4 Multifaceted Management and Utilization of Rivers through Visualization and 3D Modeling of River

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Applicable principle

Principle 9: A commitment to promoting sustainability through education

1. Overview

Aiming to develop a map that can visualize and display various information on rivers (360-degree images, 3D models, point cloud data, numerical information, etc.), this research project team selected GIS which served as a platform and acquired data. A basin geometric map was created using the selected ArcGIS, and the data display function was verified.

2. Background and Purpose

For the Waga River in Nishiwaga Town, Iwate Prefecture, we built a technical foundation by cross-sectionally investigating various technologies with the aim of creating a map that can be used in a multifaceted manner using the river as a field. The following seven issues are to be solved by this map.

(1) **Tourism promotion:** Stay-at-home tourism as a counter-measure against COVID-19

(2) **Disaster prevention:** Flood and landslide disasters, landscape improvement of riparian forests, monitoring of river facilities and erosion control sediment volume, and raising awareness of disaster prevention

(3) **Nature education:** Underwater images of river basin organisms and vegetation, natural (water) circulation, etc.

(4) **Environmental protection:** Understanding upstream forest environments and the distribution of garbage in inland rivers, which are the source of marine garbage, and also allowing for the appropriate management of fishing grounds

(5) **Welfare:** Experiencing nature through virtual reality irrespective of age or physical handicap

(6) **Cross-sectoral information sharing:** We will consider incorporating chronological information on events, disasters, construction work, etc. that occur at various points along the river into this map to post such information in a centralized manner in the future

(7) **Clean energy:** Feasibility test of small hydroelectric power generation utilizing water resources in a multifaceted manner

3. Method and Progress

We acquired and built data by obtaining 360-degree photos using RICOH's THETA V, using point cloud data (aggregate of 3D spatial coordinates) from drones and terrestrial laser measuring device, and creating 3D models using Autodesk's 3dsMax.
For the research and selection of a platform, we gathered information and discussed within the team, and selected the one which can display 360-degree photos, 3D models, point cloud data, etc., and operate quickly when displaying on a smartphone or tablet on site.
In order to publicize and introduce the above technical examples, training, and their results, we held the “3D Technology Utilization Forum ONLINE - Reconstruction Acceleration Forum 2020 -" participated by companies in the prefecture related to 3D technologies.

4. Results Obtained

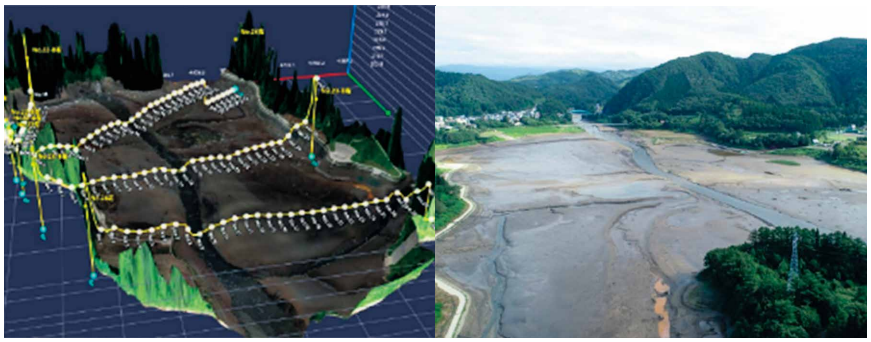
In 2020, with the cooperation of Iwate Prefectural University and local companies, the following data was acquired and integrated and displayed on a GIS (Geographic Information System) which served as data platform [Figures 1 and 2], and we developed trial website to make the information publicly available.

CG

[Figure 1] Basin geometric map

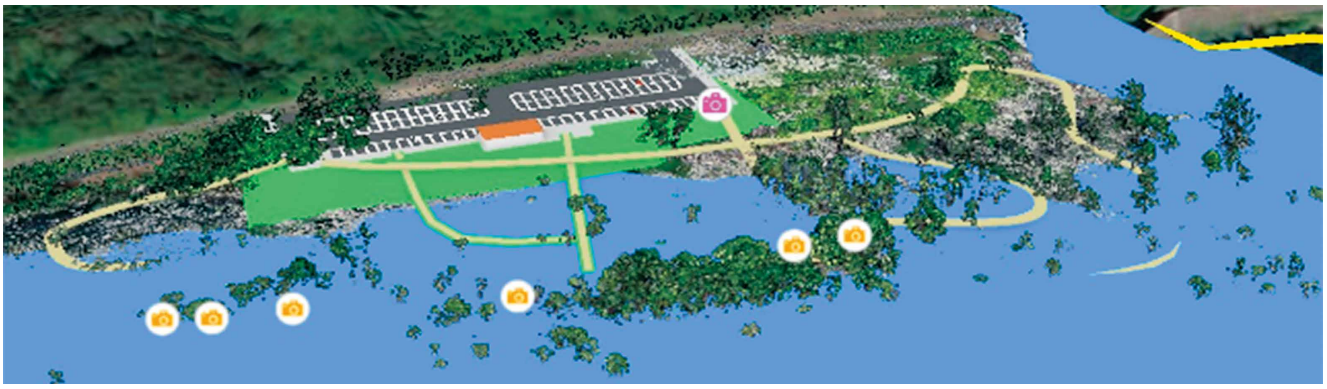
[Figure 2] Displaying 360-degree images, point cloud data, and 3D CG model

[Figure 3] Measurement of submerged forest by drone and ground laser



[Figure 4] Sediment volume measurement result by drone and Yuda Check Dam with lowered water levels

[Figure 5] Yuda Check Dam point cloud data



[Figure 6] Kawamachizukuri planning model

As the GIS which serves as a platform for the basin geometric map, through research and discussions with participating cooperating organizations, we adopted ArcGIS with good compatibility with three-dimensional data, which is important for this theme.

The data built on ArcGIS was also built as an application, and we verified that the application works smoothly on mobile terminals such as smartphones and tablets.

As this year's activities, we created integrated data on a trial basis using ArcGIS as a platform and shared the possibilities of advanced technologies with participating companies. In addition, we researched and examined the feasibility of the basin geometric map that is currently being envisioned from a technical perspective.

Among the constructed data, the CG model of the Kawamachizukuri (town planning along the river) plan, and the submerged forest point cloud data was shared with the Ministry of Land, Infrastructure, Transport and Tourism as well as Nishiwaga Town, and the point cloud data of the check dam, which was originally acquired for the dam dredging plan, was shared with the Ministry of Land, Infrastructure, Transport and Tourism.