HazMit GIS

A GIS solution for natural HAZard MITigation, based on a structured database design

Expert System for Quantitative Risk Assessment

This software–which has been implemented as the national software for natural hazard mitigation in Nicaragua–represents a quantum leap forward in the formalization of hazard data. The new database design makes it possible to:

• **Produce expert system reports,**
• **Calculate the quantitative risk for each type of hazard, and**
• **Evaluate the benefit of mitigation.**

This is achieved through these steps:

• The natural hazards are classified according to process, magnitude, and frequency
• These classes are mapped in the GIS
• Each class contains attribute data with description, mitigation options, and vulnerability as a function of mitigation
• The GIS also contains maps over the subjects of vulnerability:population and infrastructure
• Pre-programmed tools allow the user to select any area, natural hazard, and mitigation level, and to **calculate the risk cost** in terms of lives lost per year, or dollars per year.

The benefit in terms of risk management is obvious: The cost can be compared to the benefit, and one can identify the priorities in terms of which mitigation effort to implement first.
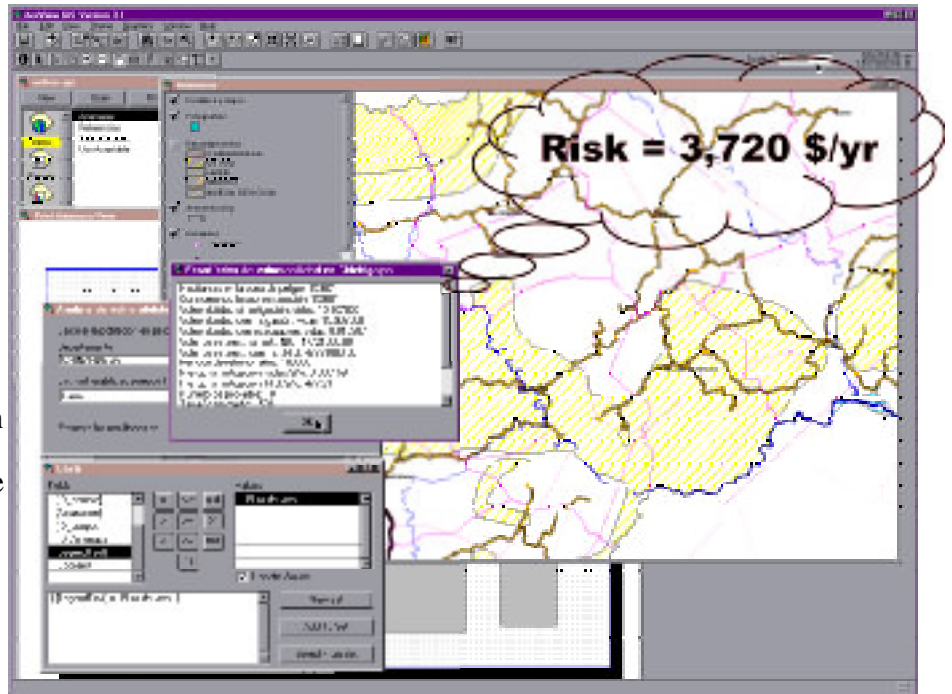
Benefits

The system is intended for three group of users, and **can generate these three types of reports**:

1. **Realty** business: realtors, buyers, developers

2. **Land use zoning**: city, county, state level planning

3. **Natural hazard mitigation**: cost-benifit analysis, sensitivity studies based on uncertainties in existing data in order to plan future studies in the most cost-effective way, etc.

The most important benefit from implementing this system is that it provides for a structured format for classifying natural hazards and vulnerability data, making quantitative and comprehensive risk analysis possible.

Key Advances
• The processes causing natural hazards were formalized into generic classes, and quantified as to magnitude, physical units, and probability / frequency / return period
• Uncertainty was handled formally as overestimation of area
• Vulnerability and mitigation options were quantified
• *Risk, in cost per unit time, is calculated formally correct with actual GIS data*

Design solution
• The GIS was built in ArcView 3.1 and programmed in Avenue
• The relational database was built in MS Access 2000 and programmed in Visual Basic
• The database is maintained by natural hazard experts
• System users interphase only with the GIS component in ArcView
• ArcView dynamically accesses data from the database to generate reports and calculate statistics
• An expert report about any area or point can be generated in HTML format
• All headlines and fixed text in the report is editable in the database
• Three levels of report detail is provided, for different uses (general, physical planning, mitigation planning)
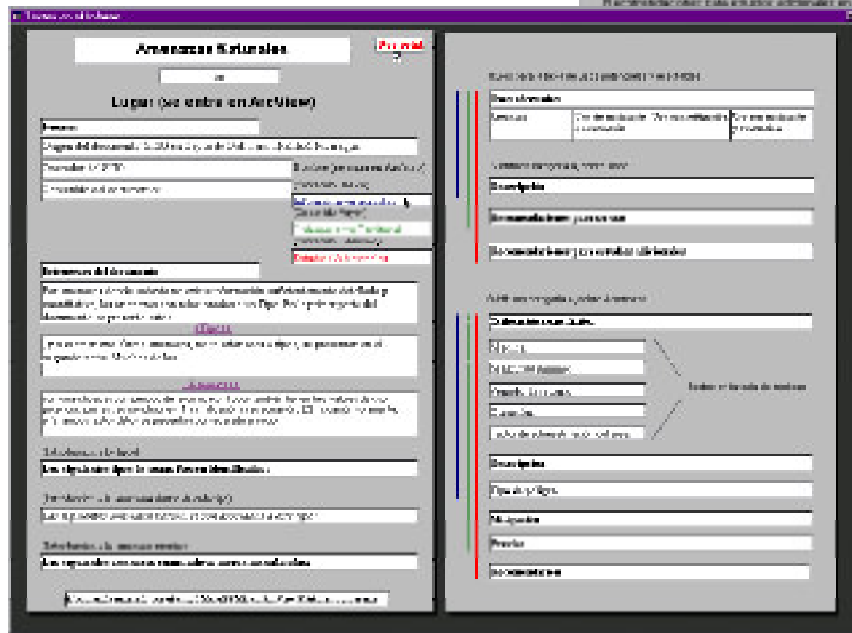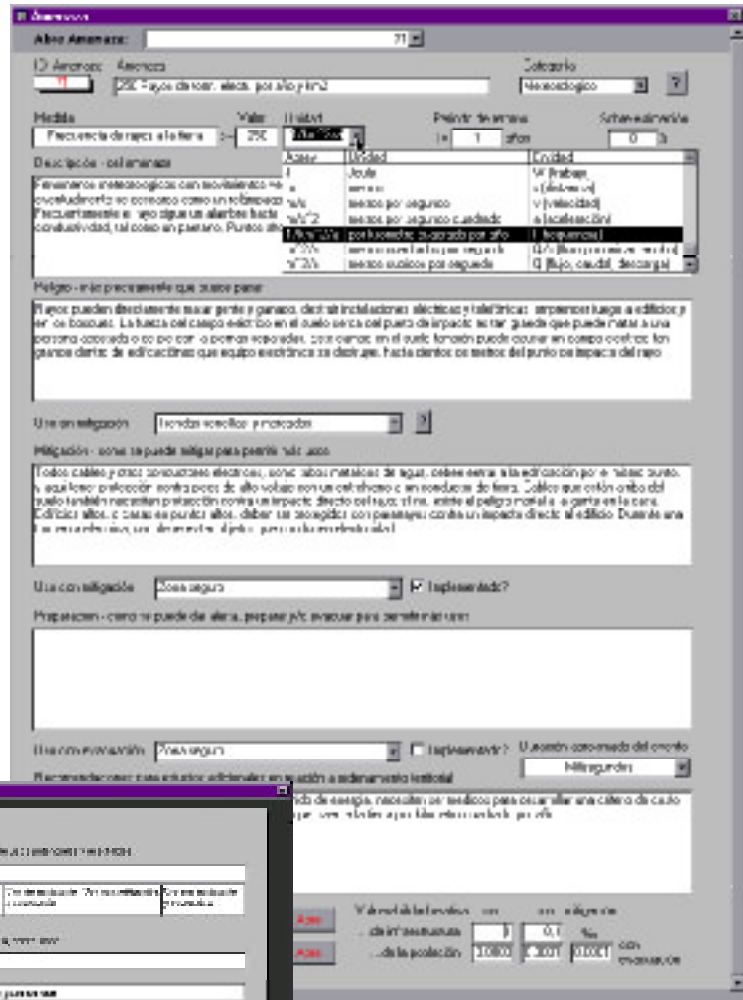
Design and implementation
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