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Smart Collaborative Platform for eLearning with application in Spatial Enabled Society

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Abstract

Spatially Enabled Society enables new educational opportunities and perspectives, by introducing integrative and multi-disciplinary approach in different scientific domains interconnected on a real time information platform. The paradigm proposed here is to learn at work place by doing and by collaborating at level of technology, information and the level of involved personal. As case study, we propose to develop an educational platform in urban planning field, are aiming to provide a real time data base, a network based on interchanges generated by different scientific stakeholders. Creating such a platform to build a bridge between academia and the private sector as well as interfaces between different disciplines and specialists and every citizen is still a challenge.

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Keywords: spatial framework, spatial enabled society, critical thinking, decision making, eLearning collaborative platform

1. Introduction

This paper proposes a Smart integrative Collaborative Platform for eLearning which can be used in real-time and by various users in order to detect and assess the processes that characterize urban and territorial development. This type of approach is focused on correlation of territorial change detection and processes related by correlation of

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various indicators and information from different domains dealing with territorial development, as well, which are influencing it. The Smart Collaborative Platform for eLearning proposes introduction of new educational methods in urban planning based on definitions configured at the level of developed applications and geospatial database information's level for relevant domains and processes. The informational tools that can be developed will provide basis for dynamic and integrated approach of the territory in order to define real- time evolution and assessment with immediate applications in interventions proposed. This integrative real-time approach trough interconnected data bases provides new opportunities for various stakeholders to monitor, asses, introduce data and provide actions in urban planning field: academia, students, enterprises, researchers, etc. At European and international level diverse methods are developed in order to identify land use changes or to reduce vulnerability to natural or anthropogenic hazards. Main tendencies in this field include two distinct directions focused mainly on data change interpretation (based on digital methods and tools: sensors, drones, spectral images interpretation, etc.) or on interpretation of specific indicators and Geographic Information Systems (GIS) aggregation in order to asses evolution in specific contexts. Initiatives use various platforms and data basis, related and with applicability and immediate results in specific research field that primary generated the initiative but without any connection between domains or in an integrative common platform. As result, one characteristic for existing European initiatives is fragmented approach of problematic of territorial development. A Smart Collaborative Platform creates the possibility to assess former changes of the territory, to predict and to react in real- time to developing processes; as well to assess interventions impact by forecasting territorial systemic reactions to diverse actions. This paper envisages to define new integrative informational environments that aim the integration of different assessment tools for urban/ territorial change detection (remote sensing, data base indicators, GIS, large text collections, image collections, etc.) with consequences on the territory and applications in spatial planning based on geospatial technologies' tools, as description of the research and applicative process from data aggregation and analysis of current situation, prediction (forecasting) of future evolution, alarm system in real time for increased negative processes and assessment of proposed. Main characteristic of a Smart Collaborative Platform for educational (and not only) purposes is trans-disciplinary approach of the territorial development problematic, by emphasizing in the same product of different domain approaches, usually used in planning as fragmented techniques (spatial planning tool) for efficient management, early detection and impact assessment of interventions; a Smart Collaborative Platform with educational purposes aims to integrate the data provided by academia with small enterprises data (acquired form urban planning practice) and other disparate data, in order to reveal in real time temporary territorial states. The rationale of a Smart Collaborative Platform used for educational (and not only) purposes in urban/ territorial planning field is to stepping up to the challenge of reduce consequences caused by urbanization (and related processes) by integrating diverse techniques and data used in social sciences, economy, urban planning, informational products and remote sensing techniques, as well as traditional fields of engineering and earth sciences.

2. State of the art

In the search for new approaches to respond to the need for good professional and academic education in Spatial Enabled Society (SES) applications, e-learning has proven to be a good alternative to traditional classroom education. eLearning can play a crucial role in capacity building in Spatial Enabled Society applications in different countries. Several aspects of e-learning are highly relevant for academic education in Spatial Enabled Society applications. eLearning supports student-centered learning approaches and knowledge exchange between students from all over the world contributing to the global knowledge bases. eLearning supports lifelong learning and continuous development of different professionals involved in the development of Spatial Enabled Society applications using geospatial information and geospatial technologies. High numbers qualified professionals are needed to implement and maintain sustainable geospatial information systems. Through e-learning large numbers of persons can be reached and trained. The major key international trends in the field of education for the development of Spatial Enabled Society applications could be classified as follows: management skills, versus specialist skills; project organized education, versus subject based education; virtual academy, versus classroom lecture courses; life-long learning, versus vocational training. Besides the new requirements from a professional point of view the academic surveying education nowadays is affected by additional determining factors like globalization, demographic development, and new public management (FIG, 2010; OECD, 2005). Professionals of today work in

an increasingly global market and the profession has grown rapidly beyond cadastral surveying, with increasing application of surveying and mapping technologies in other sectors (Fairlie, 2009). Higher education institutions and other training institutions have been looking for new ways to respond to the changing professional field. As mentioned in (FIG, 2010).the following paradigm shift in academic education is taking place:

a) From teaching to learning:
   Traditional, subject-orientated teaching will be substituted by individual project-orientated and self-organized learning. Teachers' role is changing from presenters and instructors to facilitators, mentors, tutors, coaches, and consulters.
b) From timed and on-site lectures to time and site independent education:
   Modern educational methods enable self-paced and self-directed learning with a high flexibility on time and site.
c) From self-contained studies to life-long-learning:
   The increase of worldwide knowledge is estimated to be doubled within four years. Therefore the existing concept of self-contained study courses will be replaced by the concept of continuing professional development.

eLearning is a proper facilitator to manage this paradigm shift in education. E-learning methods and tools have been introduced and are now playing an increasing role in education (FIG, 2010).Markus (2008) defines e-learning as follows:

"…e-learning is a learning process created by interaction with digitally delivered content, network-based services and tutoring support. This definition focuses on the revolutionary impact of network-enabled technology. Adding more details on methodology: e-learning is any technologically mediated learning using computers whether from a distance or in face to face classroom setting (computer assisted learning), it is a shift from traditional education or training to ICT-based personalized, flexible, individual, self-organized, collaborative learning based on a community of learners, teachers, facilitators, experts...".

At European and international level diverse research projects, publications and informatics applications have been developed in order to identify land use changes or various urban development processes with territorial influence. Main tendencies in this field include two distinct directions focused mainly on data change interpretation (based digital methods and tools: sensors, drones, etc.) or on interpretation of specific indicators and Geographic Information Systems (GIS) aggregation in order to asses evolution in specific contexts. Initiatives refer to risk prevention, vulnerability reduction or limitation of territorial transformation (land cover change, urban sprawl, deforestation, etc.) being related and with applicability and immediate results in specific research field that primary generated the initiative. For example EEA CORINE land cover (http://www.eea.europa.eu/publications/COR0-landcover) project used creation of high resolution land cover data, as part of the implementation of the Global Monitoring for Environment and Security (GMES) fast track service on land monitoring. The study is focused on determination of land use changes related to urban areas. Based on this study conclusions and data sets were developed several GIS- based assessments methodologies and analysis as fundaments for diverse development strategies. Other GIS-based assessments using CORINE data looked at the land cover/use changes in the coastal area of Istanbul (Yılmaz, 2010), assessed vulnerability to Etna volcano eruption (Rapicetta & Zanon, 2009), monitored changes in UK Natura 2000 sites (Thomson, et all., 2007) assess soil erosion risk in Ankara, Turkey (Bayramin, Erpul & Erdoğan, 2006), monitored changes in Antalya (Sonmez, Onur, Sari & Maktav, 2009), derived agri-environmental indicators (Büttner, Maucha & Kosztra 2002), evaluated land cover changes in specific countries - Slovakia and The Netherlands (Feranec, Hazeu, Christensen & Jaffrain, 2007) or in general (Alboody, Sedes & Inglada 2008).

3. The general architecture of the Smart Collaborative Platform for eLearning

In this framework we propose a Smart Collaborative Platform (SCP) in order to create value to customer by:

Fig. 1. The paradigm of the Smart Collaborative Platform for eLearning

The Learning Stack building is based on the scenarios including the formulation of problem(s) to be solved, some simulations of the initial solutions, the steps to be followed, the internal/external data (re)sources, the technologies to be used in order to learn by experience, to manage the content, for web-conferencing, to capture lecture, mobile applications, e-Portfolio, the tools for communication and collaboration.

Based on the experience of the authors, we firstly defined some general requirements that are relevant to the proposed platform:

(i) possibility of easy and flexible use minimum burdened by the underlying technology;

(ii) process alignment;

(iii) hierarchy of complex rules underlying the platform as a way to enforce the desired functionality guaranteeing that all users will be properly served.

Taking these high-level demands that relate to the technological perspective, we shall combine them with the domain details, concluding that the platform must be capable of enabling and facilitating an innovative methodology on how to conduct the learning process. In the literature (Shishkov & Van Sinderen, 2008), from this objective, some requirements elaboration was derived:

- it should be possible to mix and match learning modules offered by different organizations on geographically distributed nodes using diverse technologies;

- the mixing and matching is typically prepared and constrained by customization, by defining learning profiles, learning paths and learning policies that are generally useful with regard to a goal;

- it should be easy to add, remove and update learning modules so as to keep pace with changes in knowledge/skill demands and to profit from the availability of new or improved learning modules;

- it should be possible for the people involved as students in the Smart Collaborative Platform for eLearning in Spatial Enabled Society to transfer their experience and expertise to other people also involved as students by contributing to or co-creating the content of certain learning modules;

- the delivery of learning content should be automatically adaptable to personal conditions, such as availability, place and device characteristics, using context sensors and context reasoning.

In Platform for eLearning in Spatial Enabled Society it will be necessary to take into account also the following issues (Shishkov & Van Sinderen, 2008):

- the *education services* may be supported in terms of Information Technology and Communications (ITC) services which in turn are provided by *generic education service components*;

- *business processes* need to be analyzed in order to adequately determine orchestration (coordination) with regard to the use of Information Technology and Communications services.

A business process implements an education service, as a way to underlie the desired functionality that corresponds to a customer (end-user) need. The business process needs to be analyzed in order to define adequately data and control flow in which the supporting Information Technology and Communications services are called in the right order and with the right parameters. Thus the Information Technology and Communications services point to service components that are in general not especially developed for the application under consideration, although they are specific for the education field. They need to be configured (instantiated with the proper parameter values) in order to lead to the realization of Information Technology and Communications services that relate to business process actions (Shishkov & Van Sinderen, 2008). On the short, the goal of Platform for eLearning in Spatial Enabled Society is to be a sustainable platform for smart learning, teaching, innovation and discovery with application in Spatial Enabled Society that will be an interactive learning platform having as tasks knowledge delivery and interaction; a service oriented learning platform; sustainable learning platform based on a development strategy according to the cost-effective interaction/ expansion associated with a Learning Stack based on the scenarios including the formulation of problem(s) to be solved, some simulations of the initial solutions, the steps to be followed, the internal/external information (re)sources, the technologies to be used in order to learn by experience, to manage the content, for web-conferencing, to capture lecture, mobile applications, e-Portfolio, the tools for communication and collaboration concerns the development of the courses based on the users scenarios, the most important aspect being the capitalization information and knowledge (turning them into actionable information for decision making) obtained by interconnecting technologies on the current Intergraph Geospatial Technology conceptual vision and taking into account the aspects mentioned in the State of the art.

4. Methodological aspects in using geospatial technology in urban planning education and practice

It is in our intention to build a common integrative platform dedicated to centralize in real-time transformations and vulnerability of territory based on various sources information's: indicators collections, digital data collections (images, large text collections, etc.). The educative platform proposed extents the applications of different methodology used in related domains to spatial planning in order to define new systems and applications for efficient management of urban and territorial development. Major end-product is to develop an applicative geospatial information product based on networking and cloud technology in order to define and assess changes as well negative processes in real time, based on various data sets uploaded by different users. One characteristic for existing European initiatives is fragmented approach of problematic of the territory disparate in accordance with each sub-domain: educational, practice, administration and governance, etc.; in accordance, proposed measures for each domain rarely integrate inter-disciplinary and multi-level problematic or measures. From this perspective, spatial planning approached as a spatial enabled society trough tools and integrative network platforms can be one of the integrative domains of these fragmented specific measures by providing the appropriate tools for assessment of negative transformations (referring to multiple variables and parameters). The paradigm proposed here is to learn at work place by doing and by collaborating at level of technology, information and the level of involved personal.

5. Results

As mentioned in (Ledward, & Hirata, 2011)

"*Success in today's world requires the ability to access, synthesize, and communicate information; to work collaboratively across differences to solve complex problems; and to create new knowledge through the innovative use of multiple technologies*. "

In order to exemplify the complexity of how to work the Smart Collaborative Platform for eLearning for Spatially Enabling Society applications shall give a typical example from the current work. *The problem.* At a public utility company, with points distributed throughout the country, have to monitor all kinds of events (natural or caused by man) that can cause disasters. *The question.* How to build an application to alert some time before the occurrence of the event and / or disaster and how to plan the intervention in order to mitigate the consequences? In order to offer a solution for this problem, first of all it is necessary to have a spatial framework in order to identify with more accuracy the monitored places and to have the possibility to visualize. This require to manage the geospatial data provided by different sources and/or to access spatial data infrastructures in order to create the

spatial framework to fit well to the problem. And after to identify and (learn) to use the appropriate tools in order to visualize exactly the affected place (figure 2). In order to establish the details it is necessary to (learn how to) obtain more detailed data from the geospatial databases in connection with affected area (figure 3) based on existing resources. From detailed information obtained from different informational resources ((geo)databases, studies, etc.) has to distinguish on type of danger, based on the historical data, risk analysis, experience of workers, etc. and to make the appropriate association (figure 4). After the identification of danger(s) it is possible to send an alert according to the procedures of company and to the laws to the operational centers (figure 5) and, in the same time, the necessary and detailed information for decision making (figure 6) according to the type of intervention(s), the involved intervention's team(s), the tasks of every team and/or member of team, the plan of action on how to organize the points of intervention in the field (figure 7).

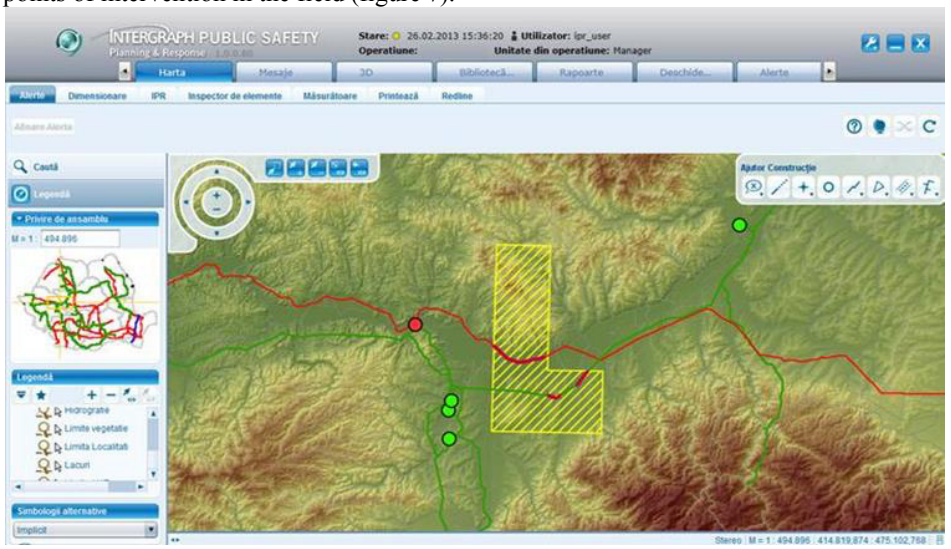

Fig. 2. Affected area

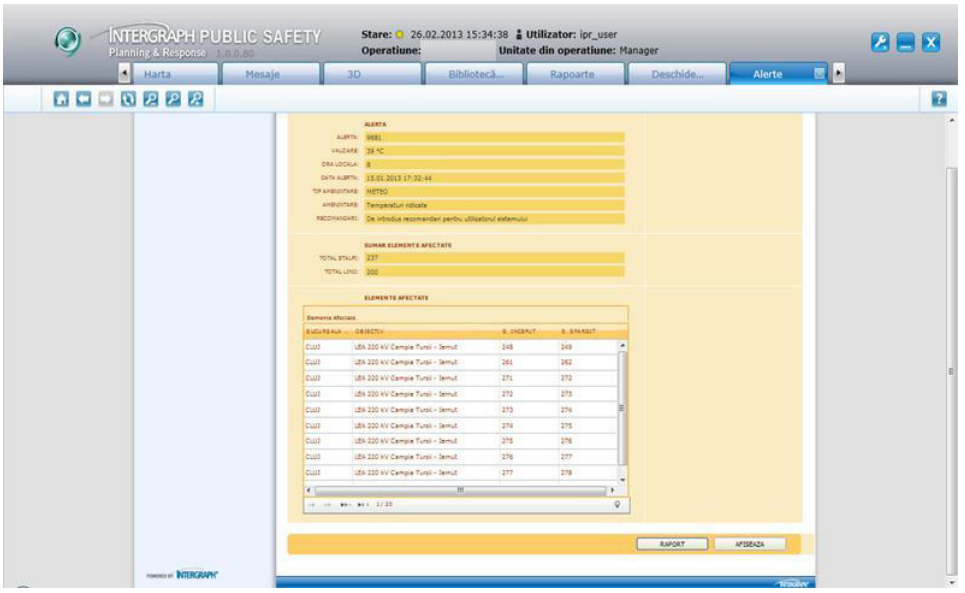

Fig. 3. The detailed information from geospatial database regarding the affected area

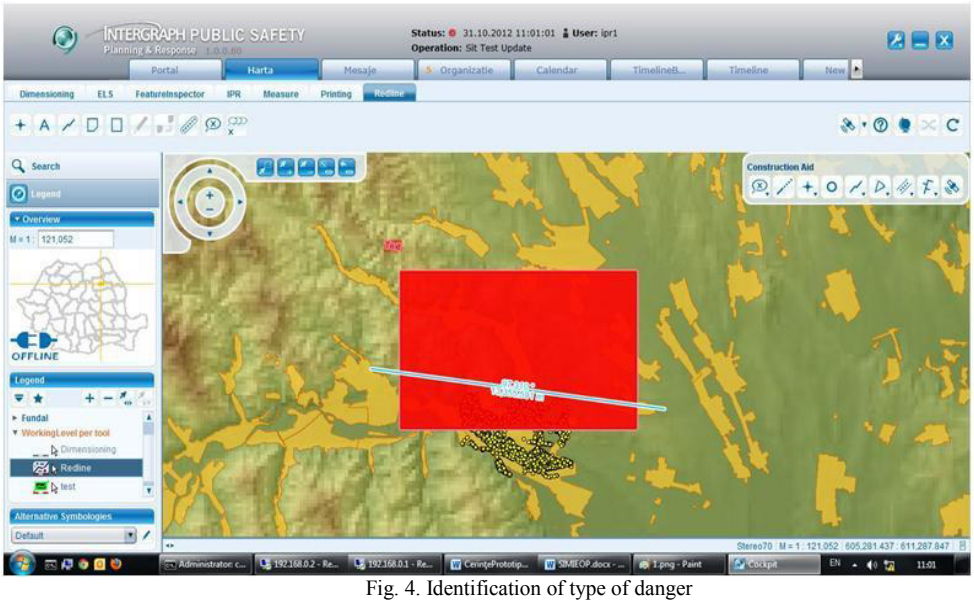

Fig. 4. Identification of type of danger

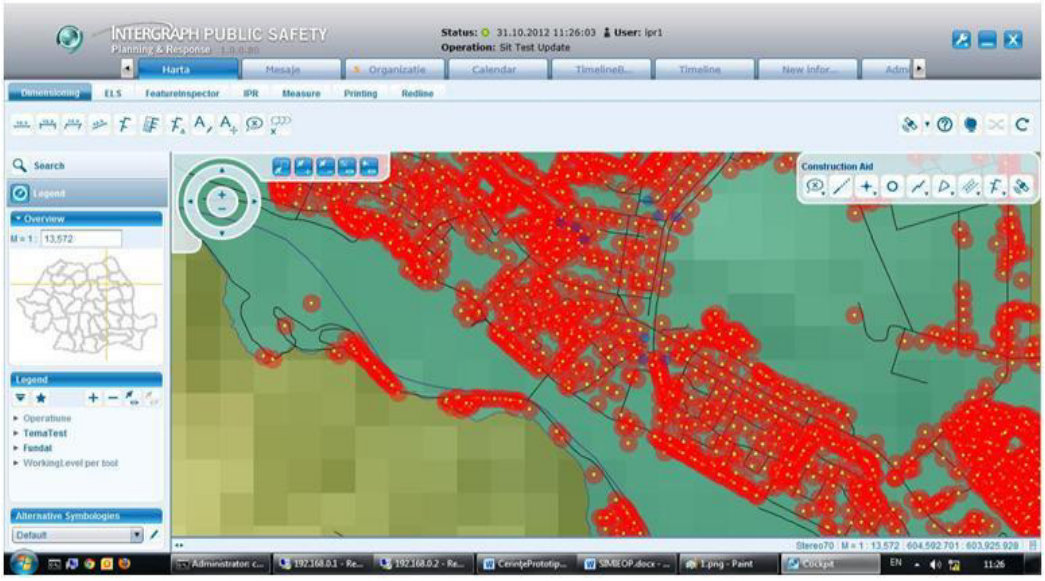

Fig. 5. An alert for affected areas

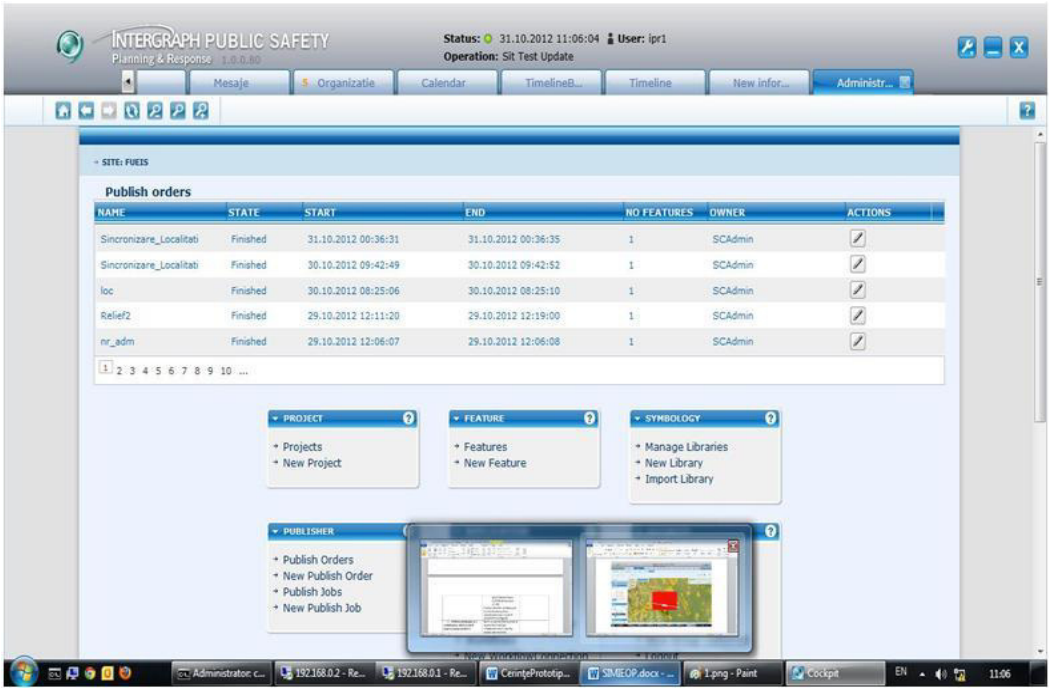

Fig. 6. The information for decision maker

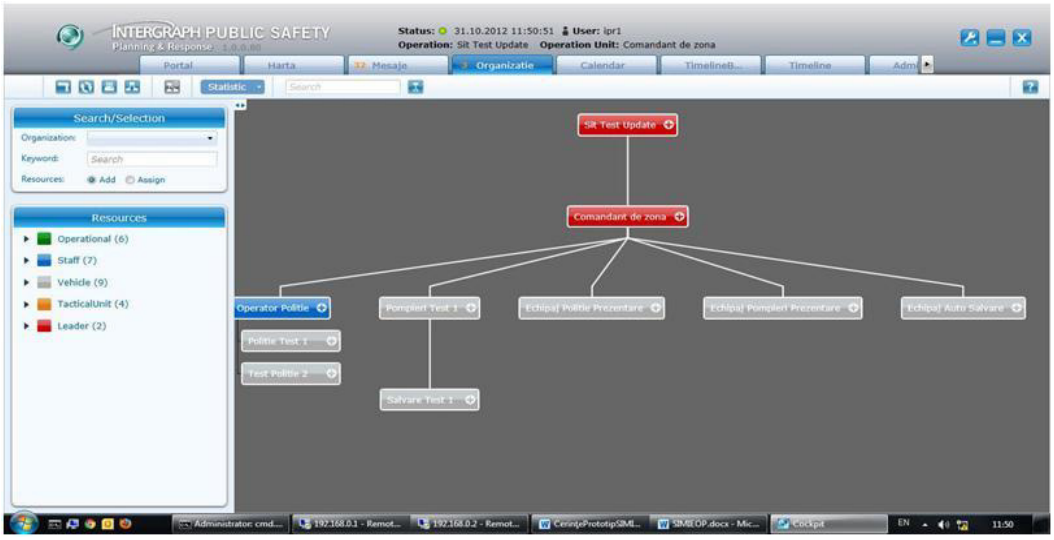

Fig. 7. The information for decision makers regarding the tasks in case of intervention(s) in affected area(s)

A possible succession of generic steps (figure 8) and the lessons (to be) learned (table 1) refers but not limited to:

- Identification of the available sources of data and informational resources;
- Identification of available tools for data processing and experience on how to use;
- Investigation on how to establish the type of danger from existing information;

- Investigation on the existing procedures in order to send the appropriate alert to appropriate center or person in charge;
- How to send the detailed information for intervention(s);
- Based On Geospatial Technology Provided By Intergraph Co.
- On The Smart Collaborative Platform For Elearning

Table 1.The succession of lessons (to be) learned in the Smart Collaborative Platform for eLearning with application in Spatial Enabled Society

	to discover			to learn	to obtain
Entity	State		background	to use associated technolc and protocols,	how to use an appropriate technolgy. effective experience in how to develop an *application for risk monitoring*
sources of data	heterogeneous, fragmented, public, private, SDIs, collections of indicators, census, digital data collections, geospatial metadata, digital maps collections, standards		laws, rules and methods for access	standards, business rules	
processing data tools	free, company, open sources, in-house developed etc.		laws, rules, formats and methods for access	associated technolc and protocols, standards	
type of danger	interdisciplinary studies, techniques and algorithms, collections of indicators, digital data collections, history		assignments based on procedure, rules, law	Symbology technology and protocols for	
danger	knowledge about danger, vulnerability, indicators, etc.		laws, rules and procedure for sending	sending/receiving, standards	
decision making information for intervention	knowledge about decision making, analysis, algorithms, tools and systems		laws, rules, formats, methods, algorithms, interpretations, interdisciplinary background methods for sending and accessing	methods, algorithm decision making to and systems associated technolc and the plan for intervention(s)	
geospatial technology	sources, formats, rules, collections, standards integrated, non-integrated, open sources, company, public or private, complying interoperability principles or not, complying with standards or not, chipper or expensive costs	free, company, open sources, in-house developed etc.	technique and economic criteria and rules for establishing the appropriate technology to be used		

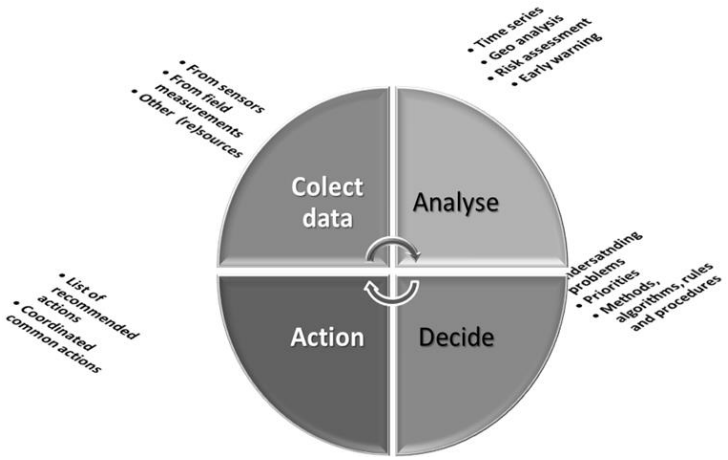

Fig. 8. The generic steps in the Smart Collaborative Platform for eLearning with application in Spatial Enabled Society

6. Conclusions and further development principles

Spatial Enabled Society seen as a Smart common Collaborative (integrative) educational and practice Platform in spatial planning field endeavors implementation of an ambitious but feasible technical research program. Within this framework a number of specific technological objectives have been identified and set as prerequisites for a Smart common Collaborative (integrative) educational and practice Platform in spatial planning field:

- Development of improved educational tools for spatial planning. This is achieved through the development and implementation and state of the art instrumentation techniques for different domains (geography, Geographic Information Systems, ecology, urban and spatial planning, economy, remote sensing) for monitoring land change that occur. Such techniques are complemented by Geographic Information Systems methodologies employed in the assemblage of geo-databases, data analysis, spectral image interpretation and evolution forecasting, interconnected in a real time network platform.
- Development of an integrative platform and real time database for decision making support for spatial planning. Besides the integration of different techniques and use of a complex indicators datasets, the Geographic Information Systems application will be developed in order to asses in real- time the impact of different interventions.

Main benefits of a Smart integrative spatial Collaborative Platform:
- Methodological principles for defining and establish hierarchy and priority of territorial transformations (causes: urbanization, urban sprawl, intensive land use, deforestation, land use change, etc.).
- Development and implementation of a Smart common Collaborative Platform which combines different tools and digital techniques (based on integrative indicators data-basis interpretation and digital methods) for each type of territorial transformation considered as a negative or potential negative process.
- Defining an integrative platform and applicative process from data aggregation and analysis of current situation, prediction (forecasting) of future evolution.
- Preparing interesting people (students, teachers, specialists in different domains, researchers, every citizens) to compete in a global economy by supporting critical thinking and problem solving, communication, collaboration, and creativity and innovation.
- Building a bridge between academia and the private sector as well as interfaces between different disciplines and specialists and every citizen.
- Connecting focus groups, collaborative projects and subsidiary projects but also users' groups.
– Proposing a new paradigm: to learn at work place by doing and by collaborating at level of technology, information and the levels of involved personal.

The geospatial application for Spatial Enabled Society will allow the view of all information of the current situation and the future forecasts. Through overlapping and integrated analysis it will be possible the selections of the most appropriate development scenarios. Information layers will be aggregated on different scenarios to respond to ad hoc, pre-defined or combined specific requirements. The time attribute will be added to highlight the current historical situation or thematically forecasting.

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