

The GIS-based energy consumption of the buildings in Scharnhäuser Park

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1 INTRODUCTION

The research work described in this paper is a part of an international research project co-funded by the European Commission called POLYCITY, which is coordinated by the Stuttgart University of Applied Sciences. The test area is the residential area Scharnhäuser Park close to Stuttgart.

This paper describes the applicability of GIS-technology for improving the energy management of urban areas. In order to achieve it, the energy related data of Scharnhäuser Park was collected, analyzed, visualized and published via Internet. The main aim of this project is to find potential energy savings. The web application shall contribute to the improvement of sustainable urban development and encourage other municipalities to realize similar projects.

2 METHODOLOGY

2.1 Data acquisition

2.1.1 Energy consumption data

The energy consumption data of all buildings of Scharnhäuser Park originate from the archive of the municipal utility company Esslingen am Neckar GmbH and from the Energy Baden-Württemberg AG (EnBW). This data are annual heating and electricity consumption data for each building in form of Excel or paper sheets. In order to organize these data, a data model was developed and implemented in an Access database.

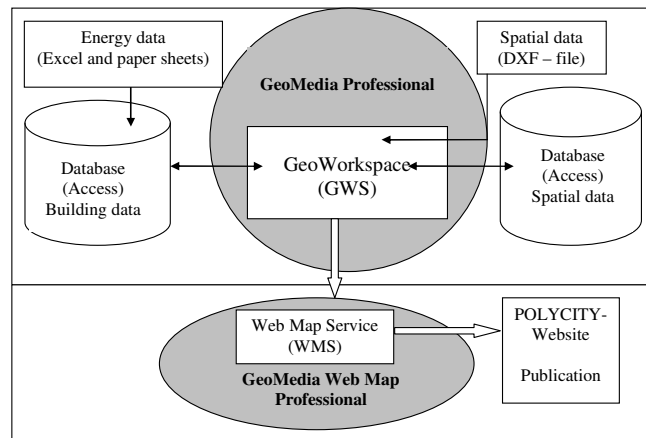
2.1.2 Spatial data

The project POLYCITY was provided with a map of Scharnhäuser Park from the city of Ostfildern. This map is a DXF-file and contains all dimensions and object information for the analyzed residential area, e.g. building name, street name, house number.

2.2 GIS – application

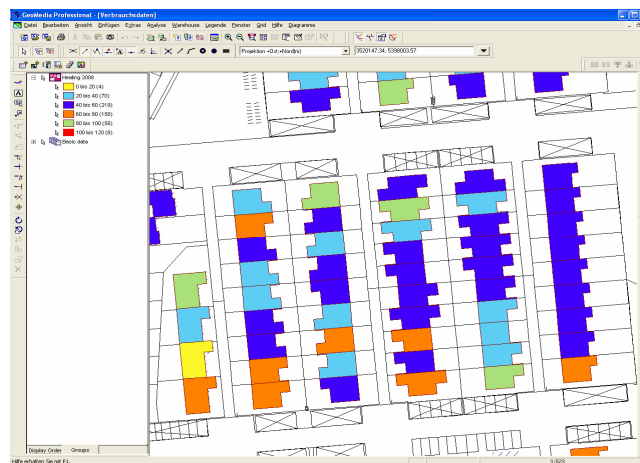
In order to be able to visualize and analyze the data of Scharnhäuser Park, the products of GeoMedia software family were used. The program GeoMedia Professional has a capability to directly access spatial data in different vendor formats and therefore use it by visualizing and analyzing it. GeoMedia WebMap Professional was used to build a geospatial web application, which provides access to geospatial data. The next picture shows the workflow for collecting, visualizing, analyzing and publishing all project related data.

Picture 1: Scheme of using GIS technology for the analysis of project related data



The collected attribute and energy consumption data were stored in an Access database. The spatial data from the DXF-file were visualized in a GeoWorkspace, where they were automatically transferred into a new Access database. The program GeoMedia Professional was used to join the spatial data with the attribute and energy consumption data by the building ID. This operation enabled to visualize the energy consumption data in a number of thematic maps, where the color indicates the degree of energy consumption.

Picture 2: Thematic map of the annual heating energy consumption of 2008

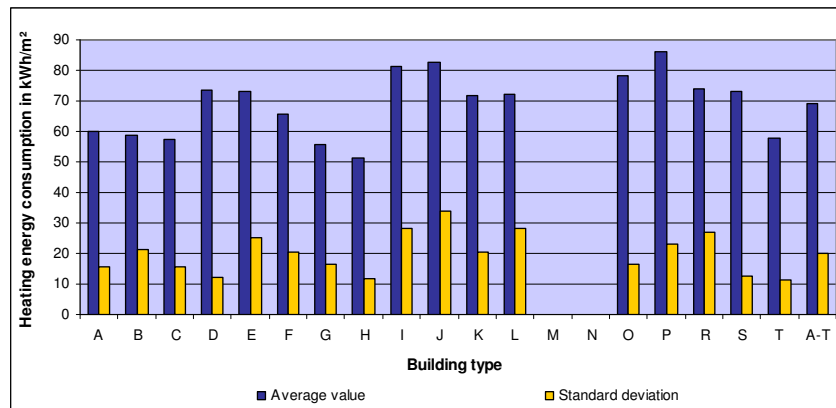


Further on, the program GeoMedia Web Map Publisher was applied for publishing the thematic maps in Internet via a Web Map Service (WMS), incl. an appropriate user interface. This WMS was finally implemented in the POLYCITY – website to publish all project related data via Internet.

3 RESULTS

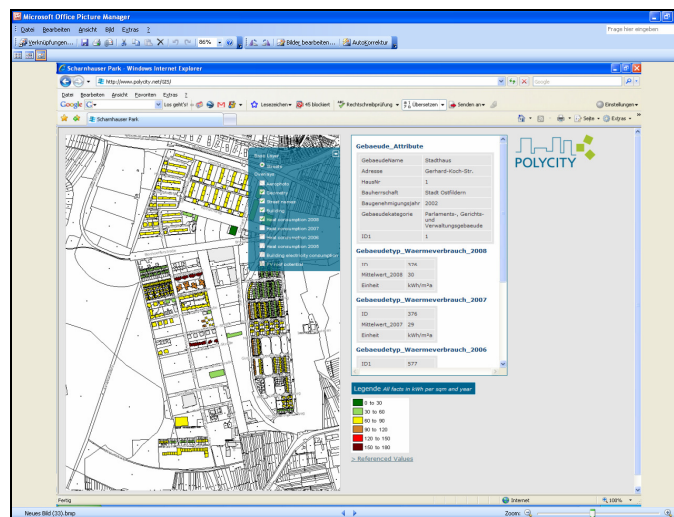
The visualization and analysis of the energy consumption data in a GeoWorkspace showed significant differences between values within one building type. For example, the standard deviation of the average value for the heating energy consumption by the building type J is up to 40 % (Picture 3). This shows possible savings in the energy consumption of the buildings by changing the user behavior.

Picture 3: Average values for the annual heating energy consumption 2006 for different building types



Within the implementation of the developed WMS interface into the POLYCITY-website, users can have a possibility to access this web portal in order to evaluate the status of their energy consumption. Regarding data privacy protection, only the average annual energy consumption data for each building type have been published.

Picture 4: POLYCITY Web GIS-Application (Heating energy consumption 2008)



Source: POLYCITY-Website

4 CONCLUSIONS

The research work described in this paper and carried out within the project POLYCITY is an example for sustainable management of urban areas. This analysis was mostly based on energy consumption data of all buildings in the residential area Scharnhäuser Park. The results of this analysis showed a high potential for reducing the energy consumption of buildings and therefore reducing the CO₂-emissions. The implementation of the developed GIS-application into the POLYCITY-website gives all users a possibility to show the energy information of their buildings. The in this research work presented concept of web-based GIS-application can serve as a model for other similar communities to support the sustainable energy management.