

INTRODUCE A 1:500 MAP WAS MADE BY THE IMAGE OF “GOOGLE EARTH” AND ITS SOFTWARE

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ABSTRACT:

A 1:500 map was made by the image of “Google Earth” and its software (named five points method) quality of the cartography is shown on the photo map, it gets great success. Please review it. The experience merits are using only five control points per map. It depends upon the rectificated model which is precise and strict, surface fitting smooth

1. PREFACE

Forty years of city survey practice is mainly to map by large scale.

Even a 1:1000 one can be ensured.

We know that Japan has announced its inventory patent which is called “ The system of map making and the method of map making” in October of 2000 (P2000-298430A). The purpose of the patent is obviously to make the city map. However, it needs more than nine control points, and the accuracy can't meet the need of the scaled map mentioned above. It's not practical.

Can we still put the skill of “GPS + Auto CAD” which keeps up with the time into practice? The author must answer this question.

Our successful practice is the best answer. It is practical and easy.

We use “GPS + Auto CAD” as our main tool, and photo map to make the map.

Only use five control points for rectification. We successfully make a 1:500 map by using “Google Earth” image. (The complete photo map covering 0.21m² is available to be reviewed by e-mail).

It strongly shows that by using aerophotograph with high resolution, any survey staff can make city map accurately and without any risk.

That is called “five points method” software which is mature, reliable, the core of the software design is image rectification model

2. RECTIFICATED MATHEMATICAL MODEL

The main requirement of the rectificated model is accurate and easy to operate. Also, the image in two dimensions can be transferred directly. Only N=5 rectificated control points is needed for each map. The coordinates of the control points are not located in a rectangular array.

Use a surface spline to solve it which can achieve good result.

Most people in our country often feel terrified at the aerophotogrammetry which is always regarded as a high-tech job with accurate and expensive equipment. They think it should be very difficult to master its skills. They also doubt how the accuracy of making a 1:500 city map o

We know a linear spline which is based upon the small deflection equation of an infinite beam. Obviously, the surface spline is a plate of infinite extent that deforms in bending only.

The differential equation relating bending deflection and load of a plate is

$$D\nabla^4 W=P \tag{1}$$

Where

- D = flexural rigidity of the plate
- W(x,y)= lateral deflect
- P= lateral load

Under the following suppose;

1. Deflections are specified at N independent points (x_i,y_i) i=1,N. this requires points loads P_i at these N point. The values of these loads must be determined to give the specified deflections.
2. Deflection is a symmetric deflection due to a point load at the point.
3. The surface spline should become flat a long distance from the applied loads

Then through complex mathematical analysis, the resulting equation is rearranged into a form useful for computation.

$$W(x,y) = A + Bx + Cy + \sum_{i=1}^N F_i r_i^2 \ln r_i^2 \tag{2}$$

Where

$$r_i^2 = (x - x_i)^2 + (y - y_i)^2$$

Use Eq.(2), we also add three static equilibrium equations to determine the N+3 unknowns.

Now in the rectification model the $N=5$, use Eq.(2) and three equilibrium equations to form eight algebraic equations so that eight coefficients may be solved

3. CHARACTERISTIC OF THE SOFTWARE

The software was named “five points method”. To operate it is very easy.

3.1 Characteristic of the Software

1. Simply operating, only a little pick and data inputting are need to rectificate an image
2. Little special skill is required, anyone who knows how to use a computer basely can make it
3. Nothing particular for computer using the software, general PC is OK
4. The rectification can be completed within a short time. For example, only 4 minute id needed for a photo map of 40cm×50cm

3.2 Processing Steps



Figure 1

1. Scan photo into computer
2. Input control points coordinate
3. Identity points on the photo has been input the computer (recognition of rectificated points)
4. Supply mapping scale
5. Rectification
6. Obtain photo map after rectification

3.3 With the Software, the Map can be Reached.

Please see the following sample (photo map)



Figure 2

4. Conclusion

As what here mention above the “know how of five points method “can be used easily, effectively and with very high accurately.

With “GPS + Auto CAD “, the large scale map can be produced.

It named “The Method for Making Large Scale Map by Using Digital Image “.

The “ Patent Application “ was already presented on 2007.03.09 with Application No. – **200710020222. X**

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