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STUDY ON EFFECTIVE ACQUISITION OF HIGHWAY FACILITY AND ATTRIBUTE INFORMATION USING HIGHWAY IMAGERY CONSTRUCTION SYSTEM

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ABSTRACT
Highway Imagery Construction System is developed for providing road information such as highway alignment, pavement condition, structural information, and scenery information etc. Therefore we acquire there data using GPS(Grobal Positioning System), IMU(Inertial Measurement Unit), DMI(Distance Measuring Instrument) and CCD(Charge-Coupled Device) and make Database after post-processing road image and positional information. In this study, We analyze previous road facility position and information of attribute in Highway Image Construction System. Lastly, we introduce to better method of construction information and then design system for matching positional information and road image.

INTRODUCTION
BACKGROUND
The Ministry of Land, Transport and Maritime began to study the development of Highway Management System (HMS) in order to support more systematic road maintenance work by avoiding the computerization of road related data that was kept in paper form in the 1990s.

In the case of existing road-related research and analysis systems, the system was operated by collecting data in the form of unit-oriented work. However, since the linkage and analysis of organic information between the road maintenance tasks is required, integration of road- .

In order to meet these demands, the Ministry of Land, Transport and Maritime Affairs has established a development direction in the form of a Geographic Information System (GIS) based system, and constructed an integrated database linking the digital map for road management and various road related information.

Through this, we prevented the duplicate storage of the data that was collected individually and laid the basis for comprehensive information provision for road and facility maintenance.

In order to maximize the utilization of the integrated road management system for road maintenance workers who are aiming to maintain the roads, it is necessary not to use the text form data, but to use the road linearity (dangerous road section), road surface (pavement, lane mark), road facilities State), and other peripheral landscape information together with location information.

To accomplish this purpose, a road image construction system capable of acquiring location information on road images and road facilities was developed.The road image construction system was developed to acquire the location and attribute information of the road facilities rather than just the simple images. To ensure the efficiency of the road facility acquisition method, a systematic acquisition process was applied by applying the latest IT and spatial information technology

OBJECTIVE
The road image acquisition system derives a process suitable for the efficient acquisition of the location and attribute information of road facilities and post-processing work.
To do this, we implemented the basic design for systemization by redesigning the post-processing process by internalizing the precise GPS time and essential observation information using the image tag technology Exif.

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It is expected that the efficiency and accuracy of acquisition of location and attribute information of road facilities will be improved through simplification and systematization of processes due to internalization of observation information.

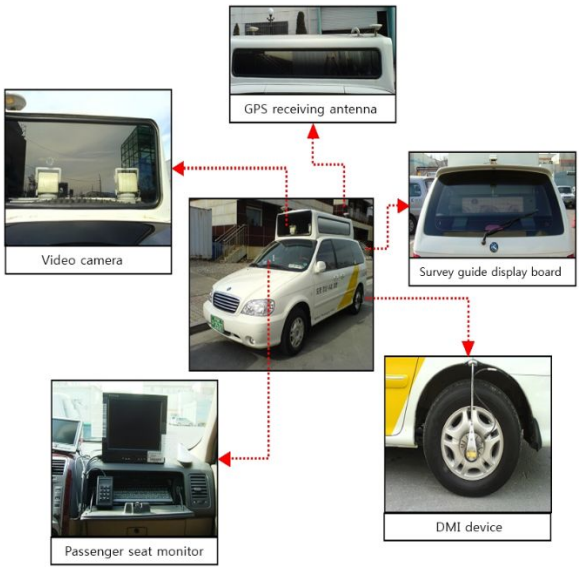
CONFIGURATION OF ROAD IMAGE CONSTRUCTION SYSTEM

In order to construct the road image construction system, the position information (coordinates) of the road facilities in the general highway is acquired by using the GPS, the inertial measurement unit (IMU) and the distance measurement unit (DMI) It is designed.

That is, by integrating devices such as GPS, IMU, and DMI, it is possible to increase the accuracy of positioning and accurately measure the three-dimensional coordinates of the object of interest on the national highway, even in areas where GPS reception is difficult or impossible.

The CCD camera installed in the vehicle acquires the image of the road every 10 meters by a trigger signal (a signal requesting acquisition of the image to the CCD camera) generated by the distance measuring device.

Figure 1 and Figure 2 show the exterior and internal structure of the road survey vehicle. The outside is composed of a GPS reception antenna, a video camera, a front passenger's seat monitor, a DMI device, and an illumination information display board. The inside of the device includes a power management device, a POS / LV sensor, a camera control device, An auxiliary power management device, a data storage computer, and a monitor.



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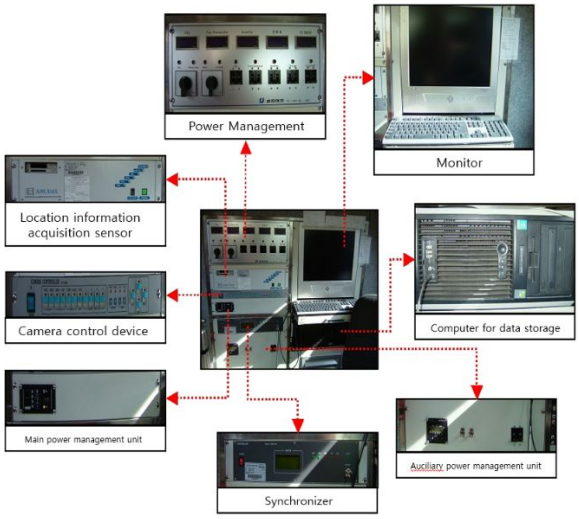

Fig 1 : Road Image Investigation Vehicle External and Inside

The synchronizing device should be set to synchronize signals from multiple sensors installed in the road survey vehicle. As shown in Figure 3, the synchronizer accumulates the number of revolutions input from the distance measuring device (DMI), generates a trigger signal (a signal requesting acquisition of an image to the CCD camera) when the number of revolutions corresponds to 10 m, And gives a signal to the frame grabber inserted in the PCI slot of the storage computer. The frame grabber activates the CCD camera to acquire images and store them on the hard disk. At this time, the event input to the position information acquisition sensor system is stored together with the GPS time. The acquired data are used to calculate the position and attitude information at the time when the image was captured via GPS time.

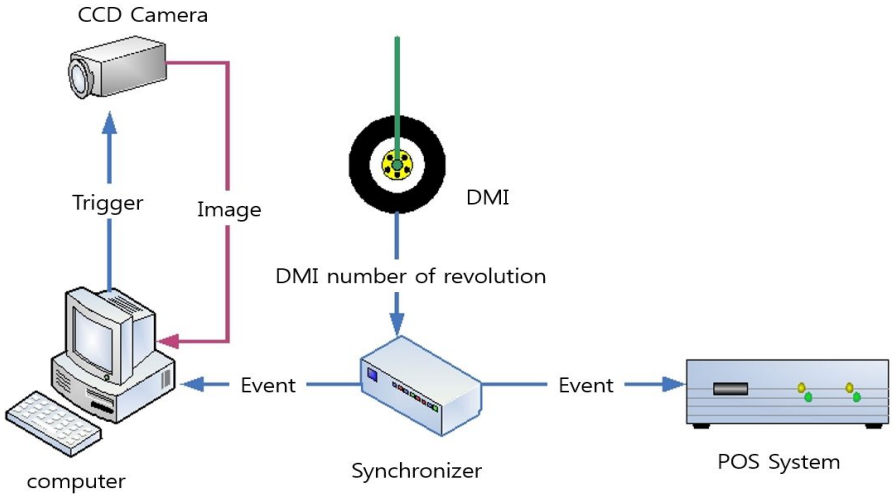

Fig 2 : System Synchronization

DESIGN DIRECTION SETTING

The design direction for efficient construction of existing road facilities location and property information is as follows.

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INTRODUCING UNIQUE IDENTIFIER GPS TIME FOR LOCATION INFORMATION MATCHING

GPS time is introduced as a unique identifier for road facility location and property information matching. In other words, it is designed to acquire visual information when a field worker inputs a road survey item by attaching a portable GPS receiver separately from the GPS installed in the vehicle, thereby matching the GPS time on the road image construction system with the event input time.

If the location information of the road image construction system and the corresponding facility event of the road survey item are synchronized with the GPS time as the unique identifier, the location of the facility can be calculated.

APPLYING MANAGEMENT SYSTEM OF ATTRIBUTES AND LINKAGE INFORMATION

It is a method to embed an observation system, observation time and related linkage information in an image file produced in an existing road image construction system.

To this end, it is possible to secure information consistency and robustness by internalizing relevant information by applying Exif (Exchangeable image file format) standard, which is a standard image tag technology.

Exif technology has been established for the purpose of adding detailed information about image in the image file format of digital camera. The main inclusion information includes camera setting information such as data and time information, shutter speed, Settings, location information, summary and copyright information (Descriptions and Copyright information).

INTRODUCED VIDEO MANAGEMENT CODE SYSTEM TO ENSURE INTEGRITY

In the existing method, the road image acquisition path is drawn as a drawing, and the border and session are reassigned by superimposing with the boundary of the national road manager, so the corresponding image file code must be changed.

This approach degrades the integrity of the information and reduces overall operating efficiency due to manual processes.

For this purpose, the image file code consists of observation system, observation sensor and observation time only, and additional information is managed by changing internal tag or separate attribute field.

Based on the design direction, we developed an effective road image information DB construction method and designed a process automation system using location information matching technique.

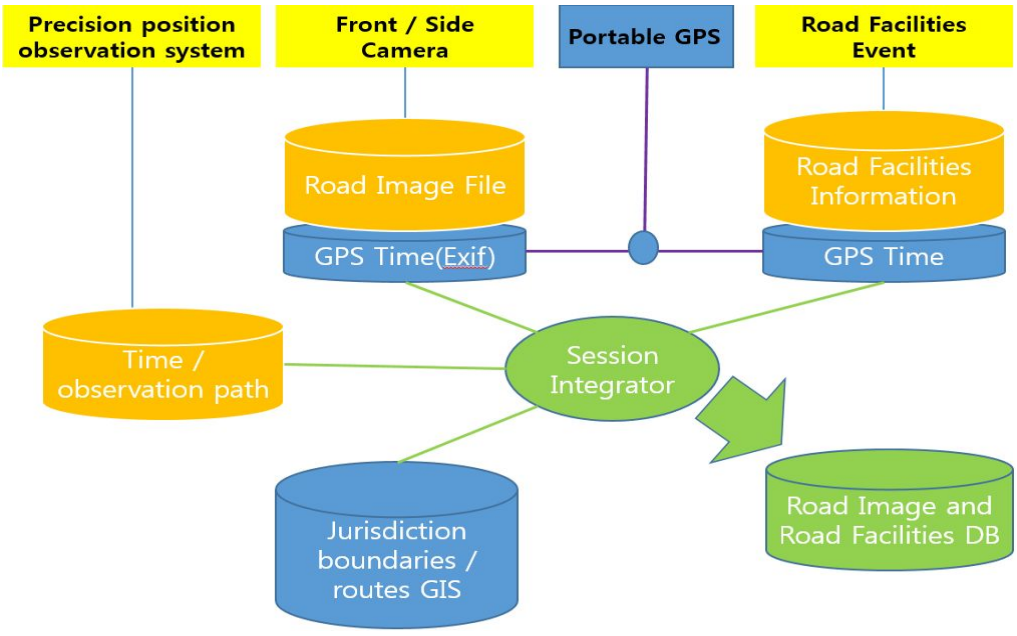

Fig 3 : System Architecture

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SYSTEM DESIGN

By using Exif's image and GPS tag technology, it is designed to maximize automation of business processes, increase acquisition efficiency and ensure consistency.

FIELD RESEARCH USING EXIF TECHNOLOGY

In the road image construction system, the road image acquisition runs the vehicle and the road image and the shooting position are automatically stored at intervals of 10 meters, and the road image file name is determined as shown in Fig.

In addition, as shown in Fig. 9, the surveyor directly generates the keypad event to input the attribute information about the distance table, the branch, and the bridge during the vehicle operation.

EX : AABBBCDDDDDDEEEEE.jpg
AA : National highway maintenance construction office code [2 digits]
BBB : National Route Route Number [3digits]
C : Upper and lower boundaries [1digits]
DDDDDD : Date of filming [6 digits]
EEEEE : Date of filming [5 digits]

Fig 4 : Image file name generation structure

Keypad events occur
Street / branch / bridge / administrative boundary / tunnel / intermediate section

Directly enter property information
Keypad No. 1: Distance Table Position
Keypad No. 2: Junction position
Keypad No. 3: Bridge point
Keypad No. 4: Administrative boundary point
Keypad No. 5: Tunnel stop
Keypad No. 6: Medium duty point

Fig 5 : Enter road survey items and attributes

At this time, in order to efficiently acquire road survey items, an identifier giving module (GPS time) and a road survey item input module for location information matching are developed, and Exif technology is applied to internalize attribute information, .

Identification for location information matching is achieved by attaching a portable GPS device to the input module in the form of USB, synchronizing the GPS time of the road image construction system with the time in the input module, thereby locating the position of the road survey item such as distance table, .

The matching image can be input detailed information of the shooting point in the road image file using Exif technology. That is, not only the location information (GPS coordinates) for each road survey item (distance table, branch, bridge, etc.) that generated the event using the keypad, but also the attribute content of the survey item can be inputted. At this time, the attribute contents can be

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improved by improving the efficiency of input by developing a separate input module, and it can be stored in the built-in DB.

DATA PROCESSING

POSPac, which is a commercial program, is software that processes the data acquired from the position information acquisition sensor mounted on the road survey vehicle and calculates the vehicle position and attitude of the photographed image.

In POSPac processing, integrated processing of sensor data is performed, and the result is generated in the ASCII form of the coordinates of the image capturing position and the road survey item event position. This is not stored in the form of an excel file, but the data is refined through the editing system as follows . That is, the DB-based editing environment is designed not the existing Excel-based shooting information and attribute information processing system, but the photographing information and the attribute information list of the grid format are displayed and the attribute information of the road image and the road survey item can be displayed or edited .

To do this, it is essential that the image file containing the identifier for location information matching in the data acquisition process and the database in which the identification information is registered. It is possible to provide an environment in which the road image photographing information and facility property information can be edited by using the built-in database in which the location information matching identifier is embedded and the terminal information is registered.

CONCLUSION

In the existing road image information construction, relevant information is not integrated in the location of road facilities and attribute information investigation step, and the system for location information matching is weak. Subsequent tasks were complicated and required a lot of time and human resources.

However, in this study, automation of matching process is performed by assigning an identifier for position information matching based on GPS time.

In addition, a more robust observation data system is secured by incorporating relevant essential observation information into the image file.

In the data processing process, the image file code has to be re - calculated according to the overlap with the adjacent jurisdiction boundary, and the code system has been modified so that it is not affected and the related property information is linked.

We analyze the required technology and design the system architecture. Based on this, it is necessary to implement real prototype and to find many improvements that can occur in the field and apply it to actual system.

Such a system is expected to be utilized as a system for collecting information on not only images but also various spatial objects as a typical form of various image-based mobile observation systems.

REFERENCES

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