορισμό, τη διάσχιση και την οπτικοποίηση μιας φυσιολατρικής διαδρομής; και *(β)* Τη χωροχρονική αναπαράσταση και οπτικοποίηση μαχών.

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ABSTRACT
In this paper we present EVISUGE, a system that allows the visualization and management of real-world scenarios on Google Earth. An EVISUGE scenario is composed of events, which are represented according to the MOME (MObile Multimedia Event Capturing and Visualization) event representation model that we have developed. The scenario events are visualized on top of the Google Earth 3D interactive maps, with respect to their spatial and temporal features. We demonstrate the EVISUGE system through real-world scenarios: *(a)* The specification, navigation and visualization of a naturalistic route; and *(b)* The spatiotemporal representation and visualization of battles.

Categories and Subject Descriptors
H.5.1 **[Multimedia Information Systems]**: Artificial, augmented, and virtual realities. H.5.4 **[Hypertext/Hypermedia]**: Navigation.

General Terms
Algorithms, Design, Human Factors.

Keywords
Event; scenario; interactive map; visualization; Google Earth;

1. INTRODUCTION
The use of interactive maps on the Web has become very popular nowadays, especially after the development of robust interactive map infrastructures like the Google Earth[1] and Google Maps[2]. An important application of the interactive Web maps is the presentation, on top of them, of multimedia content related with sites and events of interest. As an example, the natural history museum of Crete[3] allows presenting information about several types of birds on top of Google Maps.

A challenging relevant research direction is that of real-world event visualization on top of interactive Web maps. Some spatial event visualization applications exist today, like the one presented in [5], which allows the visualization of battles on top of a canvas; these applications, though, do not utilize interactive maps but other spatial representations like canvases.

Event processing has recently attracted a lot of attention in both the business and academia [6]. Formally, an event is an occurrence within a particular system or domain; the term *event* is used to describe both the real-world occurrence and its computerized representation [6]. Semantic modeling of events is a very promising research direction in multimedia as well as in business applications and business intelligence [4][1][2][3].

The representation of a real-world event on a map should include: (a) the spatial information of the event, which is represented by its position on the map; (b) the event participants (both actors and objects); (c) the temporal features of the event; and (d) the representation of any relevant events (including sub-events and preceding/following/parallel events). These real-world event representation requirements are satisfied by the *MOME (MObile Multimedia Event Capturing and Visualization)* event representation model [7] that we have developed. Interrelated real-world events may be combined to form *scenarios*; the later are visualized through the visualization of their component events, with respect to their spatiotemporal order. An important feature of the MOME model is that it supports the real-time multimedia event capturing by a one-man-crew that exploits smart devices (like, for example, cameras with automatic GPS coordinate capturing capabilities).

In this paper we present *EVISUGE (Event VISUalization on Google Earth)*, a system that allows the visualization and management of real-world scenarios on Google Earth. An EVISUGE scenario is composed of events, which are represented according to the MOME event representation model. The visualization of an EVISUGE scenario includes the visualization of its component events on top of the Google Earth 3D interactive maps, with respect to their spatial and temporal features. During the scenario event playback, the system users may interact with event shots that capture the events. We demonstrate the EVISUGE system through real-world scenarios: *(a)* The

[1] Google Earth, http://earth.google.com.
[2] Google Maps, http://maps.google.com.
[3] Natural History Museum of Crete, http://www.nhmc.uoc.gr /portal/?q=birds_amari

Primary Actor	Goal	Description
Observer	Scenario navigation/visualisation	Choose to interactively navigate through a scenario that contains one or more events
Observer	Scenario search	Perform a keywords based search to retrieve the most related scenarios
Observer	Scenario annotation	Manage (create/delete) textual annotations/comments for a scenario during its visualisation
Observer	Scenario metadata personalization	Select the scenario metadata information that will be projected during its visualization/navigation. This metadata refer to the events and the objects that are related to the specific scenario.
Observer	Scenario browsing	Browse through the existing (already stored) scenarios
Creator	Manage a scenario	Manage (create/edit/delete) a scenario. A scenario is structured of one or more events.
Creator	Manage an event	Manage (create/edit/delete) an event. The manipulation of an event is related to its spatial-temporal characteristics, its descriptive information (along with any multimedia information) and its representation (schema, fill/outline color, etc.) in Google Earth.
Creator	Create parallel events	Create events with temporal overlapping.
Creator	Manage event temporal information	Manage (create/edit/delete) the temporal information (i.e. begin/end time) in order to compute the event duration.
Creator	Manage event image information	Manage (attach/delete) an image to the event.
Creator	Manage event 2D/3D representation	Manage (create/edit/delete) the 2D/3D representation schema of the event. The schema is suitably selected from a draw suite. It may have a 3D representation. During the editing the background and the outline colors are also defined.

Table 1. The most important Use Cases of the EVISUGE System

specification, navigation and visualization of a naturalistic route; and *(b)* The spatiotemporal representation and visualization of battles.

Compared to existing applications developed over interactive Web maps, like the ones offered by the natural history museum of Crete, the major advantage of the EVISUGE system is that it allows event visualization in addition to the presentation of multimedia information on top of the map. Compared with earlier event visualization applications like [5], it allows event visualization and integration on top of interactive well accepted Web maps and not only canvases or other proprietary diagrams.

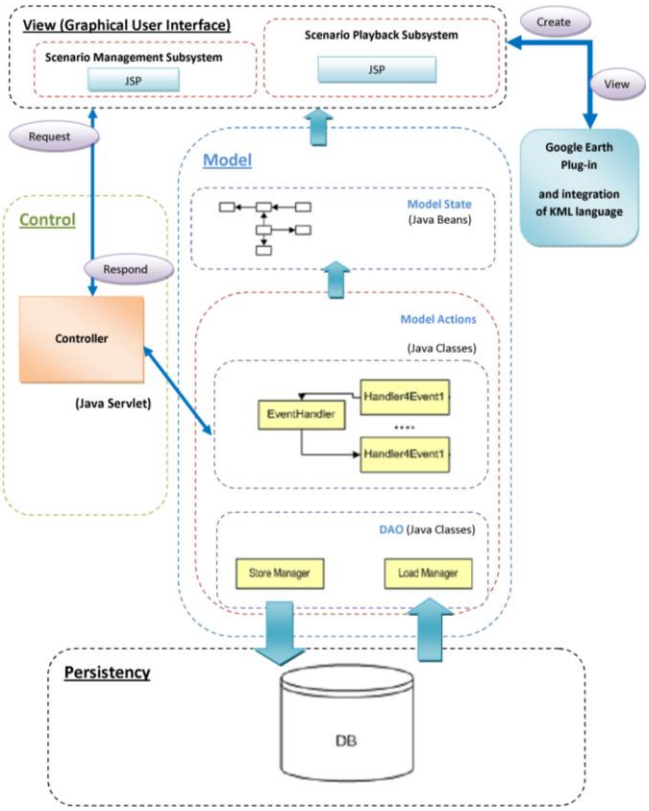

Figure 1. The EVISUGE System Architecture.

The rest of this paper is structured as follows: The EVISUGE system is presented in section 2, the demonstration is outlined in section 3 and the paper concludes in section 4.

2. THE EVISUGE SYSTEM

We present in this section the EVISUGE system in terms of system architecture and functionality.

System Architecture. The EVISUGE system architecture (depicted in Figure 1) is based on the *MVC (Model-View-Controller)* design pattern. As shown in Figure 1, the EVISUGE system comprises two subsystems:

1. The *Scenario Management Subsystem*, which allows scenario and event management, even capturing, as well as the specification of scenarios that are composed of events.
2. The *Scenario Playback Subsystem*, which allows: (a) The playback of both scenarios and events; and (b) The navigation of the routes specified in the scenarios and the visualization of the associated events. The users are also allowed to interact with the scenario visualizations by clicking on the (2D or 3D) representations of the objects that are visualized on the maps and view the information associated with them.

Both scenario management and playback are performed on top of the interactive 3D Google Earth maps. In order to achieve this, we have utilized the *Google Earth plug-in*[4] and the *KML (Keyhole Markup Language)*[5].

[4] The Google Earth Plug-in,

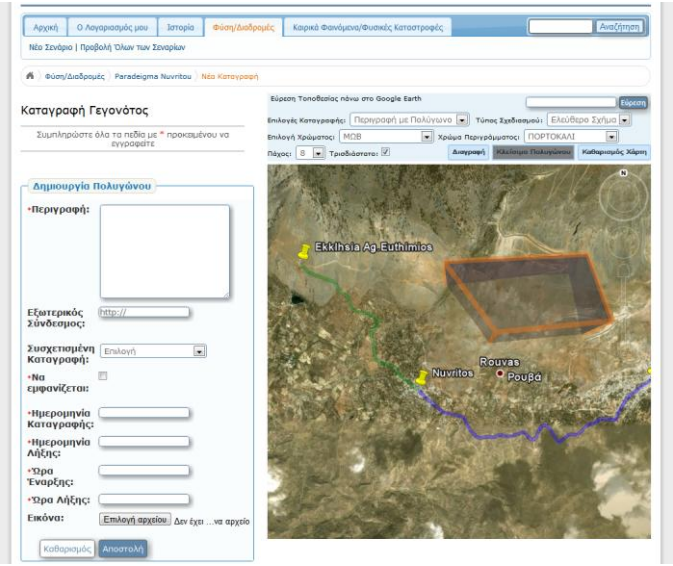

Figure 2. The EVISUGE Scenario Creator Interface.

Functionality. Table 1 presents the most important use cases that are related to the core functionality of the EVISUGE system. We distinguish two main actors; the *scenario observers*, who are accessing the system in order to navigate through the existing scenarios and optionally annotate them and the *scenario creators*, who are authoring the scenarios, registering the scenario events and appropriately representing these events on Google Earth.

3. DEMONSTRATION

The demonstration will show the EVISUGE system functionality through real-world scenarios: *(a)* The specification, navigation and visualization of a naturalistic route; and *(b)* The spatiotemporal representation and visualization of battles.

In particular, the *naturalistic route scenario* will be presented through the description of the Nyvritos-Gergeri route navigation scenario (Nyvritos and Gergeri are two villages located in south-eastern Crete, that attract a lot of tourists due to their natural beauty). Both scenario creation (supported by the EVISUGE Scenario Creator Interface shown in Figure) and scenario visualization will be presented. The visualization will be realized through the current position of a 3D model of a car. The route navigation scenario events will be visualized according to their temporal order and will be represented by polygons that allow interacting with them in order to view the relevant event shots. The event shots provide multimedia information about the events that is available in specific points of the route. The observer will be able to browse the scenario using the scenario playback bar and the buttons associate with it (placed on the bottom of the Google Earth window).

The *battle scenario support* will be presented through the scenario of the battle of Marathon. This scenario is associated with the Marathon valley and the time of the battle and has as participants the Greek army and the Persian army. The two armies are essentially crowds, which are represented on the map using polygons that change their shape according to the movements that every army (or a part of it) made in specific time points (see Figure 3). Notice that, since several parts of the armies may move simultaneously, the parallel event visualization support offered by EVISUGE is required for this scenario type.

4. CONCLUSIONS

We have presented here EVISUGE, a system that allows the visualization and management of real-world scenarios on Google Earth. An EVISUGE scenario is composed of events, which are represented according to the MOME (MObile Multimedia Event Capturing and Visualization) event representation model that we have developed. The scenario events are visualized on top of the Google Earth 3D interactive maps, with respect to their spatial and temporal features. We have demonstrated the EVISUGE system through real-world scenarios: *(a)* The specification, navigation and visualization of a naturalistic route; and *(b)* The spatiotemporal representation and visualization of battles.

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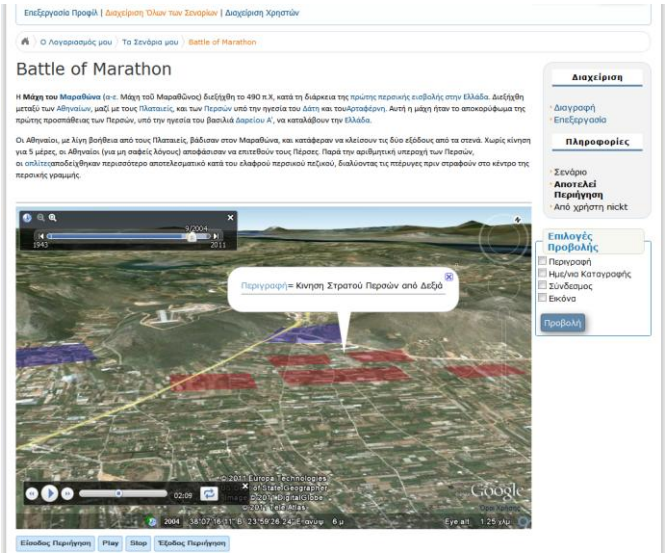

Figure 3. Visualization of the scenario of the battle of Marathon.

http://code.google.com/intl/el-GR/apis/earth/.

[5] The Kml Developer Guide, http://code.google.com/intl/el/ apis/kml/documentation/topicsinkml.html.