The E. I. E. L Project:
An Experience of a GIS Development

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EC – GI & GIS 2003
OVERVIEW

- Introduction
- The E. I. E. L. Project: Motivation
- The E. I. E. L. Data Model
- Tasks and Software Modules
- Conclusions and Further Work
INTRODUCTION

➢ **Funding**
  - Provincial Council of A Coruña (Diputación Provincial).
  - Agreement with the University of A Coruña.

➢ **Objectives**
  - Making a survey on infrastructure and equipment for the province of A Coruña.
  - Building a database consisting of both conventional and geographic data.
  - Developing applications for the maintenance and exploitation of the data.
INTRODUCTION

- The Province of A Coruña
  - 7.951 km²
  - 94 municipalities with 4.064 population centers.
  - 1.108.980 inhabitants.
  - Local administration (Diputación Provincial)
    - Needs of information
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THE E. I. E. L. PROJECT: MOTIVATION

- Survey of Local Infrastructure and Equipment (E. I. E. L.)
  - Ministry of Public Administrations requires from each Provincial Council every five years
    - Information about the condition of the infrastructure and equipment in the province
      - Alphanumeric information (DBF files).
      - Thematic Maps (hard copies)
        - One map of each municipality: Roads, Population centres.
        - Three maps of each population centre: Streets, water supply, sewage.

- Geographic Information is not Integrated with Alphanumeric Information
  - Impossible to use in other applications.
  - Difficulties in Data Maintenance for subsequent surveys.
THE E. I. E. L. PROJECT: MOTIVATION

E. I. E. L 2000

- Diputación undertakes a more ambitious project.
- Alphanumeric and Geographic Data integrated into a huge Geographic Database
  - Eases the Surveys of Subsequent Years.
  - Enables the Provincial Council to provide each of its municipalities with Geographic Information of its territory.
  - Enables the future incorporation of Geographic Information, in other applications of the Provincial Council.
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THE E. I. E. L. DATA MODEL

General Remarks

- Alphanumeric Data Model given by the Ministry
- Two Levels of Information
  - (a) Municipality. (b) Population Centre
- Two types of Entities
  - (a) Surveyed (with info.) (b) Not surveyed (ref.)
- Attributes are added to Surveyed Entities for Geographic reference
  - Vector Spatial Representation.
  - Point, Line and Surface Data types.
  - Various Spatial attributes for various scales
THE E. I. E. L. DATA MODEL

Overview

- **Huge Database**
  - 155 tables
    - Some of them consisting of more than 2.5 million tuples.
    - More than 4.5 GB of Geographic and Alphanumeric Information

- **4 main types of data**
  - Territory Structure, Relationships and Urban Planning
  - Road and street network
    - 35,521 road stretches, 41,839 street stretches, etc.
  - Water Cycle
    - more than 30,000 pipes of water supply and sewage, etc.
  - Equipment
    - more than 1,000 cemeteries, more than 1,000 sport facilities, etc.
THE E. I. E. L. DATA MODEL
Territory Structure, Relationships and Urban Planning
THE E. I. E. L. DATA MODEL
Road and street network information

- Population Center
- Surveyed Pop. Center
- Street Network
- Municipality
- Province
- Road
- Road Section
- Surveyed Municipality

Relationships:
- Population Center has Surveyed Pop. Center
- Surveyed Pop. Center accessed by Street Network
- Street Network has Geometry
- Geometry traverses Road Section
- Road Section traverses Surveyed Municipality
- Road has Province
- Municipality has Province
- Municipality N has Surveyed Municipality
THE E. I. E. L. DATA MODEL

Water Cycle Information

- **<Element>**
  - **Water supply system**
    - dumping site, water source, water conduction pipe, water tank, water treatment plant, water distribution pipe.
  - **Sewage System**
    - sewage pipe, outlet, sewage works.

![Diagram of Water Cycle Information](image-url)
THE E. I. E. L. DATA MODEL

Equipment Information

- street lighting, teaching institution, town hall, unused public building, civilian volunteer center, market, sport facility, park, cultural center, slaughterhouse, cemetery, morgue, health-care facility, and welfare center
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TASKS AND SOFTWARE MODULES

The Team

- **Big Team composed of 5 groups of experts**
  - **Experts**: Civil Engineering, Architecture and Computer Science Schools
  - 3 groups in charge of: (6 Organizers, 85 Scholars)
    - Data collection: (a) Tables (b) Maps
    - Alphanumeric Data Insertion
    - Linkage of Alphanumeric and Geographic Data
  - 1 group of Cartography: (2 Organizers, 39 Scholars)
    - Digitisation of geographic elements
  - 1 group of Computer Science (DBLAB, UDC):
    - Analysis, design and implementation of GIS applications
    - Technical support to other groups
TASKS AND SOFTWARE MODULES
Overview

- Database Creation
  - CAD File
  - Base Cartography Database
  - Map From Survey
  - Geographic Database
  - Digitisation
  - Alphanumeric Database
  - Thematic Maps

- Data Maintenance
  - Alphanumeric questionnaires From Survey
  - Linkage Control
  - Geo-alpha Linkage
  - Geo-alpha Linkage
  - Validation

- Data Exploitation
  - Final Municipal Database
  - E.I.E.L Database
  - Thematic Maps
  - Reports and Statistics

- E.I.E.L Database

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TASKS AND SOFTWARE MODULES

Description

[1] Importation

- **Objective**: To Produce Required Digital Cartography.
- **Problem**: Original CAD Cartography of Low Quality
- **Solution**: Direct Use of a Commercial GIS Tool
  - Intergraph Geomedia Professional 4.0.

[2] Digitisation

- **Objective**: To Digitize Required Geographic Entities.
- **Solution**: Development of a new GIS application
TASKS AND SOFTWARE MODULES

Description

- **[3] Alphanumeric Management**
  - **Objective**: To Build a database with the alphanumeric data collected in the survey.
  - **Solution**: Development of a typical application for alphanumeric data management.

  - **Objective**: To link the alphanumeric data of each element [3] with its geometry [2].
  - **Solution**: Development of a GIS application
TASKS AND SOFTWARE MODULES

Description

- **[6] Validation**
  - **Objective**: To Validate Geographic and alphanumeric data
  - **Solution**: Development of GIS application

- **[7] Data Maintenance**
  - To Insert, Delete and Update Geographic and alphanumeric Data
  - Generation of Data required by the Ministry

- **[8] Data Exploitation**
  - To Generate Thematic Maps.
  - To Generate indicators (quality).
  - Web Technology: Small Municipalities
### Tasks and Software Modules

#### Technology

- **Conventional GIS Applications**
  - Geodedia Professional 4.0, 5.0
    - ActiveX Controls, COM
  - Microsoft SQL Server 7.0
  - Visual Basic 6.0

- **Web GIS Application**
  - Geodedia Web Map Server 5.0
  - Active Server Pages (ASP)
  - Internet Information Server (IIS)

- **Second Generation Layered Architecture**
  - DBMS not aware of spatial data

<table>
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<th>Dual</th>
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</thead>
<tbody>
<tr>
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<td>GIS Application</td>
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<td>GIS TOOL DBMS</td>
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<td>DBMS SQL Server</td>
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CONCLUSIONS AND FURTHER WORK

Conclusions

- Data Model Extended with Spatial Attributes
  - Various Spatial attributes for Various Scales
- GIS Applications Developed
  - Eases the building of the Huge Database
  - Enables non-expert users to access Geographic Data
- Use of 2nd generation spatial architecture and vector spatial representation

Further Work

- Migration to a 3rd generation spatial architecture
  - Spatial DBMS, Spatial Indexing, Spatial SQL, etc.
- Incorporation of ISO and OpenGIS standards
  - SFS SQL (SQL/MM), WMS, etc.
- Extension to Spatio-temporal (Transaction Time Recording).
CONTACT INFORMATION

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