Adroit Technologies

GIS for MAPS

Quick Start Guide

MAPS

MITSUBISHI ADROIT PROCESS SUITE

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1. Summary

A geographic information system (GIS) is simply a way of displaying data related to specific positions on the Earth's surface to allow one to more easily understand their patterns and relationships. GIS relates to SCADA because most often the starting point of navigation in geographically dispersed projects is a map overview, since this is a natural and logical reference point to centralize information on, and control tasks from. By using the Geographic Information System (GIS) Add-on, you can add intelligence to these map overviews by providing icons that represent the actual positions of your items, such as your plant or equipment locations.

This MAPS GIS add-on consists of the following three main components:

- The GIS datasource, which stores the defined items and their hierarchy in the MAPS server, along with their icons and other configuration.
- The GIS Mapping Control, which maps the defined items of a specific GIS datasource on a map and provides navigation abilities, so that users can view and/or interact with these items.
- The Coordinate Agent, which is used to drive and manage the location property of a map item dynamically. The agent can obtain location updates from a field device provided the driver exposes the location in either Decimal Degrees (DD) or Degree Minute Second (DMS) format. The agent can also raise alarms when the location falls outside of certain areas (geofences).

2. How to configure the GIS Add-on

2.1. Add the GIS datasource

1. Ensure that you have installed the Geographic Information System (GIS) Add-on on the required MAPS Server computer.
2. Open the MAPS Designer and login to this Server.
3. In the Enterprise Manager, right click the Datasources node and select the Add Datasource option.
4. Double click GIS in the list of the available datasources.
5. Provide the required name of your GIS datasource and optionally select the desired coordinate system. Click the Finish button. The newly created GIS datasource will be available under the Datasources node.
6. Right click the Server and select the Save Server Data option to save this datasource.
7. Additional datasource can be added in the same way

2.2. Build the Hierarchy

Each GIS node potentially represents both a hierarchy item and an actual asset. This means a GIS node can simply be a logical grouping for child nodes, an actual asset in the field, or both. There are two ways of configuring the GIS datasource to add hierarchy and asset nodes.

- Use the configuration dialogs provided by the GIS datasource in the MAPS Designer to manually build the required hierarchy and add asset nodes

  Advantages:
  - Being an interactive wizard (series of dialogs), each step of the project performs its own error checking, so any mistakes that you make are immediately picked up and need to be addressed before you can continue.
  - This provides a structured "first principal" approach of creating the GIS database of items.

  Disadvantage:
  - Once you are familiar with the process of creating items and particularly if you have a large number of items to add, this method becomes unwieldy to use. Tip: We recommend that you use the configuration dialogs first to create your first site, area and items to get the hang of what data each field requires before bulk configuring your items using the Excel spreadsheet.

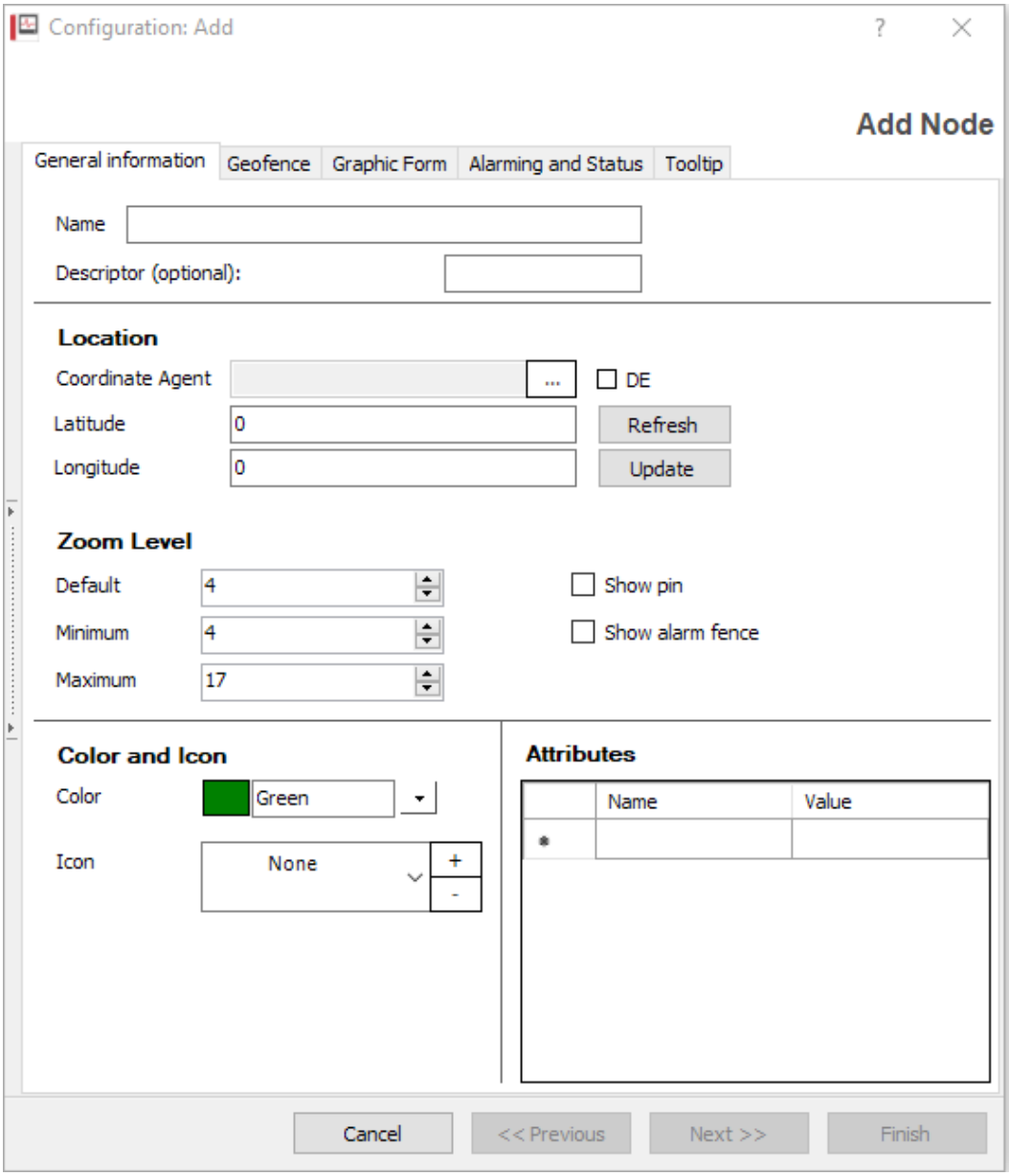
- Use an Excel spreadsheet to bulk configure the required sites, areas and their items. In this case edit the GISTemplate.xlsx that is installed into the is installed in the MAPS installation folder, which is typically: C:\Program Files\Adroit Technologies\MAPS) to create your sites, their areas and items, which already contains the necessary columns and provides further assistance regarding the required syntax and information required by each column.

  Advantage:
  - Being an Excel spreadsheet, it is easier to add the required items in bulk.

  Disadvantages:
  - Since the project is created by importing an Excel spreadsheet, limited error-checking is available.
  - Requires that you have Microsoft Excel (version 2007 and above) installed to edit this spreadsheet.

2.2.1. Using the configuration dialogs to add and configure items

1. Ensure that you have added a GIS datasource to the Enterprise Manager.
2. Right click the GIS datasource and select Add.



3. General Information:
   a. Type in the name that will identify this site, in the navigational hierarchy.
   b. Add an optional descriptor. This is a text field that can be used for filtering or identifying the asset by a codified naming convention.
   c. Set the location of the node
      i. If the location of this node should be derived from an agent, check the DE checkbox. Browse in the associated coordinate agent for the node. Clicking refresh will read the current location from the agent and populate the latitude and longitude fields. Alternatively, the latitude and longitude values can be entered manually in Decimal Degree (DD) notation. Clicking update will write these values back the the agent.
      ii. If the location is static, leave the DE checkbox unchecked and enter the static location of the node in DD notation

d. The default zoom level dictates which zoom level the map will be set to when navigating to the pin on a map control. The default zoom should be somewhere between the minimum and maximum zoom levels.
e. When viewing the pin on a map, it will only be visible when the zoom level of the map is between the specified minimum and maximum zoom levels of the pin.
f. There is also an option to hide the pin completely. This is useful when the node only represents a logical group and has no real location associated with it. Typically the location and zoom level of these nodes should be chosen that all its children will be visible when navigating to it.
g. If a geofence is defined for this node it can be displayed by checking the "Show Alarm Fence" checkbox. The fence will be drawn in the same color as the pin, but with a higher transparency.
h. Specify the color and icon of pin for this node.

Note: If you are designing your own icons, ensure that they fit within the provided icon template image ("gis icon template.svg" that is installed in the MAPS installation folder, which is typically: C:|Program Files|Adroit Technologies|MAPS) otherwise the colors of the states can be obstructed if your icons are too big.

4. Geofence:
    a. Specify the type of fence
        i. Polygon: The fence is described by a collection of points in the order they are entered
        ii. Radius: The fence is described by a radius around a centre point. This is used to define a fence that triggers when the asset is has travelled more than a specified distance from its start point.
    b. Enter the fence data for the alarm (and optionally the warning-) fence. If the pin is driven by a coordinate agent, this data will be written back to the agent when the dialog is finished or if the update button is pressed on the "General Information" tab.
5. Graphic Form:
    a. Specify a graphic form to open when the pin is clicked.
    b. Enter any aliases that the form might require.
6. Alarming and Status:
    a. Browse a tag to use to indicate that this asset is in alarm. An alarm condition will be shown whenever this tag evaluates to true.
    b. Browse a tag to drive the status of the asset. The value of this tag will be compared to a set of user defined values on the Map control. If the incoming value matches any of these values, the pin status area color will be set to the color associated to this value.
7. Tooltip:
    a. Set up a tooltip to display when hovering over this pin on a map.

If necessary, repeat this process for all your other sites and/or areas. Tip: In the Enterprise Manager, you can remove unwanted items by using the right click Delete option.

2.2.2. Using an Excel spreadsheet to bulk configure the required items

1. Ensure that you have Microsoft Excel (version 2007 and above) installed.
2. Right click on your GIS datasource and select "Export". You can use this blank export sheet as a template. It is suggested that you add the first few items from first principles before exporting, so you have a few examples of proper formatting for each column.
3. For each new item, add a new row and increment the ID. Set the ParentID equal to the ID of row that contains the item that will be the parent of the new item. To add a node to the root, set the ParentID to -1.
4. Enter the DisplayName, Descriptor, Latitude and Longitude. If the pin is driven, enter the full name of the associated coordinate agent. Otherwise leave this field blank.
5. ShowFences is set as follows:

	1	2	4	6
Pin	0	1	0	1
Fence	0	0	1	1

6. The export folder should contain an images folder. This should contain all the images that are to be used by the datasource. The images should be named appropriately. The IconKey field should match the name (without extension) of the target image.
7. Alarm- and StatusTag should be the full tag name (including slot).
8. AliasKeys and –Values should be semicolon separated lists (in matching order) of the Alias names and values repectively.
9. GeoFenceType should be set to nothing, Radius or Polygon. GeoFenceAlarmLats and –Longs should be a semicolon separated list of the latitudes (and longitudes respectively) for the alarm geofence, in order. The same applies to the WarningGeoFence fields.
10. AttributeNames and –Values should be handled like the aliases.
11. The TooltipText field should contain the entire, formatted tootltip text including placeholders and format specifiers. The TooltipSubs field should be a semicolon separated list of the full DataElement names, to be inserted at the specified positions in the tooltip text.
12. Right click on the GIS Datasource and select import. Browse in the appropriate .xls file and click Finish. The import will overwrite any current configuration completely. The process could fail if any part of the import sheet is badly formatted. Any failures will be reported, with reasons, if available.

3. Add and Configure a MappingControl

The MappingControl maps the defined items of a specific GIS datasource on a map and provides navigation abilities so that users can view and/or interact with these items.

1. If necessary, add a project and a graphic form in the Enterprise Manager window of the MAPS Designer and ensure that this graphic form is opened.
2. In the Toolbox window, open the GIS category and drag the MappingControl onto the graphic form. If you do not see the GIS category or the MappingControl, right-click in the toolbox and select "Add controls". In the configuration window that appears, find the GISMapControl item, check the box next to it and click finish. This will add the control to your toolbox.
3. Open the MappingControl Tasks menu.
   Note: This menu of tasks is displayed when the control is initially added and can be accessed by clicking its glyph usually displayed in the top left corner of the selected control.
4. Select the name of the required GIS datasource from the GIS Datasource list box. This displays the map and all the items that you have configured on it, typically by using the default icons, allowing your users to navigate between the specified items.
5. You can set the initial location of the map by using the CenterLatitude/Y and CenterLongitude/X properties of the MappingControl to specify the centre point location of the map, in decimal notation.
6. You can set the initial zoom level of the map too, by using the ZoomLevel property of the MappingControl.
7. The MappingControl has a native treeview that shows the GIS Datasource hierarchy. If required, this treeview can be hidden, by setting the ShowTreeView property to false.

The MappingControl allows users to interact with the map as follows:

- Zooming: Use the mouse wheel to zoom in and out or change the magnification of the map. Note: Ctrl + and Ctrl – also zooms in and out, pressing the Home button returns to the initial zoom level and location.
- Panning: Click and drag to pan the map or change the portion of the map that is currently viewed.
- Treeview: Click a node in the treeview to highlight the associated pin. Double-clicking will center the map at the location of the pin, at the configured default zoom level for that pin.
- Pins: By default, double clicking on a pin will open the associated graphic form for that pin, using the provided aliases. This operation can be fine-tuned, by changing the gISMapControl.OpenGF spider in the spider workspace (this spider is automatically created and configured when the Mapping Control is added to the form.
- Hovering on a pin will show its configured tooltip.

The MappingControl control selects the free OpenStreetMaps Map Provider by default. While you can also select one of the available BINGMAPS options - you need to license these before they can be used. A third option (LocalMapProvider) is also available. This is most appropriate when no internet connection is available. LocalMapProvider uses a custom offline map pack, generated specifically for the area of interest. Contact our support department for more information on custom map packs.

3.1. Alarming

Each GIS node can have an alarm tag associated with it (as configured when adding an item to the datasource). Essentially, whenever this tag evaluates to true, the Mapping Control will indicate an alarm condition for the node. Alarms are indicated in the native treeview, by a small, solid red square to the left of the treeview node. Treeview nodes also indicate when a child node is in alarm, by adding an additional red outline to the alarm indicator.

Pins on the Mapping Control also indicate alarms, by applying a red color to the AlarmIndicator area of the pin. On the default pin this is a highlighted outline of the pin.

3.1.1. Define additional colors indicating specific states for your items

In addition to the default color of your icons on the map you can define additional colors indicating specific states. These colors are applied to the StatusColor area of the pin (on the default pin this is the triangular area at the bottom of the pin.

Note: These state colors will ONLY be visible if you use the default item icons or design your own items to fit within the provided icon template, as described below. The relevant tags to use for status values were configured while adding the items to the datasource.

Configure the StatusColors property of the required MappingControl and specify the value of a specific state in the State column and its associated color in the Color column. Note: This StatusColors property defines is a list of states ONLY available to this specific MappingControl. Then typically when the value of a StatusTag associated with an item is the same as a value specified in the State column then the pin of this item is set to the specified Color.

You need to carefully decide what types of values are used for each StatusTag depending on whether certain states need to be common for all items or specific to certain items. Integer or double values work well for generic cases, string values allow a finer degree of control. Also the Color associated with the 'default ' state will be displayed when a StatusTag is not specified for an item or when the value of the specified StatusTag does not match any of the specified State values.

3.1.2. Filtering

The treeview can be filtered at runtime to make finding the required asset easier. The treeview can be filtered by name or by attribute keys (and values). Type any part of the search string into the filter box, and the treeview will automatically filter out items that don’t match.

3.1.3. Pin History

The MappingControl can also display a historical view of the recorded locations for a specific asset. To access this functionality, click on the Pin History tab. If the selected asset has logged location data, the Pin History control can be configured to display this data on the map. The length and frequency of the returned data can be configured on the Pin History control. Clicking apply will draw the collection of historical points on the map with a line connecting them in sequence. The points will show a tooltip containing the date and time associated with this point, along with the value of the StatusTag (if one was configured) at that time.

3.1.4. User Layers

You also have the option to load custom shapes onto the map using KML, SHP or SVG files. Shapefiles can be created in various 3rd party software packages (ArcGIS, MicroStation, GoogleMaps, etc). The shapefile contains the geometry of the shapes as well as their intended location on the map. While SHP an KML files have coded locations included, SVG files need to be given an canvas area so the Mapping Control knows where to draw the shape. If a valid shapefile is loaded, the shapes will be drawn on the map, in the user defined color. Map tiles are always drawn below shapes, pins are always drawn on top of shapes. Like pins, the shapes can be configured to only be displayed on certain zoom levels. The visibility of a set of shapes can be toggled can be toggled by showing or hiding the associated user layer using the UserLayers control on the Mapping Control

User layers can also be z-ordered at runtime using this control.

4. Appendix A

4.1. Core Changes

In order to include more GIS functionality and to make configuration more intuitive, a new agent type (Coordinate agent) has been created. This agent will be the primary method for representing dynamic GIS data. The features of this agent are as follows:

- Converting between multiple GIS representations
- Combines Latitude and Longitude values into a single value
- Defines warning and alarm geofences
- Raises alarms depending on position relative to the 2 fences
- Simultaneous logging of both coordinates

The agent can be driven by and represent a location as Decimal Degrees (DD) or Degree Minute Second (DMS). Latitude and longitude values can be driven independently, or as a full coordinate in either format.
The coordinate agent exposes both a warning and alarm geofence. These fences can be represented as either a polygon, defined by a collection of points, or as a radius around a centre point. In radius mode, the agent is essentially alarming when the current location is more than X meters away from a predefined point.
Since it is possible that latitude and longitude updates can arrive in different updates, the coordinate agent always logs a full coordinate – so a logged latitude will always have a corresponding longitude. This simplifies the interpretation of historical GIS data.

The rest of the GIS components have been updated to integrate more tightly with this new agent type. Henceforth, if a GIS node represents a moveable asset, that node should be driven by a Coordinate agent. It is also recommended to use a Coordinate agent for nodes that represent areas by using either the warning or alarm fence, though configuring the area without a coordinate agent is still possible. Status and Alarm tag operation remains as is. To interact with geofence alarms, the approach is still to route all alarms associated with a node to a single agent (alarmList, expression or marshal) and use that agent as the Alarm tag.
If driven by a Coordinate agent, GIS elements will reflect the security and dataelement status of the Coordinate agent. This means that if the underlying agent is bad, the GIS node will indicate this to the user. If the asset location is sensitive information, the underlying coordinate agent can be secured and the corresponding GIS Pin will not show any updated location to disallowed users.

4.2. Additional Changes

4.2.1. Alternate Coordinate Systems

GIS 3.0 (actually available since 2.0) enables the user to view his GIS data in either geographic or Cartesian representations. While most use cases will be suited to geographical representation, in some cases absolute position is either not available or not important. Examples include building management and mine maps. Typically, in this mode, traditional map tiles are irrelevant and the user can provide his own map in .SVG, .SHP or .KML formats.