

Stevens Point Wireless ArcIMS Application

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ABSTRACT

Stevens Point Water and Sewerage Department recently began the process of creating and maintaining their utility infrastructure information in ArcInfo. With their infrastructure data now available in a GIS, the Department saw the advantage of accessing the GIS data from their field vehicles through CDMA cellular phones. This paper highlights the challenges and benefits of the ArcIMS-based wireless application and provides a look at ways to customize ArcIMS.

INTRODUCTION

Stevens Point, Wisconsin, is located in the central part of the state and has a population of 24,551. In 2002, the Water Department pumped 2,666,211 gallons of water for an average of 7.3 million gallons per day.



Stevens Point Water Department serves about 8,000 customers. The physical water system consists of approximately 144 miles of pipe, 2,045 valves, 1,050 fire hydrants, and 5,944 services.



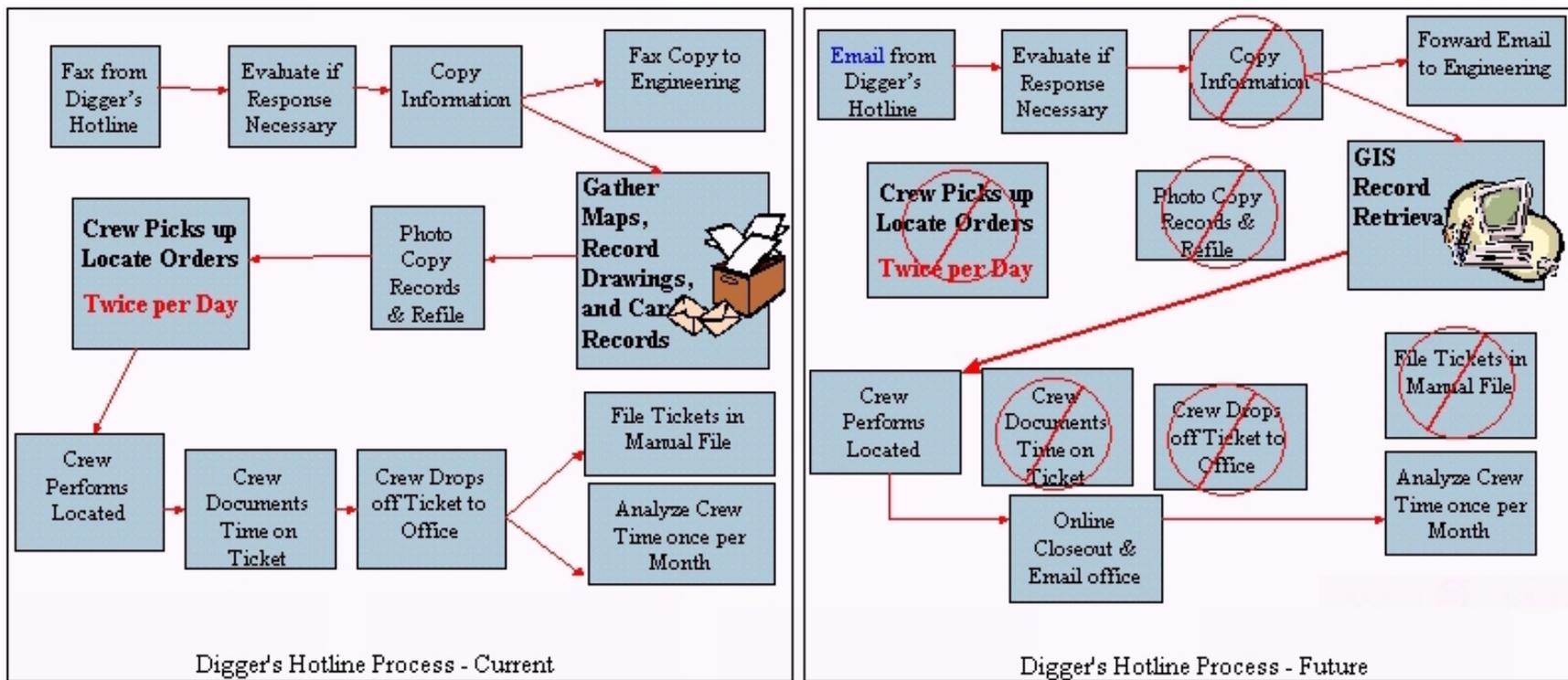
In December 1999, Earth Tech submitted a GIS Needs Assessment to the Utility detailing the need to automate the Utility's GIS processes by developing a water distribution system database. This system would support the Utility's long-term business plans.

In February 2000, Earth Tech began the process of implementing a GIS for the Utility. > This included converting 89 quarter-section maps to create a seamless GIS dataset. Datasets to be extractable from these maps included: mains, hydrants, hydrant leads, valves, and services. Parcels and other land base datasets, were to be supplied by the Portage County Planning and Zoning Department.

In October 2000, the Stevens Point Water Department contracted Earth Tech to create a Wireless Intranet GIS that would provide field and general office staff access to a GIS web server implementing ESRI's ArcIMS. Top priorities such as streamlined workflow and data accuracy for both field and office use would be met by making information accessible through a GIS with a standard Internet Explorer web browser interface.

The Stevens Point Water Utility used a labor-intensive process to locate services for Diggers Hotline. For each locate (approximately 270 per month), office staff searched through a tremendous number of hardcopy Utility records, which include thousands of feature cards, job sheets, and as-built drawings. Photocopies were made and passed on to field crews stopping at the Utility twice daily to pick up the locate information. Lastly, the field crews traveled throughout the Utility's service area to locate each service in question.

The following figures show how using the Intranet GIS greatly reduces information access time.



DATA CONVERSION

The Stevens Point Water Department maintained 89 paper-based quarter-section maps. The conversion process began by scanning, vectorizing, and converting these maps to AutoCAD drawing files. The drawing files were then cleaned and verified, to eliminate overlaps and duplicate water feature graphics. The 89 quarter-section drawing files were tiled and edgematched to create one large city-wide map, snapping features along the tile boundaries. To correctly place the dataset in the agreed upon coordinate system, the map was georeferenced using control points provided by the County. Finally, the various water features were extracted into separate datasets based on color and symbology and feature ID's were assigned.

WATER SYSTEM FEATURE ATTRIBUTION

As part of the conversion process, the Utility wanted a mechanism to input feature attributes for services, valves, and hydrants into a database for linking in their GIS. This information is stored on feature cards and job sheets. Earth Tech developed an Access-based feature application to input all the information stored on the cards.

The Utility hired two interns to enter the information. Each intern entered the same information into separate databases to allow for error checking by identifying discrepancies. When all the cards and job sheets were entered, Earth Tech merged the data and identified discrepancies when information did not match between the databases. When this process was complete, a final Microsoft SQL Server database was created.

DISTRIBUTION

The GIS Implementation project was initially to be distributed throughout the Utility office and field crew vehicles using ESRI's ArcView 3.2. However, in preparation for implementing of this system, the decision was made to switch to ArcIMS as the distribution engine. The decision process was based on; (1) the cost of multiple copies of ArcView 3.2, (2) viewing GIS datasets required freely distributed Internet browser, (3) Internet-based GIS viewer being simpler requiring less training, and (4) would hopefully ensure that personnel would utilize the system to perform their daily tasks.

The ArcIMS-based system is used mainly for field vehicles. Using cellular telephones, connected to laptops, field crew personnel can bring up water system maps in their vehicles, eliminating the need to travel back and forth between work sites and the Water Department office. The key benefit of the system is the ability of field crews to view scans of feature cards and job sheets in the field.

ARCIMS APPLICATION DESIGN

The Utility only required a simple design, thus it was decided to use the Parcel Example provided with ArcIMS as the starting template. It contains many of the processes the Utility requested, requiring minimal development to customize the application to meet the goals developed during the planning phase.

Stevens Point Utility GIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Stevens Point Utility GIS

Stevens Point Utility - 2001 (Build 1.0)

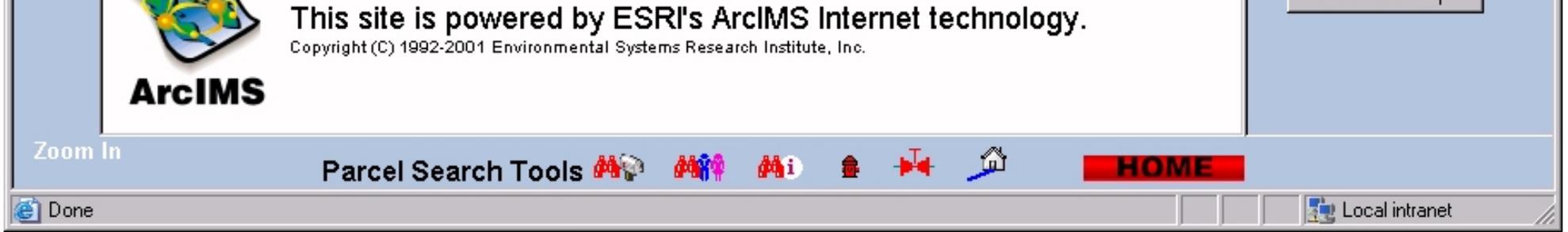
This site is powered by ESRI's ArcIMS Internet technology.

Layers

Visible Active

- Major Road Labels
- Hydrant Labels
- Valve Labels
- Main Labels
- Centerlines
- Parcels
- PLSS
- MCDs
- Centerline Geocode
- Water
- City of Stevens Point
- Stevens Point Aerial

Refresh Map



The Parcel Example is based on JavaScript and Active Server Page (ASP) code, in addition to HTML pages. The template contained parcel search tools and database linking processes.

The parcel search and identification tools were modified to work with hydrant, valve, and service features, linking them to respective feature attribute tables. This setup allowed the feature attribute tables to be separate from the shapefiles, making additions and corrections able to be handled by any office personnel.

One requirement discovered during the implementation phase, was the need for automatic activation of layers instead of using the layer on/off checkboxes. The field crews' limited computer usage and difficulty accessing this feature predicated this needed change.

For ArcIMS application and future data collection, the Utility and City of Stevens Point jointly acquired 3-inch aerial photography in the Spring of 2002. Earth Tech converted the 32 GB TIFF imagery to Mr SID format. This imagery is used to correctly locate identifiable features and promote better planning decisions.

Stevens Point Utility GIS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Stevens Point Utility GIS

Stevens Point Utility - 2001 (Build 1.0)

- House Numbers
- Hydrant Labels
- Valve Labels
- Main Labels
- Street Labels
- Hydrants
- Valves
- Hydrant Leads
- Services
- Mains
- Edge of Pavement
- Parcels
- PLSS
- MCDs
- Centerline Geocode
- Water
- City of Stevens Point
- Stevens Point Aerial

Refresh Map

Pan

Parcel Search Tools **HOME**

Map: 162892.13 , 198986.51 -- Image: 249 , 16 -- ScaleFactor: 2.2178571119187644

Local intranet

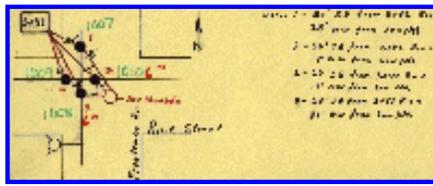
SCANNING HINTS

Large amount of scanned documents linked in ArcIMS (over 11,500 feature cards and over 25,500 job sheets), necessitated detailed planning of the scanning process and naming convention. Many documents were scanned at the Earth Tech office using a Xerox copier/scanner. The documents were saved as 2-color TIFF's resulting in 60-80 KB file sizes.

In planning the naming convention for the scanned documents, the necessary choice was to name job sheets images using the job sheet ID. This worked effectively because the database contained the job sheet ID. When the database was completed, the link was created by concatenating a URL header (http://spwd-nt/WaterJobSheets), with the Job Sheet ID field value, and image file type suffix (tif or jpg). Click for Job Sheet Example – 11368.gif.

Record 1	
Hydrant ID	164
Location	SW CORNER OF WYATT AVENUE AND CLARK STREET
CardScan	http://shbs08/HydrantCards/164.jpg
Owner	
Elevation	
Manufacturer	WATEROUS
Date Installed	5/17/01
Installed Job Sheet No	18118
Hydrant Lead	15.5
Hydrant Service ID	193
Checked By	BH
Date Checked	7/8/49
Repaired By	
Date Repaired	
Service Job Sheet No	
Remarks	OK
Hydrant Install Sheet	http://spwd-nt/WaterJobSheets/18118.JPG

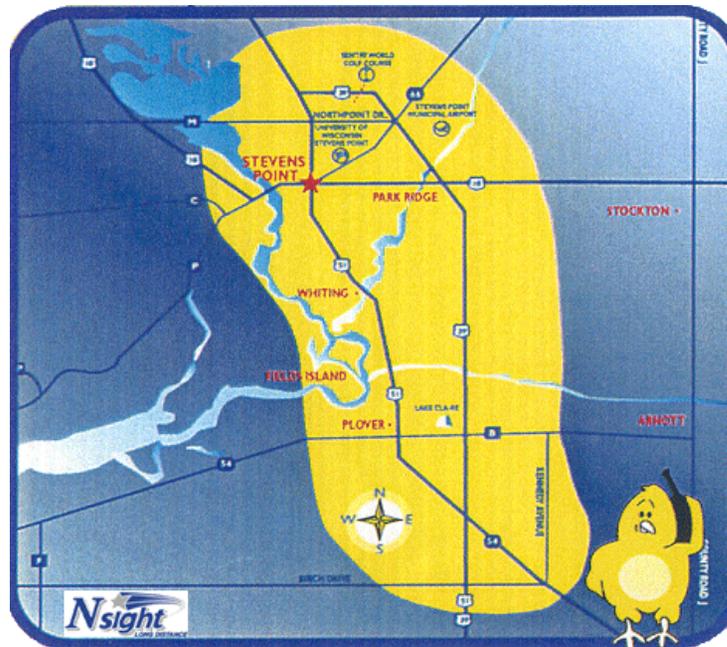
The feature card scans, and hydrant and valve cards, were first marked-up by Utility staff. Each feature was assigned an ID written on the card. When the card was scanned, the feature ID became the file name. For database linking, the same process was used for job sheets.



WIRELESS PROCESS

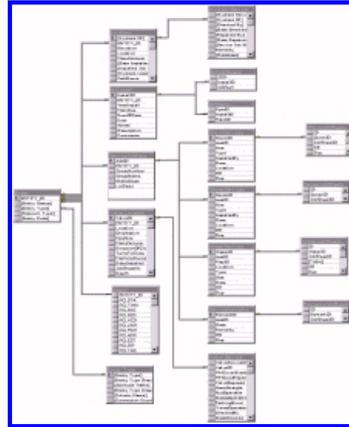
With the ArcIMS application design finalized, work began on installing it into the field vehicles. A number of pieces were required to accomplish this task.

- Laptops – Due to possible mishandling and harsh conditions, it was decided to purchase Panasonic’s ToughBook laptop computers for installation into the field vehicles.
- Nsight Cellular Coverage Area – A local cellular coverage area was available from Nsight that covered a limited area around Stevens Point. Nsight provides “Chirp” local service as shown in the following figure.



- Cellular Phone - The Motorola StarTAC ST7868W Digital Wireless Phone was chosen because it operates in both digital CDMA 800/1900 MHz and analog 800 MHz networks. Connection to the portable computer is achieved using a Motorola Data Connectivity Kit (98193) with TrueSync Software. The cable connects a CDMA Data Capable phone to the laptop via a serial (COM) port.
- In order to view the scanned TIFF images, the Utility decided to use the free Internet Explorer TIFF viewer AlternaTIFF, from Medical Informatics Engineering. AlternaTIFF is free browser add-on which can display most of the common types of TIFF image files. An additional benefit to using this software is the ability to magnify and pan, which helps for viewing small print.
- Anticipated when the application was first designed, was the need to use cellular telephones accessing multiple modems connected through a 3Com Total Control NetServer 16. Between the pilot phase and implementation, a decision was made to use, instead, a Virtual Private Network (VPN) for field access. This option allows greater flexibility in number of users and future expansion.

To correct this situation, all service tables within the SQL Server database were linked using a unique service ID. This linkage allows any service table information to display when identifying features.



CONCLUSION

Field crews were initially reluctant to use the wireless ArcIMS system because most of the Utility's personnel were novice computer users. The new process didn't feel like the "old" system. However, as their use of the system increased, the process of accessing utility information using ArcIMS became routine. As cellular phone access speed increases, this system will become indispensable to field crews for accessing accurate information on the water infrastructure in a timely manner.

ACKNOWLEDGEMENTS

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