The Proper Establishment and Use of Coordinate Systems on Marine Survey Vessels: A Case Study of CSL Heron

Jason Bartlett

ABSTRACT

Multibeam echo-sounders have developed into a device that is capable of centimetre level bathymetry. RTK GPS can provide horizontal positioning much more accurately than the widely used Differential GPS. With these two things in mind, the error budget in a hydrographic survey is now highly influenced by misalignment of the sensors with respect to the vessel's reference frame. Procedures need to be developed for establishing a vessel coordinate system and for determining sensor misalignment with respect to the ship.

It is important to understand what a coordinate system consists of before attempting to establish it on a vessel. In a kinematic environment, there exist different types of coordinate systems such as the body fixed and local level. Quantities derived by transforming between them describe vessel motion. The total sounding error budget must be re-formulated to reflect the influence of sensor integration. In order to do this, a description is provided of the misalignments that are present and their horizontal and vertical positioning effects.

A vessel survey is required to establish the coordinate system. It requires describing the vessel's orientation in space, defining the vessel's X-axis, Y-axis, and by forming the right hand system, the Z-axis. To aid in future offset measurements, redundant points are required to be established inside and outside

the vessel. Static offsets and angular orientation of sensors can also take place during the original coordinating survey. By adjusting the surveyed coordinates through a rotation and translation to the origin, the vessel coordinate system has now been realized.

Dynamic procedures also have to be employed since sensors are often changed while the vessel is in production. The Patch Test will determine the relative misalignment between the motion/heading sensor and sonar. Dual GPS antenna configurations can be used to determine the absolute misalignments of sensors with respect to the vessel’s coordinate system.

Online Support for Extended Learning for Land Surveyors

Mathieu Bourgeois

ABSTRACT

The continuing professional development and the education of land surveyors requires innovative approaches for land surveying to survive as a profession. The profession is suffering from decreased membership applicants and an aging established membership. Geographical displacement, associated costs, and course equivalency represent barriers to educational and employment opportunity for prospective surveyors. These barriers also affect the continuing education opportunities of established professional surveyors. Providing a distribution service for cadastral surveying resource material would provide the opportunity to lift those barriers and establish the starting block for a distance education module within the land surveying community.

This report consisted of two parts. First, conducting a needs analysis of students and professionals to establish requirements of a distance education component within the profession. Second, designing an educational support system to meet the needs of the profession. The educational support system consists of a digital library catalogued in a database management system which is available online. A project evaluation was conducted from a local institutions using student feedback and from a remote location to test the support systems role in distance education. The report also presents a discussion on the institutional and legal implication of the support module and recommendations to overcome funding issues.

GIS Landmark Pictures

Christine Delbridge

ABSTRACT

The objective of this project is to design, implement and evaluate a Web-based mapping system which uses landmark pictures to aid in visual navigation of a network of streets. The street network for this project is a section of Downtown Fredericton and the pictures in the system are of what the users would see at each intersection as if they were driving. Users can indicate their route on a digital street map and the system delivers a series of photos of what the driver would see at each intersection along the route.

This is a valuable system because it will make navigation in downtown Fredericton much easier for people who aren't familiar with it. The system overcomes the "top-down only" view found in traditional maps by allowing users to view what they will actually see while driving.

Requirements for the system were first defined and the system was then designed using the Unified Modeling Language (UML). It was implemented using a combination of HTML, JavaScript, Perl, and a MySQL database. The system was evaluated based on fulfillment of the requirements, usability, and flexibility for change and evolution.

Feedback from users indicates that it is a useful tool and very user-friendly application. The system can be easily expanded both geographically and functionally without changing the current functionality of the system. This project has resulted in the development of a robust, high quality navigation tool.

An Investigation of Reflectorless EDM Measurement

Kyle Harrington

ABSTRACT

Current reflectorless electronic distance measurement technology is generally thought of almost as a “miracle” tool. Manufacturers state that crews can be minimized and productivity can be increased. This is all made possible because of the improved accuracy and reliability in reflectorless systems.

Testing new technology is essential to ensure that the desired observable is being measured. With that in mind, the aim of this report is to provide possible users with information about the testing and expectations of reflectorless electronic distance measurement systems. A few possible testing methods are explored and one is finally used. The considerations relating to design, execution, analysis and re-design of the test are discussed.

Major conclusions reached in this report are: that lighter surfaced targets enable better coordinate resolution than darker surfaced objects; that design specifications for a test should mimic, as closely as possible, the circumstances for which the instrument will be used.

An Analysis of Automated Web-Based GPS Processing Services

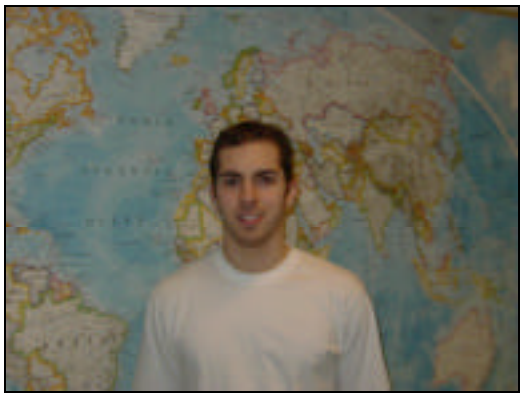
Paul Hatch

ABSTRACT

This project evaluates and critiques the available automated on-line Global Positioning System (GPS) processing services. The assessment of these services determines how each one operates in terms of sending the data, the time delay in receiving the results, and how the results compare to the known coordinates of the station used, and provides an overall evaluation of the service.

The assessment was conducted on three organizations, which provide this type of service, wherein the major selling feature was that all services were free of charge, and the user was allowed unlimited access. The data sent to each service was a twenty-four hour session obtained from the International GPS Service (IGS) for the IGS station at the University of New Brunswick; the data from the IGS is more reliable, therefore allowing for better comparisons results.

The evaluation determined that all three services were very easy to use; the results from each service were produced in a timely manner; and the coordinates obtained from each service were found to be within a reasonable tolerance.



Analysis of GPS Coordinate Transformation Using Site Calibration

Vaughn MacDonald

ABSTRACT

There have always been and always will be times when a survey must be done in an uncommon reference frame. It may be a coordinate system that has been put into place for a specific purpose, or it may be due to inconsistencies in control points local to a particular site. In any case, when surveying or laying out positions in these local coordinate systems using real time kinematic GPS it is useful to have the ability to measure in the coordinate system of interest. Trimble's site calibration feature provides this ability. This report assesses what loss of accuracy occurs when using site calibrated coordinates through the analysis of experimental data collected at location where site calibrated coordinates are being used. The client would like to know if it is acceptable to use these coordinates in laying out grades for a stream diversion project at the site. It was the findings of this report that the site calibration process introduces no significant error into a real time kinematic GPS point position, but that the site calibration will be as good as the control points that it is given. A site calibration using coordinates that lead to high residuals will produce point positions with errors of the same order. It was also concluded that the client is advised not to use site calibrated coordinates in the laying out of grades for the stream diversion due to distortions in the height system used at the site that could potentially interfere with the flow of water.

Delineating Watersheds Using a Digital Terrain Model

Wade MacNutt

ABSTRACT

The objective of this research was to investigate the procedures and challenges of delineating urban watersheds using a digital terrain model. Finding a suitable watershed delineation method using an existing digital terrain model is an important first step in developing environmental policy and awareness for the conservation of tributaries. The Fredericton Area Watersheds Association has requested this project for the following three reasons: first, as a means of establishing a procedure of watershed mapping; second, to gain important digital mapping layers; and third, to increase citizen awareness of watershed location.

This report takes a look at the digital terrain models that are available for the Fredericton area and proceeds to use a provincial dataset for its analysis. The methodology involves comparing two different delineation processes. The first is a manual delineation process using both a digital terrain model and an existing digital hydrographic network. The second is a fully automated delineation process using only the digital terrain model.

A comparison of the two methods revealed that the automated solution produced false results in certain areas. In general, the existing provincial digital terrain model is not capable of recognizing all the hydrographic features on a small urban scale. Therefore, additional elevation and topographical datasets need to be implemented in the watershed delineation process.

The following three recommendations were made: first, that a combination of the two delineation procedures should be adopted by the Fredericton Area Watersheds Association; second, that Service New Brunswick needs to include breakline data

within its digital terrain model; and third, the City of Fredericton should update its storm sewer network to include elevations.

Charts and BATS System

Parker Minard

ABSTRACT

The amalgamation of the Bombardier CL – 327 Vertical Takeoff Unmanned Aerial Vehicle with OpTech's Bathymetric and Topographic Survey system would provide a remote sensing platform of unique qualities and record massive amounts of data in potentially dangerous environments. This report will attempt to determine if the above mentioned combination of sensor and vehicle would have any economic viability to assemble outside of military direction and for whom it would be of use to. It will provide a brief background in remote sensing terms and techniques, examine the components of the sensor and the overall capabilities of the vehicle and determine if this system has any advantage over other information gathering systems. It will also attempt to determine the role a Geomatics Engineer would play in this system.

The Bathymetric and Topographic Survey system contains a Light Detection and Ranging system in addition to a digital camera. This combination allows for the real time creation of digital orthographic images.

The CL – 327 is a helicopter like vehicle capable of carrying the OpTech sensor. With its maneuverability and range, this vehicle can go places and do things that other vehicles cannot. As this vehicle is unmanned, no danger is involved for the operator. This is the vehicle's main advantage and the reason that the OpTech sensor was designed for a vehicle such as it.

There is a role for the system to play in the future of data collection, most probably in the rapid deployment of a system to a disaster of some sort or in the planning stages of a large project through dangerous ground.

The Development of a Process to Mask Out Upland Portions of High Resolution Satellite Imagery

Katie Munroe

ABSTRACT

Inventories on recreational boating activities are currently required by the Canadian Coast Guard in order to improve strategic decision-making regarding their Search and Rescue operations. Software being developed at the University of New Brunswick required upland portions of satellite imagery to be masked out. Thus, the purpose of this project was to develop a process, using PCI Geomatica software, to automatically mask out all land portions of a satellite image.

Four masking methods were tested; supervised classification, unsupervised classification, a polygon overlay, and a hybrid method. The results from each method were then compared on the basis of whether the process could be automated, the amount of user interaction required, distance of the masked shoreline from a reference shoreline, and the processing time.

Testing determined that the unsupervised method was the most appropriate means of masking the image, because it could be fully automated and therefore does not require user interaction. The work performed has clearly demonstrated the design and construction of an automated system for masking out upland portions of satellite imagery.

Designing a National Fresh Water Regime in Canada: A View to the Future of Canada's Fresh Water

Jonathan Phillips

ABSTRACT

One of the largest and most threatening crises facing our world today is the lack of clean, potable water. Canada has the potential to become a major player in this crisis due to its large supply of fresh water. Because of this potential, it is critical that Canada begin to manage its fresh water as an extremely valuable resource. Currently Canada is doing a very poor job of managing its fresh water. The water regime is fragmented, and there is much uncertainty surrounding the jurisdiction over fresh water. There are many challenging issues facing the future of Canada's water such as the bulk export of water, increased pollution, and breakdowns in drinking water safety. In order to resolve these issues and efficiently manage fresh water in the future, Canada must establish a national water regime to administer water across the country.

This project gives a clear picture of the current situation, an understanding of the problems and issues facing the existing water rights management structure, and what should be done in the future to create a stable and efficient water regime. As fresh water becomes an increasingly more precious resource the government must take prudent and effective steps toward preserving the rights to that resource.

An Assessment of Leica's Vector IV Binoculars and Rockwell's PLGR+96

Eric Quirion

ABSTRACT

Remote targeting is a method used by the military to obtain coordinate information and measurements of distant features and targets. Remote targeting uses measurements from both laser rangefinders and Global Positioning System (GPS) receivers to obtain this information. Currently, there exists little or no information on the accuracy or limitations of this type of technology. The purpose of this report is to assess the accuracy and limitations of a remote targeting system used by the Canadian Forces.

The system used was comprised of the Vector IV rangefinder binoculars and the Rockwell PLGR+96 handheld GPS receiver. The assessment of the system was carried out by testing the absolute positioning accuracy of the GPS receiver and by testing the range, azimuth, and inclination measurement accuracy of using the rangefinder. Furthermore, the accuracy of these measurements from specifications was propagated to obtain expected position errors for remote targets at different ranges.

The individual tests demonstrated that both the GPS receiver and rangefinder generally performed as expected. One of the major findings from the determination of target position errors was that the error in measuring azimuth with the Vector IV is one of the biggest contributors to the overall horizontal position error of a target.

Enhancing the Efficiency of Orbit Improvement Processing

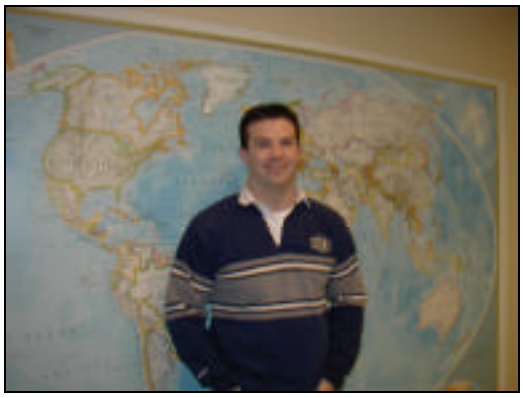
Kevin Smith

ABSTRACT

The purpose of this research project was to develop software tools to improve the efficiency of satellite orbit improvement processing using the Differential Positioning Package. The Differential Positioning Package is a software package developed within the Department of Geodesy and Geomatics Engineering at the University of New Brunswick. Orbit improvement requires a large Global Positioning System data set to be processed in five distinct stages, part of which requires DIPOP. Currently, the processing requires a very substantial amount of time to complete because of the absence of batch processing utilities.

Preliminary work involved researching the UNIX script language and in particular, the wide array of UNIX utilities available. Following this came the development of UNIX scripts to: (1) batch process the retrieval of the GPS data set and (2) batch process the pre-processing of the GPS data set. With this accomplished, the intermediate step of creating command files to direct DIPOP in processing was able to be reduced to a batch process. Finally, all of the processes were able to be linked together to form one seamless process.

Overall the scripting was successful in improving the efficiency of the processing. A substantial savings in processing time was achieved with the implementation of the final script that tied several of the processes together. The UNIX scripting utilities proved to be very valuable for many aspects of the work. However, due to a lack of time and programming problems three of the five processes were not able to be addressed. It is recommended that further work be done in this area to implement batch processing for the remaining stages where possible.



A Comparison of Conventional and RTK Methodology for Topographic and Stakeout Surveys for Cemeteries

Cory Tucker

ABSTRACT

Cemetery caretakers lay out new gravesites according to a cemetery plan with a tape by measuring from monuments with known positions referred to as control monuments. An erroneous layout of a new grave can result in disturbance of existing remains, a situation that must obviously be avoided. The positioning of the monuments upon which the caretakers rely must be done with sufficient precision to facilitate this effort, requiring survey equipment and expertise. Topographic information on the plan is also valuable when carrying out daily operations on the cemetery or planning for the future. As in most projects, the cost must be minimized. This is especially true for a cemetery survey where the not for profit organization has little or no money to fund the work.

The Global Positioning System offers the potential for increased productivity by reducing time and cost, especially when Real Time Kinematic (RTK) techniques are employed. However increased technical complexity, limitations in its capability in some environments, and increased cost of equipment must be considered before it can be decided whether it is truly advantageous to employ a RTK system instead of conventional land surveying equipment.

Stakeout and topographic surveys were carried out on Forest Hill Cemetery in Fredericton, New Brunswick to provide a control network and topographic plan for the Forest Hill Cemetery Company using both RTK and conventional equipment. It was found that the RTK did offer advantages over the conventional equipment when making connections to the local datum, when collecting certain types of

topographic information, and during field stakeout. However, the use of RTK required much more computational effort, was less reliable, and much more expensive equipment. Furthermore, trees and buildings created obstructions of the sky preventing the use of the RTK system and requiring conventional equipment to complete the task.

The efforts on Forest Hill Cemetery revealed that an efficient survey involved using RTK techniques to do a preliminary survey, and as much of the topographic survey as possible, as well as to establish markers that could be used during a conventional survey that would collect the remainder of the topographic information and stakeout the designed control network.

Estimation of Receiver Channel Directivity Pattern via Comparison of Simultaneously Collected Acoustic Backscatter from a Reson 8101 Multibeam Sonar

Jonathan Beaudoin

ABSTRACT

Multibeam sonars allow for the estimation of the seafloor's acoustic backscatter coefficient by accounting for variations in the intensity of returning sound pulses due to source level, gain, and ensonified area. A final complication remains, however: the removal of intensity variations due to transmitter and receiver directivity patterns. Left unaccounted for, these beam patterns contaminate the estimation of acoustic backscatter via the introduction of systematic errors whose magnitudes vary with sonar-relative angle.

Older models of the SeaBat 8101 allow for two methods of collecting acoustic backscatter measurements: (1) beam footprint-averaged intensities, and (2) high-resolution time-series intensities (referred to as "sidescan mode"). The analogue receive channels associated with the first method are internally calibrated, thus the measured intensities are subject only to the transmitter beam pattern. This is not the case with the sidescan intensities as the receive beams are formed through separate and uncalibrated channels and are subject to significant beam pattern contamination compared to the footprint-averaged intensities. By simultaneously collecting both types of measurements, the footprint-averaged intensities can be

used as a reference in order to infer the sidescan receive beam pattern. Though this is not the final stage in calibrating the sidescan intensities, it is a significant step towards this goal in that it allows for the construction of an empirical model of the sidescan receiver beam pattern without the necessity to perform a tank calibration.

Proposal for Optimizing the Use of GPS for Monitoring Height Displacements Over Short, Static Baselines

Jason Bond

ABSTRACT

Since the vertical component of a GPS solution is about three times worse than the horizontal, applications requiring precise vertical solutions push GPS to the limits of its abilities. In order to obtain high precision positions, meticulous efforts must be made to contain all GPS error sources. Applications requiring such precision include monitoring ground subsidence, deformation monitoring of bridges, dams and buildings and slope stability studies. Several efforts have been made to implement GPS for monitoring sub-centimetre displacements.

This paper is a proposal for investigating the methodologies and techniques that will optimize the vertical component of a GPS solution over short, static baselines. The primary objective of this research is to create a comprehensive manual with guidelines and specifications for optimizing GPS height difference measurements. A description of the challenges involved in obtaining high precision vertical GPS solutions is presented at the onset. A discussion of the significance of this particular research is then presented. Subsequently, others' attempts to implement GPS for sub-centimetre applications will be over viewed. The objectives of this research are then presented, as well as a proposed methodology to achieve them. Potential problems and complications are then addressed.

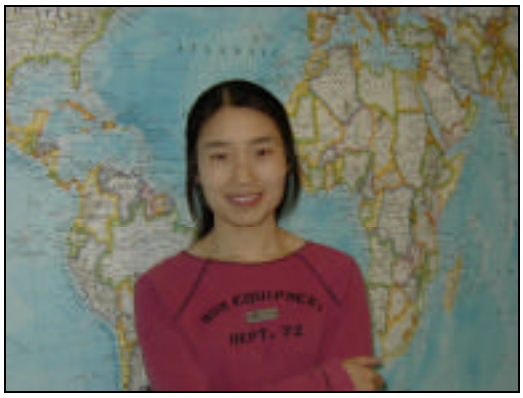
Close Range GIS : A New Way of Visualizing Geo-graphical Information

Hon Shing (Richard) Chan

ABSTRACT

Unlike the map-view paradigm of the existing geographic information systems (GIS) that helps to discover knowledge, patterns or the relationships among spatial objects in a macro-view, “Close Range GIS” (a name borrowed from “close range photogrammetry”) portrays a new way of visualizing geographical information. In this approach, data or geographical information are displayed as computer generated objects (labels and so on) that integrate with the real world image in a horizontal perspective. Mostly, these virtual objects will be displayed in a location close to the users to provide additional information about the environment the users in. Users’ viewpoint can be changed according to their need and applications.

The growing interest in Close-Range-GIS-like applications is fueled by various emerging technologies such as augmented reality, wearable computers, image-based modeling and rendering, advance positioning technologies, video mapping, various technologies in 3D data capturing and so on. Different applications are being explored such as visualizing covered objects (e.g. underground pipeworks), personal tourist guide, location-based services, visual impact analysis, etc. This paper describes the characteristics of “Close Range GIS” and explains how it is different from the existing GISs. It gives a brief review on the emerging technologies that enable “Close Range GIS” and tries to identify its implications on the future research aspects of geomatics.



Construction of Virtual Tunnel Using Panoramas

Xinyue Chang

ABSTRACT

For centuries, maps have been abstractions of the world reality which use points, lines, symbols, and shadings to depict the location of physical features, landscape conditions, and underground situations as well. As a new technique, virtual reality (VR) is a proven and potent tool for describing reality in a more alive way than maps. VR systems allow for the creation of virtual environments, which place users in a computer-simulated environment, and provide users with interactive navigations. Originally, VR was designed and developed by the computer graphics experts, and such kind of traditional VR is well known to require “laborious modeling and special purpose software”.

The objective of this paper is to construct a virtual tunnel using panorama virtual reality (PVR) technique, and this novel approach focuses on the integration of digital photographs in a virtual environment acquired with a non-metric camera, which can be readily understood and appreciated by the non-specialist. Along the tunnel, the individual picture is taken by rotating the camera through a horizontal axis, and then the picture series are warped, matched and blended into a panorama. We take the pictures stripe by stripe, where one stripe of pictures is a mosaic or a panorama, and then many sets of panorama will cover the tunnel along its longitude direction. The final visualization is a user interface, where users can freely navigate using the keyboard or mouse, and immerse themselves in the virtual tunnel.

Surveying Shore Road Allowances in Ontario

Tim Coulas

ABSTRACT

The creation of shore road allowances, one chain in width was common practice during the original township surveys, and subsequent Crown subdivisions in much of Ontario's cottage country. The title to these road allowances was usually vested in the municipality and today, the land is often occupied by the upland parcel owner. This occupation can include the primary investment of the landowner, with the cottage being located on the municipal land. Many municipalities have adopted the policy of closing these road allowances and selling them to the adjoining landowners, which has created a number of issues affecting the survey.

This paper examines the issues regarding surveying the shore road allowances in part of Ontario's northern Hastings County, and western Renfrew County. This includes issues regarding public use of road allowances, the creation of new boundaries extending from the sidelines of parcels, and issues with respect to artificially controlled lakes. With proper planning by the municipalities, combined with competent interpretation of the law by professionals, many title problems will be eliminated through this process.

Developing Guidelines and Standards for Parcel Data Capture in Ukraine

Tim Coulas

ABSTRACT

In 1995, UMA Engineering of Edmonton, Alberta was contracted to implement a land registration pilot project in western Ukraine, to support rights in land being transferred from state to private. This project had eight major tasks which included project management; public and institutional consultation; legislative and institutional review; property mapping; training and skill transfer; land registration system development; land ownership verification and adjudication; and geographic information system development.

This paper examines the issues resulting from the standard procedures for a land titling project including adjudication, demarcation, survey, registration and information management. The focus is on parcel data capture issues, with solutions often presented in the form of standards or procedural guidelines, which conform to local conditions.

Delineating Wetlands Using Multitemporal Radarsat

George Dias

ABSTRACT

Wetlands serve a variety of functions. They are a critical landscape component in the quality and quantity of the water resource in the province. Loss of wetlands can impact the retention ability for surface water. Wetlands provide habitat for wildlife species, ranging from large mammals (moose) to waterfowl (black duck). The unique hydrological regimes offer habitats for rare, threatened and endangered plants.

The purpose of this research project is to delineate the boundaries of all the wetlands in the province, using cost effective remote sensing techniques. Secondly, by applying a hydrogeomorphic model, develop a classification of wetland types based upon their moisture regime and topographic situation.

Wetland boundary extraction was accomplished by comparing RADARSAT imagery from three time periods, Spring, Summer, and Autumn, and analysing their differences. The results suggest that delineation of all wetland types may not be possible. They also suggest that shallow beam angles are more effective at detecting wetlands.

Georeferenced Civic Addressing in the Maritime Provinces

Robert W. Fish

ABSTRACT

Civic addresses are one of the most common means of identifying the location of a residence, home, land parcel, and even the human occupant. Perhaps the most crucial users of civic address data are the providers of 911 Emergency Services. In addition, nearly every government computer application related to the conduct of municipal, provincial and federal government business depends on a current, accurate civic address. Private sector organizations also benefit from and demand such information in order to effectively conduct marketing campaigns. Individuals are required to provide a valid civic address in order to effect simple tasks such as receive telephone services or mail.

The objective of this paper is to describe current initiatives in the three Maritime Provinces to establish a province-wide civic address database that contains a geographic reference for the assigned civic address. The approach to the creation of these files was different in each of the three provinces. Comparison of these databases was conducted based on address point, ownership and access of the database, associated applications and maintenance tools, as well as accuracy. The findings indicate a number of differences in terms of methodology employed in building the respective databases. However, the end results indicate the existence or potential for the existence of a complete functional and maintainable georeferenced civic address database that should result in improved quality and efficiency over the previous existing civic address databases.

An Analysis of SDI Implementation: A Comparative Case Study of Germany and Canada

Garfield Giff

ABSTRACT

A number of countries (see http://www.spatial.maine.edu/~onsrud/GSDI.htm) throughout the world have recognized the importance of a Spatial Data Infrastructure (SDI) to their economic, environmental, political and social prosperity; and thus, have taken steps to implement or formalize their existing SDIs (ANZLIC [1996] and Giff and Coleman [2001]).

The implementation process of an SDI is not etched in stone but instead will vary from nation to nation. This variation in the implementation process is in part due to the following factors: the definition a nation ascribes to an SDI—the different components; the economic climate of the nation; the political environment—government structure; the culture; and the quality of the existing general infrastructure—utility, telephone, etc.

This paper will first review the definition of an SDI and the main implementation procedures. The author will then present a summary of SDI implementation in both Germany and Canada. The paper concludes with a comparison of SDI implementation in both countries and the lessons learnt from each experience.

Semi-Automatic Extraction of Buildings in Informal Settlements Using Region Active Contour Models "Snakes"

David Mayunga

ABSTRACT

In recent years, extraction of buildings based on active contour models "snakes" has been a major topic in computer vision and image processing. Kaas et al. [1988] developed a novel technique for image segmentation that was able to solve a large class of segmentation problems that had eluded more conventional techniques. The original concept was based on "snakes", and has been used extensively in computer vision and image processing applications since then. Many active contour models have been proposed during the past two decades, which have provided satisfactory results in some applications such as road extraction, but for *building* extraction the snakes are trapped in presence of other objects in the images and fail to accurately delineate building boundaries. In this study I present a novel approach focusing on semi-automatic building extraction in informal settlement areas using high-resolution satellite images. The proposed approach integrates the texture classification method with traditional multispectral classification routine thus developing a conditional contrast detection algorithm. The algorithm detects building blobs and eliminates other objects in the images with higher accuracy without using any height information. In the next step, the classified buildings blobs will be used as inputs into the region active contour models algorithm whereby the accurate delineation of buildings is effected. The advantage of this approach over the existing methods is the ability to increase the capture range of buildings as well as providing flexible environment for the snakes to accurately delineate buildings in the images.

An Approach for Implementing GIS-Based Rural Land Inventories in Botswana

Boipuso Nkwae

ABSTRACT

The rapid tenurial transformations particularly around Botswana's peri-urban areas together with the limited land information management capabilities in Land Boards have led to unprecedented land problems. Rural and peri-urban environments are experiencing resource-use conflicts, mushrooming of squatter settlements, illegal land subdivisions and allocations. Because of this plethora of rural land problems, various land inventory pilot projects have been carried out throughout the country with varying levels of success during the past two decades. It was hoped that these pilot projects would identify unallocated land, under-utilized land as well as multiple plot allocations.

If national land inventories capabilities are to be effectively constructed and utilized, a model must be developed and tested by the local land boards. This means that the successful implementation of a land inventory project will depend upon a clear understanding of the functional or organizational processes, technical requirements, user needs and the benefit-cost implications to the land boards that will be translated into the system applications. It is the applications requirements of the inventory that should be used to define the database specifications and the information requirements for the system. This paper will present (1) the processes that led to the establishment of national land inventories, (2) an overview of such a GIS-based rural land inventory project that has been designed to serve as a pilot model for the Kweneng Land Board in Mogoditshane, and finally (3) conclusions and recommendations for future national land inventories.

A Marine Recreational Vessel Reconnaissance System

Kevin H. Pegler

ABSTRACT

Rescuing operators of small recreation vessels is a constant resource drain on the limited operating budget of the Canadian Coast Guard. As a result, a new and innovative application of small target surveillance techniques is being developed. This work is being done in support of the development of a strategic decision making tool based on risk modeling to be used to predict where in Canadian waters marine incidents are most likely to occur in support of best resource allocation.

Previous research in the use of hyperspectral imaging for search and rescue, resulted in the development of fast, non-parametric "spatio-spectral" template subpixel object detection algorithm. This work is being adapted and enhanced for use with the new, commercially available spaceborne high-resolution optical imagery. Investigations are being made regarding the utility of the Minkowski distance metrics for use in small target detection within a multispectral imagery environment. Further, research is being performed on the employment of the Mahalanobis distance metric to enhance the "spatio-spectral" template by exploiting the variance/covariance information surrounding a potential target. Preliminary results have shown that 100 percent of the vessels were detected; however, further work on reducing the number of false positives is required.

GIS Usability: Problems and Recommendations

Teresa M. Y. Tang

ABSTRACT

Traditionally, GIS (Geographic Information System) developers assume the user will adapt to any reasonable system design. Amidst the recent development in GIS, the basis of this assumption is shaken. As the GISs become, on one hand, more complex and, on the other hand, more popular and diversified in the application domains, the structural change to the GIS user community demands a review on the assumption. Over the last 15 years, human interaction with GIS has received increasing attention in the academia and the industry. These researches urged that human interaction with GIS should be adequately addressed during system development so as to enhance GIS usability.

This paper reviews two relevant GIS usability studies, outlines the common usability problems and provides some recommendations for improvement from the user's perspective. Two recent attempts to improve GIS usability are also introduced. The latest developments point the way towards the provision of multiple interaction modes and user-centred design, which enables more flexible and natural interaction between the users and the system, as well as narrows the gap between the user's and the system's conceptual models.

Semi-Automatic Road Extraction From QuickBird Imagery

Ruisheng Wang

ABSTRACT

Road information is essential for cartography, traffic management, and planning of urban and industrial areas. The automated extraction of road from aerial and satellite imagery holds a great potential due to the fact that it can significantly reduce the cost of the data collection and update, especially for Geographical Information System (GIS). Many approaches have been proposed during the last two decades. However, each proposed method has it own problem and the road extraction fails in many cases.

In this paper, road extraction will focus on IKONOS and QuickBird imagery. Among of many approaches, profile matching combined with a Kalman filter (Vosselman and de Knecht, 1995) is a novel and promising method due to its capability of crossing road junctions and its utilization of the property of Kalman filtering's optimal estimation. However, the Kalman filter used by Vosselman and de Knecht (1995) is not adjustable (the system noise is assumed as a constant) and the road tracking is single-direction based. In this presentation a new method is proposed that will adjust the system noise according to the distance difference between the predicted road center point and the measured road center point. The tracking will be double-direction based (including both forward and backward tracking), which will make full use of the available road information to achieve an optimal estimation.

The problem of diversion of Kalman filter will also be taken into account and the application of the long formula of the variance updating can avoid numeric calculation problems. The goal of our method is that the road tracker can deal with not only arbitrary salient roads, but also the partially occluded and shadowed roads.

Prototype of a Web-Based 3D Visualization System for High Resolution Satellite Stereo Images

Pingping Xie

ABSTRACT

3D visualization of aerial and satellite stereo images has been used in practice for decades. In the fields of cartography, GIS, remote sensing (RS), and other geo-spatial applications, effective 3D visualization is still a research topic. 3D stereo viewing using anaglyph mode allows the perception of depth using inexpensive complementary colour glasses such as red and blue glasses. This is an easy and inexpensive way to view 3D on a screen or a printout.

In this proposed study, a 3D system prototype will be developed to achieve a more effective Web-based colour stereo visualization using anaglyph mode based on human binocular matching sensitivity. There are three modules in this prototype: Module 1, generating epipolar image; Module 2, building an interactive stereo viewing; and Module 3, creating Web-based interactive stereo viewing. Module 1 addresses the original stereopair including (1) automatic matching of corresponding pair of geo-corrected high-resolution pan-sharpened stereo images and (2) generating the epipolar images as stereopair for easier and sharper stereo viewing. Module 2 consists of the functions of forming an colour anaglyph image by superposing the epipolar stereopair and generating interactively scalable stereo viewing to allow users to zoom anaglyph image and to refine the 3D effect for an optimal 3D display. Module 3 prepares, tests and deploys a high-resolution anaglyph image to the Internet to permit the user to access, to zoom, and to pan the image and to automatically refine the 3D effect for an optimal 3D display through a Web browser without special graphic cards or high-speed connection.