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Citizen Science and the Science of Cities

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About Me

- GIS consultant for 10 years in the Middle East, the UK and all over Europe
 - Specialist in databases, software design, development and systems integration
- PhD in Geographical Information Science from University College London (UCL) in 2007
 - Founded in 1826, 30,000 students, 5000 staff
 - Ranked 5th in the world (QS 2014)
- Now Lecturer in Geographical Information Science
 - Research interests GIS and technology
 - Citizen Science
 - 3D GIS
 - GIS data quality and usability



Citizen Science and the Science of Cities

• Overview

Introduction - Smart Cities

- Citizen Science and Extreme Citizen Science
- Case Studies
 - Noise
 - Air Quality
- Citizen Science and Smart Cities
 - Some Considerations



Smart City •An efficient, sustainable city with integrated information, active citizen participation and intelligent management

A City with a Digital Overlay



Source: IDC Government Insights, 2013



Libelium Smart World

Air Pollution

Control of CO2 emissions of factories, pollution emitted by cars and toxic gases generated in farms

Forest Fire Detection

Monitoring of combustion gases and preemptive fire conditions to define alert zones.

Wine Quality Enhancing

Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

Offspring Care

Control of growing conditions of the offspring in animal farms to ensure its survival and health.

Sportsmen Care

Vital signs monitoring in high performance centers and fields.

Structural Health

Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.



Detect iPhone and Android devices and in general any device which works with Wifi or Bluetooth interfaces

Perimeter Access Control Access control to restricted areas and detection of people in non-authorized areas.

Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.

by cell stations and WiFi routers. **Traffic Congestion** Monitoring of vehicles and pedestrian

Electromagnetic Levels

Measurement of the energy radiated

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affluence to optimize driving and walking

routes.

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Waste Management

Detection of rubbish levels in containers to optimize the trash collection routes.

Smart Parking

Monitoring of parking spaces availability in the city.

Golf Courses

Selective irrigation in dry zones to reduce the water resources required in the green.

Smart Roads

Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

Smart Lighting

Intelligent and weather adaptive lighting in street lights.

Intelligent Shopping

Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.

Noise Urban Maps

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Sound monitoring in bar areas and centric zones in real time.

Water Leakages

Detection of liquid presence outside tanks and pressure variations along pipes.

Vehicle Auto-diagnosis

Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.

Item Location

Search of individual items in big surfaces like warehouses or harbours.



Quality of Shipment Conditions

Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.

Water Quality

Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.



Where am I? > Home > News > Public Sector > Government

Budget 2015: George Osborne pledges £140m to develop Internet of Things, smart cities and driverless cars -Updated

18 Mar 2015

0 Comments

By Danny Palmer

🔰 Follow @dannyjpalmer



The government will pledge funds to develop applications for the Internet of Things and smart cities. Chancellor of the Excheguer George Osborne has announced as part of the Budget.

The funding forms part of what the Treasury describes in the Budget document as "strategic science and innovation investments to make the UK a global leader in emerging markets and technologies".

Further reading

> Internet of Things, analytics, mobile and cloud 'very much of Defence

A total of £40m will be set aside for "for demonstrator programmes, business incubator space and a research hub to develop part of the agenda' for Ministry applications for Internet of Things technologies in healthcare and 1.1 1.0.



- > Government will regret 'demonising CIO role', says former HMRC CIO
- Data protection authorities 'facing considerable resource challenges' due to digital boom
- > Heathrow third runway 'like having a dial-up connection to the Internet of Things' says Mayor of London



GISPLOUNGE

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How Spatial Big Data Underpins Smart Cities

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BY GIS CONTRIBUTOR 🛛 🗁 GIS INDUSTRY



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Han Wammes, the Business Development Manager Geospatial Information Management at 1Spatial, writes about how cities can collect and harness the necessary information to create a smart city. In this piece, Wammes makes the case that "everything happens somewhere and only when you know where everything is can you create the connections that make cities smart. Underpinning any smart city program is trusted geospatial information; one single source of reliable, locationspecific data."

Governments, local councils, utility companies and dog owners; everyone could benefit from their city becoming smarter. Mayors and local councils recognise that a smart city is crucial for a city's development and improvement in the 21st century. The UN reports that 54% of people worldwide live in a city, half of these in cities which have fewer than 500,000 people. So how can these stakeholders collect and harness the

necessary information to create a smart city? Everything happens somewhere and only when you know where everything is can you create the connections that make cities smart. Underpinning any smart city programme is trusted geospatial information; one single source of reliable, location-specific data.

The UN said in its recent report [1] "cities are where the battle for sustainable development will be won or lost". So how are cities beginning to manage this transformation? Many are starting with isolated, manageable



Smart Cities and Big Data





Smart Cities: Sensors and Big Data

 Using Automatic Number Plate Recognition to measure journey time across a city





5 minute aggregated interval travel Time (mins/km)

0.324000 - 1.220000
1.711001 - 2.335000
2.335001 - 3.133000
4.395001 - 35.53300



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Citizen Science

- Citizen Science is a form of research collaboration involving members of the public in scientific research projects to address real-world problems (Wiggins and Crowston 2011)
- "The scientific activities in which nonprofessional scientists volunteer to participate in data collection, analysis and dissemination of a scientific project" (Cohn 2008; Silvertown 2009).





Levels of Citizen Science

Level 4 'Extreme'	 Collaborative Science – problem definition, data collection and analysis 				
Level 3 'Participatory science'	 Participation in problem definition and data collection 				
Level 2 'Distributed Intelligence'	 Citizens as basic interpreters 				
Level 1 'Crowdsourcing'	• Citizens as sensors	FERTRA SO	PSq		
		ALL	5		

COMMUNITY PARTICIPATION



Citizen Science and 'Extreme' Citizen Science

	'Normal' Citizen Science	'Extreme' Citizen Science		
Users	Educated, usually with some domain knowledge	Everyone, regardless o level of literacy		
Location	Wealthy, populated and popular	Everywhere		
Role	Data collection and entry	Shaping the problem, analysing the data		
Mode of work	Crowdsourcing	Collaborative and participatory science		



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- Noise some facts
 - Noise is subjective and defined as 'unwanted sound', as such one person's noise is another person's sound. The World Health Organization (WHO) recommends an annual average night exposure not exceeding **40 decibel (dB)**
 - Sleepers that are exposed to night noise levels above 40dB on average throughout the year, corresponding to the sound in a quiet street, can suffer mild health effects like sleep disturbance and insomnia.
 - Above 55dB long term average exposure, similar to the din of a normal conversation, noise can get to trigger elevated blood pressure and heart attacks.



Map: WC1E 6BT, London



 DEFRA Road Noise Map, WC1E 6BT, from <u>http://services.defra.gov.uk/wps/portal/noise</u> (15th February 2014)

























The Hechrov-Association for the Control 4 Aircreft Noise (HACAN) has teamed up with University College Landon to facut an lideworth and produce a communal naise map. We are asking local resident to record their personal exposure to haise using noise meters as well as the new smarthone application Urdenoise, which makes noise nepping neally easy.

Come to the public launch to join in:

19th June at 7pm Isleworth Public Hall South Steet, TW7 7BG Isleworth Noise Map orline: thyuri.com/isleworthnoisemap

The Widencise smartphone opp is free to download and use:

tinyurl.com/applowidenoise tinyurl.com/googlewidenoise

If you are collecting noise data with the opp please fill in this survey: thyurl.com/isleworthsurvey

h to join in: Contact Us: (Joe Ryle)

il udnoisemapping@gmail.com B0 07427350018 The project is supported by the European Union Seventh Framework Programme as well as EPSRC and UCL.













• Air Pollution – Some Facts

- Ozone pollution causes breathing difficulties, triggers asthma symptoms, causes lung and heart diseases, and is associated with about 21 000 premature deaths per year in 25 countries in the WHO European Region
- Poor air quality is particularly an issue for children, those with heart or lung diseases, or the elderly
- The available evidence is also sufficient to assume a causal relationship between exposure to PM and aggravation of asthma as well as cough and bronchitis symptoms.
- Daily mortality and hospital admissions have been linked with short term variation of PM levels.























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http://www.everyaware.eu

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Blog	The EveryAware Project	Activities	Publications	Press	Contact	Consortium	People	
AirProbe	AirProbe International Challenge							
 This is the London Section of the AirProbe International Challenge. Documentation for Air Ambassadors Posted on 29/10/2013 by Alina Since the start of the second phase is approaching, we have prepared a few documents that will belo our Air Ambassadors getting familiar with the sensor box and the AirProbe app: AirProbe 					the			
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Citizen Science and Smart Cities

- Citizen Science gives you a personal view of your world and allows you to address local issues
 - In particular, it allows the combination of objective and subjective data
- But can the data also be aggregated and integrated with other Smart City datasets to provide an additional source of information?

It is not 'big data'

- Citizen Scientists are perceived as untrustworthy
 - No 'quality control'
 - Not professional



Citizen Science and Smart Cities: Positional Error





Citizen Science and Smart Cities: Calibration (Noise)





Class 1 Reference Meter Class 2 Meter iPod Touch running WideNoise IPhone 4 running WideNoise IPhone 3 running WideNoise HTC Explorer running WideNoise HTC Explorer running WideNoise Huawei Blaze running WideNoise

Effective WideNoise Measuring Range 50-100 dB(A)



Citizen Science and Smart Cities: Calibration (Air Quality)









Citizen Science and Smart Cities: Metadata

Transport/Buss Demo

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\sim 🗾 📉 (UK) - UK-AIR: Air Information Resource automatic and non automatic monitoring data

Spatial data set Metadata Language Resource Language Conditions Applying To Access And Use English English Metadata Date resource required on reuse. 2014-05-30T02:00:15 Limitations On Public Access Metadata Point Of Contact No limitations Ricardo-AEA. E-mail: Agnieszka.Griffin@ricardo-aea.com

Responsible Party

Author: The Department for Environment, Food and Rural Affairs, The Scottish Government, The Welsh Government and The Department of Environment - Northern Ireland, E-mail: emily.connolly@defra.gsi.gov.uk

Resource Title

UK-AIR: Air Information Resource automatic and non automatic monitoring 1.1

Released under the Open Government Licence (OGL), citation of publisher and online

Spatial Data Theme

Environmental monitoring facilities (Environmental



Citizen Science and Smart Cities: Open Questions

- Is it really true that lots of low quality measurements can be as useful as a few high quality measurements?
- Can we interpolate noise and air quality information created by citizen scientists
 - Moving from personal exposure to a general map
 - Integrating with sensor data and 'big' data



Citizen Science and Smart Cities: Open Questions

- Who has the end use of the data, ownership and credit for the work?
- Are there issues of empowerment, inclusion/exclusion, marginalisation, participation?
- What makes people start to participate and continue to contribute?
- What is the importance of local knowledge and understanding in Smart Cities?



Citizen Science and the Science of Cities

Thank You



Any Questions?