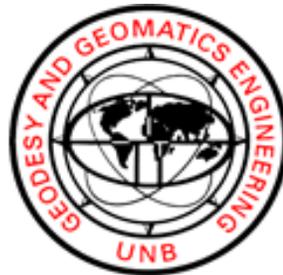


2015 UNB ENGINEERING DESIGN SYMPOSIUM

DEPARTMENT OF GEODESY AND GEOMATICS

FREDERICTON CONVENTION CENTRE

APRIL 8TH 2015



UNIVERSITY OF NEW BRUNSWICK

List of Abstracts

REMOTE SENSING/PHOTOGRAMMETRY

Low-Cost UAV Photogrammetry Accuracy Assessment.....	5
Evaluating Collision Investigation And Reconstruction Capabilities With The Trimble TX5 Laser Scanner.....	6
Mine Modelling Using Hyperspectral Imagery.....	10

DIGITAL MAPPING/GIS/CARTOGRAPHY

Discovering Mobility Behaviour Using Historical Vessel Data With M-Atlas.....	1
Predicting The 2030 Urban Extents Of Fredericton With The Sleuth Model.....	7
Mapping The Extent And Intensity Of A Natural Disaster Using Social Media.....	11
Analysis Of GSM Data In Conjunction With Twitter Data For Understanding Social Behaviour In Senegal.....	14
Aerial Mapping Techniques And Technologies: A Cost Benefit Analysis.....	15
A Spatial Analysis Of The City Of Fredericton's Bus Stop Locations.....	16
Mapping UNB Walking Paths To Compare Elevation Data Sources.....	17
Reporting Motor Vehicle Accidents Using A GNSS Based Application.....	18
Optimizing The Campus Floor Plan: An Interactive Mapping Application For E-Level Of Head Hall, UNB.....	19
Modeling Urban Traffic Using The Neo4j Graph Database.....	24

HYDROGRAPHY/OCEAN MAPPING

Using PPP-GPS To Estimate Tidal Motions In The Arctic & Comparison To A Tidal Model.....	12
--	----

LAND/WATER INFORMATION MANAGEMENT

The Effect Of Ambulatory Islands On Maritime Delimitation.....	2
New Brunswick Condominiums: Recommendations For Improving Governance By Implementing Educational Requirements.....	8
Evaluating Alberta’s Systemic Handling Of Private Mineral Rights.....	13
Canadian Marine Cadastre: Building On Lessons From The US Gulf Of Mexico.....	21

GEODESY/SURVEYING

DIM: Developing A Mobile Least Squares Adjustment Application For Android.....	3
Determining Coordinates Of The UNB Control Network Through GNSS.....	4
A Means of Assessing Output Generated by UNB’s GAPS.....	9
The Practicality Of Trigonometric Heighting: Comparing Trigonometric Heighting, Geometric Levelling, And GNSS Heighting.....	20
UNB Campus Control Network Designing A Deformation Monitoring Campaign.....	22
GNSS-Derived Orthometric Heights For Water Level Monitoring And Geoid Accuracy Assessment.....	23

Index by Author

Mitchell Allen.....	1
James Batty.....	2
Mike Bremner.....	3
Matthew Cameron	4
Chan Choi.....	5
Alice Cunningham.....	6
Charles-Olivier Cyr	7
Joe Doiron	8
Stefan Dubay	9
Lukas Fraser	10
Nathan Hughes	11
Cally (Keddy) Johnston.....	12
Richard Eric Larsen.....	13
Tianyu Liu	14
Colin Mclean	15
John Mason.....	16
Mark Mayne	17
Craig David Murray	18
Adam Paine	19
Greg Rodger	20
Eric Root.....	21
Adam Thimot	22
Matthew Williams	23
Jacob Wood	24

DISCOVERING MOBILITY BEHAVIOUR USING HISTORICAL VESSEL DATA WITH M-ATLAS

Mitchell Allen

Faculty Supervisor: Dr. Emmanuel Stefanakis

Abstract

The technologies of wireless communications and location-enabled devices pervade our society, providing new integrations and analytical capabilities. With the advances of mobile communication and Global Positioning Systems (GPS), enormous amounts of mobility data have been generated. Mobility data has been collecting the movements of people and objects for nearly decade and have generated large volumes of data throughout active databases around the world. In this paper, the remarkable analytical power of massive repositories of trajectory data is illustrated. The data is of large-scale experiment, based on two months' worth of historical marine vessels all around the globe. From this large dataset, a demonstration of the knowledge discovery process will be addressed to answer fundamental questions of mobility behaviour: How to predict areas of congestions and dense? How to determine areas where traffic is at high-risk of collisions? What are frequent patterns of movement? This report also introduces querying and mining languages that make the analytical process possible, along with the software that incorporates it all, M-Atlas. M-Atlas is specifically designed around the theory of trajectories. It is intended to provide quantitative and quality assessments of the attained results and discovery 1behavioural patterns and models so further analyses and mining.

THE EFFECT OF AMBULATORY ISLANDS ON MARITIME DELIMITATION

James Batty

Faculty Supervisor: Dr. Sue Nichols

Abstract

Ambulatory islands create challenges, ranging from disputes between nations to the termination of an island state. The truly dangerous aspect of these islands however, is that there are limited international laws and regulations addressing the impact of ambulatory islands on maritime delimitation. Without clear rules and regulations, nations do not have justified ways to delimit their respective maritime boundaries from occurrences such as sea level rising and natural disasters. The technical knowledge required to address this challenge was acquired by examining existing cases in international law, reviewing books discussing the technical components of maritime delimitation and consulting with Serge Levesque, a Technical Advisor for the Canadian Hydrographic Service. This report includes a discussion of solutions using existing law, as well as those entailing changes to the laws. The report ultimately suggests that a change in customary or conventional law is required in order to mitigate the effects of ambulatory islands on maritime delimitation.

DIM: DEVELOPING A MOBILE LEAST SQUARES ADJUSTMENT APPLICATION FOR ANDROID

Mike Bremner

Faculty Supervisor: Dr. Marcelo Santos

Abstract

The advent of survey grade GPS system has provided surveyors with an excellent tool for speeding production, but in some cases conventional surveying methods are required. The integration of GPS observations with conventional observations is problematic and can cause large random errors. Least squares estimation is an effective tool for the mitigation of random errors, that is currently underutilized. The goal of this project is to design and develop a user friendly prototype least squares application for Android; that could potentially be developed into a user end product, putting an effective least squares tool in the hands of field surveyors. The development of this application followed an Agile development strategy. During the initial planning stage, design was kept high-level. The development and testing phases of the project were modular and required significant low level design components. The result of this project is DIM, an Android application capable of reducing and recording survey measurements, then performing a least squares estimation of coordinates based on the observations. In testing, DIM has successfully adjusted the observations from a real densification network survey. Dim shows the potential to be developed into a user friendly least squares application, and may one day assist field surveyors with the integration of survey observations.

DETERMINING COORDINATES OF THE UNB CONTROL NETWORK THROUGH GNSS

Matthew Cameron

Faculty Supervisor: Dr. Marcelo Santos

Abstract

Control surveys through Global Navigation Satellite Systems have become more relevant in the last two decades. The department of Geodesy and Geomatics Engineering at University of New Brunswick desired to install a control network with the highest possible accuracy across the Fredericton campus. The network consists of ten control monuments in various locations. Survey methods involved were: GNSS static observations, precision levelling, and terrestrial traversing observations. This report describes the GNSS portion of the survey. The GNSS static surveying obtain some of the most reliable and accurate results for a network control survey. Future students can use the coordinates to compare and contrast their work with these results. The findings from this report will be a tool for further education. Through proper network design, reconnaissance and fieldwork, the GNSS survey was completed. Post-processing was completed using Trimble software which allowed for baseline processing and a 3D adjustment of the network. The results are referenced to the GRS80 ellipsoid. The results are in Cartesian and in geographic coordinates with appropriate standard deviations. The ellipsoidal height (h) was then translated into orthometric height (H) using the National Resource Canada tool called GPS-H.

LOW-COST UAV PHOTOGRAMMETRY ACCURACY ASSESSMENT

Chan Choi

Faculty Supervisor: Dr. Raid. Al-Tahir

Abstract

In the recent years, low altitude UAV aerial photogrammetry is being extensively researched by academic institutes and utilized widely in the remote sensing industry. The emergence of UAV is revolutionizing the conventional aerial photogrammetry to low altitude UAV photogrammetry. Since the low cost and high accuracy are the paramount benefits of UAV photogrammetry compared to the conventional manned aerial photogrammetry, the scope of this project focuses on the low cost UAV photogrammetry system without compromising the accuracy of the result. The goal of this project is to understand the overall process of the UAV photogrammetry and assess its accuracy. To be more precise, the objective is to utilize low cost UAV system to conduct accuracy assessment of the low altitude UAV photogrammetry. Over the course of this project, key components of UAV photogrammetry system are reviewed as well as the important tips that may benefit the reader throughout the workflow of the low cost UAV photogrammetry. Each component of the low cost UAV photogrammetry system are carefully picked and assembled. Then, the low cost UAV photogrammetry system is used to acquire aerial images. As a final result, geo-referenced and orthorectified mosaic image is generated by using photogrammetry software. Most importantly, the accuracy of the final result is tested with different quality control approaches.

EVALUATING COLLISION INVESTIGATION AND
RECONSTRUCTION CAPABILITIES WITH THE TRIMBLE TX5
LASER SCANNER

Alice Cunningham

Faculty Supervisor: Dr. Peter Dare

Abstract

Laser scanning is an emerging technology that is quickly gaining popularity in the world of accident scene reconstruction. The implementation of this remarkable technology provides the ability to resolve current issues faced by police forces across the world. Existing approaches in collision reconstruction and investigation are often time consuming, inconvenient, and potentially dangerous, as the scene must be blocked off with roads closed while evidence is gathered and measurements are made. Total stations are often used for measurements and offer many benefits, however laser scanning provides advantages such as less time at the scene, decreased time of road closure and the capability for measurements that cannot be made using traditional methods, all while achieving a comparable accuracy. This research was completed by conducting a laser scan of a mock collision scene in collaboration with the Fredericton Police Force and subsequently carrying out thorough data processing and analysis. The results demonstrate the benefits of the application of laser scanning to collision investigation and reconstruction, and explore the increased capabilities available as a result while providing a product at a comparable level of accuracy to traditional methods.

PREDICTING THE 2030 URBAN EXTENTS OF FREDERICTON WITH THE SLEUTH MODEL

Charles-Olivier Cyr

Faculty Supervisor: Dr. Raid Al-Tahir

Abstract

Informed decisions are a primary goal for every agency. The people of a community are not only interested in knowing about new plans but also why they were enacted for their specific community. With proper scientific research the answers to the public and governmental concerns can be put at ease. With the advancement of hardware and software able to process huge amounts of data, making informed decisions about community planning is possible. By using SLEUTH, the ability to spatially look into the future and define how urban growth in the Fredericton area is from 2015 until 2030 could help community planners achieve their goals. The name of the model is an acronym that represents the different layers it requires to operate. S represents Slope, L stands for Land Use, E means Excluded, U is for Urban, T signifies Transportation, and H serves as the Hillshade layer. The 12 meter totem pole named by Mr. John Bernard from the Maliseet first nation says: “Eyes on the future.” The SLEUTH model works by using historical data in order to make an urban extent prediction for a study area, ranging in size from a small city to a metropolitan. The reason why the model has been used in research projects around the world is because it has the ability to adapt to any study area.

NEW BRUNSWICK CONDOMINIUMS:
RECOMMENDATIONS FOR IMPROVING GOVERNANCE BY
IMPLEMENTING EDUCATIONAL REQUIREMENTS

Joe Doiron

Faculty Supervisor: Léo-Guy Leblanc

Abstract

Part of our education here at UNB in becoming a Professional Land Surveyor is to learn about Real Property. As part of the Survey Law course we were introduced to a different concept of ownership other than land, and that is ownership of condominium property. The development of a condominium project embraces a series of complex documents but particularly a declaration and a description (Survey and Construction plan) to define exactly what will be owned privately and in common between owners. The topic of my report will mainly deal with the Tenancy in common part being the part where all Condominium Corporations have the responsibility to maintain and administer this part of the property and its assets. My research has shown that there are issues in New Brunswick's condominium governance due to a lack of educational requirements. There are currently no requirements in the New Brunswick *Condominium Property Act* for education. Not having mandatory education in condominiums is hurting the industry. We have to be proactive and find solutions to improve the situation before it is too late.

A MEANS OF ASSESSING OUTPUTS GENERATED BY UNB'S GAPS

Stefan Dubay

Faculty Supervisor: Dr. Marcelo Santos

Abstract

A way of consistently examining the parameter and positional outputs generated by the University of New Brunswick's precise point positioning (PPP) software, GAPS (GPS Analysis and Positioning Software) was desired. The method was to compare outputs generated with the current version, GAPS v5.5.0, with future releases, and outputs generated using the Canadian Spatial Reference System's online PPP tool provided by Natural Resources Canada. A program in MATLAB was created that uses raw output files from each respective processing software, extracts relevant parameters, and performs comparisons. Final geodetic coordinates with their respective standard deviations, as well as neutral atmospheric delay (NAD) and clock difference standard deviations are differenced. A measure of the convergence time of geodetic and Cartesian coordinates, NAD, and clock differences, are found by comparing each parameter's standard deviation at every epoch with the final converged standard deviation using a Chi-squared test of the variance with a 0.05 significance level; when the two are statistically equivalent the epoch is noted and a convergence time is calculated. The program can perform comparisons with processing outputs generated from any GNSS observation, and with minor changes, can accommodate future formatting changes that GAPS or the CSRS PPP tool may make to their outputs.

MINE MODELLING USING HYPERSPECTRAL IMAGERY

Lukas Fraser

Faculty Supervisor: Dr. Peter Dare

Abstract

The current method used for mine modelling in Canada's Oil Sands involves drilling for core samples and visual inspections, a process which is slow, costly, and error prone. Mine faces were scanned using a Specim Short Wave-Infrared (SWIR) hyperspectral camera and sample materials were scanned using both the camera and an ASD FieldSpec Pro spectrometer. This paper investigates whether the samples can be used to create a spectral library that can identify those same materials in the mine faces. As it was not possible to place reference targets, ENVI's Internal Average Reflectance tool was used to convert the data from radiance to relative reflectance. A spectral library was built using spectral signatures of different mine materials in both radiance and relative reflectance. The materials were then identified in the mine faces using supervised classification techniques, specifically the Spectral Angle Mapper (SAM). The bands used for classification are around the hydrocarbon absorption features at 1730 nanometers and 2310 nanometers. Terrestrial hyperspectral remote sensing can be used to identify materials in Canada's Oil Sands, and therefore would be useful for mine modelling. The mine model could be updated in real-time every time the sensor scans the face of the mine, and classifies it using the spectral library. This would cut down on time and costs, and also reduce the need for field inspections by a geological technician.

MAPPING THE EXTENT AND INTENSITY OF A NATURAL DISASTER USING SOCIAL MEDIA

Nathan Hughes

Faculty Supervisor: Dr. Monica Wachowicz

Abstract

In 2013, the Insurance Bureau of Canada reported \$3.2 billion in severe weather insured losses, nationally. Insurance and reinsurance companies offer coverage to protect their customers against such losses. Acquiring timely, accurate, and cost effective data is a priority to these companies. This research project aims to explore the potential use of social media data to map the extent and intensity of a natural disaster. Hurricane Arthur and Hurricane Sandy were used as natural disasters and the area of focus was New York and the Maritime Provinces. The results from this research project show that the extent and intensity were best extracted using the buffering zones and spatial aggregation.

USING PPP-GPS TO ESTIMATE TIDAL MOTIONS IN THE ARCTIC & COMPARISON TO A TIDAL MODEL

Cally (Keddy) Johnston

Faculty Supervisor: Dr. John Hughes Clarke

Abstract

The motivation of this research is to use a Baffin Island fisheries mandate as an opportunity to collect simultaneous GPS observations in order to derive the tides. Knowledge of tidal heights is of significant importance for shipping and nautical charting, of which there is a substantial lack in the eastern Canadian Arctic. The observed tidal information gathered during this mandate can serve as validation to the existing Department of Fisheries and Ocean WebTide arctic9 tidal model. This paper focuses on an analytical approach of the field data collected by the MV Nuliajuk during the summer of 2014. Precise Point Positioning is used to find ellipsoidal heights and the CGG2013 geoid model is used to convert these into orthometric heights. Results show that the observed tides during this observation period match well with the arctic9 model, particularly in shape and phase. Amplitudes are different in some areas, with an average difference between the observed and model tides of approximately 0.50 metres. The differences can be explained by causes such as poor GPS signal and non-tidal water level variations. Having two GPS receivers operating simultaneously also allows for the comparison of results between the two receivers to confirm collected observations.

EVALUATING ALBERTA'S SYSTEMIC HANDLING OF PRIVATE MINERAL RIGHTS

Richard Eric Larsen

Faculty Supervisor: Dr. Sue Nichols

Abstract

The purpose of this technical report is to describe the system in the Province of Alberta that manages and supports the private mineral ownership, or freehold mineral ownership, in the province. Oil and Gas exploration and production is a huge part of the economy of Alberta so this topic is of great importance as well freehold mineral ownership in Alberta is not very common and therefore the system needs to be evaluated to ensure the system works as efficiently and effectively as possible. To complete these evaluation different aspects of the system managing these private rights were described. The history, taxation, and the royalties for the minerals were described as well as the management of the freehold mineral rights; which includes the conveyance of the rights, security of the rights, and the access to information about the rights. Professionals and Experts who work extensively with these rights and with the system in Alberta to manage these rights were interviewed to gain an in depth knowledge of the system itself and the issues that are apparent in it. All of this information was put through a set of criteria that are developed in this report to evaluate the system. The evaluation of the system did not pass based on the criteria developed. The taxation of the freehold minerals was the short coming for this evaluation of the system. From this evaluation and its outcomes four recommendations were made to improve the system. These recommendations come from the issues raised by the Professionals and Experts who work with the system and from the evaluation and criteria themselves. These four recommendations are suggested to improve the system for managing freehold minerals and their ownership in the Province of Alberta.

ANALYSIS OF GSM DATA IN CONJUNCTION WITH TWITTER DATA FOR UNDERSTANDING SOCIAL BEHAVIOUR IN SENEGAL

Tianyu Liu

Faculty Supervisor: Dr. Monica Wachowicz

Abstract

In the era of Big Data, more than 1.7 million gigabytes of data are generated every minute, and this number is still rocketing up. Global System for Mobile Communications (GSM) and social media are two important sources of big data. In this project GSM big data is analyzed in conjunction with geolocated Twitter data to discover collective hourly movement patterns in communities that can enhance our understanding about unusual social behaviours in a city. Testing with 2013 Dakar's GSM data, major social events are successfully detected by using the proposed method. Although this method is currently designed to process antenna-to-antenna voice traffic data, the same approach can be easily generalized and applied to other data types.

AERIAL MAPPING TECHNIQUES AND TECHNOLOGIES: A COST BENEFIT ANALYSIS

Colin Mclean

Faculty Supervisor: Dr. Raid Al-Tahir

Abstract

One of the most difficult tasks in the world of geomatics is keeping up with new technologies. In order to stay a leader in this industry, one must be able to identify beneficial, new surveying methods, and learn how to use them in an efficient matter. One way that geomatics companies have been providing products and services is through aerial mapping. This paper discusses three methods of aerial mapping: Traditional photogrammetry; LiDAR; and UAV. The two major aerial mapping products which are analyzed are ortho-rectified photographs, and digital elevation models (DEMs). In order to compare these methods with some sort of structure, a cost benefit analysis (CBA) was done.

A SPATIAL ANALYSIS OF THE CITY OF FREDERICTON'S BUS STOP LOCATIONS

John Mason

Faculty Supervisor: Dr. Emmanuel Stefanakis

Abstract

The City of Fredericton's bus network includes 28 buses on nine routes. It is relied upon by many but remains largely unchanged in the past 20 years. The network follows a traditional hub and spoke design, with a heavily used hub as the transition point at Kings Place, and each route spanning from downtown throughout the city in the shape of spokes on a bike wheel. With the growth of the urban core of the city, both on the North and South side, and limited municipal resources, the routes of Silverwood and Lincoln are at risk of being discontinued. The scope of this paper will attempt to compare the City of Fredericton's bus routes and measure their service quality in terms of maximizing their proximity to households. Ideally this work will; determine whether there is significant reason to cut these routes in question, which bus routes perform the best, and how these bus stops are distributed throughout the various designated zones across the city. In order to compare the City's bus routes and determine which perform the worst, a spatial analysis was done to determine how many households each bus stop services within a 500 metre interval. From the results, we can justify at least minor changes in service frequency or even a more significant change, like re-routing or cutting Silverwood or Lincoln completely. Ideally, the outcome of this paper will provide a framework from which the City may evaluate particular segments of the network.

MAPPING UNB WALKING PATHS TO COMPARE ELEVATION DATA SOURCES

Mark Mayne

Faculty Supervisor: Dr.Emmanuel Stefanakis

Abstract

There is a wide variety of public data sources that are available for everyone to use. This project will outline a methodology to be completed in which elevation data sources will be compared. These sources will include public sources that can be found on the web as well as a private source that was collected by a company. The results for this project will be site specific and will not apply to the full extent of these data sources. However patterns and trends may be observed throughout the completion of this project. Data sources that will be used include the City of Fredericton, GeoNB, Google Elevation Application Program Interface (API) and LiDAR data collected by Leading Edge Geomatics. The approach to compare these four sources revolved around obtaining a height from each source using various methods to assign an elevation to a fixed point. With a total of seven elevations being assigned to ten different control points a fair comparison could be made. All computations were carried out in ArcMap with the plotting of final results done in ArcScene. The results that will be displayed include visual comparison of the elevations and deviation of each point, as well as numerical results that were determined throughout statistical testing and analyzing. These results will influence the conclusion and determine the quality of each data source and method used. In conclusion, the ideal elevation data source to be used around the UNB walking paths would be the LiDAR data. This is due to the consistency of the data source as well as it being the most recent data collected.

REPORTING MOTOR VEHICLE ACCIDENTS USING A GNSS BASED APPLICATION

Craig David Murray

Faculty Supervisor: Dr. Monica Wachowicz

Abstract

The current system for reporting motor vehicle accidents in New Brunswick is a manual hand written method which is due for an upgrade. This system features numerous problems from the on scene reporting method all the way to the provincial database with New Brunswick department of Transportation & Infrastructure (NBDTI). The inconvenience of further transcribing hard copies of reports by the NBDTI has caused a backup of almost 2 years of data. Ultimately, a digital reporting method will need to be adopted in order to improve this process. One of the major improvements to be made is a better method of reporting accident location, via Global Navigation Satellite System (GNSS). This paper reviews the current motor vehicle accident reporting system used in New Brunswick together with a proposed digital method assisted by GNSS to improve it. In particular, this paper discusses the entire work flow of the current system, other methods used around the world along with their advantages and disadvantages as some involve using GPS in different ways. A digital method assisted by GNSS is less prone to errors, reduces redundancy in the work flow and improves the accuracy of the accident location making geo-referenced reports useful sooner in a Geographic Information System (GIS). At the end of the day, NBDTI is the last recipient of these reports and they dictate the format and method of delivery. It will only be useful to implement a new reporting system for police if it's adopted by the NBDTI as well.

OPTIMIZING THE CAMPUS FLOOR PLAN: AN INTERACTIVE MAPPING APPLICATION FOR E-LEVEL OF HEAD HALL, UNB

Adam Paine

Faculty Supervisor: Dr. Emmanuel Stefanakis

Abstract

The benefits of optimizing a campus floor plan to integrate spatial data and information are endless and only readily apparent when you really analyze the concept. The need for a tool such as this optimized floor plan is one not born out of any particular apparent flaw, but out of the readily available options that exist to improve upon the current system. Such a tool would simply benefit all members of a campus community immediately. Optimizing a tool such as the one proposed will improve the overall efficiency and organization within the campus environment, or wherever such a product is used. The more the application is improved upon, updated, and optimized, the larger benefit it will provide to the user. The final product is one that has all of the base features originally proposed; class schedules, office occupancies, room types, and building identifier numbers. Each layer representing a feature on the floor plan can be printed and distributed for use. While the final application design is not currently complete at the time of this report, the results and features that can be used do reflect the intended application of the tool. This application provides a massive assistance to those in the Geomatics Engineering department. The recognized increase in efficiency and organization within the department will be displayed prominently as its use is expanded.

THE PRACTICALITY OF TRIGONOMETRIC HEIGHTING: COMPARING TRIGONOMETRIC HEIGHTING, GEOMETRIC LEVELLING, AND GNSS HEIGHTING

Greg Rodger

Faculty Supervisor: Dr. James Secord

Abstract

Historically, trigonometric heighting has been commonly viewed as an inferior heighting method compared to geometric levelling. Theoretical examinations of the errors involved with geometric leveling and trigonometric heighting lead one to favour the application of geometric leveling in day-to-day use. The possible time-saving benefits of using trigonometric heighting in determining heights, especially in hilly terrain, are a motivating force in wanting to compare current heighting methods. The establishment of a control network on the University of New Brunswick Fredericton Campus offers a unique opportunity to compare various methods of height determination. By comparing the height determination of the UNB control network through trigonometric heighting, geometric levelling, and GNSS heighting a practical evaluation of these methods is made possible. The advent of GNSS heighting as a possible solution in determining heights and advances in traditional levels and total stations make such a practical comparison particularly useful. By establishing the UNB control network, three data sets will be produced by observations obtained in real world conditions while attempting to maximize efficiency and relative accuracy. A comparison of the datasets allows for an evaluation of the practicality of these methods.

CANADIAN MARINE CADASTRE:
BUILDING ON LESSONS FROM THE US GULF OF MEXICO

Eric Root

Faculty Supervisor: Dr. Sue Nichols

Abstract

Good governance of marine spaces is crucial in the pursuit of sustainable development. The use of a multipurpose marine cadastre enables a nation to accurately define boundaries in marine spaces and effectively manage all rights and interests associated to them. In Canada's offshore regions, the current legal and spatial framework exists to support only a fraction of those rights and interests: the oil and gas industry. This research investigates the existing spatial and legal frameworks in place to support this industry in the offshore regions of both Atlantic Canada and the United States' Gulf of Mexico. A comparison between each framework's limitations based on the mathematical datum used, legal requirements, and fitness for use in its direct implementation into a multipurpose marine cadastre is carried out. Recommendations for Canada's next steps towards a multipurpose marine cadastre are made, building on multipurpose marine cadastre initiatives in the United States' Gulf of Mexico and the work of Karen Cove in her report "Property Rights Regime for Offshore Oil and Gas Development" from 2002.

U.N.B. CAMPUS CONTROL NETWORK DESIGNING A DEFORMATION MONITORING CAMPAIGN

Adam Thimot

Faculty Supervisor: Dr. Robert Kingdon

Abstract

University of New Brunswick's Geodesy and Geomatics Engineering program is excellent and recognized worldwide, but there are always ways to improve. One area in which U.N.B.'s GGE program was lacking is practical deformation monitoring exercises, which this project attempts to rectify. This project creates the framework for a deformation monitoring campaign, including both the fieldwork and analysis aspects, as well as obtaining the first series of observations for the campaign; with the biggest emphasis put on improving education for future U.N.B. students.

The process of creating this campaign was three tiered: designing the campaign itself, designing the practical fieldwork assignment for GGE 3023, and designing the practical data analysis assignment for GGE 4022. The design of the campaign was done using mathematical tools and assessment of available equipment. This campaign may only be shown a success in future years, once data has been collected and analyzed on multiple occasions.

GNSS-DERIVED ORTHOMETRIC HEIGHTS FOR WATER LEVEL MONITORING AND GEOID ACCURACY ASSESSMENT

Matthew Williams

Faculty Supervisor: Dr. Robert Kingdon

Abstract

The motivation for undertaking this project was to make a Geomatics contribution to the Canadian River Institute's goal to determine the most sustainable course of action for the future of the Mactaquac Hydroelectric Generating Station, the Saint John River, and the local communities. This project has proven that a static GNSS network survey can be used to densify a vertical control network for the purpose of water level monitoring in a river valley. In addition, the new Canadian Geodetic Vertical Datum 2013 (CGVD2013) is suitable for a practical project of approximately 20 km extent. A GNSS network was designed and observed over the project area and the baselines were processed using Trimble Total Control Software. The project objective of 3 cm uncertainty was achieved for seven of the twelve project points. It was determined that one of the calculated values of the first order control was equivalent to the published values at a 95% confidence level.

MODELING URBAN TRAFFIC USING THE NEO4J GRAPH DATABASE

Jacob Wood

Faculty Supervisor: Dr. Monica Wachowicz

Abstract

The purpose of this project is to model urban traffic with a graph database, in my case Neo4j. Creating a graph database to model urban traffic has been completed in the past. My research focuses primarily on the City of Fredericton; using the road network information and the traffic volumes recorded by and acquired from the City. The problem now, is that various scales of traffic information are being recorded around the world. Creating a model will allow for a universal database, allowing the information to be stored and managed in one location. I have used Fredericton and specific streets and intersections located around the city hub on the south side of the St John River. The results, once the both models were generated and the literature review both suggested that the most appropriate way to represent the traffic volumes and have a focus on the flow of traffic for real-time purposes was to use the dual graph. Both graphs are similar in information, allowing users to query the data and understand the similarities, for example, AADT volume greater than 10000 or AADT northbound for the dual and primal graphs respectfully.