ArcPad™: Mobile Mapping and GIS

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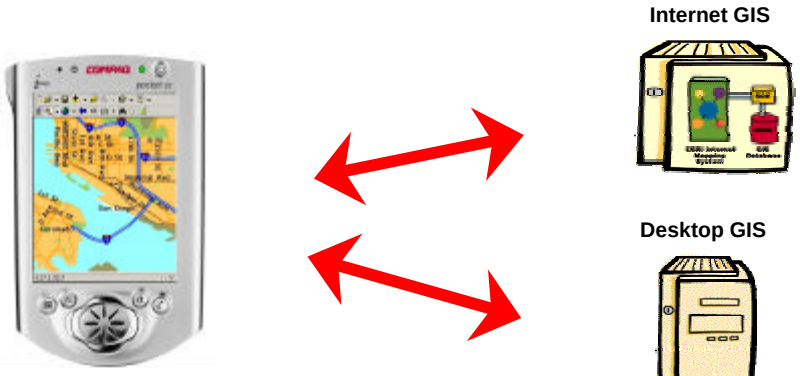
ArcPad: Mobile Mapping and GIS

Introduction

Mobile computing and wireless communication are two of the strongest trends in the computer industry today. Mobile computing is bringing fundamental changes to the way we utilize geography with the ability to bring your work with you and to interact directly with the world around you. Mobile computing comprises the integration of three merging technologies—lightweight hardware, global positioning system (GPS), and wireless communication.

ArcPad: Mobile Mapping and GIS

ESRI's ArcPad software is a mobile geographic information system (GIS) technology. ArcPad provides database access, mapping, GIS, and GPS integration to users out in the field via handheld and mobile devices. Data collection with ArcPad is fast and easy and significantly improved with immediate data validation and availability. ArcPad is part of the enterprise GIS solution and is integrated with ArcGIS.



ArcPad leverages existing mapping and GIS software systems and databases. ArcPad supports vector map and raster image display, which includes ESRI's shapefiles and LizardTech's MrSID imaging language formats. Data obtained in the field can easily be uploaded into the master database in the office. Users simply create custom input forms from their existing GIS database for use in ArcPad. Data can also be provided by the Internet via wireless communication. In addition, ArcPad offers integration with an optional GPS or differential global positioning system (DGPS) for real-time data capture. Data is now immediately available and validated in the context of an actual map.

The addition of a mobile GIS solution to ESRI's comprehensive family of GIS software programs gives users a new way to leverage their geographic databases—in the field.

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ArcPad supports numerous handheld Windows CE devices.

Many Potential Applications

ArcPad is a GIS and mapping system everyone can use. ArcPad enables specialized mapping and data collection in a wide range of industries and applications including

- Street sign inventory
- Power pole maintenance
- Meter reading
- Road pavement management
- Military fieldwork
- Mineral exploration
- Habitat studies
- Toxic inventory
- Crop management
- Property damage assessment

Key Features

The key features of ArcPad include support for industry-standard data formats; ArcIMS™ connectivity; display and query functionality; editing and data capture; optional GPS plug-in capability; a simple and modern user interface; and ArcPad Tools for ArcView® GIS, which is used to prepare data for ArcPad.

Supported Data Formats

A key feature of ArcPad is the ability to use data directly from an individual's desktop or an organization's enterprise GIS system without the need to convert to unique portable formats. ArcPad uses vector data in industry-standard shapefile format (as used by ArcInfo™, ArcView GIS, ArcIMS, and other ESRI® software programs). In addition, ArcPad directly supports the use of the following raster image formats (World file required): JPEG, MrSID (compressed images), Windows Bitmap, and CADRG raster maps.

ArcPad supports vector and raster data in a multilayered environment. Users can combine vector and raster data with the only limitations being the speed and memory capacity of the hardware in use. The map engine that supports the vector and raster data was built and tuned in accordance with the Windows CE platform, and great care has been taken to maximize performance.

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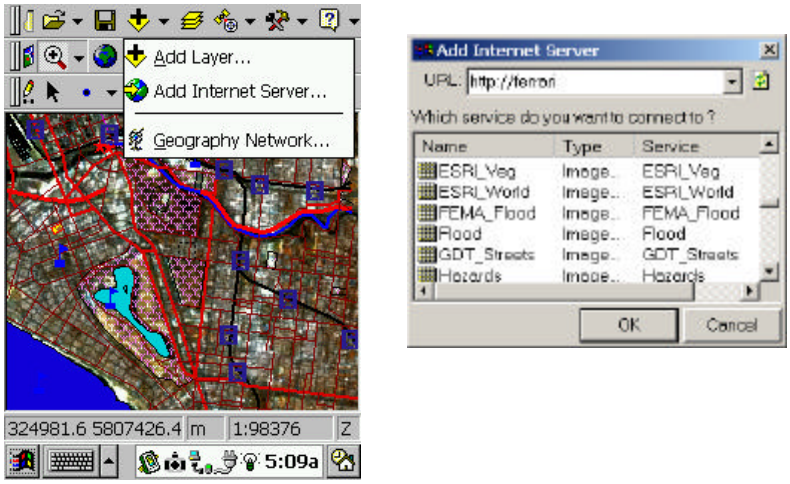
ArcPad allows users to create new shapefiles and view raster and vector data in a multilayer environment.

ArcPad supports on-the-fly datum conversion from geographic (i.e., GPS) input to the projection of the current map. A database of 200 world datums is supported and can be expanded by users if required. This greatly simplifies the problem of datum matching between maps and the GPS hardware. Moreover, ArcPad supports geodetic coordinates (latitude/longitude), Lambert Conformal Conic, Cylindrical Equal Area, and Universal Transverse Mercator map projections.

ArcIMS Connectivity

ArcPad also includes wireless data acquisition. ArcPad can act as a client to ArcIMS, ESRI's Internet mapping and GIS software, or to the Geography Network℠ (www.geographynetwork.com). Data is downloaded to ArcPad using a TCP/IP connection such as a wireless local area network, cellular phone, or a wireless modem. ArcPad includes an ArcIMS client for image services only. Features can be readily identified on the image layer.

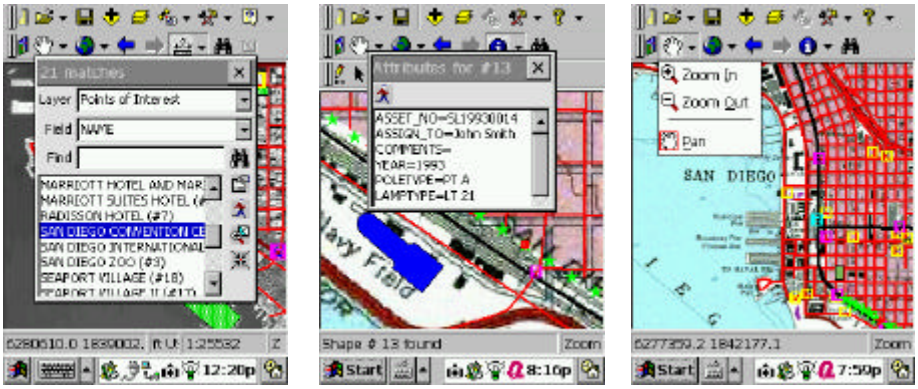


Wireless Data Acquisition with ArcPad

Display and Query

ArcPad includes a comprehensive set of map navigation, query, and display tools. Users can zoom to the extent of all visible layers or pan to features selected by an attribute

search. ArcPad also enables users to identify features and display their associated attributes; display layers with scale dependencies; create a hyperlink to external files including photographs, documents, and video or sound recordings; measure distance and area on-screen with a touch of the map; and calculate geographic statistics for selected features such as area and length. ArcPad allows users to control on-screen presentation of map data on a layer-by-layer basis. Users can set attributes such as line color, style, thickness, and fill patterns; text labels; and point symbols, as required.



ArcPad allows users to query data, locate attributes, and navigate a map in the field.

Editing and Data Capture

ArcPad allows the user to create, delete, and move point, line, and polygon features in shapefiles. Users can edit the coordinates for these features with the option to use current GPS coordinates. Shapefiles can be created in ArcPad using input from a pen, cursor, or GPS. Attributes can be manipulated through the built-in editing interface or through a user-designed form.

Users can create custom forms for use in ArcPad, which can consist of multiple pages. Forms can include required fields, read-only fields, and horizontal and vertical scroll bars for multiline edit fields. ArcPad supports the following controls for forms:

- Entry fields (single or multiline)
- Combobox (values from a list or .DBF file)
- Date (popup calendar for date)
- Check box
- Labels

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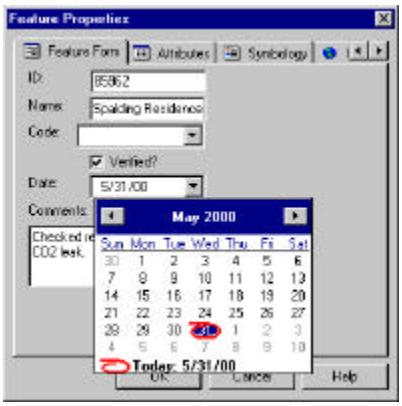

ArcPad supports a date field in its forms with a popup calendar for ease of use.

GPS Support

ArcPad also offers integration with an optional GPS or DGPS. With an optional GPS attached, ArcPad will show an individual's current position on the map in real time. Position coordinates are instantly available at the touch of a pen on the photo or map.

ArcPad is currently GPS-enabled for use with Trimble, Magellan, and Ashtech brand receivers within the United States. ArcPad can display and automatically save GPS information in ArcPad data files. Other GPS receivers can be used to display GPS information and serve as basic navigation tools. Outside the United States, ArcPad is GPS-enabled for all compatible GPS receiver brands. ArcPad supports GPS receivers that output the NMEA or TSIP protocols, in addition to the DeLorme Earthmate receiver.

ArcPad can display the following GPS information: receiver model and version, GPS mode (two-dimensional, three-dimensional, DGPS), speed over ground, course over ground, constellation, signal quality, position, altitude, compass, and differential (on/off). ArcPad includes a debug window for displaying messages received from the GPS and a message option to send messages to the GPS.

All GPS data can be recorded as a "track log" that is stored as a point shapefile (waypoint), stored as a point location (datapoint), or used to capture polygons and polylines in a shapefile. The GPS information is stored as attributes within the shapefile.

User Interface

The ArcPad user interface provides a simple and modern approach to the underlying complex functionality. Users can perform a wide range of functions through controllable toolbars. This has been a significant design criterion as screen space is limited, especially on smaller, palm-sized PC Windows CE devices.

ArcPad includes three toolbars that can be displayed or hidden depending on the functionality being performed. The Standard toolbar allows the user to activate the other toolbars, add data, access the online Help system, and save projects. The Browse toolbar activates the display tools including zoom, pan, and find. The Edit/Drawing toolbar activates the editing and form tools.

ArcPad Tools for ArcView GIS

Included with ArcPad is ArcPad Tools for ArcView GIS, which allows ArcView GIS users to extract, convert, and project data for ArcPad. ArcView GIS users can clip shapefile themes and write ArcPad project and symbology files. Users can export symbology as point themes (TrueType font symbols), line themes (line color and thickness), and polygon themes (simple raster fill).

ArcView Dialog Designer forms can be custom created for export to ArcPad, providing a simple and efficient means for data collection. Users can also create simple metadata files in ArcView GIS for use in ArcPad. The file can contain the theme title, description, name of author, and comments.

System Requirements

ArcPad has been designed specifically for the Windows CE environment and supports the following CPU chips:

- Hitachi SH3 and SH4
- StrongARM
- MIPS

These four chips account for the majority of Windows CE devices currently available including the pocket PC, palm-size, handheld, notebook, and pen computer varieties. ArcPad also supports the Allegro Field PC by Juniper Systems that combines Windows CE and DOS operating systems in one unit. ArcPad supports Windows CE 2.11, 2.12, and 3.0 (Pocket PC). ArcPad also runs on Windows 95/98, NT, and 2000.

ArcPad has a low minimal hardware requirement and operates on a 32 MB memory (recommended), 75 MHz processor, with approximately 10 MB of free disk space. A typical Windows CE system would have 32 MB memory, a 133 MHz processor, a color display, and a memory card for extra map data. ArcPad imposes very few hardware requirements; equipment specifications are typically based on the user's needs and the type and volume of map data to be used.

For more than 30 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

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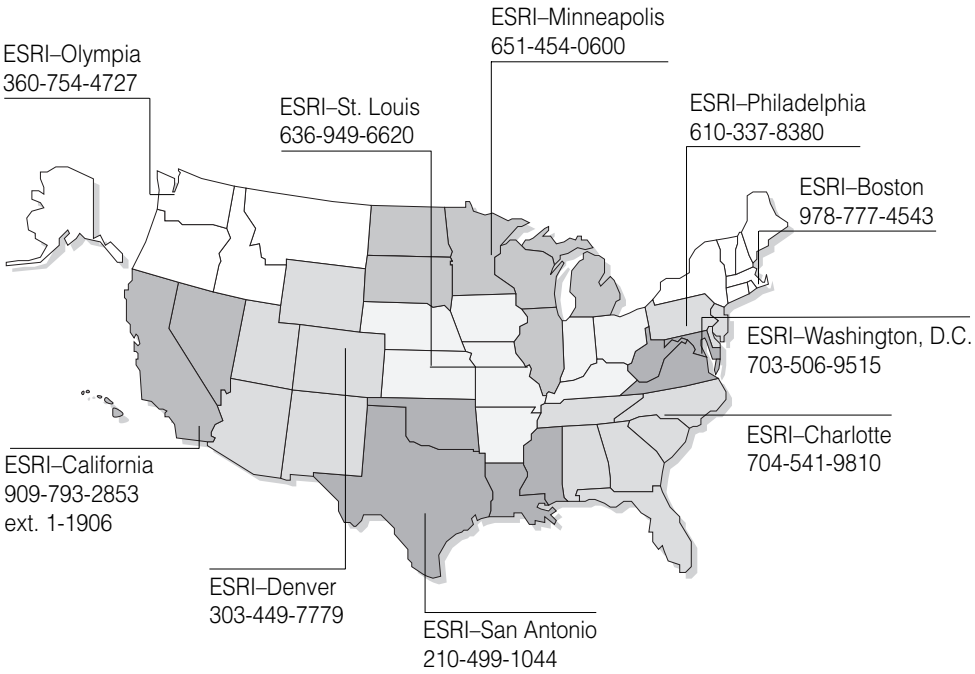

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