

# **Methodological Approach for Designing GIS Management System for State Real Estate**

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**Key words:** real estate, cost analysis, economic efficiency, GIS, management system, LADM

## **SUMMARY**

At present, GIS is being used in all fields of economic activity and administration. Its functionality combines an spatial object, described by various attributes, with its location in geographical space. The superiority of GIS technology lies in its spatial, qualitative and quantitative ability, all in one and consistent with each other. Many people have recognized the value of GIS solutions, and used them on a daily basis. Therefore, the number of GIS users grows year by year. One of many possible applications of GIS is the management system for real estate properties.

The authors of the paper work on a prototype of real estate management system for State's properties. This system requires combining both, the data from Land Administration System (i.e. the data concerning the parcel or building, owner and rights) as well as the data concerning the costs of real estate management (in a form of indicative figures and values in relation to months and years).

The modern real estate management system works as a component of integrated information system supporting the management not only of real estate but also human resources, warehouse and transport systems, fixed assets, etc. Unfortunately, the modern managing systems do not take into account the spatial characteristic of real estate location as well as the consequences emerging from this fact. This prototype system will combine the spatial characteristic with the financial analysis, forming one, coherent GIS Management System for State Own Real Estate.

The system will be tailored to significant increase the efficiency of real estate management, including the financial expenditures incurred for the construction, expansion, renovation and modernization of individual object. The functionality of the prototype will cover many aspects of spatial and economic analysis, including the communication accessibility, assessment of those buildings that are vital or needless for the administration to run and manage. The structure of the system will be modular, enabling system's development according to changing users needs.

Methodology of designing the system is an object-oriented based on Model Driven Architecture (MDA) and Service Oriented Architecture (SOA). The conceptual, logical and physical phases will be clearly divided. The conceptual model uses ISO (19 100 series) and OGC methodology, especially spatial and temporal UML application schema.

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## **1. BACKGROUND**

The superiority of GIS technology lies in its spatial, qualitative and quantitative ability, all in one and consistent with each other. Many people have recognized the value of GIS solutions, and used them on a daily basis. Therefore, the number of GIS users grows year by year. One of many possible applications of GIS is the management system for real estate properties.

The modern real estate management system works as a component of integrated information system supporting the management not only of real estate but also human resources, warehouse and transport systems, fixed assets, etc. Unfortunately, the modern managing systems do not take into account the spatial characteristic of real estate location as well as the consequences emerging from this fact. The elaborated prototype SZaNP system will combine the spatial characteristic with the financial analysis, forming one, coherent GIS Management System for State Own Real Estate.

## **2. MAIN ASSMPTIONS**

The main requirements for SZaNP relate to the functionality of the system, and also to the scope of gathered data and compatibility with the outer systems, that constitute the systems' surroundings. The new system will efficiently improve the real estate management, through rationalization of the expenditures spent on construction, renovation and modernization of particular properties. The functionality of the system will include the analysis of the real estate ownership, the technical state of the properties and also the sophisticated investment analysis. Above all, the SZaNP will identify which of the Police's properties are essential for the realization of certain duties and tasks and which are not. In the effect, the expenditures will certainly be lowered. The SZaNP is also targeted at making a module called The Police Supporting System. This system will be oriented towards various systems like land and buildings registration, land registry, and national terrain system.

The users of the SZaNP system will be the Police staff who are responsible for the support and management of real estates. When SZaNP becomes fully operational it will be possible to make analysis and reports in a short period of time, which previously took even a few weeks.

## **3. CURRENT STATE**

Currently, the Police manages the real estates through the use of two Excel files applications. They concern types of ownership, like: fixed assets or dependent possessions. The scope of gathered data includes various necessary descriptions like localization, Police unit or department and numerous expenditures. The expenditures are registered monthly, the

expenditures are expressed per person or per square meter. This solution however is not free from various faults. The first and the most important one is that table-based information systems, like spreadsheets are not a data base. The Excel files about the real estates are made and managed by a worker from the Police Logistics Department. These spreadsheets are a type of large scale analysis. The true quality of this structure is its availability and most of all the force of habit of the current users. These files however lack transparency and there are problems with making analysis, mainly because the files include 550 000 records.

Table.1 The content of currently functioning data base (source: Excel files from the Police Headquarters)

Lp.	Forma posiadania	Adres, kod, miasto, Lpowa	Kodowy obiektu	Wzrost	Ciepota	Wzrost	Wzrost	Wzrost	Wzrost	Wzrost	Charakterystyka nieruchomości			Koszty poniesione w 2009 r.		
											Przebieg	Koszt	Wzrost	Wzrost	Wzrost	Wzrost
147	Obiektu			344,41	1	0	14,247	11 406,4	11 100,4	4 296,3	297,2	0 071	33 207	44 278		
17	inne			400	1,3	0	0	72,81	72,81	40,31						
18	indywidualne			400	1,3	0	0	67,81	67,81	40,31						
19	indywidualne			400	1,3	0	0	35,01	35,01	20,01						
20	indywidualne			400	1,3	0	0	417,81	417,81	204,31						
21	indywidualne			400	1,3	0	0	336,01	336,01	279,31						
22	indywidualne			400	1,3	0	0	46,31	46,31	44,31						
23	indywidualne			400	1,3	0	0	46,31	46,31	44,31						
24	indywidualne			400	1,3	0	0	46,31	46,31	44,31						

The Excel file creates tables and analysis displaying the expenditures spent on an object. The expenditures express the monthly costs of rent presented in years, other expenditures are costs of energy per person or per square meter. Excel analysis also include the analysis of usable area, like the warehouse area, duties area. Figure 1 shows an exemplary diagram/chart of expenditures in a first half of 2009 and 2010 in all Police Departments.

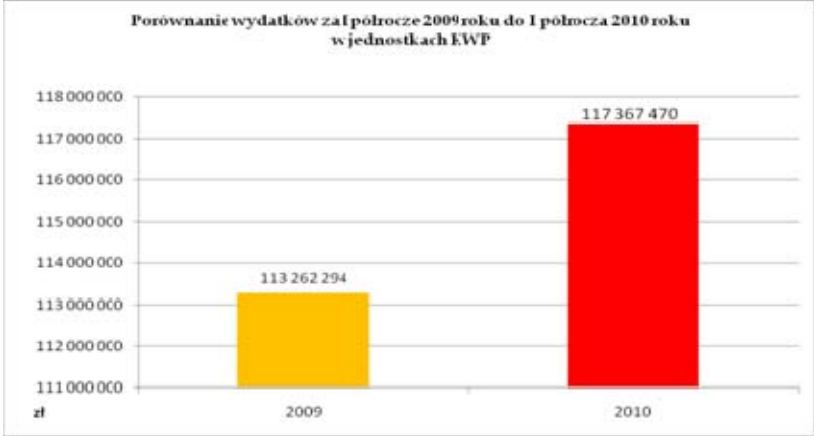


Fig.1. The comparison of expenditures spent on management of real estate in a first half of 2009 and 2010 in all Police departments. *Source: Police Excel files*

It is a necessity for the Police to manage their real estate in a more efficient way, to have quick and easy reports and analysis at any time. Previous real estate management software cannot meet essential requirements of real estate.

#### 4. SZaNP ASSUMPTIONS

##### 4.1. Compatibility with laws and regulations

In order to meet the expectations of the new system it has to comply with certain conditions for example law and regulations. The most important regulations are:

- The Act dated on 21<sup>st</sup> August 1997 about *real estate management* (Journal of Laws of 1997 No. 115, item 741, as amended);
- The Act dated on 30<sup>th</sup> May 1996 about *real estate own by the State and by the Military Property Agency* (Journal of Laws No. 163, item 1711);
- The Act dated on 27<sup>th</sup> August 2009 about *Public finance law* Journal of laws No. 157, item 1240, as amended)
- Ministry of Finance Decree dated on 2<sup>nd</sup> March 2010; Journal of Law No. 38, item 207
- Ministry of Regional Development dated on 29<sup>th</sup> March 2001, about *record of lands and buildings* (Journal of laws 38 2001 item 454)

Due to the fact that the proposed system is a data base system it requires to include certain directives of legal protection of data base, such as:

- The Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
- The Act dated on 17<sup>th</sup> July 2005, about *The Informatization of Entities that carry out public tasks* (Journal of Laws No 64 2005, item 565, as amended – Journal of Laws 2010 No. 40, item 230)
- The Act dated on 4<sup>th</sup> March 2010 about *the infrastructure of spatial information* (Journal of laws No. 74, item 489)
- The Act of Council of Ministers from 2007, about *National Interoperability Framework*
- The Act of Council Of Ministers dated on 11<sup>th</sup> October 2005, about *minimal requirements for teleinformation systems* (Journal of laws 212 2005, item 1766)
- The Act of Ministers dated from 28<sup>th</sup> March 2007, about *Country Operational Plans for the Informatization for years 2007-2010* (Journal of laws No. 61, item 415)

## 4.2. System's Functionality

The system will be responsible for making reports and analysis concerning the forms of possession, technical state of the buildings, the expenditures on renovations and modernization. Key information about the real estate will help a system user to evaluate which objects are the most pricy. This way, time and money can be reduced. The system will include every data that is important to manage the real estate. The mentioned data can be found in other systems functioning in Poland, like: lands and buildings register, martages, and national geoportal.

One of the most important assumptions of the system is its module structure. This structure will adjust the system for the growing number of the users and will enable the expansion of the system's functionality.

## 4.3. SZaNP's Scheme

The structure of the system, as shown on figure 2, supposes using one of the central data base, which will be gathered on a data server and on an especially dedicated, for this purpose, additional GIS server. The user will be given access to the data through the Internet, or any local network. The communication with the servers will be through the persistent connection like TCP/IP (LAN, WAN, Internet). An access to desirable data will be realized through world wide web pages (mobile and stationary computers can be applied).

A central server and GIS software will be placed at the Police Headquarters. It will be the most important element of the system. There also will be an edition and analysis module added. This module will manage the quality of the data (automatic control basing on attributes and geometry of gathered data). This edition and analysis module will enable more complex data updating (e.g. modification of data base structure, modification to a greater number of objects, conversion of current digital data base, transformation between terrestrial reference frames).

Also Provincial Police Departments will be equipped with edition and analysis module. The data will also be gathered, analysis will be done, reports and other tables list and specifications as well. These computer posts will be occupied by the schooled users of the system, they will also be given additional license.

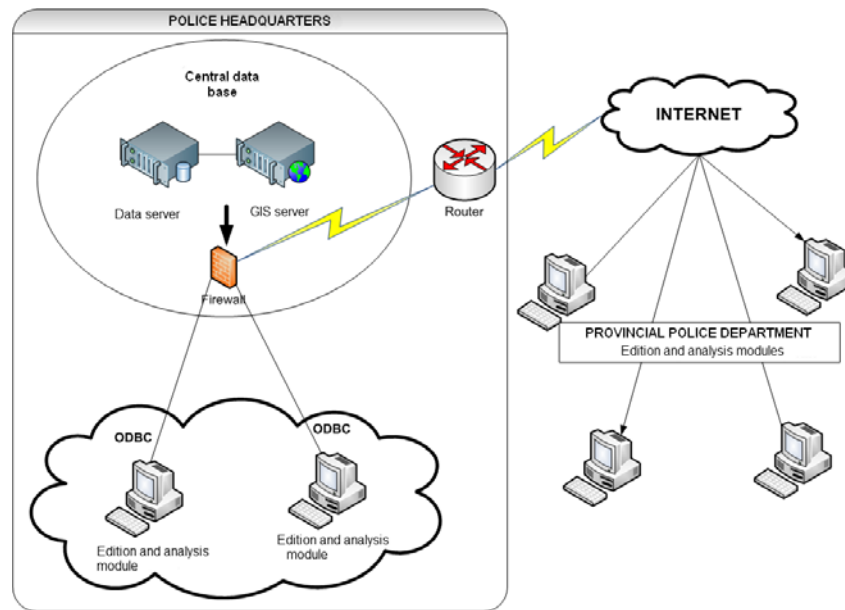


Fig.2. The structure of the SZaNP System. *Source: SZaNP System documentation.*

## 5. ANALYSIS

As it was mentioned before the current state of the real estate management bases on Excel files. The spreadsheets play a role of a data base, where the data is gathered and analysis are made. Any operations are time and energy/labor consuming. GIS techniques are very useful tools for real estate management. Fast process of data updating, quality control, defined analysis make GIS a great potential in real estate applications. Non-standard analysis are also available and they can be done in a very short period of time. GIS best recommendation is its ability to present data and results of analysis in a map format. Apart from basic queries a user can build more advanced ones. Figure 3 shows a query result for real estates of a provincial Police Department in Radom with an expression that selects a rent agreement signed for the longest possible period of time. Green color shows all objects with rent agreements and red one shows the real estate with the longest rent period (until 2019).

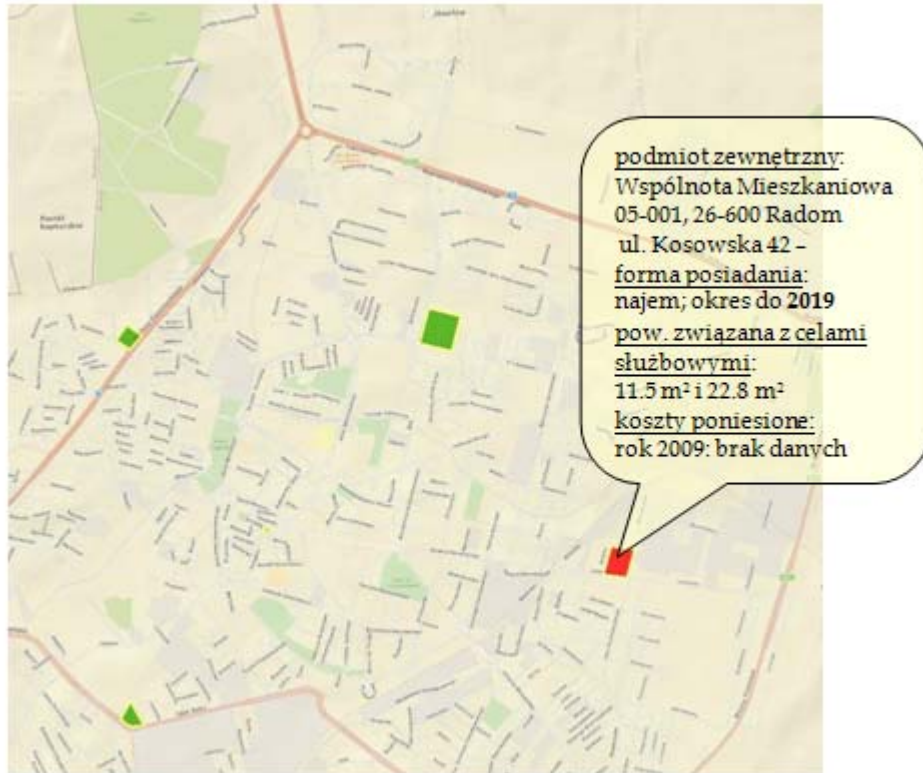


Fig.3. The real estates of Provincial Police Department in Radom with signed rent agreements. *Source: personal study.*

Another example of attribute query enhanced by spatial visualization is presented in Figure 4. The Police headquarters objects in Radom are localized under the address: Radom, Street of 11<sup>th</sup> November 37/59. The query concerned the object which was the most expensive in the year 2009 (due to the renovation works). The SZanNP System shows the localization, and also presents main information about the object. The above examples are the easiest GIS can face. Other similar or more complex analysis can be defined as well.



Fig.4. The real estates of headquarters of Provincial Police Department in Radom. The red one indicates the most expensive in the year 2009. *Source: personal study.*

## 6. SUMMARY

SZaNP with GIS module will assure effective management of Police real estates. The existing application is not suitable for the growing needs. The authors of the article suppose that complex data base that is to be offered will satisfy the users requirements. The system that will be elaborated could constantly be extended and adjusted. The new data will be easily added. Above all the proposed system will be compatible with other systems, which will be beneficial for the Police units. The SZaNP also gives possibility to use additional data, like topographic maps or ortophotomaps.

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