PROTOTYPE DEVELOPMENT OF RIVER-BED CHANGE MONITORING SYSTEM FOR RIVER MAINTENANCE MANAGEMENT

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KEY WORDS: Monitoring, Prototype, River management, Dynamic changes data, DB

Abstract: This study is to develop a river-bed variation monitoring of DEM-based, support the efficient and sustainable river management work in Korea.

There is an increasing demand for continues, systematic management and providing of information for river changes due to 4 Major River projects. By introducing a system to provide data needed for managing and maintaining variation of river bed can enhance accuracy and convenience of work. This system consists of establishing river inspection plan, river terrain monitoring, analysis for variations in river bed and providing data and built related database. On this basis, river bed variation monitoring prototype has been develop.

INTRODUCTION

In order to survey variations of river bed, continuous monitoring is essential. In Korea several research studies to survey river bed variations using the latest surveying equipments are ongoing studies; (Analysis of Accumulation/Erosion in River Using Satellite Image(Yang In Tae et al.; 2006), The Study on Accuracy Improvement of Estuary Riverbed Monitoring(Park Un Yong et al.; 2003) and The Monitoring of Sediment on the Basin Using LiDAR Data(Kang Young Mi et al.; 2006).

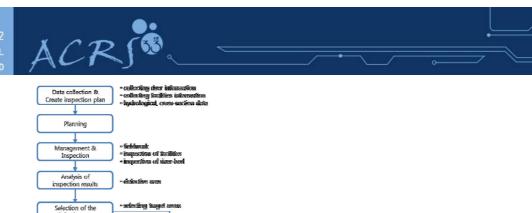
But findings based on the research study Development of a River Maintenance Management Technology Related with National River Management Data (Jo Myung Hee et al. 2012) utilization of river terrain is sufficient and focused on the analysis of the hydraulic and hydrologic models.

Therefore, this research is to build a database for dynamic river bed variations and developed a prototype for monitoring program for river bed variations based on DEM. And it is intended to enhance utilization of data by integrating it with River Information Management Geographical Information System (RIMGIS).

METHODOLOGES

■ Feature selection of River-bed variation monitoring progtam

The current maintenance and management system were surveyed in order to select features for river bed variation monitoring program. The result of the survey shows that it's difficult to analyze, store and manage river-related data systematically for river inspection plans, as inputs for river inspection plan are not computerized. And also the level of utilization for research results is extremely low because there are almost no hydraulic and hydrologic analysis functions. Problems for current river maintenance and management system are shown in Figure 1 and Table 1.



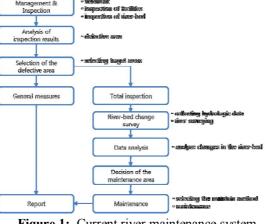


Figure 1: Current river maintenance system

Table 1: Disclosure of Problems with the River maintenance system

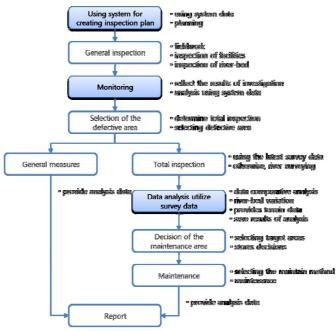
No.	Contents
1	-Absence of systematic management system about related to river report -Need to improve the river terrain data stored and provides method
2	-Need to acquire basic data for analysis
3	-Apply advanced surveying methods and River surveying regularly
4	-Requires its own hydrologic analysis

Input data were computerized by implementing functions to input inspection results into system depending on river inspection plan that is establishes every year. In addition, we intend to develop monitoring functions for variations in river beds based on acquired DEM through advanced measurement technique and analysis function for variations in river bed such as sedimentation and erosion of rivers. Items to be developed in the future are shown in Table 2 and river maintenance and management system to be improved by system development are shown as Figure 2.

Table 2: Development of technology for River-bed change monitoring

No.	Primary function	Secondary function	Explanation
1	Inspection planning		- Inspection planning - Select the target of the check
2	River-bed change	Monitoring(interval)	- DEM-based - Monitoring of the selected interval
2	monitoring	Monitoring(section)	- DEM-based - Monitoring of the selected section
		Data generation	- Select DEM - Data generation & store about cross-section
3	River-bed change	River-bed variation	- DEM-based - Variation calculated of the selected section
5	analysis	River-bed variation(section)	- CAD-based - Cross-section comparison -Variation calculate
4	Determine	Longitudinal data	- Using the data extracted from the DEM
4	Data source	Cross-section data	- Using the data extracted from the DEM - Provide data

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Figure 2: The improved River maintenance system

Design of River-bed variation monitoring program

In In order to provide the major functions for the system, database were built for establishing river inspection plan, monitoring and analysis for river bed variations. DB was developed to support task for maintaining and managing river bed variations and inter-connectivity of database have been reviewed. Design specifications for database are shown in Table 3 and design specification to implement DB are shown in Table $4 \sim 8$.

Table 3: DB	design	for River-bed	change monitoring

No.	Table name	Contents
1	GisInfo	DEM files used to support river-bed maintenance management
2	GisMaster	Management of River Information, Section Information, DEM files information
3	GisPlan	Plan of Daily(Comprehensive) Inspection & Management of Complete Information.
4	RiverCode	Storage of River code about National rivers and Local streams
5	TerritoryCode	Save the Watershed Code on the Water Resources Unit Map

Table 4 : DB Unit Plan_Gis Info

	No.	Table ID	Table IDTable Name		Create Required		
1		GisInfo	DEM Info	rmation			
No.	COLUMN ID	COLUMN NAME	ТҮРЕ	LENGTH	NULL	NOTE	
1	River ID	River code	С	7			
2	Section ID	Interval code	С	30		Ex)001-020	
3	Version	Year/Month	С	6		Ex)201205	
4	C-cols	No. columns	С	30			
5	C-rows	No. raws	С	30			

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6	LBX	Left lower X coor.	С	30	TM X coor.			
7	LBY	Left upper Y coor.	С	30	TM Y coor.			
8	C size	Cell size	С	30	Unit: m			
9	C nodata	Non data	С	30				
10	RTX	Right lower X coor.	С	30	TM X coor.			
11	RTY	Right upper Y coor.	С	30	TM Y coor.			

Table 5 : DB Unit Plan_Gis Master

No. 2		Table ID		Name	Create	
		GisMaster	Master Infe	ormation	Required	
No.	COLUMN ID	COLUMN NAME	TYPE LENGTH		NULL	NOTE
1	River ID	River code	С	7		
2	Section ID	Interval code	С	7		Ex)001-020
3	Data type 1)	Data classification	С	1		
4	Version	Year/Month	С	6		
5	File root	File path	VC	100		
6	File name 2)	File name	VC	30		
7	Reference	Remark	VC	200		
	1) Claasification of c	lata file formats				
Со	D: DEM file, B: R	tiver boundaries file, L: I	River centerlin	e file, C: River	crossing ch	nain file
nte	2) Written of Filenar	me(30)				

nts

River code(7)+Coupler(_)+Interval(7)+Coupler(_)+Year/Month(6)+Coupler(_)+Data classification(1) Ex) 2000010 + "_" + 001-999 + "_" + 201101 + "_" + D + ".asc"

	No.	Table ID	Table I	Table Name		eate	
	3	GisPlan	Plan Information		Required		
No.	COLUMN ID	COLUMN NAME	TYPE	TYPE LENGTH		NOTE	
1	River ID	River code	С	7			
2	Section ID	Interval code	С	7		Ex)001-020	
3	Plan date	Inspection plan date	С	10			
4	C user	Representatives	VC	40			
5	C type	Checking kind	VC	40			
6	C contents	Checking list	VC	200			
7	C date	Checking date	С	10			
8	C state	Status	С	40			
9	C result	Process the results	VC	200			

Table 6 : DB Unit Plan_Gis Plan

Table 7 : DB Unit Plan_River Code

No. 4		Table IDTable I		Name	Cre	ate
		Rivercode	River of Information		Required	
No.	COLUMN ID	COLUMN NAME	TYPE	LENGTH	NULL	NOTE
1	River ID	River code	С	7		
2	River name	River name	С	30		

No. 5		Table ID	Table I	Name	Create		
		Territory code	Territor	y code	Required		
No.	COLUMN ID	COLUMN NAME	TYPE	LENGTH	NULL	NOTE	
1	BSN ID	Large watershed code	С	2			
2	BSN name	Large watershed name	С	30			

Table 8 : DB Unit Plan Territory Code

Development of River-bed variation monitoring program

This research developed variations in river bed monitoring program which consists of managing river inspection plans, river transverse and longitudinal monitoring, and inquiry for variations in river bed and DEM metadata management. This system allows users to select spans for rivers that they want by providing lists of rivers while it developed input and query interface about the established date of inspection plan, name of person in charge, types of inspection plan and its contents. In addition, this system developed functions to support river transverse and longitudinal monitoring for each year and provide data for terrain elevation extracted from DEM as graphics and files. Especially, this system made it possible to inquire variations in river beds through comparison and analysis for two data. In particular by comparing DEM produced at the time of establishing river development plan and DEM produced by most recent river inspection. In addition, this research developed functions to provide sedimentation, erosion status and variations in river beds by cross-section and numerical values and developed management function for DEM information. Interfaces for each program are shown in Figure 3~6.

Manning		Cross Section		ongituian Section	Rhv	erBedUpdown	CrSec (Comp.	GisINFO	
계획수립	V10									- 0
		하친코드	72	정경계획일	담당자	정갑충류	점검내용	점겁잁	점검현황	정경렬과
		2027640	001-010	2012-05-01	<u>홍길동</u>	일상점검	하상변용	2012-05-01	정경계획	하상정비실시
		2027641	001-010	2012-05-02	<u>홍길</u> 등	일상점검	하상변동	2012-05-02	정경완료	하상정비실시
201	20 낙동강 🔻	2027642	001-010	2012-05-03	<u>홍길동</u>	월상험검	하상변동	2012-05-03	정강환료	하상정비설시
		2027643	010-020	2012-05-04	홍길동	*****	하상변동	2012-05-04	조합점검시형	<u>하상정비설시</u>
2분	0국가하천 🔻	2000010	111-222	2012-05-05	홍길순	일상점검	일상황경입니다	2012-05-05		
	2000010낙동강 🔻	1100010	111-222	2012-05-15	홍길동	4222	일상황경입니다	2012-05-15		
抱	2000010 183	2000010	111-223	2012-05-16	¥25	일상험검		2012-05-16		-
77	123-456	2000010	111-224	2012-05-17	来교통	일상점검		2012-05-17		
	123/430	2027640	111-333	2012-05-18	김성물	일상험검	화금	2012-05-18	전급환율	
치일	2012-05-19	2027640	111-333	2012-05-19	김성종	특별감감	완료	2012-05-19	0.00-	
		2027640	111-333	2012-05-20	김성물	통영경경	왕금	2012-05-20		
15178	유생률	2027640	111-333	2012-05-21	김성물	특별점검	완료	2012-05-21	-	
	11 10 10	2027640	111-333	2012-05-22	김성물	6552	와공	2012-05-22		
1294	열상평경 💌	2027640	111-333	2012-05-23	강태공	특별점검	완료	2012-05-23		
		2027640	111-333	2012-05-24	강태공	특별점검	와공	2012-05-24		
1348		2027640	111-333	2012-05-25	강태공	8923	점검증기	2012-05-25	점검증 기	-
상점검		2027640	111-333	2012-05-26	강태공	특별함경	점검증 지	2012-05-28	점감증지	
		2027640	111-333	2012-05-27	02/9	특별점검	정검보류	2012-05-27	전검보류	
		2027640	111-333	2012-05-28	신간면	5668	와공	2012-05-28		
		2027640	111-333	2012-05-29	129	일상함경	일사람건	2012-05-29	<u>청경관</u> 료	참경완료입니()
		2000010	123-456	2012-05-15	0(성출	일상험검	일상점검 입니다.			
		2000010	123-456	2012-05-18	정성률	일상점검	일상함검			
		2000010	123-456	2012-05-19	유성률	일상점검	8483			-

Figure 3: River inspection plan screen

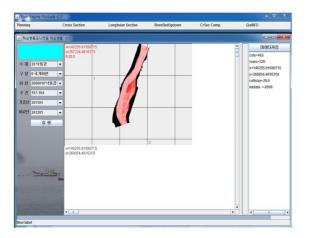


Figure 5: River-bed variation monitoring screen

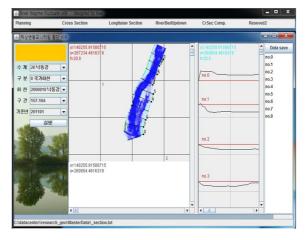


Figure 4: Cross section monitoring screen

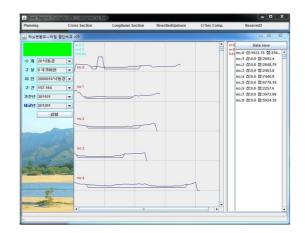


Figure 6: Analysis of River-bed variation screen



We have developed a river bed variation monitoring program, which can identify the dynamically changing river environment. This system is expected to acquire and analyze data related to dynamic variations in rivers which applied standard specification for river maintenance and management tasks using the prototype designed. And to enhance utilization of the data stored at system in a way that provides great information of river terrain data to other services and by integrating it with River Information Management Geographical Information System (RIMGIS).

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Park Un Yong, Kim Yong Bo, Back Ki Suk, 2003. The Study on Accuracy Improvement of Estuary Riverbed Monitoring. The Korean Society for GeoSpatial Information System, 11(3), pp. 23-34.

Yang In Tae, Kim Dong Moon, Chun Ki Sun, 2006. Analysis of Accumulation/Erosion in River Using Satellite Image. Korea Society of Surveying, Geodesy, Photogrommetry and Carography, 24(1), pp. 37-45.