Integrated Tool for Analysis of Irregular Shaped Small Bodies. Naru Hirata,[1] Yoshiaki Fujii,[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: naru@u-aizu.ac.jp)

Introduction: Many missions to the asteroids observed their shape, many kinds of features on surface, and material distributions. These data can be regarded as georeferenced data, because they are associated with specific locations on the surface. The geographical information system (GIS) is a powerful tool to integrate such georeferenced data for detailed analysis and visualization. However, One problem is that the target of commonly used GISs is a spherical shaped body; that is the Earth. 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). 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, an alternative tool is required for GIS-oriented analysis of remote sensing data of irregular shaped bodies. We started a project to develop an integrated software tool fulfilling for such requirement.

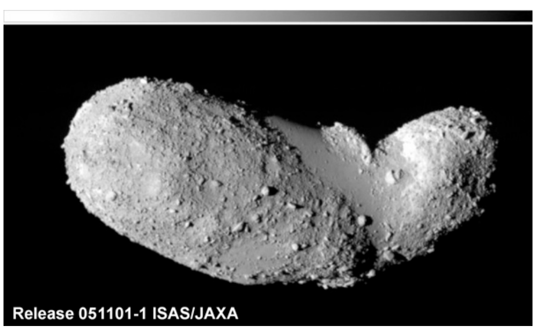

Figure 1 | Asteroid Itokawa (Release 051101-1 ISAS/JAXA [2])

Implementation: This tool was developed with OpenGL and the Gimp Tool Kit (GTK). OpenGL furnishes many APIs for 3D visualization, and GTK provides frameworks of GUI. Since both toolkits are offered to a wide range of hardware platforms and software environments, our tool works on many platforms such as MS-Windows, Solaris, Linux and MacOSX.

There are two kinds of input data for the tool. One is a polygon shape model of the asteroid, and the other is physical value mapped onto polygons. For example, the shape model of Itokawa is now available, and a gravitational slope for each polygon is derived from the shape. This tool can display the polygon model, of which polygons are colored according to 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 also use a reduced-resolution version of the shape model (49152 polygons) together with the highest one. The tool can easily switch a model to be displayed. A user can choose a viewpoint of the display arbitrarily with the reduced model, then switch to the original model for detailed investigation. The attribute data related to polygons have to be prepared for individual shape models. A user also can change a kind of attributes to be mapped on to the model.

The current version of the tool has limited number of functions for scientific analyses including extraction of profiles of the shape and the associated attributes along a user defined line. Other practical functions will be implemented into the tool in the future version.

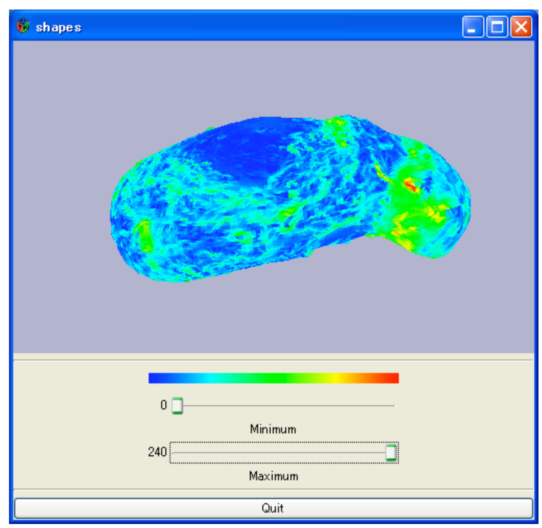

Figure 2 | Snap-shot of the tool that visualize the polygon shape model of Itokawa and local slopes.

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