Mapito.org

Open Geographic Platform for Locative Media Apps

Konstantinos Chorianopoulos, Ionian University
Department of Informatics
Corfu, Greece
choko@ionio.gr

Konstantinos Pardalis, Ionian University
Department of Informatics
Corfu, Greece

Abstract. Digital geographical maps have become an important part of many websites and mobile applications. For example, we can embed a map and geo-location tracking into a web page, or into a smartphone application. Nevertheless, the management of user maps and routes is different between the many competing geographic information services. We designed and implemented an open-source and linked-data web service for facilitating the process of a map and route management. The implementation of our open-source web application has been built on-top of existing web services that provide maps. In this way, the Mapito.org service provides an open abstraction layer above the proprietary implementations of commercial companies. Notably, the Mapito platform provides an Application Programming Interface (API), which facilitates the creation and editing of a map and the ability to download the data, or routes without visiting the Web-based user interface. In this paper, we outline the system and provide representative case studies.

Keywords: Geographic Map, API, Open Source, Linked data

I. Introduction

In the last few years, with the rapid growth and progress of mobile and web technology, digital geographical maps have become an important part of many websites and mobile apps. A digital map is usually a web service that provides maps and routes for users to search and to browse points of interest. Digital maps can be exploited for many and different purposes. For example, we can embed a map and geo-location recording into a web page.

We designed and implemented a platform for facilitating the process of a map creation and embedding in a web page, and for observation, recording and storing of users activity on the map for further processing and analysis. The implementation of our open-source web application is based on existing web services that provide maps, (currently Google Maps and Bing Maps). The main features of this web application are: the easy map creation and embedding in a web page, the ability to add custom controls for basic user interactions with the map, the recording of users activity, the route tracking through a web browser of a smartphone with GPS and HTML5 Geolocation support, the one-click switching between of map services without affecting the previous settings, and the Application Programming Interface (API), which gives the ability to developers to create, modify or delete a map and the ability to download the data, or routes without visiting the Web-based user interface of our application.

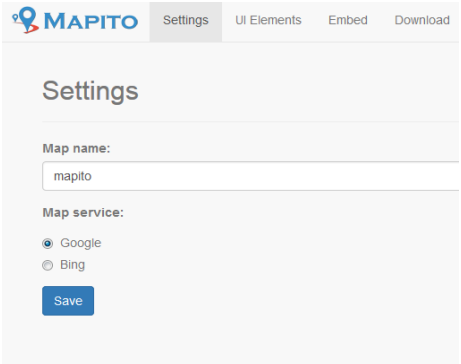


Fig. 1. The Mapito platform enables a locative media App to be switched from Google Maps to Bing Maps with just one click.

The utility of the above features is mainly to facilitate the creation and embedding of a map into a web page. Furthermore, the innovative feature of this application is the recording of the users activity on a map. The usefulness of route tracking using this system is that performs real-time storing of routes in an online database and, accordingly, the collection and analysis of routes can be done very easily.

II. Scenarios of Use

The current implementation of the Mapito.org service supports the following basic scenarios of use: 1) Geographic map embedding in a web page, such as a user web blog, 2) Programming interface for managing geographic information for a big set of data, such as a home rental web site, and 3) geolocation storage and processing for geotracking applications. We have selected to support the above basic scenarios of use, because they are very common in contemporary computer applications for locative web and mobile media. In the rest of this section, we describe the current status of geographic information for locative media apps

and we demonstrate how the mapito.org service facilitates the management of geographic information.

Users and small businesses have widely embedded geographic maps into their web presence (e.g., wordpress, e-commerce, etc), in order to assist other users to locate them. The embedding of geographic maps is based on proprietary geographic information systems. For example, if a user or a business selects to embed a customized map by Google Maps, then the user has to repeat the same process with another map providers (e.g., Bing Maps), in the case that he wants to switch. In short, the current functionality of mainstream digital geographic maps (e.g., Google Maps) is based on user lock-in, the more a user invests effort in a system, the more difficult it is to change to another system.

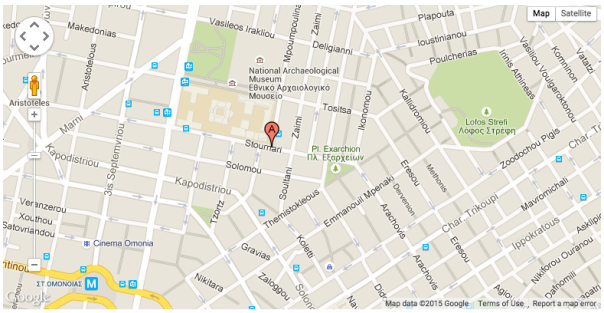


Fig. 2. Map embedding is very common in many personal and small business web sites and it includes several features, such as markers, as well as custom map navigation controls (e.g., pan, zoom, satellite)

The Mapito.org service provides an open data and open source solution for map embedding on web sites. Instead of using the proprietary code embedding by the many different digital map providers, the user employs the map embedding feature of Mapito, which is rather similar in terms of usability to the mainstream map providers. The main difference is that the user is free to change providers, as soon as he changes his mind with the click of a button.

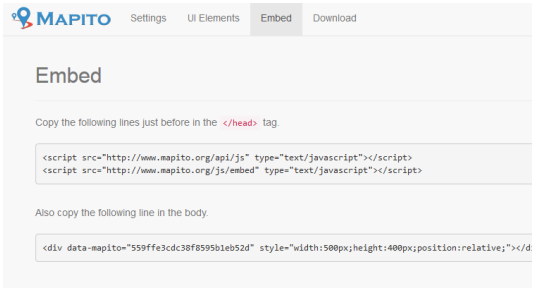


Fig. 3. Code embedding allows the creation of locative media applications that are independent of the particular cartographic implementations.

Data driven web sites might have many thousands records of geolocations associated with their main data. For example, a home rental website (e.g., Airbnb) associates each available accommodation with a geographic location, in order to assist users in selecting the most convenient for them. In addition to the geographic location of a data base record, there might be a need for additional features, such as highlighting an area on the map around the location, as well as customized controls for map navigation (e.g., pan, zoom). If the web site decides to switch the map service from one operator to another, the developers have to implement the above geographic information sub-system (locations, highlights, map controls) from scratch, since there is no common API between the competing geographic map systems.

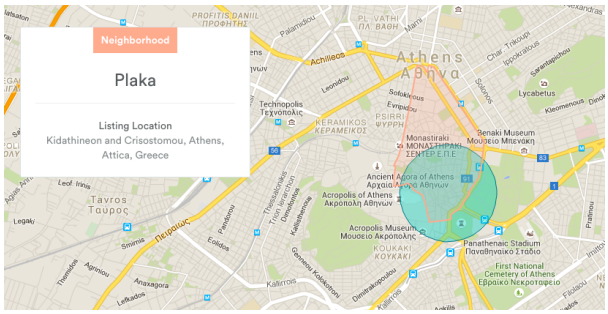


Fig. 4. Home rental web sites (e.g., Airbnb) have several thousands of records associated with geographic information and they use special markings to highlight the neighbourhood.

The Mapito system provides an API that facilitates the programmatic management of big data sets that are associated with geographic information. For example, a web site that provides a list of customized geolocated information (e.g., Airbnb) is enabled to associate its big and precious data-set with the geographic information of the mapito API. In this way, each record in the data-base is associated with a mapito record, which has no dependency with any particular digital map provider. In the unfortunate case that the geographic map provider changes some of the rules of the contract (e.g., cost, privacy, etc), then the Mapito system provides a safety net with easy switching to another provider without any lock-in and without any extra cost in time or money.

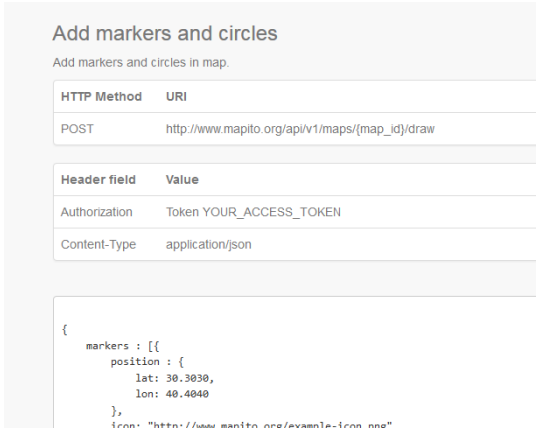


Fig. 5. In addition to the graphical user interface, Mapito.org facilitates the customization of map navigation and the definition of markers through an API for big sets of data.

The popularlity of smart phones that include large touchscreens and accurate geolocation has motivated the development and adoption by milions of users of apps that employ geographic maps and route tracking. For example, fitness motivation applications (e.g., Endomondo, Nike Run, Map my Run) employ geotracking storage and processing, in order to visualize the performance of the user and to motivate future

improvement. In particular, the storage and processing of route tracking data is a complicated functionality because it requires the storage of billions records of streaming data, as well as the processing of the raw data in order to create meaningful visualizations without sensor noise. Notably, the recognition of the user activity and the filtering of false data points is a common and important functionality, which has to be implemented for each one of these applications separately.

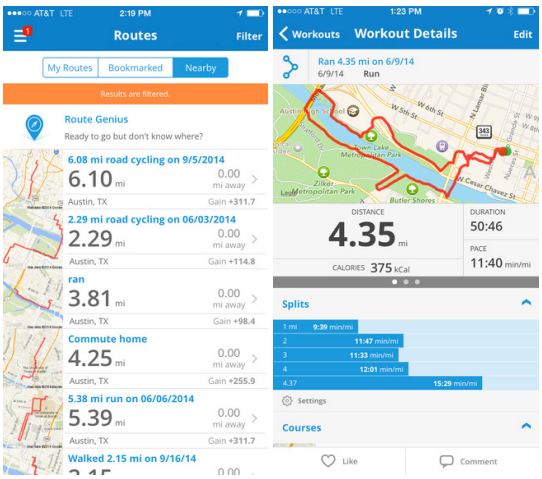
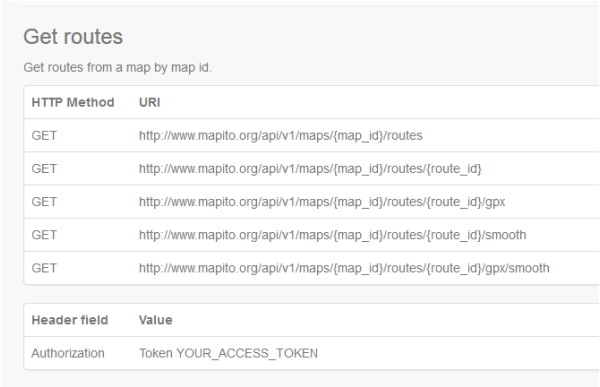


Fig. 6. Contemporary smart phone applications for health and fitness (e.g., Map my Run) include routing tracking functionality in order to visualize performance and to motivate the user to improve

The Mapito.org service provides an API that facilitates the storage and processing of route tracking data. For example, the developer of a new route tracking application (e.g., health monitoring, car pooling) could employ the generic mapito route recording and route processing (e.g., smoothing) features in order to invest more effort into the features that make his application innovative. The Mapito route API provides methods to record a stream of geolocated data, as well as methods for retrieving them. In addition to storage and retrieval of route points, the Mapito system provides a basic algorithm for smoothing the path along a set of route points [2].



Get routes

Get routes from a map by map id.

HTTP Method	URI
GET	http://www.mapito.org/api/v1/maps/{map_id}/routes
GET	http://www.mapito.org/api/v1/maps/{map_id}/routes/{route_id}
GET	http://www.mapito.org/api/v1/maps/{map_id}/routes/{route_id}/gpx
GET	http://www.mapito.org/api/v1/maps/{map_id}/routes/{route_id}/smooth
GET	http://www.mapito.org/api/v1/maps/{map_id}/routes/{route_id}/gpx/smooth

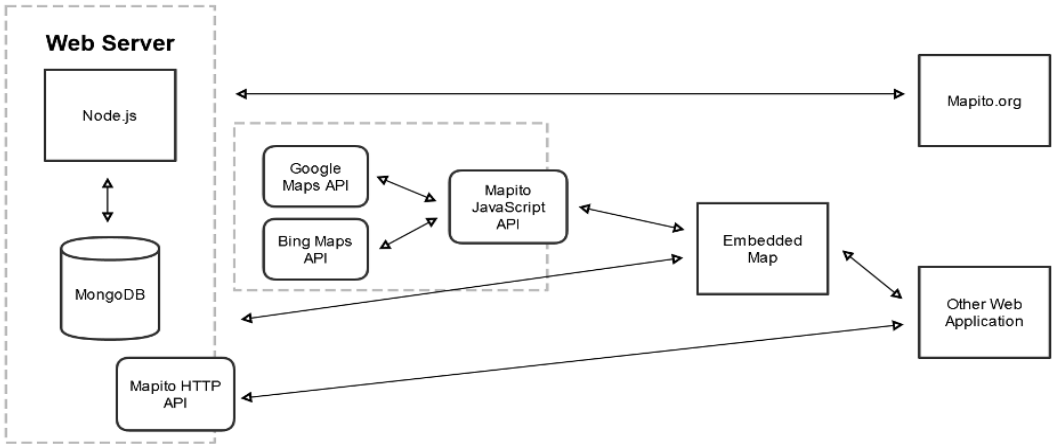
Header field	Value
Authorization	Token YOUR_ACCESS_TOKEN

Fig. 7. Mapito.org facilitates the storage and processing of route tracking data.

III. System Design

The development of the mapito.org web application was based on a series of specifications. The initial specifications were the creation of a web application for the recording of users activity on a map, the facilitating of a map creation, the adding of custom controls and easy embedding in a web page. Then, arose additional features such as adding items on a map to show points and places for users. Furthermore, added an additional feature which is the route tracking. Finally, added the API. The API provides exactly the same functionality just like the graphical user interface of the web application, but with programmatic access to the features. In order to develop the mapito.org web application we employed several internet technologies. In the frontend, we used HTML5, CSS3, JavaScript and some frameworks like Bootstrap for the creation of responsive design, JQuery for rapid development and easy handling of events, and used other smaller libraries to facilitate the development process on the client-side. In the backend, we used the Node.js platform and the NoSQL database MongoDB.

Fig. 8. The System Architecture is modular and allows users to manage their customized maps and routes through a graphical web application or through a programming interface



IV. Discussion and Further Research

The Mapito platform is a fully functional service and system[i], as well as a proposal for a new level of geographic information systems. During the past decades, there has been a lot of effort to develop proprietary (e.g., ArcGIS, Google Maps) or open source map systems (e.g., OpenStreetMaps, Mapbox) within a competitive ecosystem. The results has been a fragmented marketplace of systems and data that create user lock-in, as soon as someone has invested some effort in working (e.g., adding data) with one of them. The Mapito platform suggests that there is a significant part of overlapping functionalities between competing map systems and data, which need to become interoperable.

There are many APIs and open data map services, but there are few open source ones and none that allows the migration of application and user data. Data migration is important because without it a developer and its users are locked-in a particular technology. Mapito.org is the first linked-data and open source GIS system with an API that facilitates the development of Web services and Mobile Apps without user lock-in. Moreover, Mapito.org is creating an abstraction layer above the generic services offered by the major web-based GIS systems, in order to facilitate the migration of the user applications to new services.

A future version of this system should include more features in order to increase the coverage of geographic maps. The current system provides connections to Google Maps and Bing Maps, so another improvement can be the addition of more map services such as OpenStreetMap and HERE Maps. Furthermore, another future approach can be the online analysis of users activity data and the creation of user activity graphs.

In our previous research [1], we raised the issue that contemporary mobile computers (smart phones, tablets, wearables, etc), which are usually employed by pedestrians, provide the exact same cartography that is employed for car navigation. In order to create a visualization of popular pedestrian routes in a usable cartographic format, we have to collect and analyse as many geographic points as possible. For this purpose, we need an open data service that gathers and analyses actual pedestrian routes as recorded by mobile devices.

In ongoing research, a dynamically crowd-sourced mobile map application is dynamically visualized, where the most frequently used streets will be illustrated and dynamically modified, according to users' feedback. The most popular streets should have larger line widths, whereas the less popular ones should have narrower lines. The dynamics should not only be controlled by frequency, but also by personal preferences and user profiles, depending on several parameters, such as the weather conditions, time of day, possible health problems, etc. In addition, navigation algorithms should generate paths tailored to the user's specific demands and safety. The maps' priority should be focused on safety and enjoyment of pedestrians and they should be addressed to all people, locals and visitors. In addition, the backend system should be extented in order to consider additional means of transport such as biking.

TABLE I. Comparison between different web-based geographic information systems

	Open-Source	**Open-Data**	**API**	**Data migration**
OpenStreet	No	Yes	Yes	No
Google Maps	No	No	Yes	No
Bing	No	No	Yes	No
Here	No	No	Yes	No
Mapito.org	Yes	Yes	Yes	Yes

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References

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[2] Kasemsuppakorn, P., & Karimi, H. A. (2013). A pedestrian network construction algorithm based on multiple GPS traces. Transportation research part C: emerging technologies, 26, 285-300

[i] Mapito service: www.mapito.org
Mapito source code: www.github.org/map1t0