The Geo-Graph Simulation System
Towards Dynamic Use of a Geomatic Data Base

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ABSTRACT

This paper describes an interactive use of a Geographic Data Base. The user is free to move over the entire map or select a particular zone where graphical transformations can be processed. It is possible also to change continuously the point of view and add or suppress specific informations (electric networks, houses).

GGSS is a powerful tool allowing to open a window on a large numerical Data Base in order to produce synthetic and graphical outputs of landscape. It is used to simulate landscape topography seen at constant height.

KEY WORDS

Geographic Data Base, Relief, Planimetry, Simulation.

INTRODUCTION

Geomatic data base, i.e. data bases in which information bearing on altimetry and planimetry (roads, rivers, agglomerations, woods, ...) has been gathered in numerical form, are being developed in the United States, Japan, Canada, ... (3)(9)(11) In France, the Institut Géographique National (IGN), the state agency in charge of map production, is currently implementing a major terrain data base that will be made available to outside organizations. (1)

The evolution pace has already quickened. Geomatic Data Base are at the heart of many applications in computer-aided design or in decision-making aids in a wide variety of fields such as rural and urban planning, installation of communication networks, public works, military projects, ...

Computer graphics is an essential component of a Geomatic Data Base Management System. This is easily explainable because, designwise, geomatic data (altimetry, planimetry) are pictorial data bearing on points or objects in space (3D) that consequently must be described, located, and placed in their environment. So, the best way of interacting with a Geomatic Data Base Management System (GDBMS) is to realistically and dynamically display geomatic data onto a screen. The goal is to have a simulation tool that lets relief and planimetry be simulated from internal geomatic data structures, i.e. it allows synthesizing static and dynamic geomatic pictures from the Geomatic Data Base according to a variety of criteria.

This is the general aim of the Geo-Graph Simulation System (GGSS) currently being developed at Paris VII University in a joint project with the Institut Géographique National. The Geo-Graph Simulation System (GGSS) is implemented on an Evans and Sutherland Multi-Picture System connected to a VAX-11/780.
The procedures made available to the user of the GGSS are intended for:
a. the dynamic 3D simulation of a static terrain zone, i.e. clearly marked off and fixed during processing

1. Geo-Graph Relief (GGR) exclusively displays the relief of a terrain while displaying contour levels (constant altitude lines) or zones that are lighted or shaded according to their position with respect to the sun, the terrain is seen according to the position of the viewer who can move within a zone.
2. Geo-Graph Planimetry (GGP) displays the relief and the planimetric elements defined by the user.

b. Geo-Graph Travelling (GGT) simulates the travels of a viewer within the database, i.e. in real time, it shows the relief or the relief and the planimetry as seen by the viewer travelling over or above the terrain along a well-defined path.

Point a.1. has already been discussed in various papers. (10)(7)(8) The general functions of GGSS, its components, the nature of the problems that have arisen, the thinking behind solutions that have been adopted, and the current results of our work are presented hereafter.

GENERAL CHARACTERISTICS OF THE GEO-GRAPH SIMULATION SYSTEM (GGSS)

Geographic Data

Relief data result from the overlap of two stereographical aerial pictures and cover ca. 15 square kilometers. The corresponding topographic file contains all information visible on the pictures (roads, RR tracks, woods, rivers, dwellings,...). Data input is achieved by digitizing x,y coordinates and the altitude of these elements by specialized hardware.

Roads, dwellings, lots and other topographical elements (a point inside a zone, a water tower,...) are represented by single points or by sets of connected vectors (polylines). To every element is associated a data validation code and two parameters to subsequently indicate the position, width or height of a given element.

Interactivity

The Geo-Graph Simulation System provides the user an opportunity for genuine interaction with the system in the choice of simulations and displays of representations.

Interaction is ensured by the menus. This choice is not original, but it fully suits complex command languages. However, menus are generally static. Indeed, the task-scheduler, i.e. the module devised to manage interruptions, depends on the texts enclosed in the menu boxes and on the tasks associated with each box.

This is why we have elaborated a task scheduler generator. This generator, which results from precompilation of the call sequence uses a simple language to describe menus and actions. It generates a distributor specific to the command language. In particular, it creates menu display orders and instructions for plugging into the various tasks.

GEO-GRAPH ARCHITECTURE

The Geo-Graph Simulation System architecture is derived from its assigned functions (Fig. 1).