Visualization tool for 3D GIS data. Yoshiaki Fujii,[1] Naru Hirata,[1] Hirohide Demura,[1] and Noriaki Asada.[1]
[1]Department of Computer Software, University of Aizu,, Ikki-machi, Aizu-Wakamatsu City, Fukushima 965-8580, Japan. (e-mail: m5101124@u-aizu.ac.jp)

Introduction: Most small asteroids have very irregular shapes. The asteroid Itokawa observed by the HAYABUSA spacecraft is a good example of such irregular shaped bodies [1] (Fig. 1). Many missions to the asteroids observed their shape, many kinds of features on surface, and material distributions. The geographical information system (GIS) integrates digitized map data, other attributes on the map, and statistical data. The data on the GIS can be retrieved, analyzed, and visualized on displays. With the data displayed on the map, we can grasp many properties of the objects to be analyzed.

The irregular shaped small bodies cannot be adopted to the existing GISs commonly used for the Earth map data, because the Earth has a nearly spherical shape. For extremely irregular shaped bodies, it is impossible to define a location of an object on the surface by the standard latitude-longitude coordination. The plane map of the asteroid is also not to help to understand the general contexts of surface features, because of a large distortion. Thus, three-dimensional visualization is very useful for a GIS-based analysis of the asteroid data.

We develop a tool for visualization of a 3D figure, which is modeled with polygons. Several kinds of physical values (e.g. slope) are attributed to the polygons. The displayed model can be rotated and moved by mouse operation.

Figure 1 | Asteroid Itokawa
The terrain of Itokawa shows very variety and widespread distributeon of boulders. Release 051101-1 ISAS/JAXA [2]

Implementation: This tool was developed with OpenGL for 3D visualization and the Gimp Tool Kit (GTK) that provides GUI frameworks on multiplatform such as MS-Windows, Solaris, Linux and MacOSX.

The inputs of the tool are separated into two files; one is a polygon shape model of the asteroid, and the other is physical value mapped onto polygons. Please DO NOT submit duplicates of your abstract, should you find it necessary to replace or repair your paper, please contact the numbers provided. Gravitational slopes are now available. The can display the polygon model, and each polygon is colored according to a slope at that location (Fig. 2). Users can change the viewpoint of the model, scale of display, and color attributes arbitrarily by GUI operations. The most detailed shape model of Itokawa consists of 3145129 polygons [3]. Because this model is too large for real-time rendering by common computers, we use a reduced-resolution version of the shape model (49152 polygons) together with the highest one. The tool can switch a displaying model. Users can choose a viewpoint of the display arbitrarily with the reduced model, then switch to the original model for detailed investigation. The slope data should be prepared individually for each model.

Future Works: The current version of the tool treats attributes that have one-by-one relations to polygons. Further improvements should be needed on surface properties independent of polygons. The functions for scientific analyses will also be implemented into the tool.

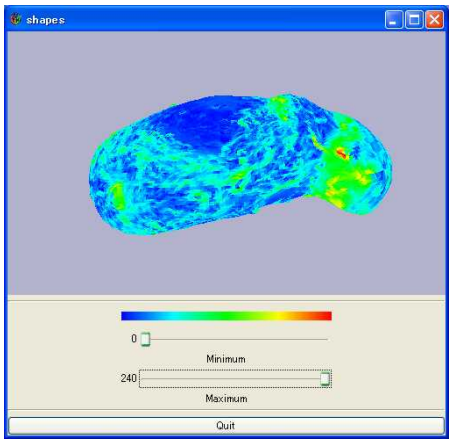

Figure 2 | 3D-GIS data visualization tool
This tool visualize polygon modeled Itokawa. The color bar was allocated by the slope value.

References:

[1] Demura, H. et al., (2006) *Science, 312,* 1347-1349
[2] *http://www.isas.jaxa.jp/*, [3] Gaskell, R. et al. (2006) *AIAA paper* 2006_6660.