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Fusion of Knowledge Management for Sustainable Development of GIS & Remote Sensing

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Abstract The knowledge management system included a customized user interface for data. A geographic information system enables us to view, analyze and understand multiple geographically referenced data. It provides us with location based information on like-vegetation, roads, villages, town, cities, or water supplies. GIS is often used for explaining events, predicting outcomes, and planning strategies. Remote sensing is the measurement of the earth using sensors on airplanes or satellites this provide a repetitive consistent view of earth, facilitating the ability to monitor the earth system and the effect of human activities on earth. Remote sensed imagery is integrated within a GIS environment. The combination of the two gives us extensive geographical knowledge. We can apply this knowledge to the way we design and develop the project. An excellent tool that is increasingly important in the detection, description, quantification and monitoring environmental changes is Remote Sensing, which, in combination with geographic information systems and fieldwork, is an effective management tool. In this paper, fusion of knowledge management for sustainable development of GIS and remote sensing for land management is reviewed, and the potential of new satellite systems to contribute to sustainable development is explored. Other elements for successful sustainable development are then compared and contrasted with information requirements.
Keywords *Remote Sensing; Data Base Technology; Image Processing; Geographic Information System; Modeling*

1. Introduction

In this time the use of remote sensing techniques widely increase due to best method of facing problem. Remote sensing has potential to detect, map and monitor degradation problems including their spread and effects with time (Adel et al., 2007). Remote Sensing has been viewed as the one of the most effective tools for environment monitoring, urban resources and environment investigation, change detection and urban growth analysis in mining industrial cities. Now days, the spatial resolutions available are going from a meter or less to few kilometers and with finest spectral resolutions (Baader, 2004). The Earth Observation data are provided by optical sensors, this new situation opens new applications and new fields of research in Earth observation (Ellis and Kalumbi, 1998). In any definition of sustainability, the key element is change (Bo et al., 1999); for example, Fresco defines sustainability as the dynamic equilibrium between input and output, In other words, they emphasize that dynamic equilibrium implies change and that in order for a land system to be sustainable, its potential for production should not decrease (Miyata et al., 2004)

2. Data Base Technology and Management System (DBMS)

Modern database technologies are based on a separation between the logical representation of the data and its physical instantiation so that one can be changed without affecting the others (Mc Guinness et al., 2006). A database management system (DBMS) stores data and provides facilities for management (Gennari et al., 2002). Managing the satellite imagery information, we design the structure of data in hierarchical process. The DBMS can offer both logical and physical data independence. That means it can protect users and applications from needing to know where data is stored or having to be concerned about changes to the physical structure of data (King et al., 2008). The development and management of information technology tools assists executives and the general workforce in performing any tasks related to the processing of information (Nair et al., 2000). Management Information system and business system are especially useful in the business data and the production of reports to be used as tools for decision making (Yu, 2007).

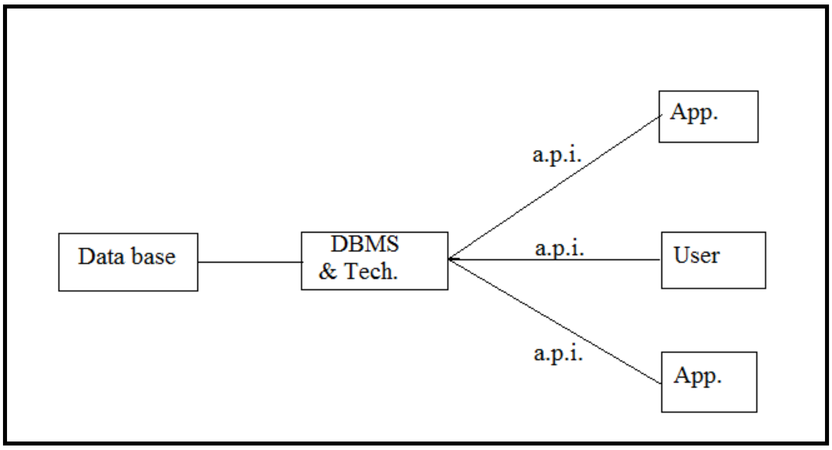

Figure 1: *Flow Diagram of Database Management System*

Using a DBMS to store and manage data comes with advantages. One of the biggest advantages of using a DBMS is that it lets end users and application programmers access and use the same data while managing data integrity (Adrades, 2002). Data is better protected and maintained when it can be shared using a DBMS instead of creating new iterations of the same data stored in new files for every new application (Li et al., 2000; Chieng et al., 2000).

3. Internet/Intranet Technology

Knowledge is the exchequer of what we already have learned. It may be evident, as in intranet content, or it may be latent as in relationships and processes that may not be documented. Knowledge and learning are iterative (Avaniti et al., 2000). The Internet is particularly well suited to facilitate and support a new and increasingly more popular medium in development, so called Knowledge Networks (Zhang, 2002). Knowledge Networks in the area of development are dedicated to the discovery of new knowledge and its application for the advantage of developing nations and regions (Hill et al., 1999). Development in Internet technology and its more acceptance and popularity there are many products available today to facilitate knowledge sharing and coloring using web technology (Scherk, 1983). The main advantage of web-based technology is it can be deployed in Internet or in intranet within the organization. Internet is also used to create a VPN (virtual private network) using internet as medium of data transmission (Gokaroju et al., 2010). We will discuss more about internet based on knowledge management system here. Organizations have used different platforms to stud a knowledge management system but in all most all cases a web browser is used as client end tool to access the knowledge management system (Sur, 2012).

4. Global Positioning System (GPS)

A satellite system that projects information to GPS receivers on the ground, enabling users to determine latitude and longitude coordinates. GPS use satellite data to calculate an accurate position on the earth. These calculations can relate the user's position to almost any map projection within micro-seconds. All GPS work in a similar manner but they often look very different and have different software (Adam et al., 1997). The most significant difference between GPS receivers is the number of satellites they can simultaneously communicate. The position reported by the receiver on the ground is a calculated position based on range-finding triangulation (Bayr et al., 1994). GPS positioning is achieved by measuring the time taken for a signal to reach a receiver (Gratton, 1990). The receiver knows that the portion of the signal received from the satellite matches exactly with a portion it generated a set number of seconds ago. There are three segments of GPS. The space segments consist of 24 satellites circling the earth at 12000 miles in altitude, the high altitude cover large area (Sharma, 1999). Each satellite transmits low radio signals with a unique code on different frequencies. The main purpose of these coded signals is to allow for calculating travel time from the satellite to the GPS receiver. The travel time multiplied by the speed of light equals the distance from the satellite to the GPS receiver. The control segment tracks the satellites and then provides them with corrected orbital and time information. The control segment consists of our unmanned control stations and one master control station. The four unmanned stations receive data from the satellites and then send that information to the master control station where it is corrected and sent back to the satellites. The user segment consists of the users and their GPS receivers (Mandal, 1999).

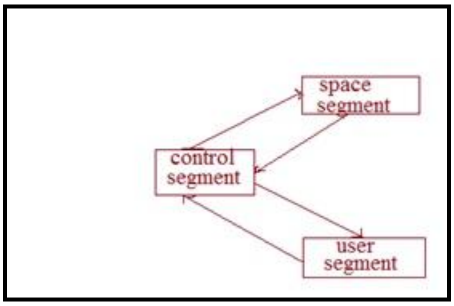

Figure 2: *Global Positioning System*

5. Image Processing

The digital image processing basically concerned with four basic operations: image restoration, image enhancement, image classification, and image transformation. The image restoration is concerned with the correction and calibration of images in order to achieve as faithful representation of the earth surface as possible. Image enhancement is predominantly concerned with the modification of images to optimize their appearance to the visual system. Image classification refers to the computer-assisted interpretation of images that is vital to GIS. The image transformation refers to the derivation of new imagery as a result of some mathematical treatment of the raw image bands (Garter, 1992).

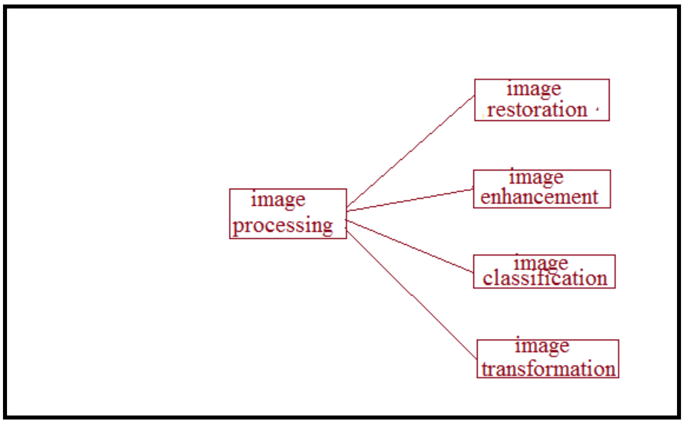

Figure 3: *Image Processing System*

In case of using multispectral data, improvements of the resolution can be gained by merging the panchromatic channel with color channels (Binaghi, 1993).

6. Artificial Intelligence

Artificial intelligence (AI) is the intelligence exhibited by machines or software. It is an academic field of study which studies how to create computers and computer software that are capable of intelligent behavior. Major Artificial Intelligence researchers and textbooks define this field as "the study and design of intelligent agents", in which an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success (Weera Singhe et al., 2011). According to a research made recently, it was discovered that there are some of the Artificial Intelligence products which could prove more beneficial when applied to remote sensing applications (Habib et al., 2000). Those tools are,

1) Knowledge based system
2) Automatic data acquisition
3) Natural network
4) Genetic algorithms
5) Ambient-intelligence (Csath et al., 1999).

7. Decision Support System (DSS)

A decision support system (DSS) is a computer program application that analyzes business data and presents it so that users can make business decisions more easily (Lee, 2002). It is an "informational application" to distinguish it from an "operational application" that collects the data in the course of normal business operation. Typical information that a decision support application might gather and present would be:

1) Comparative sales between one week and the next;
2) Projected revenue figures based on new product sales assumptions;
3) The consequences of different decision alternatives, given past experience in a context that is described.

A decision support system may present information graphically and may include an expert system or artificial intelligence (AI). It may be aimed at business executives or some other group of knowledge workers (Wald, 1999). Decision Support System Experiences, Management, and Education e.g. experiences in developing or operating Decision Support Systems ; systems solutions to specific decision support needs; approaches to managing Decision Support Systems; DSS instruction/ training approaches (Zalmanson, 2000).

Three type of data used in DSS

1) Oral (i.e. transcribed conversation)
2) Written (i.e. report, memos, email and other correspondence)
3) Video (i.e. TV and news reports) (Sanjeev Singh and Yasirkarim, 2011).

8. Expert System (ES)

It is in artificial intelligence that expert systems have had the most impact, especially in finance, telecommunications, customer service, transportation, aviation, and more recently, written communication. It is knowledge based systems; it capable of integrating the preservative of individual's disciplines (e.g. plant pathology, entomology, and horticulture) (Kojima and Takagi, 2009).

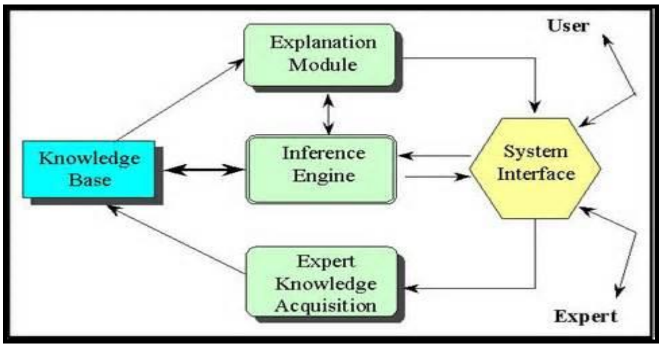

Figure 4: *Flow Diagram of Expert System*

The strength of an Expert System derives from its knowledge based an organized collection of facts and heuristics about the systems domain. An expert system is built in a process known as knowledge engineering, during which knowledge about the domain is acquired from human experts and other sources by knowledge engineers (Franklin et al., 1991). The accumulation of knowledge in knowledge bases, from which conclusions are to be drawn by the inference engine, is the hallmark of an expert system. An expert system is no substitute for a knowledge worker's overall performance of the problem-solving task, but these systems can reduce the amount of work individual must do to solve a problem, and they do leave people with the creative and innovative aspects of problem solving (Hall Kanyyes, 1987).

9. Remote Sensing

Remote Sensing has been viewed as the one of the most effective tools for environment monitoring. Space technologies have been successfully utilized worldwide in natural resources and disaster management, with the availability of high-resolution remote sensing data, monitoring of land, water resource and coasting at local scales has become possible to resource managers as a way to create timely and reliable assessments (Polidori et al., 1991). However, with respect to island ecosystem management, realization of advantage of remote sensing data for small island developing states depends upon the ability to derive incidental and detailed local information from remote sensing data and integrating it with other non-spatial information (Aguda, 1992). Three recent innovations in remote sensing (radar, hyper spectral imaging and high spatial resolution) offer promising techniques to assist sustainable development. Radar is frequently referred as a solution for mapping the structure of vegetation as well as the moisture of soils and geographical patterns. Hyper spectral remotely sensed data provide information on vegetation floristic, soil type and soil chemistry. High spatial resolution images will offer extremely high spatial resolution images (comparable to aerial photographs) within a few hours of acquisition. These innovations are reviewed, and their potential for monitoring and mapping sustainable land management (Mc Carthy et al., 1998).

10. Geographic Information System

GIS offers powerful tools for collection, storage, management and display of map related information, and helpful in judging management decisions (De Wulf et al., 1990). Potential of remote sensing and GIS for specific purposes is discussed below. From the project objectives pint of view, the GIS model helps to make decisions along a set of queries some of which include showing, the spatial distribution of different natural resources in the area, spatial distribution of some socioeconomic facilities and services, land capability and suitability analysis, land allocation, determination of carrying capacity, land improvement measures and environmental quality monitoring (Whitley et al., 1989). Geographic Information Systems and spatial technology have been around for decades. However, none of these tools were as suitable and applicable to small farmers today. The use of these tools has been a topic of great interest in the World (Rousset et al., 1987).

11. Summary and Conclusion

Construction of big projects in field of civil engineering the full knowledge of Geoinformatics is must for advanced surveys. Advanced surveys of large area done by aerial photography taken by cameras from the elevation point in the air with the help of kite, pigeons, helicopters etc. In modern time remote sensing provides clear photographs of that area with the help of satellite. Global positioning system give accurate knowledge of the earth's surface on the navigation map with in micro second with the help of satellite. Geographical information system is capable to manipulate the geological information of the earth's surface. GIS which address a broad spectrum of users such as public agencies, local communities, civil society organizations, the private sector, academic environment, and personal users have been aiming to solve problems which occurred in location-based areas. In the building block of knowledge goals, it is defined which capabilities are going to be built in which level. After the relevant objectives respectively the knowledge assets are determined, it is analyzed which of these assets are available in the organization. The building block of knowledge development, it is aimed at the development of new abilities, new products, better ideas and more efficient processes.

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References

Adam, S., Pietroniro, A. and Brugman, M.M. *Glacier Snow Line Mapping Using ERS-1SAR Imagery.* Remote Sensing of Environment. 1997. 61; 46-54.

Adel, A.A., Salami, A.S.A., Ouafae, A., Rigobert, B., Laura, D. and Gebremeskel, G., 2007: *Land Evaluation in Essaouira Province Morocco.* Proceedings of the 27th Professional Course on Geomatics and Natural Resources Evaluation, November 6, 2006-June 22, 2007, Foreign Affairs, Istituto Agronomico Per L'oltremare. 1-213.

Adrados, C., Girard, I., Gendner, J.P. and Janeau, G. *Global Positioning System (GPS) Location Accuracy Improvement due to Selective Availability Removal*. Comptes Rendus Biologies. 2002. 325 (2) 165-170.

Agenda 21, 1992. Chapter 12, Paragraph 5, United Nations World Conference on Environment, Rio de Janeiro, Brazil, June 1992. Advance Copy. 2.

Arvanitis, L., Ramachandran, B., Brackett, D., Rasoul, H., and Du, X. *Multiresource Inventories Incorporating GIS, GPS and Database Management Systems: A Conceptual Model*. Computers and Electronics in Agriculture. 2000. 28, 89-100.

Baader, F., Horrocks, I. and Sattler, U., 2004: *Description Logics*. In: Staab, S. and Studer, R. (eds.) Handbook on Ontologies: New York: Springer Verlag. 3-28.

Bayr, K.J., Hall, D.K. and Kovalick, W.M. *Observations on Glaciers in the Eastern Austrian Alps Using Satellite Data.* International Journal of Remote Sensing. 1994. 15; 1733-1742.

Binaghi, E., Madella, A., Madella, P. and Rampini, A., 1993: *Integration of Remote Sensing Images in a GIS for the Study of Alpine Glaciers.* In: Winkler, P. (ed.), Remote Sensing for Monitoring the Changing Environment of Europe. Proceedings 12th EARSEL Symposium, Hungary. 1992. Rotterdam Balkema. 173-78.

Bo, C.G., Wei, H., Si, C.T. and Larsen, N.F. *Cloud Detection over the Arctic Region using Airborne Imaging Spectrometer Data during the Daytime.* Journal of Applied Meteorology. 1999. 37; 1421-29.

Carter, W.N. *Disaster Management: A Disaster Manager's Handbook*. Asian Development Bank Manila. 1992. 15-20.

Chieng, O.W.Y. and Sauer, K. *Urban Road Transport Navigation Performance of the Global Positioning System.* Transportation Research. 2000. C-10; 171-187.

Csatho, B., Schenk, T., Lee, D.C. and Filin, S., 1999: *Inclusion of Multispectral Data into Object Recognition.* In ISPRS Inter.

De Wulf, R.R., Goosens, R.E., De Roover, B.P. and Borry, F.C. *Extraction of Forest Stand Parameters from Panchromatic and Multispectral Spot-1 Data.* IJRS. 1990. 11 (9) 1571-1588.

Ellis, L.B.M. and Kalumbi, D. *The Demise of Public Data on the Web?* Nature Biotechnology. 1998. 16; 1323-1324.

Franklin, J.F., Davis, F.W. and Lefebvre, P. *Thematic Mapper Analaysis of Tree Cover in Semiarid Woodlands using a Model of Canopy Shadowing.* Remote Sens of Environ. 1991. 36; 189-202.

Gennari, J., Musen, M.A., Fergerson, R.W., Grosso, W.E., Crubezy, M., Eriksson, H., Noy, N.F. and Tu, S.W., 2002: *The Evolution of Protégé: A Satellite Knowledge-Based Systems Development.* 32.

Gokaraju, B., Durbha, S.S., King, R. and Younan N.H. (*Ispress) Ensemble Methodology using Multi-Stage Learning for Improved Detection of Harmful.* Geosciences and Remote Sensing Letters IEEE. 2010. 3-7.

Gratton, D.J., Howarth, P.J. and Marceau, D.J. *Combining DEM Parameters Withlandsat MSS and TM Imagery in a GIS For mountain Glacier Characterization.* IEEE Transactions on Geoscience and Remote Sensing. 1990. 28; 766-69.

Habib, A., Asmamaw, A., Kelley, D. and May, M., 2000: *Linear Features in Photogrammetry.* Report No. 450, Department of Civil and Environmental Engineering and Geodetic Science. The Ohio State University, Columbus, OH 43210.

Hall-Könyves, K. *The Topographic Effect on Landsat Data in Gently Undulating Terrain in Southern Sweden.* IJRS. 1987. 8 (2) 157-168.

Hill, L.L., Janée, G., Dolin, R., Frew, J. and Larsgaard, M. *Collection Metadata Solutions for Digital Library Applications*. Journal of the American Society for Information Science (JASIS). November 1999. 50 (13) 1169-1181.

King, S.S. and Younan, R. *Information Semantics Approach for Satellite Management.* IEEE Journal. September 2008. 358-365.

Kojima, M. and Takagi, M. *Establishment of Ground Control Point Data base for Satellite Remote Sensing.* Proceedings of International Symposium on Social Management Systems, Kochiin Japan. 2009. 192-200.

Lee, I., 2002a: *Proceptul Organization of Surface.* PhD Dissertation. Department of Civil and Environmental Engineering and Geodetic Science, OSU, 157.

Li, H., Gartner, D., Mou, P. and Trettin, C. *A Landscape Model (LEEMATH) to Evaluate Effects of Management Impacts on Timber and Wildlife Habitat.* Computers and Electronics in Agriculture. 2000. 27; 263-292.

Mandal, G.S. *Forecasting and Warning Systems for Cyclones in India, Shelter*. October, 1999. 24-26.

McCarthy, T.S., Bloem, A. and Larkin, P.A. *Observations on the Hydrology and Geohydrology of the Okavango Delta.* South African Journal of Geology. 1998. 101; 101-117.

McGuinness, P.D.L., Middleton, D., Cinquini, L., Darnell, J.A., Garcia, J., West, P., Benedict, J. and Solomon, S., 2006: *Semantically-Enabled Large-Scale Science Data Repositories*. The 5th International Semantic Web Conference (ISWC06), LNCS, Springer-Verlag, Berlin. 4273; 792-805.

Miyata, T. and Takagi, M. *Acquisition Method of High Accuracy Ground Control Points for High Resolution Satellite Imagery.* Proceedings of the 25th Asian Conference on Remote Sensing, Chiangmai Thailand. 2004. 471-476.

Nair, P.K.R., Ellis, E.A., Linehan, P.E., Beck, H.W. and Blanche, C.A. *A G.I.S. Based Data Management Application for Agro Forestry Planning and Tree Selection.* Computers and Electronics in Agriculture. 2000. 27 (1-3) 41-55.

Polidori, L., Chorowicz, J. and Guillande, R. *Description of Terrain as a Fractal Surface and Application to Digital Elevation Model Quality Assessment.* Photogrammetric Engineering and Remote Sensing. 1991. 57 (10) 1329-1332.

Rousset, Marie-Christine and Brigitte Safar. *Negative and Positive Explanations in Explanations.* Applied Artificial Intelligence, An International Journal. 1987. 1 (1) 25-38.

Sanjeev Singh and Yasir Karim, 2011: *Photogrammetery & Flight Planning*. Geoinformatics. 2nd Edition. 15-20.

Schenk, T., 1983: *Multilingual Dictionary of Remote Sensing and Photogrammetry*. ASPRS. 343.

Sharma, V.K. *Use of GIS Related Technologies for Managing Disaster in India: An Overview.* GIS Development. 1999. 3 (3) 26-30.

Surya, S. *Wrapper Based Feature Subset Selection for Rapid Image Information Mining Geosciences and Remote Sensing Letter.* IEEE. 2012. 18-22.

Wald, L. *Some Terms of Reference in Data Fusion.* IEEE Tran. On Geoscience and Remote Sensing. 1999. 37 (3) 1190-1193.

Weerasinghe, H., Schneider, U.A. and Low, A. *Water Harvest- and Storage-Location Assessment Model Using GIS and Remote Sensing.* Hydrology and Earth System Sciences Discussions. 2011. 8 (8) 3353-3381.

Whitley, Edgar A., Ashwajit Singh and Georgios I. Doukidis. *An Expert System to Assist in Filing Tax Returns: The case of Indian Income Tax.* In: The Proceedings of the Fifth International Expert Systems Conference, London. 1989. 115-129.

Yu, G. *Multi-Agent Systems for Distributed Geospatial Modeling, Simulation and Computing.* Handbook of Research on Geoinformatics. Pennsylvania: Information Science Reference. 2009. 196-205.

Zalmanson, G., 2000: *Hierarchal Recovery of Exterior Orientation from Parametric and Natural 3D Curve.* Ph.D. Dissertation. Department of Civil and Environmental Engineering and Geodetic Science, OSU. 121.

Zhang, N, Wang, M. and Wang, N. *Precision Agriculture – A Worldwide Overview*. Computers and Electronics in Agriculture. 2002. 36 (2) 113-132.