Development of a Constellation Topic Map Application Controlled by WiiRemote

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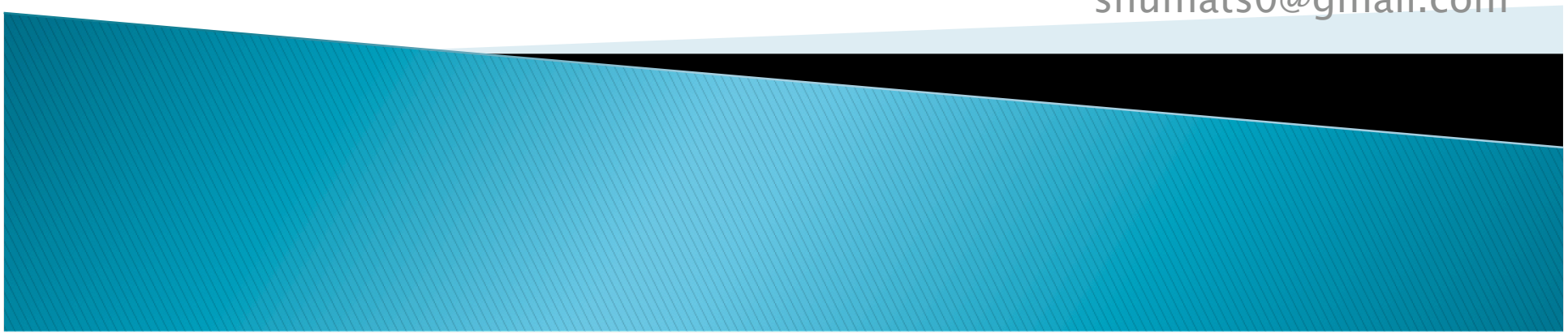
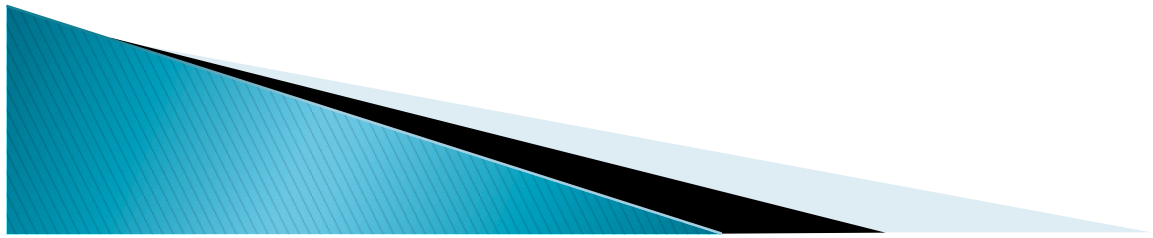
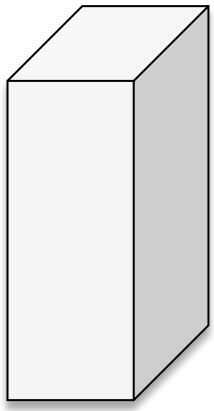


Purpose

- We are developing a multi-field study portal that is driven by a topic map. This portal includes topics of constellation.
- In this study, a system to connect real sky with online resources of constellation is developed.
- The WiiRemote, which is a popular video game interface, is utilized as an interface, to transmit the data of sky position.
- Google sky displays constellations that exist around the pointed position in the real sky, and the related topics are exhibited using topic map functionality.

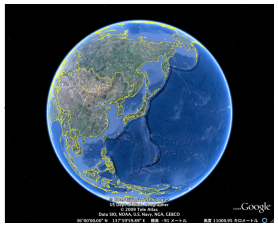


Overview



Topic Map server

④ JSP page requests Google Sky to present corresponding constellations.



GoogleSky

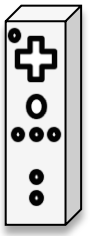
⑤ Topic map server returns JSP page including Google Sky presentation, associated constellations, etc.

③ Flash page requests the topic map server to get the corresponding constellation page.

② A flash page receives wii data, and calculate the right ascension and declination of the pointed position in the real sky.

A flash base web page to communicate with WiiRemote.

① Input data of position in the real sky, using WiiRemote.



WiiRemote

WiiFlashServer is used to transmit data from WiiRemote to flash web page.

Data acquisition

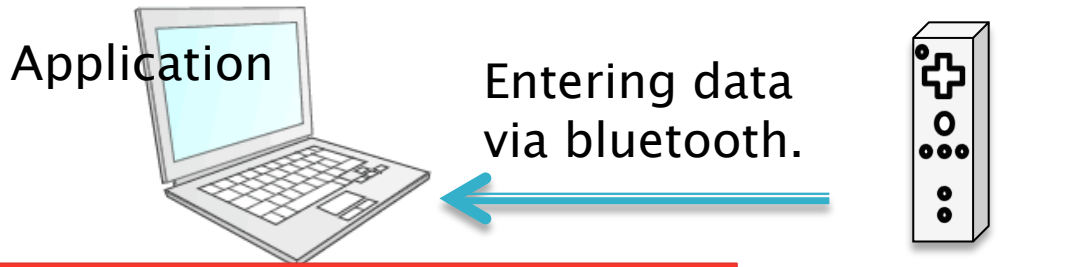
Latitude: request place topic page with Google Map presentation and carry out geocording on this page.

Azimuth: measure by magnetic compass.

Elevation: measure by the WiiRemote acceleration sensor.

Above values are input and send to web page by pushing WiiRemote buttons. WiiRemote transmit data to PC via bluetooth.

Present time: PC time.

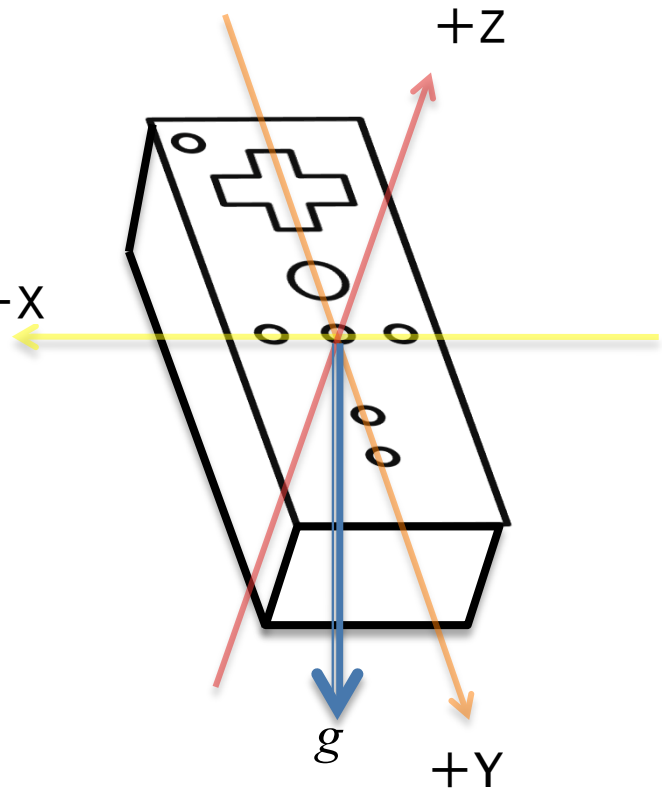


WiiFlashServer is used to transmit data from WiiRemote to flash web page.

Obtaining on elevation angle from the horizon

WiiRemote transmits the values of acceleration in the directions of three axis, to PC via bluetooth.

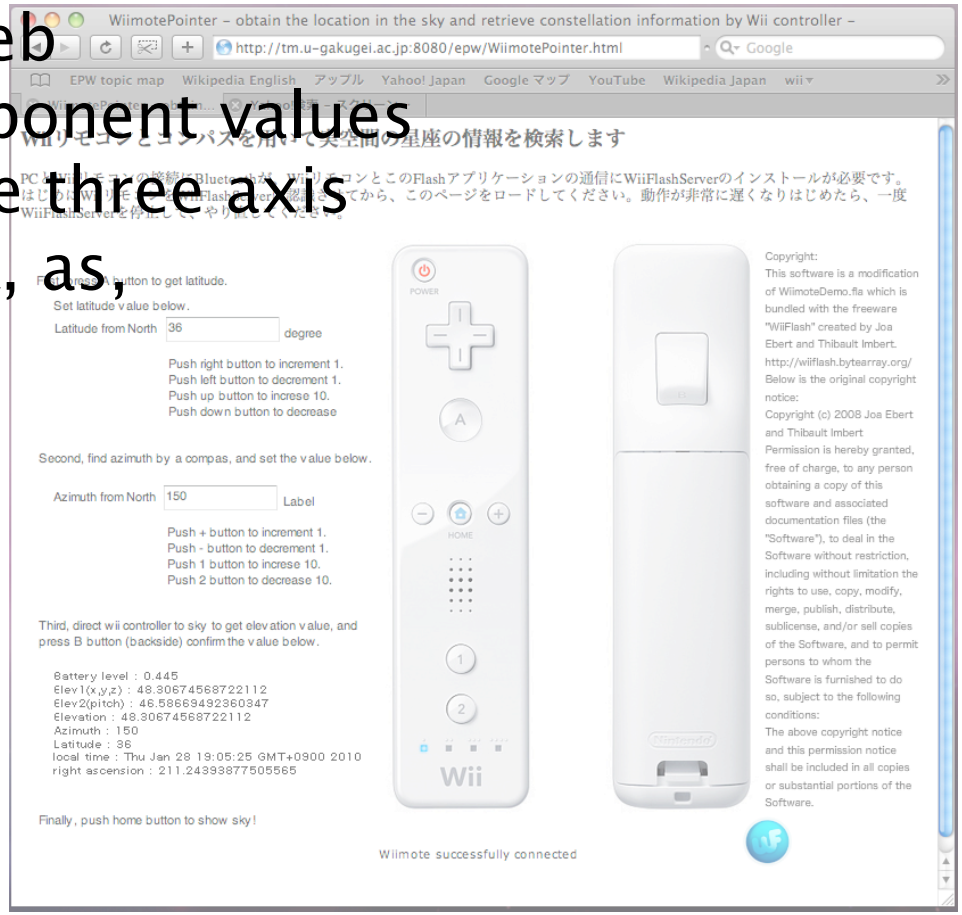
If it is set still, acceleration sensor detects gravitational acceleration g, which works as a fixed direction to determine a pointed direction of WiiRemote.



Obtaining on elevation angle from the horizon

Angle of elevation θ from the horizon is calculated by a Flash web application from the component values of gravity projected on the three axis of Wiiremote, g_x, g_y, and g_z, as,

$$\theta = -arctan\left(\frac{\sqrt{g_x^2 + g_y^2}}{g_z}\right)$$



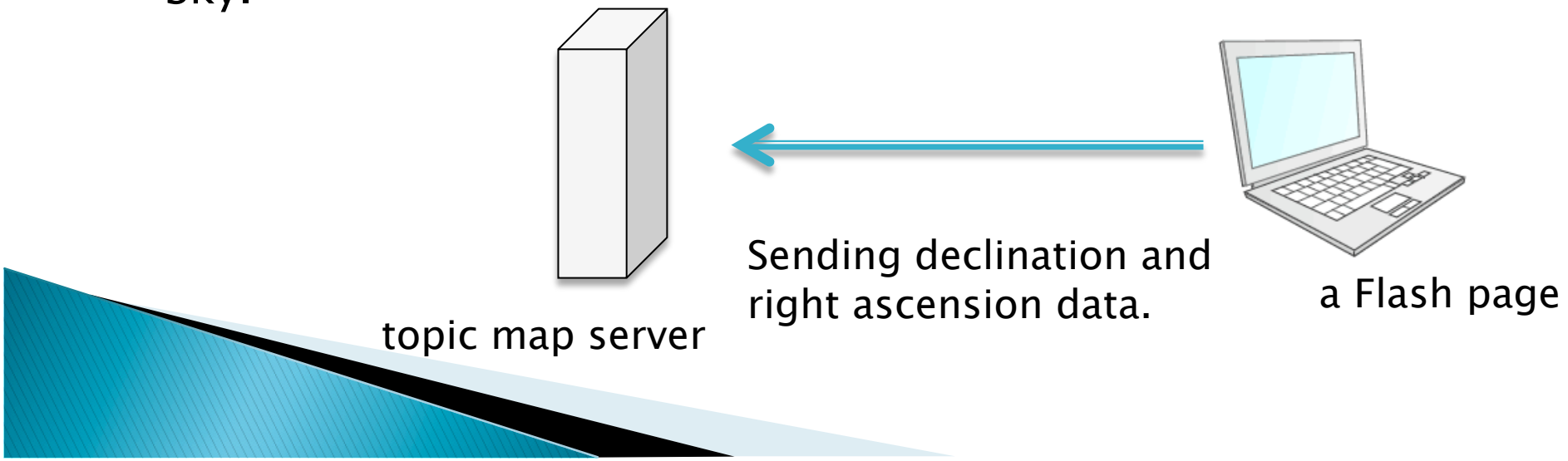
Right ascension and celestial declination

- The right ascension and the celestial declination are the longitude and latitude of the position on the celestial sphere.
- Latitude, the elevation, azimuth, and local sidereal time are required to calculate the right ascension and the celestial declination.
- Sidereal time is calculated from present time and place.

Sending latitude and longitude data

- The values of declination and right ascension are calculated by a Flash page, and are sent to sky_pointer.jsp page , to render the constellation map using Google Sky.

- The center of the rendered image of Google Sky is set to be the position that WiiRemote pointed . The instances of constellations which are included within the range ±40 degrees are loaded and exhibited below the image of Google Sky.



Screen shot of sky_pointer.jsp.

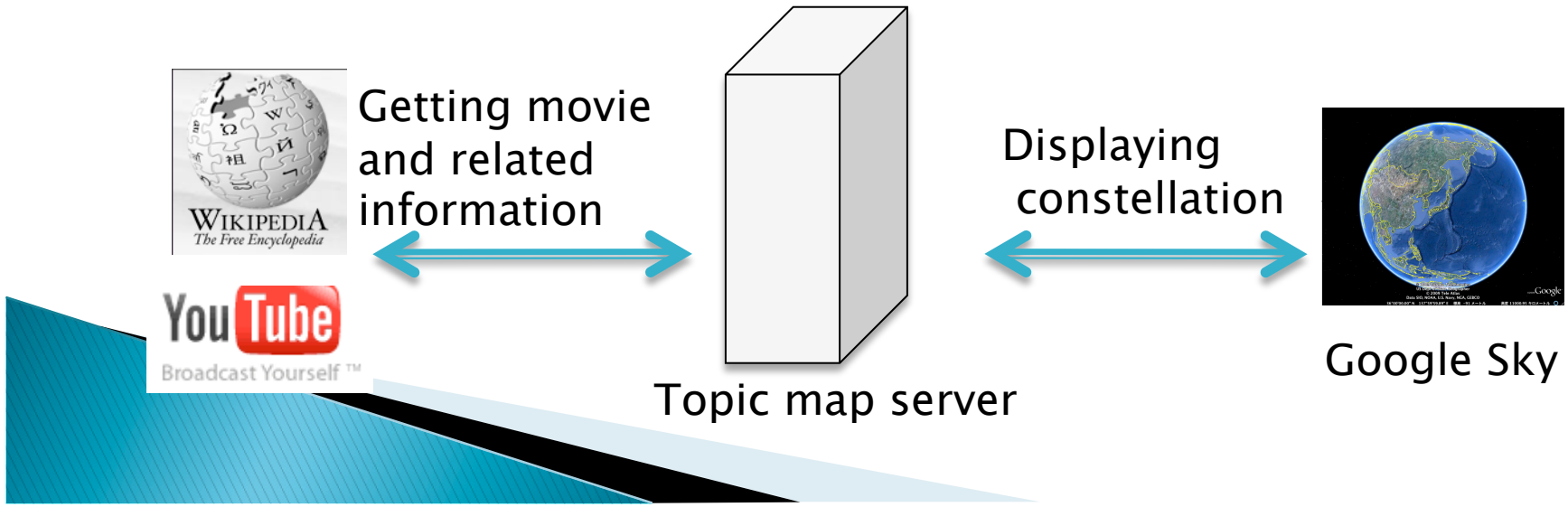
The values of right ascension and celestial declination provided by WiiRemote interface.

Image of Google sky

Links of constellation topics included range that is described

Mashup

- Topic map associates topics of constellation, mythology YouTube videos, etc., semantically.
- Topic map utilize Google Sky to render the requested constellations.



Future problems

- More topics to associate.
- Continuous pointing by WiiRemote.
- Change of time and seasons at the same position in the sky.
- Feedback to the WiiRemote from topic map server.
- 3D navigation.
- Drill resources for learning.