PHOTOGRAMMETRIC IMPROVMENT FOR MAP REVISION

J.B. LUGNANI
DEPARTAMENTO DE GEOCIÊNCIAS
UNIVERSIDADE FEDERAL DO PARANÁ
CURITIBA - PARANÁ - BRASIL

ABSTRACT

The concern of updating maps is increasing progressively, as the land is covered by systematic maps and larger scale is required for certain regions.

A critical point in the process of map revision is the detection of changes. Devices have been developed to support the operator in this task. These devices establish different combinations of overlaping images, map, orthophoto and stereo orthophoto to improve changes detection. On the other hand the problem is investigated by members of the international mapping community through digital mapping, picture processing and pattern recognition subjects. Remain on the operator, how ever, the main responsability of detecting changes, for production environments.

This paper presents a new approach for changes detection. The new concept was implemented and tested on the planicomp C100 at the graduate school of geodetic sciences - " Universidade Federal do Paraná". The approach is discussed. The results support the recommendation of the technique for production environment.

INTRODUCTION

The dynamics of the urban and land development, the changes of land use and the increasing demand of precise geographic information for planning purposes, make the map production a permanent task. To keep maps and charts updated is only possible to certain extent. Even if the concept of the classical maps is changed as a consequence of the new technology and the generation of geographic information system, the core of the problem remains: ideally, data collection have to be continous, identifications of changes should be done practically on line and it should be reliable; the storage and the out put must be updated.

In practical environment, such ideal behavior of continuous updating of maps is not feasible due to technical and economical factors. In some cases the period of map revision is established short enough to attend the requirements; in other cases this period is not satisfactory and in others, revisions are not even done; maps are made again after the original ones become useless. It is not necessary to elaborate on the inadequacy of this last case, from both economical and technical point of view.

Much of the progress lately obtained by the international cartographic community has attennuated the difficulties of map revision. Advances in the area of digital mapping such as generation of structured files of geographic data have made automation possible in good extent for map production and map revision.

On the other hand, in spite of the progresses in the area of correlation which made it possible good amount of automation in terms of hight's systems, the feature extraction is still unable to detect changes and to extract features from images to update maps. It seems reliable to predict that in a near future it will not be possible to detect changes and extract planimetric feature from image automatically. Correlation technics may bring, however, improvements in the production environment for map revision if applied in interactive systems with the operator. Ortophoto, besides of being an alternative approach to map planimetric information, has been used to facilitate the operator's task of detecting changes , identifying and transferring them to the existing map. Even the stereortophoto has been used with this purpose. Some equipment such as Stereo Zoom Transfer Scope /11/, Stereograph /3/, Topoflex /10/, and digital techniques /6/, /7/, /8/, /5/, /9/, have been development for improving, specially, the detection of changes occurred in the object space through new image of the area. The "bottle neck" for the whole process of map revision, still seems to be the detection of such object space variation. There is great dependance on the operator specially for completeness of new entities registered as new data. All the detection of changes reported comes from the comaprison of two or more of the elements: old map , old photo, new photo, new ortophoto and/or new estereotophoto. The elements may come from digital storange through analytical transformation or may be in an analogical form. Two or more of these elements are digitally or analogically transfomed to the same space, with different precision depending on the technique and then the visual comparison is made by the operator. In some cases such comparison is also made between elements in different spaces. In any case, compared images are static.

The purpose of this research was to bring the dymanics of the changes into the process of detection by the operator. It was chosen to work with analog image to test the approach.

PRINCIPLE AND METHODOLOGY

The basic principle devised to bring the dynamics of the changesinto the observable space /4/, consists in producing a stereoscopic model from one old and one new photograph. This requirement imposes certain conditions to both old and new photogrammetric flight. The stereoscopic model obtained with one old and one new image is called hybrid model.

In one optical path of theviewing system of the stereoscopic equipment where the hybrid model is to be formed, a flickering device with varying frequency is adapted. The conventional static stereomodel is then observable in the equipment when the flickering frequency is high enough. Decreasing the frequency, one of the images starts to flicker. If this is the new photograph of the hybrid model, such flickering brings into observation in dynamic ways, the changes of the object.

The simulation method was chosen to test the principle. The method was chosen due to the convenience of not having: to wait for a long time to collect adequate data; economical resources; and equipment to test the principle. It was found that the simulation method is adequate for a preliminary test of the proposed approach.

An architectonics reduced model of a urban region at a scale of 1:100, was selected to simulate the object space. To this model, after taking the first (old) photogrammetric coverage, were added some new features to represent the changed object space, and be again imaged to generate the second (new) fight.

A Rolleiflex SLX camera with reseau and a 50mm lens was used to produce both simulated flights at an scale of 1:50 of the reduced model which simulated a 1:5000 to the ground.

The Zeiss Planicomp C-100 of the Universidade Federal do Paraná was used to form the hybrid stereoscopic model. The flickering device was adapted at the right hand of the optical path of the Planicomp.

Three devices were conceived to interrupt the image viewing system. The first one, shown in Fig.1, consists of a rotary switch (1), controlled by an electrical motor (2) plugged in a frequency controller (3). The system, acting on the illumination lamp, establishes a blinking or flickering of the illumination of the viewing system of the photogrammetric equipment.

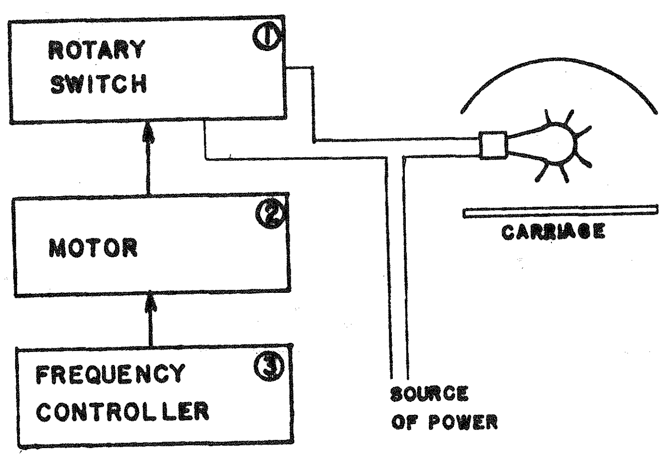

Figure 1. Variable frequency rotary switch device

The second device, Figure 2, consists of a rotary slotted disk b) adapted to an optical path of the viewing system of the stereoplotter equipment a). As in the previous case, rotation of the disk is to be variable, so that different frequencies of the light interruption are obtainable.

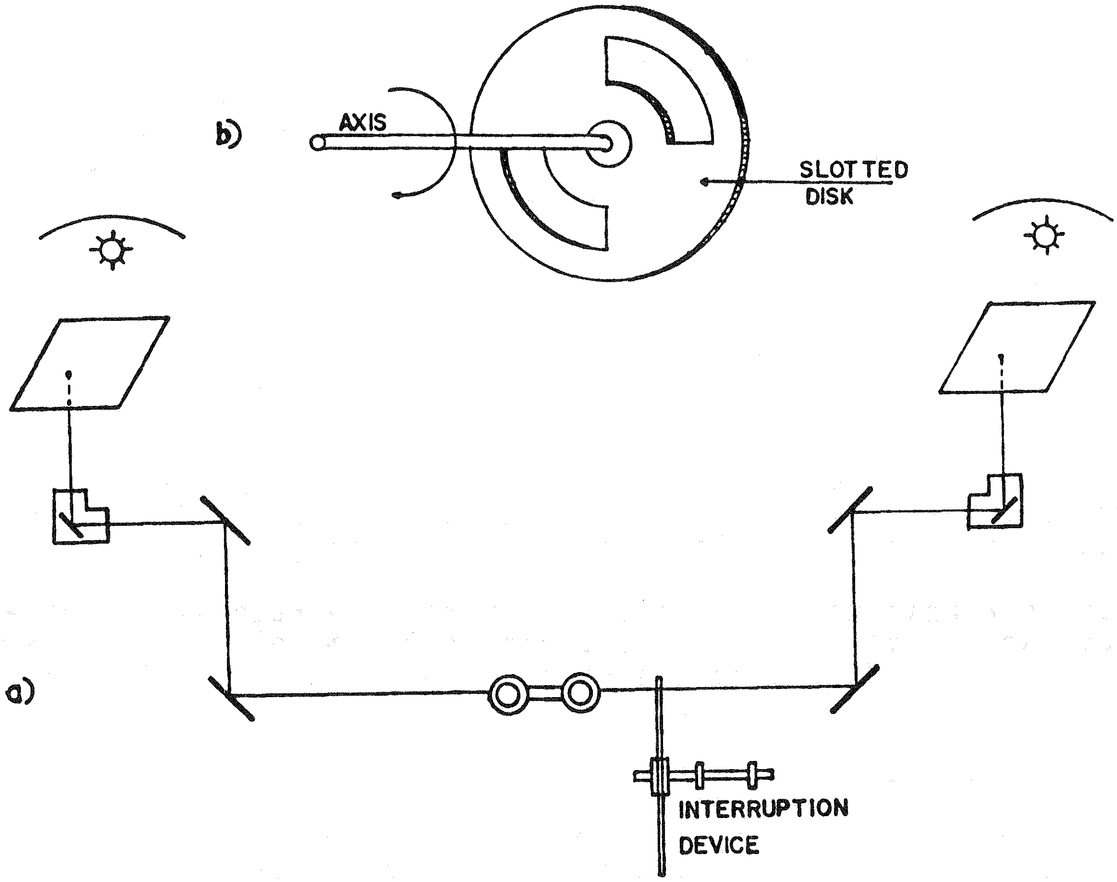

Figure 2. Variable frequency light obstruction device.

The third conceived device, Figure 3, consists of a xenon lamp (5) that flashes and illuminates one of the images in the stereoplotter equipment. This lamp is attached to a controller (4) and this to an oscilator (3). The oscilator is connected to a frequency adapter (1) and to a pattern controllar (2).

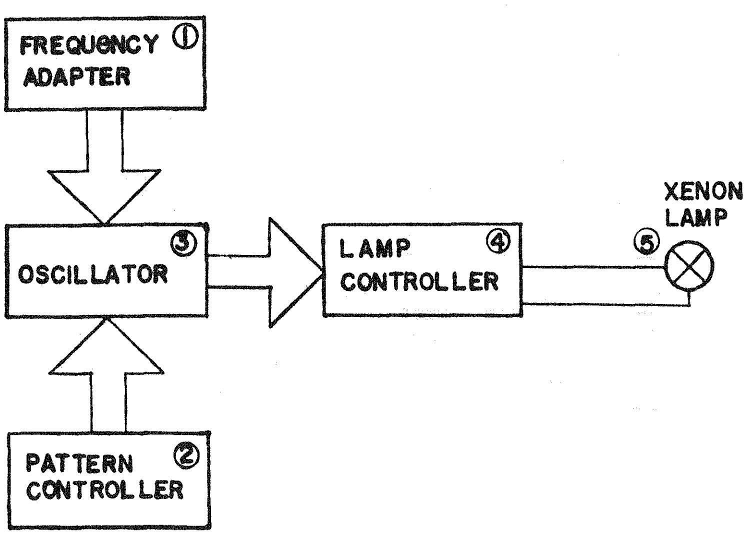

Figure 3. Electronic variable frequency of flashing device.

In the preliminary test of the principle, only the first flickering device was tested.

THE EXPERIMENT

Two different reduced models were photographed twice simulating the scale of 1:5000 of aerial coverage. For the second simulated flight several different size features were introduced in the reduced models. In this simulation, the repetitivety of position of expousure station was very precise. This is not so easy in practical flights. However it is feasible with modern navigation technology /1/, /2/.

The hybrid stereopair of nagatives was oriented at the Zeiss Planicomp C-100 with apparent continuous view of the "new mage". After obtaining the stereoscopic vision, the frequency of the flickering device was reduced progressively and the images of the objects (the changes introduced in the object space) presented dymanic variations from an steady image through high frequency flickering to slow blinking. The changing from static stereoscopic model to blinking gave a qualitative demonstration of a much easier detection of the introduced new objects. This unexplored resource for detection matches perfectly with the operator's ability to interpret the image and select effective object variations from other image differences. This approach can also be combined with the available ones to improve the data registration aspect of the map revision.

CONCLUSIONS

According to the simulation tests performed it seems adequate to conclude that:

- the flickering device applied to the hybrid model improves the changes detection.
- the proposed approach matches adequately with the need of photointerpretation and with the help of stereovision.
- it is less tiring to detect the new object when it presents some dymanics effects.

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