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

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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.
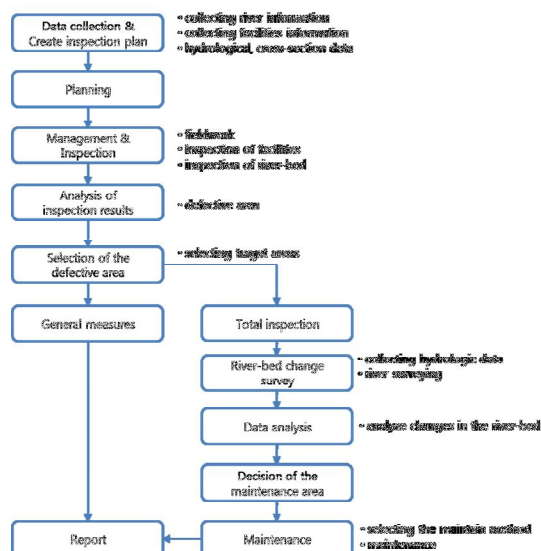
Figure 1: Current river maintenance system

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	Monitoring(interval)	- DEM-based	- Monitoring of the selected interval
		Monitoring(section)	- DEM-based	- Monitoring of the selected section
		Data generation	- Select DEM	- Data generation & store about cross-section
3	River-bed change analysis	River-bed variation	- DEM-based	- Variation calculated of the selected section
		River-bed variation(section)	- CAD-based	- Cross-section comparison -Variation calculate
4	Data source	Longitudinal data	- Using the data extracted from the DEM	
		Cross-section data	- Using the data extracted from the DEM - Provide data	
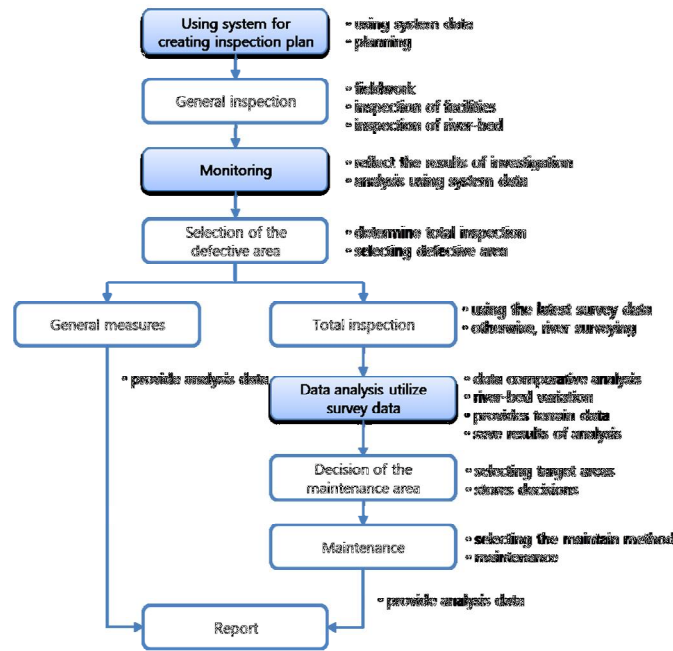
Figure 2: The improved River maintenance system

■ **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 4~8.

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

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

Table 5 : DB Unit Plan_Gis Master

No.		Table ID		Table Name		Create	
2		GisMaster		Master Information		Required	
No.	COLUMN ID	COLUMN NAME	TYPE	LENGTH	NULL	NOTE	
1	River ID	River code	C	7			
2	Section ID	Interval code	C	7		Ex)001-020	
3	Data type 1)	Data classification	C	1			
4	Version	Year/Month	C	6			
5	File root	File path	VC	100			
6	File name 2)	File name	VC	30			
7	Reference	Remark	VC	200			

Contents

1) Claasification of data file formats
   D : DEM file, B: River boundaries file, L: River centerline file, C: River crossing chain file

2) Written of Filename(30)
   River code(7)+Coupler(_)+Interval(7)+Coupler(_)+Year/Month(6)+Coupler(_)+Data classification(1)
   Ex) 2000010 + "_" + 001-999 + "_" + 201101 + "_" + D + ".asc"

Table 6 : DB Unit Plan_Gis Plan

No.		Table ID		Table Name		Create	
3		GisPlan		Plan Information		Required	
No.	COLUMN ID	COLUMN NAME	TYPE	LENGTH	NULL	NOTE	
1	River ID	River code	C	7			
2	Section ID	Interval code	C	7		Ex)001-020	
3	Plan date	Inspection plan date	C	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	C	10			
8	C state	Status	C	40			
9	C result	Process the results	VC	200			

Table 7 : DB Unit Plan_River Code

No.		Table ID		Table Name		Create	
4		Rivercode		River code Information		Required	
No.	COLUMN ID	COLUMN NAME	TYPE	LENGTH	NULL	NOTE	
1	River ID	River code	C	7			
2	River name	River name	C	30			

Table 8 : DB Unit Plan_Territory Code

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

■ **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.
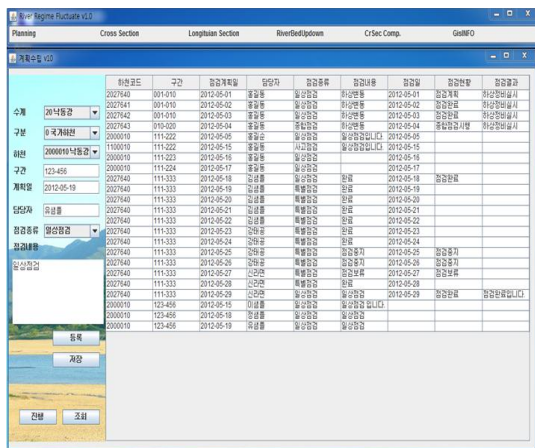
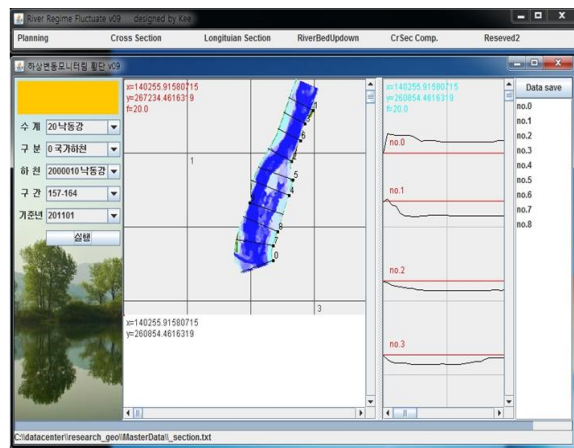**Figure 3:** River inspection plan screen
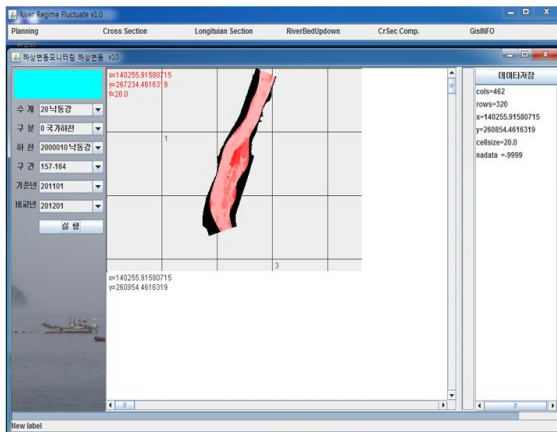
Figure 4: Cross section monitoring screen

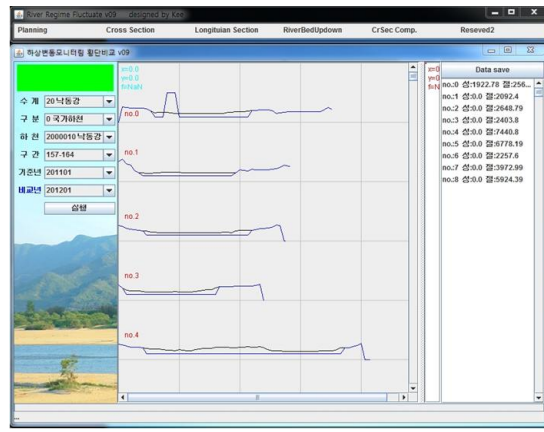**Figure 5:** River-bed variation monitoring screen

Figure 6: Analysis of River-bed variation screen

CONCLUSIONS & RECOMMENDATIONS

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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