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Case Studies

MapGuide Open Source in the San Francisco Urban Forest Project

Open Source Mapping Helps City See the Forest for the Trees

by Alex Fordyce and Charlie Crocker

Abstract

The City and County of San Francisco, the non-profit Friends of the Urban Forest (FUF) and Autodesk have launched the San Francisco Urban Forest Mapping Project that uses MapGuide Open Source technology as its central platform for a dynamic online map of the tens of thousands of trees in San Francisco's public spaces.

FUF first planted the seeds for a tree-mapping initiative that would engage the public and foster community involvement in urban forestry. The project evolved to address the city's interest in strategic planting that maximizes environmental benefit and minimizes costs and labor associated with tree care, maintenance and replacement. The Urban Forest Mapping Project supports tree planting and management by the Bureau of Urban Forestry (BUF) and FUF and it's paving the way for use of geospatial information in other city initiatives.

Dynamic Map Integrates Spatial Data and More

BUF and FUF previously managed forest data in separate systems, both heavily reliant on paper-based maps, which made it difficult to share information. BUF employees in the field recorded tree location information on paper, and that data was then entered into a database along with information from permits issued for privately maintained trees. Updates would be collected from routine tree maintenance and entered, as well.

By BUF's best estimate, the city has about 100,000 trees planted in public rights-of-way. But the number of trees and permits stored in BUF's database amounts to just under half of that total, while FUF estimates it has recorded information for 41,000 trees that it has planted.

It was clear to both organizations that a more comprehensive and accurate inventory of the city's urban forest would help BUF and FUF better fulfill their shared goals. Hence, the Urban Forest Man-

agement system comprises an integrated database, a mapping tool and online reporting applications running in a hybrid open-source and proprietary software environment.

"Using a blended model of open source and proprietary technologies, we were able to create a system that met all our development and operations needs", said Greg Braswell, IT and GIS manager of the San Francisco Department of Public Works Bureau of Engineering. *"With MapGuide Open Source, we receive an enhanced level of collaboration tools and support for data sources and geocoding from the open source development community beyond what commercial (proprietary) vendors offer."* The new San Francisco Urban Forest Map accesses a centralized repository of urban forest inventory data through the Web. A shared database schema accommodates integrated tree attribute data from BUF and FUF, as well as real-time updates to spatial data made by BUF and FUF staff.

System Combines Open Source, Proprietary Technology to Meet City's Needs

Tree attribute information and tree point spatial data are both stored in a Microsoft SQL Server database. Attribute information is accessed using ASP.NET `C#`, while point locations are mapped directly from the database using the Open Source FDO data access technology provided in MapGuide Open Source. BUF and FUF staff already skilled on the Microsoft platform will not require additional training to maintain the system.

At the same time, BUF and FUF recognized that development of the solution in the .NET application environment would contribute to the geospatial industry's knowledge about application development and open source. The project is taking advantage of other open-source community efforts as well. Because the city uses MrSID for satellite image compression, the Urban Forest Map project team used Frank Warmerdam's MapGuide Open Source raster extension to support this proprietary raster format.

Urban forest spatial data and inventory details are combined with the city of San Francisco's base map data for streets, land parcels, soil types, and other map layers to create an interactive, Web-based map. The project also offered a good opportunity to take advantage of the application performance gained by using MapGuide Open Source's SDF format - a spatial file format streamlined for web-based environments. Land base map layers, which require less-frequent updating than the tree points, are stored as SDF files, while more dynamic tree information is geocoded and stored in a database Storing tree point information in a database allows other applications in the organization to access the tree data and make updates. Those updates are then seen in real-time on the Web application. Future enhancements to the system will allow authorized users to correct geocoding errors by moving tree points to more accurate locations. By overlaying a satellite image onto the map users can find a discrepancy between a geocoded tree and its actual location on a satellite image.

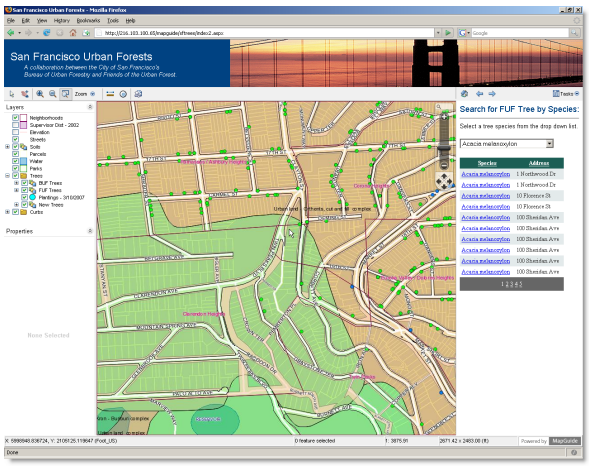

Figure 1: The San Francisco Urban Forest Mapping System quickly maps BUF and FUF trees based on an address location search.

Business rules and logic were programmed using ASP.NET `C#` to define and control application activity according to user, user role and to track edit history. While all users share some functionality when working with the application, other authorized users are offered greater functionality. For example, users of the general public can browse the urban forest searching and viewing tree data according to various criteria (for example: address, neighborhood and species). The general public can also zoom, pan and toggle map views, and add trees with such relevant information as address, photos, comments and contact information. Authorized users are offered a greater set of functionality and may edit and update tree-related data.

Mapping Project Extends Life, Value of Data

The San Francisco Urban Forest Mapping System is expected to save the city money by providing the means to inventory and map past, present and future tree locations; calculate costs and benefits of the urban forest as a whole or in specific areas, identify effective strategies for tree planting and maintenance, and streamline processes such as permit applications. Future enhancements of the Urban Forest Mapping System hope to help facilitate city planning by allowing urban forest managers to model and calculate a full cost-benefit analysis and target a strategic approach for maximum advantage in San Francisco's many microclimates.

Likewise, FUF and the City leadership also aim to use the tool to engage San Francisco community members in urban forestry initiatives and greening efforts. The community can add trees to the map; this information is captured in a separate database for validation. When their information is confirmed, these trees are added to the Urban Forest database.

The use of open source mapping technology may reach beyond the San Francisco's urban forest canopy. The project team expects the program can also be repurposed by other cities, counties and public works organizations to map and manage any number of assets, beyond trees. Figure 1 shows trees surrounding city hall

For more information on the San Francisco Urban Forest Mapping Project, visit http://www.urbanforestmap.org.

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