

# MobileMap Italy: an app for consulting and querying geographical open data on smartphone

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## ABSTRACT

We present MobileMap Italy, a mobile app that allows user to querying geographical open data on smartphones with GPS sensor and internet connection. MobileMap Italy is a native Android app and a multiplatform web app connected with WMS services of public administration.

The app is compatible with all Android devices from API level 8 (Froyo). We also developed a web app which allows consultation of published services by browser and it supports data and geo-referenced queries on maps.

MobileMap Italy allows consulting of published map services and supports data query and geocoding, using open source libraries. In particular, it uses OpenLayers and Apache Cordova open-source frameworks. Main features of the app are: pan and zoom, geocoding using OpenRouteService API, geolocation using GPS sensor; levels selection, and maps querying.

The cataloging of WMS services is fully automated by a desktop software specifically developed in Java language. All WMS service and layers information are stored in a MySQL remote database.

KEY WORDS: android, gis, mobile, wms, open data, open government.

## INTRODUCTION

Every day we witness to the expansion and diffusion of systems and methodologies for consultation and interrogation of maps across web platforms such as Google Maps, OpenStreetMap (Bennet, 2010) or similar. These platforms are often geared to common non-specialized users. Therefore, private entities and public administrations that create geospatial datasets and maps are gearing up to publish them on the web through dedicated “geoportals”. The implementation of INSPIRE (European Parliament, Council of the European Union, 2007) directive is allowing also the spread of the OGC standard for web services such as WMS (Open Geospatial Consortium, 2006a), WFS (Open Geospatial Consortium, 2010), etc. For these reasons, the goal of this research is to efficiently share institutional maps and open datasets not only on the web, but also on mobile devices, increasing their global diffusion.

We define WebGIS (Cetraro, 2011) the extension of web applications, which allow managing digital cartography: the main purpose of a WebGIS is processing and geo-referenced

information.

However, who produces institutional cartography and geographic datasets should be able to reach people and citizens by giving them detailed information and localized.

The old purpose of maps was to have a representation of the territory “on hand”, with an appropriate reduction scale, and a series of localized information to support various decisions. Bringing them on a mobile device, we provide an innovative service and modern, but, at the same time, traditional.

For these reasons, recent spread of mobile systems has required the development of GIS applications also suitable for installation on consumer mobile devices, that we call mobileGIS. We can define mobileGIS as an integrated software and hardware framework for the access of spatial data and services through mobile devices, that typically have a touch screen or miniature keyboard, via wireless networks or internet connection (Solyman, 2005).

We can distinguish two groups of mobileGIS applications (Müller et al., 2013): a first group consists of apps capable to show POI (points of interest) and able to offer geolocation, navigation and searching. Some examples are Google Maps, Bing Maps and iOS Maps. Another one consists of apps that allow users to add thematic data to maps. Some examples are ArcGIS for Windows Mobile (Guandalini, 2013), BeeGIS



Fig. 1 – Main screen of MobileMap Italy.

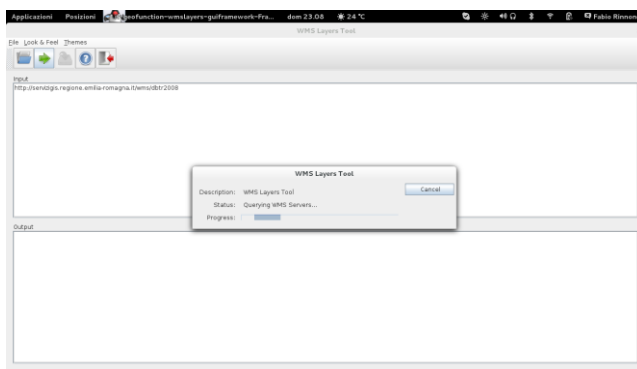


Fig. 2 – Automated Java tool for WMS categorization.

(De Donatis et al., 2008), Geopaparazzi (Delucchi et al., 2012), Beebook (De Donatis et al., 2014) and many others.

In particular, we define web-mobile-GIS (Di Pietro & Rinnone, 2013) as a tiny and portable application, based on web frameworks, which allow consultation of geographic information “in situ” on mobile devices using GPS and Internet connection.

## MOBILEMAP PROJECT

MobileMap is a project that includes several mobile applications that allow consultation and querying of open geographical data. Many examples are *MobileMap Agrigento* (Di Pietro et al., 2013), *MobileMap Enna* (Di Pietro & Rinnone, 2015), *MobileMap Trapani* and *MobileMap Sicilia*. All these apps are implemented with same frameworks of *MobileMap Italy*, but they are interfaced with different geographic open datasets. In particular they are connected to WMS server of public administrations involved, respectively Italian provinces of Agrigento, Enna, Trapani and Sicily region. All apps of *MobileMap* project allow cartographic consultation “in situ” which is very useful for surveying activities or for controlling of territory. Later, the project was extended also to allow consultation of touristic and naturalistic information.

Other similar mobile apps are *local\_id* (Álvarez Carranza et al., 2014), *RomaPRG* (Di Pietro & Rinnone, 2013; Rinnone, 2015), *OpenNatura* (Di Pietro & Rinnone, 2013), *Geo Emilia-Romagna* (Di Pietro & Rinnone, 2013) and many others.

## MOBILEMAP ITALY

We have developed a native app for Android devices, named *MobileMap Italy*, which allows consultation of cartographic services. The app is compatible with all devices from API level 8 (Froyo).

In its native implementation, it has made use of the framework Apache Cordova, released in the Apache License 2.0 (Apache Software Foundation, 2004), and which allows interfacing of JavaScript web code with native components of the Android device, such as GPS sensor.

MobileMap Italy allows the consultation of various datasets: town plans, technical maps, orthophotos, topographic databases, historical maps, geological maps, geognostic tests, forest maps, Quickbird coasts images, Digital Terrain Model, SIC, ZPS, parks and natural reserves maps, UNESCO sites, road networks, and much more. It is also possible to use OpenStreetMap, Google Maps, Bing Maps and RealVista orthophotos as base layers.

## IMPLEMENTATION

Developing of MobileMap Italy took the following steps:

- Categorization of open WMS services of public authorities in a database, through an automated and scalable desktop tool implemented in Java.
- Developing of an app for viewing services on smartphone or tablet devices, alternative to a traditional “geoportal” for consultation by desktop PC.

The Java tool automatically catalogs WMS services in CSV text format.

Java tool allows to load input CSV file that contains the list of URLs, names and descriptions of WMS services: the tool queries all servers and provides in output a CSV file containing the list of available layers of WMS services loaded. The output file format is tabular and it consists of the following fields: id, name, descr, url, layers, queryable, active. The field queryable has value 1 if the corresponding layer is queryable by user, 0 otherwise. The field active has default value 1, but it can be fixed manually if we want to deactivate visualization of corresponding layer, otherwise the corresponding layer will be selectable in the web app. The output file will be used for importing data in a relational DBMS, in our instance MySQL (Du Bois, 2004), through web database management software as phpMyAdmin or similar. Back-end code for querying database is written in PHP language and it consists of several scripts embedded in JavaScript code loaded in a remote HTTP server.

We also developed a web app that allows consultation of published services by browser, which supports viewing map data and geo-referenced queries on maps, by using open source libraries and scripting codes. The web app is



Fig. 3 – Querying layers in MobileMap Italy.

compatible with many mobile and desktop browsers, such as Internet Explorer, Mozilla Firefox, Google Chrome, etc., and with many mobile operative systems such as iOS, Android, Blackberry, Windows Phone, and many others.

For development of both native and web app has been used OpenLayers (Perez, 2012), a framework implemented in JavaScript language and released under the open license called BSD 2-clause (The FreeBSD Project, 1992). OpenLayers is a JavaScript library for displaying map data in web browsers: it provides API for building rich web-based geographic applications. OpenLayers supports GeoRSS (Open Geospatial Consortium, 2006b), KML (Open Geospatial Consortium, 2015), GeoJSON (Butler et al., 2008) and data from source using OGC standards, such as WMS and WFS. MobileMap Italy is based on version 2.x of OpenLayers.

User interface is developed using jQuery Mobile (Reid, 2011), a platform useful for developing of user-friendly mobile interfaces. jQuery Mobile is a HTML5-based user interface system designed to create responsive web sites and apps that are accessible on all smartphone, tablet and desktop devices. It is written in JavaScript language and it is released in MIT license.

## FEATURES

Main features of MobileMap Italy are:

- Pan and zoom: it allows user to increase or decrease the zoom of the map through the pinch to zoom.

- Geocoding: it allows user to enter an address used as input to request geocoding service from OpenRouteService (Neis & Zips, 2008). The output is a pair of coordinates in EPSG:4326 used to update the view and center the map.

- Geolocation: it allows user to run command for activating GPS sensor on mobile device to start geolocation task. At the end of the task, the map view will be updated and it will be centered on the point obtained.

- Levels selection: it accesses to the layers menu. Through connections to WMS servers stored in the remote database, user can activate the visibility of layers with simple buttons.

- Maps querying: it allows user to access to a menu that show only current active layers. User can select one of active layers to proceed with a query on the map. By clicking on a point on the map user send a query to the WMS service related to the selected layer and the response is displayed on a pop-up in the map.

Next releases of MobileMap Italy will be equipped with functionality of augmented reality that allow the superposition of spatial information on the visual cone framed by the camera of the device, very useful especially in mobile GIS applications (Nicholls, 2013). This approach is usually named *AR browser* and it allow user to show POI, user-created annotations, etc. All these information are shown on

top of smartphone camera view using GPS sensor and built-in magnetometer (Olsson & Salo, 2011). For its implementation, we will use the open source Mixare platform.

## CONCLUSIONS

Geoportals and WebGIS instruments are not easily accessible to non-expert users and only technicians, professionals and experts in geomatics generally use them, making ever wider the *digital divide* in the fruition of digital cartography (Mauro, 2013). However, today there is a massive spread of smartphone and tablets capable of easily delivering geographic information to all citizens. World of mobile apps is growing exponentially and on it are pouring commercial interests of the largest economic groups such as Google, Microsoft, and many others.

Moreover, cost of management and development of a mobile app are considerably lower than geoportals and cartographic server.

For these reasons, we think that publication of cartographic data on mobile devices, as shown with *MobileMap Italy* and other similar apps, can promote greater public awareness of the land by citizens and it can reduce management costs incurred by public administrations.

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