



# Provenance and Citizen Sensor Networks & more

PhD Topic presentation & potential topics of interest  
for group members @ Ontology Engineering Group,  
UPM Madrid, September 2013

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52° North GmbH

# Contents

52n

PhD Topic

Work @ OEG

52°North

ifgi

enviroCar

GeoViQua

Open Source

Air Quality Egg

More...

<http://blog.nördholmen.net/>

# CITIZEN SCIENCE AND SENSOR WEBS

# Motivational Question

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*Can sensor networks operated by citizens using off-the-shelf technology improve the understanding of environmental processes?*

# Research Questions

What level of provenance information is a reasonable compromise between requirements for scientific research and usability for citizen sensor network maintainers?

How can distributed pieces of metadata be integrated with linked data in a citizen science use case?

Can information about data quality in information products based on heterogenous sensor data be communicated (visualised) effectively?

How can contributions to derived information products be tracked in a citizen science use case?

# User Stories

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Charles the citizen

Susan the scientist  
wary Walter

Julia the journalist

Adam the admin

# Domain Use Cases

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*Using citizen science sensor networks...*

Earthquakes

Transportation

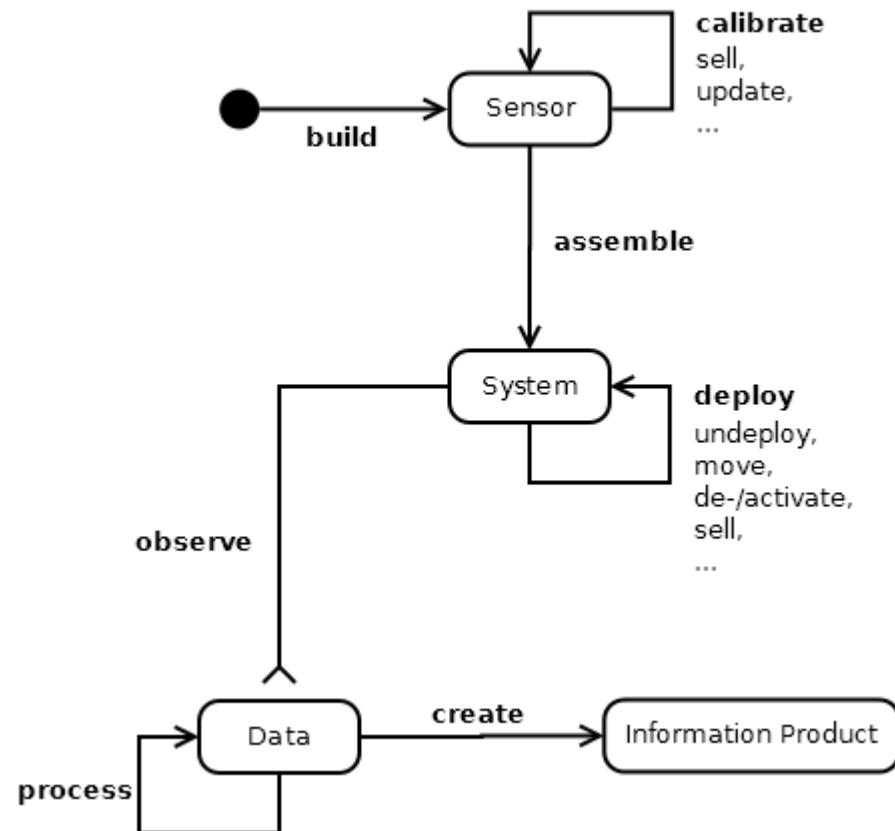
Air Quality

Climate and Weather

# **PROVENANCE FOR SSN**

## Integrate SSN and PROV-O

*Agents,  
Entities,  
Activities...*



<http://52north.org/about/52north/>

<http://blog.52north.org/>



# “Innovation through cooperation”

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Company  
is a service center  
and legal body,  
not-for-profit

is a collaboration network  
**Communities**

**Code Repositories**  
is a dissemination platform



**Workshops**

**Long Term License Management**



**ifgi**  
Institute for Geoinformatics  
University of Münster

**con•terra**



Shareholders and Principal Cooperation Partners

**Hochschule Bochum**  
Bochum University  
of Applied Sciences

**BO**



Associate Cooperation Partners



**KISTERS**

# Collaboration

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## Communities

Ilwis  
Geoprocessing ★  
Earth Observation

Security  
Semantics  
Sensor Web ★

Geostatistics ★  
3D  
Metadata Management

## Open (Virtual) Labs

Linked Citizen Science (enviroCar)

# Open Source Software

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## 52°North

52n Settings | Report Duplicate

### Project Summary

52°North Initiative for Geospatial Open Source Software GmbH is an international research and development company whose mission is to promote the conception, development and application of free open source geo-software for research, education, training and practical use.

52°North backs an open initiative, which is driven by leading research organizations and individuals in the international GIS field. Cooperation partners participate in research and development with focus on Sensor Web Enablement (SWE), Web Security and Geo-Rights Management, as well as Web Processing. New areas of research are the Web of Things and the Semantic Web.

#### Tags

spatial wps sps gis sos sensor swe sas ogc map  
sensorweb wns

#### Share

In a Nutshell, 52°North...

...has had 19,230 commits made by 96 contributors representing 3,366,491 lines of code

...is mostly written in Java with an average number of source code comments

...has a well established, mature codebase maintained by a very large development team with increasing year-over-year commits

...took an estimated 976 years of effort (COCOMO model) starting with its first commit in November, 2004

Very High Activity 4 I Use This!

Analyzed 1 day ago based on code collected 1 day ago.

#### Quick Reference

**Organization:** 52°North Initiative for Geospatial Open Source Software

**Project Links:** [Homepage](#) [Download](#)

**Code Locations:** (130 Locations)

**Licenses:** Apache-2.0 and GPL-2.0+

**Similar Projects:** [GeoBliki](#) [ows-service-...](#)  
[OXFramework](#) [sensorml-pro...](#)

**Managers:** Jan Drewnak, Daniel Nüst, Eike Hinderk Jürens, and Henning Bredel

[Browse Code](#)

#### Languages

Language	Percentage
XML	34%
Java	26%
JavaScript	12%
Other	28%

#### Lines of Code

<https://www.ohloh.net/orgs/n52>

# Student Innovation Price

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"Smart innovations for a smarter world"

- new, creative ideas, on applicable and implementable concepts
- generating new technologies and applications.
- address a certain market niche, have relevance
- ... the 52° North Student Innovation Prize for Geoinformatics was initiated to stimulate students and student entrepreneurs to generate and implement innovative ideas and concepts in the geospatial domain.



student innovation prize

# OEG & 52°North?

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... what do you think?

## Projects!

- enviroCar

## Software development!

- Revive the semantics community?!

## Students!

- <http://52north.org/about/other-activities/student-research-topics>
- Internships, external thesis supervision, ...
- Mutual advertisement (innovation price)

# 52°North (Flagship?) Software



OGC Reference Implementations...

Sensor Observation Service

Great new modular structure, JSON, ...

Sensor Planning Service

Sensor Event Service

Sensor Web Client

Mobile, server component, ...

Web Processing Service

Backends, Clients

Future: less standards, more... LOD?!

# Real Flagships?

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ILWIS

Earth Observation

Semantics

Geostatistics (sp, spacetime)

3D

Security (WSS, WAS)

Metadata (smartEditor)

**52°North Initiative for Geospatial Open Source Software GmbH**  
52North

Münster  
info@52north.org  
<http://www.52north.org>  
Joined on Feb 27, 2013

25 public repos   0 private repos   26 members

**sos-importer**  
Application to import observation data into a running SOS instance using the T-interface.  
Last updated 3 days ago

**SensorWebClient**  
The 52°North SensorWebClient provides easy access to timeseries data provided by web services of the Sensor Web domain.  
Last updated 10 days ago

**timeseries-api**  
Thin Web binding API to access timeseries data.  
Last updated 10 days ago

**geoportal-server**  
forked from Esri/geoportal-server  
Geoportal Server is a standards-based, open source product that enables discovery and use of geospatial resources including data and services.  
Last updated 17 days ago

**OX-Framework**  
Collection of middleware components accessing the Sensor Web  
Last updated 17 days ago

**WPS**  
The 52°North Web Processing Service enables the deployment of geo-processes on the web in a standardized way.  
Last updated 17 days ago

**wps-js**  
A standalone JavaScript client for WPS  
Last updated a month ago

<https://github.com/52North>

## 52n 52°North Initiative for Geospatial Open Source Software

Settings

### This Organization's Projects

#### Top Contributors \*

Contributor Name	Affiliated With	Kudos	Contributed to	12-month Commits
Christian Autermann	52°North Initiative for Geospatial Open Source Software, University of Münster, Unaffiliated	8	52°North - SOS, UncertWeb, enviroCar	1636
Henning Bredel	52°North Initiative for Geospatial Open Source Software, 52°North	8	OX-Framework, WNS, 52°North SPS, timeseries-api, UncertWeb	964
Carsten Hollmann	52°North Initiative for Geospatial Open Source Software	1	UncertWeb	829
Eike Hinderk Jürgens	52°North Initiative for Geospatial Open Source Software, Unaffiliated	8	OX-Framework, 52°North - SOS, UncertWeb	755
Matthes Rieke	52°North Initiative for Geospatial Open Source Software	8	Moving Code, OX-Framework, Sensor Bus ... [More]	324
BenjaminPross	Unaffiliated, 52°North Initiative for Geospatial Open Source Software	8	UncertWeb, 52°North WPS, enviroCar	280
Dennis Wilhelm	Unaffiliated	7	enviroCar	267
ubergesundheit	Unaffiliated	7	enviroCar	187
Daniel Nüst	52°North Initiative for Geospatial Open Source Software, Unaffiliated	9	GeoAR, Open Sensor Search, Moving Code ... [More]	145
edzer	Unaffiliated, University of Muenster	8	gstat, spacetime, UncertWeb	144

\* Data for individual projects may be more current than organization data

<http://ifgi.uni-muenster.de/>



**ifgi**  
Institute for Geoinformatics  
University of Münster

# Facts and Figures

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Münster - most liveable city in the world

<http://www.muenster.de/stadt/livcom/>

Four study programs (BSc, MSc, MSc  
Geospatial Technologies, PhD @ gsgi)

Just moved to a  
brand new building



# Spatial Intelligence Lab

## SITUATEC COMPUTING LAB

## Spatial Temporal Modelling Lab



<http://envirocar.org/>

<https://github.com/envirocar>



# enviroCar - the idea



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Cars are an important part of our daily life and crucial for modern mobility - but we only know little about our **personal impact** on the environment when we use cars!

Use ODB-II adapters to build a community-powered database of sensor measurements about cars and traffic.

Quantified self > quantified car!

# Kickstart a seminar



**Indiegogo campaign**  
<http://www.indiegogo.com/projects/envirocar>

A screenshot of an Indiegogo campaign page for "enviroCar". The page features a banner image of a car with the "enviroCar Project" logo. The logo consists of three green bars of increasing height followed by a small blue bar. Below the logo, the text reads "enviroCar Project" and "@enviroCar\_org Münster, Germany · envirocar.org". The campaign has raised 10,864€ from 10,000€ goal, with 0 time left. It has 55 funders and 18 gallery items. A section for "Select a Perk" shows a perk for 1€ labeled "Friend of enviroCar".

enviroCar  
Keep an eye on the impact you and your driving have on the environment.  
Technology – Münster, Germany

Campaign Home | Updates / 16 | Comments / 6 | Funders / 55 | Gallery / 18

10.864€  
Raised of 10.000€ Goal  
0 time left

Fixed Funding  
This campaign has ended and will receive all funds raised. Funding duration: May 14, 2013 - July 13, 2013 (11:59pm PT).

Select a Perk for your contribution

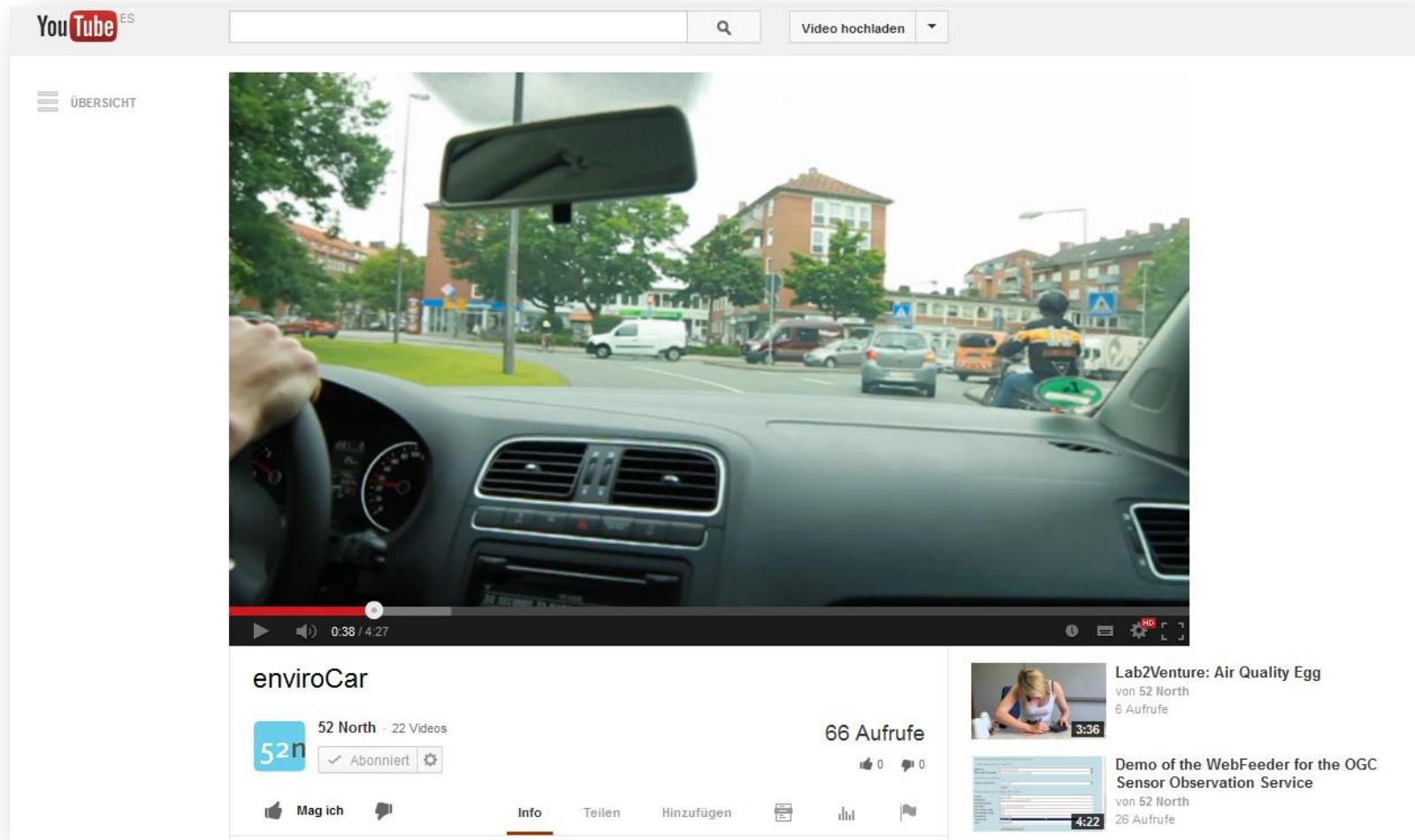
1€  
Friend of enviroCar

Do you like the idea? Become a supporter of the enviroCar citizen scientist community and be listed on our dedicated Indiegogo Thank You page.

3 claimed

10€

> Money will be used for student assistant positions

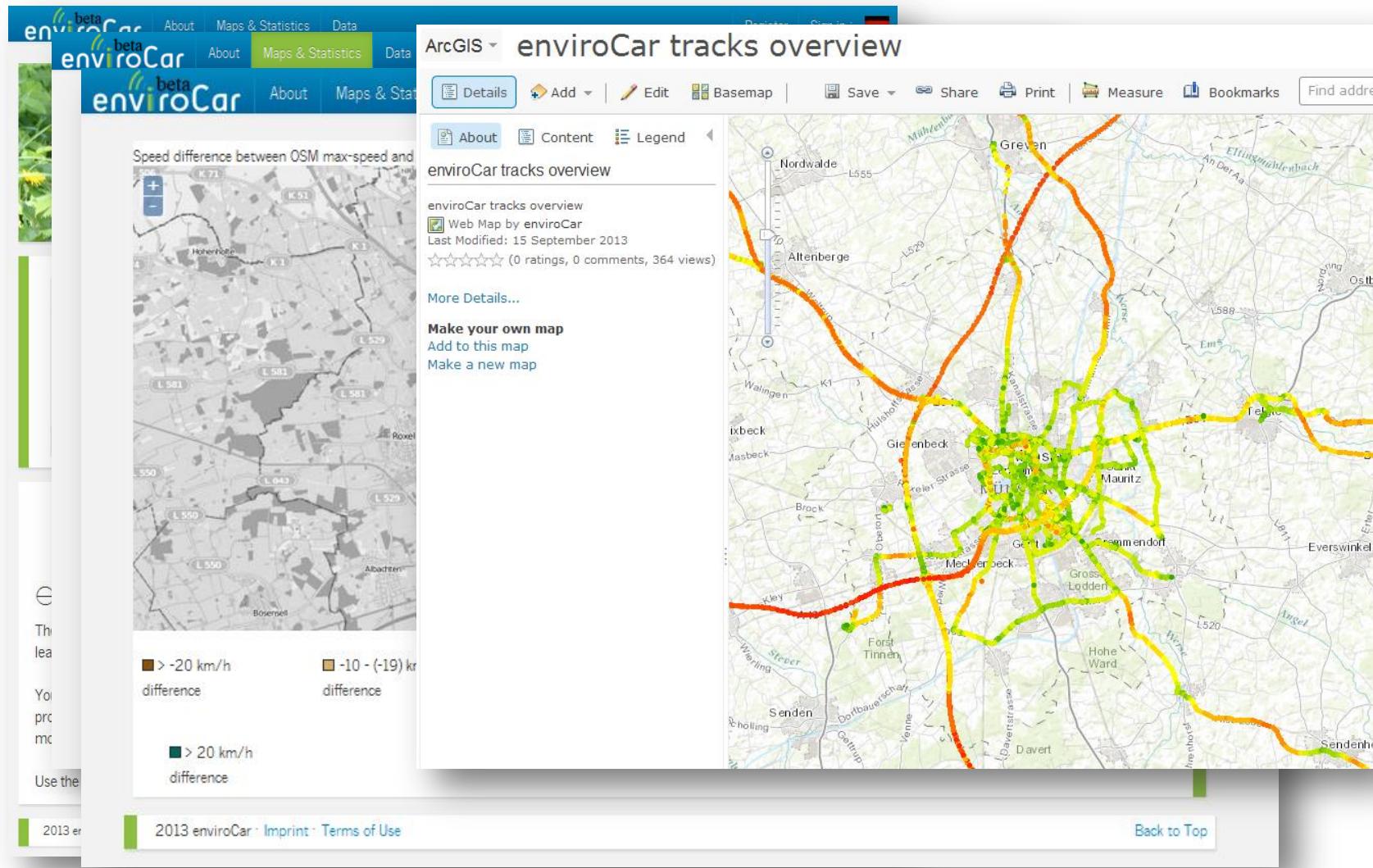


<https://www.youtube.com/watch?v=LTSuUEOfWa0>

# Website



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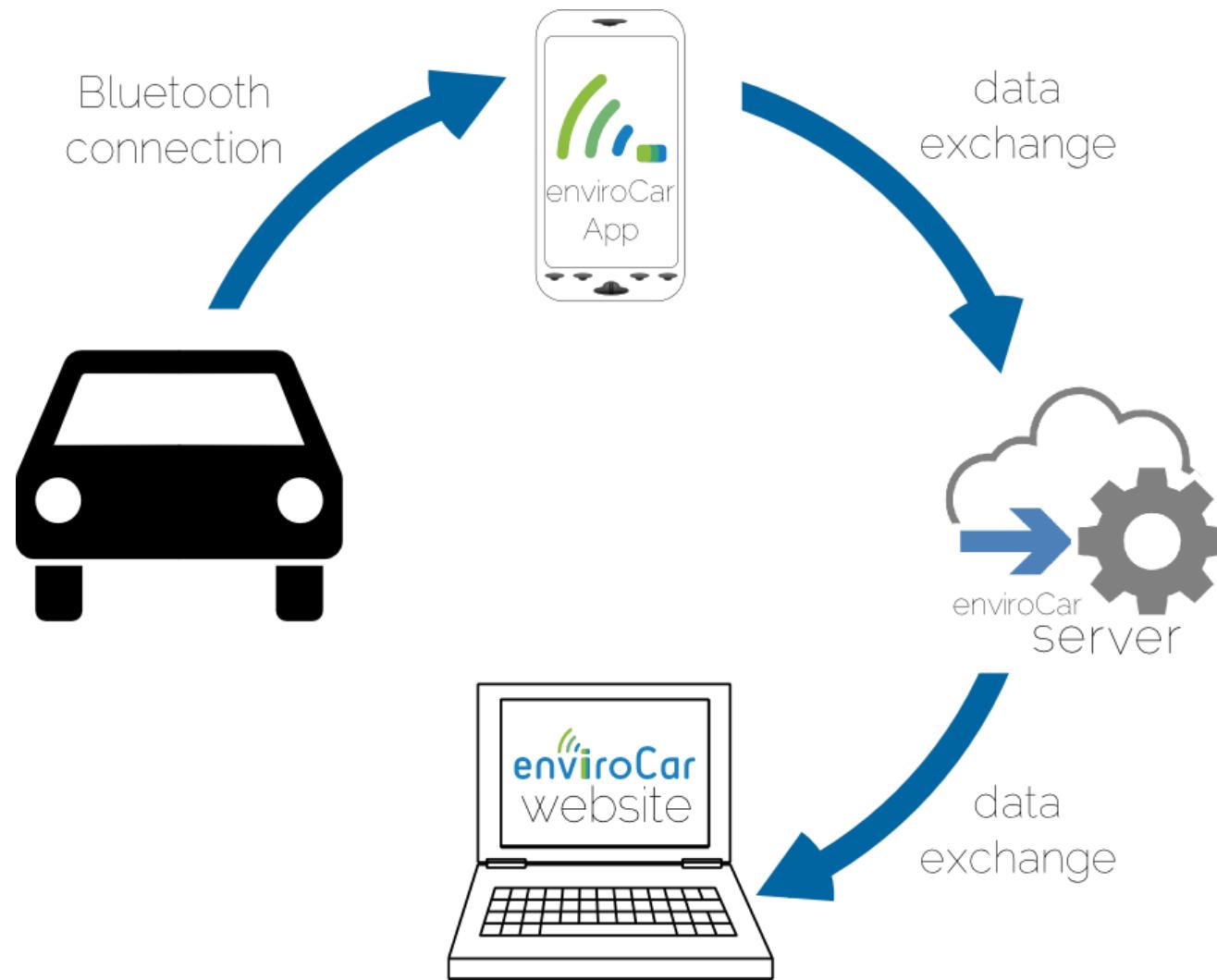
<http://torque-bhp.com/>



# Architecture

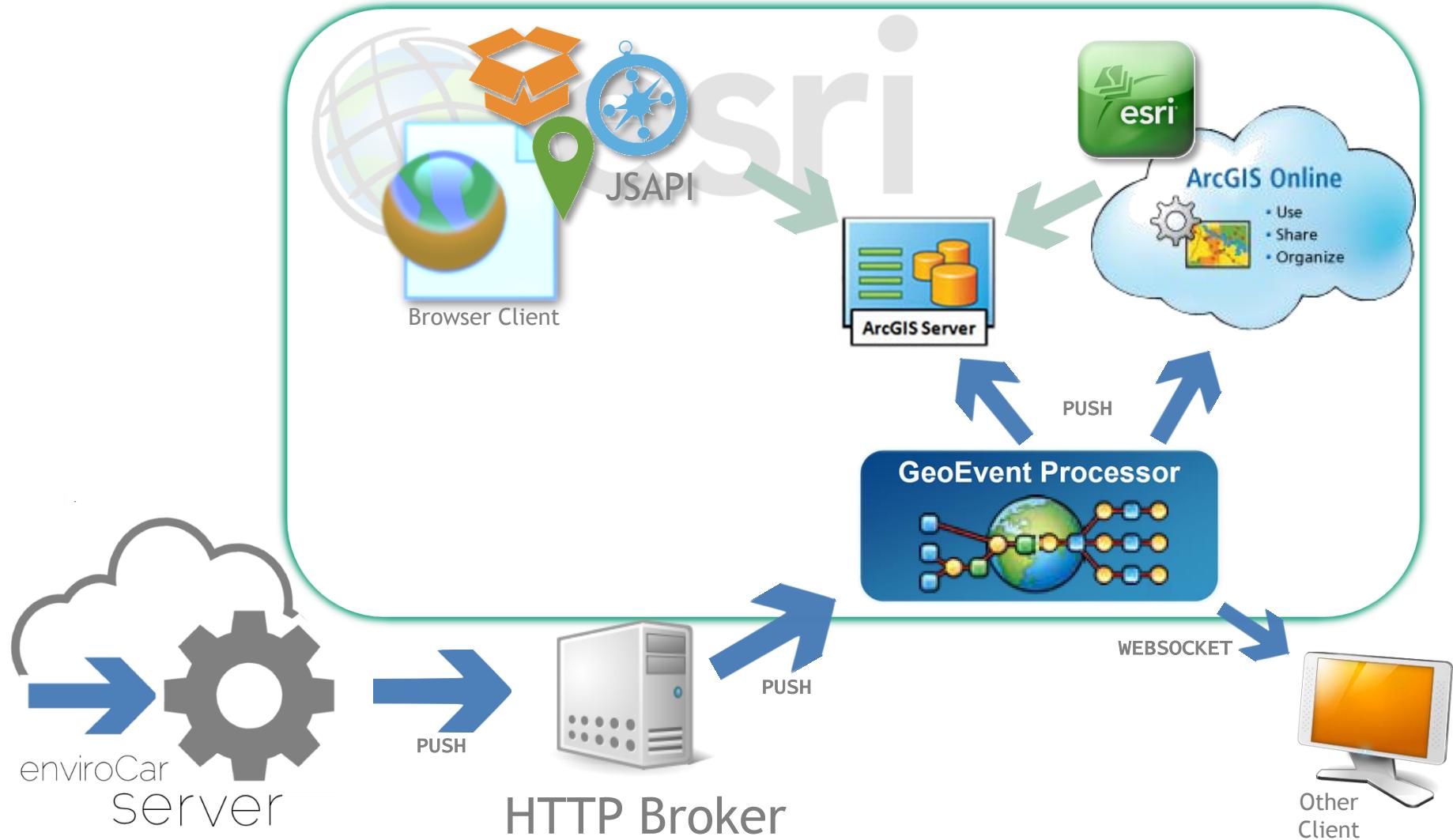


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# Event-driven dissemination

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# Are you interested?



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## Get the data

<http://envirocar.github.io/enviroCar-server/api/>  
<http://envirocar.github.io/enviroCar-server/lod/>

## Get the code

<https://github.com/envirocar>

## Get in the car!

If your car has an ODB-II slot, I'll get you a test account.

## Collaborate?

### EnviroCar Service

[Developer Guide](#)

[API Reference](#)

[Linked Open Data](#)

[Download ZIP](#)

[Download TAR](#)

[View On GitHub](#)

### Linked Open Data

Every resource is available as RDF. To request the content as Linked Data you have to set the appropriate Accept header.

For Turtle:

```
curl -u jakobi:***** -H "Accept: text/turtle" https://giv-car.uni-muenster.de/dev/rest/users/ja
```

```
@base <https://giv-car.uni-muenster.de/dev/rest/> .  
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix foaf: <http://xmlns.com/foaf/0.1/> .  
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix vcard: <http://www.w3.org/2001/vcard-rdf/3.0#> .  
@prefix dcterms: <http://purl.org/dc/elements/1.1/> .  
  
<users/jakob2> a foaf:Person .  
<users/Turbomartin> a foaf:Person .  
<users/ChristianK> a foaf:Person .  
<users/OraibMiq> a foaf:Person .  
<users/AlbertRemke> a foaf:Person .  
<users/dnnnsdnns> a foaf:Person .  
<groups/Product%20owner>
```



<http://geoviqua.org/>



# The Project



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The screenshot shows the GeoViQua project website. At the top, there is a circular logo with nodes representing partners like Crea, URB, ESS, etc., connected by lines. The main header features the text "GeoViQua" over a background image of Earth and biological cells. Below the header, a sidebar on the left lists navigation links: Home, Overview (which is selected), Objectives, Participants, Management, GeoViQua themes, Docs & publications, Cooperation, and Events. It also includes a map of Spain. The central content area has a video player showing a video of the Earth from space, with a play button at 00:27 / 10:13. To the right of the video is a "GO TO" menu with links to GeoViQua Twiki, GeoViQua schemas, and Acronyms. Below that is a "SEARCH" bar powered by Google. A "NEWS" section follows, featuring tweets from @GeoViQua. At the bottom, there are social media icons for LinkedIn, RSS, and Twitter, along with logos for the Seventh Framework Programme and the European Union.

The Global Earth Observation System of Systems (GEOSS) aims to be a global and flexible network of content providers allowing decision makers to access an extraordinary range of information directly on their desk. It brings together existing observing systems around the world while supporting the development of new systems where gaps currently exist.

<http://www.youtube.com/watch?v=4uDNwEHhJmw>

# GeoViQua Objectives

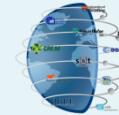


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1. The provision of innovative tools to enhance the current infrastructure capability. GeoViQua's major technical innovation is **search and visualization tools** for the community that **communicate and exploit data quality information** from GEOSS catalogues
2. The development of the **GEOLabel**. [...]
3. The harmonization, exploitation and dissemination of **project outputs**. [...]

<http://geoviqua.org/Objectives.htm>

# Producer and User Quality Model



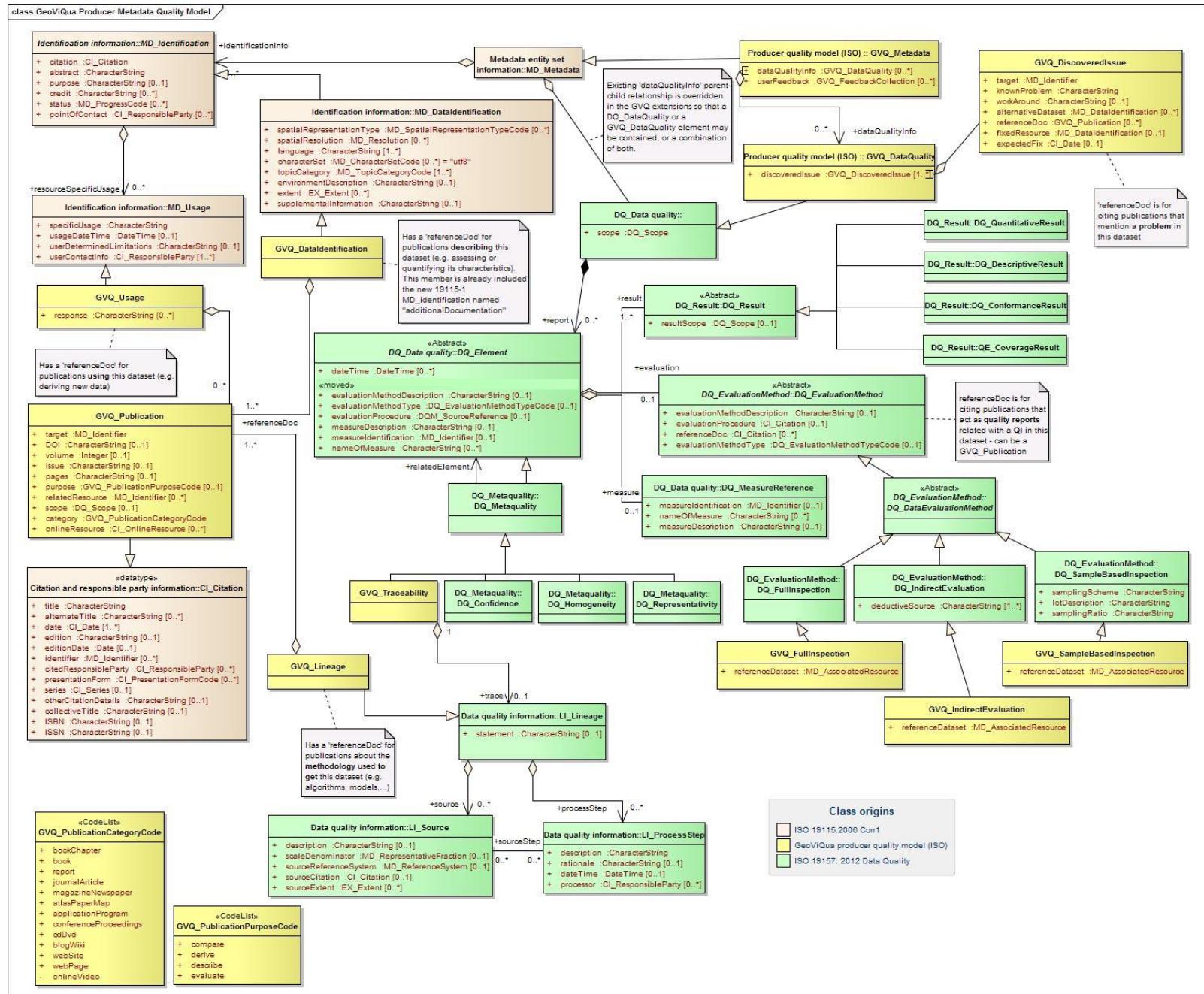
52n

## Producer Quality Model

- ISO 19115 / 19157
- Extensions to ISO (adopted by GEOSS):
  - Citations
  - Reference datasets
  - Traceability
  - Discovered Issues
  - Pixel and dataset level –UncertML
  - INSPIRE-recommended identifiers and codelists

## User Quality Model

- User feedback
- More flexible
- New model - not present in GEOSS
- Ratings
- Examples of use in named application domains
- ‘Soft knowledge’ from producers



# GEO label (and Tutorial)



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<http://geolabel.info/>

<http://tutorial.geoviqua.org/>



User-dictated circular GEO label design (information is available).



User-dictated circular GEO label design (information is available at a higher level).



User-dictated circular GEO label design (information is not available).

[...] GEO Science and Technology Committee (STC) propose to establish a GEO label - a label “to recognise the scientific relevance, quality, acceptance and societal needs for activities in support of GEOSS” [...]

<https://github.com/lushv/geolabel-service>

<https://github.com/52North/GEO-label-java>

# GeoViQua Highlights: Interesting for you?



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The catch: GEOSS and GeoPortal.org mean ISO metadata...

Studies on actual usage of metadata

Improvements to ISO MD (Lineage, ...)

**User quality model (and server implementation) - encode user feedback as LOD?**

**GEO label (begs for semantic angle, an ontology for the information behind it...)**

# OPEN SOURCE

# Google Summer of Code

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## What is it?

<http://www.google-melange.com/>

"... THE MORE CODE  
OUT THERE, THE MORE  
EVERYONE BENEFITS."



Experiences at 52° North (<http://52north.org/gsoc>)

- Great personal experience
- Good results (depending on mentor engagement)
- Can be used for “housekeeping” if student is good, or for experimental things
- “worth the time/money”

Potentially host *your projects* next year (IF we get in as a mentoring org again) ?

## Software Licenses

- You could advertise more clearly
- Interested in long term license management?

Long term projects can be tricky in academic environment...

## GitHub

- ... is the best
- is great for teaching and tracking contributions (next time: pull requests by each participant)
  - Did you use it in classes before?
  - Try it out - write a paper?

# Air Quality Egg @ MS

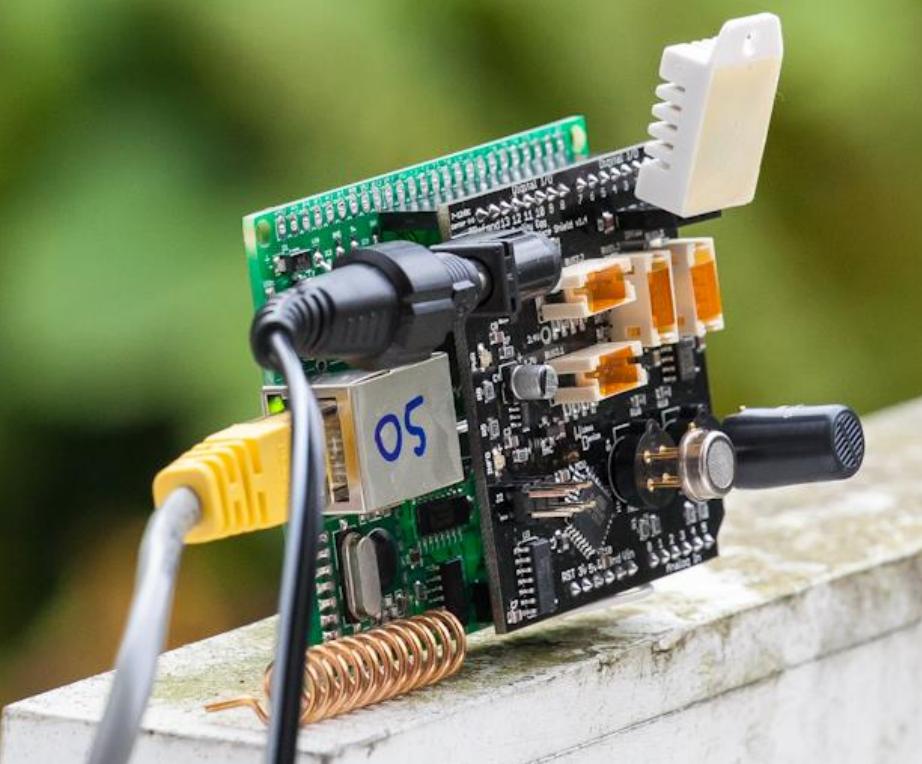


Image courtesy of S. Mukhametov

# Workshop September 2012

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20 Egg units - prototype state

Air Quality Egg Coordinators

Technical difficulties (chargers, enclosures, timing)

Quotes: “good to meet people”, “interesting method”, “basic hardware”, “disappointing”, “motivation! no product”, “first day = search for adapters and enclosures”



# Status and Future

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**Waiting** a few functioning units at some points

**Progress** of whole project: shipping units, new software revisions

## Goals:

- Transfer progress to Münster
- Geosoft II Seminar works on software side
- Communicate more in and **about** Münster
- Second workshop beginning 2013 (deploy 50% (10) units)
- Collaborate with GI@School
- Continue work on “Sensor Web Eggs”
- Continue community involvement, continue extending own experiences

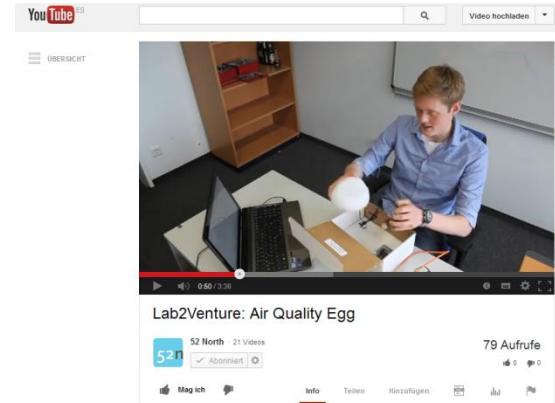


High School Students work on “business project”

<http://lab2venture.de/>

*German* documentation and installation video about Air Quality Egg

- <http://airqualityegg.net/>
- <http://www.youtube.com/watch?v=jdlI6iAupVQ>



<http://52north.org>

<http://nordholmen.net>