

Analysis of GPS logs

Dagstuhl

Wilko Quak

April 3, 2007

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Overview

- Introduction
- GPS characteristics
- System architecture
- DBMS backend
- Automatic rules
- Challenges

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Introduction

- GPS-Monitored itinerary tracking of persons
- 10 weeks * 100 respondents, each 7 days
- Communication via Website



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This is what we want:

starttime	endtime	startPoint	endpoint	modality	goal
09:00	09:15	Home	Work	Bike	work
18:00	18:15	Work	Home	Bike	work
19:00	20:00	Home	Home	Walk	leisure
23:00	23:15	Home	Station D	Bike	transfer
23:20	0:00	Station	Station X	Train	transfer

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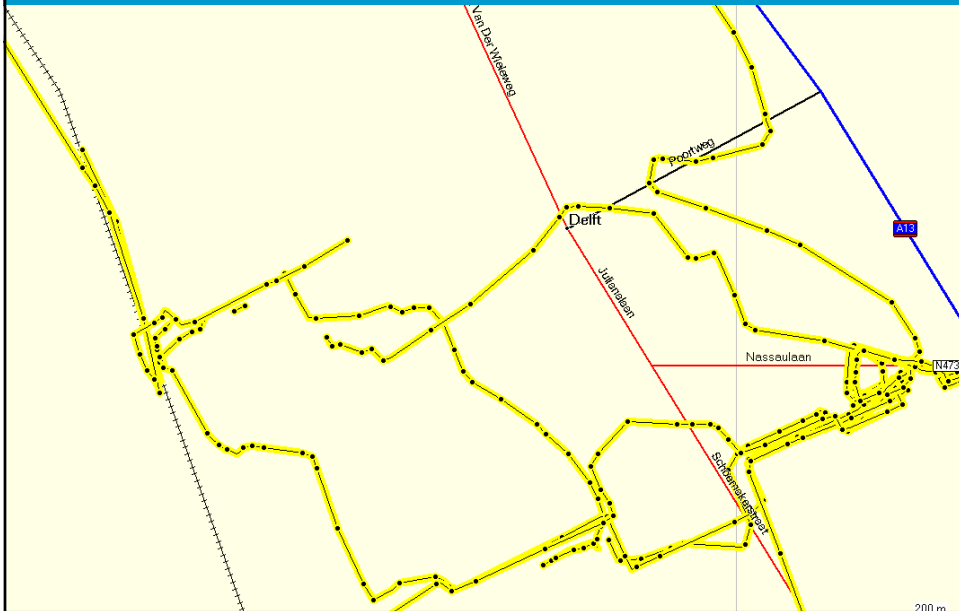
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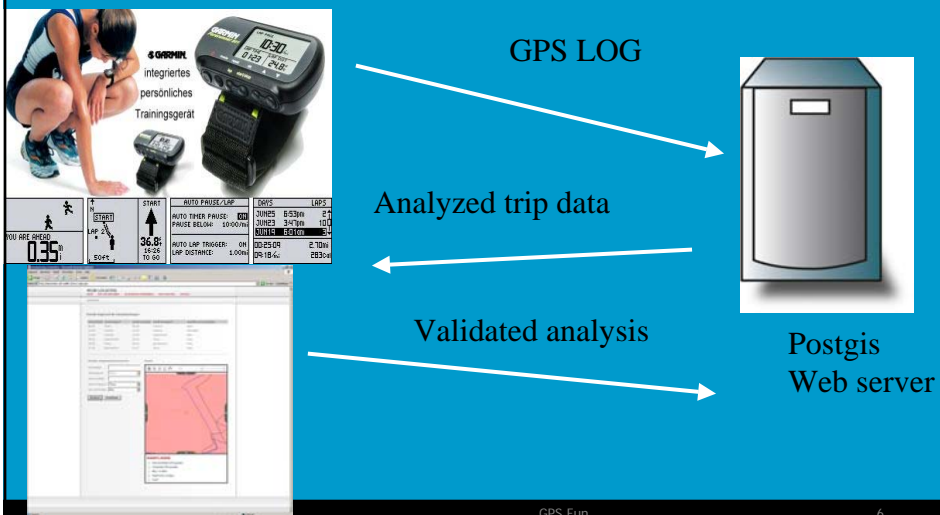
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This is what we have



This is how plan to get it



GPS Characteristics

- Accuracy 10 meters (approx.)
- Battery life 18 hours
- 10 000 trackpoints
- Works only outdoors
- Needs clear view of the sky
- Returns inaccurate logs
- Has a start-up time



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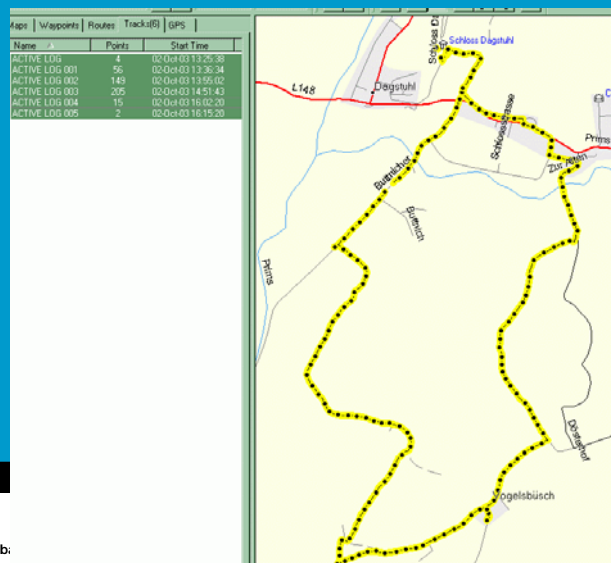
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GPS tracklog characteristics

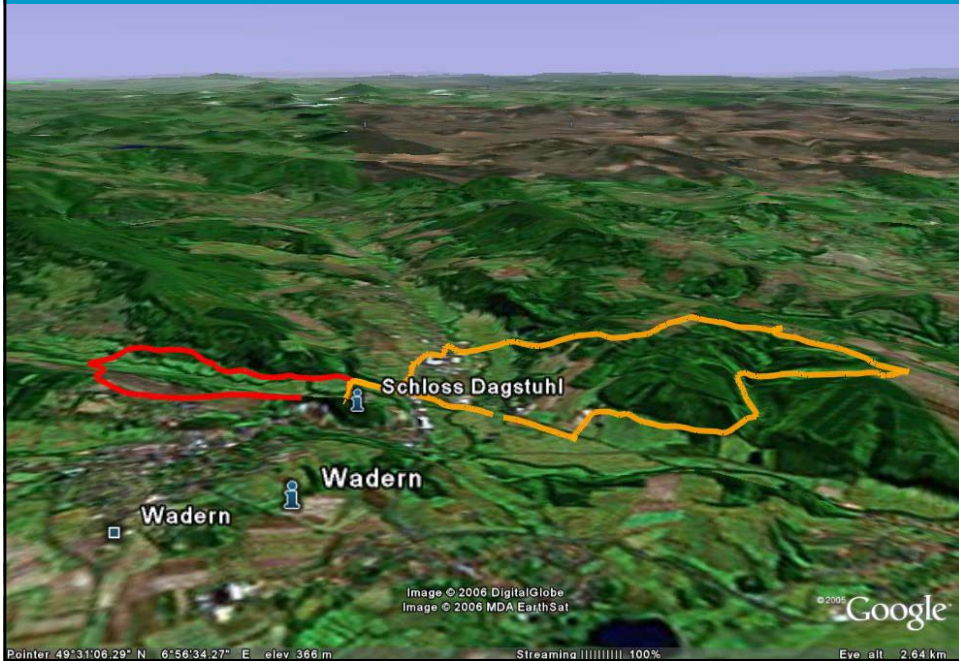
- A tracklog is a list of points:
 - timestamp
 - location
 - elevation
 - connected



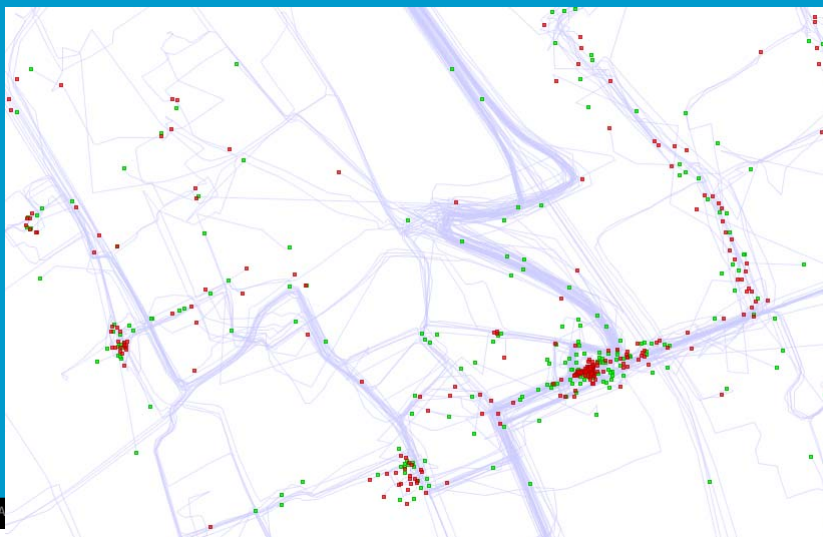
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In Google Earth



GPS Characteristics (this is my life)



Flow Control + Architecture



User: Upload tracklog

Server: Automatic Analysis

User: hand-edit data

Server: store data permanently



Internet

Web Server

PostGIS DBMS
Backend +
Mapserver

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Automatic Analysis



starttime	endtime	startPoint	endpoint	modality	goal
09:00	09:15	Home	Work	Bike	work
18:00	18:15	Work	Home	Bike	work
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23:00	23:15	Home	Station D	Bike	transfer
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Automatic reasoning is needed!

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Hand Edits

Automatic reasoning is not enough.
Keep the user in the loop!

	Vertrektijd	Vertrekpunt		Aankomst tijd	Aankomstpunt	Vervoersmiddel
<input type="checkbox"/>	09 : 00	Thuis	spitsen	09 : 15	Kantoor	Bus
<input type="checkbox"/>	17 : 00	Kantoor	spitsen	17 : 15	Thuis	Bus
<input checked="" type="checkbox"/>	19 : 00	Thuis	spitsen	19 : 05	Station	Auto
<input checked="" type="checkbox"/>	19 : 15	Station	spitsen	00 : 00	Thuis	Bus
<input checked="" type="checkbox"/>	00 : 00	Thuis	spitsen	00 : 00	Thuis	Bus
<input checked="" type="checkbox"/>	00 : 00	Thuis	spitsen	00 : 00	Thuis	Bus

Kaart:

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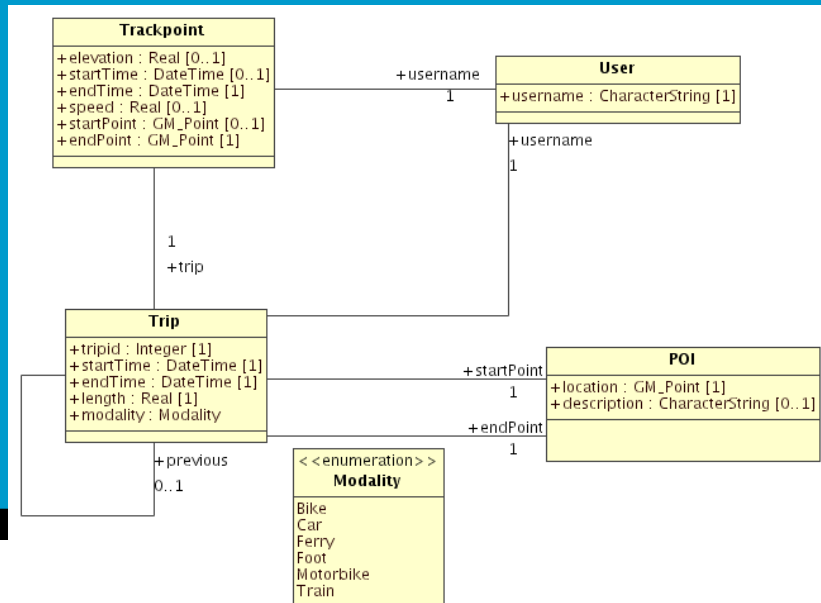
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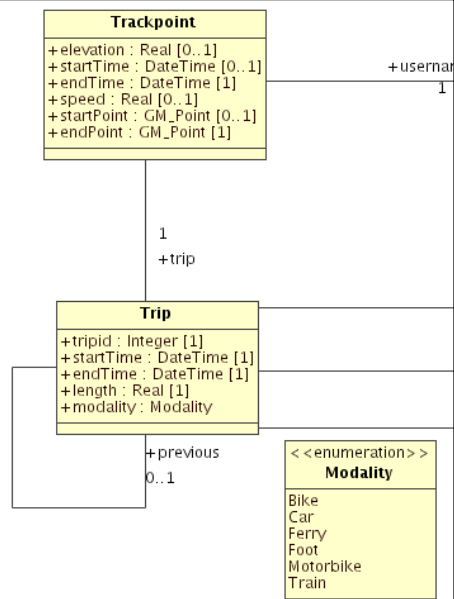


DBMS Model



Automatic analysis

- Process trackpoints to fill trip table:
 - Cleanup data
 - Split into trips
 - Derive modality
- Good guess better than noting (user is in the loop)



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Analysis Rules

- Simple logic rules:
 - No Teleport: The endpoint of one trip is the startpoint of the next trip
- Rules with external data:
 - If a track follows a railway line the user is travelling by train
- Probabilistic rules:
 - The speed distribution on a track gives probabilities for: foot, bike, car.

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Rule implementation

I have different preferred languages for every rule:

- PL/SQL
- Java
- XSLT
- Probabilistic Language (???)
- GIS system

Challenge: How do I make an integrated system?

Discussion

