



Analysis of the Possibilities of Geographic Information Systems in the Enterprise Management

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Abstract. In this report, the possibilities for expert decision making with GIS (ArcGIS) in enterprise management are explored. The tools implemented in the software as well as some user-defined tools are analyzed.

Keywords: attribute table, identification of the corresponding object.

1. EXPERIENCES OF MAKING EXPERT JUDGMENT WITH GIS

Decision-making is the responsibility with the greatest weight that one manager does. The solution defines the well-being of the enterprise or organization. It is the product of the manager’s knowledge, experience, intuition and imagination. Using software such as ArcGIS, the manager enriches his capabilities in performing his most important task making an expert solution. ArcGis is a tool that enables planning, spatial analysis, cost optimization, and resource efficiency. It’s capabilities and spheres of application are immense. Built-in tools enable the most trivial mapping tasks that are applicable in business. The most common application of GIS is to locate geographic objects by attributes or location [1].

2. ATTRIBUTE SELECTION (LINE)

Each GIS object has compiled information. Extracting objects from the system is easily feasible. One of the tasks of an existing database of establishments is to show those with a profit for the past month under USD 3,500 for instance. Very often, the layers contained in the geographic databases are extremely detailed and it is necessary that the data are being worked and reduced to the minimum necessary, which is needed to complete the task. This requires selecting a particular feature - specific location, type, characteristics, etc. The attribute table describes all the properties of the elements in a layer. In this example, the “Bars” layer

contains several sets of data that made up Fig. 1.

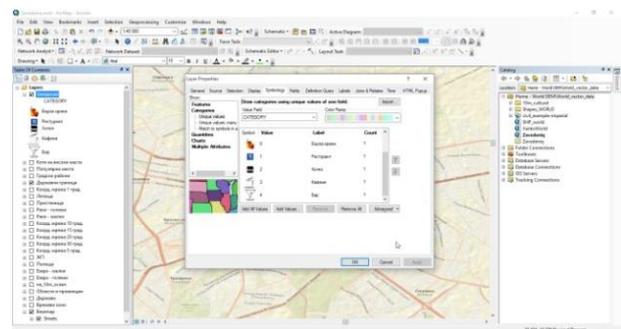


Fig. 1 Detailed layer presentation.

A movement on the core of the task is explained. Specify the layer from which a selection is made – “Bars”. Method - Create a new selection by attribute – profit on Fig. 2.

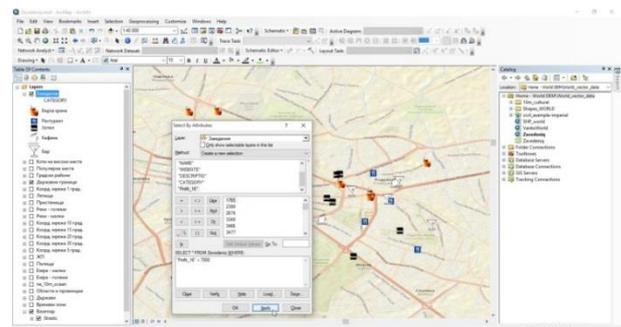


Fig. 2 Attribute selection.



Thus, all establishments with a payout of less than USD 3,500 are marked on the map. If the goal is, for example, to select only bars with such a turnover, then the selection condition will take the form – “Profit_16” <3500 AND “CATEGORY” = Bar. We can preserve the selection as a completely new layer [2, 3]. The results obtained can serve as a follow-up analysis of the reasons for lower revenues than other establishments. A layer of demographic information or real-time traffic data can serve as a benchmark.

3. DRAWING GRAPHICS

Graphics based on object data in the system can also be created with ArcGIS. Graphical information is considerably easier to perceive and provides a more strategic view of the objects. If the Symbology> Charts field is selected from the layer properties, the bar/column bar symbol may be changed to the height of the restaurant’s profit. Moreover, more columns can be added, such as the profit for a previous month and so effortlessly to compare values over time – Fig. 3.

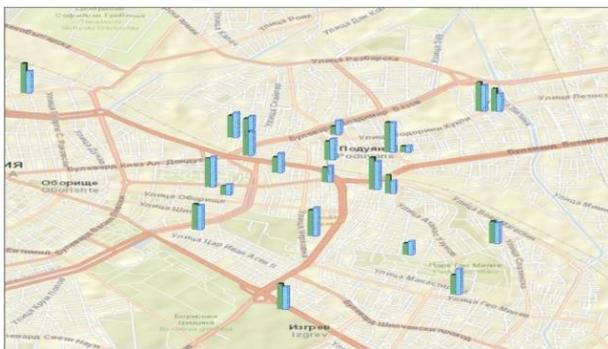


Fig. 3 A comparison of the profits of the establishments.

The green figure shows the profits for April, and blue for March. An even more detailed graph can be created by using the attribute table. For example, you need to build a restaurant earnings chart by highlighting those with a turnover of more than USD 3,500. An adviser opens to help us prepare our chart. In our case, we select vertical bars for type graphics; layer – “Bars”; graph values - earnings; on the horizon

we have establishments with their names; for the color scheme, we select light blue to show the selected restaurants (with a profit of over 3500 USD); form the title of the table and the axes.

4. CALCULATION OF THE SHORTEST PATH

ArcGIS has the geo-processor capability to calculate the shortest street path between user-specified points and generate a file containing directions for the route directions. A base map is containing a layer of road network is needed. With the Make Route Layer tools, the road network layer is analyzed and its analytical properties are determined. The route analysis layer is useful for determining the best route between a set of network locations based on certain criteria. The parameter values with the Make Route Layer tool can create a new “Roads” layer to serve for route calculations, shown on Fig. 4.

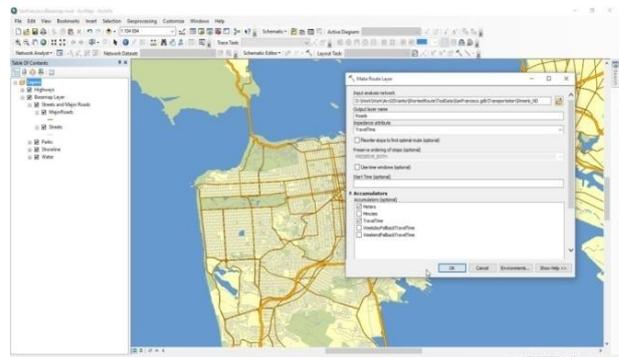


Fig. 4 Create a layer for roads.

5. LOCATING NEARBY OBJECTS IN A STREET NETWORK

Geo-processor capabilities of ArcGIS run smoothly on this task. Libraries are searched based on the starting location and travel time on the street network, calculating the shortest route to each of the nearest libraries, and generating driving directions in a text file [5]. The model can create the closest analytical layer of the network infrastructure; adds the libraries’ places from the layer library functions as facilities; adds the user-defined locations; solves it to identify routes to the nearest libraries, generates traffic directions and finds only those libraries

that are included in the routes from all the libraries that are loaded as facilities. The location of libraries used for proximity analysis is a constant. It is therefore more efficient to calculate their location on the network only once. Then the Add Locations tool to load the library as a facility in the new closest layer facility can use this information. For the Library layer, network locations are determined based on the Streets_ND data layer for the network, Fig. 5.

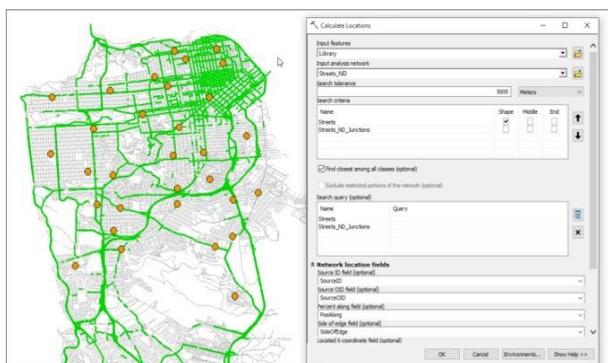


Fig. 5 Enter the location of the object.

6. REPORTING OF MOBILE TOWER SIGNAL COVERAGES

A weak signal while moving within a certain area is established. To illustrate the situation, the towers in this area are analyzed [4]. ArcGIS simulates a person with a mobile phone that moves in the area. The tool should display the current signal strength while driving. We enter their attributes - name, scope, etc. The towers are ready to be positioned on the map. The towers can be added using the Editor tool, Fig. 6.



Fig.6 Deploying the towers of the area

Topology operators allow work and manipulation of object geometry - change, extension, and shape shrinkage. The tower can be turned as a “point” element into a circle to draw on the map. The tower's scope attribute can be used to determine the radius of the circle in meters of the map. Thanks to the “cursor” feature, it is possible to browse several features and process each of them individually. After the ArcGIS compilation, circles reflecting the ranges of all towers with a radius are displayed according to the values in the attribute table on Fig. 7.



Fig. 7 Scope of towers.

7. DISPLAY THE SIGNAL STRENGTH

The signal strength of a mobile device on the map can be calculated in percentage. Several rules are introduced. An Assumption is that if the device is located next to the tower, its signal will be 100 % and if it is located exactly on the edge of the coating, the signal will be 0 %. The formula can be used to determine the signal strength:

$$S = \frac{R-d}{R} \cdot 100 \quad (0.1)$$

where: S is the signal strength in percent, R is the range of the connected tower, and d is the distance from the mobile to the tower. If the phone is without bandwidth, a negative value will be obtained. It is not a problem, however, in the presence of a detailed geographic database with the characteristics of the towers, to produce a real model, taking into account dBm (decibel-mille) signal strength values. To convert any power P (in W), such as x (in dBm), or reversed, the following equations can be used:



$$x, \text{ dBm} = 10 \log_{10} \frac{P(\text{W})}{1 \text{ mW}} = 10 \lg(P + 30)$$

$$P, \text{ W} = \frac{10x(\text{dBm})}{1000} = \frac{10[x(\text{dBm}) - 30]}{10}$$

P, W is the power in W, and $x, \text{ dBm}$ is the power ratio in dBm.

After compiling, a fully functional tool is designed to show how many percent is the signal of the mobile phone that would be positioned at that location and also which is the nearest tower next to it and the tower is designed to start blink, shown on Fig. 8.

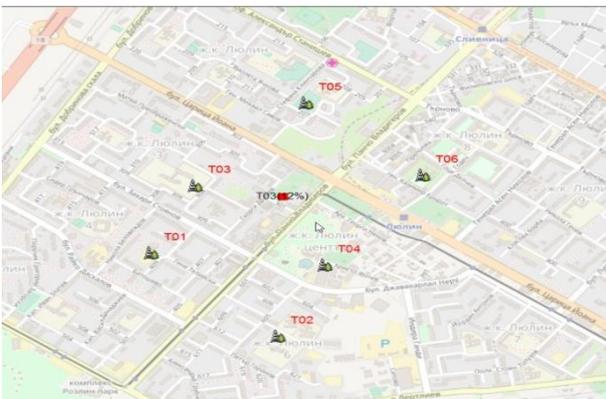


Fig. 8 Measuring the signal strength and the nearest tower.

8. CONCLUSION

With the use of GIS technology the efficiency of workflows can be improved, duplicate activities can be reduced, operational activities can be optimized and communication - improved. A reduction in costs can be achieved and the return on investment can be increased. Management of spatially information provides a control over everything that happens in the environment. Anything that is contained in a span area can be described in detail and any change is timely reflected. This is also the power of GIS technology in the enterprise management.

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