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Development of Track Log & POI Management System using Free and Open Source Software

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Introduction

Recent advanced performance of **low-cost GPS** and **GPS-enabled cell-phones** has contributed a great deal to the development of location-aware services and systems.

The advancements have promoted collaborative projects such as **OpenStreetMap** or other **User Generated Contents** services.

the **ubiquity of location information** is one of the recent developments in geospatial technologies.

Previous work @ FOSS4G2008

@FOSS4G2008

Development of Real-time Tracking & Log Management Prototype System using FOSS

An open framework for
GPS data collections and management

To provide interoperable services
and data between LBS and other geospatial services

- focused on real-time tracking
- Implemented quality filtering for GPS signal
  using DOP (Dilution of Precision)
  and GPS positioning status data
  (3D, 2D or no fix)
- Implemented map-matching functionality

Interactive Track log on-the fly Display Function

GPS Track Log Search

IP Address: 160.193.

Date: 2008-06-09

Time Between: 0AM To 11PM

PDOP < 2

GPS Mode 3D

Display GPS Track Log

>> GPS Data Upload

>> Log Statistic Page

KML

Download KML Track Log

GPX

Download GPX Track Log

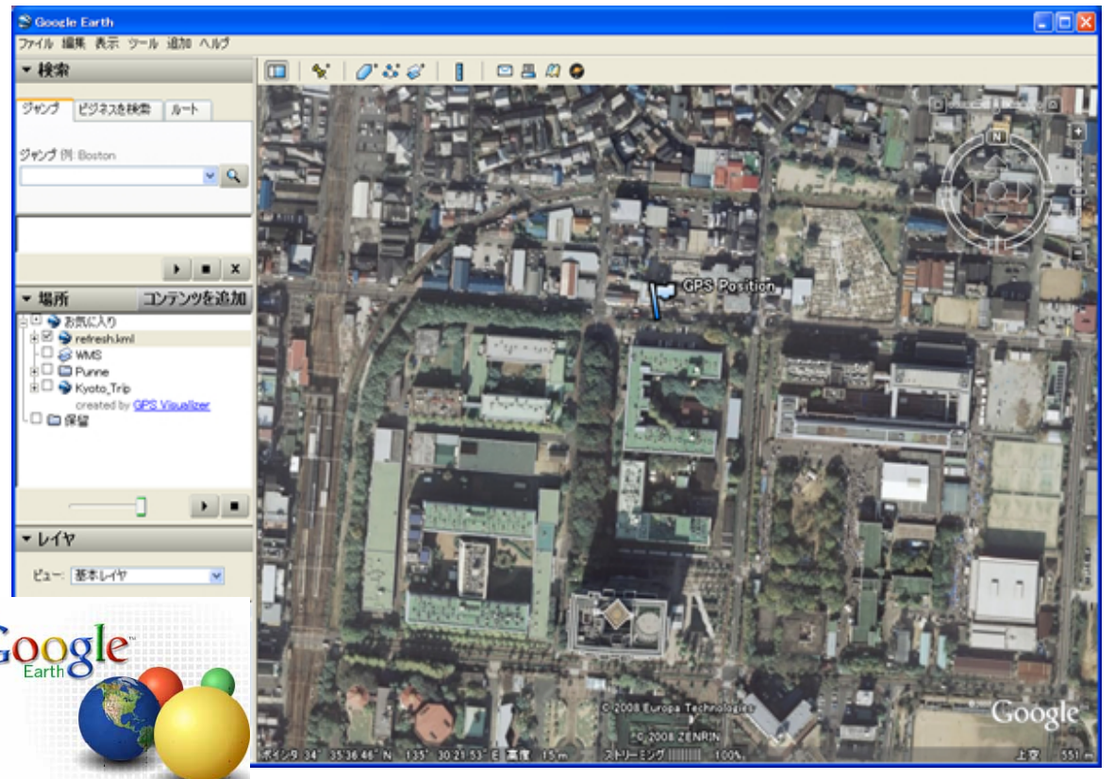
Display Track Log using Google Earth

using OpenLayers + PostGIS

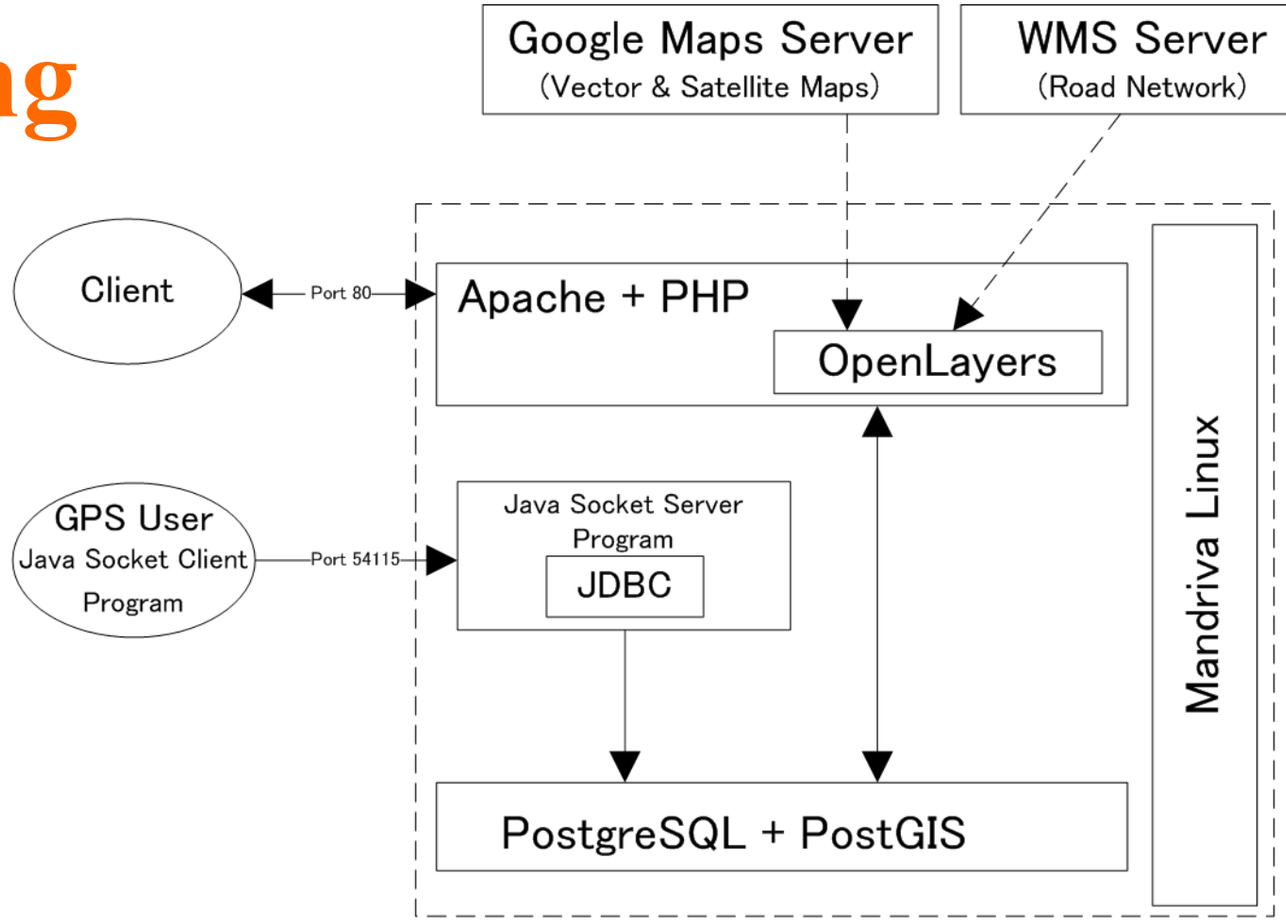
System Overview on
Real-time Tracking

Mozilla Firefox

OpenLayers™



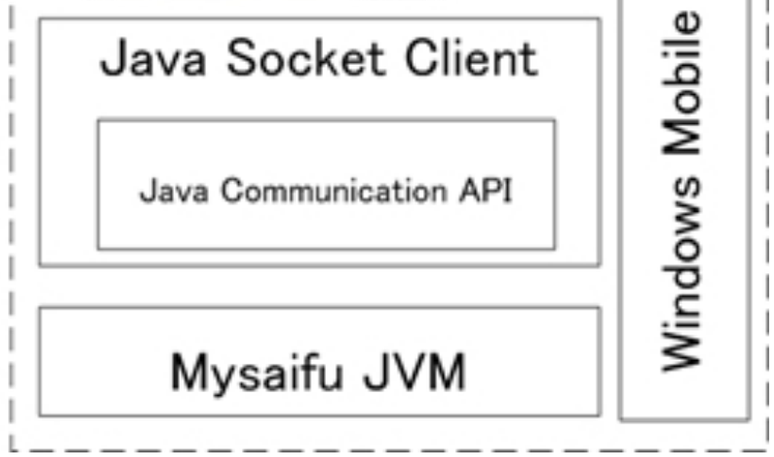
Google Earth



Hicom 406BT-C GPS

Bluetooth

SHARP EM-ONE



Track Log & POI Management System

One of the important geospatial services is **Point of Interest (POI)** management.

POI provides vital information as contextual data **to enable spatial searching** since street maps alone are not enough to provide LBS and **POI can enhance more usabilities of LBS**.

Recently, it is becoming easier for users to make POI databases for their various purposes since,

- GPS-enabled cell-phones and digital cameras are freely used by the general public.

- many web applications for building POIs have been popular and also implementing web mapping functions, such as **Flickr** and **Google Picasa Web Album**.

Functions and Features

- **Data Collection**
  - Real-time data collection
  - Non real-time (using GPS loggers)

- **Data Management**
  - Track log database
  - **POI database (Internal DB -> Flickr)**

- **Data Quality Enhancement**
  - HDOP (Horizontal Dilution of Precision)
  - Numbers of satellite
  - GPS fix mode (e.g. 3D, 2D or no fix)
  - **Line simplification** (the Douglas-Peucker algorithm)
  - **PgRouting shortest path functions**

- comply with **Open Geospatial Standards**

Google Street View

a Test Site in Osaka City

Google Street View

a Test Site in Osaka City

Data Quality Enhancement

Data Quality Enhancement 1

GPS Signal Quality Filtering

GPS Track Log Search

IP Address: 119.72.

Date: 2008-06-09

Time Between: 0AM To 11PM

HDOP < No Filtering

GPS Mode Not Fixed

Number of Satellite >= 1

HDOP
GPS Mode
Number of Satellite

GPS Track Log Search

IP Address: 119.72.

Date: 2008-06-09

Time Between: 0AM To 11PM

HDOP < 5

GPS Mode 3D

Number of Satellite >= 3

Display GPS Track Log

>> GPS Data Upload
>> Log Statistic Page

Download KML Track Log

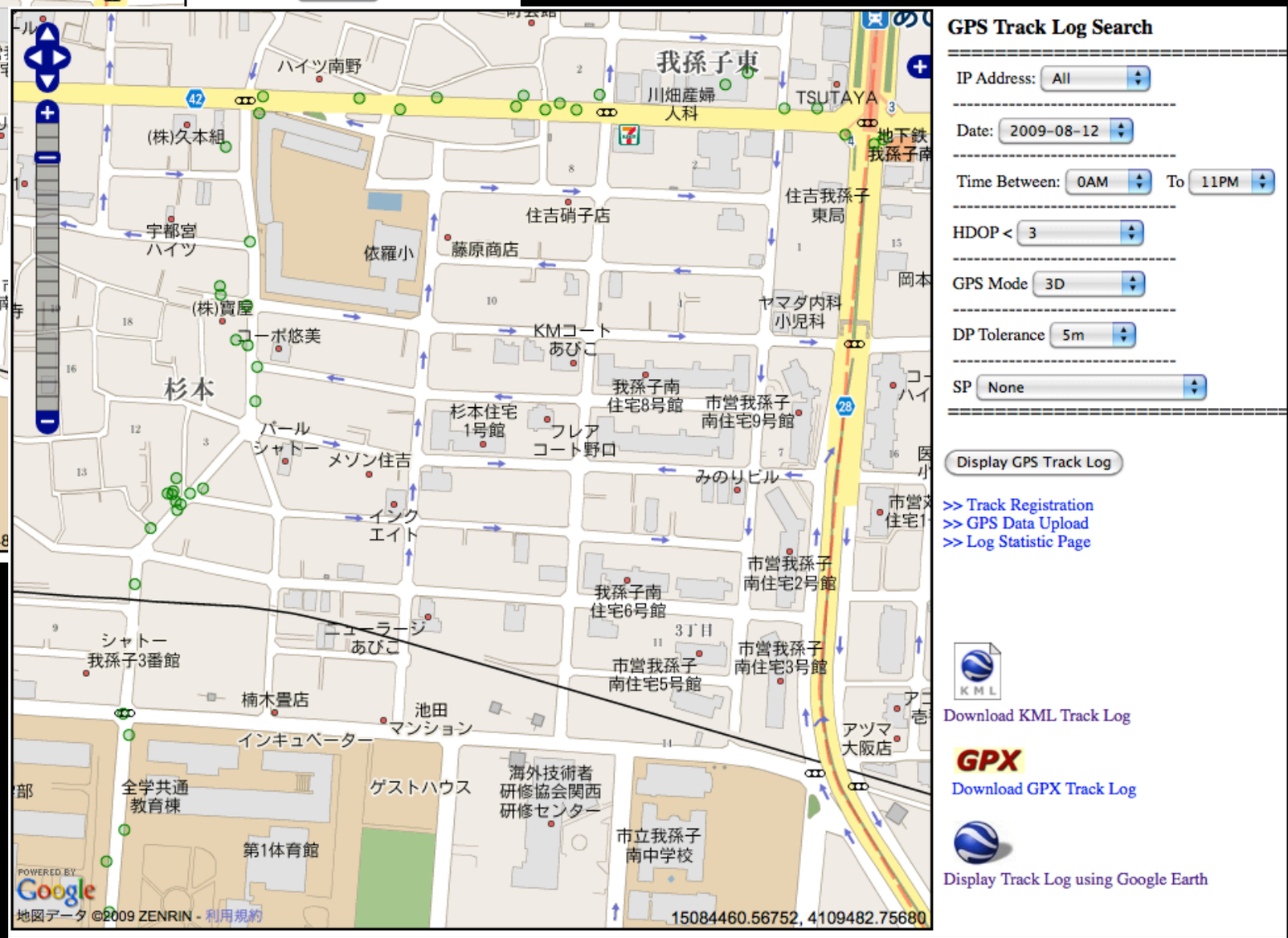
Download GPX Track Log

Display Track Log using Google Earth

Data Quality Enhancement 2

Line Simplification (the Douglas-Peucker algorithm)

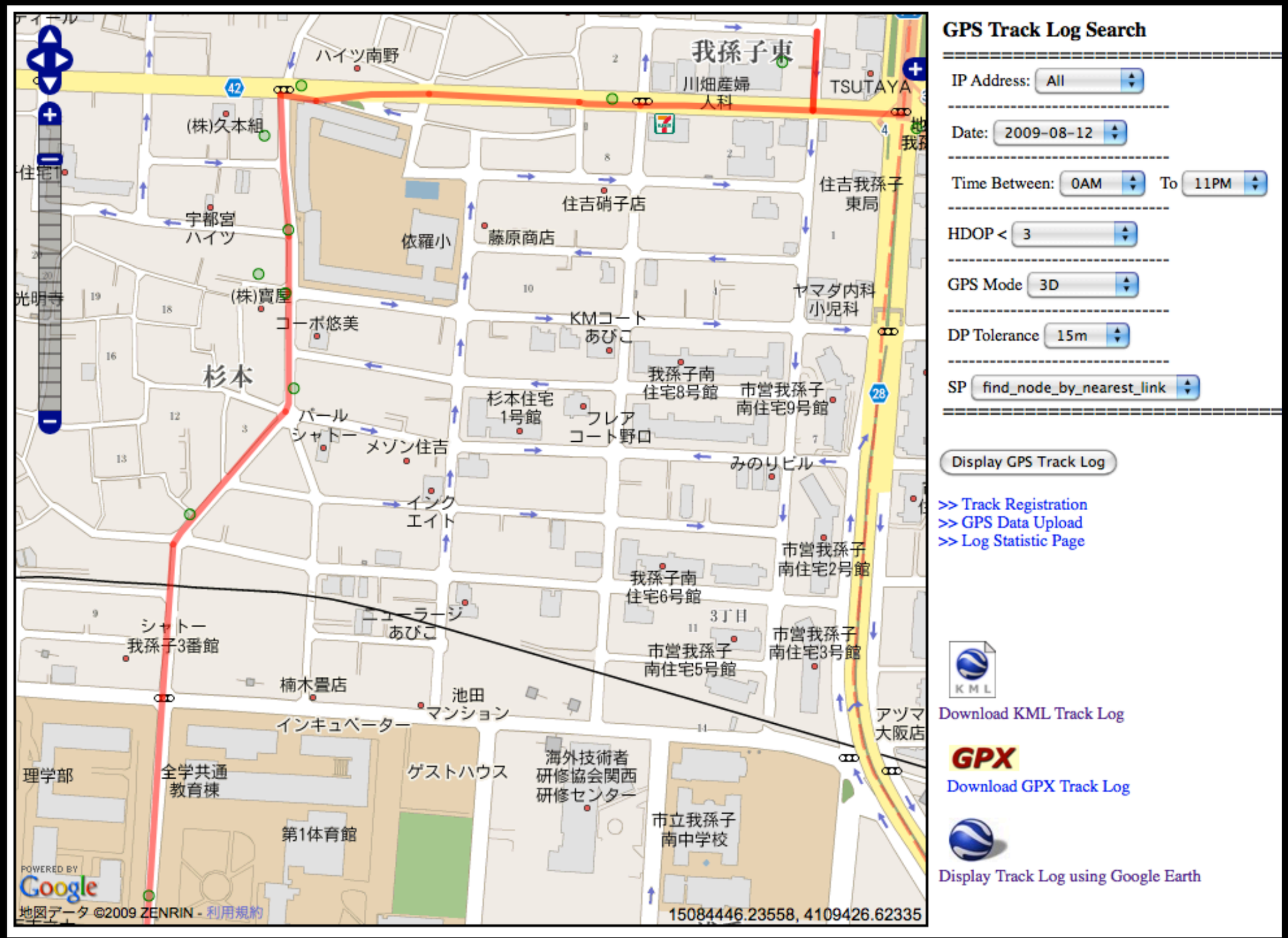
Tolerance = 0m



Tolerance = 5m

Data Quality Enhancement 3

PgRouting Shortest Path Function



Track log Request URL

http://gisws.media.osaka-cu.ac.jp/DP/douglas-p2.php
?address=%25
&stime=00%3A00%3A00
&etime=23%3A59%3A00
&sdate=2009-08-12
&sp=find_node_by_nearest_link
&hdop=3
&gpsmode=3
&dp=10


```
−<route>
 −<edge id="1">
    <id>DK27120001585</id>
   −<wkt>
      MULTILINESTRING((15085204.3580346 4109394.21506489,15085122.4145205 4109398.0091607))
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    <length>0.082</length>
  </edge>
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   −<wkt>
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    </wkt>
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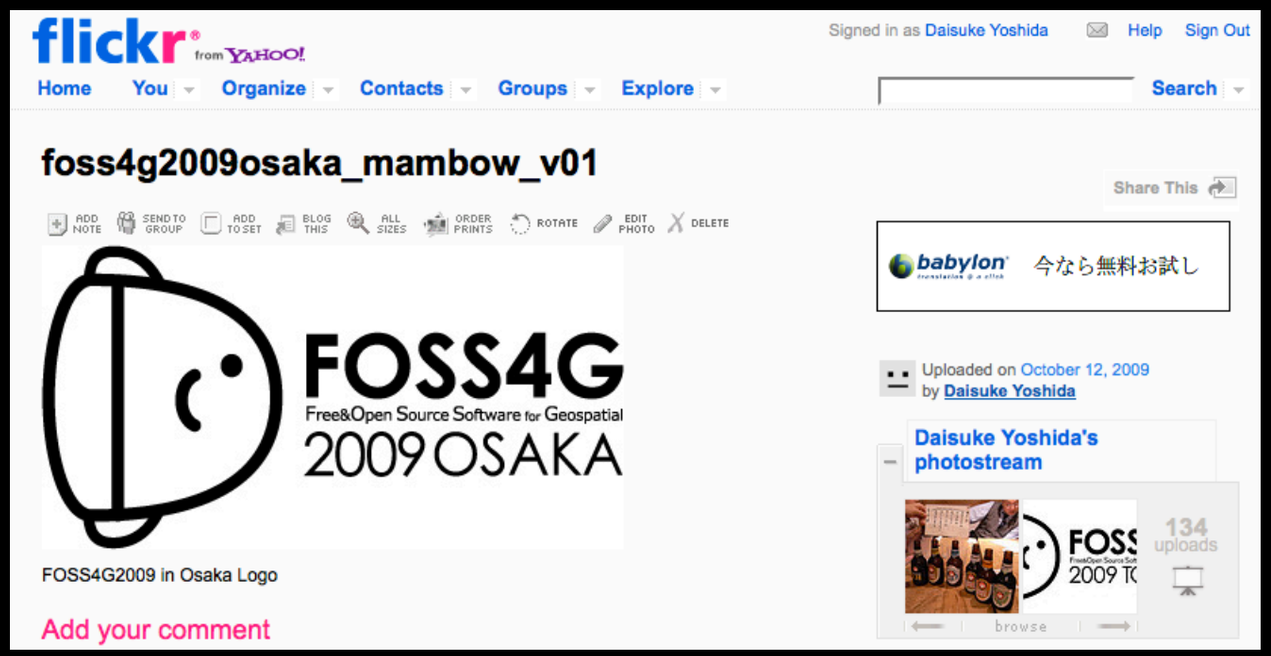
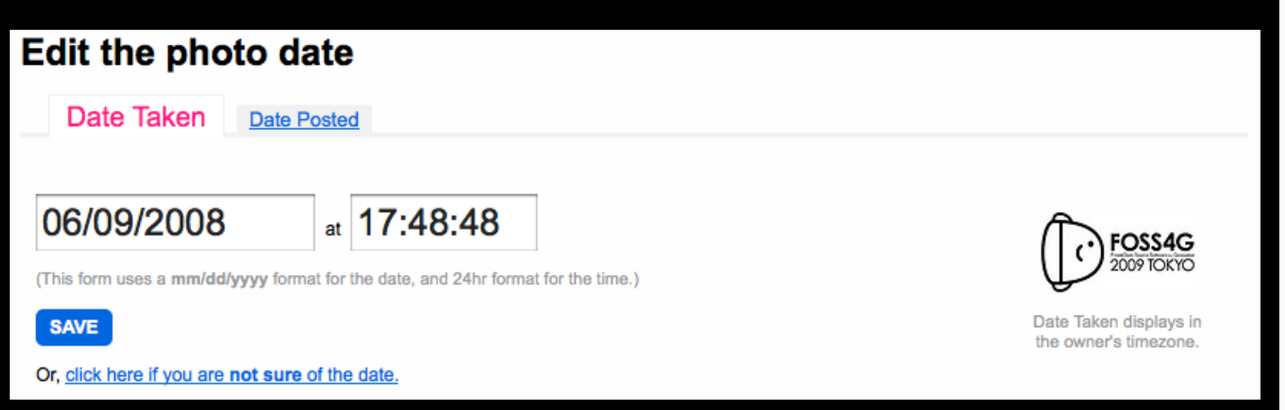
POI Management

POI Management using flickr





Taken on
June 9, 2008 at 5.58pm PDT

Posted to Flickr
October 5, 2009 at 4.28PM PDT

Edit the photo dates

What is EXIF data?

Almost all new digital cameras save JPEG (jpg) files with EXIF (Exchangeable Image File) data. Camera settings and scene information are recorded by the camera into the image file. Examples of stored information are shutter speed, date and time, focal length, exposure compensation, metering pattern and if a flash was used.

Source: Digicamhelp.

Your privacy

If you like, you can prevent the link to your EXIF data from displaying on the photo page. Set this in your privacy options.

Camera:	Canon IXY Digital 700
Exposure:	0.1 sec (1/10)
Aperture:	f/2.8
Focal Length:	7.7 mm
Exposure Bias:	0 EV
Flash:	Off, Did not fire
ISO Speed:	50
File Size:	175 kB
File Type:	JPEG
MIME Type:	image/jpeg
Image Width:	800
Image Height:	600
Encoding Process:	Baseline DCT, Huffman coding
Bits Per Sample:	8
Color Components:	3
X-Resolution:	180 dpi
Y-Resolution:	180 dpi
Orientation:	Horizontal (normal)
Date and Time (Modified):	2009:08:24 12:59:24
YCbCr Positioning:	Centered
Related Image Width:	3072
Related Image Height:	2304
Padding:	(Binary data 2060 bytes, use -b option to extract)
Date and Time (Original):	2009:08:24 03:59:24Z
Date and Time (Digitized):	2009:08:24 12:59:24
Compressed Bits Per Pixel:	3
Max Aperture Value:	2.8
Metering Mode:	Multi-segment
Color Space:	sRGB
Focal Plane X-Resolution:	10816.90141 dpi
Focal Plane Y-Resolution:	10816.90141 dpi
Sensing Method:	One-chip color area

EXIF Data

Taken Date & Time
Location Information
many other information

flickr API

http://www.flickr.com/services/rest/?
method=flickr.photos.search
&format=rest
&api_key=d87af44aa963d0488f3b7f640239e22c
&per_page=10
&user_id=8105900@N03
&max_taken_date=2008-10-09+15:05:11
&min_taken_date=2008-10-09+01:02:33
&extras=geo, date_taken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 -<photos page="1" pages="1" perpage="10" total="5">
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    latitude="0" longitude="0" accuracy="0" datetaken="2008-10-09 02:21:45" datetakengranularity="0"/>
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    <photo id="3018913712" owner="8105900@N03" secret="a7993c77c0" server="3215" farm="4" title="Dubai 2008" ispublic="1" isfriend="0" isfamily="0"
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  </photos>
</rsp>
```

POI Management using flickr

GPS Track Log Search

IP Address: 119.72.

Date: 2008-06-09

Time Between: 0AM To 11PM

HDOP < 5

GPS Mode 3D

Number of Satellite >= 4

Display GPS Track Log

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>> Log Statistic Page

Download KML Track Log

Download GPX Track Log

Display Track Log using Google Earth

Data Export Function

Exported as KML

Google Earth

Exported as KML

Google Maps

Google maps http://gisws.media.osaka-cu.ac.jp/tmp/track.kml 地図を検索 検索オプションを表示

お店やサービス、住所、場所を検索 詳細

ルート・乗換案内 | マイマップ

Google Earth で表示 | 印刷 | 送信 | リンク

マイマップに保存

コンテンツ

- Track Log Export
  Exported on 2009-10-13T14:00:36
  - Suntory
    Owner Name: Daisuke Yoshida
  - Suntory
    Owner Name: Daisuke Yoshida
  - Yamanaka
    Owner Name: Daisuke Yoshida
  - Yoshida Marry
    Owner Name: Daisuke Yoshida
  - foss4g2009osaka_mambow_v01
    Owner Name: Daisuke Yoshida
  - foss4g2009tokyo_mambow_v01
    Owner Name: Daisuke Yoshida
  - Raw Data
    by Daisuke Yoshida, OCU, JAPAN

gisws.media.osaka-cu.ac.jp
のコンテンツの表示

このマップ上のコンテンツはサードパーティによって提供されたもので、その内容について Google は一切の責任を負いかねます。

Exported as KML

Virtual Earth

bing Beta

Business name or category ... | Address, location, or landmark

Businesses | Collections | Locations

view collection http://gisws.media.osaka-cu.ac.jp/tmp/track.kml

welcome | directions | collections | options | share | print

Tour in 3D | Map all | Share

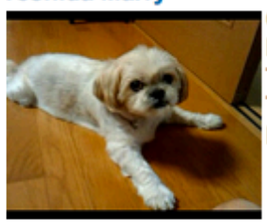
Raw Data

Rating: ☆☆☆☆☆

Content from gisws.media.osaka-cu.ac.jp Subscribe

1 **Raw Data**
by Daisuke Yoshida, OCU, JAPAN
Length: 0.68 miles

Yoshida Marry



Owner Name: **Daisuke Yoshida**
Date: **2008-06-09**
Time: **17:47:48**
Tags: **marry yoshida**
Photo from Flickr

foss4g2009tokyo_mambow_v01

Owner Name: **Daisuke Yoshida**
Date: **2008-06-09**
Time: **17:48:48**
Tags: **logo tokyo foss4g2009**
Photo from Flickr

foss4g2009osaka_mambow_v01

Owner Name: **Daisuke Yoshida**
Date: **2008-06-09**
Time: **17:57:38**
Tags: **osaka foss4g2009**
Photo from Flickr

Yamanaka

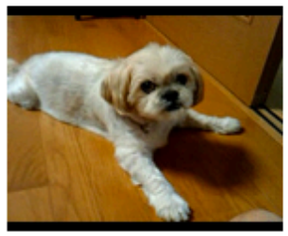
Owner Name: **Daisuke Yoshida**
Date: **2008-06-09**
Time: **18:00:47**
Tags: **beer soba**
Photo from Flickr

2D 3D | Road | Aerial | Bird's eye | Labels

我孫子町駅 | 梅山歯科 | 室生会松井医院 | あびこ病院 | 岡部歯科医院 | 北谷医院 | 阪和記念病院

Yoshida Marry

Owner Name: **Daisuke Yoshida**
Date: **2008-06-09**
Time: **17:47:48**
Tags: **marry yoshida**
Photo from Flickr
More info...

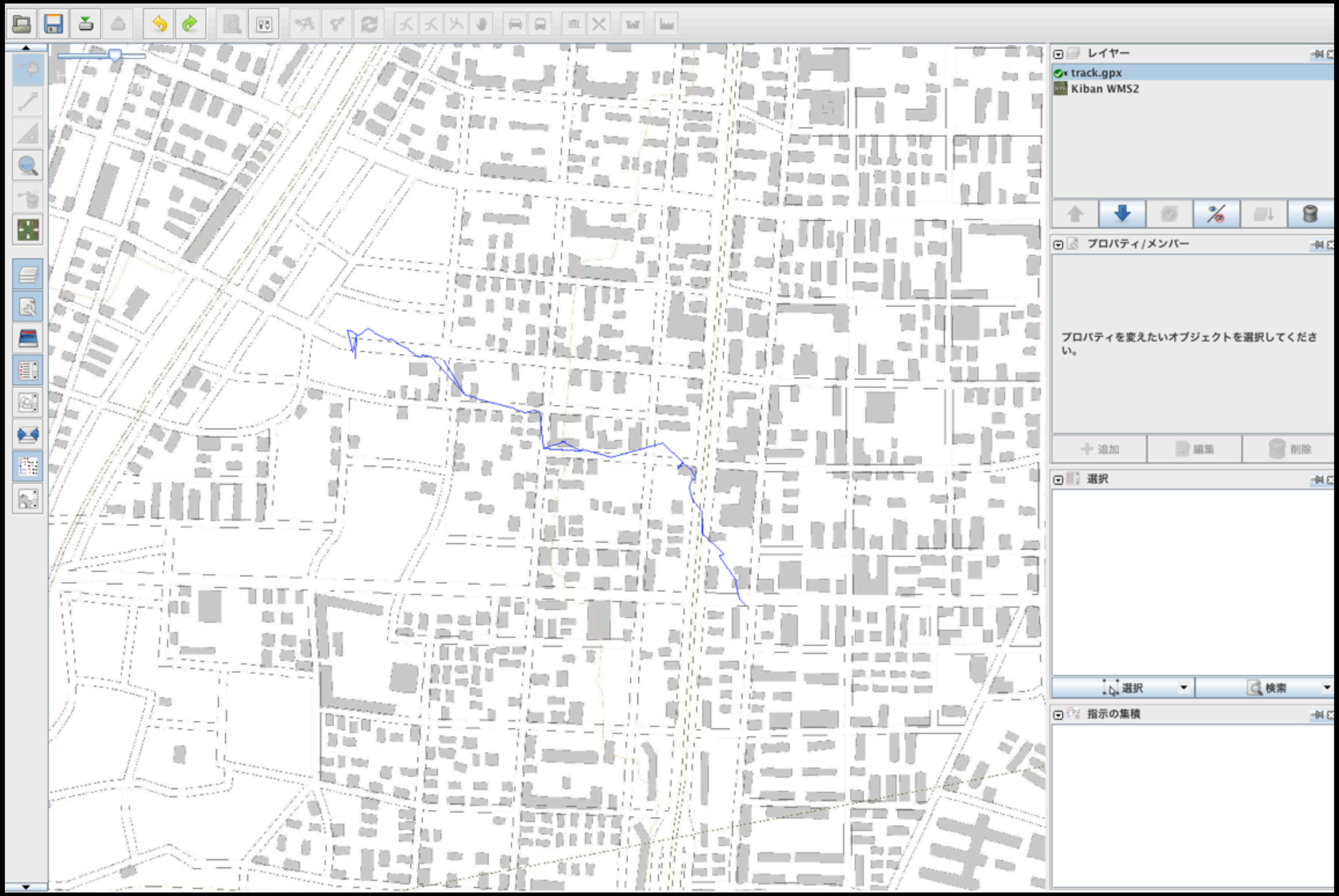


Add to collection
Drive from here or Drive to here
Zoom to: street | city | region

150 yds

Exported as GPX

JOSM



Summary

The track log management function provided an interactive interface for log management and synchronizing POIs by Flickr API mashup.

The GPS data enhancement has implemented using quality filtering, line simplification and shortest path functions and also provide these functions as web services.

The prototype provided interoperable functionalities and data between other geospatial applications through open standards.

The outcome contributes to various location-based data collection projects such as OpenStreetMap or other UGC services.

Further Development

The processes in the prototype will be implemented as OGC WPS

Some parts are already done.

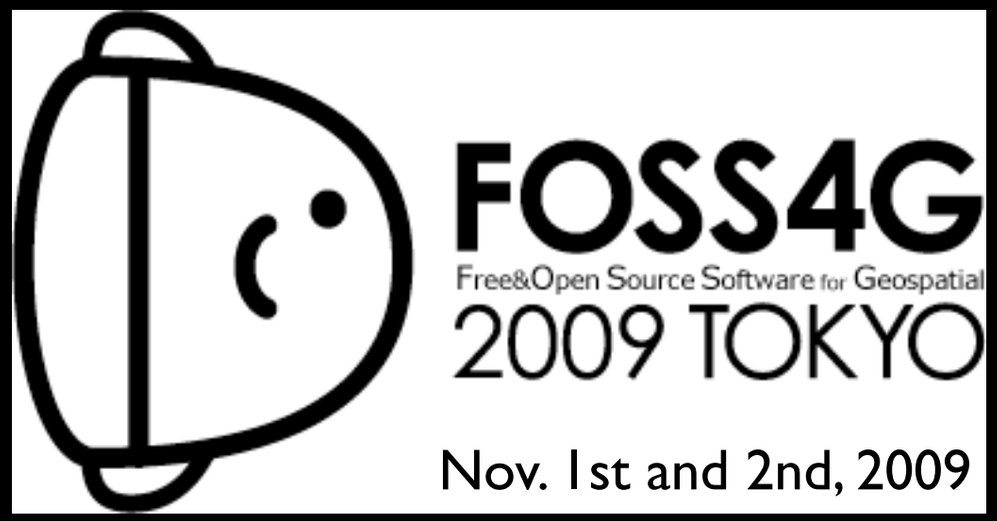
Open web processing services for improving accuracy of GPS tracks using filtering and map-matching

using **PyWPS**

will try with Open WPS platform **ZOO**

for faster performance

for higher interoperability with other GIS applications



Thank you very much

m(_ _)m