Possibilities of Application of Geographic Information Systems to Security Education

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Abstract

The basis of security education consists in analytical work which is aimed at averting or minimizing safety risks of different forms and their causes. The security environment is a dynamically evolving environment and its changes can be very effectively monitored by geographic information systems tools (GIS). GIS systems are commonly used worldwide as an effective tool for analysis and visualization of data, and are widely used in the field of security and security sciences.

Keywords: security education, crises management, security environment, GIS

1. Introduction

Practice highlights the need to modernize the educational process security staff. This means that an expert should be educated on the principles of modern knowledge-based society including the use of information communication technologies. Graduates focused on security should obtain and acquire knowledge to be able to analyze the security environment, identify and evaluate security risks and threats and predict their evolution, define procedures and measures to manage them (Kováčová & Vacková, 2014). They should also know how to manage managing crisis situations in accordance with available resources and capacities. Taking into account that today, managers have 10 times more information available than 10 years ago and 3 times less time to decide, it is necessary to utilise all support systems for analysing. Currently, there are a variety of special computer systems used for data analysis and decision support. Many government information systems are built on these systems and these systems should know...
graduates actively use in their work. Data processed in geographically oriented information systems further comprise a spatial component compared to conventional information systems. The spatial component allows evaluating and presenting phenomena not only qualitatively and quantitatively, but in addition the spatial context.

2. Geographic information systems in education

Information technologies are being utilized in the educational-application process nowadays. GIS systems are computer systems used to store, update, handle, analyze and present a text-numeric and graphic data (ová, 2013). Among the most universal GIS software include ArcGIS from ESRI. It is a system for creating, managing, and analyzing geographic data. ArcGIS is usually described as the most comprehensive GIS software thanks to a powerful tool for editing, analysis and modeling capabilities with data models. ArcGIS offers users several working environment - ArcMap (ArcView, ArcEditor, ArcInfo), ArcGlobe, ArcScene, and ArcCatalog ArcReader (Blišťanová, Blišťan & Križovský, 2013). It offers a tool to (Gonzalez, 2002):

- integrate spatial data from different sources, ranging from imagery to all kinds of geographic and alphanumeric data, using a consistent framework (e.g. providing a common geo-reference, presenting data sets as map layers, aggregating data to a scale required for analysis);
- analyze complex spatial relationships at great speed (e.g. map overlays, neighborhood analysis, network analysis);
- visualize results of computerized analysis (e.g. screen display, printed maps, graphs, and tables).

The use of GIS in social sciences and in many professional fields as well as engineering sciences, increased the need for qualified people (Korucu, 2012). ArcGIS is widely used in many industries as well as in government. In Slovakia, the government information systems operated just based on ArcGIS software. Slovakia is a member of the EU is bound by the directives, which provide free access to information, interoperability and data sharing in a common exchange formats common to all EU Member States.

The use of GIS in social sciences and in many professional fields as well as engineering sciences increased the need for qualified people. The increase of software number, decrease in expenditures and usage flexibility in GIS applications caused to solve the problems of design and planning. It also caused to be used widely by the people who had no technological experience. Especially, in recent years, aiming to generalize the use of GIS in educational activities, many people, organizations, institutions and companies have done various studies and the result of these studies have started to be seen (Korucu, 2012). Students in addition to education GIS systems acquire general computer skills as well as skills database. To general computer skill shall be assignable: file management, downloading and uploading Internet-based data manipulation (unzipping, saving, printing, formatting data). To database skills can be included classifying data differently, observing the results on maps, sorting, querying, creating and populating new fields. Students also learn to working in teams to tackle real world problems creating reports and presentations (Bednarz, 2004).

3. Application of GIS in security education

In the area of security GIS systems have a wide range of application from the analysis of the security environment through the classic but also special spatial analysis and simulation to the creation of outputs exactly to the requirements of individual participants.

3.1 Analysis of the security environment of GIS

The use of various software products for the analysis of the security environment is already standard, due to the efficiency and offering visualization and simulation tool. The current time is focused on informatization of society and it offers many of the necessary data in digital form, some directly usable in GIS. In Slovakia, there is a relatively large number of GIS implemented in the competence and management of the government or other entities. Among the most significant in scope and content of GIS can be assigned Information System Geodesy and Cartography (IS
GKK - ZBGIS), Military Information System area (visual) and the Environmental Information System (IS RU), which are an important source of spatial information. (Krömer, Musial & Folwarczny, 2010).

Fig. 1. 3D view of infringements in Košice in 2011 (Blistanova et al., 2013)

Quality input data and maps of risk sources are a precondition for a comprehensive assessment of territory or parts thereof. Mapping the risk assessment process, which identifies areas with different levels of risk. The resulting risk map allows identify the type and level of risk for each part of the study area. The risk mapping the classification and quantification of risk in relation to the territory. It is a measure of risk to the map (Krömer, Musial, Folwarczny, 2010).

Students should learn to create a comprehensive database of sources of risk - risk mapping. Consequently, they should learn to used properly tools for data processing, classify them and prepare map outputs appropriately presenting quantified risks. Examples include maps of crime (Fig. 1) fires or maps etc. ..

The analysis of the security environment is now an important part of security managers 32]. GIS systems are fully usable in the analysis of the security environment and the analysis results can be presented in the form:
- Online data warehousing offering primarily but also processed data,
- Web map services,
- Mapping portals,
- Normal map outputs - digital as well as printed.

3.2 Use GIS in crisis management and Decision-making

The area of crisis management is characterized primarily by the need for effective and quick decision-making, which involve working with large amounts of spatial data. Decision-making process within the security management is a process that presents a sequence of precisely defined steps (actions) that lead to the formulation of the problem to determine the objectives - solutions. Choosing the most suitable alternative solutions and taking a decision is the result of the decision-making process. Decision making is one of the most important activities, so is often referred as the core of management. Manager should obtain skills especially in the educational process at the university, or specialized courses. The process of experts education for management positions includes acquiring skills in the use
of specialized software aimed at supporting decision-making in crisis situations. GIS offer a wide range of tools for analyzing data and analysis results are used effectively in the decision-making process.

As an example may be mentioned the establishment of the GIS map server Fire and Rescue Service Olomouc Region. Specifically for crisis management layer objects were developed, emergency planning, health care facilities, emergency housing, food, etc.. There were also prepared flood extent maps from previous years, etc. These data are helpful in deciding for example, in the selection of evacuation points, planning routes and so on. (Černý & Korinek, 2010; Šimák, L2001). Slovakia is currently GIS in crisis management used only for coordination centers integrated rescue system, which are a prerequisite for localization of the caller. It is necessary to provide information for the most accurate definition of the conditions action by one or more components of the integrated rescue system for management action and coordination. GIS systems are, however, fully applicable to other tasks, from modeling phenomena such as flood wave, the spread of hazardous substances, fire, etc.. to capacity planning in addressing the crisis itself. Modeling phenomena requires deeper knowledge in several areas. These models should be the basis for job security managers, under which they should prepare different scenarios eg. planning rescue work (Fig. 2), etc. ..GIS should become an essential information tools for crisis staffs, not only at the level of central government authorities, but also at the municipal level. They are the perfect tool able to focus and present all relevant and timely data needed for effective decision-making process. GIS allow the effective cooperation of competent workers from different sectors and professions, and share important information. The indisputable advantage the crisis staffs is the possibility of modeling phenomena crisis and subsequent simulation of their further development (Lošonczi, Kelemen & Kováčová, 2013).

![Fig. 2. Use of GIS systems for evacuation planning (project result FLOODLOG)](image)

4. Conclusion

GIS systems offer a wide range of tools for solving a wide range of tasks. The advantage is their use in the analysis of the security environment by mapping resources through the assessment of the state to create maps for
risks and risk groups. They also have a wide application in areas such as crisis management and decision support. In the world are mapping GIS portals standards and the use of GIS systems in decision-making is a common practice. Despite the fact that in Slovakia there are geographic information systems in the field of used sufficiently, their integration in the study of security management its rationale in view of the continuing informatization of public administration as well as the possibilities offered by the practice. The introduction of teaching GIS to track objects within the security education in universities in Slovakia is an important step to be close to its advanced Europe and in the use of modern information technology in education.

References

Bednarz, S., W., (2004): Geographic information systems: A tool to support geography and environmental education? GeoJournal 60:191–199, 2004. Kluwer Academic Publishers. Printed in the Netherlands. P. 191 -199

Blištan, P., Blištanová, M. (2013). Digitálne zdroje údajov pre analýzu bezpečnostného prostredia. In: Recenzovaný zborník referátov z vedeckej konferencie so zahraničnou účasťou. Sustainability - Environment - Safety 2013. Bratislava, 11.-12. október. Vydal: STRIX - Žilina.

Blištanová, M., (2013). Možnosti analýzy bezpečnostného prostredia nástroji GIS. In: Bezpieczenstvo w procesach globalizacji – Dzis i jutro. Katowice. Str 9-18.

Blištanová, M., Blištán, P., Krížovský, S., (2013). Mapovanie kriminality v meste Košice. Vysoká škola bezpečnostného manažérstva v Košiciach, vydanie prvé, Košice, s.88, ISBN: 978-0-89282-90-6.

Černý, J., Korinek, K., (2010). Využití geografického informačního systému HZS Olomouckého kraje v oblasti krízového řízení. In: Časopis 112, ročník IX, číslo 4/2010. Dostupné on line: http://www.hzsocr.cz/casopis/casopis-112-rocnik-ix-cislo-4-2010.aspx?q=Y2hudW09Ng%3D%3D

Gonzalez, R.M., (2002). Joint learning with GIS: multi-actor resource management. In: Agricultural Systems 73, 99–111

Korucu, M., G., (2012): GIS and types of GIS education programs. Procedia - Social and Behavioral Sciences 46, 209 – 215.

Kováčová, L. - Vacková, M. (2014). Achieving of environmental safety through education of modern oriented society, In: Conference proceedings of 14th GeoConference on Ecology, Economics, Education and Legislation, 17-26. June, Bulgaria, Volume II, ISBN 978-619-7105-18-6, str. 3-8.

Krömer, A., Musial, P., Folwarczny, L. (2010). Mapování rizik. Vydalo Sdružení požárního a bezpečnostného inženýrství v Ostrave, str, 126. ISBN: 978-80-7385-086-9.

Lošonczi P., Kelemen, M., Kováčová, L., (2013): Identifikácia, analýza a hodnotenie využitia krízových scenárov v bezpečnostnej edukácii na VŠBM v Košiciach. In: Košická bezpečnostná revue. - ISSN 1338 - 4880. - Roč. 3, č. 1, s. 83 - 90.

Šimák, L., (2001). Krízový manažment a geoinformácie pri riešení krízových situácií.