Automatic deformation analysis system
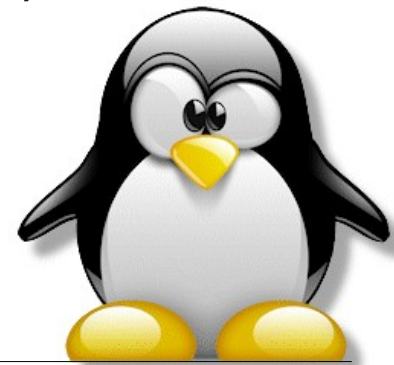
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Overview

- Getting the idea

- Components of the system

- Future plans

Aim: to create a framework not a single application,
       based on several other OS project

Getting the idea

2007 – buying two Leica TCA 1800 Robotic Total Station (RTS)

2008 – Demand for fast observations (day & night) and deformation results in the Hungarian Nuclear Power Plant

2009 – Settlement of the Ch. building of BUTE, Soldata: Cyclops and Geoscope Web

2011 – Szonja Zemkó BSc. student's diploma work

2011 – New subject for MSc. Students "Tunnel observations and automatic measurements"

2011 – Starting the open source project, we can't find any similar OS project

Robotic Total Station (RTS)

Total station is an electronic/optical instrument that can measure horizontal and vertical angles and slope distance
An RTS has servo motors and remote control through RS-232

Three possible tasks to solve

- RTS + Automatic Target Recognition (ATR) – fixed prisms repeated observation (deformation analysis)
- RTS + Lock on prism – moving prism control of moving objects
- RTS + Direct reflect EDM – scanning e. g. volume calculation

FOSS4G CEE 2012

Prague, 2012. may 21-23

Components of the System

Sensors (RTS): Leica TCA 1800, 1201; Trimble 5503

Sensor driver API (Tcl)

DBMS (PostgeSQL/PostGIS)

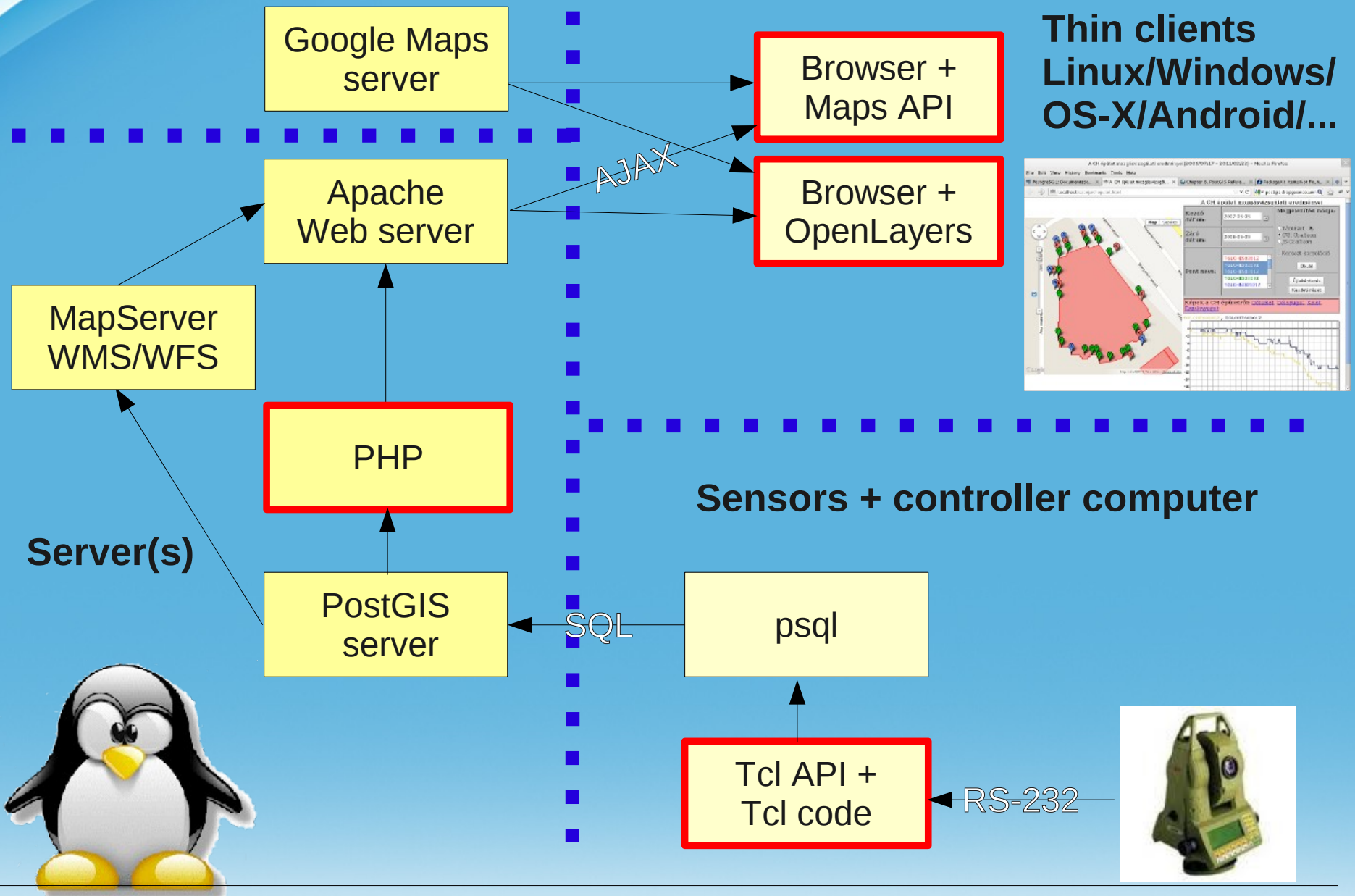Web server (Apache) + PHP

OpenLayers or Google Maps API 3

MapServer

Browser + JavaScript

Logic diagram

Tcl API

Simple high level interface, to hide the differences
among different robotic total stations
Base functions – serial line (RS-232) handling,
message handling (send and receive messages),
error handling
Instrument specific functions – e.g. rotate, measure distance, ...
Instrument independent functions – conversions, COGO, ...

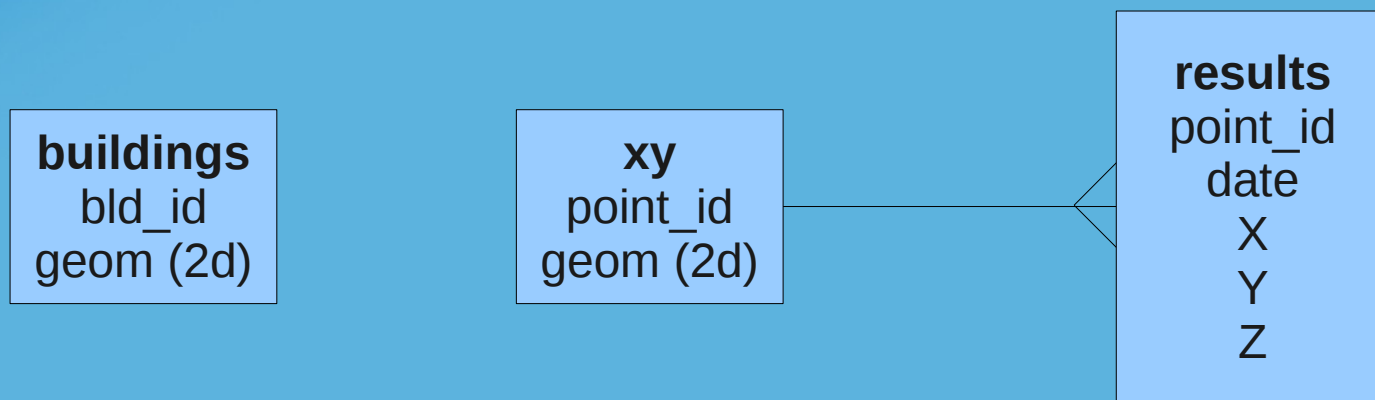## Sample applications (high level functions)

robot.tcl – automatic measurement of installed prisms
scan.tcl – measure at regular angles
search.tcl – search prism

Database

Simplified database schema in PostGIS (3 tables only)

buildings
bld_id
geom (2d)

xy
point_id
geom (2d)

results
point_id
date
X
Y
Z

SQL commands generated from Tcl scripts
psql – PostgreSQL console + Unix pipe
Internet connection necessary on field or delayed upload
Shell script to combine commands
cron job to start script regularly

Presentation of data

PHP scripts to query data (AJAX)
Three different query
- Points – to display points on background map
- Buildings – to display extra polygons on background map
- Survey – to query points movement in a given period of time

JSON data is generated from database and sent to Javascript

Javascript libraries used
Openlayers or Google Maps API 3
Datepicker control

Line graphs/charts
Dygraphs/OWTchart/GNUPlot

Background map
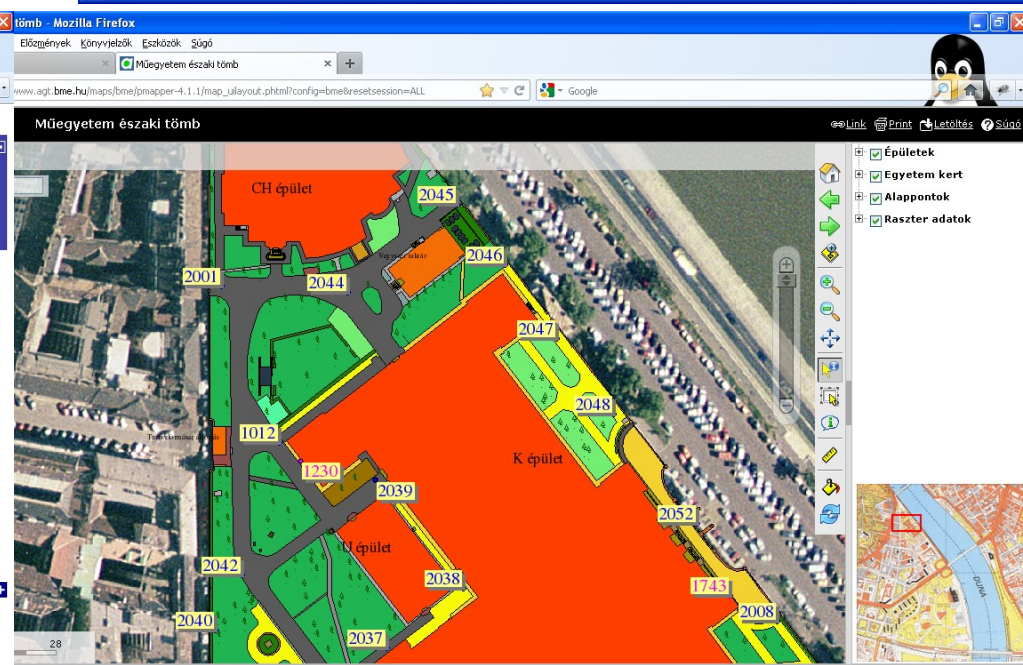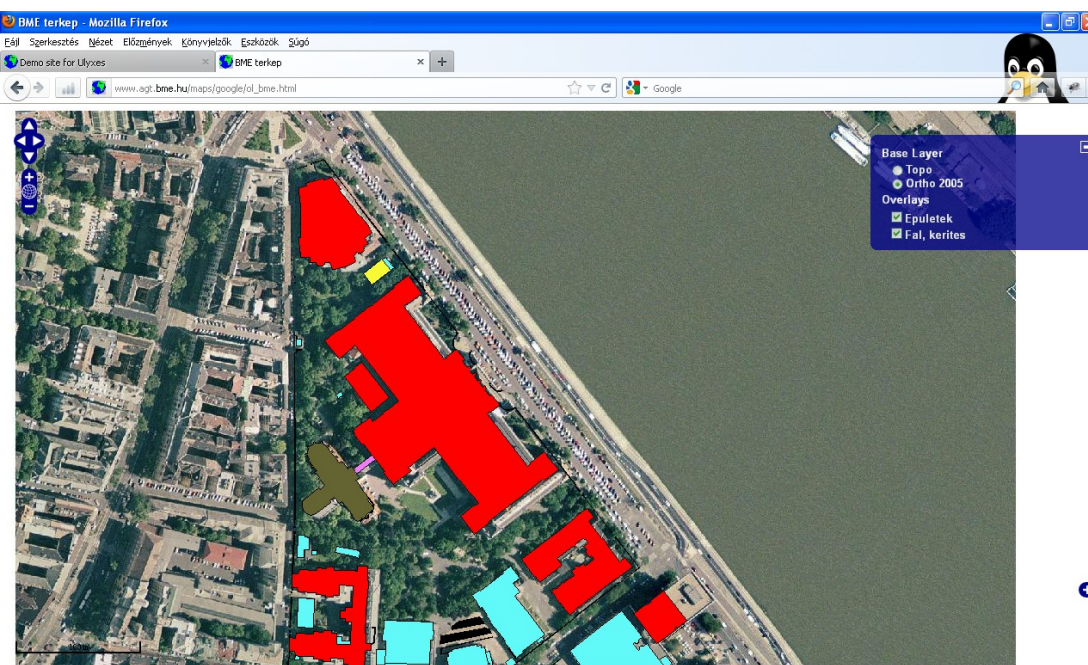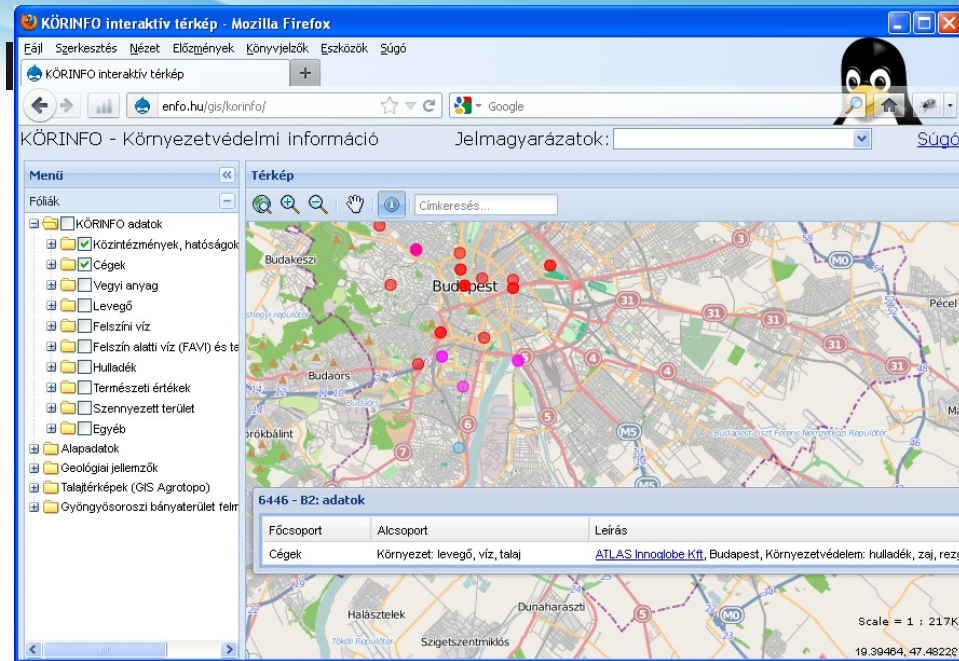
Several possible solutions

Google maps + Google Maps API

Google maps + OpenLayers

OpenStreetMap + OpenLayers

WMS/WFS server

- Mapserver + OpenLayers
- Mapserver + MapFish
- Mapserver + p.mapper
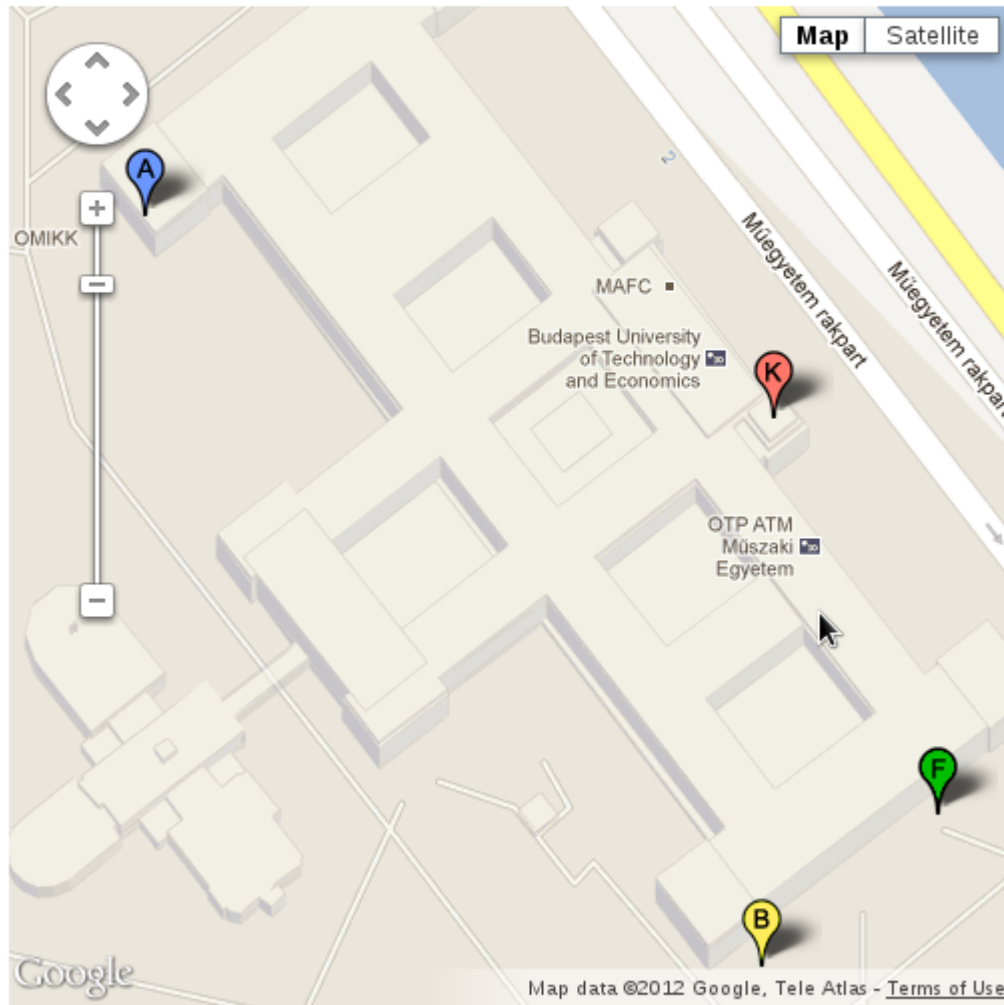- GeoServer + OpenLayers

Web client with Google Maps API

Web client with Google Maps API

File Edit View History Bookmarks Tools Help

Demo site for Ulyxes

www.agt.bme.hu/maps/ulyxes/

owtchart setcolors

Map Satellite

Demo dataset

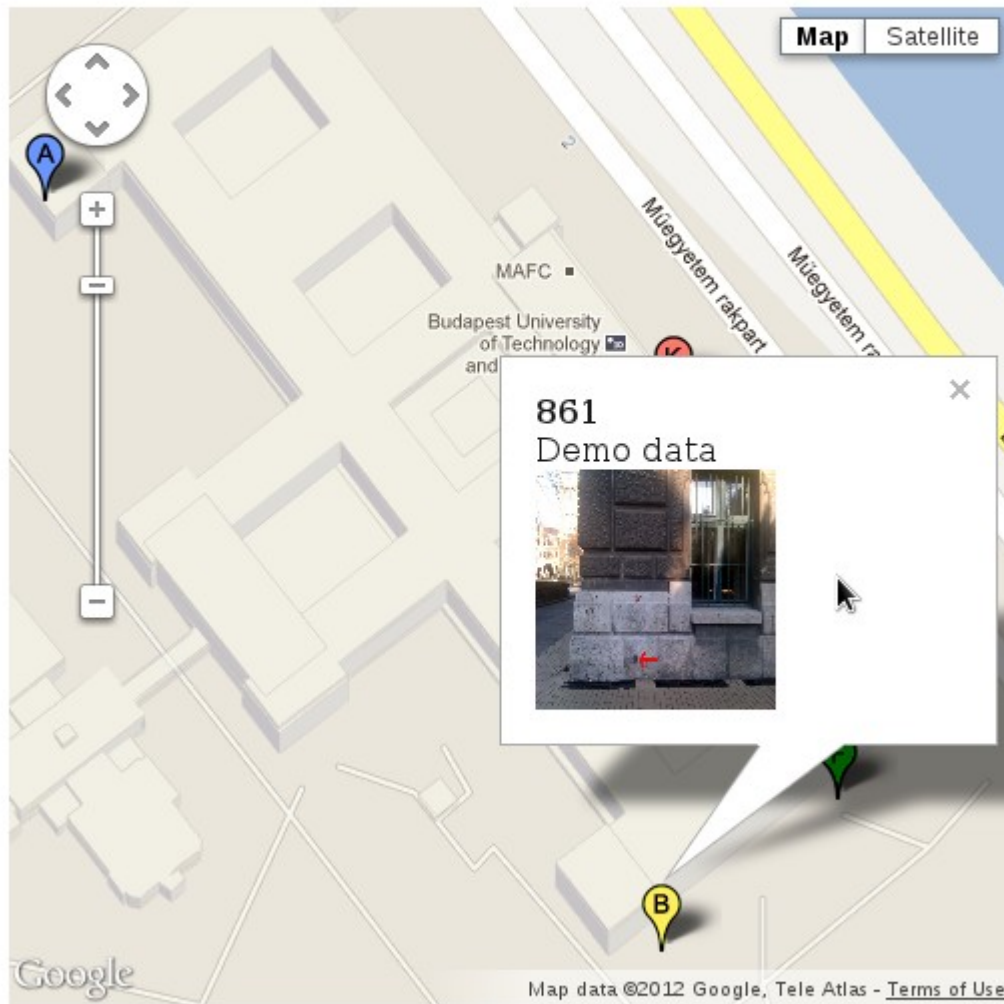|		Query type:
Start date:	2012-05-01	● Tabular
End date:	2012-05-14	○ Chart
Point names:	1230 1743 620 861	Submit

Reset query

Initial zoom

MAFC

Budapest University of Technology and

861
Demo data

Google

Map data ©2012 Google, Tele Atlas – Terms of Use

	1230	1743	620	861
2012-05-01	10	8	11	8
2012-05-02	11	11	10	9
2012-05-03	10	9	7	11
2012-05-04	5	6	4	4
2012-05-05	9	6	7	9
2012-05-06	4	5	6	5
2012-05-07	6	6	6	8
2012-05-08	3	5	4	7
2012-05-09	5	2	5	8
2012-05-10	4	6	4	6
2012-05-11	1	3	3	1
2012-05-12	2	1	1	6

Bridge deformation (MSc. students)

Future plans

Separate homepage for the project

Adopting new sensors
• Total stations from other vendors
• Meteorological observation (temperature, pressure)

Rewriting Javascript code using jQuery

Implementing SOS standard

More sample applications and background map solutions

Involving volunteers in the development

Data analysis (regression, cross-correlation, etc.)

Tcl API

http://www.agt.bme.hu/php/browse.php?/foss

Demo site

http:/www.agt.bme.hu/maps/ulyxes