Denver Water Uses ArcGIs Engine to Field Collect Customer Facilities

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Abstract:
Denver Water has developed an ArcGIS Engine interface using customer information from our data warehouse and linking it to a map interface showing parcels, water facilities, and orthophotography. A ruggedized Tablet PC is used with a Blue Tooth-enabled GPS unit in a backpack. The interface has been developed using .NET tools. In the field, the collector is able to choose a customer from the data warehouse record, view and zoom to the parcel for the customer or choose a parcel from the map view and zoom to the customer record. The meter pit and stop boxes will be captured using data warehouse information on where the meter pits and stop boxes are located on the customer's property. This project will benefit Denver Water immensely because we will be able to use our customer locations to analyze main shutoffs, planned shutoffs, critical customers, and balancing of meter reading routes.

Paper:

History

Denver Water was established in 1918 and now serves over 1 million customers within a 250 square mile metropolitan area, with over 250,000 accounts. Our collection system covers a large part of the state on both sides of the continental divide. Most of our supply comes from mountain snowmelt which we bring to our treatment plants via tunnels and conduits.

Denver Water's GIS database stores data about the collection facilities, properties, treatment plants, reservoirs, pump stations and distribution facilities. We have recently taken steps to improve the spatial accuracy of these distribution facilities through a field survey of surface facilities using RTK GPS and adjusting the database to match those coordinates. The GIS data is stored in a non-versioned SDE 8.3 database, it is edited and maintained using a CAD Client interface from AutoCAD 2002.

The Project

Missing from our database were locations for all of the customers we serve. We have begun a project to collect coordinates for our customers' meter pits and stop boxes using Arc Engine, wireless GPS and Panasonic Toughbooks. We call this project the Customer Location Conversion project or CLC.

CLC will collect nearly 190,000 existing residences and businesses in the first phase. Future phases will capture the remaining customers in our service area. New dwellings and businesses will be added to the database when their taps and meter pits are installed. Once these features are collected, Denver Water will

generate tap locations from the locations to 'attach' each home to the water main serving it via a tap feature.

Benefits

Benefits of this data capture are many.

We will have the ability to locate a meter pit in the field quickly, during service calls. Denver Water recently converted to Automated Meter Reading and the meter pits no longer need to be opened every other month for readings. Those meter pits will become harder to find in the future as they are covered by landscaping and other environmental debris. A stop box is used to shut off water at a residence. We will be able to quickly locate a customer's stop box for emergency or delinquent shut offs.

We'll be able to manage our meter reading routes more efficiently using the collected customer locations. The meter reading routes can be balanced and spatially analyzed for the most efficient collection route and number of customer assigned to a route.

Denver Water will be able to determine customers served by a main when emergency shut outs occur or planned outages for system improvements need to happen. We can identify critical customers who should not be out of service during emergencies and planned outages.

Denver Water does an annual Cement Mortar Lining project, which requires we know what customers are being served by the main so they can have alternative services installed before the work begins. We want to find the right customers affected by the project, this identification currently takes 2 weeks to complete.

Denver Water can do consumption analysis with historical usage amounts by customer for plan reviews and system improvements once we know what customers are served by our facilities.

Project Hardware

The CLC collection crew will carry a wireless PowerMAX Bluetooth DGPS from CSI Wireless in a backpack. The units have mapping-grade accuracy that give a GPS coordinate to within three feet of a stop box or meter location. A Panasonic CF-18 Toughbook tablet computer with Intel Pentium M 1.1GHz / 1GB SDRAM / 40GB HDD stores the coordinate as an event in the database. The tablet uses Microsoft Windows XP TabletPC Edition 2005.

Project Technology

The project consists of two applications, the Controller application and the Remote application. The Controller application resides on a desktop computer

and manages the check in and check out of data. The Remote application manages the collection of data from the field.

Customer information is extracted from our internal CIS Data Warehouse (Informatica), which is classified in our new database by billing cycle and route. Data collectors will checkout a CycleRoute to a specific user and machine (Panasonic Toughbook) from the Controller application. The data collector will then open the Remote application on the Toughbook which will display all of their checked-out CycleRoute information. The Remote application displays the CycleRoute data organized by addresses in a treeview on the right side of the screen and on the corresponding map by highlighting the landbase parcel for the customer. This application was designed using a dockable windows interface which allows multiple windows to communicate with each other in a visible and clean layout. The CycleRoute customer address data is integrated with the embedded ArcGIS Engine application via our county GIS landbase layers, which contain an address for each parcel. The collector has the ability to select a parcel on the map which will then highlight the corresponding customer record on the treeview. The selection of an address in the treeview will also highlight and zoom to the corresponding parcel on the map. The wireless Bluetooth backpack GPS will track the movement of the data collector as they walk through the neighborhoods. Once the customer is located and identified by the application, the GPS coordinate collection of customer facility data (meter pits, stop boxes, detached ERTs, and/or premise locations) may now begin. The customer information record includes 4 letter codes to help locate the meter pit and descriptions for where stop boxes are located relative to the meter pit.

Some of the products and technologies employed in this application include:

Microsoft Visual Studio .NET (C#) for code development
SQLServer2000 MSDE for the database
ESRI ArcGIS Engine Runtime for customized embedded mapping components
TierDeveloper .NET Enterprise for data-tier code generation
Microsoft Windows Message Queuing for asynchronous message processing
Actipro DockableWindow .NET Controls for the user interface

Project logistics

Denver Water is utilizing its meter reading crews for data collection. These employees know the field conditions best and have been accessing and finding meter pits for many years, in most cases. There will be one person in charge of the project from the meter reading section. This person will coordinate with the collectors and assure that the project stays on track. This person will also be the one to revisit those addresses where unexpected results were achieved. Flags are stored in the database to indicate where a revisit should take place.

Examples include where no meter pit or stop box was found, where the meter is internal to the house and a meter pit was found at the address or any other anomalies were found. The features will be recollected by the project coordinator to complete the field collection phase.

The field collection portion of the project is expected to take a year and half. A follow up effort will create the tap locations for each of the field collected customers via a desktop computer application also using ArcEngine and data from our tap database within a similar interface to what's being used in the remote collection application.

Summary

The success of this project hinges on easy to understand collection methods, providing the most data we can to help them locate facilites and a field verification process for the collected data by the meter reading staff while still in front of the customer's residence. This staff is not generally computer literate. By having the map and the customer data linked within a single interface we have created this simple process that is easy to understand.

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