On-line System for Real-time Digital Photogrammetry

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ABSTRACT

Window system enables the establishment of integrated environment of digital close range photogrammetry which is based on object-oriented-technique centering around event by reinforcing the interface with user. So, in this study, this researcher established the on-line system of digital photogrammetry that the acquisition of digital image and the image interpretation are possible with real time, and could develop the system that the correction and renewal of more efficient digital map are possible through this.

1.Introduction

It can be said that the most basic work in the information activity of information-oriented-society is must in the acquisition of useful information and that the acquisition of more prompt and useful information is essential in the establishment of geographical information system also. It is the real situation that the system for the acquisition and input of prompt and reliable topographical space information should be developed essentially for it and that the demand about the development of more efficient system for the input and correction of data is increasing for the correction and renewal of national digital map also. Besides, the prompt handling of multilateral space information should be made through more competitive system development, and not only the exact financial resources for all sorts of facilities will have to be secured but also the competitive power of mapping system will have to be reinforced.

In this study, this researcher tries to establish the system for the acquisition of geographical information which utilizes digital close range photogrammetry technique and develop the system for correction and renewal by the standard code of digital map through it. For this, this researcher establishes the digital camera interface for the acquisition of real-time digital image and develops the module for the interpretation of acquired digital image and the extraction of coordinates. Besides, this researcher tries to develop graphic engine, so that the compilation about the topography/geographical material of existing digital map as well as the expression and storage may be possible, for

satisfying the topographical information acquired by digital proximal photogrammetry to the standard code of digital map. On the basis of this, not only this researcher tries to confirm the spot about the topography/geographical material of digital map but also this researcher tries to present the application possibility of digital close range photogrammetry for the correction and renewal of all sorts of entities.

2. Establishment of System

As windows environment enables the integral environment establishment which is based on the object-oriented-technique centering around event by reinforcing the interface with user, we should complete the systematic design about right recognition of analysis routine, approachableness, and processing etc. and the hierarchical diagram about the mutual compatibility and constant attribute etc. among classes, for the efficiency increase of digital photogrammetry.

So, in this study, this researcher established the digital photogrammetry system of windows system, by designing the analysis routine that the independent connection performance is possible about input of 8 bit image, independent taking of picture information, abstraction of target image, decision of target area, reject limit, image segmentation, location, correction of distortion, decision of pixel size, pixel coordinates transformation, coordinates transformation of scan image, direct linear transformation, and bundle adjustment, passing through the preprocessing course of raw image.

Established system gets to perform the analysis module to want through mouse or keyboard that the interface with user is possible and enables visual analysis in addition to quantitative analysis to be based on simple data processing. And, we may acquire the location accuracy of sub-pixel beyond the location accuracy of characteristic of hardware about the image of size of standardized pixel space acquired from horizontal/vertical frame graver from the viewpoint of software, by defining the class about target recognition and location on the basis of pixel information of 256 stages. Besides, so as to extract more effective method of target location, we may choose the analysis routine to be suitable for the hierarchical of system most, by arranging 6 kinds of methods of image segmentation and 5 kinds of methods of location.

We may extract direct linear transformation coefficient and outside look element by utilizing the result of control point and the image coordinates with the data of Cholesky procession formula and may offer the convenience of system management for image analysis by designing the routine to process data to be able to measure more exact 3 dimensional position through using them as the initial value of bundle control.

Like this, this researcher could uplift the convenience, clearness and intuitive nature of system by establishing the integral environment of digital photogrammetry through forming the hierarchical relation and framework about the module of image analysis and the classes. And, about the independent data of various process courses that automation level is different, consistent analysis came to be possible through the systematic establishment to reach from lower class to upper class. As each analysis module exists in the form of objectification, the additional establishment of module and class that user may help analysis is easy, and the geometrical analysis to correspond mutually among images came to be possible without all the knowledges about image structure.

The digital close range photogrammetry system and digi -tal map correction/renewal system that this researcher tries to develop through this study is composed of the real-time interface between digital camera and computer on the basis of the graphic engine to be able to correct and compile of the digital map like fig. 1 and of the module for the

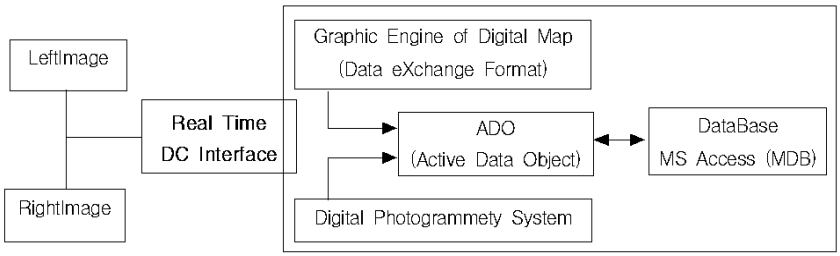

Fig. 1 Digital Close Range Photogrammetry System for Real-time Image Interpretation

The Composition of interface for the acquisition of solid image was based on the component about the Kodak DC 260 camera. Component included the synchronization for the acquisition of solid image newly, and it was composed of the part of option establishment for the acquisition of solid image, the synchronization part about solid image, and the part of data transmission by serial communication. Fig. 2 is what showed the composition of component for the acquisition of real time solid image.

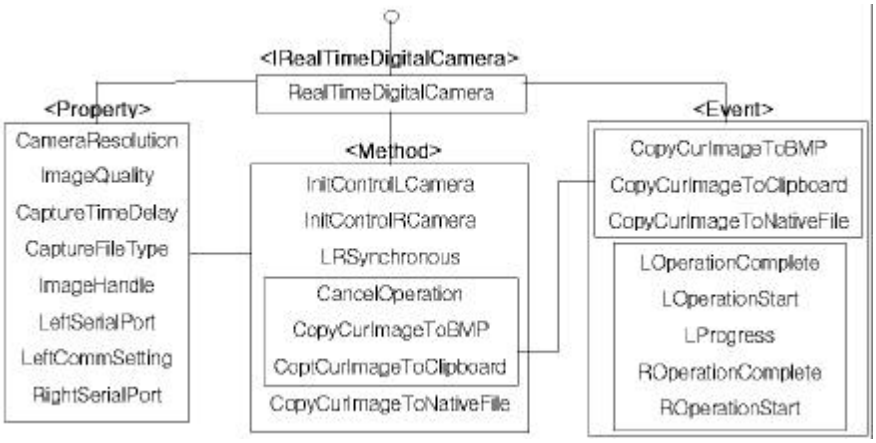

Fig. 2 Component to Acquire Real-time Solid Image which uses Digital Camera

Digital close range photogrammetry system was composed of the part to acquire left right image, the part to handle image, and the part to input ground datum point, and the part to interpret by control of speed of light as what is for extracting 3 dimensional coordinates about the voluntary measuring point in image from real time solid image. And, it was composed, so that Block Table about the topography/geographical material code of digital map of 1:1,000 and 1:5,000 may be included for the data compatibility with the graphic engine of digital map. Block Table was compos -ed of MS Access database approach module by using ADO (Active Data Object). And, it was composed, so that not only it may be expressed on digital map but also it may by utilized as the correction and renewal data for existing topography/ground material, by using 3 dimensional coordinates about the voluntary measuring point and Block Table.

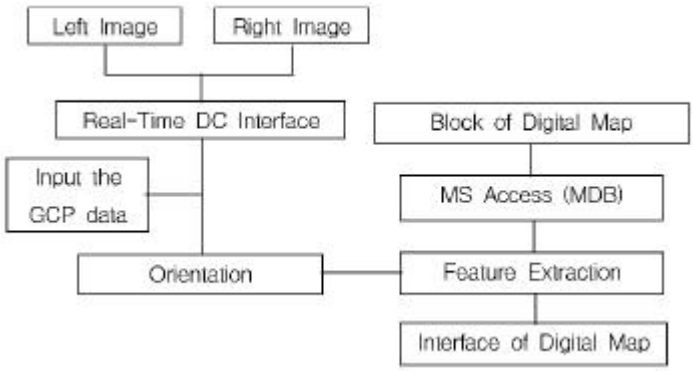

Fig. 3 Digital Close Range Photogrammetry System for Image Analysis

Graphic engine for the management of digital map was composed on the basis of the input and output of DXF pile. And, it was composed, so that it may approach MS Access database by using ADO(Active Data Object) for managing all the entities of DXF pile. It was composed, so that R-tree structure may be made for the retrieval and compilation of topography/ground material of input digital map. And, it was composed, so that it may support the functions for the analysis of all sorts of layer of digital map for the con -venience of user and for the basic management.

3. Application of System

The flow chart of digital image handling for the development of this system is as in fig. 4, and real-time digital camera interface component registered Visual Basic 6.0 environment like fig. 5. Fig. 6 is what showed the part of real time image acquisition of digital close range photogrammetry system which utilized it.

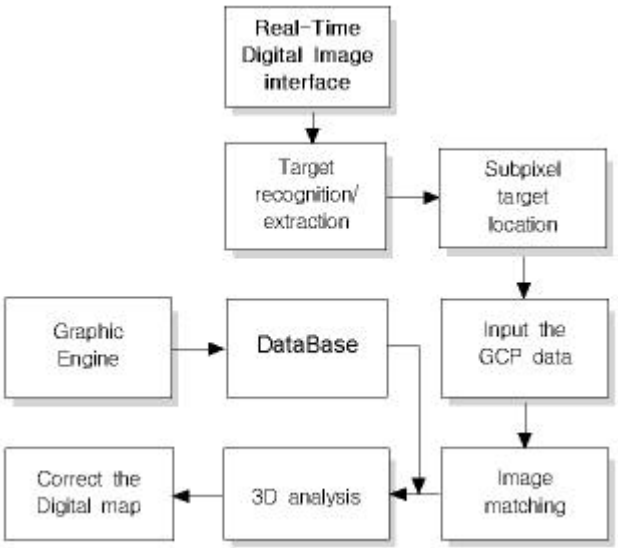

Fig. 4 Flow Chart of Digital Image Analysis for the Correction and Renewal of Digital Map

Fig. 5 Real-time Digital Camera Interface Component

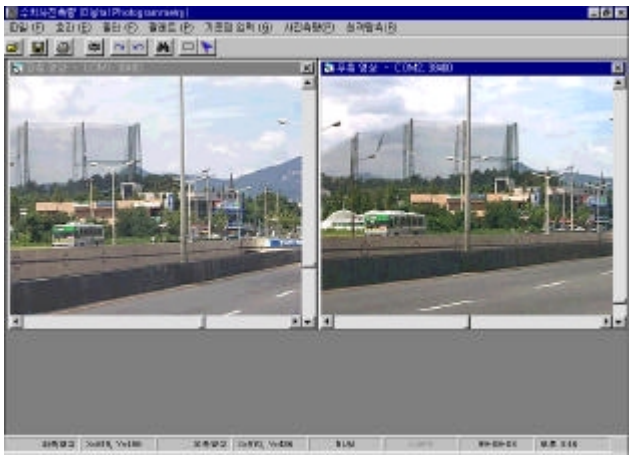

Fig. 6 Acquisition of Real-time Image (Digital Close Range Photogrammetry System)

Left. right image acquired through real-time DC inter -face was constituted, so that it may support the input function of ground datum point for the interpretation of digital photogrammetry and the control of pixel number of the expansion windows for the input of ground datum point may be possible in accordance with image size. Fig. 7 is what showed the establishment scene of pixel number about the expansion window for the input of ground datum point, and fig. 8 is what showed the input scene of ground datum point about left. right image.

Fig. 7 Establishment Scene of Pixel number about Expansion Windows

Fig. 8 Expansion Windows for the Input of Ground Datum Point about Left . Right Image

Fig. 9 is what showed the panel for the confirmation and establishment of input ground datum point, and fig. 10 is what showed the 3 dimensional coordinates nature and result panel of unknown point performed by bundle control. System for the correction and renewal of digital map is being made on the basis of module for the input and output of DXF digital map, and it is including the diverse digital map viewing functions such as the expansion function about voluntary character etc. as is in fig. 11 as well as the basic function for reduction/expansion and movement.

Fig. 9 Confirmation and Compilation of Ground Datum Point

Fig.10 Acquisition of 3 Dimensional Coordinates about Voluntary Unknown Point

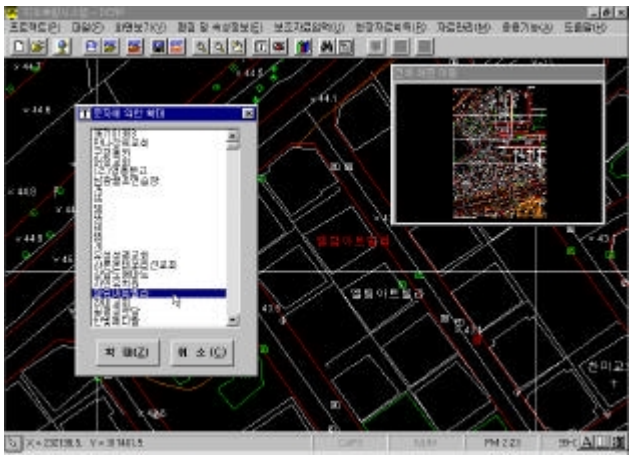

Fig. 11 Expansion Function about Voluntary Character

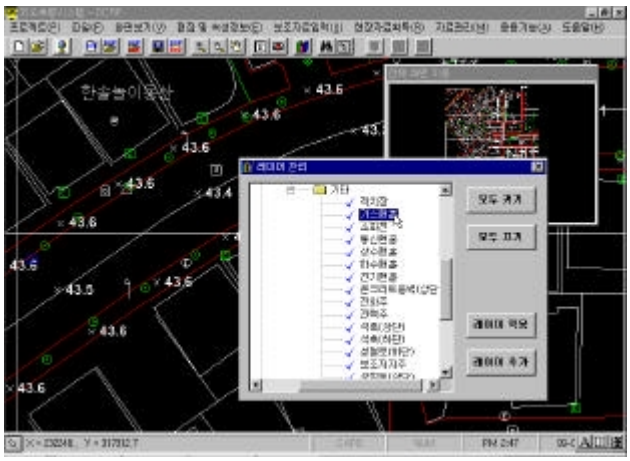

Fig. 12 Management of Layer about the Digital Map

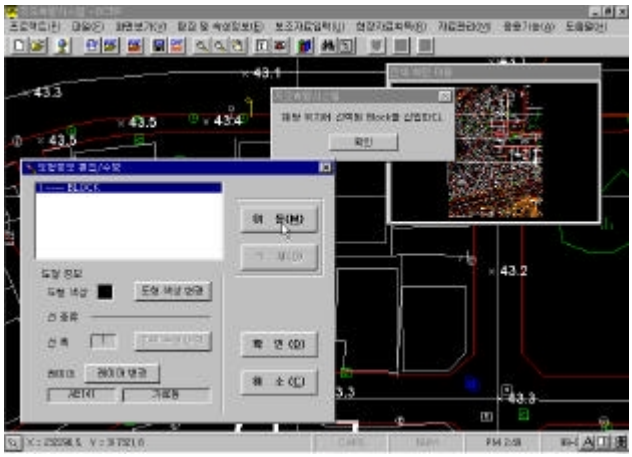

Fig. 13 Retrieval and Compilation of Topography/ Ground Material

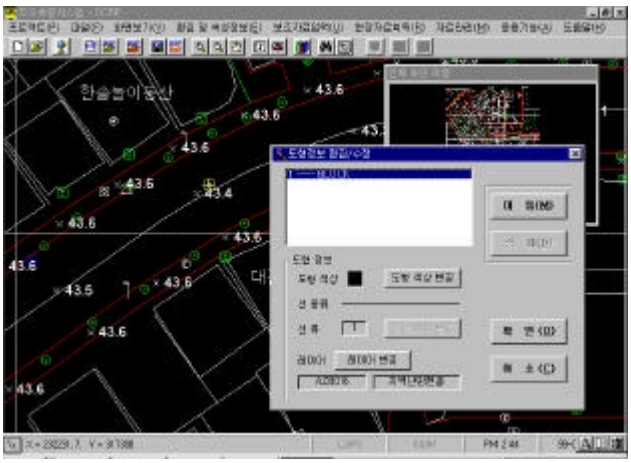

Fig. 14 Insertion of Topography/Ground Material by Digital Close Range Photogrammetry

Besides, about the management of digital map layer, this researcher expanded the easiness which is based on the mana - gement of digital map at spot by using the topography /ground material name about the digital map of 1:1,000 and 1:1,500 as is in fig. 12. And, this researcher constituted, so that the management of digital map may be easy, by adding the function of retrieval and compilation of topography/ground material as is in fig. 13. About this compilation function, this researcher expanded, so that relevant topography/ground material may be inserted in 3 dimensional coordinates acqui -red by photogrammetry technique through the interface with digital close range photogrammetry system as is in fig. 14.

4. Conclusion

In establishing the system for the correction and renewal of digital map by real-time digital close range photogrammetry, for acquiring the image of higher resolution with real-time, this researcher constituted real-time digital camera interface, and constituted the system of digital close range photogrammetry and the system for the management and compilation of digital map. This researcher could develop efficient system that the correction and renewal of more efficient digital map through it. In case of the system for the correction/renewal of digital map, it is considered that the composition of the interface with system for acquiring all sorts of location information such as the interface with GPS and the interface with Total Station etc. is possible and that the application in very diverse application fields such as GPS and the establishment of Van photogrammetry system to apply digital close range photogrammetry system etc. will be possible.

5. References

1) J.M..Kang, S.H.Bae, S.H.Song, "Establishment of Digital Photogrammetry Technique to use Window System" , Korea Societry of Civil Engineering, the 19th volume, No. III-2, pp.325-334. 1999.

2) J.M.Kang, J.H.Choi, S.H.Song, "Establishment of GPS Lap-top Computer System for the acquisition of real-time topography information", Korean Topographical Space Information Society, the 6th Volume, No.2, pp.81-90, 1998.

3) M.R.Shortis, T.A.Clarke, and T.Short, "A Comparison of some Techniques for the Subpixel Location of Discrete Target Images", SPIE Videometrics, Vol.2350, pp.239-250, 1994.

4) Ramesh Jain, etc, "Machine Vision", 1992.

5) Rafael C. Gonzalez, "Digital Image Processing", 1992.

6) Randy Crane, "A Simplified approach to Image Processing", 1997.

7) Ron Graham, "Digital Imaging", 1998.

8) Sabry F.El-Hakim, "Application and performance evaluation of a vision-based automated measurement system", SPIE Videometrics, vol.1820, pp.181° 195, 1992.

9) S.H.Han, Yongru Huang "Analysis of 3D coordinate Accuracy for Dynamic Object with respect to Target Center Localization Method", ARSP 10th conference CD-ROM.

10) T.A.Clarke, M.A.R.Cooper, J.Chen, and S.Robson, "Automated Three Dimensional Measurement Using Multiple CCD Camera Views", Photogrammetry Record, pp.27° 42., 1995.