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Innovative Projects In The Field Of Geographic Information Analytics And Cartography, In Energy And Electricity Worlds

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Abstract:

80% of the electrical grid data is spatial data, such as the location of power stations, transmission grid lines, substations, electric lines up to the customer, electricity poles, transformers and photovoltaic installations. Therefore, when you come to analyze electricity data, you must refer to the location of the electricity details and analyze them from the GIS world and show them in the cartography world.

The importance of the geographic electric analyst is important in general and in particular in helping decision makers to reach the best decisions based on engineering, geographic, commercial and business data.

The geographic analyst profession is also beginning to occupy a respectable place in the world of electricity and energy companies. The knowledge required by the analyst is a combined knowledge from the world of electrical and energy engineering and tools and knowledge from the world of data, derived from geographic data science .

And this is where I came up with the idea that we "have" a "new" professional or new view that called: Electricity Energy Geographic Analyst. And you can even give this profession a name: "EEGA".

The main projects, which I research and manage in GIS, Cartography together with electrical data include:

Building a visual geographic portal with beautiful cartography. Calculation models of the power grid's ability to absorb distributed generation facilities of renewable energies appear behind the cartography. The internal organizational portal and the external portal are a visual cartographic result of an analytical analysis of the calculation of the electricity chain from the power station through the substations to the customer. The analytical result answers the question of whether the current electricity grid has the capacity to absorb new renewable energy producer facilities in the electricity grid. Smart integration of technical and commercial data that ultimately provide the planner with a database and a tool for planning the production of renewable energies. To achieve this product, we used a software tool that knows how to handle the topological connections between space and points in the electricity network. The tools to perform the task are convenient and there is no need for much programming to perform the data analysis, nor almost any need to program and show the data in a beautiful visualization such as a geographic dashboard or a portal. The portal is intended for the State of Israel's goal of reaching 30 % of renewable energy by 2030. To view the external accessibility: https://iecil.maps.arcgis.com/apps/webappviewer/index.html?id=322fe1abffb744fcb478d4d2abf69388&locale=he (figure 1).

2. Another example of electrical geographic data analysis is a joint work we did with the sustainability and environment department aimed at creating a database of an electricity network and data on poultry and birds in Israel. Its result is GIS geographic information that classifies the areas in Israel that present many birds electrocution possibilities. The collection of information included data on bird flight. Information on bird spotting from GPS. Data on existing faults in the electricity network, environmental data such as water sources, garbage dumps and agricultural fields. In addition, we integrated geographic models from the ecological world. The project provides new information that was not available until now. It is important to note that Israel is one of the countries where many birds pass through (figure 2). .

3. Another project which we named is a Digital Twin at a substation. This project is basically a visual geographic information of a substation in 3D. The basis for the information is a scan of the substation by Lidar Technology, presenting a three-dimensional model of the entire station. On this information we added layers of architectural information, electrical layers, and station equipment data and thermographic images. And we intend to connect operational data and environmental geographic data such as climate, lightning to the three-dimensional model. The goal is to present a snapshot of the electrical system in terms of failures, early maintenance or prediction of expected failures related to environmental

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conditions and electrical parameters. The ultimate goal is to share most of the data on a visual platform called Digital Twin. (figure 3).

4. Another example is trees that endanger the electricity grid and can cause malfunctions and power outages. In the project we see a cartographic image,resulting from the data analysis. The result is an indication of certain trees that will endanger the electricity grid which call for preventive maintenance activities. In this case, data from aerial photographs, image analysis of the location of the trees and their height, as well as the state of the health of the trees were combined using indicators from the world of agriculture. We connected everything with the electricity grid data. In this case the data and tools are spatial tools that also support raster information. In the attached picture you can see the electricity network and the forest. The red colour indicates the trees that nust be treated. (figure 4).

5. Another and extremely important project is fault analysis and fault prediction in the geographic electricity network. The project included collection and integration of environmental data of lightning, soil types, soil displacements, earthquakes and climate data of rains and winds. These, together with real faults and momentary drops and losses of energy in the network will enable the integration of the data and its investigation to answer the questions of complex reasons for faults in the electricity network. The purpose of the project was to examine the use of big data to analyze faults and define an order of priority for renewing the electricity grid. To understand where points of failure exist and expected events to improve network reliability and predict future events. In the figure 5, we can see a geographic heat map that shows failure places in the electricity network. The red colour symbolizes the most problematic places in the electricity network.

In this article I connected two worlds: The world of electricity and energy data with the world of geographic information, visualization and cartography. The combination between these worlds produces new knowledge and innovations.

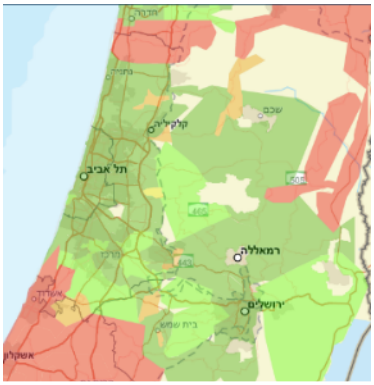

Figure1: Substation poligons renewable energy

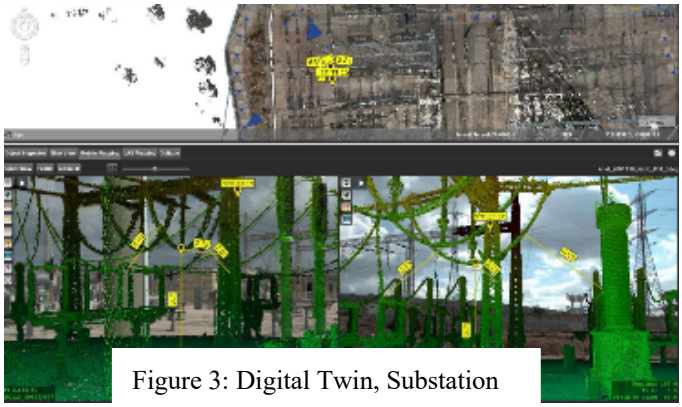

Figure 3: Digital Twin, Substation

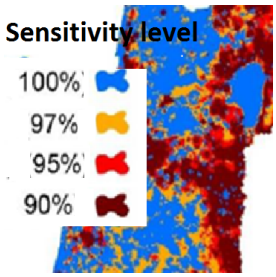

Figure2: Electrocution of birds

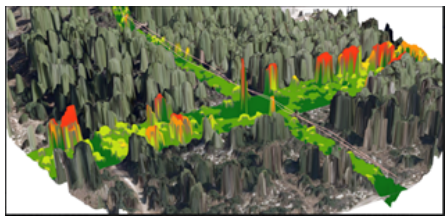

Figure 4: Dangerous trees to electric

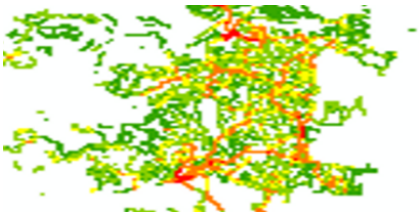

Figure 5: Heat map, electric fault

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