# Smart Globe with GEBCO Worldmap and Gazetteer

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This geographic information service integrates various types of contents, including the B-8 Gazetteer of Geographical Names of Undersea Features, web cartoons, and games in order to promote the public understanding and awareness of GEBCO activities and ocean topography across the world.

KHOA is currently developing a globe and an associated application which allocate a cell positional information to the GEBCO World Map globe and allow it to be recognized by smart phone cameras with the 80% or above optimized recognition rate and speed. (To be completed by December 2013)

## Ⅰ. Map Recognition Technology

### ❖ Map Recognition Technology

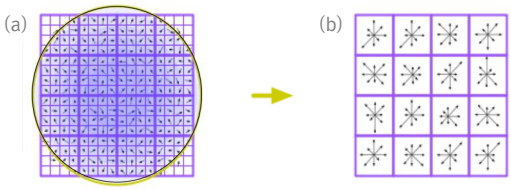
- Limits of marker-based image recognition
  - Overlaps in images on QR code or frame marker based maps
- Map recognition technology using the extraction of natural features
  - Recognizes feature points on the map and compares these feature points with those in similar areas
- Optimization Goals
  - Recognition rate of 80% or above, recognition speed of 5 seconds or less in a WiFi zone

Figure 1. Frame Markers ▶

### ❖ Algorithm

- SIFT (Scale Invariant Feature Transform)
  - Efficiently adjusts to different scales and angles and the rotation of an object
- Application of Gaussian function to images
  - Takes a difference of Gaussian (DOG)

▼ Figure 2. Feature Point Descriptors



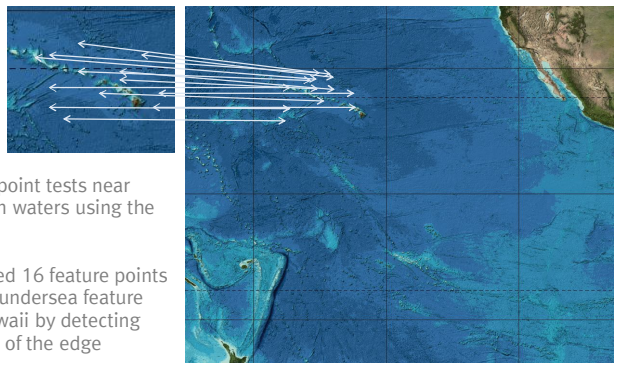

(a) Image Gradients (b) Keypoint Descriptor

## Ⅱ. Development Methodology and Contents

### ❖ Feature Point Tracking Test using GEBCO World Map

An area containing the specific latitude and longitude in which a user is interested on the globe is defined as a cell. A cell is the minimum unit that a smart phone can recognize as an image. Each cell is allocated with a position ID.

▼ Figure 3. Feature Point Tests



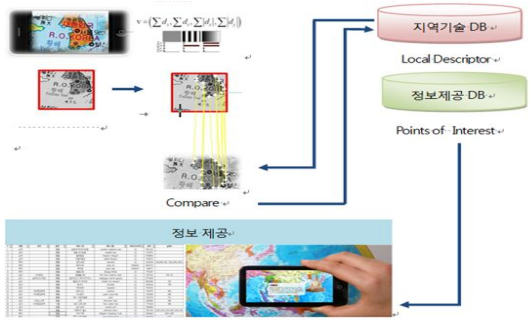
- Feature point tests near Hawaiian waters using the globe
- *Extracted 16 feature points from an undersea feature near Hawaii by detecting changes of the edge

**Map Recognition & Extraction System**

- Feature Point Extraction

**Processing System (Engine)**

- Map Image Recognition

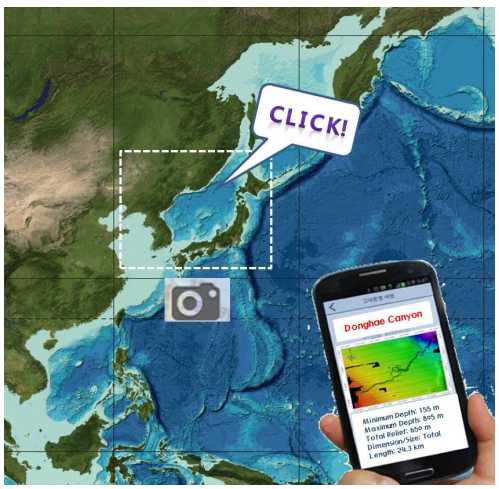


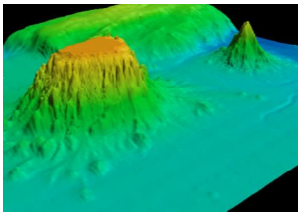

▲ Figure 4. Basic System Composition

(1) Development of the image recognition engine and integrated geographic information system using latitude and longitude coordinates

(2) Development of applications & contents (Gazetteer, Cartoons, etc.)

## Ⅲ. Services



▲ 3D topographic map with history and remarks in gazetteer


▲ Cartoons


▲ Games

- Popularity (To increase the public interest through the use of smart phones)
- Convenience (To allow access to a wide range of information anywhere in the world via the globe)
- Expandability (To provide real-time updates of various contents in the future)