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Method and study on User-Friendly GUI System Implementation Using Sonar Sensor Data

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Abstract: Background/Objectives: In the case of military purposes and fisheries, there is a need for information on seabed characteristics. Therefore, research is needed to acquire information on the sea floor topography while moving through the sea using towfish. Methods/Statistical analysis: acquire the information on the undersea topography from towfish, import the acquired binary data, and display the information in ASCII form. After displaying the information, it supports the preprocessing and post-processing by saving and loading data file in real time through File I / O. Findings: Currently, systems and programs that display information on the sea floor terrain are widely used overseas. However, there are not many in Korea at This is the current situation. Towfish is move the ocean floor and acquires information about the terrain, and then uses TCP / IP to pass data on the towfish's information to the socket. This information is passed to the binary form, and it is converted from the GUI to ASCII format and displayed so that it is easy for the user to confirm. In addition, information is scanned for undersea features other than towfish information. This information comes in binary form as the information of towfish, but when it is displayed, it is displayed as a 2D image. By displaying 2D images, users can easily check the appearance of the Undersea topography. Improvements/Applications: It is possible to use it as a GUI program that can check the information about the Undersea topographyin the naval military facilities or fishing boats.

Keywords: Tow fish, File I/O, Real-Time, GUI System, Sonar Sensor Data, 3D Undersea topography

I. INTRODUCTION

Since the seabed topography varies complexly both temporally and spatially, a corresponding method is needed to accurately describe it[1].There are many methods and programs for terrain scanning and information acquisition in land, such as radar. But, the way to scan the Undersea topography terrain at the bottom is much harder than the land, and it consumes a lot of time and money. In Korea and overseas, the Undersea topography is explored using the side scan sonar. Side Scan Sonar is a scanning instrument that acoustically imaged the undersea in a planar concept with a side scan acoustic survey. Side Scan Sonar displays the shape of the seabed as an image by scanning the left and right seabed surface with sound waves around the course of the survey line[2].So, even if Sonar is used to scan undersea features by launching sonic waves around undersea features, information usually comes in binary for msuch information cannot be verified by ordinary users. So we need to provide a program that makes it easy for users to see these binary information at a glance. In this paper, we propose a GUI system that converts binary information into ASCII data to make it easier for users to check information.

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II. RELATED WORK

There have been many researches on the exploration of seafloor topography using Sonar. A lot of researches are going on, such as research on sonar surveying oceanographic terrain, research on acquiring more accurate information using Sonar, and research on GUI system that makes it easy for users to confirm such information.

2.1. Domestic

All over the world, the Autonomous Underwater vehicle (AUV) for sonar imaging has been studied[3] . This research is a study on the hull control system and algorithm for submarine imaging using Side Scan Sonar.They also studied the system to reach the destination by moving to the autonomous navigation system.

In addition, research has been conducted on three-dimensional dynamic analysis of towed cables towing marine exploration equipment.This research used a more general governing equation including the bending stiffness component of the governing equations for the marine cables, estimates the tension generated at the towing unit according to the towing speed of the towing ship and the weight of the lateral scanning sounder, made to was estimate the overall shape of the cable for a given time.[4]

A pose-graph SLAM study based on image features was performed using Side Scan Sonar. Unlike the MATLAB-based bathmeter simulator [5], the Side Scan Sonar module was developed in C ++ language, which provides faster computing performance than MATLAB. [6]

In addition, several studies have been carried out in Korea. there are many researches on researching and exploring surveillance equipment. However, research on the GUI system for users has not been conducted yet.

2.2.Overseas

There are many researches and programs on Sonar imaging and GUI system in overseas. For intensive use in navigation, interpretation and visualization in data acquisition and processing through

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GIS software, research has been conducted on integrating video system hardware and software into portable packages that can be efficiently deployed from 7-meter ships [7] .

EdgeTech uses its own technology to create towfish and develop software to make it easy for users to identify information.This software allows you to define the mode, which provides High Definition Mode (HDM) or High Speed Mode (HSM) using Multi-Pulse technology [8] to provide.

also researched and developed Python-based software that interacts with Tritech Side Scan Sonar and can use the device without installing proprietary software running on a computer that is built into the vehicle itself [9].

Overseas, there are many studies on Sonar's video shooting and improvement of the efficiency and quality of the exploration equipment. However, unlike in Korea, research and development of software has been done so that users can use and manipulate easily. In this regard, research and development of software should be done as soon as possible in Korea.

III. GUI SYSTEM

As mentioned above, the information acquired from towfishcan not be verified by the user in binary form.In this paper, we take TCP / IP communication and acquire binary type information acquired from towfish, convert it into ASCII type data through process, and display this ASCII data in GUI to make it easy for users to check.

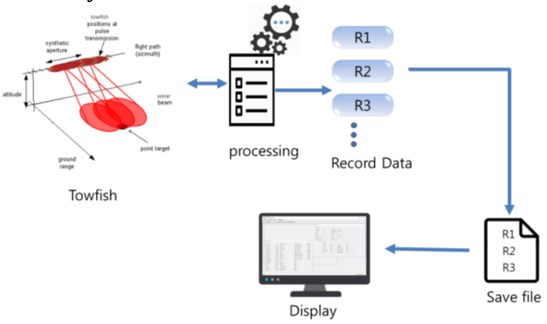

Fig 1. GUI Full System Diagram (ASCII Data)

Figure 1 shows the overall system configuration of the GUI for ASCII Data. As Towfish moves, the acquired information is processed in turn and converted into ASCII information. The changed information is displayed on the GUI system in real time. In addition, the user can check the stored information in the post-processing mode by loading the pre-processing file as well as the pre-processing, while simultaneously displaying the data in the form of a file.

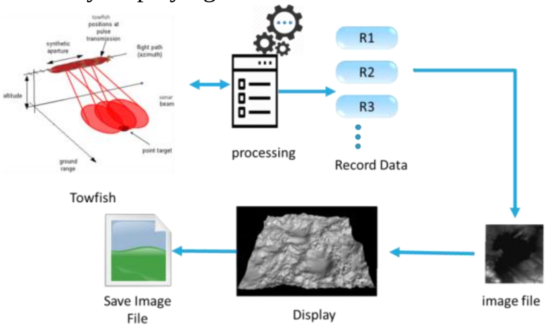

Fig 2. GUI Full System Diagram (Image Data)

Figure 2 shows the GUI overall system configuration for Image Data.Like a Figure 1, the data of the sea surface acquired by moving the towfish is converted into image data by image processing. After being converted in order, it is called in GUI system in real time to display the image of the Undersea topography. It is a post-processing method in which the displayed information is recalled by loading the saved file It provides a function that allows the user to check the missed parts again in real time situations.

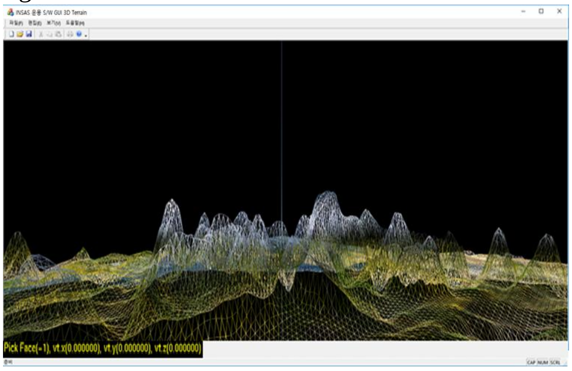

Fig 3. Display of 3D undersea topography using stored image file

Figure 3 loads the saved image file and displays the 3D terrain in 3D.When saving an image, the image is saved in the form of a Height Map [10].The Height Map stores the images in black and white as values of height as a single value, and raises corresponding vertices by the corresponding value. Load an image stored in the Height Map format, the display will be as shown in figure 4.

IV. RESULT

As described in Chapter 3, the software was developed based on the overall configuration diagram. The language is based on C ++ language and GUI frame is composed using MFC.

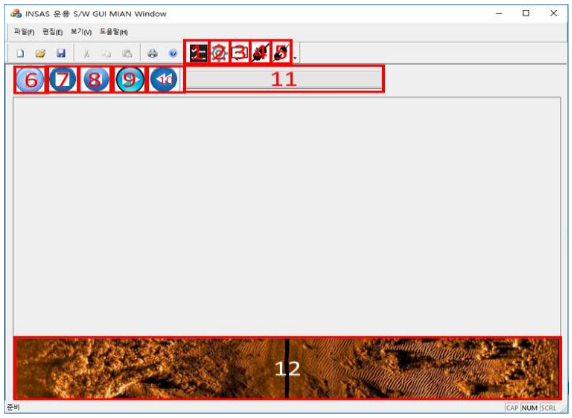

Fig 4. GUI operation S/W

Figure 4 shows the main frame of operation S / W. Users can check basic operation and information by using the buttons and toolbars that are configured in this Main Frame:

① State : Display status information of towfish

② GPS : Display the current position of towfish

③ Other State : Display information other than the information displayed in the State window

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④ Connect : It connects with towfish using TCP / IP and displays the information

⑤ Disconnect : Disconnect from towfish

⑥ Play : towfish displays images of scanned terrain

⑦ Stop :Disable image display Off ≒ Disconnect

⑧ Pause : Pause image display

⑨ Forward: Move to the next location image from the currently displayed image location

⑩ Backward : Move to the previous image position from the currently displayed image position

⑪ Progress Bar : You can see where the current exhibition is located

⑫ 2D Image : 2D Image Display

These functions are provided so that the user can use them easily and conveniently.

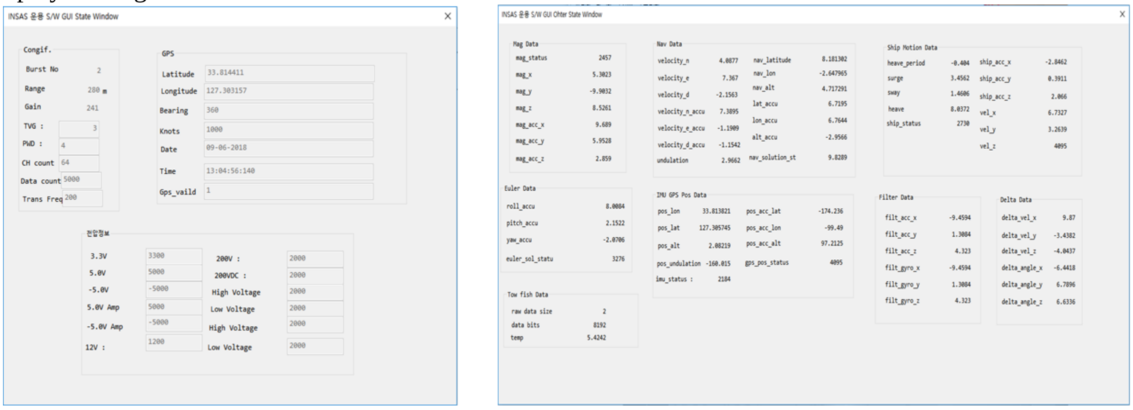

Fig 5. Display the imported information by connecting with towfish

Figure 5 shows to connect with towfish to display information. It manages the interface to send and receive data, I / O to file, and displays information in text form, which is essential information and management aspect of towfish.

V. CONCLUSION

In this paper, we have conducted the research and the method of displaying in the GUI system after processing the ASCII type data using the binary data that towfish searches for the undersea feature. In addition, when data is generated using TCP / IP, data is recorded in real time to display and file I / O simultaneously. After the 2D image was displayed, it was saved as an image file of Height Map type and the 3D undersea topography was displayed. In the future, the status information of towfish will be provided not only as text but as Graph. In addition, 2D and 3D GUI frames are divided at present, but we will work on combining two frames together to make it easier for users to check efficiently.

As mentioned in Chapter 2, there is no active development and research on software for displaying the image and status information of the ocean while the towfish is moving in Korea. I hope that this research will enable the development of software so that users can use and manipulate easily and effectively in the future.

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