

Development of Multiple Query Web GIS for
Growing Databases A Case study of Land and
Water Information Management



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April 28, 2011

DECLARATION

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Abstract

Land and water information systems are developed for managing the information such as location, its limit, characteristic, structure, ownership if available and other relative attributes. For presenting the geographical locations of the land and water features, map based systems are being developed. Present day Geographic Information Systems (GIS) are map based systems which enable the interaction of several map layers for desired output. Most of the available WebGIS applications for land and water information are limited to selected features, such as roads, rivers, buildings and forest features. Some are limited to defined Geographical area, while only primary attribute values are displayed by some other applications. However, with the increment of requirements for WebGIS application, information and functions are being enhanced rapidly. When serving large data through a WebGIS application, performance tend to be slowed. Therefore it is important to identify the issues of WebGIS application in case of growing databases.

Overall objective of the study is to identify the issues and concerns related to the development of Web GIS applications for growing databases and then to develop a land and water information system in order to identify management issues pertaining to the tool development associated with map serving and combined querying. The specific objectives of the research are: Identification of WebGIS performance issues with respect to the spatial coverage expansion and attribute expansion and development of a land and water management WebGIS tool with user friendly search capability considering possible expansion of coverage.

As very first step, the issues of available web GIS applications are identified by a literature survey. Meanwhile, a evaluation on development methodology, performance optimization techniques and performance calculation methods is carried out. The work commenced with the development of WebGIS application including information and functionality at basic level. According to the user survey, the application was enhanced for another three stages with growth of database and functional operations. The growth rate of database size second stage of the application is twice than first stage. While third stage growth rate is five times than second stage and fourth stage having about fifteen times of growth rate of features. The testing process of each stage was carried out to identify user familiarity, accuracy and performance level of the application. Performance level was identified by calculating the response time of functions at each stage.

GeoInfo WebGIS application with better efficiency level of functionalities, user friendly features and high accuracy level is one of major results of this research. Functionalities of WebGIS application are listed as (i) Query for land and water features, their attributes and relative features. (ii) Map the geographically location of water and land features and (iii) GIS operations such as location identification, measure length/area, map zoom in/out, pan map and vector and raster data layers loading. JavaScript, XML, HTML, and PHP are programming languages for the development of the application, while Postgis is selected as the database. Database to database functions take high response time of 22.5 seconds in Version 4 while map to database

having the 3.42 seconds as minimum compared with first level of WebGIS function categories. When considering all the functions are considered, "Measure Tool Operation" has the minimum response time of 0.42 seconds and Maximum is the 59.2 seconds and it is the response time of "Displaying list of Buildings" function. A rapid increment of response time is with functions of fourth versions. Other identified issues are non responsive situations with loading images, take more time to data loading and map overlaying when browsing and changing .

By evaluating results of the verification process it is identified that database transactions directly affect the efficiency of functions of WebGIS application. Reasons for Identified issues of WebGIS land and water management are (1). Issues with performance of stored procedure (2). No factor query index (3). Low efficient configuration of server (4).Issues with cache memory and (5). Trying to load heavy maps and data

Recommendations for WebGIS development are (1).Database to database functions should be minimize as possible for the best performance of Water and land information management WebGIS application. (2). When serving the Raster and Polygon data, size should be in small components as possible. (3).Careful action should be taken when loading more than 10 or 20 records at a given time



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TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Introduction	1
1.2	Main Objectives and Target Outputs	4
1.2.1	Overall objective	4
1.2.2	Specific objective	4
1.3	Research Methodology	5
2	LITERATURE SURVEY	7
2.1	Field Data Collections methods	7
2.1.1	Land data	7
2.1.2	Collect land data in field	8
2.2	WebGIS application evaluation	9
2.2.1	Features and functionalities	9
2.2.2	The Software , applications, tools and techniques	12
2.2.3	Functionality design methods	14
2.2.4	Structural concepts for WebGIS	15
2.2.5	Problems	16
2.2.6	Issues and complexity of development process	16
2.2.7	Performance with factors	17
2.3	DBMS for WebGIS application	19
2.3.1	Performance	19
2.3.2	Issues and problems	19
2.3.3	Concepts and theory	20
2.3.4	Growing databases and issues	21

2.3.5	DBMS optimization for growing databases	21
2.4	Testing methods and criteria	22
2.4.1	Efficiency of functional testing methods	22
2.4.2	Performance testing methods	22
2.5	Evaluate the WebGIS applications	22
3	METHODOLOGY AND DESIGN	28
3.1	Outline of Research Methodology	28
3.1.1	Introduction and flow of research methodology	28
3.1.2	Database Development	30
3.1.3	Application development methodology	32
3.1.4	Stage based development of the application	32
3.1.5	Verification	39
3.1.6	Evaluation and results generation	43
3.2	Conceptual Design	43
3.2.1	Conceptual design of the system	43
3.2.2	Web GUI design	44
3.3	Outline of Database Development	48
3.3.1	Database Structure	50
3.4	Field Data Collection	53
3.4.1	Introduction	53
3.4.2	Study area	55
3.4.3	Planning of data collection	55
3.4.4	Data Form Testing	58
3.4.5	Data Collection	61
3.4.6	GPS measurements	63
3.4.7	Verification and gap filling	66
3.4.8	Data collection problems	66
3.5	Database Development	69
3.5.1	Introduction	69
3.5.2	Geographic location database development	69

3.5.3	Attribute database creation	73
4	DEVELOPMENT AND RESULTS	78
4.1	Introduction	78
4.2	Nature of WebGIS application	78
4.3	Function Design	79
4.3.1	Function Identification	79
4.3.2	Function groups	80
4.3.3	Version development	81
4.4	Function Development	84
4.4.1	Introduction	84
4.4.2	Function grouping for development	84
4.4.3	Development Process	84
4.5	GUI Development	86
4.5.1	GUI Feature Selection	86
4.6	Performance Optimization	88
4.6.1	Web page optimization	88
4.6.2	GIS optimization	90
4.6.3	PostGIS database optimization	92
4.7	Verification of WebGIS	92
4.7.1	Introduction	92
4.7.2	Functional verification	93
4.7.3	Accuracy verification	93
4.7.4	Identified functional issues	96
4.7.5	Performance issues	96
4.7.6	Performance Verification	98
4.7.7	Calculation	98
4.7.8	Response time analysis	99
4.8	Results	100
4.8.1	Development of GeoInfo WebGIS application	100
4.8.2	Land and Water Information Management	124

4.8.3	WebGIS performance issues	126
4.8.4	Performance of WebGIS application with growing database	127
4.8.5	Issues and Constraints with WebGIS Application	132
4.8.6	Recommendation for WebGIS Application Development	134
4.8.7	Recommendation for GUI designing	134
5	DISCUSSION	135
5.1	Introduction	135
5.2	WebGIS Application Development	136
5.2.1	GeoInfo WebGIS application	136
5.2.2	Field data collection	136
5.2.3	Interface designing	140
5.3	Response Time Evaluation	141
5.4	Performance Issues	141
5.4.1	Performance issues Summary	143
5.5	Recommendation for WebGIS Development	144
5.5.1	Reasons for identified issues	144
5.5.2	Recommendation for WebGIS development	145
5.6	Future Work	146
5.6.1	Improvements for the application	146
5.6.2	Improvements for the research	146
6	CONCLUSION	147
	REFERENCES	148
	Appendix A FUNCTIONAL FLOW DIAGRAM OF WEBGIS APPLICATIONS	154
	Appendix B DATABASE AND FUNCTIONAL DEVELOPMENT	157
	Appendix C FUNCTION IDENTIFICATION	167
	Appendix D FUNCTIONS OF GEOINFO WEBGIS APPLICATION	172

Appendix E RESPONSE TIMES OF GEOINFO WEBGIS APPLICATION 203



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LIST OF FIGURES

Figure : 1.1	Methodology Flow Chart	6
Figure : 3.1	Data Collection Methodology Flow Chart	31
Figure : 3.2	Overall Applications Development Process	34
Figure : 3.3	Major Deign Aspects of Version 1	35
Figure : 3.4	GIS Layer Operation Design (From A to B of Figure 3.3)	36
Figure : 3.5	GIS Layer Module (From C to D of Figure 3.3)	37
Figure : 3.6	GIS Tool Operation Methodology (From E to F of Figure 3.3)	38
Figure : 3.7	Verification Methodology Structure	39
Figure : 3.8	Verification Methodology Flow	40
Figure : 3.9	Group of Functionalities Version 3 and Version 4	42
Figure : 3.10	Conceptual Design of Web GIS Application	44
Figure : 3.11	Building Problem with Boundary Toughing	52
Figure : 3.12	Study Area for Data Collection	56
Figure : 3.13	Initial Data Collection Sheet	57
Figure : 3.14	Building Identified in the Field were Marked on the Printed Map	58
Figure : 3.15	Final Data Collection Sheet	59
Figure : 3.16	Data Collection Zones	62
Figure : 3.17	A completed Data Collection form	65
Figure : 3.18	Data Entering Issues Identification Form	67
Figure : 3.19	Address and Person Arranged in Building Polygon	71
Figure : 3.20	Tile Index Creation	73
Figure : 4.1	Colour Palette for Colour Testing	87

Figure : 4.2	Issues Identified because of Layer Overlapping	96
Figure : 4.3	Formula Creation for Performance Testing	99
Figure : 4.4	Main Structure of GeoInfo Web GIS Application	112
Figure : 4.5	Basic Contents of Geoinfo Web GIS application	113
Figure : 4.6	Results Colour Pallet with marks for colours	116
Figure : 4.7	”Search ” Menu of Version 1	118
Figure : 4.8	”Advanced Search ” Menu of Version 2	118
Figure : 4.9	Menus of Version 3	118
Figure : 4.10	Tool bar of Version 1 and Version 2	119
Figure : 4.11	Tool bar of Version 3	119
Figure : 4.12	Boundary Folder for Version 1,2 and 3	119
Figure : 4.13	Label Folder for Version 1 and 2	119
Figure : 4.14	Label Folder for Version 3	120
Figure : 4.15	Back Ground Map Folder	120
Figure : 4.16	Comparison of Performance of WebGIS Application	123
Figure : 4.17	Response Time of Functions	127
Figure : 4.18	Response Time of Functions of Map to Map Operation Group	128
Figure : 4.19	Response Time of Functions of Map to Database Operation Group	129
Figure : 4.20	Response Time of Functions of Database to Map Operation Group	130
Figure : 4.21	Response Time of Functions of Database to Database Opera- tion Group	131
Figure : 5.1	Main Structure of web site	140
Figure : A.1	Methodology Flow of Spatially Identification of Features - version 2	155
Figure : A.2	Methodology Flow of Spatially Identification of Features -V 3	156
Figure : B.1	Converting the Shap File Into the SQL file	159

Figure : D.1	The UPS Zone of the WebGIS	173
Figure : D.2	GIS Options Consist of Tools for Suitably Visualizing the Geographic Layer Information	174
Figure : D.3	Scale Bar at Two Different Map Zoom Levels	175
Figure : D.4	User Options Include Activating either One or Many Boundaries	176
Figure : D.5	Place Names Labels on the Geoinfo WebGIS	177
Figure : D.6	Building Label Display on the Moratuwa DSD Area	177
Figure : D.7	Roads labels within Moratuwa DSD area	178
Figure : D.8	Scanned Map Background on the GeoInfo WebGIS	178
Figure : D.9	Scanned Map Background on the GeoInfo WebGIS when a User Zooms In	179
Figure : D.10	Satellite Map as the Background	179
Figure : D.11	Background Sat Image can be Zoomed to Detail if Resolution is Satisfactory	180
Figure : D.12	Tool Bar and Menu Bar Sections	180
Figure : D.13	Tools Tab Enables a User to Perform Various Map Actions	181
Figure : D.14	Information of Find Tool	182
Figure : D.15	Ruler Tool to Measure Length on a Map	183
Figure : D.16	The Ruler Tool Enables the Measurement of a Distance along a User Selected Path	183
Figure : D.17	Menu bar with direct search and advanced search	184
Figure : D.18	Point to Advanced Search in order to get the building sub menu	184
Figure : D.19	Search for Postal Division Dialog Box	185
Figure : D.20	Enter Name on the Information Tab for Map Search	185
Figure : D.21	List of Postal Division for the User Selection as Moratuwa	186
Figure : D.22	List of Areas of Moratuwa Postal Area	187
Figure : D.23	Street list	188
Figure : D.24	Information of Selected Road.	188

Figure : D.25	List of postal Numbers	189
Figure : D.26	Information of Selected Building	190
Figure : D.27	Information of Persons Related Address	191
Figure : D.28	Zoomed and highlighted view of the building	191
Figure : D.29	Options to be Selected Building, Roads and Water Streams from the Source Building	192
Figure : D.30	Enter the Road Name	192
Figure : D.31	Results of Roads According to Entered Word	193
Figure : D.32	Location of Selected Road on Map	194
Figure : D.33	List of Addresses of Selected Road	195
Figure : D.34	Water Stream Enter Dialog Window	195
Figure : D.35	The location of the Selected Water Stream	196
Figure : D.36	Select Building sub Menu	197
Figure : D.37	First Selection for Building - Size of the Buildings	198
Figure : D.38	Second Selection for Building - Type of the Buildings	198
Figure : D.39	Third Selection for Building - Roof Type of the Buildings	199
Figure : D.40	Fourth Selection for Building - Purpose of the Buildings	199
Figure : D.41	List of Address According to the User Selection	200
Figure : D.42	List of Types of Roads	200
Figure : D.43	List of Road Length Groups	201
Figure : D.44	List of Roads Based on User Selection of Road Type and Road Length	201
Figure : E.1	Response Time Distribution of Map to Map Functions of Ver- sion 1	205
Figure : E.2	Response Time Distribution of Map to Database Functions of Version 1	206
Figure : E.3	Response Time Distribution of Database to Map Functions of Version 1	206
Figure : E.4	Response Time Distribution of Database to Database Func- tions of Version 1	207

Figure : E.5	Response Time Distribution of Map to Map Functions of Version 2	208
Figure : E.6	Response Time Distribution of Map to Database Functions of Version 2	208
Figure : E.7	Response Time Distribution of Database to Map Functions of Version 2	209
Figure : E.8	Response Time Distribution of Database to Database Functions of Version 2	209
Figure : E.9	Response Time Distribution of Map to Map Functions of Version 3	210
Figure : E.10	Response Time Distribution of Map to Database Functions of Version 3	210
Figure : E.11	Response Time Distribution of Database to Map Functions of Version 3	211
Figure : E.12	Response Time Distribution of Database to Database Functions of Version 3	211
Figure : E.13	Response Time Distribution of Map to Map Functions of Version 4	212
Figure : E.14	Response Time Distribution of Map to Database Functions of Version 4	213
Figure : E.15	Response Time Distribution of Database to Map Functions of Version 4	213
Figure : E.16	Response Time Distribution of Database to Database Functions of Version 4	214



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LIST OF TABLES

Table : 3.1	Data Structure and Linked Stages	49
Table : 3.2	Database Structure and Linked Stages	51
Table : 3.3	Data Sources for Geographic Map	53
Table : 3.4	List of Feature Attributes	60
Table : 3.5	Study Area for each Versions of WebGIS Application	72
Table : 4.1	Basic Information for GeoInfo WebGIS Versions Categoriza- tion	82
Table : 4.2	Basic Concept for Selection of Functions for Versions	83
Table : 4.3	Configuration of MS4W Components and Their Operations	84
Table : 4.4	Function Grouping for Development	85
Table : 4.5	Performance Issues Identified from Functional Versification	97
Table : 4.6	Features and Data Collection Efforts in Data Collection Zones	103
Table : 4.7	Distribution of Building Units According to the Purpose	104
Table : 4.8	Road Distribution in the Study Area	105
Table : 4.9	Contribution of Efforts by Various Personnel	107
Table : 4.10	Attribute Data Description - Version 1	108
Table : 4.11	Attribute Data Description - Version 2	108
Table : 4.12	Attribute Data Description - Version 3	108
Table : 4.13	Attribute Data Description - Version 4	109
Table : 4.14	Geographic Data Description - Version 1	109
Table : 4.15	Geographic Data Description - Version 2	109
Table : 4.16	Geographic Data Description - Version 3	109
Table : 4.17	Geographic Data Description - Version 4	109
Table : 4.18	Component Descriptions of GeoInfo WebGIS Application	111

Table : 4.19	GUI Arrangement with Version 1, 2 and 3	117
Table : 4.20	User Needs, Satisfactory Level and Aspirations of User Inter- face of Web GIS Application	121
Table : 4.21	Performance Comparison of Web GIS Applications	122
Table : 4.22	Building Summary based on Size	125
Table : 4.23	Permanent or temporary state	125
Table : 4.24	Road Type Information	126
Table : 4.25	The Expand of the Data	126
Table : 4.26	Data Wise Calculation of Response Times	131
Table : 4.27	Summary of the Performance of the Expanding Database . . .	132
Table : 4.28	Identified Issues with Web GIS Application	133
Table : 5.1	Road Distribution in the Study Area	140
Table : C.1	Distribution and Availability of Functions in Version 1,2 and 3	170
Table : E.1	Average Response Times for Function of each Version . . .	203

