Examining the Potential of Crowdsourced Volunteered Geographic Information for Environmental Observation and Regulation

Dr. Peter Mooney and Dr. Andrea Ballatore

Hands Up Survey: *On your travels here to NUIG did you do any of the following?*

ACTIVE-PRODUCER

-Tweeted, posted, bloged etc a geo-located audio/text/visual update of your progress *"Hey I'm at Eyre's Square Galway"*

- Checked in to your social network/gamified social network

PASSIVE-PRODUCER

- clicked on 'suggested search results with geo information'

- had your GPS turned on on your smartphone

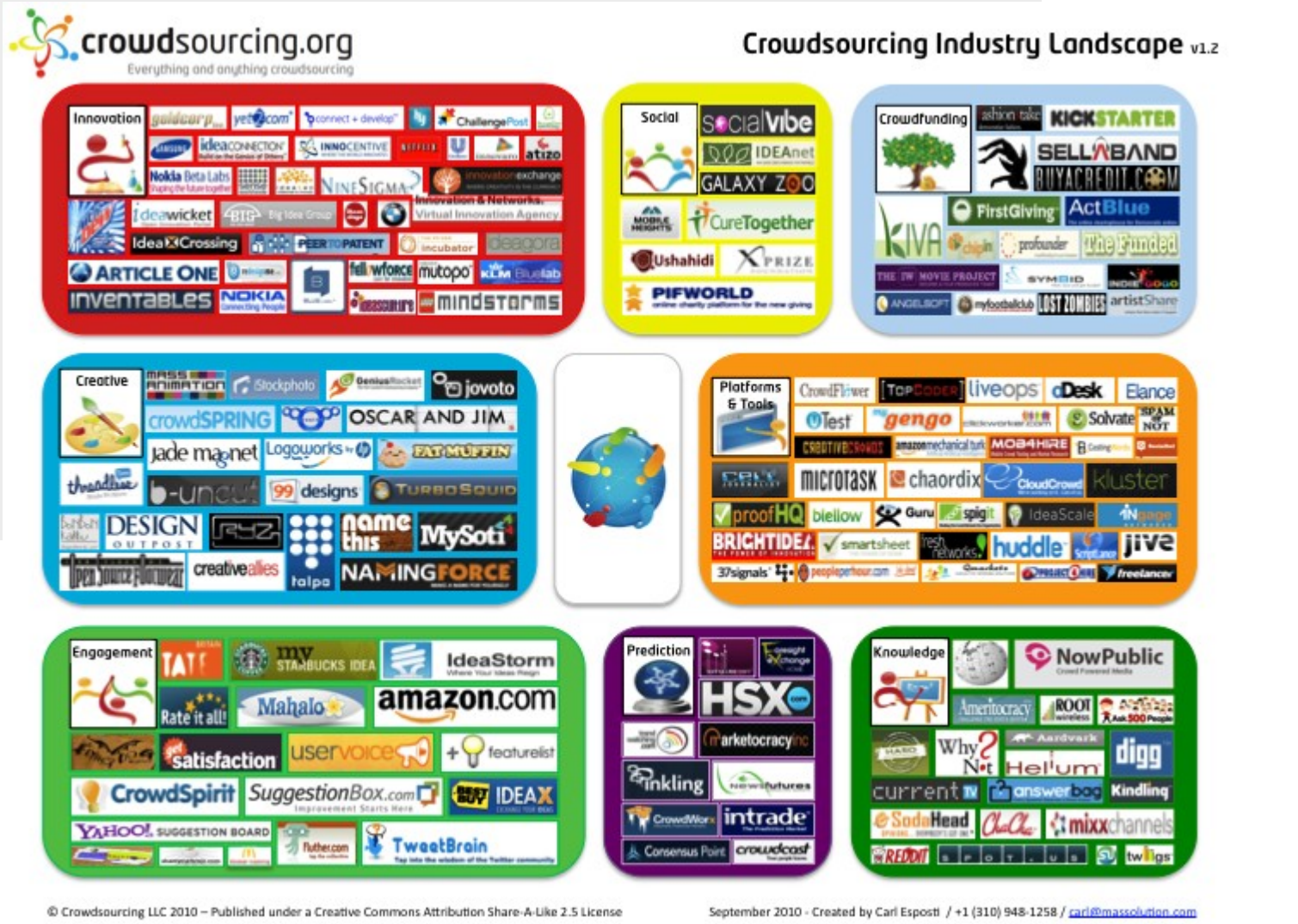
GEO CONSUMER

- Read hotel reviews, used or printed online mapping, generated navigation or directions, used geo-recommendations, weather apps,

Today's presentation will aim to explain the potential of crowdsourcing for environmental regulation

1. What is "Crowdsourcing" and what can it do?
2. Examples of crowdsourcing, showcases, etc with emphasis on 'the environment'
3. Research ideas - ways forward - exploring possibilities

What is "Crowdsourcing"?



A role for crowdsourcing?

Environmental regulation is as much about citizen participation as it is based on legal implementation by local, regional, and national agencies

Embracing the potential of crowdsourcing, especially for environmental development planning and monitoring of issues by citizens, could expand governments understanding of the issues facing their citizens.

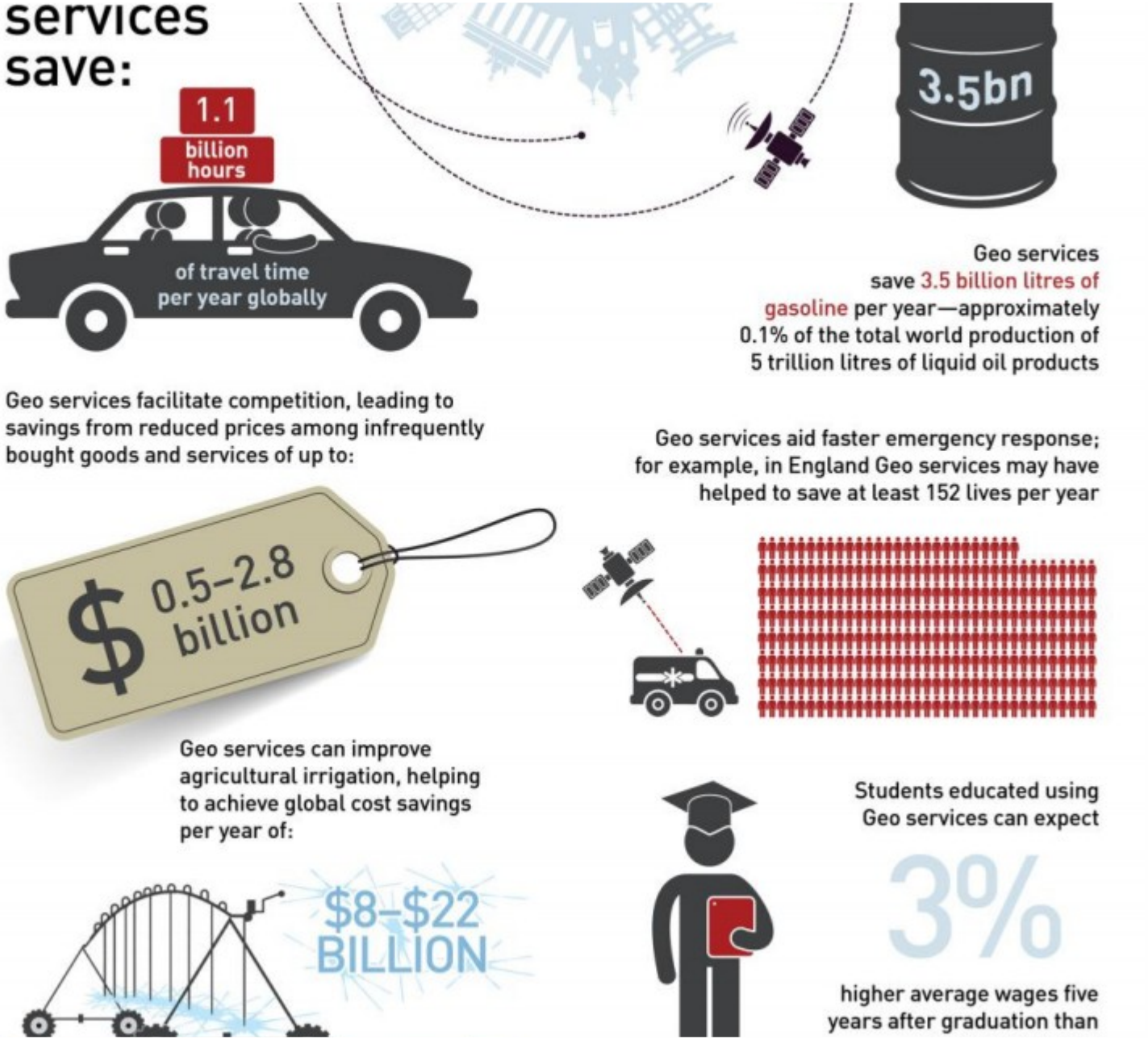
Ultimately this has the potential to raise the political legitimacy of the government in the eyes of citizens and other governments/regulators alike.

Volunteered Geographic Information (VGI)

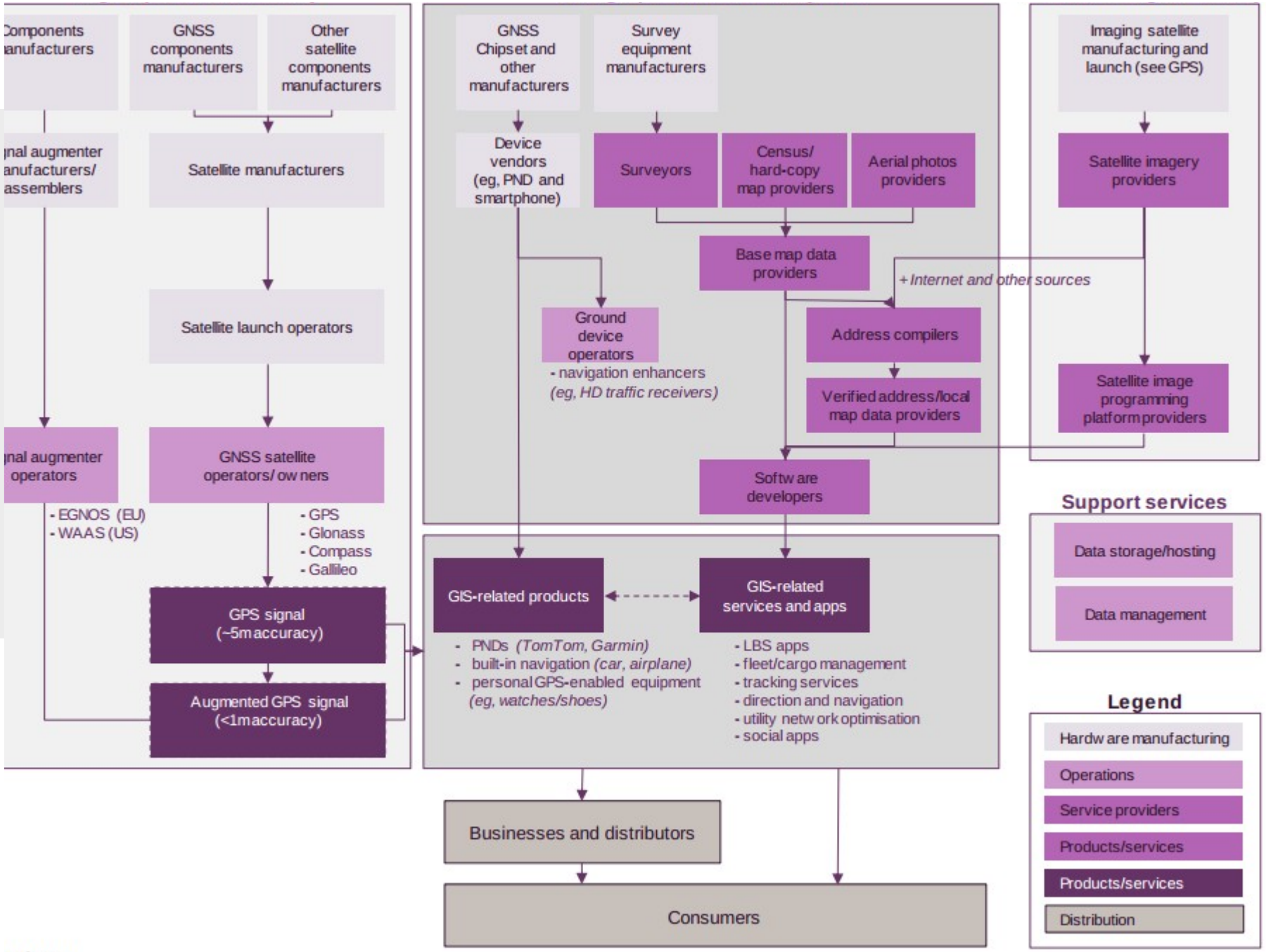
Volunteered Geographic Information (VGI) formally introduced by Goodchild (2007) – with obvious inter-relationships with urban sensing, citizen science, etc

Phenonemum which has grown out of: Web 2.0, ubiquitious computing, user-generated content, Open Data, accessibility to geo-services, geo-hardware, geo applications, the 'Internet of Things', etc

A combination of physical geo data collection (ie map making),OR indirect or passive (gps tracing, geo tweets), geo-social networking, collaboration amongs networks of citizens in the production of any type of geo data and information

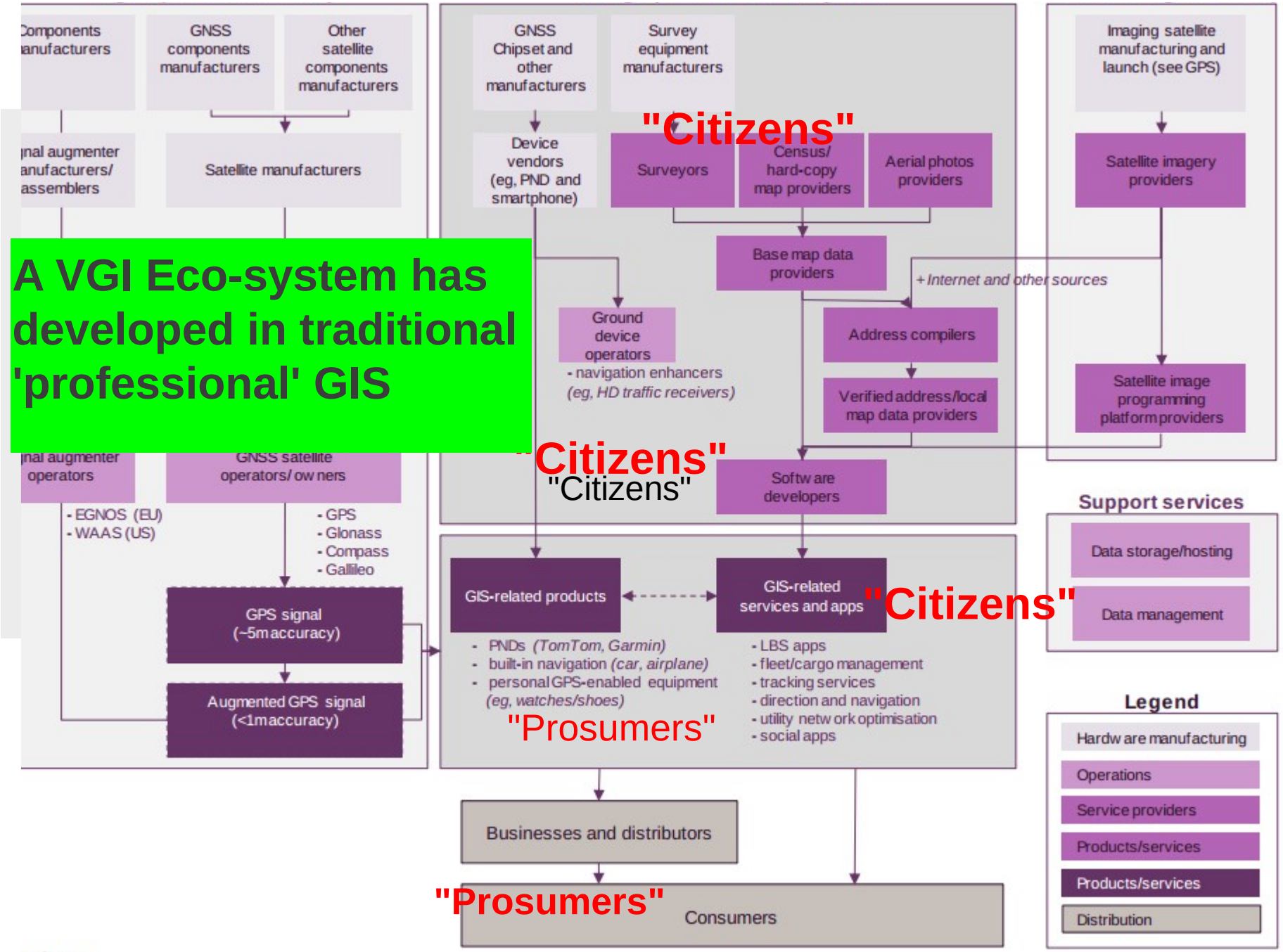


http://www.oxera.com/Oxera/media/Oxera/downloads/reports/What-is-the-economic-impact-of-Geo-services_1.pdf



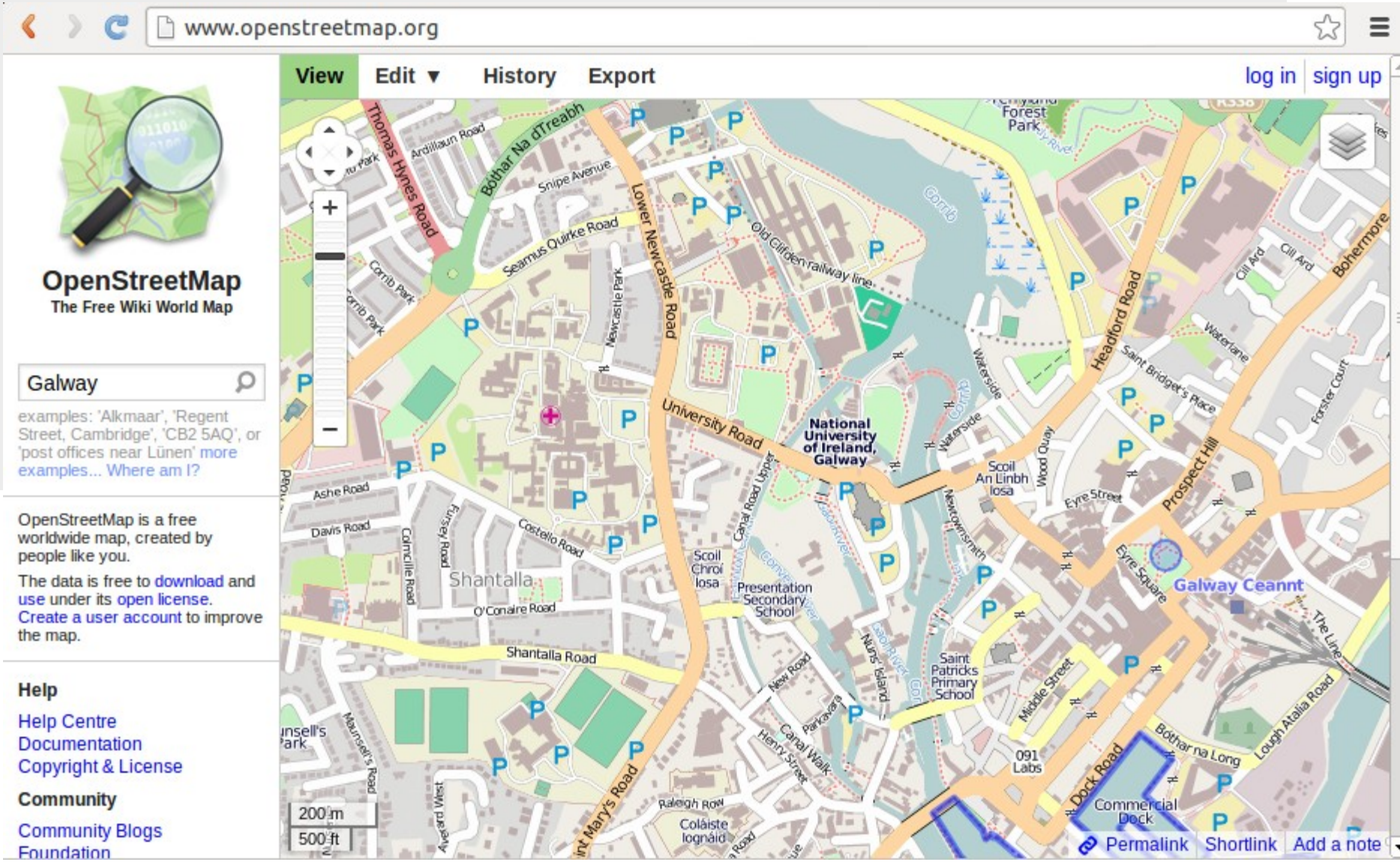
e: Oxera.

What is the economic impact of Geo serv


Components manufacturers
GNSS components manufacturers
Other satellite components manufacturers
GNSS Chipset and other manufacturers
Survey equipment manufacturers
Imaging satellite manufacturing and launch (see GPS)
"Citizens"
Satellite manufacturers
Device vendors (eg, PND and smartphone)
Surveyors
Census/ hard-copy map providers
Aerial photos providers
Satellite imagery providers
A VGI Eco-system has developed in traditional 'professional' GIS
Base map data providers
+ Internet and other sources
Ground device operators
- navigation enhancers
(eg, HD traffic receivers)
Address compilers
Verified address/local map data providers
Satellite image programming platform providers
operators
GNSS satellite operators/ owners
"Citizens"
"Citizens"
Software developers
Support services
- EGNOS (EU)
- WAAS (US)
- GPS
- Glonass
- Compass
- Galileo
Data storage/hosting
Data management
GPS signal (~5m accuracy)
GIS-related products
GIS-related services and apps
"Citizens"
Augmented GPS signal (<1m accuracy)
- PNDs (TomTom, Garmin)
- built-in navigation (car, airplane)
- personal GPS-enabled equipment (eg, watches/shoes)
"Prosumers"
- LBS apps
- fleet/cargo management
- tracking services
- direction and navigation
- utility network optimisation
- social apps
Legend
Hardware manufacturing
Operations
Service providers
Products/services
Products/services
Distribution
Businesses and distributors
"Prosumers"
Consumers

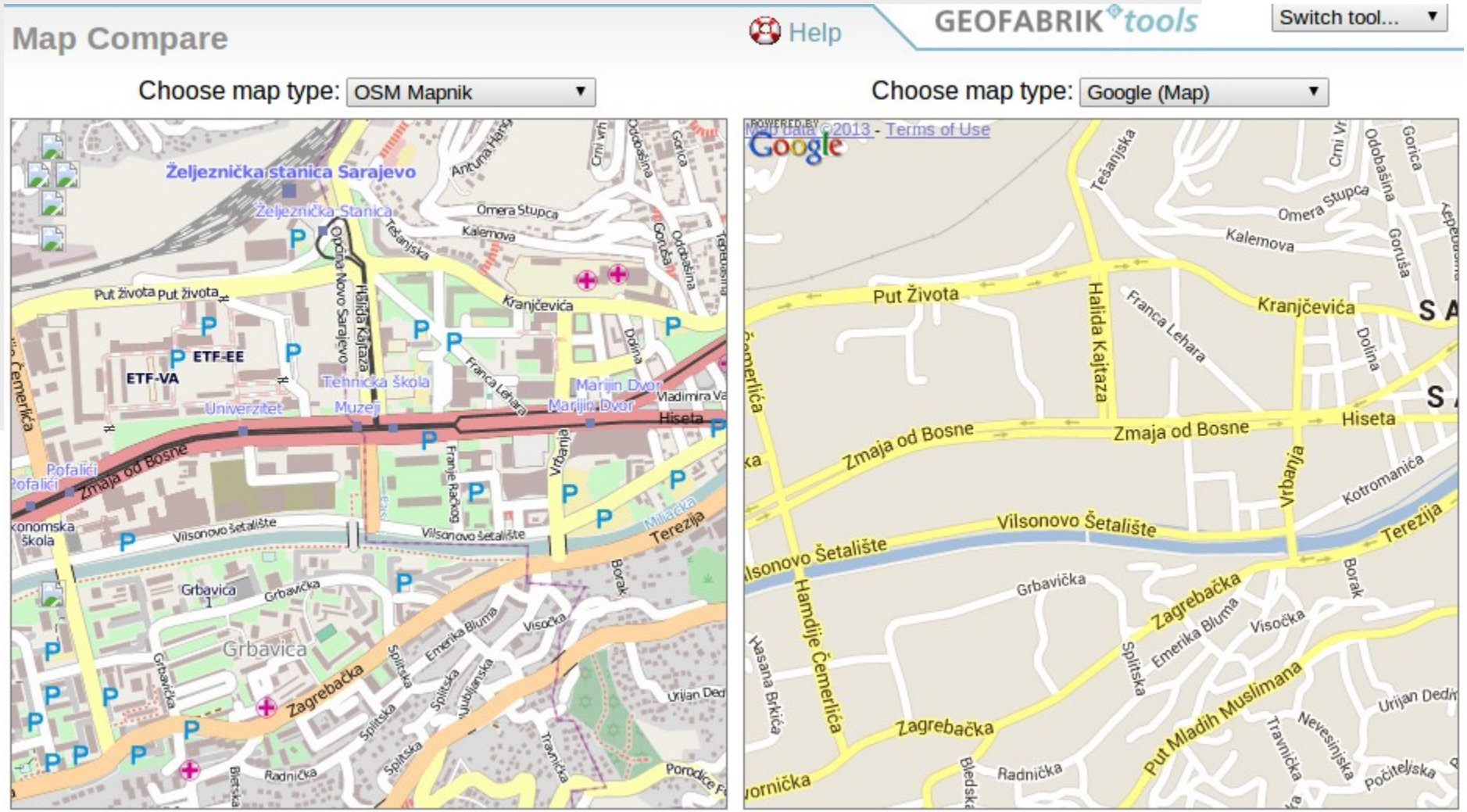
e: Oxera.

OpenStreetMap: The most famous VGI project on the Internet



Anything mappable appears on OSM: Here is Stade Roland Garros

OSM vrs Google: Downtown Sarajevo



http://www.fl1200.nl/faq/

Matthijs Tissen (16 years old - Hilversum, NL)

Balloon, consumer grade GPS, Camera

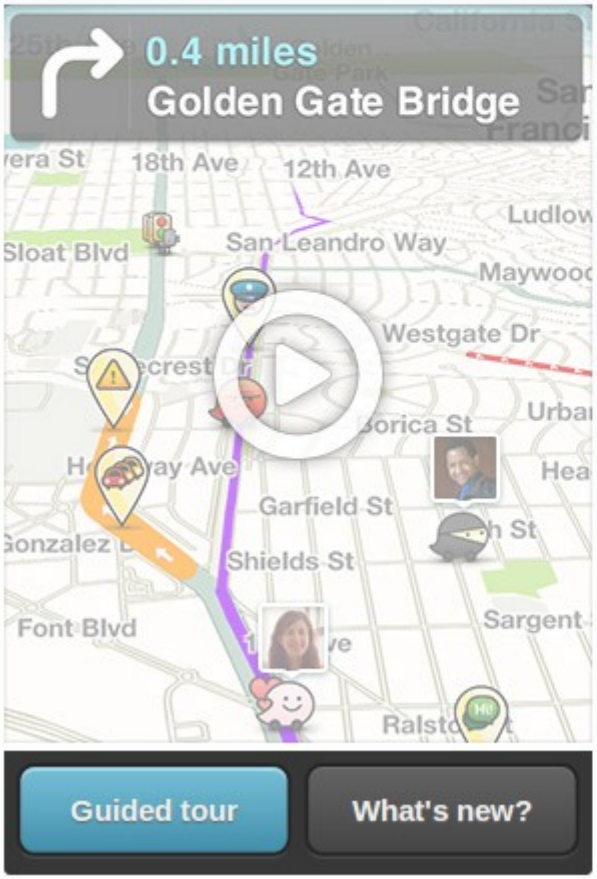
Flight path - avoiding residential areas only at high altitudes

Amazing captures of high resolution, spatially referenced, aerial imagery!

June 2013: Google acquires Waze for $1.4bn

waze TRAFFIC, TOGETHER.

Live Map | My Dashboard | Community | Support | B



Get the best route, every day, with real-time help from other drivers.

Download

FREE

Available on the App Store

GET IT ON Google play

Waze is the world's fastest-growing community-based traffic and navigation app. Join other drivers in your area who share real-time traffic and road info, saving everyone time and gas money on their daily commute.

VGI and 'the citizen sensor' are very closely related

One of the greatest assets of citizen collected information is <Observation> at a <PLACE> at a given <TIME>

- Our 'everyday' smartphone is now a collection of sensors which 10 years ago would have only been available to industry

- Using the same principles and philosophies of VGI there are more and more examples of citizens collecting environmental data themselves or connecting to sensor networks to share collected information

Can Citizen Scientists Be Our First Line Of Defense In Environmental Disasters?

It can be months before the true experts finally get into an area affected by disasters like oil spills, but there are thousands of concerned citizens interested in documenting what's happened. The problem is: We never use their data.

199 64

How do you assess the impact of a large oil spill? Not easily, says Sabrina McCormick. If it's like the Gulf disaster, the oil will have spread far and wide, and the effects will be lingering and insidious. It'll take scientists years to take readings, and even then, their conclusions are likely to miss a lot.

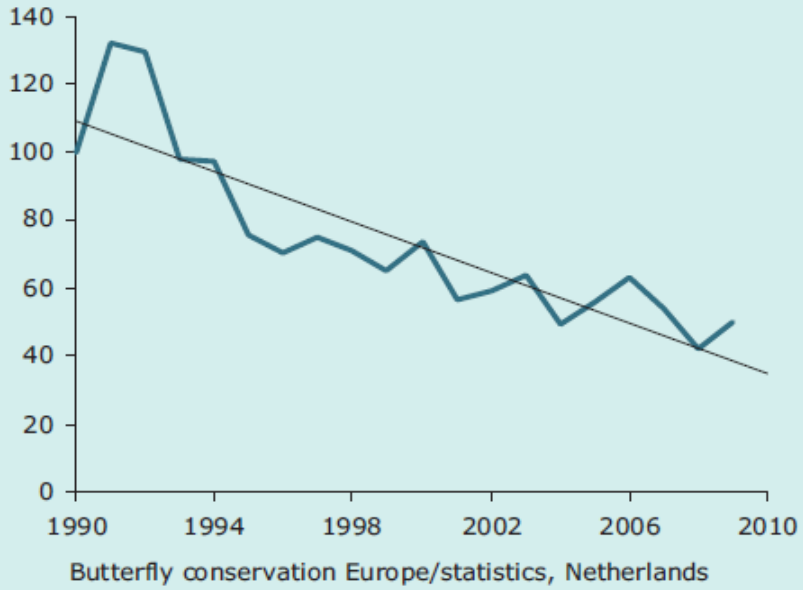
fastcoexist.com/1681099/can-citizen-scientists-be-our-first-line-of-defense-in-environmental-disasters

The Biodiversity Community have embraced 'citizen scientists' for decades

Box 2 Grassland butterflies

The indicator covers 17 species of grassland butterflies and is based on national Butterfly Monitoring Schemes in countries across Europe. The indicator is based on the fieldwork of thousands of trained professional and volunteer recorders, counting butterflies on approximately 3 500 transects scattered widely across Europe ([12]).

SEBI indicator 01: Grassland butterflies ([13])



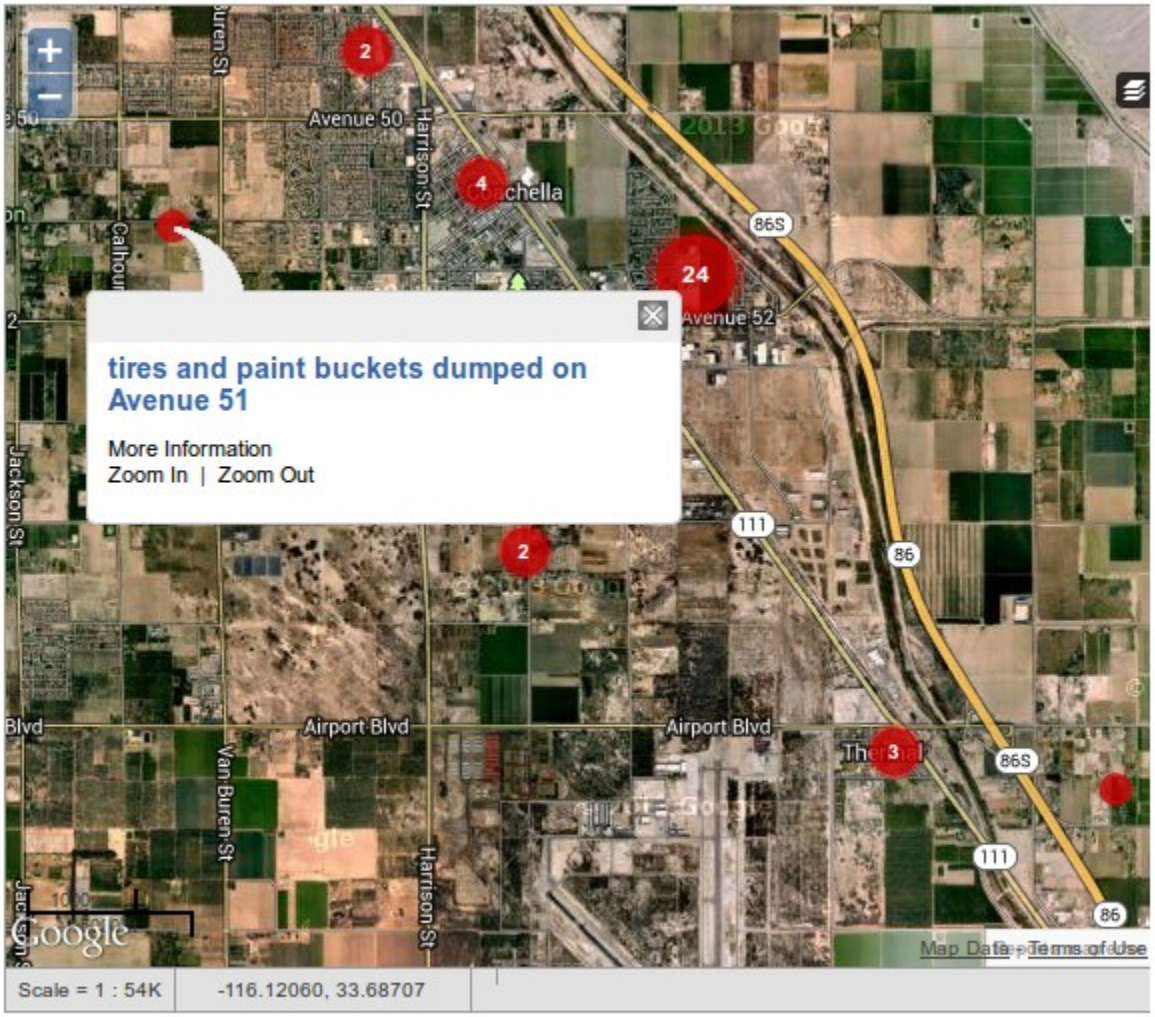
Butterfly conservation Europe/statistics, Netherlands

Geographical coverage

The indicator shows that since 1990, butterfly populations have declined by more than half, indicating a dramatic loss of grassland biodiversity.

http://www.eea.europa.eu/publications/biodiversity-monitoring-in-europe

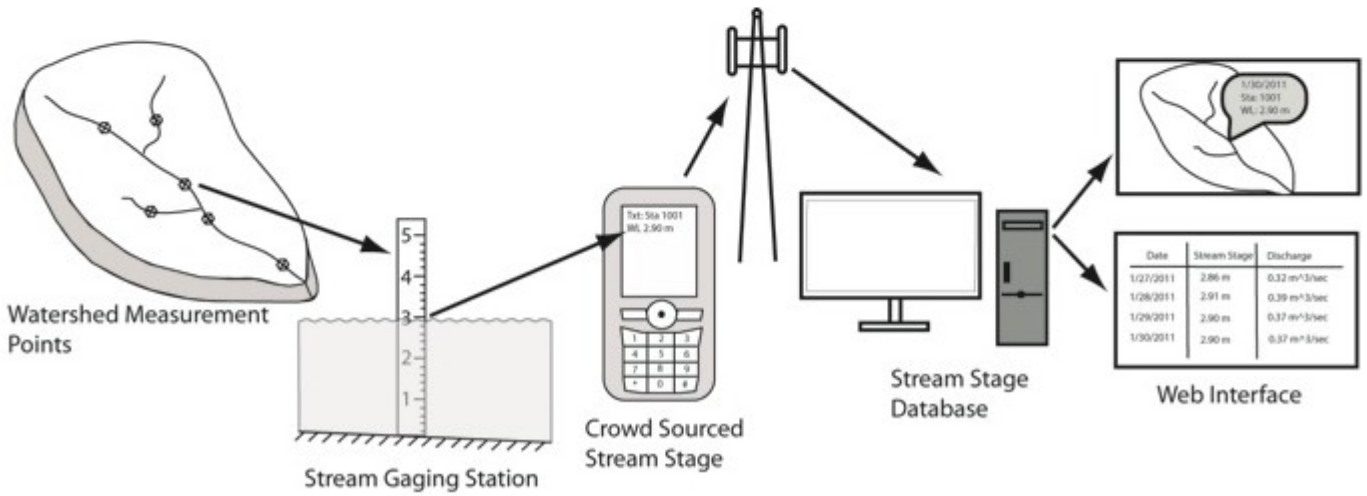
ivan-coachella.org/report/ - CA, USA: Citizen report of environmental problems



- ALL CATEGORIES
- ILLEGAL DUMPING
- DUST
- BAD AIR QUALITY CONDITIONS
- PESTICIDE PROBLEMS
- OIL SPILL
- ABANDONED SITES
- FIRE
- VECTOR
- CONFINED ANIMAL FACILITIES
- DAMAGED ROAD
- GEOTHERMAL PLANTS
- OFF-ROAD VEHICLES
- OTHER

CrowdHydrology

The CrowdHydrology mission is to create freely available data on stream stage in a simple and inexpensive way. We do this through the use of "crowd sourcing", which means we gather information on stream stage (water levels) from anyone willing to send us a text message of the water levels at their local stream. These data are then available for anyone to then use from Universities to Elementary schools.



Open source, open interfaces, and low-cost hardware and software are instrumental in the “big data” effect from citizen sensing

ARDUINO

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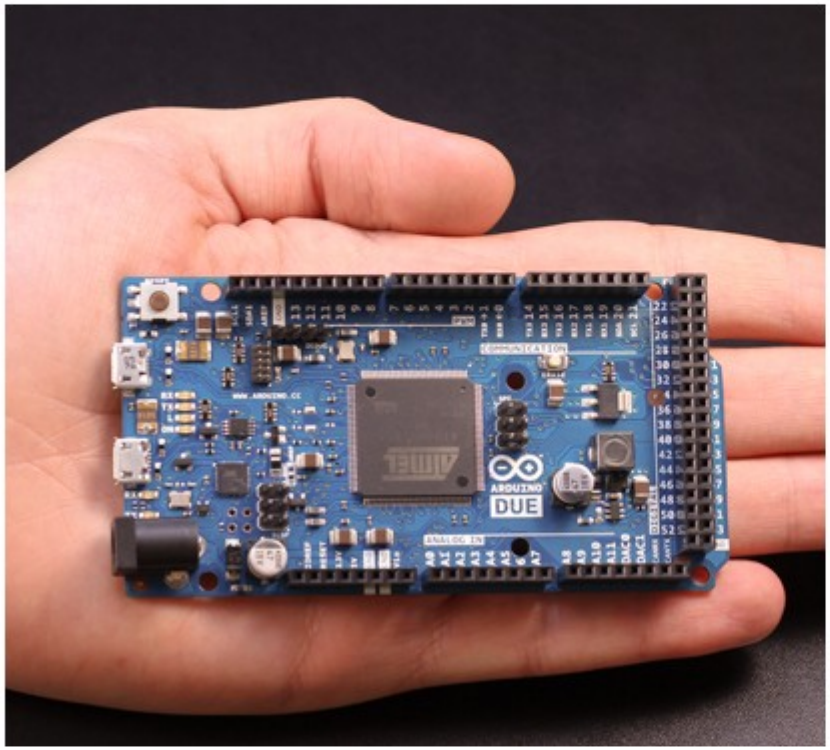
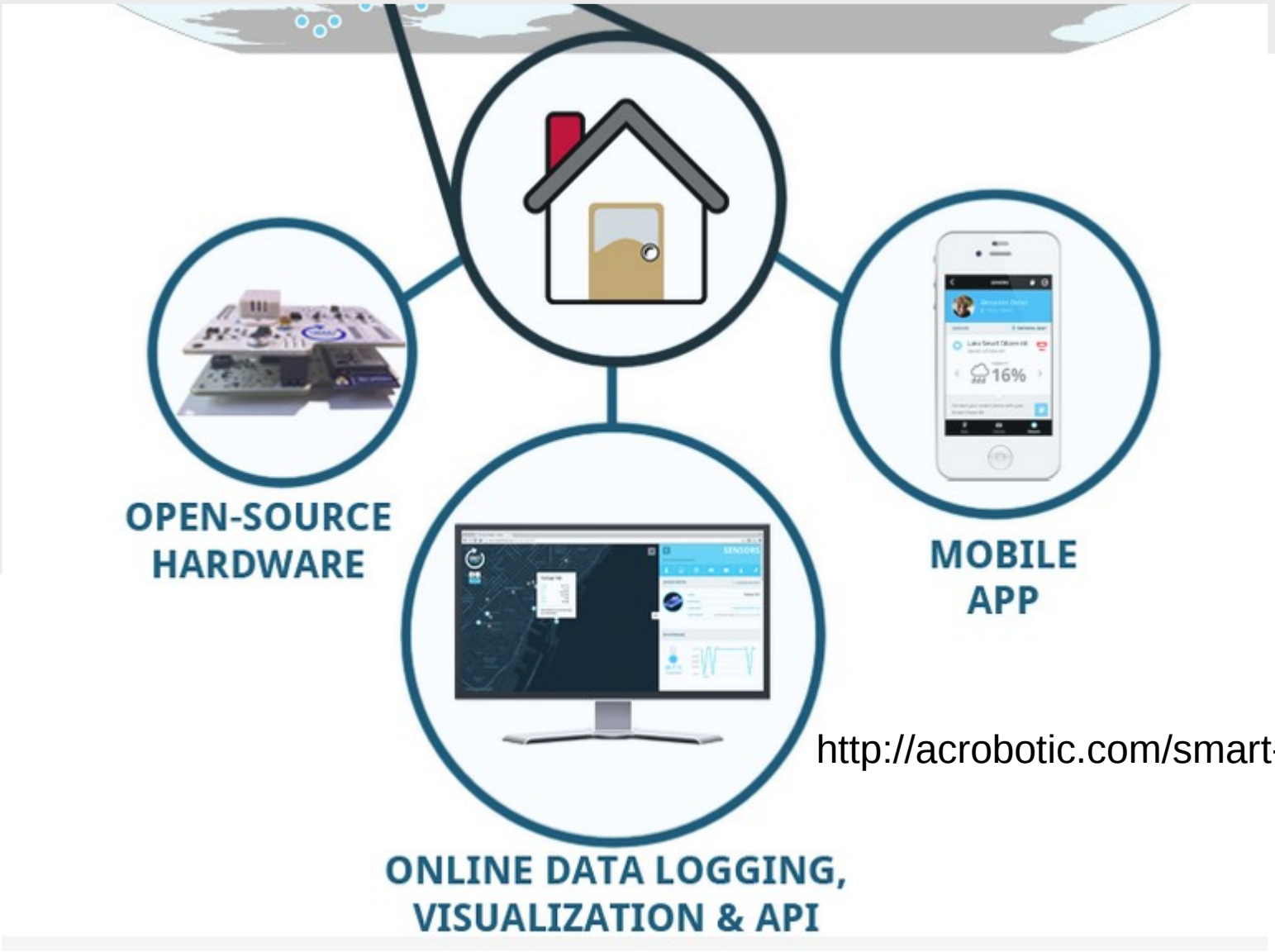


Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

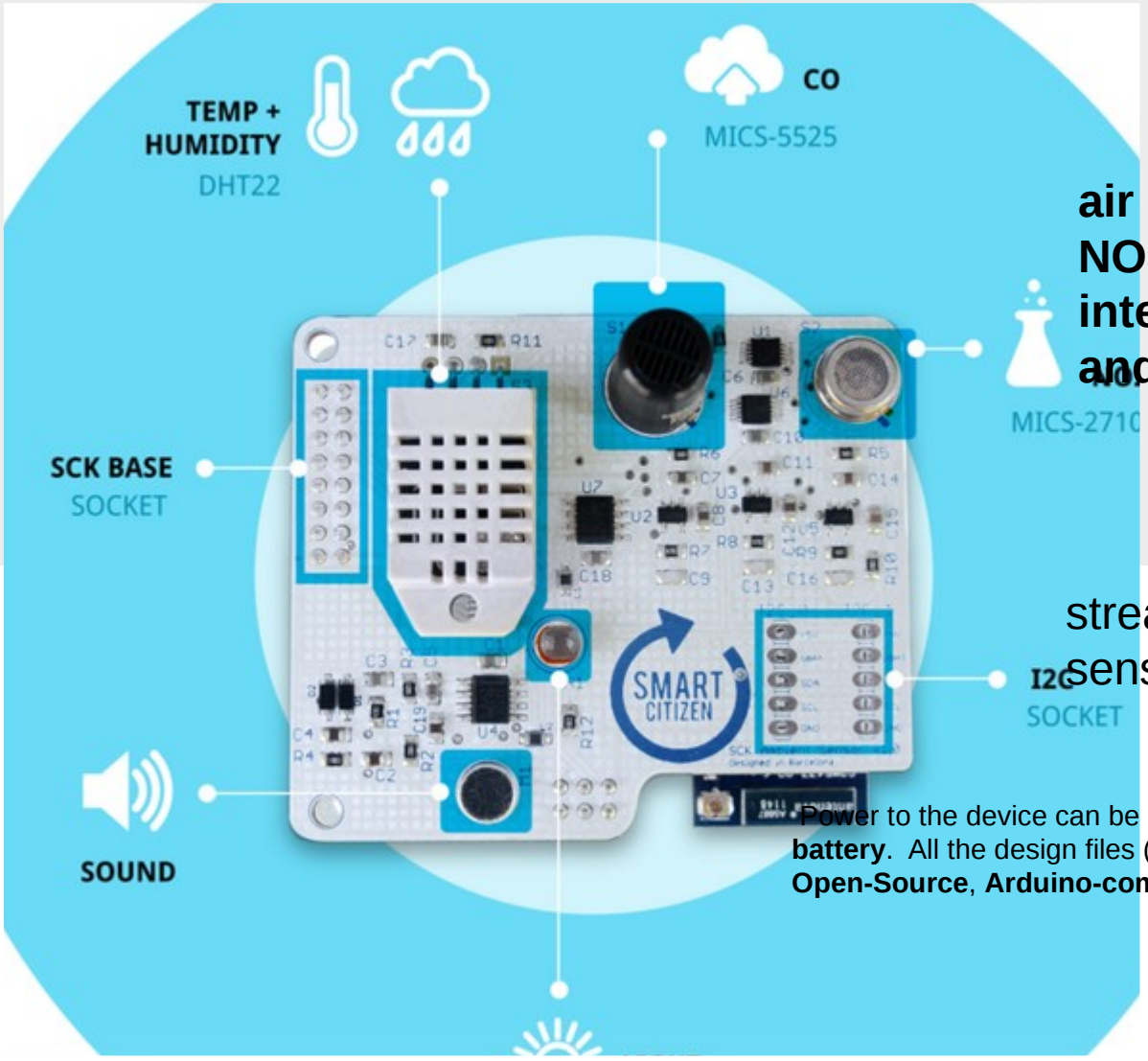
Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the **Arduino programming language** (based on **Wiring**) and the Arduino development environment (based on **Processing**). Arduino projects can be stand-alone or they can communicate with software running on a

The 'smart-citizen' project



http://acrobotic.com/smart-citizen

'Smart-citizen' Kit: Arduino-based hardware

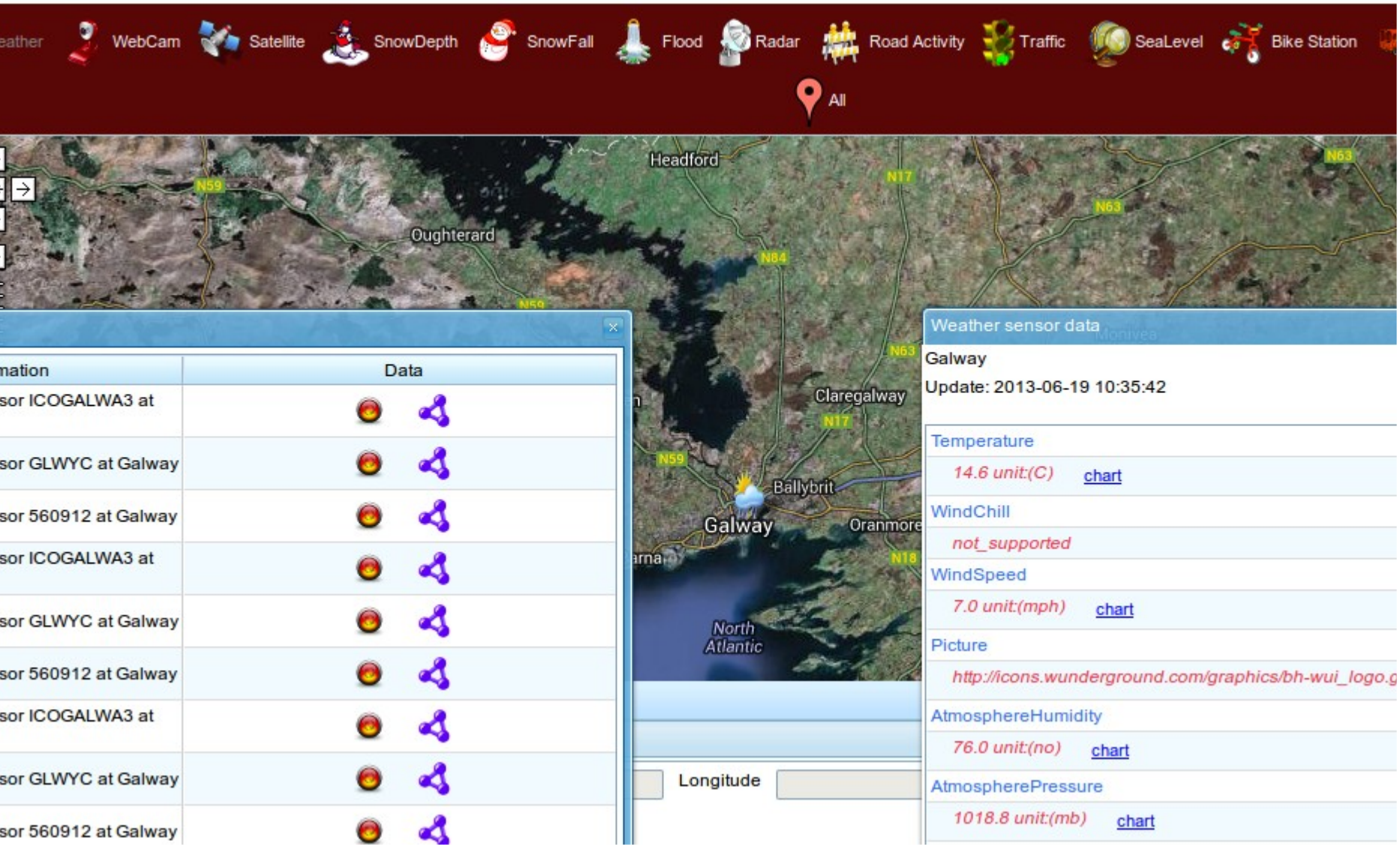


air composition (CO and NO2), temperature, light intensity, sound levels, and humidity

stream data measured by the sensors over **Wi-Fi**

Power to the device can be provided by a **solar panel** and/or **battery**. All the design files (schematics and PCB layout) for this **Open-Source**, **Arduino-compatible** device are available

DERI (NUIG) - **Linked Sensor Middleware**



Our current research in VGI and outlook on a research agenda

Our research is based upon a geocomputation platform

- **Evolution of VGI datasets** – what spatial processes govern how VGI is collected and grows? Can we predict? Forecast?
- **The semantics of the crowd** – how to make sense of the latent knowledge provided by citizens in their contributions?
- **Social Interaction in VGI?** Do the crowd interact and collaborate? 10% of the crowd does 90% of the work**!**
- **Bespoke measures of VGI Data Quality**.

Developing an ICT and Environmental Regulation Research Agenda – Our agenda items

- **Understanding** the characteristics of the crowd? What type individuals are in the crowd?
- What types of environmental regulation or enforcement can “the crowd” feasibly assist government or agencies with?
- What **incentives** for participation? Citizen inspired or driven from the top-down?
- **Verification** of data towards the operational use of these data in environmental monitoring and regulation

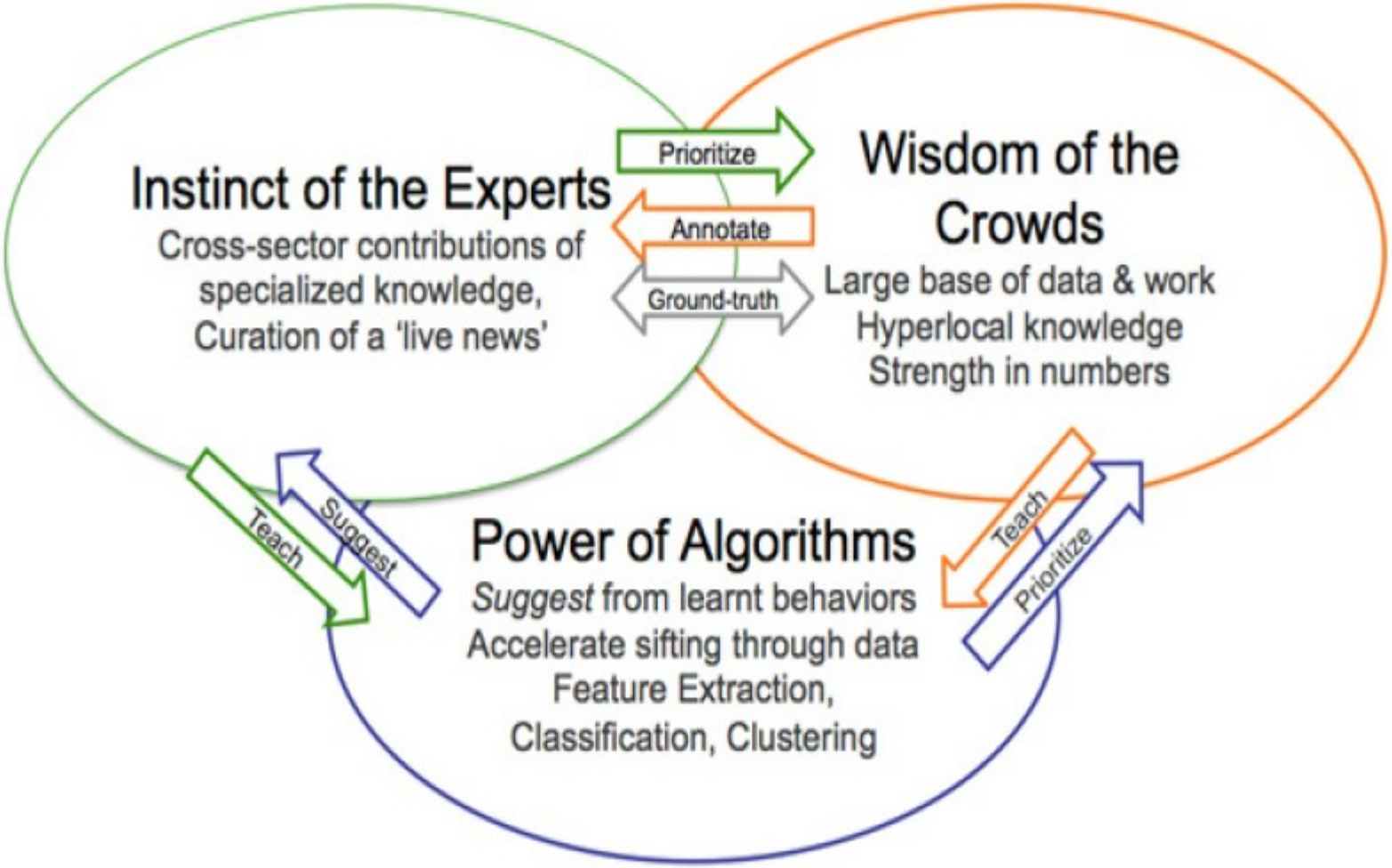
Ensuring Crowdsourced Data is reliable is a massive challenge

"*Take the human element out of the crowd*" (McCormack, 2012)

Active data collection through smartphone application interfaces – or passively via on board sensors, or sensor networks, etc which can greatly **reduce 'noise'** in data processing

Balancing crowd dynamics: for example [expert, local] vrs [enthuastic, remote] vrs [committed, biased]

Kamel Boulos et al, 2011
“We must integrate experts, crowds, and machine learning”



The wisdom of the crowd must be harnessed effectively

Comment is free

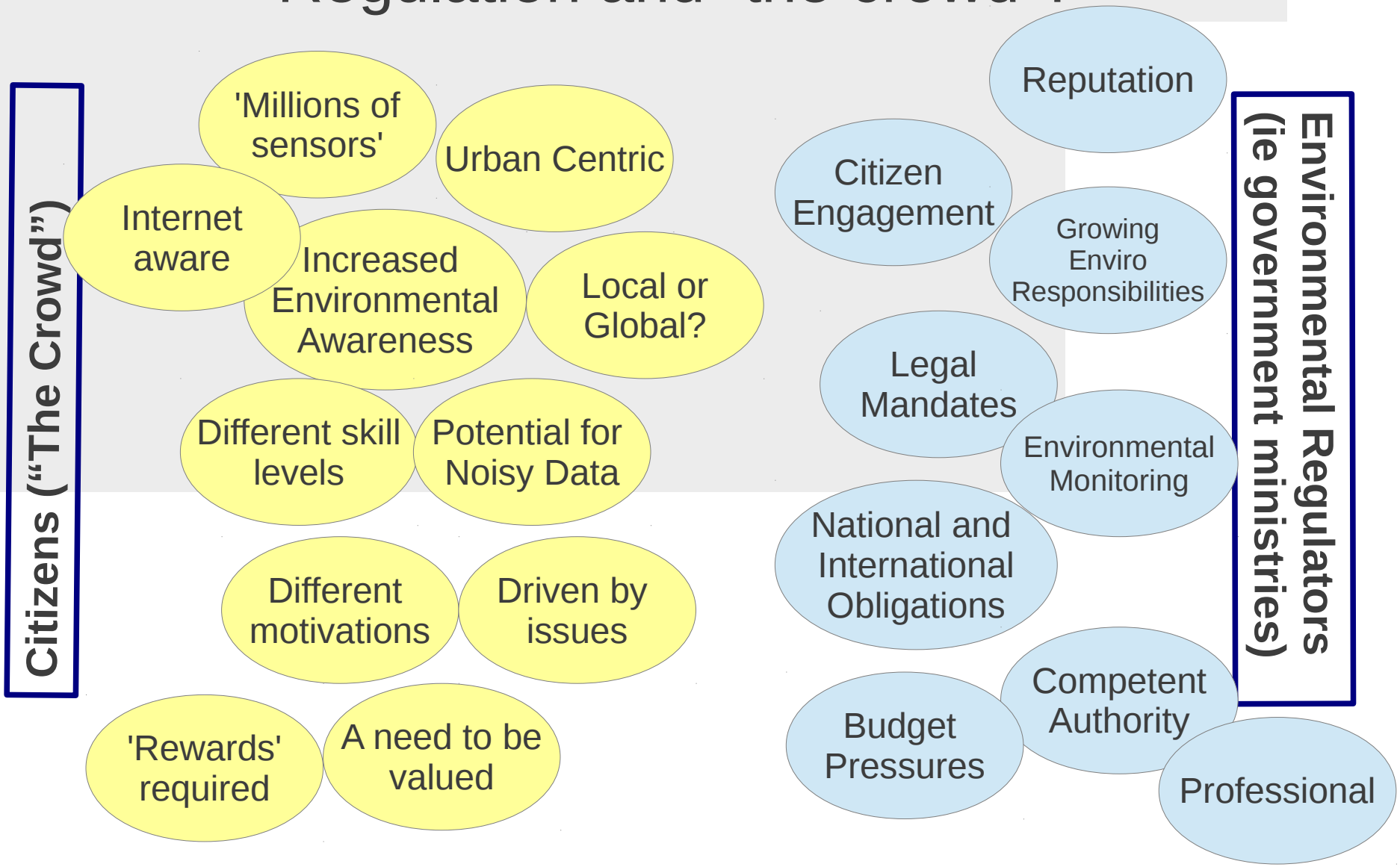
Boston and the new media: the far from madding crowd

If it is to be trusted more than social media, the mainstream media must do better than the adage: 'Never wrong for long'

Editorial
The Guardian, Tuesday 23 April 2013
Jump to comments (43)

The streets of Boston were emptied last week to allow the FBI and the Boston police to do their job. The internet, however, was an all too crowded place. It was crammed with speculation, some of it very damaging. Within minutes, web forums were in full production mode: there had been four bombs instead of two; the Boston library had been targeted; online wanted posters appeared naming people who turned out to be innocent. Hard evidence, the FBI's release of photos and video of the two bombers, crumbled in the hands of the social media forum Reddit. The citizen investigators identified the second suspect, the man in the white hat, as a Brown university student who disappeared on 16 March, a mistake for which the thread's moderator apologised.

Where is the intersection of Environmental Regulation and “the crowd”?



Related research activities we are involved in

- "**Crowdsourcing and National Mapping**" - with EuroSDR, AGILE, Uni Nottingham, ESRI
- "**Mapping and the Citizen Sensor**" TD100 EU COST Action (MC and WG Chair)
- "**European Network Exploring Research into Geospatial Information Crowdsourcing**" IC1203 COST Action (WG Member)
- **"Geo2APPS" GEographic Open data to Applications for People, PA and companieS**- proposal submitted to EU CIP-ICT PSP-2013 – with FBK Italy + consortium – WP Leader

Our Research Interests for "*ICT and Environmental Regulation*"

- Machine learning, graph algorith**ms for knowledge and information** extraction from VGI and Citizen Generated Content
- Automated (semi-supervised) methods for **quality assessment** of this information
- **Building use-case specific methodologies** for environmental regulation – using ICT to leverage the advantages of the crowd whilst minimising impact of the problems associated with crowdsourcing

EMAIL: peter.mooney@nuim.ie or p.mooney@epa.ie
http://www.cs.nuim.ie/~pmooney/