

# Development of a System Prototype for Insurance Rate Information Based on Natural Disaster Risk

Jihun Kang, Insu Lee, and Jung Ok Kim

Spatial Information Research Institute  
 Korea Cadastral Survey Corporation  
 Seoul, Korea  
 {kangdaejang, les05, jungok}@lx.or.kr

**Abstract**—In Korea, a research has been conducted on individual insurance rates for natural disasters. However, there is no system yet for managing comprehensive disaster insurance rate data or for representing an insurance rate map. In this study, a system for preparing Natural Disaster Insurance rate maps is proposed to transparently operate and activate the natural disaster insurance. Then, the availability of the insurance rate management is confirmed to develop a prototype system based on the aforementioned architecture.

**Keywords**—Insurance rate; insurance rate system; natural disaster; disaster map; open source.

## I. INTRODUCTION

Over the last decade, Korea’s financial damage from natural disasters has reached 8.3293 trillion won. Such damage has been caused mainly by floods due to heavy rains (51.6%), typhoons (26.3%), heavy snowfall (20.2%), and wind/gale (1.9%) [1]. For the victims to effectively recover from property losses in all kinds of storm and flood damages, Korea developed a Natural Disaster Insurance and has been operating it since 2008 [2].

Natural Disaster Insurance, which is controlled by the National Emergency Management Agency and is sold and operated by private insurance companies, charges a single rate across all regions [3]. To investigate the viability of this single-rate issue, a study on the application of individual insurance rates by region is ongoing. Also, in 2014, a Natural Disaster Insurance Rate Map was produced based on a study in Ulsan, South Korea.

Since individual insurance rates are calculated considering the risks (caused by typhoons, flooding, and snowfall) of the concerned area all together, they can be complex and variable. Because the Natural Disaster Insurance Scheme should be fair and reliable, it must be managed using a system. In this study, to verify the need for such a system, a web-based system prototype for the Insurance Rate information management was developed. Moreover, the availability of the system was confirmed by overlaying various spatial data on the insurance rate map and suggesting a system construction plan.

## II. INSURANCE RATE INFORMATION SYSTEM PROTOTYPE

A web-based prototype system for a Natural Disaster Insurance rate information service was developed. The

architecture of the system design is shown in Figure 1. The design of the architecture based on open-source software can be advantageous in cost and ease of use.

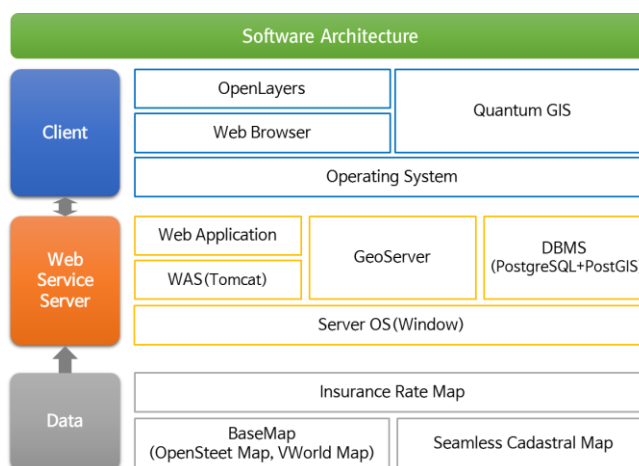


Figure 1. Software architecture of the prototype system

The Client tier consists of the web browser for displaying the information, Openlayers as the 2D Geographic Information System (GIS) engine, and Quantum GIS for managing the natural disaster risk data (insurance rate map) and the map-based data such as Digital Elevation Model (DEM) and the digital map. Although Quantum GIS is not directly related to the web-based prototype system, it is needed for the modification of the data such as for the projection transformation. The Server tier consists of Tomcat [5] for processing web applications, Geoserver for servicing geospatial data, and PostGIS (included in the PostgreSQL [6]) for managing the spatial and non-spatial databases. The Data tier consists of the insurance rate map based on natural disasters, the base map using the maps Application Programming Interface (API), and the seamless /cadastral map of Korea.

The insurance rate map is formed in the SHP data format, with the data coming from Ulsan, Korea. The base maps used were Open Street Map as the vector map, and VWorld Map as the aerial image map. VWorld Map is a map manufactured under the sponsorship of the Ministry of Land, Transport, and Maritime Affairs, which provides high-

resolution aerial images in Korea. The seamless cadastral map is also formed in the SHP (ESRI shpapefile) data format and uses data from the same region as that for the insurance rate map. For the maps to be overlapped in between, ITRF 2000 Datum [7] and TM projection [8] was used.

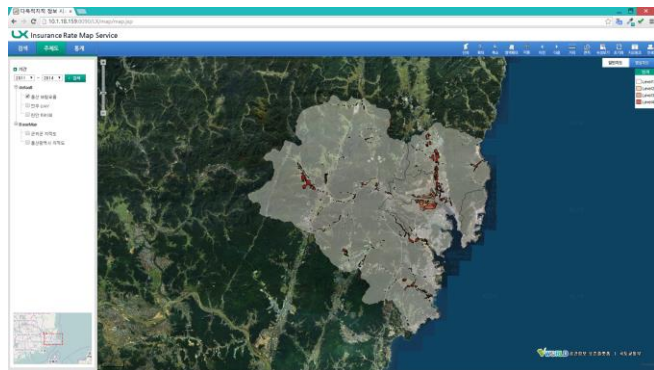


Figure 2. Main interface for the Insurance Rate Map service

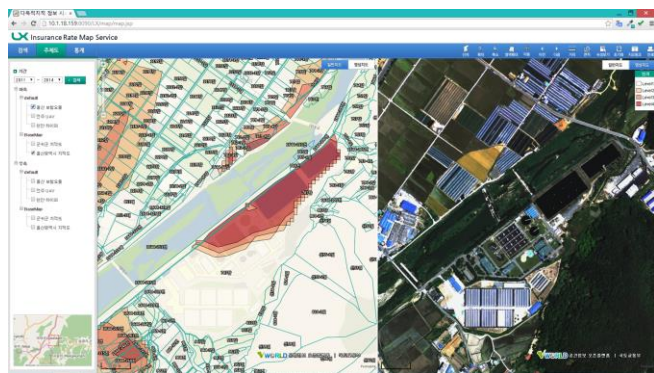


Figure 3. Geolink

The main interface of the prototype system is presented in Figure 2. This system can operate the general functions of map systems such as zoom, move, measurement tools, property view, and print. The system can also overlay a natural disaster map on a cadastral map for a nested view. In this case, the location of the nesting area is difficult to confirm, so Geo-link is implemented using Openlayers [9], as shown in Figure 3. Geo-link is a technology for splitting a browser window into two, with the locations of each half-window related to each other. Each layer of the respective domain can be individually controlled.

### III. CONCLUSION AND FUTURE WORK

Through the web-based Natural Disaster Insurance information system prototype, the necessity of the insurance rate map service was assured. Also, the effective visualization of the insurance rate information was studied through overlay of spatial information. If the system is put in service, it will be able to operate a fair insurance scheme.

Although this prototype system is limited to providing premium rate information, in the near future through research, the National Insurance Rate Map is expected to be

produced, which is based on Storm Risk Map, Flood Risk Map, and Snow Risk Map. To the extent of the production, a managing system to make them integrated is also needed. This management system will be used to predict and reduce natural disaster risks.

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